*Pleione* 9(2): 283 - 288. 2015. **ISSN: 0973-9467**


# Gymnosperms of Northeast India: distribution and conservation status

**J. S. Khuraijam**[1] and **Rita Singh**[2]

[1]Botanic Garden, CSIR-National Botanical Research Institute, Rana Pratap Marg, Lucknow – 226 001, Uttar Pradesh, India
*E-mail*: jskhuraijam@yahoo.com
[2]*Corresponding author*: University School of Environment Management, GGS Indraprastha University, Sector 16C, Dwarka, New Delhi – 110 078, India
*E-mail*: rsinghipu@yahoo.co.in

[Received 30.04.2015; Revised 29.10.2015; Accepted 07.11.2015; Published 31.12.2015]

**Abstract**

Plant diversity in Northeast India comprises elements of Himalayan and Indo-Malayan region. Gymnosperms of the region also share distribution with adjacent regions especially the coniferous plants. Northeast India has highest diversity of gymnosperms in India. With 24 species, conifers are the most diverse group followed by Gnetales with 6 species. Cycads are represented by only one species. In the paper, a list of gymnospermous plants with their range of distribution and conservation status is given and threats to the species are discussed.

***Key words*:** Gymnosperms, Northeast India, distribution, threats, conservation status

## INTRODUCTION

Despite of the fact that the living gymnosperms are considerably less diverse than the angiosperms at species, genus, family and order levels, they are far more diverse at class level (Anderson *et al.* 2007). There are about 1026 species of living gymnosperms including ca 627 species of conifers, 331 species of cycads, 80 – 100 species of gnetophytes and one extant ginkgophyte (Rao 1994; Price 1996; Farjon 1998; Jones 2002; Pant 2002; Whitelock 2002; Anderson *et al.* 2007; Eckenwalder 2009; Osborne *et al.* 2012;). Of the 13 extant gymnosperm families nearly 50 % are monogeneric and had their diversity radiation in the Early Cretaceous or Early to Mid-Tertiary (Anderson *et al*. 2007). In India, there are seventy-five species of extant gymnosperms (Singh & Dash 2014). Northeast India which constitutes the elements of the Himalayan and Indo-Malayan region, has the highest diversity of gymnosperms in India. Taxonomic uncertainties coupled with misidentification at species level led to increase or decrease of number of species over a period of time. It needs urgent taxonomic recalculations of accepted names instead of counting synonyms as separate species thereby increasing the number of species names not the "species".

In the present paper, currently accepted names of gymnosperm taxa and their distribution in Northeast India are given (Table 1). The plant list will clarify the present confusion over the taxonomic positions of certain species and their distribution. The list can serve as base for future research of this group of plants of the region.

## Conifers:

Conifers are confined to the higher altitudes and most of the species are found in Arunachal Pradesh and Sikkim. Twenty-four species belonging to 5 families namely Cephalotaxaceae, Cupressaceae, Pinaceae, Podocarpaceae and Taxaceae are found in the north-eastern states of India (Table 1). The recently discovered *Amentotaxus assamica* D.K. Ferguson of Taxaceae, is an endangered taxon known only from Arunachal Pradesh within the altitudinal range of 1600 – 2000 m. *Pinus bhutanica* A. Grierson *et al*. is restricted to Tenga Valley in Arunachal Pradesh (Sahni 1990). The genus *Pinus* is widely distributed in the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, Sikkim, Himachal Pradesh, and Uttarakhand. All the seven species of *Pinus* found in India are known to occur in Eastern Himalaya and six of these occur in Arunachal Pradesh. *Pinus kesiya* Royle *ex* Gordon and *P. roxburghii* Sargent are widely cultivated by the forest departments in North-eastern states especially in Manipur to reclaim forest areas from shifting cultivation.

**Table 1**. Distribution of gymnosperms in Northeast India and their conservation status.

| Name | Family | Distribution | Conservation status |
|---|---|---|---|
| **Conifers** | | | |
| ***Abies delavayi*** Franch | Pinaceae | Arunachal Pradesh | Least Concern |
| ***Abies densa*** Griffith | Pinaceae | Arunachal Pradesh, Sikkim, West Bengal | Least Concern |
| ***Abies spectabilis*** (D. Don) Spach | Pinaceae | Arunachal Pradesh | Near Threatened |
| ***Amentotaxus assamica*** D.K Ferguson | Taxacaeae | Arunachal Pradesh | Endangered |
| ***Cephalotaxus mannii*** Hooker *f.* [Syn. *Cephalotaxus griffithii* Hooker *f.*] | Cephalotaxaceae | Assam, Meghalaya, Nagaland, Manipur | Vulnerable |
| ***Cupressus torulosa*** D. Don [Syn. *Cupressus corneyana* Knight & Perry *ex* Carrière] | Cupressaceae | Arunachal Pradesh, Sikkim | Least Concern |
| ***Juniperus recurva*** Buchanan-Hamilton *ex* D. Don | Cupressaceae | Assam, Sikkim, Arunachal Pradesh | Least Concern |
| ***Juniperus squamata*** Buchanan-Hamilton *ex* D. Don | Cupressaceae | Sikkim | Least Concern |
| ***Juniperus indica*** Bertoloni | Cupressaceae | Sikkim, Arunachal Pradesh | Least Concern |
| ***Juniperus wallichiana*** Hooker *f.* & Thomson *ex* E. Brandis | Cupressaceae | Eastern Himalayas | Least Concern |
| ***Larix griffithii*** Hooker *f.* | Pinaceae | Assam, Arunachal Pradesh, Sikkim | Least Concern |
| ***Nageia wallichiana*** (C. Presl) Kuntze [Syn. *Podocarpus wallichianus* C.Presl] | Podocarpaceae | Assam, Meghalaya | Least Concern |
| ***Picea spinulosa*** (Griffith) A. Henry | Pinaceae | Arunachal Pradesh, Sikkim | Least Concern |
| ***Picea brachytyla*** (Franchet) E. Pritzel | Pinaceae | Arunachal Pradesh | Vulnerable |
| ***Pinus armandii*** Franchet | Pinaceae | Arunachal Pradesh | Least Concern |
| ***Pinus bhutanica*** A.J.C. Grierson, D.G. Long & C.N. Page | Pinaceae | Arunachal Pradesh | Least Concern |
| ***Pinus kesiya*** Royle *ex* Gordon | Pinaceae | Assam, Meghalaya, Nagaland, Manipur | Least Concern |
| ***Pinus merkusii*** Jungh *et* de Vries | Pinaceae | Arunachal Pradesh | Vulnerable |
| ***Pinus roxburghii*** Sargent | Pinaceae | Arunachal Pradesh | Least Concern |
| ***Pinus wallichiana*** A.B. Jackson var. ***wallichiana*** | Pinaceae | Arunachal Pradesh, Sikkim | Least Concern |
| ***Pinus wallichiana*** var. ***parva*** K.C. Sahni | Pinaceae | Arunachal Pradesh | Least Concern |

| Name | Family | Distribution | Conservation status |
|---|---|---|---|
| ***Podocarpus neriifolius*** D. Don | Podocarpaceae | Sikkim, Meghalaya, Arunachal Pradesh | Least Concern |
| ***Taxus wallichiana*** Zuccarini [Syn. *Taxus baccata* subsp. *wallichiana* (Zuccarini) Pilger] | Taxaceae | Arunachal Pradesh, Meghalaya, Nagaland, Manipur | Endangered |
| ***Tsuga dumosa*** (D. Don) Eichler | Pinaceae | Arunachal Pradesh | Least Concern |
| **Cycads** | | | |
| ***Cycas pectinata*** Buchanan-Hamilton | Cycadaceae | Assam, Meghalaya, Manipur, Sikkim, West Bengal | Vulnerable |
| **Gnetales** | | | |
| ***Gnetum gnemon*** Linnaeus var. ***gnemon*** | Gnetaceae | Arunachal Pradesh, Assam, Meghalaya, Mizoram, Tripura | Least Concern |
| ***Gnetum gnemon*** var. ***brunonianum*** (Griffith) Markgraf | Gnetaceae | Arunachal Pradesh, Assam, Mizoram | Least Concern |
| ***Gnetum gnemon*** var. ***griffithii*** (Parlatore) Markgraf | Gnetaceae | Assam, Nagaland, Mizoram | Least Concern |
| ***Gnetum montanum*** Markgraf | Gnetaceae | Arunachal Pradesh, Assam, Nagaland, Manipur, Sikkim, West Bengal | Least Concern |
| ***Ephedra gerardiana*** var.***sikkimensis*** Stapf [Syn. *Ephedra saxatilis* var.*sikkimensis* (Stapf) Florin] | Ephedraceae | Sikkim | Data deficient |

## Cycads

Out of the 10 taxa of *Cycas* known in India, only one species *Cycas pectinata* Buchanan-Hamilton is found in Northeast India. At global level, it has one of the most widespread distributions ranging from Nepal, India, Bangladesh to Southeast Asian countries. In Northeast India, the species is found in Assam, Meghalaya, Manipur, Sikkim and West Bengal (Singh & Singh 2014). Deb (1958) reported *Cycas siamensis* Miquel from Manipur. During the field surveys by the authors in 2007 – 2014, the populations were found to be of *Cycas pectinata*. This species was reported from Tripura by Deb (1983) however during the explorations in the state, the authors couldn't locate the species in wild habitats (Singh & Singh 2014).

## Gnetales

Two genera *Gnetum* and *Ephedra* belonging to the order Gnetales are found in Northeast India. *Gnetum gnemon* Linnaeus and its taxonomically accepted two varieties are native to Northeast India and Southeast Asian countries. *Gnetum montanum* Markgraf grows in dense forest of Arunachal Pradesh, Assam, Nagaland, Manipur, Sikkim and West Bengal (Hajra *et al*. 1996; Bhatnagar & Moitra 2004; Das & Yadav 2011). *Gnetum gnemon* Linnaeus and *Gnetum montanum* Markgraf are important food sources in Nagaland (Ramakrishnan 2007). *Ephedra gerardiana* var. *sikkimensis* Stapf is endemic to northern Sikkim and is only species of *Ephedra* in Eastern Himalaya.

## Threats

All the species of gymnosperms in Northeast India are listed in one or the other categories of IUCN Redlist. These species are threatened in the wild mainly due to deforestation, land

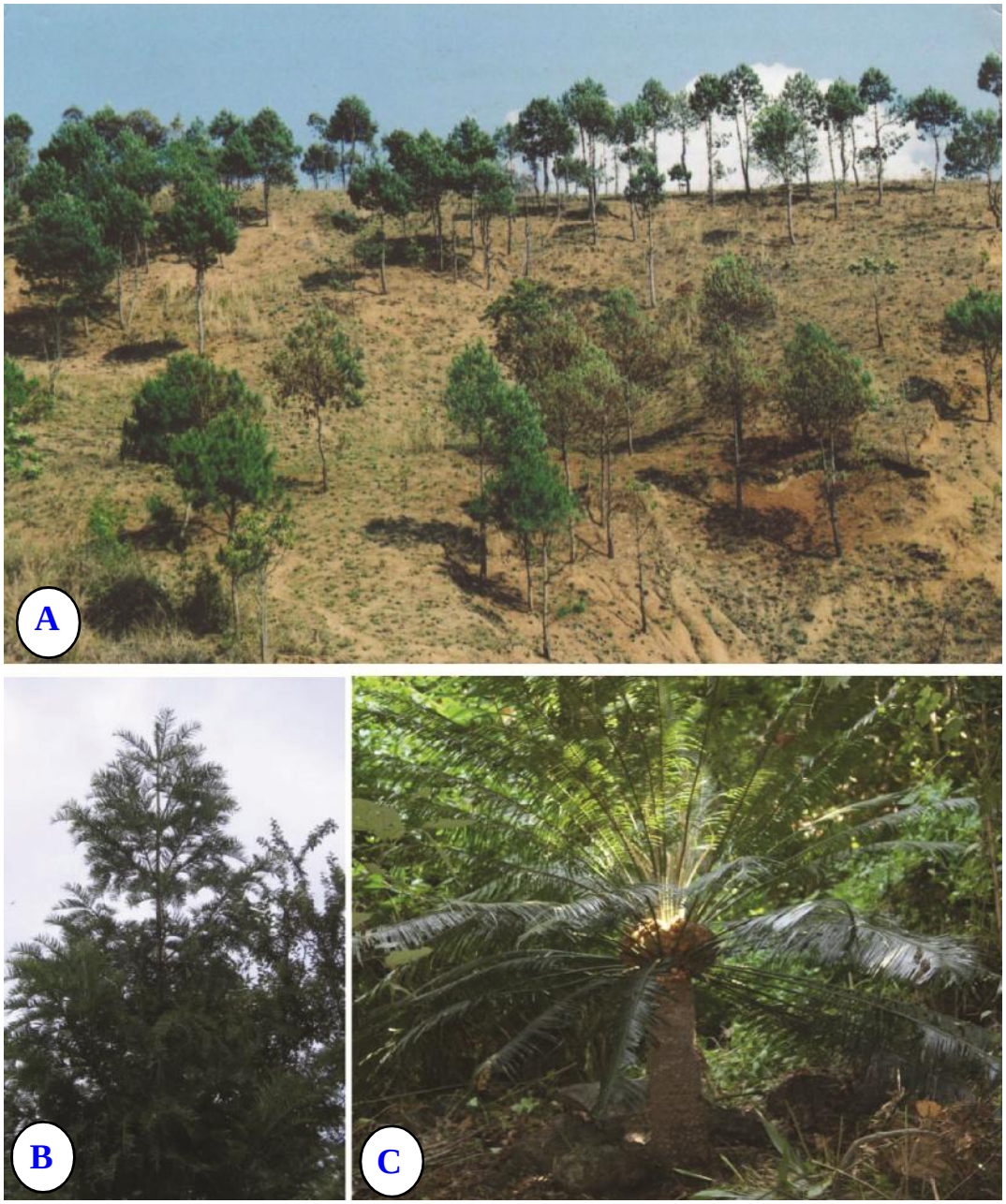


**PLATE – I**: **Fig. A.** An open forest of *Pinus kesiya* Royle *ex* Gordon; **Fig. B.** A young tree of *Taxus wallichiana* Zuccarini; **Fig. C.** A female plant of *Cycas pectinata* Buchanan-Hamilton

transformation and shifting cultivation which is a common practice in these states. Illegal logging of timber is one of the main threats to the coniferous species. *Pinus* species are widely used in furniture industry and as firewood. Populations of *Cycas pectinata* in Assam are the worst affected due to the habitat destruction and over harvesting for medicine, decoration and rituals (Singh & Singh 2014). Illegal trade of cones is widespread in the states of Assam, Meghalaya and Tripura with its origin from the Naogaon district in Assam

where the smugglers collect cones both male and female from Doboka Reserve Forest. Gnetales of Northeast India are the least studied group which is also affected by the forest destruction and collection of leafy-twigs and seeds for consumption as food.

## CONCLUSION

Gymnosperms though less diverse as compared to angiosperms, they covers the landscape of the temperate regions. With magnificent coniferous trees, the Himalayan region is major centre of diversity of the gymnosperms. Northeast India with two main landscapes – the Eastern Himalayas, and sub-Himalayan region is adobe for the gymnosperms. Coniferous plants are confined to the higher altitude, whereas cycads and gnetales are confined to warm tropical lower hills. Due to the prevailing threats to their habitats, these species are now facing severe threat to their survival in the region. Considering the similarities in landscapes and plant diversity, the state governments of the region should collaborate with the appropriate authorities to conserve these rare, endangered and threatened species.

## LITERATURE CITED

Anderson, J.M.; Anderson, H.M. & Cleal, C.J. 2007. *Brief History of the gymnosperms: classification, biodiversity, phytogeography and ecology. Strelitzia 20*. South African National Biodiversity Institute, Pretoria.

Bhatnagar, S.P. & Moitra S. 2004. *Gymnosperms*. New Age International (P) Ltd., Publishers, New Delhi.

Das, A.P. & Yadav, S.R. 2011. Distribution of *Gnetum montanum* Markgraf (Gnetaceae) in Terai and Duars of West Bengal, India. *Pleione* 5(1): 205 – 207.

Deb, D.B. 1958. Endemism and outside influence on the flora of Manipur. *J. Bombay Nat. Hist. Soc*. 55: 313 – 317.

Deb, D.B. 1983. *Flora* of*Tripura State*. Vol. 2. Today and Tomorrow Printer and Publisher, New Delhi.

Eckenwalder, J.E. 2009. *Conifers of the world: the complete reference*. Timber Press, Portland.

Farjon, A. 1998. *World checklist and bibliography of conifers.* Royal Botanic Garden, Kew.

Hajra, P.K.; Verma, D.M. & Giri, G.S. 1996. *Materials for the Flora of Arunachal Pradesh*: Volume 1. Flora of India (Series -2 ). Botanical Survey of India, Calcutta.

Jones, D.L. 2002. *Cycads of the world*. Smithsonian Institution Press, Washington DC.

Pant, D.D. 2002. *An Introduction to Gymnosperms, Cycas and Cycadales*. Birbal Sahni Institute of Palaeobotany, Lucknow, India.

Price, R.A. 1996. Systematics of the Gnetales: a review of morphological and molecular evidence. *Intl. J. Pl. Sc.* 157 (6, Suppl.): S40 – S49.

Osborne, R.; Calonje, M.A.; Hill, K.; Stanberg, L. & Stevenson, D. 2012. The World List of Cycads/La Lista Mundial de Cícadas, In Stevenson, D., Osborne, R. and Blake, A.S.T. (eds.) *Procd. 8th Intern. Conf. Cycad Biol.*, Panamá, Panamá, January 2-8, 2008, Memoirs of the New York Botanical Garden, 106: 480 – 508.

Rao, R.R. 1994. *Biodiversity in India (Floristic Aspects)*. Bishen Singh Mahendra Pal Singh, Dehra Dun.

Sahni, K.C. 1990. *Gymnosperms of India and adjacent countries*. Bishen Singh Mahendra Pal Singh, Dehra Dun.

Ramakrishan, P.S. 2007. Tribal man in the humid tropics. In Sengupta, N. (ed.) *Economic Studies of Indigenous and Traditional Knowledge*. Academic Foundation, New Delhi

Singh, K.J. & Singh, R. 2014. Population assessment and distribution of *Cycas pectinata* Buchanan-Hamilton in Northeast India. *Pleione* 8(1): 17 – 25.

Singh, P. & Dash, S.S. 2014. *Plant Discoveries 2013*. Botanical Survey of India, Kolkata

Whitelock, L.M. 2002. *The Cycads*. Timber Press, Portland.