

Conservational importance of Monotypic Angiosperm taxa in mountains and plains of India and its *status quo*

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Abstract

There is a continuous taxonomic riddle existed among taxonomists on the *status quo* of Monotypic taxa among the Angiosperms of the world in general and of India in particular. The International Code of Nomenclature for algae, fungi and plants (ICN) have prescribed rules for naming taxa framed by international community for uniformity, universal applicability and stability which are based on two major principles, Type concept and Priority of publication. The World Flora Online is the taxonomic backbone for all known plants which provides present status with details of species and its synonyms along with publication details. Monotypic taxon is a unit if it represents single taxa within it, i.e., a family is monotypic if represented by a single genus with single species and a genus is monotypic if represented by the 'type species' only. In India, Uniyal & Mathur (1994) have initially compiled and reported 189 monotypic genera spread over 70 families of Angiosperms in flora of India which was again rectified by Rana & Ranade (2009) documenting 236 monotypic genera spread over 63 families. The said data has been extensively used by all the taxonomic institutions in India including Botanical Survey of India (BSI). But the present status of Monotypic Angiosperms of India is not the same as many new species were identified under some monotypic genera as well as some of the species were replaced within different genera as a part of rectification process. Therefore, to find the exact status of already established monotypic taxa and to document status quo of monotypic Angiosperm taxa in India, an extensive review has been done with the help of various taxonomic databases and recent literatures the result of which is presented in the present communication. The conservational importance of these monotypic taxa distributed over mountains, hill ranges and plains of India are highlighted as the need of the hour.

Key words: Conservation, Monotypic Angiosperm taxa, World Flora Online, *status quo*, India

Introduction

Angiosperms or the flowering plants are the largest and highly diversified group plants dominating major vegetation of earth except snow forests. Angiosperms occupy almost every habitat on earth, from deserts to high mountain peaks and from freshwater ecosystems to marine estuaries. Angiosperms are comparatively recent group of seed plants, and considered to be young, evolved about 130 million years ago, and flourished from the Jurassic Period to early the Cretaceous Period. Based on the number of cotyledons developed upon germination, the angiosperms have traditionally been divided into the monocotyledons (Monocots) and the dicotyledons (Dicots) (Angiosperm Phylogeny Group, 2016). In India, about 20,000 flowering plants were recorded so far including cultivated or naturalised ones with approximately 15% endemic species. Total 257 families were listed with currently accepted genera, of which 213 families belong to Dicots and 44 to Monocots (Botanical Survey of India, 2021). Among these, more than 4300 species are endemic and more than 1240 species are in threatened categories (BSIENVIS, 2021) and these can be accessed mainly in different forest localities in hills and mountains having a diverse geographic spatial distribution.

A taxa is said to be monotypic if it represents a single taxa within it, *i.e.*, a family is monotypic if represented by a single genus with single species and a genus is monotypic if represented by the 'type species' only. Many monotypic genera have been described as such taxa possess a number of distinct autapomorphies, *i.e.*, character unique to that species, making it easily distinguishable from other related species having divergence with synapomorphies (Schrire and Lewis, 1996). Monotypic taxa are different from endemic plants in the sense that all monotypic taxa are likely to be endemic to a region, but all endemic plants are not monotypic taxa (Rana and Ranade, 2009). About 38% of the monotypic taxa are endemic to India and restricted to different bio-geographic regions of the country (Rana and Ranade, 2009). Geographical isolation of the species is a barrier for complete circumscription of the plants. Though the Himalayan range acts as a geographical barrier, it also functions as a crucible for the evolution of new species complexes in the ecological niches and habitats offered by the Himalayan mountain systems (Nayar, 1996).

India is rich in all the three levels of biodiversity-such as species diversity, genetic diversity and habitat diversity. The total number of flowering plant species although only 18,000, the intra-specific variability found in them make it one of the highest in the world. Moreover, 38% of the flowering plants and 18% of the total flora were recorded as endemic to this country (Nayar, 1977). The wide range of plant diversity is reflected even within each taxonomic level in the total flora. Amongst the flowering plants, several families show great diversity and are represented by more than 100 species. On the other end of spectrum, there were as many as 72 monotypic families in the Indian flora; among which about 236 genera of the flowering plants were monotypic which have 176 genera of Dicotyledonous and 60 of Monocotyledonous genera where the family Poaceae with 32 taxa can be considered the most dominant, followed by Leguminosae (15), Asteraceae (12), Rubiaceae (11), Orchidaceae (10), and others (Rana and Ranade, 2009). These five dominant Angiosperm families together account for about one-third of the total number of Monotypic Angiosperm taxa in India. Leguminosae is the most dominant Dicot family in India having highest number of species (Rana & Ranade, 2009; Botanical Survey of India, 2021; ENVIS, 2021). Earlier records showed that Leguminosae have 1297 total species in India covering 15 Monotypic species (Rana & Ranade, 2009) which is the dominant Monotypic family of Dicots as well. The members of Monocot families are generally herbaceous and members of Dicots have all the life forms like herbs, shrubs, climbers/lianas and trees. Among all, four Monotypic families were earlier recognized in India having only one genus and one species within it which are Circaeasteraceae, Plagiopteraceae, Tetracentraceae and Trichopodaceae (Rana & Ranade, 2009; Botanical Survey of India, 2021).

Monotypic taxa are important not only in floristic studies, but also in phytogeography and phylogenetic studies. They have the most important role in identifying the origin and route of migration of those taxa with the help of the distribution pattern. It helps in tracing the evolutionary line among the lower taxa. They represents species which could be lost forever and their related genomes do not exist anywhere else in the region which opens up further attention to study of molecular biology

and cytogenetics to tap the information as they are threatened in terms of related taxa and from the conservational point of view. Likewise, the region harbours numerous plant species having medicinal, aromatic and other economic use, which deserve immediate attention for conservation and sustainable use.

As the evolutionary processes are directional, it is important to establish phylogenetic status of monotypic taxa for determining evolutionary direction of a particular taxon and its higher levels have going through. It is difficult to envisage that in the same higher taxonomic unit, different subunits are subjected to different or opposing evolutionary directions and pressures. Some effort is also required to trace the distribution limits for a monotypic taxon and to then explain how this distribution is linked to geographic and geological factors. Further, time to take up studies in this interesting group of taxa in a comprehensive and holistic way was also felt (Rana and Ranade, 2009).

In the present communication, a study is undertaken to re-visit and evaluate the present status of Monotypic genera distributed under different families, having different life forms (herbs, shrubs and trees etc.) in India. The study is aimed to evaluate the present status of reported Monotypic taxa within different families under study and to establish present status of Monotypic Angiosperm taxa in India. The result of the study also tries to establish 'Monotypic taxa' as a category to be considered for conservation purpose similar to RET species as this category also have conservation need.

Methodology

For status evaluation of Monotypic taxa in India for the first instance, 236 Monotypic genera including 176 genera of Dicot and 60 genera of of Monocot within 72 families (Rana & Ranade, 2009; Botanical Survey of India, 2021) are taken into consideration. The earlier report on the respective species under the genus and family concerned are taken as reference material and studied their present taxonomic status with respect to Monotypic status and distribution in India. Further, all the other families and genus reported after 2009 till 2021 in different literatures (Angiosperm Phylogeny Group, 2016; The Plant List, 2021; Plants of the World online, 2021) and discussing various newly reported plant species and other taxa from India after 2009 till date (BSIENVIS, 2009-2021) were also consulted for the purpose. All the materials are scrutinized in the Plants of the World online Database (Plants of the World online Database, 2021) along with Red data list of IUCN (IUCN Red list of Threatened species, 2021) to enquire for the recent conservation status. Research data are preserved in North East Herbarium of Ayurveda Research (NEHAR) of Central Ayurveda Research Institute, Guwahati, Assam (India).

Results and Discussion

Results of the present communication shows that the five dominant families having Monotypic genera are remains same but with different number of genera at present into the enumeration. The present study results also shows that Poaceae is still maintaining the most dominant family of having monotypic genera but number became less from 32 to 27 now. Likewise, next family Compositae now became third (changed from 12 to 9), Leguminosae became second from third (from 15 to 8); Rubiaceae became fifth (from 11 to 6) and Orchidaceae became fourth (from 10 to 7) which are enumerated in **Table 1**. Moreover, within the dominant Dicot family of monotypic taxa, *i.e.*, Leguminosae, earlier 15 species were enlisted. But after careful scrutiny, only 8 species retain the status of monotypic taxa within the family. Among the taxa, removed from the recent monotypic list, 5 were in the same taxonomic position, but the respective genus is reported with more than one species, and hence, their status as monotype has been lost and other two species became synonym of other taxa. There are some other noteworthy facts come up during the study which are to be studied in detail for further verification both in literature and field; so that authentic information can be generated. For example, *Mecopus nidulans* Benn. (syn: *Uraria retrofracta* Wall.) is distributed throughout India including Andaman Islands, but leaving the Northeastern region and it is also distributed in countries of Southeast Asia like South China and Malaysia (Plants of the World online, 2021). All these area are covering the west, north, east and south directions of Northeastern region of India. Therefore, there is a

scope of field exploration for the particular species to discover and establish its distribution in the Northeastern region of India. Also in case of *Tamarindus indica* L., which is a very common species; the species is accepted with 3 synonyms; but the taxa have still to be resolved with two other taxa of species level due to its variability with high distributional range (The Plant List, 2021).

Table 1. Dominant families of monotypic genera of India

Existing record (BSI-ENVIS 2021)		Reported in the present study	
Dominant Families	Monotypic genera	Dominant Families	Monotypic genera
Poaceae	32	Poaceae	27
Leguminosae	15	Compositae	9
Asteraceae	12	Leguminosae	8
Rubiaceae	11	Orchidaceae	7
Orchidaceae	10	Rubiaceae	6

The list of monotypic Angiosperm species which were attended by IUCN for conservational status is given in **Table 2** where their status is also provided. This list clarifies that among the total of 140 monotypic Angiosperm species, only 24 plant species are evaluated till now for their conservation status, 116 species are still have to be attended by the conservationists for the purpose. Among these, Though 19 species have been placed under Least Concern category, *Parakaempferia synantha* A.S.Rao & D.M.Verma (Herb, Zingiberaceae) is Critically endangered and distributed only in the state of Assam within India (Newman and Sabu, 2019). Three species are Endangered, namely, *Limnopoa meeboldii* (C.E.C.Fisch.) C.E.Hubb. (Herb, Poaceae) distributed in the state of Kerala (Rehel, 2011); *Bulleyia yunnanensis* Schltr. (Epiphytic herb, Orchidaceae) distributed in eastern Himalayan region (China Plant Specialist Group. 2004) and *Aldrovanda vesiculosa* L. (Herb, Droseraceae) distributed in the state of West Bengal (Cross and Adamec, 2020) and one species is Vulnerable which is *Chloroxylon swietenia* DC. (Shrub, Rutaceae) distributed in Central and Southern states of India (Asian Regional Workshop on Conservation & Sustainable Management of Trees, 1998).

Table 2. List of monotypic Angiosperm species attended by IUCN for conservation status

Monotypic taxa	Family	Habit	distribution in India and world	Conservation status by IUCN
<i>Chloroxylon swietenia</i> DC.	Rutaceae	S	Madhya Pradesh, Orissa, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala	Vulnerable
<i>Aldrovanda vesiculosa</i> L.	Droseraceae	H	India (West Bengal), Central Europe, Australia	Endangered
<i>Bulleyia yunnanensis</i> Schltr.	Orchidaceae	EH	India (Eastern Himalaya, Arunachal Pradesh and North Bengal), SW China	Endangered
<i>Pistia stratiotes</i> L.	Araceae	H	India (throughout), Sri Lanka, tropics of the world	Least concern
<i>Brasenia schreberi</i> J.F. Gmel.	Cabombaceae	H	India (Meghalaya), Bhutan, North America, East Australia, East Africa	Least concern
<i>Butomopsis latifolia</i> (D. Don) Kunth	Alismataceae	H	India (Plains, Assam and the Deccan), Tropics of the Old World	Least concern

<i>Mecopus nidulans</i> Benn.	Leguminosae	H	India (Himalaya), South China, Malaysia	Least concern
<i>Pongamia pinnata</i> (L.) Pierre	Leguminosae	T	India (throughout)	Least concern
<i>Tamarindus indica</i> L.	Leguminosae	T	India, native of tropical Africa	Least concern
<i>Centrostachys aquatica</i> (R.Br.) Moq.	Amaranthaceae	H	India (Assam, Coromandal, and the Circars), Bangladesh, Nepal, Burma, Tropical Africa	Least concern
<i>Desmostachya bipinnata</i> (L.) Stapf	Poaceae	H	India (cosmopolitan)	Least concern
<i>Limnopoa meeboldii</i> (C.E.C.Fisch.) C.E.Hubb.	Poaceae	H	India (Kerala)	Endangered
<i>Polytrias indica</i> (Houtt.) Veldkamp	Poaceae	H	India (West Bengal), SE Asia	Least concern
<i>Vossia cuspidata</i> (Roxb.) Griff.	Poaceae	H	India (Assam and West Bengal), Burma, tropical Africa	Least concern
<i>Parakaempferia synantha</i> A.S.Rao & D.M.Verma	Zingiberaceae	H	India (Assam)	Critically endangered
<i>Scyphiphora hydrophylacea</i> C.F.Gaertn.	Rubiaceae	T	India (Andamans and Karnataka), Australia, Caledonia	Least concern
<i>Enhalus acoroides</i> (L.f.) Royle	Hydrocharitaceae	H	India (South India and Andaman & Nicobar Islands), Australia	Least concern
<i>Kleinhovia hospita</i> L.	Malvaceae	T	India (Karnataka, Kerala and Tamil Nadu), Singapore, Sri Lanka, Java, Philippines	Least concern
<i>Pangium edule</i> Reinw.	Achariaceae	T	India (Great Nicobar Island), Malaysia and Micronesia	Least concern
<i>Hydrocera triflora</i> (L.) Wight & Arn.	Balsaminaceae	H	India (throughout Bengal, Deccan Peninsula), Sri Lanka, Burma	Least concern
<i>Lawsonia inermis</i> L.	Lythraceae	S	India (throughout), Afghanistan, Iran	Least concern
<i>Nypa fruticans</i> Wurm	Arecaceae	H	India (West Bengal), Sri Lanka, Malay Peninsula, Australia	Least concern
<i>Pajanelia longifolia</i> (Willd.) K.Schum.	Bignoniaceae	T	India (Meghalaya and Andaman & Nicobar Islands), Bangladesh, Burma	Least concern
<i>Suriana maritima</i> L.	Surianaceae	ST	India (Andaman & Nicobar Islands, Lakshadweep)	Least concern

			and Tamil Nadu), Pakistan, Sri Lanka	
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[N.B: H: Herb, EH: Epiphytic herb, S: Shrub, ST: Small tree, T: Tree]

Conclusion

It is appealing to note that many of the species whether placed earlier under Monotypic taxa of India or became Monotypic species of different families after rearrangement (116 among 140) are not evaluated by IUCN for their conservation status till today. It is evident from the present communication that among 24 evaluated species, IUCN have placed 1 as Critically Endangered, 3 as Endangered, 1 as Vulnerable and rest 19 as Least concern. As most of the species have restricted distribution and some are even recorded as Endemic besides recorded and used for medicinal values; the need to access the conservation status of these Monotypic species in general in India and in particular to different geographical regions covering hills & mountains and plains & wetlands of the country. Also, the present communication appeal IUCN to provide a separate category to Monotypic taxa from conservation point of view.

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