

Floristic studies on some rare plants in Western Ghats of Nasik District, M. S.

Estudios florísticos sobre algunas plantas raras en Western Ghats del distrito
de Nasik, M.S.

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ABSTRACT

The present study deals with taxonomical aspects along with the observation regarding threats, flowering and fruiting period, precise locations of some rare plants of Western Ghats in Nasik District of Maharashtra. Extensive field visits and botanical excursions were conducted during period of investigation i. e. from 2013-2019 in and around the forest area of Nashik district. The major areas that were explored during study are mainly forest pockets and hills regions of Trimbakeshwar, Brahmhagiri mountains, Anjaneri hills, Adwadi hills, Sinnar and environs hilly ranges, Kelzar hilly areas, Mulher, Salher, etc. During the study: more than 150 species of rare plants belonging to 46 families were recorded. The probable reasons that were observed from the decrease of rare plant species population are destruction of natural habitats due to increasing illegal acquiring of forest land, massive deforestation and rapid urbanization. Also, *ex-situ* conservation of some plant species within the college botanical garden was attempted. However: the present study highlights an effective and purposeful conservation strategy to be adopted for the sustainable use and conservation of important rare plants in the region.

Keywords: Nasik, Rare plants, Western Ghats.

RESUMEN

El presente estudio aborda aspectos taxonómicos junto con la observación de amenazas, período de floración y fructificación, ubicaciones precisas de algunas plantas raras de Western Ghats en el distrito Nasik de Maharashtra. Se realizaron extensas visitas de campo y excursiones botánicas durante el período de investigación i. mi. desde 2013-2019 en y alrededor del área forestal del distrito de Nashik. Las principales áreas que se exploraron durante el estudio son principalmente bolsas de bosques y regiones montañosas de Trimbakeshwar, montañas Brahmhagiri, colinas Anjaneri, colinas Adwadi, Sinnar y cordilleras montañosas circundantes, áreas montañosas de Kelzar, Mulher, Salher, etc. Durante el estudio: más de 150 Se registraron especies de plantas raras pertenecientes a 46 familias. Las razones probables que se observaron de la disminución de la población de especies de plantas raras son la destrucción de hábitats naturales debido a la creciente adquisición ilegal de tierras forestales, la deforestación masiva y la rápida urbanización. Además, se intentó la conservación ex situ de algunas especies de plantas dentro del jardín botánico de la universidad. Sin embargo: el presente estudio destaca una estrategia de conservación eficaz y decidida que se adoptará para el uso sostenible y la conservación de importantes plantas raras en la región.

Palabras clave: Nasik, Plantas raras, Western Ghats.

INTRODUCTION

The Western Ghats range starts near the border of Gujarat and Maharashtra, south of the Tapti river, and runs approximately 1,600 km through the state of Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala ending at Kanyakumari, at the southern tip of India. (Daniels 2008). Western Ghats in India is well known and has some 'hot spots' characterized both by exceptional levels of plant endemism and by serious levels of habitat loss. These include Mahabaleshwar-Khandala, Agumbe-Phonda and Ratnagiri-Kolaba ranges from Maharashtra. (Myers; 1988;Raju and Reddy et.al.; 2010). The climate and rain fall pattern have led to a variety of unique plant species. It is also recognized as a center for origin of several cultivated plants and houses a variety of medicinal plants. There are 159 flowering plant taxa belonging to 81 genera and 31families found to be strictly endemic to the Sahyadri Ranges. (Gaikwad; 2014).

The forest pockets of Western Ghats of Maharashtra have great potentiality both from economical and botanical point of view. (Lakshminarayana et al. 2001). Western Ghats in several locations of Maharashtra and India; is under huge human pressure and numbers of species are rare, endangered and threatened (RET). (Kumar et.al. 2012; Chandore;2015). Many threatened plants are found growing naturally in the areas like Dhule, Jalgaon and Nandurbar and Nasik district. (Patil;2003; Kshirsagar and Patil; 2008). Moreover; large number of these plant species are rare and have been found to be used for curing various diseases by traditional healers. However; their uprooting, harvesting, grazing, shifting cultivation etc. for the purpose of food, fodder and medicines by tribal and local people have been found to be the major threats to them. (Daniels;1997; Jagatap et.al.2008). A rare species is one with small population that is not presently endangered but is at risk. Among a set of ecologically similar species, those that are rare will have a greater extinction risk than those that are common (Johnson 1998; Matthies et. al. 2004). Thus; species are considered rare if their area of occupancy or their numbers are small when compared to the other species that are taxonomically or ecologically comparable. Understanding the causes of rarity is fundamental to developing strategies to reduce extinction threats associated with species rarity. (Flather and Sieg; 2007). The current trends of ever-increasing commercialization, industrialization along with anthropogenic disturbances have resulted in overharvesting and making them rare plant species of Western Ghats. Thus; this vanishing flora needs to be protected and conserved due to their key role as an essential commodity for health care (Gustafsson *et al.*, 2002; Kala, 2002).

In order to evolve suitable strategies for conservation; the domestic cultivation of rare plants must be adopted. Therefore; attempts are needed towards the cultivation and ex situ conservation of selected plant species within college botanic gardens. (Kshirsagar;2012).

MATERIAL AND METHODS

Study area: The Nashik district of Maharashtra (19°35' 20°50' and 73°30' 74°55') is prominently represented by the eastwardly flowing the Godavari river with its tributaries; and Western Ghats region with peaks like Kalsubai (1646 meters) and Trimbak (1294 meters). (Fig.1 and 2). The forest vegetation of Nashik district is dry deciduous. Annual rainfall is around 750 mm and temperature in a year is varying between 5°C and 45°C. (www.nashiknic.in).



Fig. 1. Satellite map of Nashik district in Maharashtra, India.



Fig. 2. Location map of Nasik district in Maharashtra, India. (Map source: Official website of Nasik district)

Identification, documentation and systematic enumeration of collected plant species from different areas, forest pockets of Western Ghats of Nashik district; was done by referring standard flora (Lakshminarasimhan 1991, Pradhan and Singh 2005). Also, collection, transplantation of propagating structures like rhizomes, tubers and seeds etc. was attempted in so as to conserve the rare plant species within the college botanical garden. The floristic diversity of selected rare plant species is illustrated using digital photographs. (Fig. 2).

RESULTS AND DISCUSSION

The present research work is an outcome of frequent field visits and surveys carried out during the period from July 2013 to December 2019 so as to record occurrence and distribution of rare plant species. The results of the study have revealed that 150 plant species belonging to 46 families having 115 genera and 07 varieties. Among them 68 were herbs, 30

were trees, 12 were climbers and 32 shrubs, 06 twiners, 02 parasites, 01 epiphytes. Familywise distribution of recorded plant species revealed that plant families like Fabaceae was found to be represented by maximum i.e. 21 plant species followed by Malvaceae, Asteraceae, Orchideae, and Liliaceae that represented 07 plant species each. (Table 1; Fig. 3).

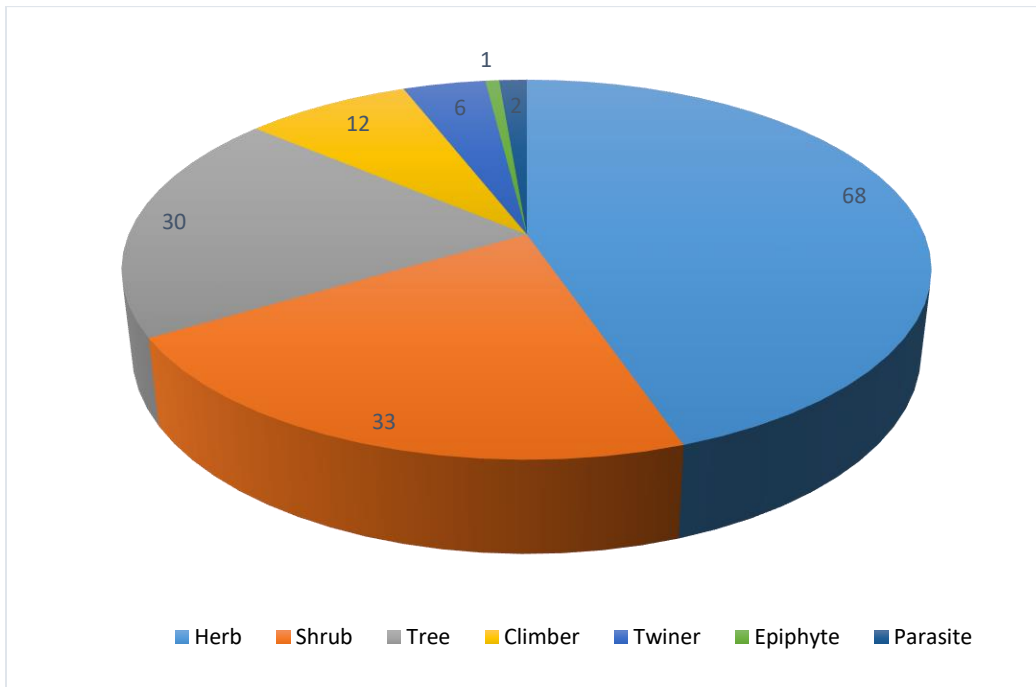


Fig. 3. Habit wise distribution of recorded rare plant species.

Table 1. List of Plant species life forms (habit) of the categories under study

Sr. No.	Botanical Name	Family	Habit
1	<i>Clematis wightiana</i> Wall	Ranunculaceae	Climber
2	<i>Miliusa tomentosa</i> (Roxb.) Sinclair	Annonaceae	Tree
3	<i>Cocculus pendulus</i> (J. R. & G. Forest.) Diel.	Menispermaceae	Shrub
4	<i>Capparis aphylla</i> Roth.	Capparaceae	Shrub
5	<i>Cleome feline</i> L. f.		Herb
6	<i>Cleome monophylla</i> L.		Herb
7	<i>Cleome simplicifolia</i> (Comb.) Hook. f. & Thoms		Herb
8	<i>Hybanthus enneaspermus</i> (L.) Muell.	Violaceae	Herb

9	<i>Cochlospermum religiosum</i> (L.) Alst.	Cochlospermiaceae (Bixaceae)	Tree
10	<i>Tamarix ericoides</i> Rottler & Willd.	Tamariscineae	Shrub
11	<i>Abutilon persicum</i> (Burm.f.) Merr.		Shrub
12	<i>Hibiscus hirtus</i> L. var. talbotii (Rakshit)		Shrub
13	<i>Hibiscus vitifolius</i> L.	Malvaceae	Shrub
14	<i>Kydia calycina</i> Roxb.		Tree
15	<i>Triumfetta pentandra</i> A. Rich		Shrub
16	<i>Urena lobbata</i> L. var. <i>sinuate</i>		Shrub
17	<i>Waltheria indica</i> L.		Shrub
18	<i>Melochia corchorifolia</i> L.	Sterculaceae	Herb
19	<i>Sterculia colorata</i> Roxb.		Tree
20	<i>Sterculia villosa</i> Roxb.		Tree
21	<i>Sterculia urens</i> Roxb.	Sterculaceae	Tree
22	<i>Corchorus depresses</i> (L.) Stock		Herb
23	<i>Corchorus olitorius</i> L.	Tiliaceae	Herb
24	<i>Grewia serrulata</i> DC.		Tree
25	<i>Garuga pinnata</i> Roxb.	Burseraceae	Tree
26	<i>Cassine albens</i> (Retz.) Kosterm.	Celastrineae	Tree
28	<i>Celastrus paniculatus</i> Willd.		Shrub
29	<i>Scutia indica</i> Brongn.	Rhamnaceae	Shrub
30	<i>Ampelocissus latifolia</i> (Roxb.) Planch.	Ampelideae (Vitaceae)	Climber
31	<i>Vitis auriculata</i> Wall. Ex Wight & Arn.		Climber
32	<i>Rhus sinuata</i> Thunb.	Anacardiaceae	Shrub
33	<i>Alysicarpus pubescences</i> var. <i>vasavedae</i> Law.	Fabaceae	Herb
34	<i>Clitoria biflora</i> Dalz.		Herb
35	<i>Crotalaria pusilla</i> Heyne ex Roth		Herb
36	<i>Crotalaria retusa</i> L.		Shrub
37	<i>Delonix elata</i> (L.) Gamble		Tree
38	<i>Erythrina suberosa</i> Roxb.		Tree

39	<i>Flemingia strobilifera</i> var. <i>fruticulosa</i> (Benth.) Baker.		Shrub
40	<i>Indigofera trifoliata</i> L. var. <i>duthiei</i> (Drum. ex Naik) Sanjappa		Herb
41	<i>Mucana pruriens</i> (L.) DC.		Climber
42	<i>Ougeinia oojeinensis</i> (Roxb.) Hocher.		Tree
43	<i>Pueraria tuberosa</i> (Roxb.ex Willd.) DC.		Shrub
44	<i>Psoralea corylifolia</i> L.		Herb
45	<i>Pterocarpus marsupium</i> Roxb. var. <i>acuminatus</i> Prain		Tree
46	<i>Rhynchosia capitata</i> (Heyne ex Roth) DC.		Herb
47	<i>Smithia conferta</i> J. E. Sm.		Herb
48	<i>Smithia purpurea</i> Hook.		Herb
49	<i>Smithia sensitiva</i> Aiton. var. <i>Sensitive</i>		Herb
50	<i>Teramnus labialis</i> (L.f.) Spreng.	Fabaceae	Herb
51	<i>Uraria picta</i> (Jacq.) Desv.		Shrub
52	<i>Uraria refescens</i> (DC.) Schindl.		Herb
53	<i>Vigna trilobata</i> (L.) Verdc.		Herb
54	<i>Couroupita guianensis</i> Aubl.	Myrtaceae	Tree
55	<i>Cucumis setosus</i> Cogn.	Cucurbitaceae	Climber
56	<i>Kedrostis rostrata</i> Cogn.		Climber
57	<i>Centella asiatica</i> (L.) Urb.		Herb
58	<i>Pimpinella adscendens</i> Dalz.		Herb
59	<i>Pimpinella heyneana</i> (DC.) Kurz	Umbelliferae	Herb
60	<i>Pimpinella tomentosa</i> (Dalz. & Gibs.) C.B.		Herb
61	<i>Anthocephalus indicus</i> A. Rich.		Tree
62	<i>Hymenodictyon orixense</i> (Roxb.) Mabberley		Tree
63	<i>Ixora pavetta</i> Andr.	Rubiaceae	Tree
64	<i>Pavetta indica</i> L.		Shrub
65	<i>Cyathocline purpurea</i> Cass.	Asteraceae	Herb
66	<i>Kleinia grandiflora</i> (Wall. Ex DC.) Rani		Shrub
67	<i>Pentanema indicum</i> (L.) L.		Herb

68	<i>Sphaeranthus indicus</i> L.		Herb
69	<i>Synedrella nodiflora</i> (L.) Gaertn.		Herb
70	<i>Tricholepis amplexicaulis</i> C.B. Clarke		Herb
71	<i>Tricholepis radicans</i> DC.		Herb
72	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	Shrub
73	<i>Diospyros melanoxyton</i> Roxb.		Tree
74	<i>Diospyros chloxyton</i> Roxb.	Ebenaceae	Tree
75	<i>Catharanthus pussilus</i> (MarMur.) G. Don	Apocynaceae	Herb
76	<i>Wrightia arborea</i> (Dennst.) Mabb.		Tree
77	<i>Caralluma adscendens</i> (Roxb.) var. <i>fimbriata</i> (Wall.) Grav. & Mayur		Herb
78	<i>Hemidesmus indicus</i> R. Br.		Shrub
79	<i>Holostemma ada-kodien</i> Schult.	Asclepiadaceae	Twinner
80	<i>Tylophora dalzellii</i> Hook.		Climber
81	<i>Tylophora indica</i> (Burm. f.) Merr.		Climber
82	<i>Strychnos nux-vomica</i> Linn.	Loganiaceae	Tree
83	<i>Centaurium meyeri</i> (Bunge) Druce	Gentianaceae	Herb
84	<i>Adelocaryum lambertianum</i> (C. B. Clarke) R. R. Mill.		Herb
85	<i>Arnebia hispidissima</i> DC., Prodr.	Boraginaceae	Herb
86	<i>Cynoglossum wallichii</i> G. Don		Shrub
87	<i>Argyreia sericea</i> Dalz.		Twinner
88	<i>Argyreia strigosa</i> (Roth) Roberty	Convolvulaceae	Climber
89	<i>Ipomoea campanulata</i> L.		Climber
90	<i>Solanum ferox</i> L.	Solanaceae	Herb
91	<i>Solanum wrightii</i> Benth.		Tree
92	<i>Buchnera hispida</i> Buch. Ham ex D. Don		Herb
93	<i>Kickxia ramosissima</i> (Wall.) Janchan		Herb
94	<i>Striga angustifolia</i> (Don) Saldanha	Scrophulariaceae	Herb
95	<i>Striga densiflora</i> (Benth.) Benth.		Herb
96	<i>Verbascum chinens</i> (L.) Santapau,		Herb

97	<i>Aeginetia indica</i> L.		Parasite
98	<i>Orobanche cernua</i> Loefl.	Orobanchaceae	Parasite
99	<i>Heterophragma quadriloculare</i> (Roxb.) K. Schum.		Tree
100	<i>Oroxylum indicum</i> Vent.	Bignoniaceae	Tree
101	<i>Radermachera xylocarpa</i> (Roxb.) K.		Tree
102	<i>Tecomella undulata</i> (Sm.) Seem.		Tree
103	<i>Barleria cristata</i> Linn. Var. <i>dichotoma</i> (Roxb.) Brain		Shrub
104	<i>Barleria lawaii</i> T. Anders		Shrub
105	<i>Hemigraphis latebrosa</i> (Heyne ex Roth) Nees		Herb
106	<i>Lepidagathis cuspidate</i> Nees	Acanthaceae	Shrub
107	<i>Neuracanthus sphaerostachys</i> (Nees) Dalz.		Shrub
108	<i>Petalidium barlerioides</i> Nees		Shrub
109	<i>Thunbergia fragrans</i> Roxb. var. <i>Laervis</i> Nees		Climber
110	<i>Gmelina arborea</i> Roxb.	Verbenaceae	Tree
111	<i>Symphorema involucreatum</i>		Shrub
112	<i>Anisomeles indica</i> (L.) O. Kuntze		Herb
113	<i>Anisomeles malabarica</i> R. Br.		Shrub
114	<i>Colebrookea oppositifolia</i> J.E. Sm.	Lamiaceae	Shrub
115	<i>Lavandula bipinnata</i> (Roth.) O. Ktze		Herb
116	<i>Leonotis nepetifolia</i> (L). R. Br.		Herb
117	<i>Pogostemon deccanensis</i> (Panijgr.) Press		Herb
118	<i>Dendrothoe falcate</i> (L. f.) Ettingsh	Loranthaceae	Shrub
119	<i>Euphorbia rothiana</i> Spreng.	Euphorbiaceae	Herb
120	<i>Casearia graveolens</i> Dalz.		Shrub
121	<i>Flacourtia indica</i> (Burm. f.) Merr.	Salicineae	Tree
122	<i>Flacourtia montana</i> Grah.		Tree
123	<i>Habenaria grandifloriformis</i> Blatt. & McCann		Herb
124	<i>Habenaria heyneana</i> Lindl.		Herb
125	<i>Habenaria marginata</i> Colebr.	Orchideae	Herb

126	<i>Habenaria furcifera</i> Lindl		Herb
127	<i>Habenaria rariflora</i> A. Rich.		Herb
128	<i>Vanda parviflora</i> Lindl		Epiphyte
129	<i>Zeuxine strateumatica</i> (L.) Schecht.		Herb
130	<i>Costus speciosus</i> (Koen.) E. Sm.	Scitamineae	Shrub
131	<i>Curcuma caesia</i> Roxb.		Herb
132	<i>Curcuma pseudomontana</i> J.Graham.		Herb
133	<i>Curculigo orchioides</i> Gaertn.	Hypoxidaceae	Herb
134	<i>Hypoxis aurea</i> Lour.		Herb
135	<i>Dioscorea belophylla</i> (Prain.) Haines		Twiner
136	<i>Dioscorea bulbifera</i> L.		Twiner
137	<i>Dioscorea hispida</i> Dennst.	Dioscoreaceae	Twiner
138	<i>Dioscorea oppositifolia</i> L.		Climber
139	<i>Dioscorea pentaphylla</i> L.		Twiner
140	<i>Asparagus racemosus</i> Willd.	Liliaceae	Shrub
141	<i>Chlorophytum bharuchii</i> Ansari		Herb
142	<i>Chlorophytum tuberosum</i> (Roxb.) Baker		Herb
143	<i>Gloriosa superba</i> L.		Herb
144	<i>Iphigenia magnifica</i> Ansari & Rolla		Herb
145	<i>Drimia indica</i> (Roxb.) Jessop.		Herb
146	<i>Scilla hyacinthiana</i> (Roth)Macbr.		Herb
147	<i>Commelina hasskarlii</i> B. Clarke		Herb
148	<i>Cyanotis fasciculata</i> (Heyne ex Roth) J.A. & J. H. Schult	Commelinaceae	Herb
149	<i>Cyanotis tuberosa</i> (Roxb.) Shult. & Schult.f.		Herb
150	<i>Arisaema murrayi</i> (Grab.) Hook. f.	Araceae	Herb



Fig. 4. Photo plate showing floral diversity of recorded rare plant species.

Row I: left to right A-*Habenaria grandifloriformis*, B- *H. heyneana*, C- *H. rariflora*, D- *H. marginate*. Row II: left to right E-*Barleria cristata*, F- *B. lawaii*, G- *Alysicarpus pubescences* var. *vasavedae*, H-*Gloriosa superba*. Row III: left to right I- *Aeginetia indica*, J- *Plumbago zeylanica*, K- *Woodfordia fruticosa*, L- *Abutilon persicum*

The major causes of getting plant species rare from the study area are trade, overexploitation, habitat loss, habitat fragmentation, over grazing, soil erosion, climate changes, loss of reproduction, lower rates seed germination capacity and shifting cultivation practices of the tribal people along with heavy encroachment. The present study revealed 150 rare flowering plant species from the study area and these have been critically analyzed

following the IUCN (Mace and Stuart 1994, 2000) guidelines. Fabaceae family; the 4th largest plant family of angiospermic plants in India, (Raju and Reddy et.al.; 2010) which has a wider geographical distribution in other parts of Western Ghats as well as in Eastern Ghats. (Rampilla and Khasim; 2016). However; during the present study; the family Fabaceae is found with maximum number of plant species observed throughout the study area. Out of the recorded rare plant species; some tree species like *Cochlospermum religiosum*, *Sterculia urens*, *Garuga pinnata*, *Erythrina suberosa*, *Gmelina arborea* etc. found at forest pockets and outskirts Peith, Kalwan and Surgana tehsils which have been utilized ethnomedicinally for the sustainable development of the local tribal people. (Yadav;1997,Deshmukh 2010, Khairnar;2010, Khairnar et.al.2012). The plant species which are found quite frequently throughout the area of study; are *Barleria cristata*, *Urena lobata*, *Cleome simplicifolia* *Sterculia urens* etc. (Rathoure; 2020). Similarly; plant species belonging to families like Asteraceae, Malvaceae, Lamiaceae have shown their periodic/regular occurrence around the places like Baglan, Sinnar and Chandwad areas of Nasik district. Such observations are in accordance to the earlier works in these areas. (Pawar;2020; Jadhav; 2016). Also, apart from their rarity; some plant species found climate-high altitude specific which are *Abutilon persicum* *Smithia purpurea*, *Vigna trilobata*, *Pimpinella tomentosa*, *Arisaema murrayi*, *Habenaria heyneana* etc. (Auti et.al. 2020). Attempts are being made towards the protection and ex situ conservation of selected plant species within college botanic garden and in particular, reserved areas. However, there is an urgent need to evolve a sound strategy for the management and conservation of these plants on a long-term basis. To evolve suitable strategies for conservation the domestic cultivation of rare plants must be adopted.

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