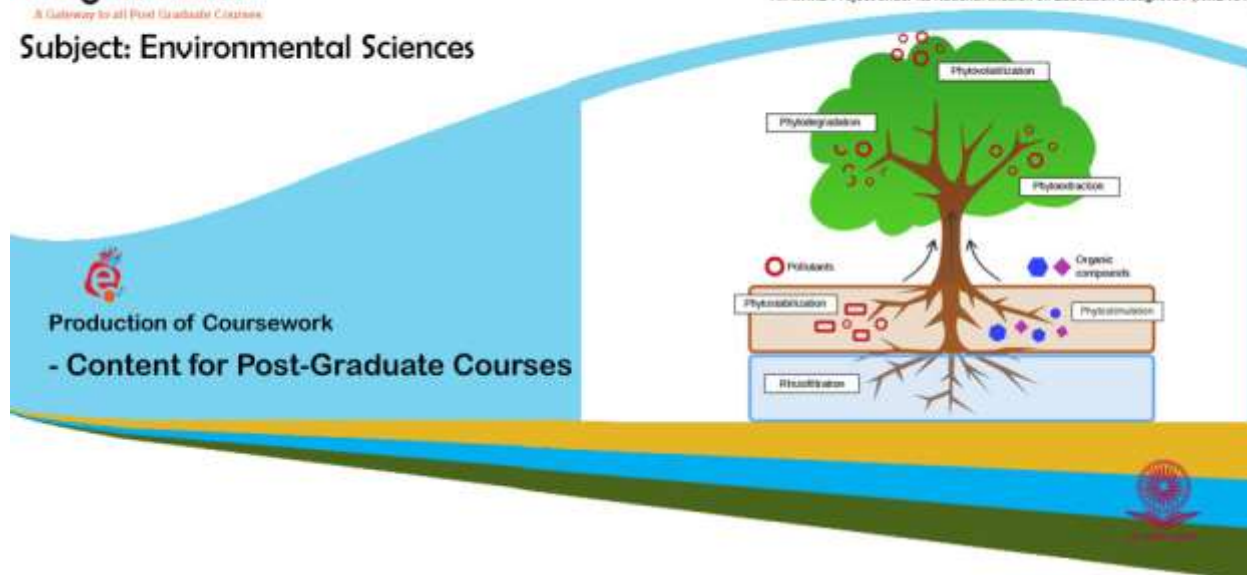


Subject: Environmental Sciences



Paper No: 03 Biodiversity and Conservation

Module 26: Endemic Species of India

Development Team

Principal Investigator & Co- Principal Investigator	Prof. R.K. Kohli Prof. V.K. Garg & Prof. Ashok Dhawan Central University of Punjab, Bathinda
Paper Coordinator	Prof. Daizy Batish Panjab University, Chandigarh
Content Writer	Prof. Daizy Batish Panjab University, Chandigarh
Content Reviewer	Dr. Sunil Mittal Central University of Punjab, Bathinda
Anchor Institute	 Central University of Punjab

Description of Module	
Subject Name	Environmental Sciences
Paper Name	Biodiversity and Conservation
Module Name/Title	Endemic Species of India
Module Id	EVS/BC-III/26
Pre-requisites	
Objectives	<p>In the module we will study about :</p> <ul style="list-style-type: none"> • Types of Endemism • Habitat for Endemics • Theories of endemism • Endemism in India • Endemic species of India
Keywords	Species distribution, Endemism ; endemic, Habitat for Endemics; Characters of endemism

Module 39: Endemic Species of India

Learning Objectives:

- Types of Endemism
- Habitat for Endemics
- Theories of endemism
- Endemism in India
- Endemic species of India

Introduction

The concept of endemism is central to the study of biogeography. The term 'endemism' was coined by **A.P. de Candolle (1855)** for the distribution of an organism (plant, animal or microorganism) in a limited geographical area. In Ecological terms, it states that a plant or an animal lives only in a particular location, such as a specific island, habitat type, nation or other defined zone. It is the association of a biological taxon with a unique and well-defined geographic area. The cosmopolitan distribution or cosmopolitan is the antithesis of endemic, and refers to a taxon which is extremely widespread in many world regions. For example, highest numbers of endemic taxa are found in Australian region. All important islands and mountain chains (except isolated piece of the country like Italy) from 48° N to South wards possess endemics. Maximum proportion of endemism is found in West Australia and South African regions. All the southern land masses have great number of species confined to themselves i.e. endemism is higher in old landmasses than in young e. g. land of northern hemisphere, which are covered by the Pleistocene ice sheets have lower number of endemics.

Types of Endemism

Two general classes of endemism are widely recognized: **Paleoendemism** and **Neoendemism**.

- a) *Paleoendemic species*: Paleoendemics means "ancient endemics" these are the organisms (animals or plants) that are restricted to an area because they have died out

elsewhere. A fossil record elsewhere is the best evidence for paleoendemism (e.g., in *Sequoia*, *Sequoiadendron*, *Lyonothamnus*). These are also described as those species which used to live in a large area in the past, but now live only in a smaller area. These species are often systematically isolated taxa, whose distribution areas represent the remnants of originally larger distribution ranges that have been reduced due to environmental changes. For example, species A is widely distributed throughout the whole mountain range. Any change occurring in the environmental conditions of the region, leads to a reduction of the distribution of species A. Species A does not extinct entirely; it survives in a small area at the periphery of its former distribution range. Now, species A is a known as paleoendemic species of that area.

- b) *Neoendemic species*: Neoendemism means that a species has recently appeared which is closely related to the main species or one that has formed following hybridization and is now classified as a separate species. This is a common process in plants especially those which exhibit polyploidy. These species result from the divergent adaptation to differing environmental conditions, thereby, leading to the formation of new species that are locally distributed. The evolution of neoendemic plant species is often triggered by polyploids. The endemic species may have a higher ploidy level than its related taxa (apoendemics), or it may be diploid while its related taxa have a higher ploidy level (patroendemics). In cases where the endemic taxon and its related taxa are of equal ploidy level, the endemic species are called schizoendemics. Apo-, patro-, and schizoendemics are further subdivisions of neoendemic. For example, species B immigrates to an area and colonizes the upper region of mountain chain. As a result, the population of species B gets separated and the two subpopulations are isolated from each other. Since the environmental conditions of the two subpopulations are not identical they show different adaptations. The divergent evolution in the subpopulation

may lead to the formation of new species or subspecies that are locally distributed and are called as neoendemic species.

Habitat for Endemics

The biological organisms have different patterns of distribution where they live on the globe. The territory where a species lives is called its distribution, it describes that where in the world that species naturally occurs. Therefore, based on their habitat of distribution on entire globe species can be cosmopolitan, endemic or disjunct (**Figure 1**). For example, the distribution of polar bears restricted to Arctic region and lemurs occur naturally only in the Island of Madagascar region is consider as the endemic species of that particular region. Another example of endemic species is Bay checkerspot butterfly i.e. *Euphydryas editha bayensis* occurring in only one region in the San Francisco Bay area. In contrast to this, brown rats (i.e. *Rattus norvegicus*), occurring everywhere, are considered as cosmopolitan species.

Characters of endemism

They are localized in distribution because of their narrow ecological amplitude and are unable to invade in fresh areas. They lack potentially to migrate because of saturate genomes. Real endemics never migrate while Neo-endemics have the potential to migrate. The dispersal propagules are not able to sustain during migration to other area. It may be due to physical barriers.

Theories of endemism

There are two main theories of Endemism.

The first theory believes that the last survivors of once flourishing flora which is now declining are the relics or epibiotics which are endemics.

However, second theory believes that these are recent and youthful forms in course of gradual extinction. According to Willis age-and-area hypothesis, most endemic species are considered to be youthful i.e. youngsters rather old relic. The concept of endemism includes two types of

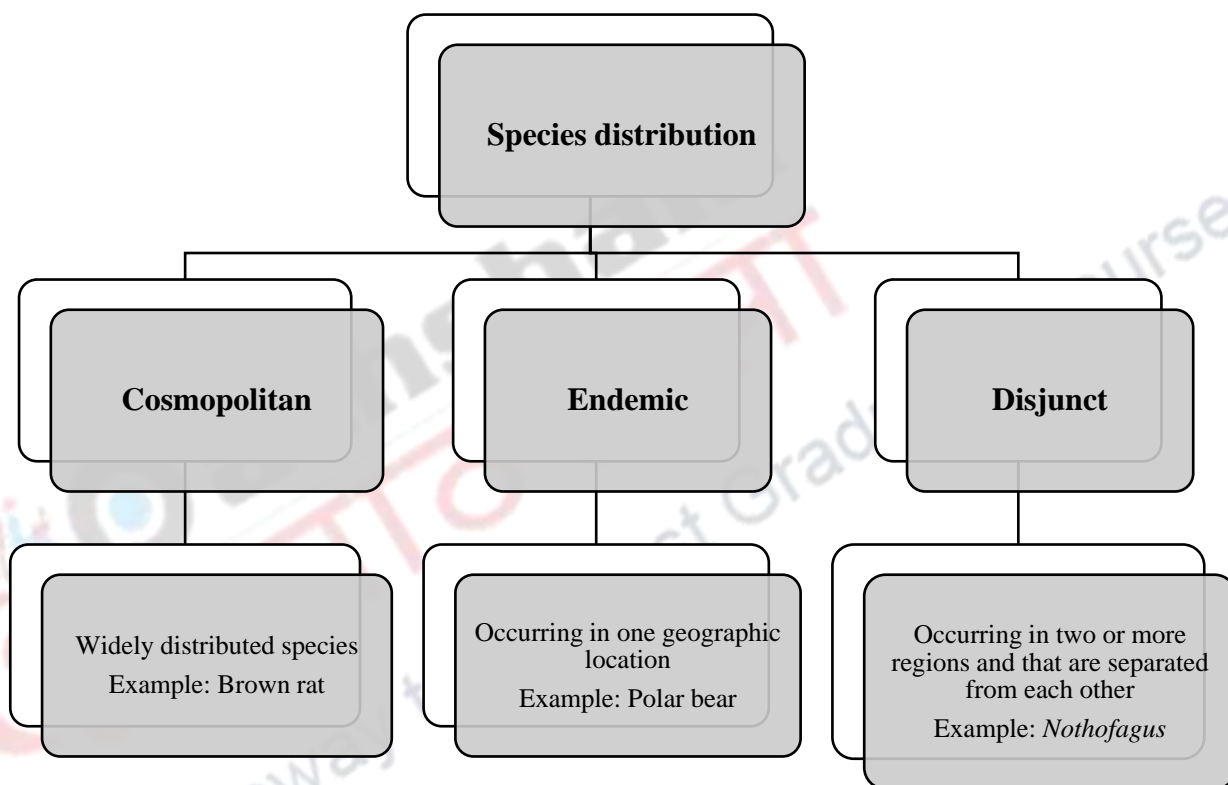


Figure 1: Based on species distributional range of species they can be categorized into various types.

organisms whose areas are confined to a single regions: endemics (which are relatively youthful species), and epibiotics (which are relatively old relic species). The theory is also known as Age and Area hypothesis. The first theory is supported by Geographers e.g., *Sequoia semipenirens* of the central Valley of California and Oregon and *S. gigantea* of Sierra Nevada which are endemic to their respective native homes, were extensively distributed in Cretaceous

and Tertiary periods. The supporters of second theory have the examples of *Primula*, *Impatiens* and *Rhododendron* etc. According to this theory, Area is directly proportional to its age in the scale of evolution. So, a small area of distribution shows relatively young in age e.g., *Coleus* is distributed on the summit of the dry Ritigala mountains in Sri Lanka, with two species *C. elongatus* and *C. barbatus*. *C. elongatus* is endemic and *C. barbatus* is widely distributed in tropical Asia and Africa. Willis believed *C. elongatus* to be derived from *C. barbatus*.

Factors Responsible for Endemism

Factors responsible for the production of endemics are natural crossing among the closely related plants growing under favorable conditions and Mutations. If the condition of isolation is developed the effect becomes more pronounced.

- Endemism is found in isolated e.g., islands, isolated areas etc. Mountains also have more endemic species as they are isolated e.g., 70% sp. of Himalayas is endemic.
- Climate also is one of the factors e.g., North of Himalaya is dry plateau of Tibet and South Himalayan range has alluvial fertile soil. According to Chatterjee the percentage of endemic species of Dicot plants in India is more than 50. Maximum endemic plants are found in the Himalayas and South India. Indo-Gangetic plains have a very small number of endemic species.

Stebbins, (1942) has given a genetic explanation for the endemic. He told that such taxa have depleted their store of genetic variation (biotype depletion) and they are unable to expand their range.

There are multiple causes of rarity and endemism. Three primary factors describe the distribution of endemics:

- Geographical area
- Ecological role of species
- Isolation

Stebbins (1980) has given the gene pool/ niche interaction theory to explain origin of rarity and endemism. “According to theory, the primary cause of localized or endemic distribution patterns is adaptation to a combination of ecological factors that are themselves localized. Factors of soil texture and chemical composition are the most important but by no means the only ones. Next to the climatic and edaphic factors, those inherent into the gene pool of the population are of critical importance. They include the total amount of variability, the amount of variability that can be released at any one time, and the amount of variation that can be generated with respect to those particular characteristic that affect most strongly the establishment of new population”

Endemism in India

India is a tropical country, that is one of the mega-diversity centres, with only 2.4% of the world's land area, accounts for 7-8% of all recorded species, including over 45,000 species of plants and 91,000 species of animals. It is situated at the tri-junction of the Afrotropical, Indo-Malayan and Palaeartic realms, all of which support rich biodiversity. Being one of the 17 identified megadiverse countries; India has 10 biogeographic zones and is home to 8.58% of the mammalian species documented so far, with the corresponding figures for avian species being 13.66%, for reptiles 7.91%, for amphibians 4.66%, for fishes 11.72% and for plants 11.80%. Four of the 34 globally identified biodiversity hotspots, namely the Himalaya, Indo-Burma, the Western Ghats-Sri Lanka and Sundaland, are represented in India. The diverse physical features and climatic conditions have resulted in a variety of ecosystems such as forests, grasslands, wetlands, and desert, coastal and marine ecosystems which harbour and sustain high biodiversity and contribute to human well-being. In India, there are following four mega endemic centres:

1. Indo-Burma covering Mizoram, Manipur, Nagaland, Meghalaya, Tripura and Andaman Islands

2. Himalaya covering Jammu & Kashmir, Himachal Pradesh, Uttarakhand, northern part of West Bengal (Darjeeling), Sikkim, northern part of Assam and Arunachal Pradesh.
3. Western Ghats falls within the states of Tamil Nadu, Kerala, Karnataka, Goa, Maharashtra and Gujarat.
4. The Sundaland covering the Nicobar Islands.

Peninsular India is the richest endemic centre. It harbors nearly 82% of the total endemic genera of the country. Peninsular India has a high concentration of endemic genera (40 genera). There is no endemic family in India. There are only 49 genera endemic to India, of which 36 are unspecific. Hill tops provide a good environment for endemism next to islands. The species richness and high endemism in the Western Ghats is due to varied latitudinal and altitudinal gradients with varied rainfall and temperature. India has large number of endemic species.

Endemic: The term “endemic” is used to denote a species, genus or other group confined to a small area like Single Island, a group of islands, a mountain chain or a comparatively small country like South Africa or West Australia, largely bounded by sea or by a marked alteration of climate.

Endemic species (ES): An “Endemic Species” is one that is only found in a particular region and nowhere else in the world. Since these species are not widespread and may be confined to only one or two protected areas, they are of great conservation concern.

A plant may be said to endemic to a certain state, to a country or to a continent. Although, there is no country or islands that have all its species endemic, yet it is very common to find genera with all their species endemic

Endemic species of India

The numbers of endemic plant under different plant groups mentioned in the fifth report of convention of Biological Diversity (CBD) 2014 reported by Botanical survey of India are given

in **Table 1**. According to this report data, nearly about 4045 species of flowering plants (angiosperms) endemic to India are distributed amongst 141 genera belonging to 47 families. These are concentrated in the floristically rich areas of North-east India, the Western Ghats, the North-west Himalaya and the Andaman and Nicobar Islands. Some examples of endemic plant species of India are *Rhododendron* sp. (Ericaceae), *Beaumontia grandiflora* (Apocynaceae), *Eleusine coracana* (Poaceae), *Caryota urens* (Arecaceae), *Aegle marmelos* (Rutaceae), *Crotolaria juncea* (Fabaceae), *Ficus religiosa* (Moraceae), and *Seasamum indicum* (Pedaliaceae) and other plant species belong to families like Rubiaceae (6 genera), Rosaceae, Asteraceae, Primulaceae and Acanthaceae etc. Some examples of the endemic animal species found in India are Lion-tailed macaque, Nilgiri Langur, Brown palm civet and Nilgiri tahr.

Table 1: Endemism in different plant groups of India

S.No.	Plant Group	Total no of species in India	Number of Endemic species	Percentage (%)
1.	Angiosperms	17, 926	4, 045	22.57
2.	Gymnosperms	74	8	10.81
3.	Pteridophytes	1, 267	196	15.47
4.	Bryophytes	2, 504	642	25.64
5.	Algae	7, 244	1, 949	26.91

Source: BSI (2013)

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