

# Asian Resonance

## The Floristic and Vegetational Studies of Baglan Forest Ranges of Nashik District, Maharashtra

### Abstract

Baglan is situated at 20° 56' North longitude and 74° 04' East longitude. Its area is about 619 square miles. The Western Ghat has been considered one of the global hotspot and the study area is an extreme north part of western ghat. Its flora was poorly documented. Therefore floristic surveys were carried out between 2008 to 2011, which resulted in record of total of 493 angiosperm taxa. They are fall under 308 genera and 86 families. The dominant families were Fabaceae (69 species), Poaceae (40), Asteraceae (30), Cyperaceae (25), Euphorbiaceae (22), Malvaceae and Rubiaceae (20), Lamiaceae (12) and Mimosaceae (11). The life form spectrum was characterized by Raunkiaers system. The life form spectrum was dominated by therophytes (50.70 %), phanerophytes (35.10 %), denoting a typical thero-phanerophytic climate.

**Keywords** : Vegetation, Flora, Baglan, Nashik District, Maharashtra.

### Introduction

Man has surveyed remote galaxies and has stood on the surface of moon but has not so far come anywhere near to completing a taxonomic catalogue of the fewer than half a million species of higher plants that grow on our planet (Burmmitt *et al.*, 2001). Botanists were exploring the floristic regions of the world for several centuries and their efforts have succeeded only in preparing a more realistic taxonomic account of the plants of Europe. The gravity of the situation is so severe in the tropics due to variety of reasons, the foremost being habitat destruction at an alarming rate leading to loss of biodiversity, essential for the sustenance of life on earth. Thus, conservation of biodiversity has gained prime consideration all over the world since the earth summit at Rio de Janeiro in 1992. The first and foremost process in ascertaining the biodiversity is the taxonomic treatment of living organisms. This can be achieved only through the process involving extensive exploration, identification and documentation. Earlier works in this branch of science in the Indian subcontinent resulted in the preparation of national and provincial floras. Further studies on local and regional floras paid increased attention at ecological level in addition to taxonomic treatment, which proved to be more beneficial in the management practices.

In spite of the accelerated floristic studies in Peninsular India during the last three decades, several parts of the dense forest areas which are extreme outside the Western Ghats are yet to be thoroughly explored. The Baglan forests are rich region with respect to species diversity and endemism in the Nashik district. This region is under severe biotic pressure and conserving the biodiversity is a challenging task.

### Objectives of the Study

1. To survey intensely and extensively the forest wealth by inventory method.
2. To critically examine the floral composition, floral elements, biological spectrum, economically important plants, rare and endangered species and exotic species.
3. To study the qualitative and quantitative characters in a community.
4. The analytical study of species in the community is based on quadrat method by recording frequency, density, abundance, cover and basal cover etc.
5. To study the quantitative importance of the species within a community, the densities, abundance, frequency and IVI of the species.



**Devram Gopal Jadhav**

Assistant Professor & Head,  
Deptt. of Botany,  
M.G.V's, Arts, Science and  
Commerce College,  
Manmad, Maharashtra

6. To carry out the computer analysis of the similarities and differences based on the role of the dominant species and other components of the communities of the vegetation.
7. To carry out a detailed study on the phytodiversity, distribution of species and their association with respect to environmental conditions like edaphic factors, climatic conditions and biotic factors.

## Review of Literature

Plant collections from Malegaon and Baglan forests of Nashik district are not significantly high with respect to collections from elsewhere in Maharashtra State. Despite the presence of rich flora in the mountains, only a few collections were reported in the works of early plant collectors such as Graham (1839), Dalzell and Gibson (1861), Naime (1894), Lisboa (1896), Woodrow (1898), Cooke (1901-1908), Talbot (1909-1911), Blatter and Hullberg (1918), Blatter (1928), Blatter and Mc Cann (1935), Santapau (1953, 1960, 1967), Chakravarty (1959), Santapau and Kapadia (1966). Nevertheless, all the above works have not mentioned any precise locality in the study area. The Malegaon and Baglan forest ranges of Nashik district is not explored and surveyed well with respect to plant diversity and ecology; perhaps it is comparatively poor in forests. However mountain ranges along the Sahyadri such as Salher, Mulher, Mangi-Tungi, Galane etc. is rich in flora.

In recent few years some of the research workers have contributed their studies in this area and published some research papers (Mahajan, 1986; Nair, 1986; Patil, 1990; Khoshoo, 1995; Nirmal Kumar, 1996; Yadav, 1999; Mahajan, 2000; Jadhav, 2002; Khairnar, 2003; Sonawane, 2005; Sonawane, 2006).

## Materials and Methods

The Nashik district is located between latitude  $20^{\circ} 50'$  and longitudes  $73^{\circ} 35'$  and extend over the area of 15,587 sq. km. It is bounded on the north-west by the Dangs and Surat district of Gujarat state on the north by Dhule district, on the east by Jalgaon and Aurangabad district, on the south by Ahmednagar and south-west by Thane district of Maharashtra state, District is divided in to 15 revenue talukas. For the sake of convenience the Baglan forest are divided into Satana and Taharabad forest divisions that are situated at  $20^{\circ} 56'$  North longitude and  $74^{\circ} 04'$  East longitude. Baglan forests (Satana and Taharabad) are one of the northern sub-divisions, is bounded on the north by the Pimpalner sub-division of Khandesh; on the east by Malegaon; on the south by Kalvan; and on the west by the Gujarat State. Its area is about 619 square miles. The forest area under the control of the Forest Department consists of the reserved forests covering 2,920.07 km<sup>2</sup> (1,127.44 sq. miles), the protected forests covering 245.45 km<sup>2</sup> (94.77 sq. miles) and unclassed forests, 173.32 km<sup>2</sup> (66.92 sq. miles). Western Ghat has been considered one of the global hotspot and study area is an extreme part of western ghats.

The results embodied in this work are based on collection from 2008 to 2011 through well-planned

exploration in these forest ranges. Numbers of extensive explorations of 3-5 days duration were made in different localities of Baglan (Satana & Taharabad) forests with emphasis on intensive rather than extensive explorations. In monsoon the explorations were of longer duration so as not to miss anything of the ephemeral flora that comes up with the rains. During outings all the plants in different stages of development were collected and ample field notes taken; a pertinent attention was paid to habit, habitat, relative abundance, distribution, colour and odour of the flowers etc. as far as possible efforts were made to obtain the local names and ethno botanical data of the species collected. This data was confirmed by repeated queries at different places.

All the collected plants were processed for herbarium by dry method as per the routine herbarium techniques recommended by Santapau (1955) and Jain and Rao (1976). Specimens were critically examined in the laboratory with the help of floras mainly Flora of Presidency of Bombay (Cooke, 1958 Reprinted), Flora of Gujarat State, (Shah, 1978), Flora of Sawantwadi (Almeida, 1990), Flora of Nashik, district (Laksh. & Sharma, 1991), Flora of Maharashtra state Dicotyledones Vol 1 (ed. N.P. Singh & S. Karthikeyan, 2000), Flora of Maharashtra state Dicotyledones Vol. 2 (ed. Singh et al., 2001), Flora of Maharashtra state Monocotyledons (ed. Sharma et al., 1996), Flora of Marathwada (V.N. Naik, 1998), manuals, monographs and other available literature for provisional identification. The enumeration is mainly based the available collections, besides the data gathered from research publication pertaining to the present area.

The arrangement of families based on Bentham and Hooker's (1862-1886) system of classification with minor modifications, in conformity with Hutchinson (1953, Revised 1973) and Cronquist (1868) are considered so far circumscription of certain families are concerned. Genera and species within the families are arranged in alphabetical order for easy reference. The overall taxonomy, habit or growth forms, distribution and local names largely follow the recent "Flora of Maharashtra State" (Sharma et al., 1996; Singh & Karthikeyan, 2000; Singh, et al., 2001) with some amendments in the distribution and nomenclature of species.

## Results and Discussion

### Floristic Richness and Taxonomic Diversity

A record of 493 wild and natural plant species (flowering plants) representing 308 genera and 86 families are found in the study area, bringing out the genus species ratio is 1: 4.13 and 1: 3.67 respectively. The dominant families were Fabaceae (69 species), Poaceae (40), Asteraceae (30), Cyperaceae (25), Euphorbiaceae (22), Malvaceae and Rubiaceae (20), Lamiaceae (12) and Mimosaceae (11). The life form spectrum was characterized by Raunkiaers system. The life form spectrum was dominated by therophytes (50.70 %), phanerophytes (35.10 %), denoting a typical thermo-phanerophytic climate.

# Asian Resonance

## Hydrophytic Vegetation

The plant species observed in aquatic and marshy conditions usually occurs along river banks, nallahs, ponds, tanks and dams. Supply of oxygen, carbon dioxide, mineral salts, nature of substratum, depth of water, temperature and high humidity affect the characters and extent of the aquatic vegetation. The common species are *Aeschynomene aspera* L., *Aeschynomene indica* L., *Alternanthera sessilis* (L.) R. Br. ex DC., *Ammania baccifera* L., *Ammania senegalensis* Lam., *Bacopa monnieri* (L.) Penn., *Canscora decurrens* Dalz., *Coix gigantea* Koen. ex Roxb., *Crinum viviparum* (Lam.) R. Ansari & V.J. Nair., *Cyathocline purpurea* (Buch-Ham. ex D. Don.) O. Ktze., *Cyperus exaltatus* Retz., *Cyperus iria* L., *Cyperus nutans* var. *Elusinoideus* (Kunth) Haines., *Echinochloa colona* (L.) Link., *Echinochloa frumentacea* (Roxb.) Link., *Eclipta prostrata* (L.) L., *Eleocharis atropurpurea* (Retz.) J. & K. Presl., *Eleocharis geniculata* (L.) R. & S., *Eragrostis gangetica* (Roxb.) Steud., *Eragrostis japonica* (Thunb.) Trin., *Eriocaulon margaretae* Fyson., *Fimbristylis bis-umbellata* (Forssk.) Bub., *Fimbristylis complanata* (Retz.) Link., *Fimbristylis dichotoma* (L.) Vahl., *Fimbristylis ferruginea* (L.) Vahl., *Fimbristylis microcarya* F. v. Muell., *Fimbristylis tetragona* R. Br., *Glinus lotoides* L., *Grangea maderaspatana* (L.) Poir., *Hygrophylla serpyllum* (Nees) T. And., *Ischaemum rugosum* Salisb., *Kyllinga squamulata* Thonn., *Ludwigia perennis* L., *Rorippa indica* (L.) Hiern., *Rotala densiflora* (Roth. ex R. & S.) Koehne., *Rotala indica* (Willd.) Koehne., *Rotala rotundifolia* (Buch-Ham. ex D. Don.) Koehne., *Sphaeranthus indicus* L. and *Typha angustifolia* L.

## Grassland Vegetation

The landscape unit dominated by grasses which ranges from village grazing land, extensive low pastures of dry regions to rolling grassy downs in the hilly regions are included under grassland vegetation. They are according to season, altitude and other biotic pressure. The dominant grasses are *Abelmoschus manihot* (L.) Medik. ssp. *tetraphyllus* (Roxb. ex Horn.) Borss., *Abutilon hirtum* (Lam.) Sweet. ssp. *indicum* (L.) Sweet., *Achyranthes aspera* L. var. *porphyristachya* (Wall ex Moq.) Hook. f., *Alternanthera sessilis* (L.) R. Br. ex DC., *Argemone Mexicana* L., *Biophytum sensitivum* (L.) DC., *Blumea eriantha* DC., *Cleome viscosa* L., *Echinochloa colona* (L.) Link., *Echinochloa frumentacea*

(Roxb.) Link., *Hygrophylla schulli* (Buch-Ham.) M.R. & S.M. Al., *Portulaca tuberosa* Roxb., *Sida rhombifolia* L., *Sonchus asper* (L.) Hill., *Tephrosia purpurea* (L.) Pers., *Tephrosia villosa* (L.) Pers., *Triumfetta pentandra* A. Rich., *Urena lobata* L. and *Xanthium indicum* Koen.

## Epiphytic and Parasitic Vegetation

The epiphytic plant species in the study area are *Aerides crispum* Lindl., *Aerides maculosum* Lindl., *Dendrobium aqueum* Lindl., *Dendrobium barbatum* Lindl., *Dendrobium ovatum* (Willd.) Kranzl., *Habenaria marginata* Coleb., *Vanda tessellata* (Roxb.) Hook. ex G. Don. and *Zeuxine strateumatica* (L.) Schltr. which grow on tree species like *Boswellia serrata* Roxb., *Diospyros melanoxylon* Roxb., *Mangifera indica* L. and *Tectona grandis* L. f. The root parasites growing on the grasses are *Sopubia delphinifolia* (L.) G. Don., *Striga densiflora* (Bth.) Bth. and *Striga gesnerioides* (Willd.) Vatke. *Cuscuta reflexa* Roxb., *Dendrophthoe falcata* (L. f.) Etting. and *Viscum articulatum* Burm. f. are the common stem parasites growing generally on *Acacia chundra* (Roxb. ex Rottl.) Willd., *Mangifera indica* L., *Tectona grandis* L. f. and *Wrightia tinctoria* R. Br.

## Exotic Plants

Biodiversity loss caused by invasive species may soon surpass the damage done by habitat destruction. According to World Conservation Monitoring Centre (1992) second whorls threat to existence of biodiversity is the biological invasion of exotic species. Some exotic plants recorded in the study area are *Annona reticulata* L., *Argemone Mexicana* L., *Cassia obtusifolia* L., *Euphorbia geniculata* Orteg., *Ipomoea nil* (L.) Roth., *Lantana camara* L., *Mimosa pudica* L., *Parthenium hysterophorus* L., *Prosopis cineraria* (L.) Druce., *Psidium guajava* L. and *Xanthium indicum* Koen.

## Life Forms

since the life form is related to the environment around the plants, the biological spectrum is also regarded as indicative of the prevailing environment, i.e. Higher percentage of the therophytes indicate long dry season, the chamaephytes indicates an extreme cold climate, the hemicryptophytes indicates conditions suited for the development of extensive grassland etc. The biological spectrum in the present study is characteristic of tropical arid region with the dominance of therophytes (50.70 % of the recorded species) followed by phanerophytes (35.10 %). It indicates the thermo-panerophytic climate of the study area.

**Table 1: Showing the Number and Percentage of Dicot. and Monocot Families, Genera and Species**

SN	Classes	Number of Families	Number of Genera	Number of Species
A	Dicotyledonae :			
	Polypetalae	31	105	188
	Gamopetalae	31	114	154
	Monochlamydeae	09	33	44
Total		<b>71</b>	<b>252</b>	<b>386</b>
Percentage		<b>83.52 %</b>	<b>79.74 %</b>	<b>78.61 %</b>
B	Monocotyledoneae	14	64	105
	Total			
Percentage		<b>16.48 %</b>	<b>20.26 %</b>	<b>21.39 %</b>
Total of Dicots & Monocots (A+B)		<b>85</b>	<b>316</b>	<b>491</b>

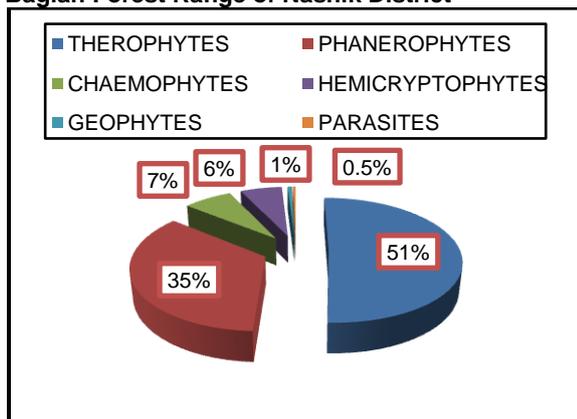
**Table 2. : Ratio and Percentage of Monocots and Dicots**

Rank	Number		Total	Ratio		Percentage	
	Mono-cots	Dicots		Monocots	Dicots	Mono-cots	Dicots
<b>Families</b>	14	71	85	1 : 5.1		16.48 %	83.52 %
<b>Genera</b>	64	252	316	1 : 4.13		20.26 %	79.74 %
<b>Species</b>	105	383	491	1 : 3.67		21.39 %	78.61 %

**Table 3: Ten Dominant Families with Genera and Species in Baglan Forests.**

Sr.No	Families	Total Genera	Total Species
1	Fabaceae	30	69
2	Poaceae	29	40
3	Asteraceae	24	30
4	Cyperaceae	08	25
5	Euphorbiaceae	15	22
6	Acanthaceae	14	21
7	Malvaceae	11	20
8	Rubiaceae	14	20
9	Lamiaceae	09	12
10	Mimosaceae	05	11

**Figure 1: The pie chart of life form of Species of Baglan Forest Range of Nashik District**



### Conclusion

It has long been felt that the intensive rather than extensive floristic studies of different geographical regions are necessary for the proper documentation, conservation plans and sustainable utilization of plant resources. Due to indiscriminate exploration of forest resources, over grazing and introduction of invasive exotic species, a number of indigenous species are under pressure and may be face threat of extinction in future. This research paper may help to identify species for conservation prioritization and also to pay special attention for conservation of phytodiversity of the study area.

### Acknowledgements

I am very much thankful to the Mahatma Gandhi Vidyamandir's General Secretary, Dr. Prashant Dada Hiray, Coordinator Dr. Apoorva Bhau Hiray and Principal Dr. Subhash Nikam for their support in all respect. Thanks to the officials of the Nashik district forest department for their help and cooperation.

### References

1. Agarwal, S.K. The Biological spectrum of the flora of Gogunda and Prasad (Udaipur-Rajasthan). *J Biol. Sci.* 17: 67-71. 1974.
2. Almeida, M. R. 1996. *Flora of Maharashtra, Vol. I*. Blatter Herbarium, Mumbai, Vol. II, Mumbai, 1999.
3. Bentham, G. & J.D. Hooker. *Genera Plantarum*, Vol. I.III. London. 1862-1883.
4. Bharucha, F.R. and D.B. Ferreira. The biological spectra of the Matheran and Mahabaleshwar Flora. *J. Indian Bot. Soc.* 20: 195-211. 1941.
5. Blatter, E. & F. Hallberg. New Indian Scrophulariaceae and some notes on the same order. *J. Bombay nat. Hist. Soc.* 25: 416-429. 1918.
6. Blatter, E. New Commelinaceae from the Western Ghats. *J. Bombay nat. Hist. Soc.* 33: 73-77. 1928.
7. Blatter, E & C. McCann. The Bombay Grasses. *Sci. Monogr. No. 5 Imp. Counc. Agric. Res. Mem. India.* 324. 1935.
8. Bor, N.L. Ecology: theory and practice (Presid. Addr., Bot. Sec.) *Proc. 29<sup>th</sup> Indian Sci. Congr.* 145-179. 1942.
9. Braun-Blanquet J. New York. McGraw Hill Book Company. 1932.
10. Brummit, K. R, Castroviejo S, Augustine C, Chikuni Anthony E, Orchard Gideon F, Smith Warren L. Wagner. 2001. *The species Plantarum Project, An International Collaborative Initiative for Higher Plant Taxonomy. Taxon* 50(4), 1217-1230.
11. Caines S.A. Life forms of Phytoclimate, *Botanical Review* 16: 1-32. 1950.
12. Chakravarty, H.L. Monograph of Indian Cucurbitaceae (Taxonomy and distribution). *Rec. Bot. Surv. India* 17: iii + 234, fig. 96. 1959.
13. Cherian, P. J. & R. D. Pataskar. Studies on the vegetation of Surgana- Harsul ranges of Sahyadris, Nashik District, Maharashtra, *Bull. Bot. Surv. India*, 11 : 381-397, Map. 1. (1969). 1972.
14. Cooke, T. 1901-1908. *The Flora of the Presidency of Bombay*, Vols. I and II, London, *BSI Reprint*. Vols. I-III, 1958, 1965.
15. Dalzell, N. A. & A. Gibson, *Bombay Flora*, Bombay. 1861.
16. Desai R.K. and H.N. Ant. Life Forms and Biological Spectrum of the Flora of Vadali Range Forest, *Life Science Leaflets* 4 : 60-63, 2012.
17. Ellenberg H. and Muller-Dombois D. (Eds.). New York. John Wiley and Sons. 1974. 547p.
18. Graham, J. *A Catalogue of Bombay Plants growing in Bombay and its vicinity*,

# Asian Resonance

- spontaneous, cultivated or introduced, as far as they are ascertained*, Mumbai. 1839.
19. Jadhav, J.T. *Phytosociological studies of the flora of Tryambakeshwar and Vani (Saptashringi) Nashik District*. Ph.D. thesis, North Maharashtra University. 2002.
  20. Kambhar S.V. and K. Kotresha. Life Forms and Biological Spectrum of a Dry Deciduous Forest in Gadag District, Karnataka, India. *Research and Review: A Journal of Botany*, Vol. I, Issue I, 1-28, 2012.
  21. Khairnar, D.N. Ethnomedicinal observations of endangered *Madhuca longifolia* from Nashik district, Maharashtra. *Geobios* 36: 223-224. 2003.
  22. Khoshoo, T.N. Census of India's Biodiversity: Tasks Ahead, *Curr. Sci.* 14-17. 1995.
  23. Lakshminarasimhan, P. & B.D. Sharma. *Flora of Nashik District*. Series 3. Bot. Surv. Ind., Calcutta. 1991.
  24. Lakshman, N. The applications of Raunkiaer's life form. *J. Indian Bot. Soc.* 41: 585-589. 1962.
  25. Lisboa, J.C. List of Bombay Grasses. *J. Bombay nat. Hist. Soc.* 5: 116-131, 226-232, 337-349. 1980; 6: 189-219. 1891; 7: 357-390. 1892; 8: 107-119. 1893 (1890-1893). (Repr. in book form under the title *List of Bombay Grasses and their uses*. Bombay, 1896).
  26. Mahajan, D.R. *A contribution to the flora of Nashik District. (Maharashtra)* M. Phil. Dissertation, South Gujarat University, Surat (Unpublished). 1986.
  27. Mahajan D. R. and D. F. Nikumbh, An Addition to the Flora of Nashik District (Maharashtra), *Biojournal*, Vol. 12. No. 1 & 2, pp 1:7, 2000.
  28. Meher-Homji, V.M. History of dry deciduous forests of Western India, in '*Ecology and Archaeology of Western India*', concept publishing company, New Delhi. 1977.
  29. Misra, K.C. *Manual of plant ecology*, Oxford and IBH, New Delhi. 1974.
  30. Naik, V.N. *Flora of Marathwada*, Vol. I & II. Amrut Prakashan, Aurangabad. 1998.
  31. Naime, A.K. *The flowering plants of Western India*. Bombay & London 1894.
  32. Nair, N.C. & P. Daniel. The floristic diversity of the Western Ghats and its Conservation: A review. *Proc. Indian Acad. Sci. (Anim. Sci. & Plant Sci.)* Suppl. 127-163. 1986.
  33. Nirmal kumar J.I., S.S. Yadav & M. Verghese. Plant diversity of Ukalapani forest, Navapur Range, North Western Ghats. *J. Swamy Bot. Cl.* 13: 41-45. 1996.
  34. Oosting, H.J. *The study of plant communities: An introduction to plant ecology*. 2<sup>nd</sup> ed. W.H. Freeman and co., Sanfrancisco and London. p. 440. 1956.
  35. Patil, D.A. The Vegetation of the river Girna (Maharashtra). *J. Econ. Tax. Bot.* 14: 655-657. 1990.
  36. Raunkiaer, C. *The life forms of plants and statistical plant geography*. Clarendon press. Oxford. 1934.
  37. Santapau, H. Flora of Khandala on the Western Ghats of India. *Rec. Bot. Surv. India*, 16 : 1-396. 1953. 2nd revised 1960, Calcutta, 3rd revised 1967, Calcutta.
  38. Santapau, H. & Z. Kapadia. *The Orchids of Bombay*. Govt. of India Press, Calcutta. 1966.
  39. Sarup, S. The Biological spectrum of the flora of Mt. Abu. Univ. Rajasthan Stub. *Biol. Sci.* 1. 1952.
  40. Sharma, B. D. and Balakrishnan, N. P. (eds), *Flora of India Vol. 2 (Papaveraceae – Caryophyllaceae)*, Botanical Survey of India, Calcutta, 1993.
  41. Sharma, B. D. and Sanjappa, M. (eds), *Flora of India Vol. 3 (Portulacaceae – Ixonanthaceae)*, Botanical Survey of India, Calcutta, 1993.
  42. Sharma, B. D., S. Karthikeyan and N. P. Singh (Eds.) *Flora of Maharashtra State. Monocotyledones*. B.S.I. Fl. India, Ser.2. Calcutta. 1996.
  43. Singh, N.P. & Karthikeyan, S. *Flora of Maharashtra State - Dicotyledons. Vol. I*, Flora of India series 2, Bot. Surv. India, Pune. 2000.
  44. Singh, N.P., P. Lakshminarasimhan., S. Karthikeyan & P.V. Prasanna. *Flora of Maharashtra State - Dicotyledons. Vol II*, Bot. Surv. Ind., 2001.
  45. Sonawane, Y.D., D.U. Ahire & D.C. Pendse. Some medicinal plants of Malegaon taluka of Nashik district. *Geobios* 33: 103-104. 2005.
  46. Sonawane, Y.D., Z.S. Ansari & Y.B. Mamude. Utilization of some medicinal plants of Baglan taluka of Nashik district (Maharashtra State). *J. Swamy Bot. Cl.* 23:173-174. 2006.
  47. Talbot, W. A. *Forest Flora of the Bombay Presidency and Sindh*. Vol. I and II Govt. of Bombay, Poona. 1909-1911.
  48. Warming E. Oxford. Clarendon Press. 1909.
  - Whitaker R. H. New York. Macmillan Publishing Co. 1975.
  49. Woodrow, G.M. The flora of Western India. *J. Bombay Nat. Hist. Soc.* 11: 118-130, 265-273. 1897; 420-430, 635-651. 1898; 12: 162-176. 1898; 354-373, 515- 526. 1899; 13: 427-442. 1901 (1897-1901).
  50. Yadav, S. R. and S. M. Bhuskute, A new record of the genus *Molineria* Colla (Hypoxidaceae) for the state of Maharashtra. *J. Bombay nat. Hist Soc.* 96 (1): 176-179. 1999.