Indian J. Applied & Pure Bio. Vol. 28(2), 303-310 (2013).

Preliminary survey of Flora of Bhopal (M.P.), India; collection and digital imaging

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ABSTRACT

The study was carried out in different parts of Bhopal and 106 plants were identified and collected during the flowering, fruiting and seed developing stages. These plants were classified into three categories: - 1. Trees 2.Shrubs and 3. Herbs and described in relation to their botanical name, family, genus, and species. Out of the 106 plant species, 74 were trees belong to 36 families, 19 were shrubs belong to 13 families and 12 were herbs and grasses belong to 6 families. This study shows great variation in the flora of Bhopal (M.P).

Most plant pigments are not stable as herbarium vouchers. Hence the photograph of each plant was captured and attached with specimen. These photographs, combined with herbarium vouchers are critical to the process of verifying the authenticity of the plants.

Key Words: Family, Trees, Shrubs, Herbs, Herbarium.

It is that range of biodiversity that we must care for- the whole thing – rather than just one or two stars. Present days living beings are the "Islands in the sea of death." Throughout history, mankind has been benefited from plants in many ways, fundamentally for food and shelter, yet also for other purposes including clothing, medicines and cosmetics to name the few. All around the globe, different cultures have made use of plants that grew around them. The traditional knowledge of the uses and dangers of plants that could be found in hedgerows, forests and fields was helpful and sometimes invaluable. For aging for plants particularly herbs in the wild is something that humans have done for centuries. Today, however, a number of plants that once were abundant are now sadly endangered because of extensive human activities like urbanization, industrialization, deforestation and due to changes in the climat[4]. India is among the richest floristic biodiversity zone on the earth, where plants have made a good contribution to the development since ancient times. Our ancient literature also has remarkable information right from Atharveda, which provides rich references on native plants and their properties to alleviate human suffering and for enhancement of long

and healthy life. Our ancient Materia medica is also based mainly on diverse plants found all over the Indian subcontinent[2]. The biodiversity found on earth today consists 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 perished due to various reasons. It is therefore very necessary to have proper knowledge regarding the various species of plants inhabiting in any particular area at that particular time period[6]. Some taxonomic work in this area has also been done by Mishra[7], Mishra, Kotwal[8,9] & Mishra *et al.*,[10], So the present study was undertaken to carry out the preliminary survey of the flora in Bhopal of M.P state. Bhopal has an average elevation of 500m meters (1401 ft). Bhopal is located in the central part of India, and is just north of the upper limit of the *Vindhya* mountain ranges. Located on the *Malwa* plateau, it is higher than the north Indian plains and the land rises towards the *Vindhya Range* to the south. The city has uneven elevation and has small hills within its boundaries. The major hills in Bhopal comprise of Idgah hills and Shyamala hills in the northern region and Arera hills in the central region. According to the report of Forest Survey of India the total forest cover is 12.01% including the scrub which is less than the area reported under the land use classification while working plan of Bhopal forest division (T.) (1999) mentioned 15.77 % forest out of total geographical area of Bhopal. The division divided in to the two forest range *i.e.* Berasia and Samardha.

Berasia: Berasia forest range is situated about 45 km from Bhopal. The total area of range is 28389.09 ha with 64.93 % forest area.

Samardha: Samardha forest range mostly covered the around the forest of Bhopal city. The total area of range is 15330.22 ha with 35.07% forest area.

According to current master plan, the municipality covers 697 square kilometers. In Bhopal there are 18 lakes but two are most popular. These lakes are the *Upper Lake* (now renamed to Bhojtal) and the *Lower Lake*. Locally these are known as the Bada Talab and Chota Talab respectively. The catchment area of the Upper Lake is 360 km² while that of the Lower Lake is 9.6 km². The Upper Lake drains into the Kolar River. The *Van Vihar National Park* is a national park situated besides the Upper Lake. Bhopal has a *humid subtropical climate*, with cool, dry winters, a hot summer and a humid monsoon season. Summers start in late March and go on till mid-June, the average temperature being around 30°C (86 °F), with the peak of summer in May, when the highs regularly exceed 40°C (104 °F). The monsoon starts in late June and ends in late September. These months see about 40 inches (1020 mm) of precipitation, frequent thunderstorms and flooding. The average temperature is around 25°C (77 °F) and the humidity is quite high. Temperatures rise again up to late October when winter starts, which lasts up to early March. Winters in Bhopal are cool, sunny and comfortable, with average daily temperatures around 16°C (61°F) and little or no rain. The winter peaks in January when temperatures may drop close to freezing on some nights. Total annual rainfall is about 1289mm. The proposed study was undertaken in the Bhopal with the following objectives:-

1. To identify and collect the floristic elements of the area and making permanent record for the preservation of specimens.
2. To capture the photograph of each plant and attach it with specimen.
3. Study of Plant species is helpful in knowing the status of individual plant species in the study area.

Itinerary of Data Collection :

The plant specimens were collected from different regions of Bhopal from time to time (July2011 to June 2012) .The collection of specimens carried out during flowering and fruiting period to facilitate the process of identification and was done according to Bentham and Hooker's system of classification[3] and divided into trees, shrubs and herbs. The herbarium was prepared by treating the specimens with 2% mercuric chloride solution to provide protection against insects and fungal attack. It was done immediately after collecting the specimens before they get wilted. They were then wrapped in the alternating layers of newspapers and blotting papers. The papers were changed after 24, 48 or 72 hours as per the need of specimen. After drying, plant specimens were mounted on herbarium sheets with gum and given accession number of the entire Specimen collected.

Digital images, like other photographic representations, can transmit an infinitesimal number of difficulties to describe characteristics at a single glance. Recording the physical attributes of the Specialized Collections using digital cameras to record the taxonomic characteristics used to distinguish one plant from another, these include flower color, vegetative characteristics, fruit, and fall color. Most plant pigments are not stable as herbarium vouchers. Hence the photograph of each plant was captured and attached with specimen. These photographs, combined with herbarium vouchers are critical to the process of verifying the authenticity of the plants.

In the present study, only different plants from different areas of Bhopal were studied and a preliminary survey was carried out. The plants were identified and collected during flowering, fruiting and seed developing stages and described accordingly in a detailed manner with respect to their botanical names, family to which they belonged. The plants were classified and listed as per the classification of Bentham and Hooker[3] who had classified all the plants on the basis of their flowering, fruiting and developing stages and external features into different families. Similar studies were done by Vavilov[15], Joshi[5], Sing and Sing[13], Uniyal *et al.*,[14], Choudhary and Wadhwa[1] Rau[11], Semwal[12], who also surveyed the different Himalayan regions and identified the valuable plants.

The study was carried out in the different parts of Bhopal and 106 plants were identified and collected during the flowering, fruiting and seed developing stages. These plants were classified into three categories: - 1. Trees 2. Shrubs and 3. Herbs and described in relation to their botanical name, family, genus, and species. Out of the 106 plant species, 74 were trees belong to 36 families, 19 were shrubs belong to 13 families and 13 were herbs belong to 5 families. This study shows great variation in the flora of Bhopal (M.P).

Table-1. Showing Trees along with their corresponding Family, Genera and species studied in the present Survey

S.No	Family	Genus	Species	Common name
1.	Rubiaceae	*Adina*	*cordifolia*	Haldu
2.	Mimosaceae	*Albizzia*	*procera*	Safed siris
3.	Combretaceae	*Anogeissus*	*latifolia*	Dhaora
4.	Burseraceae	*Boswellia*	*serrata*	Salai
5.	Papilionaceae	*Dalbergia*	*paniculata*	Dhobin
6.	Sapotaceae	*Madhuca*	*latifolia*	Mahua
7.	Rubiaceae	*Mitragyna*	*parvifolia*	Mundi
8.	Papilionaceae	*Pterocarpus*	*marsupium*	Bija
9.	Combretaceae	*Terminalia*	*tomentosa*	Saj
10	Verbenaceae	*Tectona*	*grandis*	Teak
11.	Bombacaceae	*Salmalia*	*malabaricum*	Semal
12.	Bignoniaceae	*Stereospermum*	*suivens*	Padar
13.	Combretaceae	*Terminalia*	*arjuna*	Koha
14.	Myrtaceae	*Syzygium*	*cumini*	Jamun
15.	Moraceae	*Ficus*	*glomerata*	Gular
16.	Burseraceae	*Garuga*	*pinnata*	Kekad
17.	Apocynaceae	*Nerium*	*indicum*	Kaner
18.	Arecaceae	*Hyophorbe*	*lagenicaulis*	Bottle palm
19.	Euphorbiaceae	*Phyllanthus*	*emblica*	Aonla
20.	Combretaceae	*Terminalia*	*chebula*	Harra
21.	Anacardiaceae	*Spondias*	*mangifera*	Amra
22.	Moraceae	*Ficus*	*religiosa*	Peepal
23.	Moraceae	*Ficus*	*krishnae*	Fig.
24.	Mimosaceae	*Samanea*	*saman*	Rain tree
25.	Ulmaceae	*Holoptelea*	*integrifolia*	Churel
26.	Bombacaceae	*Bombax*	*ceiba*	Silkcotton tree
27.	Caesalpineaceae	*Bauhinia*	*purpurea*	Orchid tree
28.	Rubiaceae	*Gardenia*	*lucida*	Dikmali
29.	Arecaceae	*Oreodoxia*	*regia*	Royal palm
30.	Santalaceae	*Santalum*	*album*	Sandal wood
31.	Caesalpineaceae	*Hardwickia*	*binata*	Anjan
32.	Annonaceae	*Polyalthia*	*longifolia*	Asok
33.	*Meliaceae*	*Azadirachta*	*indica*	Neem
34.	Mimosaceae	*Pithecellobium*	*dulce*	Jagal jalebi
35.	Caesalpiniaceae	*Tamarindus*	*indica*	Imli

36.	Mimosaceae	*Prosopis*	*juliflora*	Ironwood
37.	Caesalpiniaceae	*Delonix*	*regia*	Gul mohr
38.	Oleaceae	*Nyctanthes*	*arbortristes*	Night jasmine
39.	Apocynaceae	*Alstonia*	*scholaris*	Devil tree
40.	Ebenaceae	*Diospyros*	*melanoxylon*	Tendu
41.	Anacardiaceae	*Lannea*	*grandis*	Moyan
42.	Anacardiaceae	*Buchanania*	*latifolia*	Achar
43.	Lythraceae	*Lagerstroemia*	*parviflora*	Lendia
44.	Celastraceae	*Elaeodendron*	*glaucum*	Jamrasi
45.	Celastraceae	*Zizyphus*	*xylopyra*	Ghoni
46.	Caesalpineaceae	*Bauhina*	*malabarica*	Asta
47.	Caesalpineaceae	*Bauhinia*	*racemosa*	Asta
48.	Caesalpineaceae	*Bauhinia*	*retusa*	Asta
49.	Rutaceae	*Aegle*	*marmelos*	Bel
50.	Caesalpineaceae	*Bauhinia*	*variegata*	Kachnar
51.	Fabaceae	*Cassia*	*fistula*	Amaltas
52.	Mimosaceae	*Acacia*	*catechu*	Khair
53.	Sapindaceae	*Schleichera*	*oleosa*	Kusum
54.	Boraginaceae	*Saccopetalum*	*tomentosum*	Kari
55.	Fabaceae	*Butea*	*monosperma*	Palash
56.	Malvaceae	*Kydia*	*calycina*	Baranga
57.	Oleaceae	*Schrebera*	*swietenioides*	Moka
58.	Mimosaceae	*Albizzia*	*odoratissima*	Chichwa
59.	Mimosaceae	*Albizzia*	*lebbeck*	kala siris
60.	Tiliaceae	*Grewia*	*tiliaefolia*	Dhaman
61.	Fabaceae	*Ougeinia*	*dalbergioides*	Tinsa
62.	Cochlospermaceae	*Cochlospermum*	*religiosum*	Gugal
63.	Meliaceae	*Soymida*	*febrifuga*	Rohan.
64.	Bignoniaceae	*Dolichandronew*	*falcata*	Medhsiagh
65.	Lecythidaceae	*Careya*	*arborea*	Kumbhi
66.	Boraginaceae	*Cordia*	*macleodii*	Dainyar
67.	Bombacaceae	*Eriolaena*	*hookeriana*	Bondidhaman
68.	Simaroubaceae	*Ailanthus*	*excelsa*	Maharukh
69.	Mimosaceae	*Acacia*	*leucophloea*	Reunja
70.	Rubiaceae	*Morinda*	*tinctoria*	Aal
71.	Mimosaceae	*Acacia*	*feriuginea*	Safed khair
72.	Simaroubaceae	*Balanites*	*roxburghii*	Hingoni
73.	Rhamnaceae	*Zizyphus*	*mauritiana*	Ber
74.	Myrsinaceae	*Embelia*	*robusta*	Baibrang

Table-2. Showing Shrubs along with their corresponding Family, Genera and species studied in the present Survey.

S.No	Family	Genus	Species	Common name
1.	Asclepiadaceae	*Calotropis*	*procera*	Muda.
2.	Solanaceae	*Datura*	*stramonium*	Datura
3.	Asteraceae	*Parthenium*	*hysterophorus*	Carrot grass
4.	Verbenaceae	*Lantana*	*indica*	Sage
5.	Apocynaceae	*Vinca*	*rosea*	Periwinkle
6.	Solanaceae	*Withania*	*somnifera*	Ashvagandha
7.	Rubiaceae	*Gardenia*	*turgida*	Safed phendra
8.	Sterculiaceae	*Helicteres*	*isora*	Marorphali
9.	Tiliaceae	*Grewia*	*hirsuta*	Gangerua
10	Apocynaceae	*Holarrhena*	*antidysenterica*	Kurchi
11.	Celastraceae	*Gymnosporia*	*montana*	Beklal
12.	Papilionaceae	*Indigofera*	*tinctoria*	Neel
13.	Apocyanaceae	*Carissa*	*carandas*	Karonda
14.	Lythraceae	*Woodfordia*	*fruticosa*	Dhawai
15.	Rubiaceae	*Randia*	*dumetorum*	Mainphal
16.	Acanthaceae	*Petalidium*	*barleioides*	Indrajata
17.	Papilionaceae	*Flemingia*	*semialata*	Banrahar
18.	Arecaceae	*Phoenix*	*acaulis*	Bhuichhind
19.	Papilionaceae	*Desmodium*	*pulchellum*	Chipti

Present investigation shows that Shrubby vegetation is dominating the area. The predominating shrubby plants includes *Lantana indica, Calotropis procera,* Dominating woody plants includes *Dalbergia sissoo, Terminalia chebula* and dominated herbaceous plant are *Carissa carandas, Vetiveria zizanioides* etc. Among the shrubs the dominating family were Fabaceae, Asteraceae, Caesalpineaceae, Rutaceae, Solanaceae and Bignoneaceae occurring in 1st, 2nd,3rd,4th, 5th, 6th place in survey area respectively.

Among trees the main dominating families were Fabaceae, Bombacaceae,and Verbenaceae occurring in 1st, 2nd, 3rd, place in survey area respectively. The least representation of tree families were Combretaceae, Burseraceae, least representative of shrub family was Caesalpineaceae and the least

Table-3. Showing grasses and herbs along with their corresponding Family, Genera and species studied in the present Survey.

S.No	Family	Genus	Species	Common name
1.	Gramineae	*Sorghum*	*halepense*	Barru
2.	Poaceae	*Vetiveria*	*zizanioidesz*	Khus
3.	Poaceae	*Dichanthium*	*annulatum*	Kali
4.	Poaceae	*Iseilema*	*laxum*	Mushin
5.	Poaceae	*Heteropogon*	*contortus*	Kusal
6.	Poaceae	*Dendrocalamus*	*strictus*	Bamboo
7.	Poaceae	*Cymbopogon*	*martini*	Rusa
8.	Poaceae	*Saccharum*	*spontaneum*	Kans
9.	Poaceae	*Apluda*	*aristata*	Phuera
10.	Mimosaceae	*Mimosa*	*pudica*	touch me not
11.	Rubiaceae	*Randia*	*uliginosa*	Kolahendra
12.	Caesulpinaceae	*Cassia*	*tora*	Panwar
13.	Euphorbiaceae	*Phyllanthus*	*niruri*	Bhuiamla

representative of herb families were Mimosoideae and Rubiaceae in the survey area. Bhopal showed great floral variation as evident from the present survey. This survey of Bhopal is an attempt to initiate the further intensive and exhaustive exploratory studies so as to have better utilization of our floral wealth for the betterment of humanity. In the race for urbanization, we are somewhere losing our natural flora. These investigations and further documentation of plant species are helpful in knowing the status of individual plant species in the study area and thus playing an important role in their preservation and making us aware about their usefulness. The harvesting practices, ecological status, commercial uses, population decline and density of the plant shows that if control measures are not taken, the species fall into the extinction from wild category in the near future.

Authors are thankful to local people of Bhopal and Department of Botany, Saifia Science College, Bhopal for their sincere guidance.

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