

Biodiversity profile

The genus *Rhododendron* in north-east India

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Abstract

The genus *Rhododendron* belongs to the family Ericaceae and was described by Carl Linnaeus in 1737 in *Genera Plantarum*. Joseph Hooker's visit to Sikkim Himalaya between 1848 and 1850 unfold the rhododendron world of this area. Within the brief span that he travelled in Sikkim, he gathered and described 34 new species and details of 43 species including varieties from the Indian region in his monograph entitled 'Rhododendron of Sikkim Himalaya'. Since then many workers had added to the list, and currently about 121 taxa have been recorded from India, out of which 117 (98%) taxa are distributed in north-east India. The paper presents the distribution of the genus *Rhododendron* in north-east India and world based on literature, field studies and examination of herbarium specimens. It also discussed the status of the genus in natural habitat in recent years and the need for conservation.

Key-words: *Rhododendron*, distribution, north-east India

Introduction

The genus *Rhododendron* belongs to the family Ericaceae and was described by Carl Linnaeus in 1737 in 'Genera Plantarum'. Joseph Hooker's visit to the Sikkim Himalaya between 1848 and 1850 unfold the rhododendron world of this area (Hooker 1849). Within the brief span he traveled in Sikkim. Hooker gathered and described 34 new species and details of 43 species, including varieties from the Indian region in his monograph entitled 'Rhododendron of Sikkim Himalaya'. It was followed by the publication on the 'Indian Rhododendron' by Clarke (1882) who recorded 46 species. Since then many species have been described and recorded from north-east India by various workers (Calder *et al.* 1926; Razi 1959; Nayar and Ramamurthy 1973; Nayar and Karthikeyan 1981; Naithani 1990). Later, preliminary enumerations of the genus at national and regional levels were made by Pradhan (1985, 1986), and Ghosh and Samaddar (1989). Floristic diversity of the Indian rhododendrons was dealt in detail by Mao *et al.* (2001). Other important studies

from the region are the 'Rhododendron of Sikkim-Himalayan' (Pradhan and Lachunga 1990), 'Rhododendrons in India' (Sastry and Hajra 2010) and the 'Rhododendrons of Sikkim' (Pradhan 2010). Revision of the genus at world level was carried out by Cullen (1980) and Chamberlain (1982).

North-east India comprising the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura lies between 21°34'N to 29°50'N latitude and 87°32'E to 97°52'E longitudes and covers an area of ca 262060 sq. km (Fig. 1). It represents about 8% of the India's total geographical area. North-east India is part of both Himalaya as well as Indo-Burma biodiversity hotspots in the world. It forms a unique biogeographic province encompassing major biomes recognized in the world. On account of its unique geographical features, this region forms the richest reservoir of floristic diversity in India supporting about 50% of the total 18000 flowering plant species of India. The region exhibits rich diversity in orchids, zingibers, yams, rhododendrons, bamboos, canes and wild relatives of cultivated plants. The region is also well represented by many primitive families such as Magnoliaceae, Lauraceae, Hamamelidaceae, Degeneriaceae, Tetracentraceae and



Figure 1. Map of north-east India with the number of *Rhododendron* taxa including natural hybrid found in different states.

Lardizabalaceae which grows in the region and further eastwards but does not occur in other parts of India. Based on the distribution of primitive angiosperms in South-East Asia, Takhtajan (1969) considered the area – East Himalaya-Fiji region as the cradle of ‘angiosperms’ where angiosperms have diversified. The paper presents the distribution of the genus *Rhododendron* in north-east India based on literature, field studies and examination of herbarium collection. Of the 8 states of north-east India, the genus is not reported from within the present political boundaries of Assam and Tripura. The paper also discusses affinities with neighboring countries, endemism, present status of the genus in natural habitat and the need for conservation.

Diversity

The genus *Rhododendron* occupies a very important place in the high altitude biodiversity in north-east India. Based on literatures, field studies and author’s personal herbaria

collection, currently 120 taxa (73 spp., 22 subsp. and 25 var.) and 3 natural hybrids have been recorded from India, out of which 117 (98%, excluding 3 taxa, viz. *R. arboreum* subsp. *nilagiricum* in South India, *R. colletianum* and *R. anthopogon* subsp. *hypenanthum* from western Himalaya) are distributed in north-east India (Table 1, 2). In addition to the taxa listed in Table 2, the following natural hybrids, viz. *R. candelabrum* (*R. campylogynum* x *R. thomsonii*), *R. decipiens* (*R. hodgsonii* x *R. falconeri*) and *R. imberbe* (*R. barbatum* x *R. arboreum*) have been recorded from north-east India. However, it is likely to discover even new species as more than 50% of the state is still unexplored or under-explored. The highest numbers of taxa is recorded from Arunachal Pradesh (106), followed by Sikkim (40), Manipur and Nagaland (10), Mizoram (4) and Meghalaya (3) (Table 1). Twenty one taxa are epiphytic (sometimes terrestrial), 28 taxa are medium size tree or shrub and the rest are small shrubs. The most widely distributed species in the region is *R. arboreum*. Highest variation was observed in *R. johnstoneanum*, *R. maddenii* and *R. lepidotum*

Table 1. A glance of *Rhododendron* taxa present in the different states of north-east India (some or many of the taxa are common to two or more states)

Taxa	Biogeographic Zone					
	Eastern Himalaya			Indo-Myanmar		
	Sikkim	Arunachal Pradesh	Meghalaya	Manipur	Mizoram	Nagaland
Species	23	64	0	6	2	6
Subspecies	11	19	1	1	1	1
Variety	6	23	2	3	1	3
Total taxa	40(+2*)	106(+3*)	3	10	4	10
Endemic taxa	2(4.7%)	9(8%)	2(66.6%)	6(60%)	2(50%)	6(60%)

Note: *Natural hybrids.

Table 2. Distribution of *Rhododendron* in north-east India and world.

Name of Taxa	Distribution	
	North-east India	World
<i>Rhododendron anthopogon</i> D. Don subsp. <i>anthopogon</i>	Sikkim, Arunachal Pradesh	Bhutan, China
<i>Rhododendron arboreum</i> Smith subsp. <i>arboreum</i>	Sikkim	Bhutan, Nepal
<i>Rhododendron arboreum</i> Smith subsp. <i>cinnamomeum</i> (Lindley) Tagg var. <i>cinnamomeum</i>	Sikkim, Arunachal Pradesh	Nepal
<i>Rhododendron arboreum</i> Smith subsp. <i>cinnamomeum</i> (Lindley) Tagg var. <i>roseum</i> Lindley	Sikkim, Arunachal Pradesh	Bhutan, Nepal and China
<i>Rhododendron arboreum</i> Smith subsp. <i>delavayi</i> (Franchet) Chamberlain var. <i>delavayi</i>	Manipur, Meghalaya, Mizoram, Nagaland, Arunachal Pradesh	Myanmar, Thailand, China
<i>Rhododendron arboreum</i> Smith subsp. <i>delavayi</i> (Franchet) Chamberlain var. <i>peramoenum</i> (Balf.f. & Forrest) Chamberlain	Arunachal Pradesh	China
<i>Rhododendron argipeplum</i> Balf.f. & Cooper	Sikkim and Arunachal Pradesh	Bhutan, China
<i>Rhododendron arizelum</i> Balf.f. & Forrest	Arunachal Pradesh	China
<i>Rhododendron arunachalense</i> Chamberlain & Rae	Arunachal Pradesh (Endemic)	-
<i>Rhododendron baileyi</i> I.B. Balfour	Sikkim	Bhutan, China
<i>Rhododendron barbatum</i> Wall. ex G. Don	Sikkim, Arunachal Pradesh	Bhutan, Nepal and China
<i>Rhododendron beanianum</i> Cowan	Arunachal Pradesh	Myanmar
<i>Rhododendron bhutanense</i> D.G. Long & Bowes Lyon	Arunachal Pradesh	Bhutan and China
** <i>Rhododendron blumei</i> Nuttall,	Arunachal Pradesh	China
<i>Rhododendron boothii</i> Nuttall	Arunachal Pradesh	China
<i>Rhododendron callimorphum</i> Balf.f. & W.W. Smith var. <i>callimorphum</i>	Arunachal Pradesh	China
<i>Rhododendron calostrotum</i> Balf.f. & Kingdon-Ward subsp. <i>riparium</i> (Kingdon-Ward) Cullen	Arunachal Pradesh	Myanmar and China
<i>Rhododendron camelliiflorum</i> Hook.f.	Sikkim, Arunachal Pradesh	Bhutan and Nepal
<i>Rhododendron campanulatum</i> D. Don subsp. <i>aeruginosum</i> (Hook.f.) Chamberlain	Sikkim, Arunachal Pradesh	Bhutan
<i>Rhododendron campanulatum</i> D. Don subsp. <i>campanulatum</i>	Sikkim, Arunachal Pradesh	Bhutan and Nepal
<i>Rhododendron campylocarpum</i> Hook.f. subsp. <i>campylocarpum</i>	Sikkim, Arunachal Pradesh	Bhutan, Nepal and China
<i>Rhododendron campylogynum</i> Franchet	Arunachal Pradesh	China and Myanmar

Table 2. Contd.....

Name of Taxa	Distribution	
	North-east India	World
<i>Rhododendron cephalanthum</i> Franchet subsp. <i>cephalanthum</i>	Arunachal Pradesh	China and Myanmar
<i>Rhododendron cerasinum</i> Tagg	Arunachal Pradesh	China (S.E. Xizang), Myanmar (N.E.)
<i>Rhododendron chamaethomsonii</i> (Tagg & Forrest) Cowan & Davidian var. <i>chamaethauma</i> (Tagg) Cowan & Davidian	Arunachal Pradesh	China
* <i>Rhododendron charitopes</i> Balf.f. & Farrer subsp. <i>tsangponse</i> (Kingdon-Ward) Cullen,	Arunachal Pradesh	China
<i>Rhododendron ciliatum</i> Hook.f.	Sikkim, Arunachal Pradesh	Bhutan, Nepal and China
<i>Rhododendron cinnabarinum</i> Hook.f. subsp. <i>cinnabarinum</i>	Sikkim, Arunachal Pradesh	Bhutan, Nepal and China
<i>Rhododendron cinnabarinum</i> Hook.f. subsp. <i>xanthocodon</i> (Hutchinson) Cullen	Arunachal Pradesh	Bhutan and China
<i>Rhododendron concinnooides</i> Hutchinson & Kingdon Ward	Arunachal Pradesh (Endemic)	-
<i>Rhododendron coxianum</i> Davidian	Arunachal Pradesh (Endemic)	-
<i>Rhododendron crinigerum</i> Franchet var. <i>crinigerum</i>	Arunachal Pradesh	Myanmar and China
<i>Rhododendron dalhousiae</i> Hook.f. var. <i>dalhousiae</i>	Sikkim, Arunachal Pradesh	Bhutan, Nepal and China
<i>Rhododendron dalhousiae</i> Hook.f. var. <i>rhabdotum</i> (Balf.f. & R.E. Cooper) Cullen	Arunachal Pradesh	Bhutan and China
<i>Rhododendron dalhousiae</i> Hook.f. var. <i>tashii</i> U.C. Pradhan	Sikkim (Endemic)	-
<i>Rhododendron dendricola</i> Hutchinson	Arunachal Pradesh	China and Myanmar
<i>Rhododendron electeum</i> Balf.f. & Forrest var. <i>electeum</i>	Arunachal Pradesh	China and Myanmar
<i>Rhododendron edgeworthii</i> Hook.f.	Sikkim, Arunachal Pradesh	Bhutan, Myanmar and China
<i>Rhododendron elliotii</i> Watt	Manipur and Nagaland (Endemic)	-
<i>Rhododendron eudoxum</i> Cowan var. <i>eudoxum</i>	Arunachal Pradesh	China
<i>Rhododendron exasperatum</i> Tagg	Arunachal Pradesh	Myanmar and China
<i>Rhododendron falconeri</i> Hook.f. subsp. <i>eximium</i> (Nuttall) Chamberlain	Arunachal Pradesh	Bhutan
<i>Rhododendron falconeri</i> Hook.f. subsp. <i>falconeri</i>	Sikkim, Arunachal Pradesh	Bhutan and Nepal
* <i>Rhododendron faucium</i> D.F. Chamberlain	Arunachal Pradesh	China
<i>Rhododendron flinckii</i> Davidian	Arunachal Pradesh	Bhutan
<i>Rhododendron formosum</i> Wallich var. <i>formosum</i>	Meghalaya (Endemic)	-
<i>Rhododendron formosum</i> Wallich var. <i>inaequale</i> (Hutchinson) Cullen	Meghalaya, Manipur, Nagaland, Mizoram, Arunachal Pradesh (endemic)	-
<i>Rhododendron forestii</i> Balf.f. ex Diels subsp. <i>forestii</i>	Arunachal Pradesh	China and Myanmar
* <i>Rhododendron fragariflorum</i> Kindon-Ward	Arunachal Pradesh	Bhutan and China
<i>Rhododendron fulgens</i> Hook.f.	Sikkim, Arunachal Pradesh	Nepal, Bhutan and China
<i>Rhododendron fulvum</i> Balf.f. & W.W. Smith	Arunachal Pradesh	Myanmar and China
<i>Rhododendron glaucophyllum</i> Rehder var. <i>glaucophyllum</i>	Sikkim	Nepal, Bhutan, China
<i>Rhododendron glaucophyllum</i> Rehder var. <i>tubiforme</i> Cowan & Davidian	Arunachal Pradesh	Bhutan and China
<i>Rhododendron glischrum</i> Balf.f. & W.W. Smith subsp. <i>rude</i> (tag & Forrest) Chamberlain	Arunachal Pradesh	China

Table 2. Contd.....

Name of Taxa	Distribution	
	North-east India	World
<i>Rhododendron grande</i> Wight	Sikkim, Arunachal Pradesh	Nepal, Bhutan and China
<i>Rhododendron griffithianum</i> Wight	Sikkim, Arunachal Pradesh	Nepal and Bhutan
* <i>Rhododendron haematodes</i> subsp. <i>chaetomallum</i> (I.B. Balfour & Forrest) D.F. Chamberlain	Arunachal Pradesh	China
<i>Rhododendron hodgsonii</i> Hook.f.	Sikkim, Arunachal Pradesh	Bhutan, Nepal and China
<i>Rhododendron hookerii</i> Nuttall	Arunachal Pradesh (Endemic)	-
<i>Rhododendron hylaeum</i> Balf.f. & Farrer	Arunachal Pradesh	China and Myanmar
<i>Rhododendron imperator</i> Kingdon-Ward	Arunachal Pradesh	Myanmar and China
<i>Rhododendron johnstoneanum</i> (Watt ex) Hutchinson	Manipur, Mizoram and Nagaland (Endemic)	-
<i>Rhododendron kasoense</i> Hutchinson & Kingdon-Ward	Arunachal Pradesh	China
<i>Rhododendron kendrickii</i> Nuttall	Arunachal Pradesh	Bhutan and China
<i>Rhododendron kesangiae</i> D.G. Long & Rushforth var. <i>Kesangiae</i>	Arunachal Pradesh	Bhutan
<i>Rhododendron keysii</i> Nuttall	Sikkim, Arunachal Pradesh	Bhutan and China
* <i>Rhododendron lacteum</i> Franchet	Arunachal Pradesh	China
<i>Rhododendron lanatum</i> Hook.f.	Sikkim, Arunachal Pradesh	Bhutan and China
<i>Rhododendron lanigerum</i> Tagg	Arunachal Pradesh	China
<i>Rhododendron lepidotum</i> Wallich ex G. Don	Sikkim, Arunachal Pradesh, Manipur and Nagaland	Nepal, Bhutan, Myanmar and China
<i>Rhododendron leptocarpum</i> Nuttall ex C.B. Clarke	Arunachal Pradesh, Sikkim	Bhutan, Myanmar and China
<i>Rhododendron lindleyi</i> T. Moore	Sikkim, Arunachal Pradesh	Nepal Bhutan and China
<i>Rhododendron ludlowii</i> Cowan	Arunachal Pradesh	China
<i>Rhododendron macbeanum</i> Watt ex Balf.f.	Manipur and Nagaland (Endemic)	-
<i>Rhododendron maddenii</i> Hook.f. subsp. <i>crassum</i> (Franchet) Cullen	Arunachal Pradesh, Manipur, Nagaland	Myanmar, China and Vietnam
<i>Rhododendron maddenii</i> Hook.f. subsp. <i>maddenii</i>	Sikkim, Arunachal Pradesh	Bhutan
<i>Rhododendron megacalyx</i> Balf.f. & Kingdon-Ward	Arunachal Pradesh	Myanmar and China
<i>Rhododendron megeratum</i> Balf.f. & Forrest	Arunachal Pradesh	Bhutan, Myanmar and China
<i>Rhododendron mekongense</i> Franchet var. <i>rubrolineatum</i> (Balf.f. & Forrest) Cullen	Arunachal Pradesh	China
<i>Rhododendron moulmainense</i> Hook.f.	Arunachal Pradesh	China, Myanmar, Taiwan, Japan, S. Indo-China to W. Malayasia
<i>Rhododendron nayarii</i> G.D. Pal	Arunachal Pradesh (Endemic)	-
<i>Rhododendron neriflorum</i> Franchet subsp. <i>phaedropum</i> (Balf.f. & Farrer) Tagg	Arunachal Pradesh	Bhutan, Myanmar and China
<i>Rhododendron nivale</i> Hook.f. subsp. <i>nivale</i>	Sikkim, Arunachal Pradesh	Nepal, Bhutan and China
<i>Rhododendron niveum</i> Hook.f.	Sikkim, Arunachal Pradesh	Bhutan
<i>Rhododendron nuttallii</i> Booth	Arunachal Pradesh	Bhutan and China
<i>Rhododendron papillatum</i> Balf.f. & Cooper	Arunachal Pradesh	Bhutan

Table 2. Contd.....

Name of Taxa	Distribution	
	North-east India	World
<i>Rhododendron pendulum</i> Hook.f.	Sikkim, Arunachal Pradesh	Bhutan, Nepal and China
* <i>Rhododendron piercei</i> Davidian	Arunachal Pradesh	China
<i>Rhododendron pocophorum</i> (Balf.f ex) Tagg var. <i>pocophorum</i>	Arunachal Pradesh	China
<i>Rhododendron prostitum</i> Balf.f. & Forrest var. <i>prostitum</i>	Arunachal Pradesh	Myanmar and China
<i>Rhododendron pruniflorum</i> Hutchinson	Arunachal Pradesh	Myanmar and China
<i>Rhododendron pumilum</i> Hook.f.	Sikkim, Arunachal Pradesh	Nepal, Bhutan, Myanmar and China
<i>Rhododendron santapau</i> A.R.K. Sastry, S.K. Katak, P.A. & E.P. Cox	Arunachal Pradesh (Endemic)	-
<i>Rhododendron setosum</i> D.Don	Sikkim, Arunachal Pradesh	Bhutan and China
<i>Rhododendron sherrifii</i> Cowan	Arunachal Pradesh	China
<i>Rhododendron sidereum</i> Balf.f.	Arunachal Pradesh	Myanmar and China
<i>Rhododendron sikkimense</i> U.C. Pradhan	Sikkim and Arunachal Pradesh (Endemic)	-
<i>Rhododendron sinogrande</i> Balf.f. & W.W. Smith	Arunachal Pradesh	Myanmar and China
<i>Rhododendron subansiriense</i> Chamberlain & Cox	Arunachal Pradesh (Endemic)	-
<i>Rhododendron succothii</i> Davidian	Arunachal Pradesh	Bhutan
<i>Rhododendron taggianum</i> Hutchinson	Arunachal Pradesh	Myanmar and china
<i>Rhododendron tanastylum</i> Balf.f. & Kingdon-Ward var. <i>tanastylum</i>	Arunachal Pradesh	Myanmar and China
<i>Rhododendron tephropeplum</i> Balf.f. & Farrer	Arunachal Pradesh	Myanmar and China
<i>Rhododendron thomsosnii</i> Hook.f. subsp. <i>thomsonii</i>	Arunachal Pradesh, Sikkim	Nepal, Bhutan and China
<i>Rhododendron triflorum</i> Hook.f. var. <i>bauhiniiflorum</i> (Watt ex Hutchinson) Cullen	Manipur and Nagaland (Endemic)	-
<i>Rhododendron triflorum</i> Hook.f. var. <i>triflorum</i>	Sikkim, Arunachal Pradesh	Nepal, Bhutan, Myanmar and China
<i>Rhododendron trilectorum</i> Cowan	Arunachal Pradesh	China
<i>Rhododendron tsariense</i> Cowan	Arunachal Pradesh	Bhutan and China
<i>Rhododendron uvarifolium</i> Diels var. <i>uvarifolium</i>	Arunachal Pradesh	China
*** <i>Rhododendron vietchianum</i> Hooker	Mizoram	Myanmar, Laos and Thailand
<i>Rhododendron vaccinioides</i> Hook.f.	Manipur, Nagaland, Arunachal Pradesh, Sikkim	Nepal, Bhutan, China and Myanmar
<i>Rhododendron virgatum</i> Hook.f. subsp. <i>virgatum</i>	Sikkim, Arunachal Pradesh	Bhutan and China
<i>Rhododendron wallichii</i> Hook.f.	Sikkim and Arunachal Pradesh	Nepal, Bhutan and China
<i>Rhododendron walongense</i> Kingdon-Ward	Arunachal Pradesh	China
<i>Rhododendron wattii</i> Cowan	Manipur and Nagaland (Endemic)	-
<i>Rhododendron wightii</i> Hook.f.	Sikkim and Arunachal Pradesh	Nepal, Bhutan and China
<i>Rhododendron xanthostephanum</i> Merrill	Arunachal Pradesh	Myanmar and China

*Report based on Cox (2004, 2006), **Poorly described species, *** Doubtful occurrence

in different natural habitats. For example, in Arunachal Pradesh, *R. maddenii* grows as terrestrial plant in West Kameng and Tawang districts, whereas in Lower Subansiri district it is mostly growing as epiphytes on big tree trunks. They show a great variation in flower and leaf morphology. These complex groups need more detail studies.

Affinity with Flora of Neighboring Countries

Out of the 117 *Rhododendron* taxa so far recorded from north-east India, 65 taxa (55%) are found to be common with China followed by Bhutan (46 taxa), Myanmar (28 taxa), Nepal (22 taxa) and one species each with Thailand, Vietnam, Taiwan, Japan and Malaysia indicating a close similarity with rhododendron floras of the neighboring countries (Fig. 2). Many of the species are common to one or more countries. Of the species found in the region, *R. moulmainense* has the widest common distribution (China, Myanmar, Taiwan, Japan and Malaysia), followed by *R. maddenii* subsp. *crassum* (China, Myanmar and Vietnam). The states of Arunachal Pradesh and Sikkim have very close affinity with China, Bhutan and Myanmar in terms of *Rhododendrons* flora which is obvious as the two states are close to these countries. However, more than 50% of the taxa found in the other four states, viz. Manipur, Meghalaya, Mizoram and Nagaland are endemic and unique to the states.

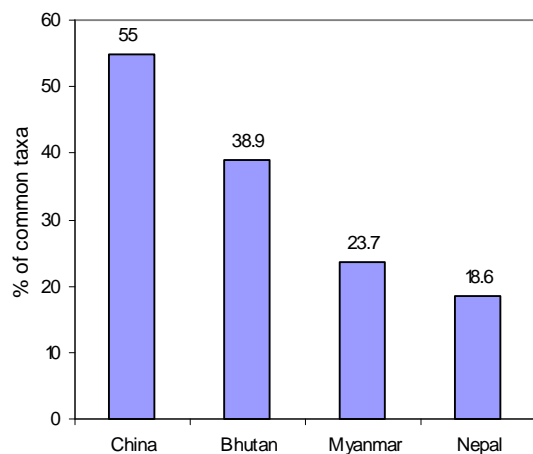


Figure 2. Percentage (%) of taxa common to neighboring country(s).

Endemic Taxa

Endemism of species indicates antiquity of its flora due to special condition of climate or micro-climate in the ecosystem, and natural or geographical barriers around the area. Based on the present study, 17 (13.8%) taxa of Indian *Rhododendron* are found to be endemic to north-east India, out of which 16 (13%) taxa, viz. *R. arunachalense*, *R. concinnoides*, *R. coxianum*, *R. dalhousiae* subsp. *tashii*, *R. elliotii*, *R. formosum* var. *formosum*, *R. formosum* var. *inaequale*, *R. hookerii*, *R. johnstoneanum*, *R. macabeanum*, *R. nayarii*, *R. santapau*, *R. sikkimense*, *R. subansiriense*, *R. triflorum* var. *bauhiniiflorum* and *R. wattii* (except *R. arboreum* subsp. *nilagiricum*) are endemic to north-east India. The maximum numbers (9) of endemic taxa occurs in Arunachal Pradesh, followed by Manipur and Nagaland (with 6 taxa each), and Mizoram, Meghalaya and Sikkim (with 2 taxa each) (Fig. 3). However, in terms of the percentage of endemic taxa, Meghalaya has the highest (66.6%) (2 out of the 3 taxa are endemic), followed by Manipur and Nagaland (60%), Mizoram (50%), Arunachal Pradesh (8.2%) and Sikkim (4.7%).

Major Threats

North-east India is inhabited by more than 200 tribes of different ethnic groups and cultural entities who live largely in the close vicinity of this rich biodiversity. Agriculture is the main occupation and many of these people practice 'jhum' or shifting cultivation to grow cereals, vegetables and fruits. In recent past, the rich floristic diversity of North-east India has been severely degraded. The increasing human population and the various anthropogenic activities through direct and indirect couple with natural calamities are resulting to loss of habitats. The epiphytic (sometimes terrestrial) species with much less population in natural habitats are the most vulnerable group as the host trees are deforested rapidly in many areas. In the high altitude areas of Arunachal Pradesh, rhododendrons are indiscriminately cut for firewood by the local people, military establishments and by the people constructing border road as it burns easily and also the common tree species found in those areas. These factors are contributing to the increasing rate of disappearance or extinction of rhododendrons from the natural habitat. The frequent forest fire during the dry season, particularly in Manipur and Nagaland, is another factor which is threatening the species survival.

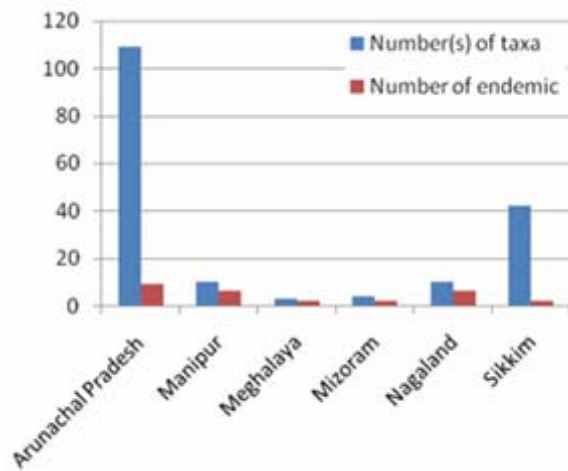


Figure 3. Number of taxa present in the different states of north-east India.

Based on the authors field studies, the taxa found in the states of Manipur, Nagaland, Meghalaya and Mizoram have become rare and threatened as the species are only found in few pockets in those states. However, the author feel insufficient data to comment on rare and threatened status of the taxa found in Arunachal Pradesh and Sikkim as in these two states the distribution of rhododendron is much more. Proper population studies in fields need to be undertaken to ascertain the status of the different species found in these two states. Earlier workers had recorded 46 rare and threatened taxa of *Rhododendron* (Sastry and Hajra 1983; Kataki 1983; Rao and Haridasan 1983). This number may be on the lower side as lots of developmental activities have taken place in the region in recent years and the natural habitats are shrinking very rapidly.

Conservation of the Taxa

Considering the rich species diversity, economic potential and vulnerability, the genus *Rhododendron* requires urgent conservation measures *in situ* and *ex situ*. The endemic taxa in the different states in the region require immediate conservation. *In situ* conservation can be brought about by creating public awareness of the importance of the species and establishing gene sanctuaries, national parks and biosphere reserves. This can be achieved only when the local communities are involved, as more than 90% of the forest land in the region is owned by communities over which the

state government has no control. Therefore, the involvement of the local population is very vital for any conservation measures as they are the people who use the forest in their localities. Presently, Sikkim is the only state in India where *in situ* conservation steps have been taken up for *Rhododendron* species. The Sikkim Forest Department and the Sikkim Rhododendron Society have taken up various efforts, such as fencing the *Rhododendron* rich area and declaring Khangchendzonga National Park to protect and conserve the species. Also, recently the World Heritage Group has taken up to help conserve the Sikkim Himalayan *Rhododendron* species. Recently, WWF, Arunachal Field Station and Enrock India are working on *in situ* conservation of the rhododendron rich areas in W. Kameng and Tawang districts of Arunachal Pradesh with the local people.

Ex situ conservation can be brought about by cultivating these species in gardens and parks under suitable climatic conditions in the region through seeds and vegetative cuttings or by *in vitro* tissue culture techniques. There should not be much difficulty in rehabilitating these species in botanic gardens and parks as most of these species have been successfully introduced and growing in Europe and America. Botanical Survey of India, Eastern Regional Centre, Shillong has taken up tissue culture of 8 *Rhododendron* species and successfully mass propagated. Hence, there is an urgent need for popularization and propagation of this magnificent group of plants, which has a great potential in floriculture in the hill stations of north-east India and for conservation.

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