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Research Article

ANALYSIS OF VEGETATION AND FLORAL DIVERSITY OF NIMAR REGION, MADHYA PRADESH, INDIA

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ABSTRACT
The Nimar region is situated in southern western part of Madhya Pradesh and covering four districts namely West Nimar (Khargone), Barwani, East Nimar (Khandwa) and Burhanpur. Northern part of Nimar region is covered with Vindhyan scabs and Southern part with Satpura hill ranges. Present study records a total of 1039 plants species which are distributed in 595 genera and 124 families. Different life forms diversity is Herbs (704), Shrubs (122), Trees (139), and Climbers (74) and represented 67 % of herbaceous elements of total flora. Therophytic vegetation is dominant.

Keywords: *Floristic Diversity, Life Form Diversity, Nimar Region, Therophytic Vegetation*

INTRODUCTION
The biodiversity found on earth today consisting of many millions of distinct biological species which is the product of nearly 3.5 billion years of evolution. During this past 3.5 billion years, a wide variety of plants came into existence, flourished and then vanished due to various reasons. India is twelfth mega biodiversity nation in the world and has the richest floristic diversity and harbors 17000 flowering plants. Himalaya and Western Ghat is the two hottest hotspot in India. Knowledge of forest structure and floristic are necessary for the study of forest dynamics, plant animal interactions and nutrient cycling (Reddy and Pattnaik, 2009). It is therefore necessary to have proper knowledge regarding the various species of plants inhibitating of any particular area at that particular time period (Joshi *et al.*, 2004). The vegetation and flora of Nimar region is rich and diverse. Nimar region is situated in the south western part of Madhya Pradesh lying between 21^0 -05'N Latitude and 74^0 – 25' to76^0-14'E Longitude. Politically there are four districts covering the Nimar region mainly West Nimar (Khargone), Barwani, East Nimar (Khandwa) and Burhanpur. Topographically Nimar region is situated centrally in Northern part covered with Vindhyan scabs and in Southern part with Satpura hill ranges. The Satpura in East Nimar bifurcates into two parallel ridges on either side of Tapti Valley. The northern part of Satpura extends up to eastern part of Harsud and more or less along the boundary between Khandwa and Burhanpur. On the highest peak, about 800 ft (244 m) above the plain and 1800 ft (549 m) above sea-level, stands the fortress of Asirgarh.
The whole area occupied by black cotton soil. In general the area is arid and dry. In winter season temperature ranges from 9^0 - 27^0 C and in summer 35^0 – 48^0 C. The average rainfall of the area varies between 83-1100 mm. Nimar region falls under tropical dry deciduous forest (Champion and Seth 1968).Major part of Barwah, Khargone and Khandwa occurs in Narmada Valley (Ray and Sainkhediya 2012). The area is drained by the Narmada, Tapti, Kunda, Deba, Veda, Abna, Gohan, Chota Tava and Machak (Sainkhediya and Ray 2012). Bijagarh, Katkut, Barwah, Asirgarh, Bawangaja has a rich pocket of vegetation and dense forest.

Vegetation
Forest of Nimar is classified into Teak forest and Mixed forest.

Teak Forest:
Teak (Tectona grandis) is the dominant component of Teak forest. Teak is associated with Albizia lebbach, Anogeissus latifolia, Lagerstroemia parvifolia, Madhuca longifolia, *Terminalia elliptica, Terminalia belleria, Terminalia arjuna, Soymida fabrifuga, Lannea coromandeliana, Butea monosperma, Lagerstoemia parvifolia, Anogeissus latifolia, Boswellia serrata, Buchnania cochinchinensis, Hardwickia binata, Acacia catechu, Acacia nilotica, Vitex nergundo.*

Middle storey is occupied by Acacia catechu, Buchnania cochinchinensis, Catunarangeum spinosa, Dendrocalamus strictus, Wrightia tinctoria. The common smaller trees and shrubs are *Helicteres isora, Gardenia latifolia, Holarrhena antidisenteria, Woodfordia fruticosa, Nyctanthus arbor-tristis, Maytenus emarginata, Mimosa hamata.* The common woody climbers found in the area are *Capparis zeylanica, Cocculus hirsutus, Cryptolepis buchanani, Wattakaka volubilis, Milletia extensa.*

Ground cover of the forest is dominated by annual herbs. Common plants of these category are *Acanthospermum hispidum, Alysicarpus spp. pubescences, Alysicarpus rugosus, Alysicarpus monilifer, Senna Tora, Senna occidentalis, Crotalaria medicaginea, Indigofera cordifolia, Rungia repens, Bidens biternatea, Corchorus aestens, Xanthium struminum, Ocimum americanum, Ocimum canum, Zornia gibbosa, Enecostema axillare, Phyllanthus fraternus, Phyllanthus amarus, Sida cordifolia, Hibiscus abelmoschatus, Alternanthera bettzickiana, Alternanthera tenella, Typha angustifolia, Hygrophilla auriculata.*

Some common sedge is Cyperus spp. *Fimbristylis spp., and Scirpus spp.*

Common grasses are *Apluda mutica, Aristida adscensionis, Brachiaria eruciformis, Cenchrus ciliaris, Cynodon dactylon, Cynodon dactylon, Dichanthium aristatum, Echinochloa colonum, Heteropogon contartus, Themeda laxa., Seteria pumila.*

Common herbaceous climbers are *Cissempelos pareira, Tinospora cordifolia, Ipomoea pestrigridis, Ipomoea hederifolia, Pergulia daemia.*

Mixed Forest

Anjan forest, Salai forest and Khair forest included under mixed forest. In Anjan forest is mixed with *Acacia catechu, Hardwickia bipinnata, Butea monosperma* Salai forest are dominated by *Boswellia serrata* along with other element like *Cochlospermum religiosum, Diospyros melanonoxylon.* 30 percent Khair forest is covered by Acacia catechu associated with *Phylanthus emblica, Terminalia bellerica.*

Certain vegetation is found in cracks and crevices of old wall. Few of them are *Chloris virgata, Lindenbergia indica, Kikxia ramosisima and Oplismenus burmanni.*

Some members of Hedge vegetation are *Clerodendron inerme, Clerodendron phlomidies, Opuntia elatior, Dioscorea bulbifera, Euphorbia nerifolia.*

Aquatic Vegetation

There are numerous ponds, Rivers, Tank, Ditches, Lakes, where unique type of aquatic flora is found. Some are free floating or submerged and some are marshy habitats. Common aquatic plants are *Eichornia crassipes, Lemna minor, Pistia stratiotes, Spirodella polyrhiza, Hydrilla verticillata, Nymphaeae nouchalli, Nymphoides hydrophylla, Potamogeton crispus, Sagittaria sagittifolia, Ceratophyllum demerseum, Utricularia aurea, Trapa natan.*

MATERIALS AND METHODS

The plant exploration work was conducted in Nimar region to document the floral diversity during the year 2010-2013. Intensive and extensive plant survey had been carried out covering almost all habitats in different season. The vegetation and distribution pattern of the plants were studied. Standard method had been followed for plant collection and herbarium preparation (Jain and Rao 1977). Plant species were identified with the help of flora and Keys and other available literature (Hooker 1872-1897; Ray 1984; Mudgal *et al.*, 1997; Singh *et al.*, 2001; Hains 1924). Some plant specimen were examined and identified from BSI Central circle, Allahabad. The entire plant specimen was deposited in herbarium of PMB Gujarati Science College, Indore. Following sites have been visited and surveyed for plant collection

Khandwa**:** Kalibith, Pandhana, Omkareshawar.

Burhanpur**:**Chandgarh,Asirgarh, Nepanagar.

Khargone**:** Bistan, Barud, Bijagarh, Julwania, Peepaljhopha, Bhagwanpura, Maheshawar, Balwada, Sirvel, Katkut, Segaoan, Mandleshwar, Jhirnia and Barwah.

Barwani**:** Rajpur, Thikri, Bawangaja, Khirkia, Anjad, Nagalwadi, Sendhwa.

RESULTS AND DISCUSSION

Present study reports 1039 plant species which are distributed in 124 families 595 genera (Table-1). Dicotyledons consists of 761 species with 444 genera and 358 species with 149 and Monocot belongs to 278 species and 151 genera (Table-2, Figure 1). In an average 4.71 genera occur per family and 1.76 species occur per genus according to Good(1974). The average size of family is 23 Genera and 415 species. The study area reports 595 genera and 1039 species which appear to be a good representation of the flora for a small region.

Out of the 124 families monocotyledons share 19.76 % (24 families) and Dicotyledonous share 80.64 parsentage (100 families). Monocotyledons represents 25.38 % (151genera) and Dicotyledonous 74.62 % (444genera) of total genera. Dicotyledonous share 73.24% and monocotyledons share 26.76 % of total no. number of species found in the study area Table-2.

The most diverse families are Poaceae (141), Fabaceae (92), Asteraceae (60), Cyperaceae (54), Acanthaceae (46), Euphorbiaceae (45), Caesalpiniaceae (28), Malvaceae (25), Amaranthaceae (23), and Scrophulariaceae (21). About 51% species diversity is restricted to the ten dominant families (Table-3). Nimar has 139 tree species which forms a definite shape to the vegetation. 67 % of the flora consisting of herbaceous elements. 122 shrubs and 74 climbers have been reported from the study area accounting 19 % of the vegetation (Table-4; figure 2).

Table 1: Phytodiversity of Nimar region and Madhya Pradesh

No. of family	No. of Genera		No. of Species	
	Nimar region	M.P.	Nimar region	M.P.
Ranunculaceae	1	4	1	9
Magnoliaceae	-	2	-	2
Dilleniaceae	-	3	-	3
Annonaceae	2	5	2	8
Menispermaceae	2	5	2	6
Berberadaceae	-	1	-	1
Nymphaeceae	2	2	2	4
Papaveraceae	1	2	1	3
Brassicaceae	5	9	5	13
Capparaceae	4	4	15	16
Violaceae	1	2	1	3
Bixaceae	-	1	-	1
Polygalaceae	1	2	3	14
Pittosporaceae	-	1	-	1
Cochlospermaceae	1	2	1	2
Flacourtiaceae	2	3	2	5
Caryophyllaceae	3	6	3	8
Portulaceae	1	1	3	3
Tamaricaceae	1	1	1	2
Elantinaceae	1	2	2	3
Hypericaceae including Clusiaceae	-	1	-	2
Dipterocarpaceae	1	1	1	1
Theaceae	-	1	-	1
Malvaceae	9	13	25	40
Bombacaeae	3	4	3	5
Sterculaceae	6	10	8	12
Tiliaceae	3	3	18	23
Linaceae	1	2	1	4

Malphighiaceae	-	3	-	4
Geraniaceae	-	1	-	1
Zygophyllaceae	1	1	1	2
Oxalidaceae	2	3	3	7
Balsaminaceae	1	1	2	3
Rutaceae	3	10	4	16
Simaroubaceae	1	1	1	1
Ochaceae	-	1	-	2
Balanitaceae	1	1	1	-
Burseraceae	3	3	3	3
Olacaceae	-	1	-	2
Opiliaceae	-	2	-	2
Meliaceae	5	8	5	9
Celastraceae	2	3	3	7
Rhamnaceae	2	5	5	13
Vitaceae	4	4	7	6
Leeaceae	1	1	2	5
Sapandaceae	4	8	4	10
Sabiaceae	-	1	-	1
Anacardiaceae	5	7	5	8
Moringaceae	1	1	1	2
Fabaceae	38	61	92	196
Caesalpiniaceae	10	10	27	35
Mimosaceae	8	13	21	37
Rosaceae	1	4	1	1
Vahliaceae	-	1	-	1
Crassulaceae	1	1	1	2
Droseraceae	-	1	-	2
Haloragaceae	-	1	-	2
Callitrichacaeae	-	1	-	1
Rhizophoraceae	-	1	-	1
Combretaceae	4	5	8	17
Myrtaceae	2	4	3	9
Lecythidaceae	1	2	1	2
Melastomataceae	-	4	-	6
Lythraceae	5	6	9	16
Punicaceae	-	1	-	1
Onagraceae	1	1	2	5
Trapaceae	1	1	1	1
Passifloraceae	1	1	2	2
Caricaceae	-	1	-	1
Cucurbitaceae	**12**	**14**	**20**	*****
Begoniaceae	-	1	-	1
Cactaceae	2	1	2	2
Aizoaceae	2	1	2	2
Molluginaceae	2	1	5	5
Apiaceae	5	15	5	20
Cornaceae	-	1	-	1
Alangiaceae	1	1	1	-
Rubiaceae	15	25	21	52

Asteraceae	46	62	60	106
Stylidiaceae	-	1	-	1
Campanulaceae	1	3	1	7
Plumbaginaceae	1	2	1	3
Primulaceae	1	3	1	6
Myrsinaceae	2	2	2	6
Sapotaceae	3	4	3	5
Ebenaceae	1	1	3	5
Oleaceae	3	5	4	20
Salvadoraceae	1	1	1	1
Apocynaceae	9	15	13	24
Asclepidaceae	14	19	16	29
Periplocaceae	1	-	2	6
Loganiaceae	2	4	2	2
Buddlejaceae	1	1	1	2
Gentianaceae	6	6	8	17
Menyanthaceae	1	1	2	2
Polemoniceae	-	1	-	1
Hydrophyllaceae	-	1	-	1
Boraginaceae	7	8	14	30
Ehretiaceae	1	-	4	-
Convolvulaceae	7	11	20	50
Solanaceae	5	11	12	27
Scrophulariaceae	16	26	21	69
Orobanchaceae	1	2	1	3
Lentibulariaceae	1	1	1	14
Gesneriaceae	1	4	1	4
Bignoniaceae	4	17	4	18
Pedaliaceae	3	2	3	2
Acanthaceae	28	38	46	103
Verbenaceae	9	18	14	35
Lamiaceae	14	20	19	62
Plantaginaceae	1	1	1	2
Nyctaginaceae	4	4	6	7
Amaranthaceae	10	13	23	27
Chenopodiaceae	1	1	1	3
Baselliaceae	1	1	1	1
Phytolaceae	-	1	-	1
Polygonaceae	4	4	7	13
Podostemaceae	-	1	-	1
Aristolochiaceae	1	1	2	3
Piperaceae	1	2	1	3
Lauraceae	-	5	-	7
Proteaceae	-	1	-	1
Lauraceae	1	5	1	7
Loranthaceae	3	3	4	7
Santalaceae	1	2	1	2
Euphorbiaceae	18	29	44	96
Urticaceae	2	10	2	17
Ulmaceae	2	3	3	6

Cannabaceae	1	1	1	1
Moraceae	3	6	11	33
Casuarinaceae	2	1	2	1
Ceratophyllaceae	1	6	1	2
Salicaceae	-	2	-	2
Hydrocharitaceae	4	5	4	7
Burmanniaceae	-	**1**	-	**1**
Orchidaceae	10	33	13	88
Costaceae	1	1	1	1
Zingiberaceae	3	7	5	22
Marantaceae	-	1	-	1
Musaceae	1	1	1	1
Cannaceae	1	1	1	1
Iridaceae	-	1	-	1
Amarayllidaceae	2	3	4	8
Hypoxidaceae	1	2	1	2
Agavaeceae	2	-	2	-
Taccaceae	1	1	1	1
Dioscoreaceae	1	1	6	15
Liliaceae	8	16	10	34
Smilacaceae	1	1	1	2
Pontederiaceae	2	1	2	2
Xyridaceae	-	1	-	2
Commelinaceae	3	7	7	27
Juncaceae	-	1	-	2
Arecaceae	3	6	3	8
Araceae	7	11	9	14
Pandanaceae	-	1	-	1
Typhaceae	1	*	1	*
Lemnaceae	3	3	3	7
Alismataceae	1	3	1	5
Najadaceae	1	1	2	4
Aponogetonaceae	-	1	-	1
Potamogetonaceae	1	1	1	6
Zannichelliaceae	-	1	-	1
Eriocaulaceae	1	1	5	13
Cyperaceae	14	11	54	131

Table-2 Diversity of family,Genera and Species

	Dicot		**Monocot**		
Category	**No.**	**Percentage**	**No.**	**Percentage**	**Total**
Family	**100**	**80.64**	**24**	**19.76**	**124**
Genera	**444**	**74.62**	**151**	**25.38**	**595**
Species	**761**	**73.24**	**278**	**26.76**	**1039**

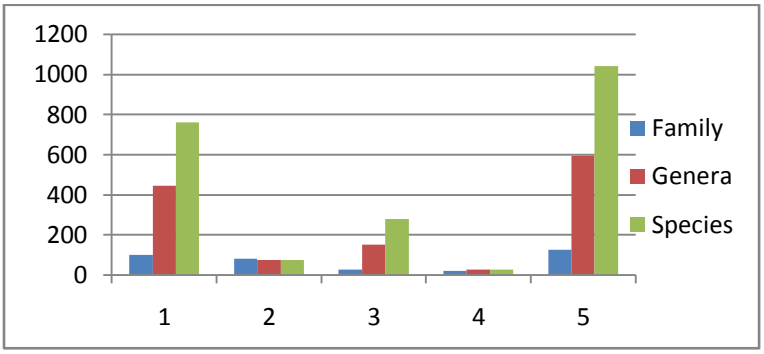

Figure 1: Species diversity

Table 3: Dominant families of Nimar region

S.No.	Family	Genera	Species
1.	Poaceae	79	141
2.	Asteraceae	46	60
3.	Leguminoaceae	38	92
4.	Acanthaceae	28	46
5.	Euphorbiacae	18	44
6.	Scrophulariaceae	16	21
7.	Rubiaceae	15	21
8.	Cyperaceae	14	54
9.	Lamiaceae	14	19
10.	Asclepidaceae	14	16

Table 4: Life form diversity

S.No.	**Category**	**No. of species**	**Percentage of species**
1	Herbs	704	67.2
2	Shrubs	122	11.8
3	Trees	139	13.8
4	Climbers including tanners	74	77.2
	Total	1039	100

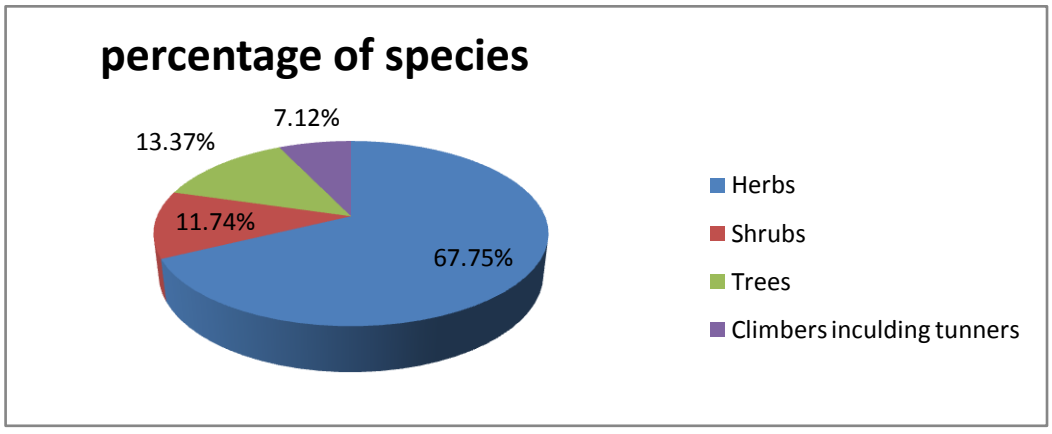

Figure 2: Different Life form diversity

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