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Plant Diversity In India - Role In Economic Development : A Report

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Abstract - India has a total geographical area of about 329 million hectares with a coastline of over 7500 km. The ecological or ecosystem diversity of the country is enormous, ranging from sea level to the highest mountainous ranges in the world; hot and arid conditions in the northwest to cold arid conditions in the trans-Himalayan region; tropical wet evergreen forests in Northeast India and the Western Ghats; mangroves of Sundarbans and fresh water aquatic to marine ecosystems.

Keywords : Plant Diversity, Gymnosperms, Pteridophytes, Lichens, Fungi, Algae.

I. INTRODUCTION

To our present day knowledge over 47500 species of plants belonging to various groups have been documented from India. The angiosperms forms the most dominant and conspicuous vegetation cover comprising of over 18,000 species which represents more than 11.4% of the world's known flowering plant species. Out of the 511 recognized plant families 315 families with more than 4000 genera are represented in the Indian flora of which Poaceae is the largest family with about 260 genera and more than 1200 species. Over 60 families of flowering plants are monotypic represented by just one species in India like Turneraceae, Illiciaceae, Ruppiaceae, Tetracentraceae, etc. Impatiens, Carex, Dendrobium, Habenaria, Rhododendron, Taraxacum, Astragalus, Saussurea, Ficus, Primula, etc. are some of the dominant genera of flowering plants. About 15% species of Vascular plants are of trees which include some of the highly valued timber species of the world.

Species in certain groups like Orchids, Bamboos, Rhododendrons, Citrus, Hedychiums, Impatiens, Pedicularis, Primulas, etc. exhibit remarkable diversity in this country. The Indian Flora also shows rich diversity in aquatic flowering plants. Some important families of aquatic plants are Alismataceae (8 species), Aponogetonaceae (6 species), Azollaceae (1 species), Barclayaceae (2 species), Butomaceae (1 species), Cabombaceae (2 species), Callitrichaceae (3 species), Isoetaceae (10 species), Najadaceae (7 species), Nelumbonaceae (1 species), Nymphaeaceae (7 species), Podostemaceae (24 species), Pontederiaceae (13 species), Ceratophyllaceae (3 species), Hydrocharitaceae (13 species), Potamogetonaceae (6 species), Ruppiaceae (1 species), Salviniaceae (3 species), Trapaceae (2 species), Typhaceae (4 species), Zannichelliaceae (1 species), etc. The species of the families Podostemaceae and Tristichaceae grow on under water rocks in fast flowing streams. The ten families. which have genera with large number of species are Balsaminaceae (Impatiens 200 species), Fabaceae (Crotalaria 104 species), Scrophulariaceae (Pedicularis 98 species), Ericaceae (Rhododendron 97 species), Primulaceae (Primula 135 species), Myrtaceae (Syzygium 91 species) Moraceae (Ficus 100 species) Saxifragaceae (Saxifraga 89 species) and Piperaceae (Piper 88 species). Diversity of largest interesting economic families are : Poaceae: Poaceae is represented 1291 species and 263 genera in India. About 105 genera of Indian grasses are represented by one species only. The genus Poa (55 species) has the maximum number of species. Other genera with 25 or more species are Ischaemum (46 species), Dimeria (35 species), Panicum (34 species), Isachne (30 species), Eragrostis (30 species), Festuca (27 species), Stipa (25 species) and Digitaria (25 species). Maximum degree of species diversity of grasses is found in peninsular India with more than 50 per cent of the Indian total. In this area Tamil Nadu alone has about 460 species. The North-east India is another grass rich area with about 480 species. Orchidaceae: On account of varied topographical, ecological and climatic conditions; family Orchidaceae exhibit enormous species diversity in India. Al most all the habitats a variety of orchids are found. Maximum diversity found in tropical and subtropical forests. According to the present estimate, based on literature survey and herbarium records, about 1229 species belonging to 177 genera of orchids are recorded from India. The species diversity at generic level is equally interesting. Genus Bulbophyllum shows maximum diversity and is represented by 105 species. It is followed by Dendrobium (103 spp.), Habenaria (71 spp.), Eria (54 spp.), Oberonia (52 spp.), Liparis (43 spp.), Coelogyne (38 spp.), Eulophia (29 spp.), , Peristylus (27 spp.), Cymbidium (25 spp.), Calanthe (25 spp.), etc.

A region wise analysis of genera and species of family Orchidaceae shows that, the eastern Himalayan region

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comprises of 870 species distributed in 159 genera, while in the western Himalayan region it is only 288 species under 75 genera. The peninsular India comprises 379 species belonging to 89 species. A total of 115 species belonging to 53 genera are recorded from Andaman & Nicobar islands. About 18 genera of Indian orchids are identified as monotypic. Arundina graminifolia distributed throughout the country is one of the most common monotypic orchid. Acrochaene, Aenhenrya, Anthogonium, Bulleya, Cephalantheropsis. Dickasonia, Eriodes, Herpysma, Hygrochilus, India, Jejosephia, Neogyna, Ornithochilus, Risleya, and Stereosandra are some other monotypic genera found in eastern Himalaya. Fabaceae (Leguminosae): Leguminosae is the third largest family of flowering plant with over 19,400 species under 730 genera. The family with 179 genera and 1242 species is the second largest family of flowering plants in India. The family is divided in to three sub-families, Papilionoideae(Faboideae), Mimosoideae and Caesalpinioideae. Of the three subfamilies, Mimosoideae comprises about 23 genera and 173 species distributed mainly on the peninsular region, Western Ghats and in N.E. India, apart from a few cultivated in gardens.

The subfamily Caesalpinioideae is represented by 35 genera and 175 species; while Papilionoideae (Faboideae) is represented by 140 genera and 894 species (Sanjappa 1995). The species of Papilionoideae are distributed in varied biogeography zones from tropic to Alpine region and the subfamily Caesalpinioideae restricted up to the temperate region. In the commercial point of view the species is next to Orchidaceae and Poaceae. Asteraceae : The family Asteraceae represents fourth largest flowering family in India. Hajra el al., (1995a, 1995b) published a detailed, revised taxonomic account of the family in India comprising 892 species, 37 subspecies, 123 varieties and 13 forma in 177 genera, 12 tribes and 17 sub tribes.

Maximum diversity of the family found in the western with 550 species followed by the Eaststern Himalaya (including the N.E. region) with over 350 species, Western Ghats with about 250 species. and Andaman & Nicobar Islands, with just 25 species. It is interesting to note that 60 out of 61 species of Saussurea are also confined to Himalayan region alone while all the Indian species in genera Tanacetum, Taraxacum and Waldheimia are also confined Himalaya only. Out of 177 genera found in India, 80 genera are represented by single species, while 19 genera are monotypic. Rubiaceae: The family Rubiacae is most tropical, woody family distributed predominantly in the tropical, subtropical region of our country. The family is represented by 579 species, under 112 genera, 28 tribes and 4 subfamilies. Various economical genera of family are Coffea (Coffee), Cinchona (Quinine), Rubia (Madder), Cephaelis (ipecac) etc. The genus Hedyotis with 68 species is the largest genus followed by Ophiorhiza (47), Psychotria (44) etc.

II. GYMNOSPERMS

The gymnosperms represent the most primitive type of seed plants. Though lesser in number as compared to other groups, but are equally important providing timber, wood, pulp, resins, tars, turpentines, etc. In India the group is represented by 144 species and 8 varieties belonging to 12 families and 46 genera. Including about 26 species of exotics which are introduced in various India gardens. Family Pinaceae (7 genera and 42 taxa) is the largest family followed by Cupressaceae (11/28), Ephedraceae (1/12) and Gnetaceae (1/10). The dominant genera are Ephedra (8 spp.). The dominant genera are Ephedra, Pinus, Juniperus and Gnetum. Abies tpectabilis, Cupressus torulosa, Taxus wallichiana, Pinns wallichiana ind P. roxburghii are widely distributed in the Himalayas while Cedrus Jendara, Picea smithiana, Abies pindrow are confined to Western Himalaya ind Abies densa and Larix griffithiana to the Eastern Himalaya. Many species like Pinus gerardiana (WH), P. kesiya (EH), P. merkusii (EH), P blmtanica (EH), Cephalotaxus manii (EH) have very restricted and localized distribution in the respective Himalayan zones. Amentotaxus assamica and Pinus wallichiana var. parva are endemic to Arunachal Pradesh while Cycas beddomei, Cycas sphaerica, Gnetum contractum, Gnetum latifolium var. macrocarpum, are endemic Andhra Pradesh (Cuddapah district), Orissa (Puri & Angul), Kerala & Tamilnadu(Nilgiri), and Andaman & Nicobar Islands respectively. Most species of Gnetum are woody climbers/lianas and along with Cycas are mostly confined to North eastern India, Eastern & Western Ghats and Andaman islands. Juniperus species grow near timberline. Abies spectabilis has been found growing at an altitude of 5350 m in Kashmir, probably the highest limit for any tree species. Pinus gerardiana (seeds) and Gnetum gnemon (leaves and strobili) have edible value while Ephedra spp. (Ephedrine) and Taxus wallichiana (Taxol) are known for their medicinal value.

III. PTERIDOPHYTES

The Pteridophytes (fern and fern-allies) represented by over 1200 taxa under 204 genera grow in all climatic zones of the country. They grow in a variety of habitats and show range from epiphytes like species of genera Arthomeris, Belvisia, Microsorium, Lycopodium Polypodium, Oleandra, Drynaria, Asplenium, Lepisorus, Vittaria,etc. to terrestrial like species of genera Cyathea, Alsophila, Angiopteris Osmunda, Equisetum, Lycopodium, Pteris, Pteridium, Polystichum, Athyrium etc. and aquatic like species of Marsilea, Azolla and Salvinia. Though the pteridophytes in general prefer shady and moist places but a few species like Woodsia elongata, Actmopteris radiata survive in dry places. Acrostichum speciosum and A. aurexum grow in mangrove forests. Lygodium flexuosum and Microsorium normale are climbers. Some species of Vittaria, Lepisorus and Asplenium prefer tree tops. Tree

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ferns like Cyathea spinulosa and C. gigantea adorn the tropical forests. The North eastern India including Eastern Himalaya is the richest region representing 2/3rd of the known Pteridophytes from India, i.e. ca 845 taxa under 179 genera followed by South India including Eastern and Western Ghats with 345 taxa under 117 genera and North India including Western Himalaya with 340 taxa under 101 genera. The families like Polypodiaceae (ca 137 spp.), Dryopteridaceae (ca 125 spp.), Athyraceae (ca 97 spp) Thelypteridaceae (ca 83 spp.), Selaginellaceae (ca 62 spp.) and genera like Selaginella (ca 62 spp.), Pteris (ca 62), Dryopteris (ca 53 spp) Asplenium (ca 45 spp.) and Polystichum (ca 45 spp.) are the dominant families and genera in the Indian Pteridophytic flora. About 17% of the species are endemic to India. Some species of Diplazium, Dryopteris and Marsilea are eaten. Similarly, Adiantum capillus-veneris, Selaginella bryopteris and species of Lycopodium, Polystichum and Marsilea are well known for high medicinal properties in India.

IV. LICHENS

The Lichens being represented by 2280 species and 239 infraspecific taxa (ca 13,500 in the world) under 299 genera and 74 families, (Sinha, 2009) also constitute an interesting component of Indian flora, occur on various substrata in tropical, subtropical, temperate and alpine regions of India. Out of these, about 508 species (22.2 %) are endemic. Most of them are neoendemics belonging to crustose forms, described mostly from Western Ghats and Andaman and Nicobar Islands. An analysis of species diversity at family level indicates that foliose Parmeliaceae shows maximum diversity with 345 species and widely distributed in subtropical, temperate and alpine regions of India. It is followed by crustose family Graphidaceae with 269 species, mostly distributed in tropical and subtropical regions. The other dominant families are Thelotrematacеae (130 spp.); Pyrenulaceae (116 spp.); Caliciaceae (103 spp.); Lecanoraceae (98 spp.) Physciaceae (97 spp.); Trypetheliaceae (78 spp.); Teloschistaceae (75 spp.) and Collemataceae (67 spp.), Similarly at generic level, genus Graphis shows maximum diversity and represented by 111 species in tropical and subtropical regions of India. The next genus with 84 species is Pyrenula which is also distributed in tropical regions of the country. The other dominath genus that are found in India are Pyrenula (84 spp.); Lecanora (83 spp.); Caloplaca (65 spp.); Usnea (60 spp.); Porina (60 spp.); Cladonia (58 spp.); Parmotrema (51 spp.); Pertusaria 50 spp.); Thelotrema (44 spp.).

V. FUNGI

Fungi include the majority of non-flowering plants and constitute a group of heterotrophic organisms subsisting as parasites or as saprophytes on other organisms or their residues. They span the world and are as numerous and varied as flowering plants. Fungi range from microscopic organisms to huge solid bodies; from life savers like penicillin to killers such as ergot; from rusts and mildews which damage growing crops to yeasts which have been used since time immemorial in the preparation of food and drink. As per our present state of our knowledge, about 14756 species are recorded from India under 45 classes, 120 order, 345 families and 2660 genera (Sharma 2011). Out of the total number known from India, ca. 3,500 species are endemic. Deuteromycotina (Fungi Imperfecti) together with Ascomycotina and Basidiomycotina account for more than 88% of the Indian mycoflora. Deuteromycotina, alone represents ca 40% followed by Ascomycotina (ca .25%) and Basidiomycotina (ca 23%). It is interesting to note that out of ca. 2660 genera of Indian fungi, ca. 1197 (46%) have only one species, while ca 1275 (48%) genera have two to ten species.

The number of described/recorded species from India appears to be an underestimate keeping in mind the vastness of the country and a great variety of substrate and environmental conditions present. Another fascinating group of fungi is Aphyllophoraceous fungi which constitute a cosmopolitan group, fruiting mostly on dead woods and wood products throughout the world under different environmental conditions. The sufficient substratum provided both by angiosperm and coniferous tree species and coupled with a great diversity in ecological habitats provide rich environmental conditions for the growth of these fungi in the Himalayan forests from tropical to alpine zones. The forests in Western Himalaya (Jammu & Kashmir, Himachal Pradesh and Garhwal and Kumaon regions of Uttarakhand); Eastern Himalaya (Arunachal Pradesh, Assam and Meghalaya) and Sikkim Himalaya (Sikkim and Darjeeling district of West Bengal) occupy a climatic zone with pronounced variations in seasonal temperature. Due to greater diversity in woody tree species and more precipitation, eastern Himalayan forests have richer aphyllophoraceous mycoflora than western Himalaya.

A total of 681 aphyllophoraceous fungi (676 species and 5 varieties) belonging to 188 genera and 26 families have been recorded from India. In terms of genera family Polyporaceae (68) is followed by Corticiaceae (48) and Hymenochaetaceae (9) whereas in terms of species Polyporaceae (c 213) and Corticiaceae (c 138) are followed by Hymenochaetaceae (96), Thelephoraceae (38), Clavariaceae (28) and Stereaceae (19). Out of the total 188 genera found in this zone, c 60 genera (37%) have only one species, 114 genera (60%) have two to nine species, while 12 genera (3%) have ten or more species each. Phellinus with about 52 species is the largest and widely distributed genus in Himalaya followed by Ramaria (26), Trametes (19), Tomentella (18), Inonotus (17), Hyphodontia (14), Polyporus (13), Phlebia (12), Antrodia (11), Hyphoderma (11), Ganoderma (10), Hymenochaete (9) and Oligoporus (9).

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VI. ALGAE

Algae are a highly diversified group of green plants standing near the lowest rung of the ladder of evolution of life with enormous economic implications, not only as primary producers and pollution indicators but also as a source of several natural products, biofertilizers and fine chemicals. Algae occurs even in wide range of habitat and have been distributed all over land and water system and are adopted to extreme environment conditions with respect to different environmental factors, availability of nutrients, etc. They occur in fresh water ecosystems like lakes, ponds, rivers, wetland etc. and marine water system like salt marches etc. The Chlorophyceae are represented by 328 genera, 2592 species, 817 variety 336 forma; Xanthophyceae are represented by 25 genera, 66 species 3 variety 2 forma; Chrysophyceae 25 genera, 82 species 9 variety 2 forma; while Euglenophyceae21 genera, 384 species, 117 variety, 15 forma in India (Gupta 2012). While the Cyanoprokaryota are represented by 90 genera and 1,232 species (includes 939 species, 207 varieties and 86 forms) under 18 families in India (Gupta, 2012).

The fresh water algae, dominated by Chlorophyceae (green algae), Bacillariophyceae (diatoms) and Cyanophyceae (blue green algae) represent the major portion of Indian algae. The genera Spirogyra, Nitella, Volvox, Anacystis, Zygnema, Mougeotia, etc. are dominant and well known. Over 70 species of the Indian stoneworts belong to genera Chora, Tolypella, Nitellopsis, etc. Oscillatoria, Lyngbya, Phormidium are dominant genera of blue green algae. Species of genera Nostoc and Anabaena are common in Indian rice fields.

The marine algae (seaweeds) known for their varied colours, are an attractive group of plants found growing on the ocean floors and the long stretches of Indian sea coasts. A total of ca 856 species described from Indian coasts. Out of ca 680 species, so far recorded, ca 50% belong to Rhodophyceae (red algae), ca 25% to Chlorophyceae (green algae), ca 22% to Phaeophyceae (brown algae) and ca 3% to Cyanophyceae (blue green algae). The Gujarat coast, the islands stretches in Gulf of Mannar and Andaman and Nicobar group of islands are of special interest and excel other areas for luxuriance, variety and abundance of marine algae. In India, over 45 species of marine algae are useful mainly as source of Agar-Agar (species of Gelidium, Gelidiella and Gracilaria); and Algin (species of Sargassum, Turbinaria, Dictyota, Padina, etc.). Some species are also useful as food (species of Ulva, Enteromorpha, Turbinaria, Gracilaria and Porphyrd); as fodder (species of Dictyota, Padina, Sargassum, etc.) and manure (all sea weeds in coastal areas).

VII. CONCLUSION

The diversity of plant life exists for many reasons - a key factor being adaptive changes which allow different species to thrive in the many varied environments of the world.

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