Chapter - III

PLAN OF WORK
AND
METHODS ADOPTED
A) FIELD STUDY:

The present comprehensive floristic account of the Balaghat Ranges of Maharashtra is an outcome of critical field surveys carried out between the year 2009-2014, combined with herbarium studies and library consultations. Field visits of 1-3 days duration were undertaken to various nooks and corners of Balaghat Ranges of Maharashtra. During the floristic survey, every effort was made to collect the plants in all three seasons viz. premonsoon, monsoon and postmonsoon. Special attention was paid to under or unexplored remote areas of the study area. In addition to the collection of wild plants, an effort had been made to collect weeds which cover a wide range of ecological habitats. Cultivated plants have also been collected as the work had been undertaken to study the flora of the region. Each wild species is represented by three good specimens, which are well preserved in the form of herbarium specimens. During the field visits, information of habit, habitat, odor and color of flower, distribution, altitude, longitude and latitude and other such features which cannot be deduced from examination of the mounted herbarium specimens was recorded. In addition to this, local names and uses if any were gathered from villagers.

After following the conventional method of preservation such as drying with the news papers and poisoning by treating the specimens with the absolute alcohol saturated with mercuric chloride to protect them from fungal and insect attacks (Santapau, 1955; Jain & Rao, 1960; Rao & Sharma, 1990), the specimens were mounted on herbarium sheets. A total of 1522 field numbers comprising about 4565 specimens were collected and deposited in Herbarium of Walchand College, Solapur during the present study.

The field identifications were confirmed satisfactorily with help of regional and national floras, besides recent relevant monographic works and revisions. Doubtful identifications were confirmed by matching the specimens with the authentic herbarium specimens deposited in Botanical Survey of India, Pune; Blatter Herbarium, St. Xavier’s college, Mumbai and herbarium of Botany department of Dr. B.A.M. University, Aurangabad.
B) PLAN OF THE TAXONOMIC ACCOUNT:

Under the ‘systematic treatment’, families of the flowering plants are arranged according to APG III (2009) system of classification. All the genera under a family and the species under a genus or subspecies or varieties under a species are arranged in alphabetical order for the sake of convenience.

Dichotomous indentate keys are provided for the families, genera and species. These keys are artificial and largely based on exomorphic characters. The family keys with modifications wherever necessary have been largely adapted from Gamble (1915-1935). Cultivated species have also been included in the keys to genera and species.

Author citation and binomial of each plant species is verified with international Plant name Index (IPNI, 2012), The Plant list (2010) and Tropicos (2013). The nomenclature has been adapted, as far as practicable based on latest taxonomic literature and in accordance with the recommendations made by ICBN. For each species, correct name has provided with basionyms if any and full citations. Synonyms wherever found necessary to connect the name with national or state floras have also been given. The local name has provided wherever available.

The species description shows primary characters that not reflected in the keys. It is followed by relevant data on flowering and fruiting. The representative herbarium specimens are cited under each species. A short ecological note, distribution and a critical note on identity, variation, nomenclature, present status and uses of the species have given at the end.

Appropriate maps, tables and figures presenting various data in connection with the present work are given wherever necessary. Photographs depicting some individual species and line drawings of some species have also been provided (Plate I-X and Figure 4-27). A metric system has used for measurements in the present work.

The references quoted in the prologue of the species are not cited in the bibliography in order to avoid repetition. Other relevant references are incorporated at the end of systematic account.
C) AREA UNDER STUDY:

**Topography and Drainage System:** Balaghat Mountain range is an eastward spur of Western Ghats of India (Sahyadri Mountain) running north-west to south-east in Maharashtra. It is located from 18° 47' 40.26" - 18° 32' 29.28" N latitude and 75° 20' 26.90" - 76° 48' 56.18" E longitude, in the basins of rivers Manjra, Sindphana and Sina and their tributaries; mainly spread over Ahmednagar, Beed, Latur, Osmanabad and Solapur districts (Figure 1), and forms a natural boundary between Western-Maharashtra and Marathwada subdivisions of the State. Balaghat occupies an area about 18,111.34 km² in Maharashtra.

The entire Balaghat region is situated at an average height ranges between 610-792 m above mean sea level, sloping towards the south and east, forming the water divide between the Godavari River and Krishna River valleys. Except the southern and western parts of the Balaghat region, which are drained by the tributaries of the Bhima river, the rest of the region is drained by the Manjra and Sindphana rivers and their tributaries belonging to the Godavari drainage system.

*Manjra:* The Manjra rises above Gaurwadi near the northern edge of the Balaghat plateau in Beed district and flows in a southeasterly direction towards Osmanabad district. The Manjra along with its tributaries, the Terna, the Tawarja and the Gharni drains to the south Balaghat region, while its three other tributaries, the Manar, the Tiru and the Lendi drain the area to the north of the Balaghat plateau.

*Sindphana:* The Sindphana rises in the Chincholi hill at the north-western apex of the Balaghat Ranges and flows in a northeasterly course past Amalner. After the confluence of its tributaries, the Bindsura, the Saraswati, the Gunwati, the Wan and the Kinha; the Sindphana has a fairly long easterly course up to Majalgaon, after that it flows north-eastwards and northwards to join the Godavari at Kshetra Manjrat.

*Sina:* The Sina river, a major left-bank feeder tributary of the Bhima river rises 22 km west to Torna in Ahmednagar district and runs along the western boundary of Balaghat plateau, receives many tributaries draining the Paranda, Madha, Karmala, Osmanabad, Mohal and Solapur talukas. All these are more or less parallel streams flowing in southerly or south-westerly direction and having their sources on the western Balaghat scarp faces of Kunthalgiri, Osmanabad, Tuljapur and Naldurg watershed.
Figure 1. Location map of Balaghat Ranges of Maharashtra.
In spite of these water resources the region suffers from heavy drainage due to steep slopes ultimately affect the agriculture to a considerable extent. The rivers and rivulets which are dry for major part of the year are enormously powerful in monsoon and flow with great speed. This naturally impoverishes the soil cover and exposes bare rocks at many places. Recently there have been some serious efforts to control soil erosion, chiefly by constructing major as well as minor dams all over the region. Some of these collect enormous amount of water drained down the hills during monsoon and serve as perennial water reservoirs.

Geology and Soils: The entire region has the rock type composed of basaltic lava-flows which erupted in the Cretaceous-Eocene age and is popularly known as Deccan traps. These lava-flows are sometimes associated with inter-trappean beds such as limestones, sandstones, clay shales, red bole-beds and coriaceous beds. The presence of a thin mantle of black cotton soil almost everywhere on basalts, river alluvium, sands, gravels, slits and clays represent the recent deposits. Calcareous concretions and nodules commonly found in the soil are concentrated in the vicinity of stream courses.

Major part of the region has deep black soil derived from the trap rock. Certain variations occur due to exposure and protection. Most of the hill tops are bare or covered by coarse gravel while the low lying areas accumulate clay and soil. On the basis of fertility status, the entire land of Balaghat region can be classified in three zones, the most fertile zone being in the southern part of Osmanabad district, the medium fertile zone scattered in Beed, Solapur and Osmanabad districts and most unfertile zone being situated in the western part of Osmanabad district and in Jamkhed taluka of Ahmednagar district. The soils in general are below normal or alkaline in reaction. The pH range varies from 6.5 to 8.5. The organic carbon content of most of the soils is low or medium. The phosphorus is within medium range. Zinc available to the crops varies from 0.8 to 6.4 ppm (Gajbe et al., 1976). Thus, the soils in general, are rich in calcium and magnesium carbonates and are deficient in nitrogen and phosphorus.
Figure 2. Map showing selected plant collection sites in study area.
Climate: The climate of the region is characterized by a hot summer and general dryness during major part of the year i.e. from November to the first week of June. It is followed by the south-west monsoon season which lasts till the end of September. The cold season commences from November and ends in the month of February.

Rainfall and humidity: The rainy season is considered from middle of June to the end of September, which is followed by a sultry period from about the end of September to the middle of November. The rainfall during the south-west monsoon in the months of June to September amounts to about 74% of the annual rainfall. September is the rainiest month. About 17% of the normal annual rainfall in the region is received in the post-monsoon months of October and November. The normal average rainfall is about 90 cm but is rather variable from year to year (Table 1 and Figure 3). It has been decreased considerably in the recent years.

Table 1. Showing month wise rainfall for the years 2010 - 2013.

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th></th>
<th>2011</th>
<th></th>
<th>2012</th>
<th></th>
<th>2013</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Month</td>
<td>R. F. (mm)</td>
<td>% DEP.</td>
<td>R. F. (mm)</td>
<td>% DEP.</td>
<td>R. F. (mm)</td>
<td>% DEP.</td>
<td>R. F. (mm)</td>
<td>% DEP.</td>
</tr>
<tr>
<td>January</td>
<td>20.8</td>
<td>995</td>
<td>0.0</td>
<td>-100</td>
<td>0.0</td>
<td>-100</td>
<td>0.0</td>
<td>-100</td>
</tr>
<tr>
<td>February</td>
<td>3.0</td>
<td>20</td>
<td>8.0</td>
<td>208</td>
<td>0.0</td>
<td>-100</td>
<td>0.6</td>
<td>-77</td>
</tr>
<tr>
<td>March</td>
<td>0.0</td>
<td>-100</td>
<td>0.1</td>
<td>-97</td>
<td>0.0</td>
<td>-100</td>
<td>10.6</td>
<td>171</td>
</tr>
<tr>
<td>April</td>
<td>1.1</td>
<td>-87</td>
<td>14.2</td>
<td>89</td>
<td>10.8</td>
<td>44</td>
<td>7.9</td>
<td>5</td>
</tr>
<tr>
<td>May</td>
<td>5.7</td>
<td>-81</td>
<td>11.0</td>
<td>58</td>
<td>17.2</td>
<td>-35</td>
<td>10.9</td>
<td>-59</td>
</tr>
<tr>
<td>June</td>
<td>151.7</td>
<td>5</td>
<td>51.9</td>
<td>-61</td>
<td>46.5</td>
<td>-65</td>
<td>111.3</td>
<td>-16</td>
</tr>
<tr>
<td>July</td>
<td>351.5</td>
<td>108</td>
<td>185.8</td>
<td>20</td>
<td>145.1</td>
<td>-6</td>
<td>238.4</td>
<td>55</td>
</tr>
<tr>
<td>August</td>
<td>284.6</td>
<td>54</td>
<td>181.3</td>
<td>18</td>
<td>49.6</td>
<td>-68</td>
<td>76.5</td>
<td>-50</td>
</tr>
<tr>
<td>September</td>
<td>163.4</td>
<td>-16</td>
<td>51.5</td>
<td>-72</td>
<td>114.3</td>
<td>-38</td>
<td>210.2</td>
<td>15</td>
</tr>
<tr>
<td>October</td>
<td>59.9</td>
<td>-23</td>
<td>59.5</td>
<td>-30</td>
<td>50.4</td>
<td>-41</td>
<td>62.7</td>
<td>-26</td>
</tr>
<tr>
<td>November</td>
<td>27.1</td>
<td>19</td>
<td>0.0</td>
<td>-100</td>
<td>6.4</td>
<td>-71</td>
<td>4.7</td>
<td>-79</td>
</tr>
<tr>
<td>December</td>
<td>1.3</td>
<td>-75</td>
<td>0.0</td>
<td>-100</td>
<td>0.0</td>
<td>-100</td>
<td>2.4</td>
<td>-48</td>
</tr>
</tbody>
</table>

1. The rainfall in millimeter (R/F) shown are the arithmetic average of rainfall of stations under the region.
2. % Dep. are the departures of rainfall from the long period averages of rainfall for the region. (Data source: http://www.imd.gov.in/).
The relative humidity is extremely low for major part of the year (35%-50%) while it is highest during south-west monsoon (85%).

**Temperature:** The winter season starts in the middle of November and continues till the end of February. December is the coldest month of the year with mean daily minimum temperature at 11.7°C. The temperature may sometimes further drop to 2°C. From March the days temperature increase progressively, the nights are comparatively cool. The unbearable heat of the afternoon in the summer season is sometimes relived by thundershowers. May is the hottest month of the year with mean daily maximum temperature at 41.6°C and the mean daily minimum at 22.4°C; on individual days during the hot season the temperature occasionally shoots up to 43°C or 44°C. With onset of south-west monsoon in the region there is an appreciable drop in the temperature (Table 2 and Figure 3).

**Table 2.** Showing average and absolute temperature, snow days and fog days.

<table>
<thead>
<tr>
<th>Month</th>
<th>Temperature °C</th>
<th>Average snow days</th>
<th>Average fog days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average ( max ) ( Min )</td>
<td>Absolute ( max ) ( min )</td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>31.3 16.3</td>
<td>38.1 9.4</td>
<td>0</td>
</tr>
<tr>
<td>February</td>
<td>34.1 18.1</td>
<td>38.8 6.6</td>
<td>0</td>
</tr>
<tr>
<td>March</td>
<td>37.5 21.8</td>
<td>42.7 14.8</td>
<td>0</td>
</tr>
<tr>
<td>April</td>
<td>39.9 24.6</td>
<td>44.1 15.5</td>
<td>0</td>
</tr>
<tr>
<td>May</td>
<td>39.8 25</td>
<td>45.1 18.3</td>
<td>1</td>
</tr>
<tr>
<td>June</td>
<td>34.4 23.4</td>
<td>44.3 17.8</td>
<td>0</td>
</tr>
<tr>
<td>July</td>
<td>31.8 22.6</td>
<td>37.8 16.7</td>
<td>0</td>
</tr>
<tr>
<td>August</td>
<td>31.1 21.9</td>
<td>37.1 13</td>
<td>0</td>
</tr>
<tr>
<td>September</td>
<td>31.9 21.8</td>
<td>37.1 14.8</td>
<td>0</td>
</tr>
<tr>
<td>October</td>
<td>32.6 20.6</td>
<td>38.7 12.4</td>
<td>0</td>
</tr>
<tr>
<td>November</td>
<td>31.9 18.2</td>
<td>36.4 10</td>
<td>0</td>
</tr>
<tr>
<td>December</td>
<td>30.7 15.6</td>
<td>34.9 7.7</td>
<td>0</td>
</tr>
</tbody>
</table>

(Data source: http://www.meoweather.com/)
**Winds:** Winds are generally light to moderate with some strength in the south-west monsoon. In monsoon, season winds are mainly from directions between south-west and north-west. In the post monsoon season winds blow from north-west and north are common in the mornings while in the afternoons they blow from direction between north and east. In the cold season, their direction is variable. North-west and south-west winds are more common. In summer, winds are mostly from directions between west and north.

**Figure 3.** Showing month wise arithmetic average and departures of rainfall, absolute and average temperature.

![Month wise rainfall, average and absolute temperature](image)

**D) VEGETATION:**

According to Champion & Seth (1968) the vegetation of Balaghat Ranges can be divided into tropical dry deciduous forests, open scrub jungles and vast tracts of grasslands.

**Tropical dry deciduous forests:** These are confined to the Ghatangri, Ramling, Tuljapur hills, Naldurg, Yermala hills and Hadongri in Osmanabad district; Patoda, Naigaon, Sautada, Manjarsumba and Kapildhar in Beed district; Wadwal-Janwal bet in Latur district and Ukkadgaon, Pangari and hills near Barshi in Solapur district. In addition, there are small forest pockets formed here and there in the valleys of hilly ranges all over the region while hill tops are more or less barren due to gusty winds.
prevailing during summer. The forests are open, under stocked and large grassy areas are often met with due to biotic interference such as illicit felling, excessive grazing, fire and encroachments. The growth of teak in the region is not prominent and significant association was not observed. Trees are usually stunted. The most dominant tree species are Acacia leucophloea, A. senegal, A. tomentosa, Albizia lebbeck, Anogeissus latifolia, Bauhinia tomentosa, B. purpurea, Boswellia serrata, Casearia tomentosa, Cassine albens, Cordia dichotoma, Dalbergia latifolia, Diospyros melanoxylon, D. chloroxylon, Gardenia resinifera, Grewia serrulata, Lannea coromandelica, Syzygium cumini, Sterculia urens, Tectona grandis, Terminalia alata and T. bellirica. In addition to these, there are subdominant tree species like Ailanthus excelsa, Bauhinia racemosa, Bridelia retusa, Butea monosperma, Cochlospermum religiosum, Cordia macleodii, Dalbergia sissoo, Flacourtia indica, Holoptelea integrifolia, Maytenus senegalensis and Pterocarpus marsupium.

A large number of shrubs and bushes occupy considerable areas in small and disturbed forests. Common shrubs are Canthium coromandelicum, Carissa congesta, Catunaregam spinosa, Grewia tiliifolia, Lantana camara var. aculeata, Rhus mysorensis, Securinega leucopyrus, Ventilago denticulata, Woodfordia fruticosa and Ziziphus spp. The ground layer which is covered mainly by a large number of annual herbs between July and October is dominated by legumes and grasses. Most common among these are Alysicarpus tetragonolobus, A. luteo-vexillatus, A. hamosus, A. pubescens, Andropogon pumilus, Apluda mutica, Aristida adscensionis, A. funiculata A. redacta, Arundinella tuberculata, Blepharis repens, Chamaecrista pumila, Crotalaria filipes var. filipes, C. hebecarpa, C. albida, C. hirta, C. orixensis, Dichanthium odoratum, Eragrostis minor, Hibiscus lobatus, Hackelochloa granularis, Indigofera linnaei, I. duthiei var. duthiei, I. glandulosa var. glandulosa, Leucas stricta, Ophiuros exaltatus, Polygala persicariaefolia, Spermacoce ramanii, Rostellularia procumbens, Rungia repens, Setaria intermedia, S. pumila, Sida acuta, S. cordata, S. mysorensis, Striga asiatica, S. gesnerioides, Vigna trilobata, V. radiata and Zornia diphylla.

The common climbers are Ampelocissus latifolia, Argyreia strigosa, Aspidopterys cordata, Cissampelos pareira, Coccinia grandis, Cocculus hirsutus,
Combretum albidum, Diplocyclos palmatus, Dregea volubilis, Mukia maderaspatana and Tinospora cordifolia.

**Open scrub jungles:** Due to excessive biotic interference coupled with scanty rainfall resulting in xeromorphic conditions, xerophytic species such as Agave americana, A. vivipara var. vivipara, Aloe vera, Asparagus laevisimus, Caralluma adscendens, Euphorbia neriifolia, E. nivulia, E. tirucalli, Furcraea foetida, Opuntia elatior, Sarcostemma viminalis subsp. viminalis are common in occurrence; this leads to thorn scrub formations. These are generally observed in low rainfall areas in Ashti, Patoda and Kej talukas in Beed district; Renapur, Ausa, Nilanga, Shirur-Anantpal, Devani and Chakur talukas in Latur district; Bhoom, Paranda, Tuljapur, Osmanabad, Umarga and Washi talukas in Osmanabad district and Jamkhed in Ahmednagar district. The scrub jungles include scattered bushes, sparse trees and stunted grasses as soil is shallow in the region. Further, an overgrazing, illicit felling and frequent fires contribute towards poor regeneration. The common trees are Acacia catechu, A. chundra, A. leucophloea, Anogeissus latifolia, Butea monosperma, Diospyros melanoxylon, Dichrostachys cinerea var. indica, Dolichandrone falcata, Euphorbia neriifolia, Grewia tiliifolia, Morinda coreia, M. citrifolia, Ziziphus caracutta, Z. mauritiana, Z. rotundifolia, Z. xylpyrus and many others. The common shrubs are Balanites aegyptiaca, Capparis decidua, C. divaricata, C. sepiaria, Carissa congesta, C. opaca, Lantana camara var. aculeata, Maytenus senegalensis, Mimosa hamata, Prosopis juliflora, Rhus myosorensis, Securinega leucopyrus and Senna auriculata. A few twiners like Ampelocissus latifolia, Argyreia strigosa, Cissus repens, Aspidopterys cordata, Cissampelos pareira, Cocculus hirsutus, Combretum albidum, Cryptolepis Buchananii, Cuscuta campestris, Diplocyclos palmatus, Dregea volubilis, Mukia maderaspatana, Pergularia daemia, Rivea hydropsperiformis, Rhynchosia minima var. minima, Oxystelma esculentum and Tinospora cordifolia grow on small trees and bushes.

During monsoon members of the families Asteraceae, Cucurbitaceae, Cyperaceae, Euphorbiaceae, Commelinaceae and Poaceae become predominant covering the ground.

**Grasslands:** In Balaghat region, grasslands are by no means natural grasslands but have most probably developed in response to severe biotic influence together with unfavorable climatic conditions. They are therefore considered as secondary
formation of disclimax. The grasses and other herbaceous species are interspersed with fire resistant trees and shrubs such as Acacia catechu, A. chundra, A. eburnea, A. horrida, A. senegal, Annona squamosa, Butea monosperma, Canthium coromandelicum, Capparis decidua, C. divaricata, Dolichandrone falcata, Erythrina suberosa, Ixora pavetta, Lantana camera var. aculeata, Mimosa hamata, Phyllanthus reticulatus, Rhus mysoensis, Securinega leucopyrus etc. and large number of unpalatable thorny bushes. Dominant grass species in order of their dominance are Lophopogon tridentatus, Eragrostis ciliaris, E. minor, Aristida adscensionis, A. funiculata, A. stocksii, Chrysopogon fulvus, Dichanthium caricosum, D. odoratum, D. pertusum, D. annulatum, Ischaemum pilosum, Digitaria ablu dens, D. ciliaris, D. stricta, Dinebra retroflexa, Eragrostis gangetica, Echinochloa colona, Eragrostiella bifaria, Eremopogon foveolatus, Hackelochloa granularis, Heteropogon contortus, Iseilema anthe poroides, Sehima ischaemoides, S. sulcatum, S. nervosum, Rottboellia cochinchinensis, Pennisetum pedicellatum, P. polystachion, Oplismenus burmannii, Oropetium roxburghianum, Vetiveria lawsonii, Setaria intermedia, S. pumila, S. verticillata, Sporobolus capillaris, S. festivus, S. indicus, Tragus mongolorum, Arundinella pumila, A. tuberculata, Cenchrus setigerus, Cymbopogon martinii, Chionachne koenigii, Pseudanthistiria hispida, Dactyloctenium aegyptium and Melanocenchris jacquemontii.

Riverian vegetation: Common trees along the banks of rivers and streams are Acacia nilotica, Butea monosperma, Cordia dichotoma, Erythrina suberosa, Phoenix sylvestris, Pongamia pinnata, Syzygium cumini, Terminalia arjuna and Terminalia bellirica. Associated shrubs include Acacia torta, Vitex negundo, Clerodendrum phlomidis, Clerodendrum serratum, Ficus hispida, Indigofera tinctoria, Morinda coreia, M. tomentosa, Santalum album, Tamarix ericoides, Phyllanthus reticulatus, Ventilago denticulata, Woodfordia fruticosa and others. Dry and sandy stream and river beds harbor a large number of herbaceous species occurring along the banks and in shallow waters. These are Alternanthera sessilis, Ammannia baccifera, Bacopa monnieri, Cleome chelidonia, Commelina paludosa, Hygrophila schulli, Limnophila dubia, Nicotiana plumaginifolia, Persicaria glabra, Polygonum plebeium, Stemodia viscosa, Sutera dissecta, Sopubia delphinifolia, Typha angustifolia, Veronica anagallis-aquatica and many members of Cyperaceae and Poaceae.
**Hydrophytic vegetation:** The fresh water flora of the region occurs in tanks, rivers, streams, ponds, ditches and perennial dams. Pure aquatic herbs are observed during monsoon season and these are replaced by wet mud associates, which in turn are replaced by dry mud associates ultimately making space for xerophytic herbs. The species that are common during monsoon include a number of emergent species such as *Aeschynomone indica*, *Cyperus corymbosus*, *C. compressus*, *C. iria*, *Fimbristylis ferruginea*, *Eleocharis atropurpurea*, *Hemarthria compressa*, *Linnophila dubia*, *Panicum paludosum* and *Sesbania bispinosa*. A few submerged aquatics are also found which include *Ceratophyllum demersum*, *Hydrilla verticillata*, *Najas graminea*, *N. indica*, *N. malesiana*, *Nymphaea nouchali*, *Ottelia alismoides*, *Potamogeton crispus*, *P. nodosus*, *P. perfoliatus*, *Stuckenia pectinata* and *Vallisneria natans*. The submerged aquatics are mixed with few free-floating members such as *Eichhornia crassipes*, *Lemma perpusilla*, *L. gibba*, *Pistia startiotes* and *Wolffia globosa*.

Many marsh-loving plants occur on wet margins and edges of various water bodies and around cultivation fields. These are *Ammannia baccifera*, *A. multiflora*, *Anagallis pumila*, *Bergia ammannioides*, *Canscora decurrens*, *Dentella repens*, *Gnaphalium polycaulon*, *Ipomoea aquatic*, *I. carnea*, *Hoppea dichotoma*, *Corchorus aescuans*, *Monochoria vaginalis*, *Oxalis corniculata*, *Persicaria glabra*, *Phyla nodiflora*, *Polygonum plebeium*, *Typha angustifolia* and *Veronica anagallis-aquatica*.

The plants like *Blumea bifoliata*, *B. lacera*, *Chrozophora prostrata*, *Desmodium triflorum*, *Gomphrena serrata*, *Cyathoclone purpurea*, *Grangea maderaspatana*, *Heliotropium supinum*, *H. marifolium*, *Sphaeranthus senegalensis*, *Stemodia viscosa*, *Verbascum chinense*, *Zeuxine strateumatica* and few others are common in drying ponds and ditches in post monsoon season.

Solanum nigrum, S. elaeagnifolium, Tridax procumbens, Verbascum chinense, Vernonia cinerea, Withania somniferum and many grasses.

Wall vegetation: Acalypha indica, Aerva lanata, Ageratum conyzoides, Amaranthus spp., Aristida adscensionis, Bidens bitemnata, Blainvillea acmella, Boerhavia diffusa, B. erecta, Chloris viridis, Cleome gynandra, Euphorbia hirta, Glinus lotoides, Glossocardia bosvallia, Heteropogon contortus, Mollugo pentaphylla, Leucas urticifolia, Peristrophe paniculata, Setaria pumila, Triantha portulacastrum, Tribulus terrestris and Vernonia cinerea are the dominant in wall flora.

Weeds: Weeds the plants that are not wanted where they grow. Usually, they are competitors for the crops, lawn grasses and garden plants. They cause tremendous loss to yield. In Balaghat region, weeds of crop fields in general may be classified into two categories viz. monsoon weeds and autumn weeds. The monsoon weeds appear in the fields along with the Kharip crops and continue to grow with them as long as enough moisture is available in the soil. Most common these are Alternanthera sessilis, Alysicarpus tetragonolobus, A. vaginalis, Andropogon pumilus, Biophytum reinwardtii, Cardiospermum helicacabum, Catharanthus pusillus, Celosia argentea, Chloris barbata, Cleome viscosa, Commelina forsskalii, C. hasskarlii, Corchorus olitorius, Convolvulus arvensis, Cyanotis cristata, Datura inoxia, Dactyloctenium aegyptium, Dienebra retroflexa, Dichanthium caricosum, Indigofera glandulosa, Emilia sonchifolia, Enicostema axillare, Launaea procumbens, Leucas spp., Melilotus albus, M. indicus, Merremia emarginata, Oxalis corniculata, Polygala arvensis, Portulaca oleracea, P. quadrifida, Rhynchosia minima, Rostellularia diffusa var. diffusa, Sida acuta, Solanum virginianum, Striga angustifolia, Tonningia axillaris and Xanthium indicum.

Autumn weeds appear in September and October, and continue to grow along Rabi crops until harvest in February. They are relatively less in number when compared with the monsoon weeds. Most common autumn weeds are Ageratum conyzoides, Alternanthera pungens, Chrozophora rottleri, Cyathocline purpurea, Euphorbia hirta, E. prostrata, E. rothiana, Ischaemum spp., Striga densiflora, Stemodia viscosa, Tricholepis glaberrima and many others.
E) PLANTS OF ECONOMIC AND MEDICINAL IMPORTANCE:

The variety of plants are being cultivated in Balaghat region for multifarious uses such as cereals, pulses, drugs, condiments, spices, fibres, oil seeds, fruits, vegetables, timber, tannins and bidi-wrapping. They are categorized as follows.

**Cereals:** The main cereal crops that are grown in the region include *Sorghum spp.* (Jowar), *Triticum aestivum* (Gahu), *Pennisetum americanum* (Bajri) and *Zea mays* (Maka). In addition to that, *Echinochloa frumentacea* (Rala, Sawa), *Eleusine coracana* (Nachani), *Oryza sativa* (Bhat, Rice), *Panicum miliaceum* (Rala) and *Setaria italica* (Warai) are also grown in the region on small scale.

**Pulses:** The chief pulses that are grown in this region include *Cajanus cajan* (Tur), *Cicer arietinum* (Harbhara), *Lathyrus sativus* (Kasari lakh), *Lens culinaris* (Masur), *Macrotyloma uniflorum* (Kulith, Hulga), *Pisum arvense* (Watana), *P. sativum* (Matar), *Vigna aconitifolia* (Matki), *V. angularis*, *V. mungo* (Udid), *V. radiata* (Moog), *V. unguiculata* var. *unguiculata* and *V. unguiculata* var. *cylindrica* (Chawali).

**Oil seeds:** *Arachis hypogaea* (Bhumbug), *Brassica campestris* (Mohari), *B. juncea* (Mohari), *B. nigra* (Mohari), *Carthamus tinctorius* (Kardai), *Cocos nucifera* (Naral), *Glycine max* (Soybean), *Guizotia abyssinica* (Lahan Karala), *Helianthus annuus* (Suryaphul), *Linum usitatissimum* (Jawas), *Ricinus communis* (Erand) and *Sesamum orientale* (Til) are grown for seeds which yield non-essential, edible or non-edible oils.

**Vegetables:** A large number of plant species are grown for vegetables such as *Abelmoschus esculentus* (Bhendi), *Allium cepa* (Kanda), *Allium sativum* (Lasun), *Amaranthus hybridus* (Rajgira), *Amaranthus roxburghianus* (Tandulja), *Amaranthus viridis* (Math), *Atriplex hortensis* (Chandan batwa), *Benincasa hispida* (Kohola), *Beta vulgaris* (Beet), *Brassica oleracea* var. *botrytis* (Phul kobi), *Canavalia gladiata* (Abai, Patadi), *Capsicum annuum* var. *acuminata* (Mirchi), *C. annum* var. *grosset* (Dhabbu mirchi), *Citrullus fistulosus* (Kharbuj), *Citrullus lanatus* (Kalingad), *Coccinia grandis* (Tondali), *Colocasia esculenta* (Alu), *Cucumis melo* var. *agrestis* (Shendani), *Cucumis melo* var. *utilissimus* (Shendad), *Cucumis sativus* (Kakdi), *Cucurbita maxima* (Tambda bhopla), *Cucurbita moschata* (Kashi bhopla), *Cyamopsis tetragonoloba* (Gawar), *Daucus carota* (Gajar), *Hibiscus cannabinus* (Ambadi),
Hibiscus sabdariffa (Lal ambadi), Ipomoea batatas (Ratale), Lablab purpureus (Wal, Papdi), Lagernaria siceraria (Dudhi bhopla), Luffa acutangula (Dodka), Luffa cylindrica (Ghosale), Lycopersicon esculentum (Tomato), Momordica charantia (Karle), M. cymbalaria (Kadwanchi), Moringa oleifera (Shewga), Phaseolus vulgaris (Shrawan ghewda), Raphanus sativus (Mula), Rumex vesicarius (Chuka), Sesbania grandiflora (Hadga), Solanum melongena (Wangi), Solanum tuberosum (Batata), Spinacia oleracea (Palak), Trichosanthes anguina (Padwal) and Trigonella foenum-graecum (Methi).

**Fruits:** Annona reticulata (Ramphal), Annona squamosa (Sitaphal), Carica papaya (Papai), Citrus aurantifolia (Limbu), Citrus karna (Id limbu), Cocus nucifera (Naral), Emblica officinalis (Awala), Ficus carica (Anjir), Mangifera indica (Amba), Manilkara zapota (Chiku), Musa paradisiaca (Keli), Phyllanthus acidus (Rai awala), Pithecellobium dulce (Wilayati chinch), Psidium guajava (Peru), Punica granatum (Dalimh), Syzygium cumini (Jambhul), Tamarindus indica (Chinch), Vitis vinifera (Draksha), Ziziphus mauritiana (Bor) and Ziziphus rotundifolia (Bor) are cultivated for their fruits.

**Fibre yielding plants:** Agave americana (Kektad), Gossypium arboreum (Cotton) and Hibiscus cannabinus (Ambadi) are grown for fibres in Balaghat region.

**Cash crops:** Gossypium arboreum (Cotton) and Saccharum officinarum (Oos) are the important cash crops of the region.

**Timber yielding trees:** Major timber yielding trees include Acacia chundra (Khair), Acacia nilotica, Azadirachta indica (Neem), Hardwickia binata (Anjan), Syzygium cumini (Jambhul) and Tectona grandis (Sagwan).

**Medicinal plants:** About 286 plant species of medicinal importance are recorded from Balaghat region. Some of them are Abrus precatorius, Acacia chundra, Acacia concinna, Acmella oleracea, A. paniculata, Aegle marmelos, Aloe vera, Andrographis paniculata, Anogeissus latifolia, Argyreia nervosa, Argemone mexicana, Aristolochia indica, Asparagus racemosus var. javanica, Bacopa monnieri, Barleria prionitis, Balanites aegyptiaca, Bauhinia variegata, Boswellia serrata, Butea monosperma, Caesalpinia bonduc, Cassia fistula, Celastrus paniculata, Centella asiatica, Citrus medica, Cissus quadrangularis, Convolvulus arvensis, Crinum asiaticum, Curculigo

F) PLACES OF BOTANICAL INTERESTS:

Naigaon Mayur Sanctuary: Naigaon is the place well known for the peacock and has been declared as a sanctuary by the government of Maharashtra for the protection of peacock (Pavo cristatus). It covers an area of 29.90 Km². It is located in Patoda taluka of Beed district. The altitude of this region is ranges between 650-895 m above mean sea level. The average annual rainfall is ranges between 500-800 mm. The vegetation type of this area falls under mixed dry deciduous forests. The most dominant tree species are Acacia catechu, A. chundra, A. horrida, A. nilotica, A. polyacantha, A. tomentosa, Anogeissus latifolia, Bridelia retusa, Bauhinia purpurea, B. tomentosa, Buchanania cochinchinensis, Casearia tomentosa, Cassine glauca, Cassia fistula, Cordia dichotoma, Dalbergia latifolia, Diospyros melanoxylon, D. chloroxylon, Flacourtia indica, Grewia serrulata, Holarrhena pubescence, Lannea coromandelica, Madhuca longifolia, Maytenus senegalensis, Mitragyna parviflora, Rhus mysoresensis, Spondias pinnata, Sterculia urens, Syzygium cumini, Tectona grandis, Terminalia alata, T. arjuna, Ziziphus caracutta, Z. nummularia and Z. rotundifolia.

The ground is covered with grasses and herbaceous flora in monsoon season which form good fodder. The dominant herbs are Alysicarpus luteo-vexillatus, A.

This vegetation is best suited for Peacocks. The other birds observed along with peacock are Bulbul, Lave, Hariyal, Karkocha, Kingfisher, Pilak, Titar and Woodpecker and animals like black bucks, Hares, Wolfs, Foxes and Hyenas.

**Yedshi-Ramling Wild Life Sanctuary**: Yedshi-Ramling Sanctuary is the place well known for its rich biological diversity and luxuriant vegetation. It covers an area of 22.37 sq. km. It is located just 25 km away from Osmanabad town proper. The hilly terrain is chief feature of the sanctuary. The altitude of this region is ranges between 650-795 m above mean sea level and annual rainfall is between 500-800 mm. The vegetation of this area falls under mixed dry deciduous category. The forests are open, under stocked and large grassy areas are often met with due to biotic interference. The dominant tree species in order of their dominance are Acacia senegal, A. tomentosa, Annona squamosa, Anogeissus latifolia, Barleria longiflora, Boswellia serrata, Bombax ceiba, Buchanania cochinchinensis, Casearia tomentosa, Cassine glauca, Cassia fistula, Cordia dichotoma, Dalbergia latifolia, Diospyros melanoxylon, D.


The animals observed in the sanctuary include antelopes, ant-eaters, black bucks, foxes, Jackals, Hyenas, Panthers, porcupine, wolves and wild boars. Many beautiful birds such as Grey partridge, Grey quail, Golden oriole, Kingfisher, Green pigeon, Woodpecker etc. are also observed in the sanctuary.

Yedshi-Ramling is a famous tourism place, indeed it is an oasis to the people of drought prone region of Maharashtra and popularly known as second Mahabaleshwar.

Sautada Water Fall: It is well known waterfall, called after the village name Sautada. The river Vaitarna raises at a place called Cikhlı about 1.6 km from Sautada village falls down from a height of about 68.59 m and then further cuts its course through rugged hills and mountains clad with forests. The scene of the water falling down from such a great height is pleasing to the eye. From the mountain cliff down to the level of the river basin a flight of about 600 steps has been built. At the base of the
fall there is a pond known as dev-kund. It is so-called because it is supposed to have been created by Ram by shooting an arrow. Further away is a big water strip in the form of a doh called Sitakund. The vegetation of the area is of mixed dry deciduous forests. The dominant trees and shrubs of the area include *Acacia campbellii*, *A. chundra*, *A. polyacantha*, *A. nilotica*, *A. tomentosa*, *Albizia lebbeck*, *Anogeissus latifolia*, *Bauhinia tomentosa*, *Cassine glauca*, *Erythrina suberosa*, *Euphorbia caducifolia*, *Flacourtia indica*, *Helicteres isora*, *Kleinia grandiflora*, *Terminalia arjuna* and *Tamarix ericoides*.

Common climbers and twiners of the area include *Abrus precatorius*, *Acacia caesia*, *A. torta*, *A. pennata*, *Aspidopterys cordata*, *Canavalia cathartica*, *Carissa congesta*, *C. opaca*, *Cissampelos pareira* var. *hirsuta*, *Clematis heynei*, *Cocculus hirsutus*, *Combretum albidum*, *Gymnema sylvestre*, *Merremia hederacea*, *Mucuna pruriens*, *Rhynchosia minima* and *R. rothii*. Some interesting herbs of the area are *Alysicarpus hamosus*, *A. monilifer*, *A. ovalifolius*, *A. tetragonolobus*, *Bidens biternata*, *Cosmos sulphureus*, *Euphorbia coccinea*, *E. corrigioloides*, *E. laciniata*, *Indigofera cassioides*, *I. deccanensis*, *Malva parviflora*, *Pimpinella heyneana*, *Plectranthus barbatus*, *Senecio edgeworthii*, *Striga asiatica* var. *lutea*, *Utricularia bifida*, *U. caerulea*, *U. striatula* and *Waltheria indica*.

**Mukundraj:** Mukundraj, one of the most celebrated and earliest poets of Maharashtra who composed verse in simple Marathi. His samadhi is located at a distance of 3.21 km from Ambajogai town, on the slopes of Balaghat ranges, and the hill adorned by the samadhi is known as Mukundraj hill. The tops of the hills are clad with dense forests in the rainy season when the streams come trickling down the valley from the hill tops, the view is bewitching. The vegetation type of this area falls under mixed dry deciduous category. The dominant trees and shrubs of the area are *Acacia chundra*, *A. planifrons*, *A. nilotica*, *A. tomentosa*, *Albizia lebbeck*, *Anogeissus latifolia*, *Barleria longiflora*, *B. cristata*, *Bauhinia tomentosa*, *Cassine glauca*, *Clerodendrum serratum*, *C. phlomidis*, *Cordia dichotoma*, *Dichrostachys cinerea*, *Dolichandrone falcata*, *Ehretia aspera*, *Erythrina suberosa*, *Euphorbia caducifolia*, *Helicteres isora*, *Indigofera cassioides*, *I. astragalina*, *I. duthiei* var. *trifoliata*, *Kleinia grandiflora*, *Lantana indica*, *Mimosas hamata*, *M. prainiana*, *Terminalia alata*, *Sarcostemma viminale* subsp. *viminale* and *Vitex trifolia*.