

Endangered Medicinal Plants

A. B. Chaudhuri

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Endangered Medicinal Plants

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- Environmental and Herb Shrub Flora (1991)
- Himalayan Ecology and Environment (1992)
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- Biodiversity of Sundarbans and Andaman Mangroves (under publication)
- Wetlands - A Vanishing Resource in India (under publication)
- Forests, Environment and Man (under publication)

Endangered Medicinal Plants

by

A.B. Chaudhuri

Ex-Director, Forest Survey of India

2007

DAYA PUBLISHING HOUSE

DELHI-110 035

© 2007, A.B. Chaudhuri (b. 1926-

ISBN : 978-81-7035-441-3

ISBN 81-7035-441-2

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Published by : **Daya Publishing House**
1123/74, Deva Ram Park
Tri Nagar, Delhi - 110 035
Phone: 27383999
Fax: (011) 23244987
E-mail: dayabooks@vsnl.com
Website: www.dayabooks.com

Showroom : 4760-61/23, Ansari Road,
New Delhi - 110 002
Ph.: 23245578, 23244987

Laser Composed by : **Vaishnav Graphics & Systems**
New Delhi - 110 055

Printed at : **Chawla Offset Printers**
Delhi - 110 052

PRINTED IN INDIA

Dedication

Dedicated to Dr. Rakesh Chopra, M.D. and Associate Doctor, Oncologists of Apollo Indraprastha Hospitals of New Delhi whom I have observed deeply involved in the treatment of cancer affected patients very sincerely and ceaselessly by application of latest multi-quality drugs. India needs to conserve its medicinal plants for indepth research on such plants to discover life-saving drugs.

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Acknowledgements

The author duly acknowledges the magnanimity of various editors and authors in permitting this writer to use excerpts of their published materials with due acknowledgements.

Thanks are also due to the librarians of Institute of Chemical Biology and State Forest Department for helping this writer with various documents needed for reference work using their libraries.

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Preface

I am a forester by profession and a botanist by University degree. Right from my college days I was interested in identification of plant species. During my 34 years of forestry service and thereafter I have all along kept interest in the identification of species. My postings in the State as Working Plans division, Silvicultural division and in the Centre as Chief Co-ordinator Pre-investment Survey of Forest Resources and Director of Forest Survey helped me in the job of knowing species of all categories of plants. I have made a lot of status survey of tree, shrub, herb, flora also.

With these background, I have published a good number of books indicating status of various species. This has given me confidence to state that this country's medicinal plant is in jeopardy and are facing crisis due to various biotic and abiotic causes.

India is a vast country and the number of plant species is high and therefore my observation may be taken as broad based. This leaves much work to be done by foresters and botanists in future. I have not changed/corrected the nomenclature used by various scientists. Also analysis of Western, Central and Eastern Indian flora has been made in this treatise.

Hope the appropriate authorities will take steps to save India's medicinal plants from utter ruination.

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Block-10, Flat - 4,
Kolkata-700 040

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Author

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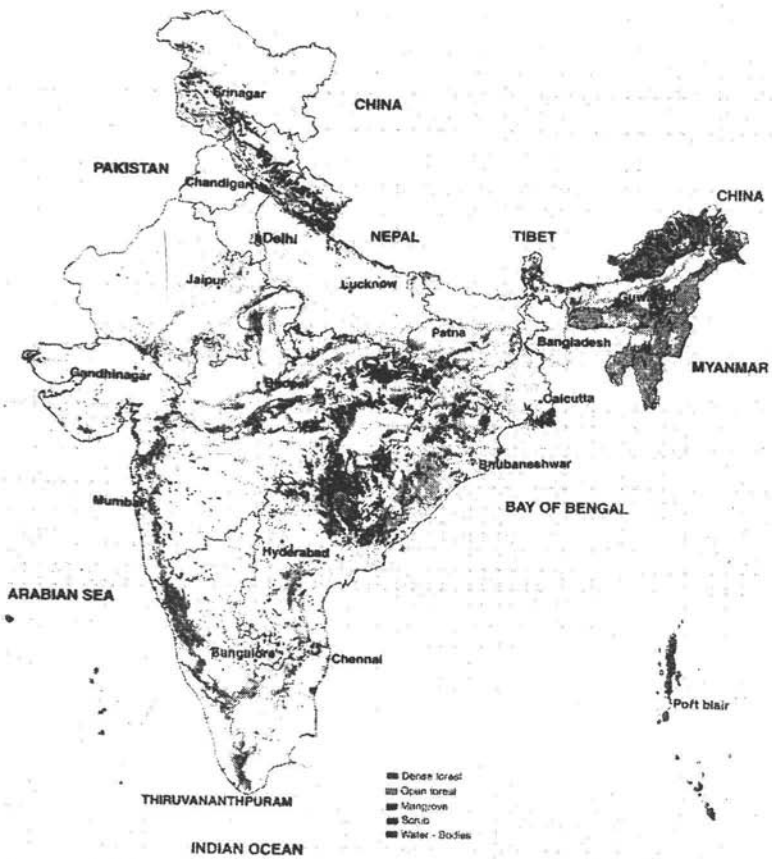
Chapter One

Depletion of Land, Deforestation and Medicinal Plant Crisis

The black and white map represents a rough status of forest in India about 70 years back. Since 1980 Forest Survey of India and NRSA prepared Forest maps of India with the help of Satellite imagery, but in small scale, it was not possible, therefore,



Map 1 : Forest Map of India



Map 2 : Distribution of Forest Cover in India

to draw a correct picture of existing forests in India. The problem has now been solved. Several maps follows and by superimposition it is possible to mark the areas vulnerable to pollution and related problems. Maps of drought prone area, flood affected and soil eroded areas will expose other problems of the country *vis-à-vis* forest cover.

The coloured map of India shows the concentration of dense forests which cover large areas in Arunachal Pradesh, North Bengal, Nowgaon of Assam, Western Himalayas in Uttaranchal, Himachal Pradesh and J&K, Western Ghat in Karnataka, Kerala,

Bastar in Chattishgarh, Chandrapur in Maharashtra. It also shows the open forests in yellow colour and Scrub in red.

The appended tables (1 and 2) show the forest cover of the country prepared by Forest Survey of India.

Various threats that the country faces has been shown in several charts.

Change in Forest Cover

The change in forest cover of the country, as per the present and the preceding assessments, is given in Table 2a. The net increase in the forest cover of the country is 3,896 sq.km. The dense forest has increased by 10,098 sq.km. and mangrove by 44 sq.km., whereas open forest has decreased by 6,246 sq.km.

The forest cover in different states and union territories in the present and preceding assessments, along with the data period of the respective assessments, is given in Table 2b. The table reveals that the states of Andhra Pradesh, Arunachal Pradesh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal have registered increase in the forest cover. The States and the Union Territories showing decrease in forest cover are Assam, Bihar, Goa, Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Andaman & Nicobar Islands and Dadra & Nagar Haveli. In Chandigarh and Daman & Diu there was no change in the forest cover during these two assessments.

It is to be noted that the period during which the change in the forest cover has occurred is not uniform in all the states but it varies between 2 to 5 years, because satellite data used in the interpretation are of different dates. The average difference at the national level is about 3 years. In Andhra Pradesh, net increase of 939 sq.km. in forest cover has occurred in 5 years (1993-98), whereas in Mizoram, loss of 43 sq.km. has occurred in 4 years (1994-98). It needs to be underlined that in case of 11 states where the method of interpretation has changed from visual to digital, the present assessment, as such, is not comparable to the preceding assessment because of change in the scale of interpretation. The area of forest cover in such cases has been suitably transformed from 1:50,000 to 1:250,000 scale to

Table 1.1 : Extent of Dense forest, Open forest and Mangrove in States/UTs

| State/UT | Dense forest | Open forest | Mangrove | Total forest cover | Per cent of geographic area | Scrub |
|-------------------|--------------|-------------|----------|--------------------|-----------------------------|-------|
| Andhra Pradesh | 24,190 | 19,642 | 397 | 44,229 | 16.08 | 9,559 |
| Arunachal Pradesh | 57,756 | 11,091 | 0 | 68,847 | 82.21 | 104 |
| Assam | 14,517 | 9,171 | 0 | 23,688 | 30.20 | 324 |
| Bihar | 13,274 | 13,200 | 0 | 26,474 | 15.23 | 1,914 |
| Delhi | 35 | 53 | 0 | 88 | 5.93 | 3 |
| Goa | 995 | 251 | 5 | 1,251 | 33.79 | 16 |
| Gujarat | 6,430 | 5,504 | 1,031 | 12,965 | 6.61 | 2,948 |
| Haryana | 449 | 515 | 0 | 964 | 2.18 | 191 |
| Himachal Pradesh | 9,120 | 3,962 | 0 | 13,082 | 23.50 | 566 |
| Jammu & Kashmir | 11,019 | 9,422 | 3 | 20,441 | 9.20 | 3,089 |
| Karnataka | 24,832 | 7,632 | 0 | 32,467 | 16.93 | 4,489 |
| Kerala | 8,429 | 1,894 | 0 | 10,323 | 26.56 | 91 |
| Madhya Pradesh | 81,619 | 50,211 | 0 | 131,830 | 29.73 | 3,853 |
| Maharashtra | 26,613 | 19,951 | 108 | 46,672 | 15.17 | 7,160 |
| Manipur | 5,936 | 11,448 | 0 | 17,384 | 77.86 | 177 |
| Meghalaya | 5,925 | 9,708 | 0 | 15,633 | 69.70 | 261 |
| Mizoram | 3,786 | 14,552 | 0 | 18,338 | 86.99 | 125 |
| Nagaland | 5,137 | 9,027 | 0 | 14,164 | 85.43 | 14 |

contd...

Table 1.1 – contd...

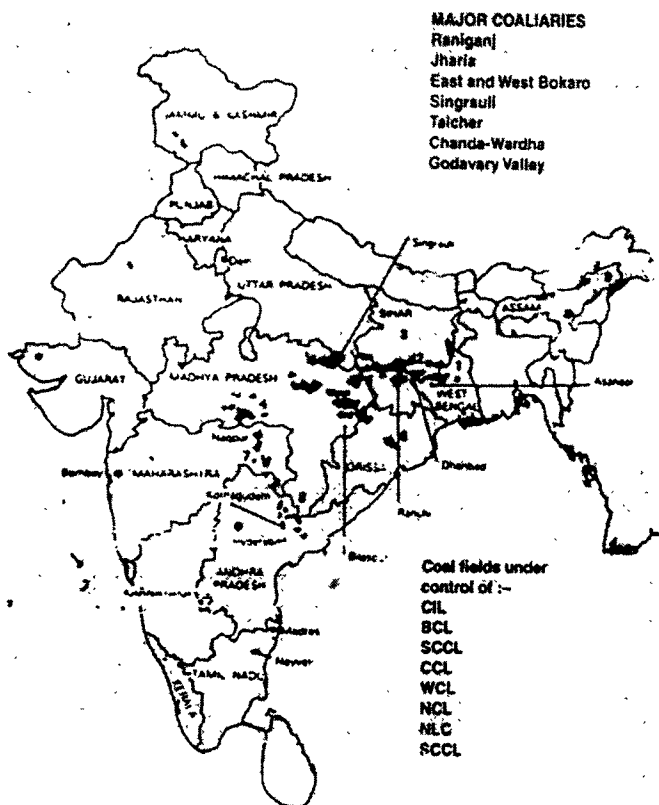
| State/UT | Dense forest | Open forest | Mangrove | Total forest cover | Per cent of geographic area | Scrub |
|---------------------------|----------------|----------------|--------------|--------------------|-----------------------------|---------------|
| Orissa | 26,073 | 20,745 | 215 | 47,033 | 30.21 | 5,439 |
| Punjab | 517 | 895 | 0 | 1,412 | 2.80 | 107 |
| Rajasthan | 4,309 | 9,562 | 0 | 13,871 | 4.05 | 6,921 |
| Sikkim | 2,363 | 755 | 0 | 3,118 | 43.94 | 386 |
| Tamil Nadu | 8,659 | 8,398 | 21 | 17,078 | 13.13 | 2,836 |
| Tripura | 2,228 | 3,517 | 0 | 5,745 | 54.79 | 38 |
| Uttar Pradesh | 22,902 | 11,114 | 0 | 34,016 | 11.55 | 1,177 |
| West Bengal | 3,565 | 2,672 | 2,125 | 8,362 | 9.42 | 98 |
| Andaman & Nicobar Islands | 6,515 | 125 | 966 | 7,606 | 92.21 | 0 |
| Chandigarh | 6 | 1 | 0 | 7 | 6.14 | 0 |
| Dadra & Nagar Haveli | 159 | 43 | 0 | 202 | 41.14 | 10 |
| Daman & Diu | 0 | 3 | 0 | 3 | 2.68 | 0 |
| Lakshdweep | 0 | 0 | 0 | 0 | 0 | 0 |
| Pondicherry | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 377,358 | 255,064 | 4,871 | 637,293 | 19.39 | 51,896 |

Table 1.2a : Class-wise change in forest cover

(sq.km.)

| Class | Assessment 1999 | Assessment 1997 | Change |
|--------------|--------------------|--------------------|---------------|
| Dence forest | 377,358 | 367,260 | +10.098 |
| Open forest | 255,064 | 261,310 | -6.246 |
| Mangrove | 4,871 | 4,827 | +44 |
| Total | 637,293 | 633,397 | +3.896 |

COAL FIELD AREAS OF INDIA



Map 3 : Coal field areas of India

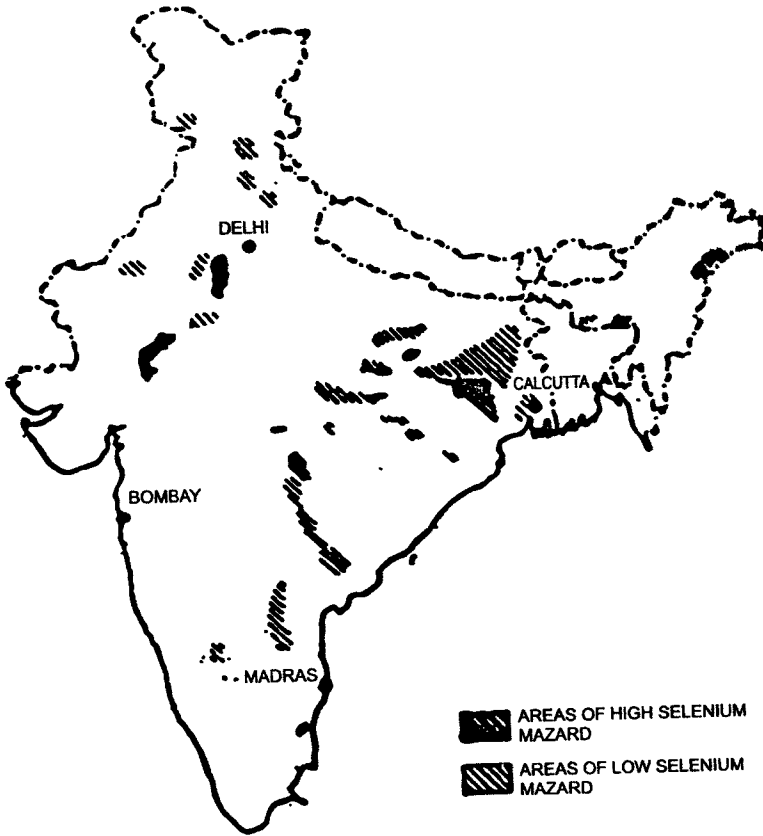
Table 1.2b : Comparative account of forest cover of States/UTs in 1997 and 1999 assessments

| State/UT | 1997 Assessment | | 1999 Assessment | | Change (sq.km.) |
|-------------------|-------------------------|--------------------------|-----------------------------|--------------------------|--------------------|
| | Data period | Forest cover (sq.km.) | Data period | Forest cover (sq.km.) | |
| Andhra Pradesh | Oct. 93 | 43,290 | Nov. 98-Jan. 99 | 44,229 | +939 |
| Arunachal Pradesh | Nov. 94 & Nov. 95 | 68,602 | Dec. 98-Feb. 99 | 68,847 | +245 |
| Assam | Dec. 93, Apr. & Nov. 94 | 23,824 | Dec. 98 | 23,688 | -136 |
| Bihar | Nov.-Dec. 94 | 26,524 | Oct. 96-Jan. 97 | 26,474 | -50 |
| Delhi | Oct.-Nov. 92 & 94 | 26 | Oct.-Nov. 98 | 88 | +62 |
| Goa | Dec. 93 & 94 | 1,252 | Dec. 95-Jan. 96 | 1,251 | -1 |
| Gujarat | Oct.-Dec. 94 | 12,578 | Oct.-Dec. 96 & 97 | 12,965 | +387 |
| Haryana | Oct. 92 & Oct.-Nov. 94 | 604 | Nov.-Dec. 96 | 964 | +360 |
| Himachal Pradesh | Oct. 94 & Nov. 95 | 12,521 | Oct.-Dec. 98 | 13,082 | +561 |
| Jammu & Kashmir | Nov. 94 & 95 | 20,440 | Nov.-Dec. 96 & Sep.-Oct. 97 | 20,441 | -1 |
| Karnataka | Dec. 93-Jan. 94 | 32,403 | Dec. 95-Jan. 96 | 32,467 | +64 |
| Kerala | Dec. 95 | 10,334 | Jan. & Mar. 96 | 10,323 | -11 |
| Madhya Pradesh | Oct.-Nov. 94 | 131,195 | Oct.-Dec. 96 | 131,830 | +635 |
| Maharashtra | Oct.-Nov. 93 | 46,143 | Oct.-Nov. 96 | 46,672 | +529 |
| Manipur | Dec. 93-Feb. 94 | 17,418 | Dec. 98 | 17,384 | -34 |
| Meghalaya | Dec. 93 | 15,657 | Dec. 98 | 15,633 | -24 |
| Mizoram | Dec. 93-Feb. 94 | 18,775 | Dec. 98 | 18,338 | -437 |

contd...

Table 1.2b - contd...

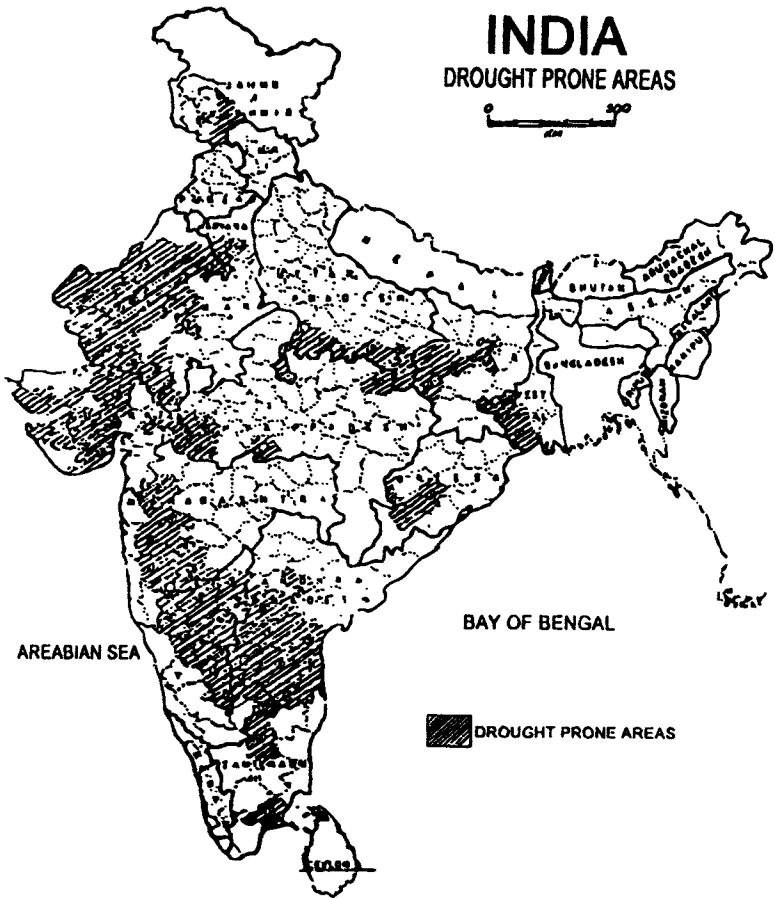
| State/UT | 1997 Assessment | | 1999 Assessment | | Change (sq.km.) |
|---------------------------|-----------------|--------------------------|---------------------------|--------------------------|--------------------|
| | Data period | Forest cover (sq.km.) | Data period | Forest cover (sq.km.) | |
| Nagaland | Dec. 93-Oct. 94 | 14,221 | Dec. 98 | 14,164 | -57 |
| Orissa | Oct.-Nov 93 | 46,941 | Nov.-Dec. 95 | 47,033 | +92 |
| Punjab | Oct. 94-Jan. 95 | 1,387 | Nov.-Dec. 96 | 1,412 | +25 |
| Rajasthan | Nov.-Dec. 94 | 13,353 | Oct.-Dec. 96 | 13,871 | +518 |
| Sikkim | Sep. 94 | 3,129 | Nov. 98 | 3,118 | -11 |
| Tamil Nadu | Mar. 94 | 17,064 | Jan., Mar. & Sep. 96 | 17,078 | +14 |
| Tripura | Dec. 93 | 5,546 | Dec. 98 | 5,745 | +199 |
| Uttar Pradesh | Oct.-Dec. 94 | 33,994 | Oct.-Dec. 96 | 34,016 | +22 |
| West Bengal | Oct.-Dec. 93 | 8,349 | Dec. 95-Feb. 96 & Dec. 96 | 8,362 | +13 |
| Andaman & Nicobar Islands | Dec. 94 | 7,613 | Mar. 97 & Jan.-Mar. 98 | 7,606 | -7 |
| Chandigarh | Oct.-Nov. 94 | 7 | Jan. 99 | 7 | 0 |
| Dadra & Nagar Haveli | Oct.-Dec. 94 | 204 | Nov. 96 | 202 | -2 |
| Daman & Diu | Oct.-Dec. 94 | 3 | Nov. 96 & Oct. 97 | 3 | 0 |
| Lakshdweep | - | 0 | - | 0 | 0 |
| Pondicherry | - | 0 | - | 0 | 0 |
| Total | - | 633,397 | - | 637, 293 | +3,896 |



Map 4 : Map showing selenium polluted areas

maintain consistency in comparison. For doing so, digital interpretation was done on both the scales using the same data of the sampled area. A ratio factor was then estimated for each sheet for converting the area of forest cover from 1:50,000 to 1:250,000 scale.

Map 3 showing major coal belts of India. Foresters have a very wide field of works to perform in the form of soil conservation and afforestation to ameliorate the disturbed environment.

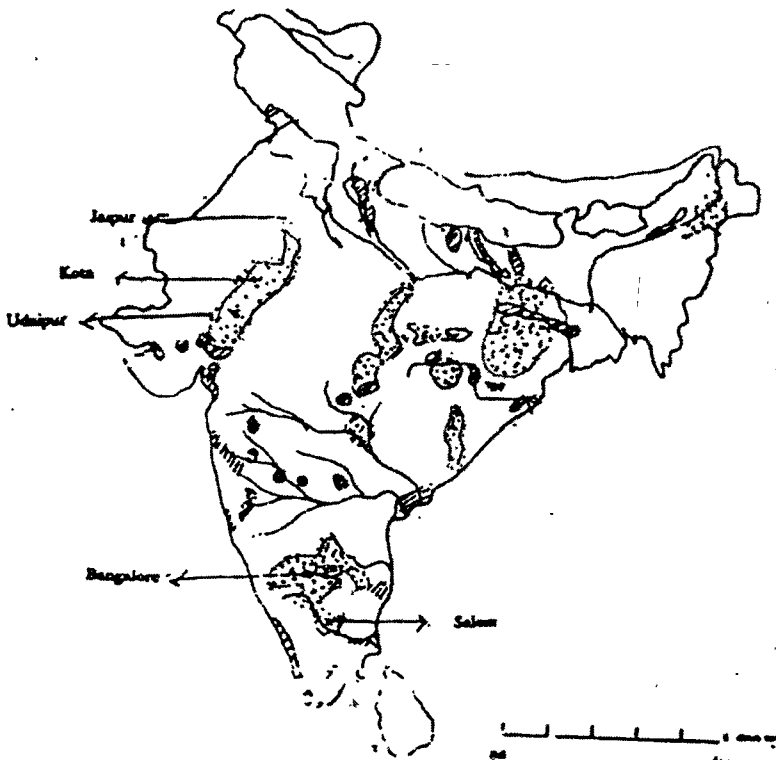


Map 5 : Map of India showing the drought prone areas.

Map 4 may be super imposed on other maps on mine, mineral, thermal power site maps and the depth of the environmental problems assessed.

Map 5 represents the drought prone areas of India which very frequently become the victim of drought and sometimes severe drought conditions.

A rough presentation of Industrial and mining areas of the country has been made on this map. The cumulative affect of all the issues presented in the maps 4-9 has to be assessed and

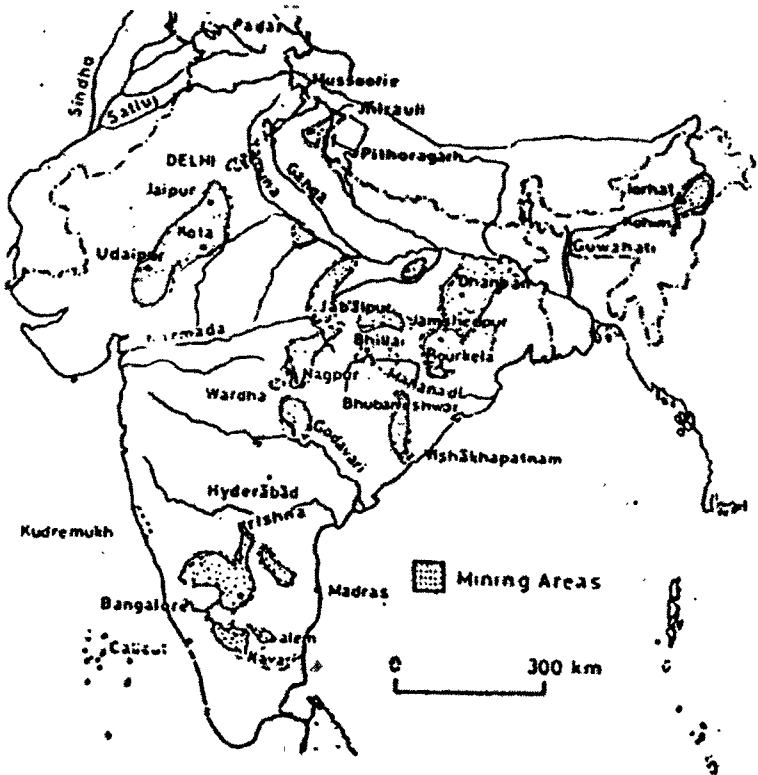


Map 6 : Industrial and mining areas.

remedial methods adopted. Foresters have a great role to play in amelioration.

Map 7 broadly shows the mine areas of this country. The map has to be read along with other maps and steps taken to rehabilitate and ameliorate the environment through various forestry methods.

Of the aforesaid geographical distribution of medicinal plants of India, the richest regions are the Himalayan forests and Western ghat forests. Other areas are either arid, desert or heavily populated regions of the plains.



Map 7 : Mining areas of India

India Facing a Perilous Landuse and Environmental Crisis

The plannings of India were done without considering the terrible landuse situation on which the country's future stands. It is like building castles over a soft, cracked and dilapidated foundation that might breakaway anytime like quick sand. The authors drew parallel between the Roman emperor 'Nero' (37-60 AD) (dream of building new city of Rome while he was

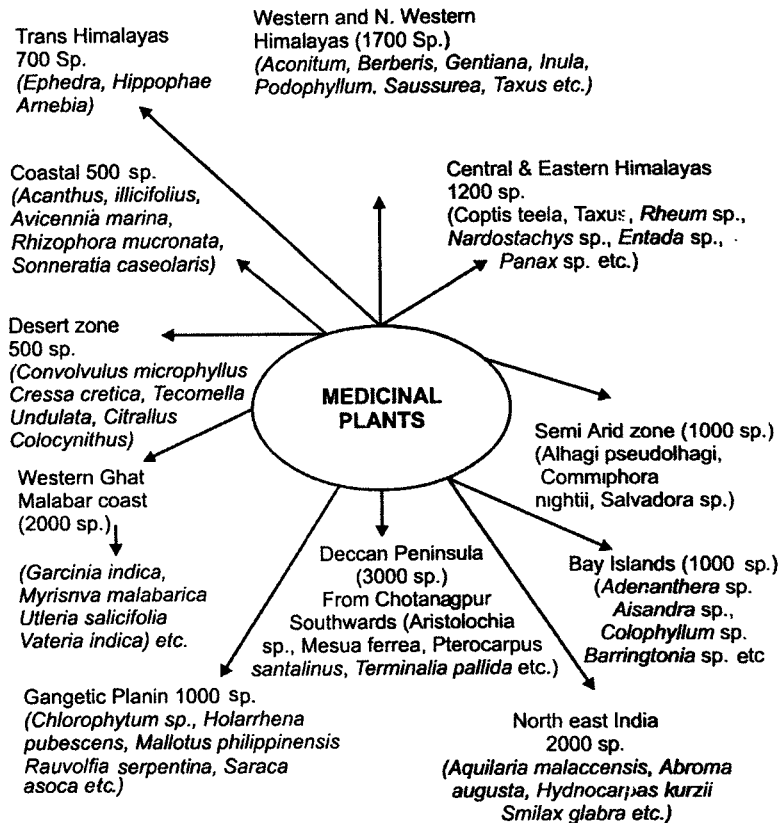


Chart 1 : Biogeographical distribution of medicinal plants.

playing lyre in full view of burning city) and the planning for development of modern India, the latter having been fully oblivious of landuse situation.

Besides these natural calamities India has to tackle the problems of a huge poverty-stricken, illiterate, unemployed mass where even amenities like safe drinking water, education and medical help etc. are lacking.

The author while analysing various facts and figures, documented by the Planning Commission of India, the National Commission of Agriculture and the National Commission on Flood found that they have registered 70% of the total 3.2 million

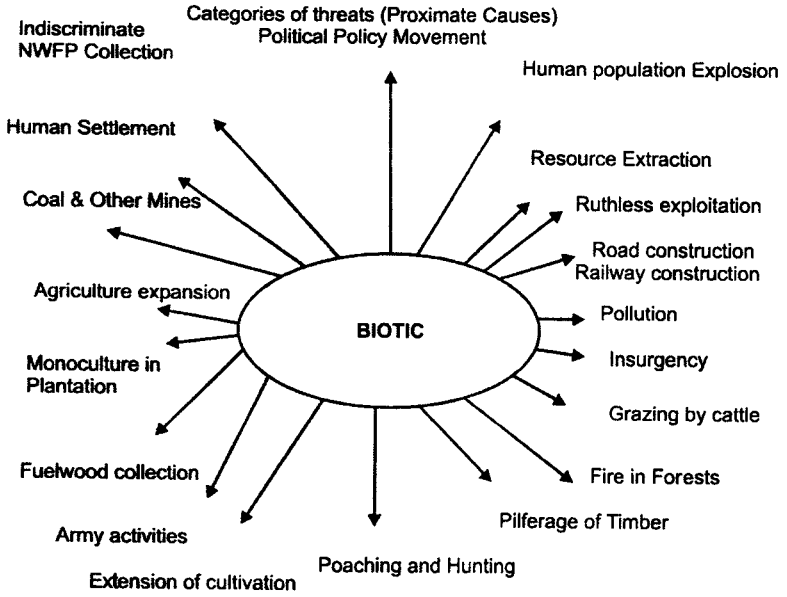


Chart 2 : Threats to India's Nature

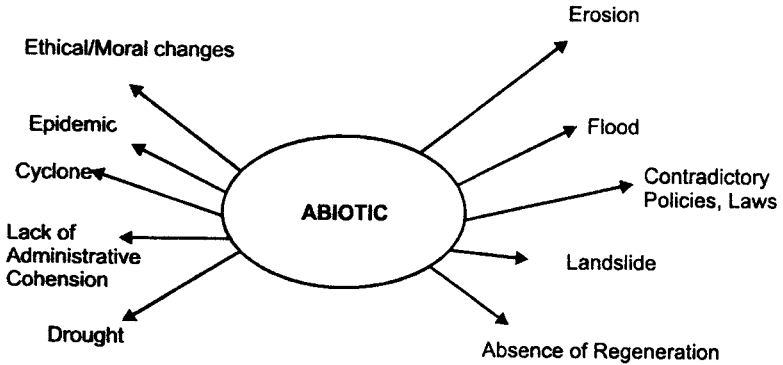


Chart 3 : Root Causes

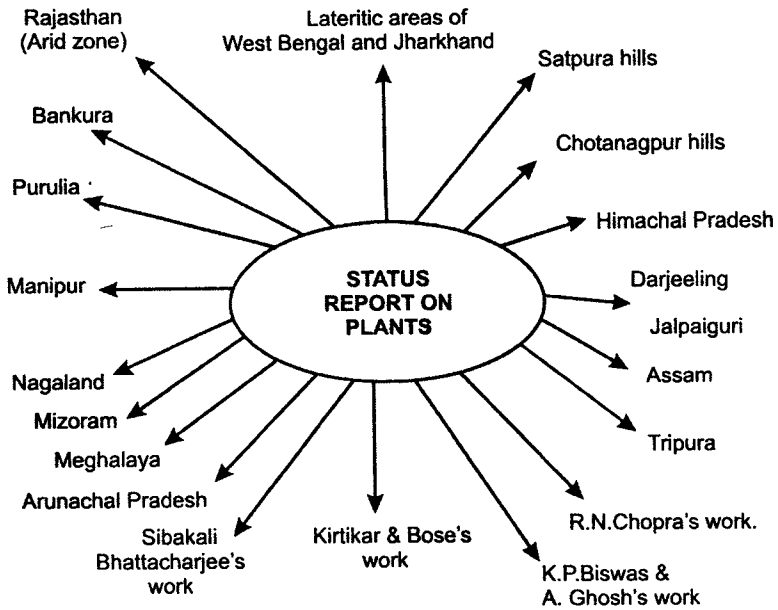


Chart 4 : Selected study Area
(Comments based on published reports supplemented from author's field work)

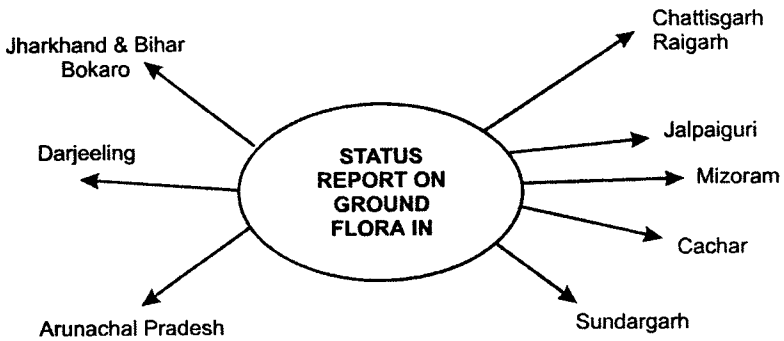


Chart 5

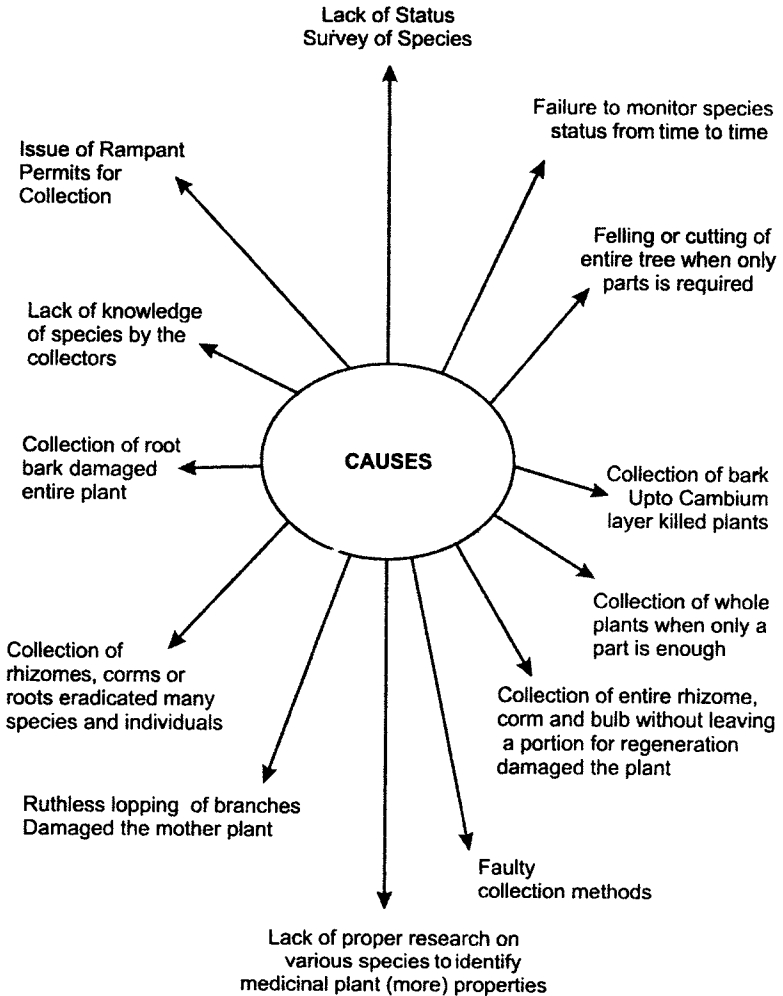


Chart 6 : Other causes of depletion of medicinal plants

sq.km. of land has been reeling under flood, drought and erosion etc. Such landuse condition has to be tackled effectively before India takes up a massive, gigantic and long-duration projects. They have stressed that India needs to create an effective cover of plants by massive afforestation mingled with soil conservation engineering works, reclamation of waterbodies—big or small. Here comes the role of foresters who are well- equipped to create a better India. They have training, expertise and the character built over an experience of about 200 years to rehabilitate depleted soil.

This chapter presents some data on flood, drought, soil, erosion, forest cover, etc. and relevant issues.

Medicinal Plants (A dwindling resource)

The author sincerely feels that the vast reservoir of medicinal plant resources of India is in peril. The readers may peruse the chapters on 'medicinal plants' detailed in the books (i) Biodiversity Endangered (India's Threatened Wildlife and Medicinal Plants) and (ii) Megadiversity Conservation (Flora, Fauna and Medicinal Plants of India's Hot Spots) of the author.

The author has analysed various issues on the subject and has given a broad view of the status of important plants.

The author has stressed the point about qualitative study by the Botanical Survey of India on the flora of various region. Without quantitative studies the status of any plant cannot be ascertained. As such, analysis of ground flora (herbs, shrubs, climbers) which form the bulk of medicinal plants is essential to determine the status of a plants.

Forest Survey of India, has initiated the study of ground flora all over the country which should focus some important features of ground flora.

A Resource that is Fragmenting Rapidly

Indians are fortunate to be blessed with varieties of climate, from tropical to alpine and desert to humid. It has therefore, a large array of vegetation and having more than 20,000 plant species. Most part of this sub-continent falls in the biotic region of tropical deciduous forests and tropical scrub forests. Tropical rain forests occupy a narrow belt in the west coast, north-east

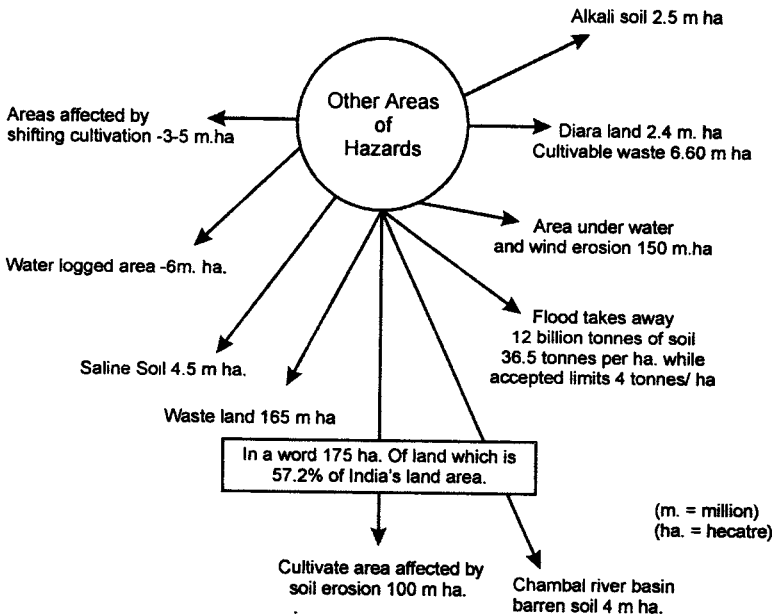
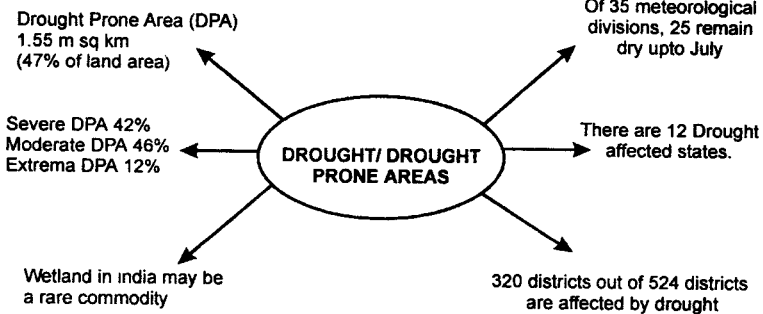


Chart 7 : Perilous land use (Vohra's Assessment)

India and in Andaman and Nicobar Islands. The desert and arid zone vegetation is found in Rajasthan and adjoining areas. Sub-tropical, temperate and alpine forms of vegetation are found in the Himalayas, Nilgiris and other hill regions.

PERILOUS LAND USE (Contd...)**Accelerated erosion:**

| | |
|--------------------|-------------------|
| Water erosion | – 90 million ha. |
| Wind erosion | – 50 million ha. |
| Seasonal flood | – 12 million ha. |
| Inundated annually | – 0.7 million ha. |
| Total land area | – 328 million ha. |

Various Hazards : Drought prone area 155 m. sq.km.

- Ravine affected area - 73–69 lakh ha.
- Degraded areas 35 million ha. (Vohra (1978))

FAO 1981 Degraded Forest 15.095 million ha.

- Scrub (no tree) – 5.378 m. ha.
- Open forest (scattered trees) – 5.393 m. ha.
- Forest, subjected to heavy biotic pressure – 4.324 m. ha.
- Rate of degraded in 0.8 million ha. per year Khan 1987

**Indians
Horrendous
Land
Degradation
situation**

Various arid zones :

| | | |
|----------------|---|-------------|
| Desert zone | – | 929000 ha |
| Arid zone | – | 13455200 ha |
| Semi-arid zone | – | 6686000 ha |
| Sub-humid zone | – | 110000 ha |
| Humid zone | – | 211000 ha |

Desertification

Arid areas 3200000 ha
(12% of country's area)

The extent of forest and the condition may be perused from maps and tables.

India has 16 major vegetation types which are • Tropical Wet evergreen forests. Tropical Semi-evergreen forests • Tropical moist deciduous forests • Littoral and Swamp forests • Tropical Dry deciduous forests • Tropical thorn forests • Tropical dry-evergreen forests • Sub tropical broad leaved hill forests • Sub-

tropical dry evergreen forests • Sub-tropical pine forests
• Montane wet temperate forests • Himalayan moist temperate forests • Himalayan dry temperate forests. Sub alpine forests. Moist alpine Scrub forests • Dry alpine Scrub forests.

The Himalayan region is fragile; also the Thar desert, the western and eastern ghats. The Himalayan region covers 50.0 million ha. The ecological stability of the region is not only important for the local population it is equally important for the entire Indo-Gangetic basin. The arid region occupy 31 million ha., 60 per cent of which lie in Rajasthan. Grazing, fire, uncontrolled collection of wood continue round the year.

The extent of erosion may be visualised from the media report (Times of India dt. 11.11.05) quoted in this chapter.

Crisis Facing Medicinal Plants

The present conception of people over a wide circle is that India's floral and faunal resources are considered very rich. In the past sixty years the biotal scenario has undergone a drastic change due to uncontrolled biotic factor; some abiotic factors have also aggravated the situation. The Department of Forests was created since the sixties of nineteenth century and on the recommendation of the Government of India enacted Wildlife Protection Acts for conservation of 'Birds', 'Elephants' and 'Rhinoceros' and lately Wild Life (Protection) Act of 1972 for protection of all biotal species those are threatened of existence. This Act of 1972 takes care to protect various categories of flora and fauna in consideration to their present status. In various management plans drawn for Forest Divisions adequate care had been taken to preserve threatened tree species; but little care was taken for the preservation of herb and shrub flora which form bulk medicinal plant materials.

India has more than 1500 tree species of which only few are regenerating. Over-exploitation, selective exploitation, grazing and fire are threatening their survival. Trees which occupy the topmost layer of a forest may not serve a foolproof function against various atmospheric hazards; top middle and bottom, the middle layer has the maximum number of species; next is the bottom layer and it is hardly much forest left in the country where the bottom and middle storey trees stand. Even the top

layers have been stripped off of many tree species. All these give a dismal picture of the state of vegetation in this country.

Of all life-forms of plants in India, the number of herb species outnumber others. Roughly, the number of shrub species is about double the number of tree species while the number of herbs is about four times the shrubs.

Over-exploitation of tree crops in all the three storeys cause considerable physical damage to shrubs; these shrubs are essential for soil binding and create a micro climate for the survival of young plant regeneration; besides, they help litter formation and conservation of water.

Shrubs and young regeneration of other plant species suffer irreparable losses due to repeated grazing and fire. These latter two factors are directly responsible for eradication of plant species where only those with underground stems survive. The authors' research reveals that only about 40 to 50 per cent of the species survive such depredation; also the density of occurrence of species is affected. Vast tracts of forests where grazing and fire have a free play have now very coarse grass and a few fire-hardy shrub and some annual herb species.

About ninety species of shrubs are conspicuous in the temperate hills of India which have colourful flowers; they also grow in profusion. Special mention may be made of rhododendron and roses. In the plains, however, more than one hundred species occur but they do not have conspicuous flowers. In eastern India there are at least a hundred species of fodder shrub; it is about two thirds in other parts of the country. There are at least forty genera of shrubs yielding edible fruits which attract avifauna, animals and men alike.

A survey made by the authors all over the country has revealed that only fifty species of shrubs are commonly found. Lantana, Eupatorium, Clerodendrum, Calotropis, Cassia, Carissa, Ipomoea, Capparis, etc. are found conspicuous and are occurring in profusion all over the country. It should be considered an ominous indication of systematic disappearance of species primarily due to anthropogenic factors. The number of shrub species in the country is about 4500 (tree species about 1500); but wide occurrence of only 50 species is hardly to be believed which is too meager.

Vast shrub resources of this country have not been studied from medicinal, aesthetic and environmental point of view. This country has shrub flora occurring on wide ranges of alkaline, saline, estuarine, sandy soils in varied climatic conditions. The time is ripe to select typical shrubs that have conspicuous flowers, wide range of foliage patterns and shapes and plant them in arboreta, parks and gardens. Some shrubs are indispensable ingredients of parks, gardens, residential quarters premises and in environmental planting to arrest air pollution.

An attempt has been made to list some common and conspicuous shrubs occurring all over the country (state-wise) and to mark some common medicinal plants. Although some of these shrubs are obnoxious weeds (*Eupatorium*, *Cleistanthus*, *Lantana*, *Calotropis*, *Euphorbia*, *Jatropha* etc.), quite a good number occur on dry rocky and sandy areas (*Euphorbia*, *Opuntia*, *Agave*, etc.) which provide shade, protect soil, shelter birds and bear fruits for man and animal besides, providing plants of medicinal values. Vast avifaunal species in the country side derive a lot of food and seek shelter in such shrub flora.

A quotation from Times of India, Nov. 11, 2005 by Chandrica Mago reads:

Alarm bells are ringing for "sons of the soil". The government says the country is losing its soil at an unacceptable rate. The country's average soil erosion rate is 16 tonnes per hectare per annum – more than three times the acceptable norm. The figure goes as high as 80 tonnes in the Himalayas. Scientists say the figure for Hoshiarpur is the highest in the country, at a whopping 400 tonnes a hectare every year. It takes a million years to replace topsoil.

In areas losing soil, the impacts can be drastic. Productivity comes down. Agriculture minister Sharad Pawar recently estimated that soil erosion leads to a loss of about 8–9 million tones of valuable nutrients. Second, the siltation rate goes up in crucial water reservoirs. It is reducing storage capacity by 2% each year. This impacts water availability on all fronts. Third, certain grass and tree species are vanishing. Down stream, silt in rivers is forcing them to change course.

Each earthquake creates a more suitable ground for erosion. There are about 300 small tremors in a year across the

mountains – we may not feel them but the soil does. Melting glaciers are leading to more erosion in specific locations, says J.S. Samra, Indian Council of Agricultural Research deputy director-general.

The problem is getting worse since there are more people and livestock crammed into the same amount of land. Trees are being cut, grasses are vanishing, leaving bald patches vulnerable to erosion when the rain comes down hard. It doesn't matter how much it rains in a year – what matters is the intensity of rain, the sheer force which loosens the soil. One rain drop falls at 16 metres a second, says Samra "You can actually see the holes it leaves in the ground. Yet, it's a problem little talked of outside scientific circles." Samra says, soil erosion across the country ranges from 2–80 tonnes per hectare every year, with rainfed areas suffering more than irrigated plains. An acceptable range is 5 tonnes. The irrigated Indo-Gangetic plain, where water is trapped, has a rate of less than 2 tonnes. After the Himalayas, the highest rates of 40–50 tonnes show up in the Nilgiris and the western and eastern Ghat.

If there are forests and even better, grass, the ground holds. Cultivated rather than forested slopes are more vulnerable to erosion. There are solutions and programmes to check erosion - but they have made limited impact. The best solution, says Samra, is to treat catchments, creating trenches to hold the water and reduce the speed of flow. If water velocity increases two times, its cutting capacity goes up four times and its carrying capacity, eight times. Too much erosion can muddy the waters so much that fish starve for oxygen. Bihar is a victim of uncontrolled erosion as water floods in from Nepal, Rajasthan, of course has its own set of problems – wind, not water, erosion."

Destructive forces have also affected these forests. Refugee rehabilitation (25,000 East Bengal refugees) has been responsible for bulk destruction and clear felling of about 1,0000 ha. Has augmented substantial depletion of the forests.

Selection felling done to ensure natural regeneration has opened up extensive areas of forests which have lost the character of tropical forests. Many areas have been exposed to erosion. Most significant change and degradation has been caused by severe cyclone which is a regular feature of Andaman

forests. Hundreds of square kilometers of forests have been uprooted and damaged (shallow root system and heavy crown of trees). Ground flora has also been disrupted.

All these derogatory factors combine to bring a synergetic destructive presence on the soil of the country.

Chapter Two

Medicinal Plants of India : An Observation

This chapter summarises the findings of a group of experts observation on the subject.

This chapter enumerates broadly the following information:

- Richness of flora.
- Past history.
- Use of herbal drugs in India.
- Plants used in drug industry.
- Essential oils.
- Phyto-pharmaceuticals.
- Export market.
- Commercial value of medicinal plants used as drugs.
- Trade market.
- Threat to plant biodiversity.
- In-situ conservation.
- Ex-situ conservation.
- Cultivation.
- Action Plan.

The author acted as a Chairperson in Forest Bio-Diversity Section of a study initiated by the Department of Environment, Govt. of West Bengal. His findings along with those of four other Chairpersons findings were compiled in a report entitled "Biodiversity Strategy and Action Plan for West Bengal". Some relevant paragraphs from that report are presented taking the liberty that the author was a part of the compilers of the report.

The study of medicinal plants has assumed great importance in India and abroad. In various states of India, no proper inventory of medicinal plant have been prepared. So far the work done in the field is in the form of scattered or isolated efforts, aiming mostly towards medicinal use of the items. In fact, preparation of an inventory alone would not be able to meet the growing need of planned utilization of medicinal plant resources within the states. Some basic information on the medicinal plant species is also required to design and implement proper management plan for the extraction and use of medicinal plants in future. It is also important to assess the level and extent of exploitation of medicinal plant from the wild stock and to put in place necessary checks. The knowledge in this field would enable introduction of timely cultivation in necessary cases and maintain the required balance between proper sustainable use and exploitation of limited natural resources.

Status of Medicinal Plants

India harbours a wide range of medicinal and aromatic plants mostly used in Ayurvedic, Unani, Siddha, Homeopathic, Allopathic and other alternate medicinal practices such as folk medicine, home remedies, household remedies naturopathy, tantra-therapy, Amchi and tribal medicine. The plants used in alternate medicine are awaiting a touch of modern knowledge.

A rough conception is that out of 17,500 flowering plant species known from India, more than 4000 species are used as medicinal plants of which 300 species yield gum and dyes and about 100 species yield essential oils and are used as raw materials in drug industry. About 200 drugs are of animal and mineral origin.

Keeping in mind this perspective it can be mentioned that the Rigveda (4500–1600 B.C.) an old repository of human knowledge, quoted 67 plants of medicinal value. The Atharva Veda and the Yajurveda mention 200 and 81 species of plants of therapeutic value. Charak (1000 B.C.) and Sushruta (800 B.C.) quoted 341 and 395 medicinal plants respectively in their Samhitas. Ethno-botanical studies have added about 1680 species of medicinal value in the existing list of medicinal plants in India.

In last 75 years the basic active principles like salicylic acid, alkaloids, sapouins, glycosides, steroid compounds have been isolated from higher group of plants except Ephedrin from Ephedra (a gymnosperm), Taxol from Taxus (Gymnosperm), new alkaloid from Lycopodium, ergot from Claviceps fungus and other antibiotic from fungi groups. During 1950, only 2000 alkaloid was known to the world. By 1970, the number increased to 4000, and in 2000 A.D. it has been estimated to be about 10,000 alkaloids, of which 5000 are chemically less known.

The discovery of hallucinogenic use of morning glory has stimulated further studies of Datura, Cannabis, and Papaver in India. The hallucinogenic drugs are very much in demand in today's world. Very recently steroidal sapogenious substance has also attracted phyto-chemists to give more attention in their research.

India uses herbal drugs utilizing nearly 450 plant species in different formulations (Kapoor and Mitra, 1979).

In this context three orchids can be mentioned which are used in traditional medicine and at present endangered or vulnerable (Lucas and Syng. 1978). Paphiopedium druryi is native to Kerala but is endangered or extinct from the wild due to forest fires and excessive collection. There is an indication of its use in Ayurvedic medicine and that it might contain useful alkaloids. Various authorities have indicated its decline in the wild state (U.C. Pradhan, 1975, 1976, 1977; Mammen and Mammen, 1974). Dendrobium pauciflorum is endangered, possibly extinct from West Bengal and Sikkim in areas open to tree felling. It can be rediscovered in the wild, it is likely to contain some alkaloid of potential value. Diplomarhis hirsute, which possibly contains useful alkaloids in the tubers, is restricted to very few numbers in West Bengal in a region vulnerable to landslides. Its decrease in number has been pointed out by G.M. Pradhan (1976) and Varman and Sahni (1976). Another species Dendrobium nobile, deserves mention. Occurring in the Himalayas regions of India and China, it is a source of dendrobine, a principal alkaloid and is exported in tones from China in dehydrated form (Pemupahishey, 1974). The abundance of this species in India is decreasing rapidly and is a matter of serious concern (Santapu, 1970, Kataki, 1976).

An examination of the traditional systems of medicine – Ayurveda and Unani systems indicated that *Rauvolfia serpentina* used by medicine men of India, Sri Lanka, Nepal and Myanmar for treatment of insanity. This is possibly associated with hypertensive encephalopathy. Most European physicians were very skeptical of the purported properties of the plant. However in 1952, the alkaloid reserpine was isolated, thus confirming the plant's value. Since then the alkaloid extract as well as purified alkaloids of *Rauvolfia serpentina* have become very important in the treatment to control hypertension.

Medicinal Plants Based Drug Industry in General

Medicinal plants based drug industry has four major segments :

- Plant drugs for WHO recognized Indian systems of medicine.
- Over the country non-prescription items involving plant parts, extracts and galenicals.
- Essential oils.
- Phyto-pharmaceuticals.

Besides these, plant derived materials including fats, oils, waxes, latex, pectins, resins and oleoresins, gums and other exudates, vegetable dyes and tannins, lignin, cellulose, starch, hydrocarbons and many other bio-chemical compounds (Pryde *et al.* 1981; Schultes, 1980) are important primary items. On top of these primary products are numerous secondary compounds and chemical intermediates, including sterols, alcohols, alkaloids, resins and esters.

These diverse categories are almost certain to expand as scientific research comes up with more products from tropical plant – not only items more in number, but materials with greater complexity and novelty. In the light of speedy expansion of the global chemical industry, it is clear that we shall need much more additional supplies of organic chemicals.

The chemical industry continues to drive most of its feedstock from fossil fuel. But due to the oil cartel *i.e.*, the Organisation of Petroleum Exporting Countries (OPEC), many petrochemicals have increased 6–7 times in price whereas vegetable fats and oils have not even doubled in price.

Fortunately, almost all petrochemicals can now be replaced by phyto-chemicals.

Medicinal Plants Based Drug Industries in Indian System of Medicine

According to Handa, in 1992, there are more than 6,780 pharmacies in Indian systems of medicine of which 551 are on loan license and the remaining are from D. In West Bengal, over 642 pharmacies are in existence of which 620 are for the production of Ayurvedic drugs and rest 22 for Unani drugs. All these are licensed pharmacies. Besides these, there are many small manufacturing units using medicinal plants and thousand of vaidyas, and hakims preparing their own drugs from various medicinal plants.

Plant Parts Extracts

The direct utilization of plant material is a feature of traditional systems of medicine not only in India, but also in developed countries like Europe, U.S.A., Western countries now a days are very much fond of herbal formulations of health, food, preparation of decoctions, tinctures, etc. And total extracts of plants also from a part of many pharmacopoeias of the world. The current trend of medicinal plants based drug is to procure standardized extracts of plants as raw material.

Essential Oils from Plants

The essential oil industry was traditionally a cottage industry in India. Since 1947, a number of industrial companies have been established for large-scale production of essential oils, oleoresins and perfumes. The essential oils, oleoresins from plants being produced in India include ajawain oil, celery oil, citronella oil, lavender oil, eucalyptus oil, geranium oil, cedarwood oil, sandalwood oil, lemongrass oil, vetiver grass root oil, mentha oil, turpentine oil and resin from pines. This forms a sizeable and well-established industry in India having annual oil production of about 50,000 tons. [I]-lonone from lemongrass oil for perfumery, and [I]-lonone from vitamin A synthesis are produced in India. Before 1960, Menthol was not produced in India, but the introduction of Japanese mint – *Mentha arvensis* L. (Lamiaceae) and subsequent improvements there upon have

enabled India to produce more than 600 tons of menthol and till date top the world market in export of natural menthol.

Limonene is the bye-product of citrus industry. Though turpentine oil and eucalyptus oil also yield limonene, but the best economically cheap raw materials is the discarded orange and lemon neel which are being used by Brazilian phyto-chemical industries. India, particularly West Bengal has not yet tapped this source for limonene production.

Phyto-pharmaceuticals

Since the independence of India, the production of plant based modern drugs in India and West Bengal in particular was mostly confined to quinine, from cinchona. During the last five decades, bulk production of plant based modern drugs has become an important segment of Indian pharmaceutical industry. Some of the phyto-pharmaceuticals which are produced in India include Morphine, Codeine, Papaverine, Thebaine, Emetine, Quinine, Quinidine, Digoxin, Caffeine, Hyoscine, Hyoscyamine, Xanthotoxin, Psoralen, Colchicine, Rutin, Berberine, Vinblastine, Vincristine, Nicotine, Strychnine, Brucine, Ergot, Alkaloids, Senna, Glycosides, Pyrethroids, Podophyllotoxin resin, Steroid compounds etc. Phyto-pharmaceuticals for which technology has been developed for undertaking large-scale production include L-dopa from *Mucuna pruriens*, Ajmaline and Ajmalicine from *Rauvolfia serpentina* and *Catharanthus roseus* respectively and B-acetyl glycyrrhetic acid from *Glycyrrhiza glabra*. Medicinal plant based drug industries have started facing and will face in future, dwindling supply of plant materials from natural resources. So promoting cultivation of medicinal plants which are being extensively used by the industry, will help to solve the problem of the industry.

Status of India in Herbal Export Market

India's share in world herbal medicine market is mere 11% and the total market from Indian systems of medicine and Homeopathy is about US \$ 1 billion – stated by G.C. Burman, Chairman of Dabur India Ltd.

India is losing out on the herbal export front, while China earns US \$ 5 billion annually from herbal trade which is five times more than India's export turnover. Intensive efforts are

being made in India to boost its export of traditional medicines to match at least half of China's current export level by 2010. Indian exporters feel that given an effective and sustained push, its traditional medicine export would be able to make significant profit, almost equal to that earned from export of computer software.

Traditional medicine manufacture and practices are largely based on plant products. The international market for traditional products is amount US \$ 62 billion and is expected to reach US \$ 5 trillion by 2050.

Commercial Value of Medicinal Plants and Plant-based Drugs

Medicinal plant diversity has its economic value and it has local, regional, national and international implications like patent right, intellectual property right etc. It has also has an alternative value, an intrinsic value (Pearce and Moran, 1994), which is academic/scientific, that is unrelated to direct human use.

Medicinal plant species are used for therapeutic purpose in three ways:

- As traditional and alternative medicines singly or in formulations, such as those prepared and dispensed by traditional and alternate medicine practitioners, which may or may not attract a market price.
- As commercial products, dispensed by prescription or over the counter sales, such as patented/licensed medical products of Allopathy, Homeopathy, or traditional systems medicine.
- As bazaar medicine singly or in formulations.

All these usually have economic value. For the lack of adequate and appropriate data, it is near impossible to evaluate the returns from the first and the third categories. The economic value of plant based drugs, therefore, largely rests on the second category uses. It is estimated that in rich countries, 25% of all medical drugs are based on plants and their derivatives (Principe, 1991). In the poor world, this is about 75%.

The economic value of a particular medicinal plant depends upon a number of factors as follows:

- Certain plant species are used in a large number of formulations. The use of a particular species with

reference to the number therapeutic effects it can produce or the number of formulations in which it is an ingredient, is expressed as the therapeutic index and frequency index respectively. A higher index reflects a higher economic value attributable to a particular species.

- Certain species are of great importance in the treatment of particular diseases, as they happen to be the only species with that therapeutic potential, as the alkaloids of *Taxus baccata* in the treatment of cancer. Such species attract high market rate.
- Some species have narrow distribution and/or occur in small populations, and/or may be difficult to cultivate. Such species also command a higher price such as *Aquilaria agalocha* of Tripura, *Trichopus zeylanica* of South India, *Coptis teeta* of Arunachal Pradesh etc.
- Certain species of medicinal value like *Rauvolfia serpentina*, *Gloriosa superba*, *Swertia chirayita*, *Ipomoea digitata* have been over exploited and so now occur rather scarcely in wild conditions in West Bengal.
- There are certain therapeutically active constituents produced by plants such as digoxin and digitoxin that could not be produced synthetically. So, the economic value of the plant bearing digoxin is naturally on the higher side.
- The cost involved in isolation and purification of an active principle involve several considerations. For example, it requires about a ton of leaves of *Catharanthus roseus* to obtain 1 gm of the alkaloid vincristine, essentially needed to treat leukemia, Vincristine is one of the expensive plant products costing about US \$ 24000/g. Vinblastine, another alkaloid from the same species, used to treat Hodgkin disease is present in quantity 1000 times more than vincristine. One gm. of vinblastine, costs about US \$ 6,800. It has now become possible to convert vinblastine into vincristine through bio-transformation. Thus several factors govern the cost of the raw material and the final product of medicinal plant.

Commercial Value of Plant-based Drugs

The introduction of a single new synthetic drug into the market would take about 10 to 15 years of time and expenditure in the scale of about US \$ 100 to 300 million (Abelson 1990). Plant based drugs would take a comparatively much less time and expenses than synthetic drugs. Hence, plant based medicines would be far inexpensive, unless the market prices are inflated by other considerations.

The commercial evaluation of plant based drug is different from that of the source raw material of medicinal plants, for both depend much upon the demand and the supply potential. For medicinal plants, the source material, the land use value, cost of collection/cultivation, costs of preparation, packaging and transport are the criteria. For plant-based drugs, the cost of discovery, clinical testing, processing, packaging and marketing, add up.

According to Pearce and Moran (1994) economic value of medicinal plants and plant based drugs mostly depend upon the following criteria.

The actual market value of the plants being treated.

The market value of the drugs of which the plant are the source material; and the value of the drugs in terms of their life saving potential and value of 'statistical life', which is estimated to be US \$ 4 million on 1990 price.

Trade Market in Medicinal Plant Parts : The National Scenario

The markets dealing with medicinal plant parts (herbs and crude drugs) in India is a highly disorganized and less studied sector. So far little idea has been generated on the nature and quantum of trade in medicinal plant parts. The demand, supply and price structures are highly unstable. Even today, India lack a total and updated inventory on which particular plant parts are being traded in the market. There are much confusion and controversy regarding names of the items in trade. Moreover there exist practices of adulteration and also of selling totally different items as inferior substitutes. There is no definite system of quality control. There are items banned to be exported without cultivation certificate, but majority of the enforcement staff does not have any idea on identification of such items or even the

existing law. The trade routes and source of most of the items are not exactly known or studied. Transit formalities and tax structure is not uniform in different states and major wholesale markets. The overall situation demand immediate attention from the Central Government, respective State Governments, and other sectors dependent on the market. A commercial database on the market has to be prepared and carrying out a detailed analytical survey on the market economy is an urgent necessity.

Trade Market in Medicinal Plant Parts : The West Bengal Scenario

In West Bengal there are two major markets dealing with herbs and crude drugs. During 2000, TRAFFIC – India conducted an all-India survey on trade in medicinal plant parts which also covered these two local markets. The following observations and findings were generated mostly during that market survey, which would perhaps give a general idea of these West Bengal two markets.

The Kolkata Market

The wholesale medicinal plant market in Kolkata is situated almost totally within Burrabazaar area in West-Central zone of the city very close to river Hooghly. The market area is roughly restricted within 1 km² area bounded by Biplabi Rashbehari Basu Avenue (Old Canning Street) in the South, Kali Krishna Thakur Street in the North, Rabindra Sarani (Old Chitpur Road) in the East and river Hooghly in the West. About 90% of the major trading units of Kolkata lie within this area.

The market is a relatively old one in medicinal plant trade originating in the later half of the nineteenth century. Even upto the late 1980's the market was gradually expanding. It was the most important center for medicinal plant parts collected from the North East India and from Nepal. The number of traders (including major retailers) increased slowly from around 10 to about 60, though in a considerable number of cases it resulted from split in family business. During the last 15–20 years the growth of the market has become almost stagnant; not even 10 new traders entered the market, and during the same period some also left the business. Now the number of traders from the Kolkata Market (leaving aside the minor retailers) is about

65–70 of which about 60% are wholesaler cum retailers. Only three traders from Kolkata are regular exporters. Outside these 65–70 traders there are about 15–20 traders, who in the process of dealing with Yunani medicine, deal with crude drugs and herbs. Most of these shops are located on Rabindra Sarani, south of Mahatma Gandhi Road crossing, opposite to famous Lal Masjid.

The medicinal plant trade in Kolkata is not in a flourishing state. According to most of the traders, Delhi and Mumbai have taken away the business from Kolkata. This is perhaps due to the reasons mentioned below:

- With the improvement of communication system, most of the suppliers have become direct with the major wholesalers and exporters of Delhi from where they are getting better rate/offer since today's Delhi market is a far more competitive market than that of Kolkata.
- The payment terms in Delhi and Mumbai are much better than in Kolkata. In Kolkata market generally a supplier has to wait for around 3/4 months to get their payments fully cleared and this hampers the overall trade dynamics.
- Allegedly, some of the Ayurvedic and other herbal medicine manufacturers drifted away from West Bengal for general reasons. On the contrary many new units are growing up around Delhi, Mumbai and also in South India.
- Reportedly the tax structure is much better in Delhi. It is now 4% in Kolkata but even in the beginning of 1999, it was 12%. But in Delhi the rate has been uniformly 2%. With around 10% difference in tax rate it was not feasible for the Kolkata traders to compete with the Delhi traders even through keeping lower margin. Since the lowering of the tax rate the market situation has now become relatively favourable for the Kolkata traders, but now they are facing it difficult to regain the lost business.
- The Kolkata market also suffered from loss of business from the North East India. Due to reasons beyond control and also due to legal imposition, the supply of herbs and crude drugs coming from the North East has been greatly hampered during the last 15 years. Also due

to several reasons the supply from Nepal has diverted to Delhi or in some cases to China.

- Cultivation of medicinal plants is being attempted with great effort in South India and also reportedly in West / North West India. But in the Eastern region the attempts so far made are scanty and casual. The wild stock of medicinal plants are being depleted at a very fast rate due to over exploitation or premature extraction. Unless economically viable cultivation of local/introduced species does not become successful, it is difficult for any market to flourish. Since such instances are rare, rather non-existing in West Bengal, quite naturally the market is suffering from stagnation.

In 2000, the medicinal plant part trading community of Kolkata formed an association in the name West Bengal Herb and Crude Drug Dealers' Association, to look after the interest of the community and medicinal plant trade as a whole.

Siliguri Market

The other important market dealing with medicinal plant parts in West Bengal is the market in Siliguri. There are only 4–5 wholesale traders. The market is mostly dependant on plant parts collected from North Eastern states, Sikkim and Bhutan. But recently, as mentioned earlier, due to reasons beyond control and also due to legal imposition, the supply of herbs and crude drugs coming from the North East has been greatly hampered. (What could be gathered from the secondary sources that due to the insurgency problems prevailing in the NE states, collection in the forest areas has been heavily affected. Since in most of the forests there are alleged terrorist group base, even the local people do not dare to enter the forests areas for collection of low profit items. Moreover, during the last 20 years the business community has suffered a lot from the extortionist of different political groups).

The supplies from Nepal (partially), Sikkim and Bhutan (wholly) generally enter the mainland market through Siliguri. The place also has been proximity to North Bengal forest areas. The market seems to be small but dynamic. In general, the Siliguri market is apparently a self sufficient one surviving almost solely on local supply, and feeding a significant quantity

of medicinal plant parts to other parts of India. The Siliguri market is also operating in the reverse direction. Supply of several items to the retailers of North Eastern states is maintained through Siliguri, usually from Kolkata and rarely from Utter Pradesh or Delhi also.

Some General Observations on Kolkata & Siliguri Markets

The items available in the market are sold by trade names, and no authentic list/compilation of scientific names corresponding to these trade names is available in the market. Kapoor Kachri available in Kolkata market might not belong to the same species which is being sold in Delhi or Mumbai Market. Lack of reference sample collection within public access is a big problem.

It seemed that in most of the cases even the drug manufacturers do not bother with the species level identification and use. This is apparently true also with the quality factor.

The traders are well aware about the general quality of the product they are selling and in most of the cases they give cheaper rate explaining to the buyer why the rate is cheaper (*e.g.*, slight degradation in quality due to long time storage). In reality – apparently in majority number of cases – the traders are not mixing inferior quality product with that of superior quality. Instead they are asking for cheaper rate against quality sacrifice. In such cases actually the buyers are going for less wanted compromise.

Lack of state level inventory of medicinal plant parts in trade and also absence of an identification handbook for common people can be strongly felt. Most of the traders are not much aware of the trade restrictions and conservation laws.

Till date, the State Forest Department in West Bengal has not shown much concern over the nature or quantum of the trade in medicinal plant parts within the state.

Major Stakeholders

The major stakeholders in the field are drug manufacturers, traders in herbs and crude drugs, medicine practitioners (particularly Ayurvedic, Hakimi, Unani, Sidha, Amchi and other alternative medicine practitioners dependent mostly on

medicinal plants or their derivatives), cultivators, collectors. Co-operative with cultivation and collection, Central and State Government Departments (particularly State Forest Departments and the recently formed Dept. of Indian Systems of Medicine of the Central Govt.), Scientists, research institutions, universities and NGOs.

Major Causes for the Loss of Biodiversity

General Threat to Phyto-diversity in India.

Apparently the quick decline of the vegetation cover of a country is directly linked with the rapid population growth (102 crores in India) with an ever increasing needs. The, major causes of the loss of biological diversity in India both in the hills and plains are anthropogenic. However, eight major causes for the loss of biodiversity have been identified namely—(i) Habitat loss and fragmentation, (ii) Introduced species, (iii) Over exploitation of plant and animal species, (iv) Pollution of Soil, Water and atmosphere, (v) Global climate change, (vi) Expansion of Industry, agriculture and forestry, (vii) Want of pollinating vectors, (viii) Unisexual flowered species.

Threat to Medicinal Plants in Particular

All the factors described above threatening the phyto-diversity in India broadly cover most of the threats to medicinal plant species. Over-exploitation and indiscriminate use of wild resources in commercial demand now-a-days plays a great role not only behind the quick decline of the species concerned, but also becomes a threat for the survival of other associated species, thus acting as the major factors disturbing the entire ecosystem.

For medicinal plants, like other plant parts in commercial demand, premature exploitation is another factor which is additionally responsible for rapid destruction of wild stock. Whenever a plant is in high demand, premature exploitation is expected to threaten next season's propagation and regeneration of the species.

In this country, so far little work has been done to assess the level and extent of exploitation of plant species in commercial demand for medicinal purpose. The inventory is also not at all comprehensive or updated. Local area specific threats or species locally endangered are yet to be studied.

But going for medicinal plant cultivation in response to growing demand for certain species can be a lucrative agricultural option in West Bengal. Timely attempt to do so, would not only save some of the species from possible extinction, but also feed the state economy with assured and sustained financial benefit in near future.

Ongoing Initiatives

Protection and Conservation Strategies

Control of 'Wildlife Trade' is the most effective measure to protect the wild potential resources for their sustainable use. Using IUCN (1994) methods, Botanical Survey of India — the nodal organization responsible for monitoring and preparation of the list of plants to be included in the negative list of export — has so far listed 53 species for restriction in trade.

Defection of different threat groups/categories is the primary data source of taking the effective measure of protection and conservation of potential plant resources. It is roughly estimated that about 10% of higher plants are under — different threat categories. Botanical Survey of India has already published 4 volumes of Red Data Book of Indian plants (RDB) accounting relevant information of more than 800 species.

Convention of International Trade in Endangered Species of Wild flora and Fauna (CITES), is the international treaty to regulate the international trade of wild species.

The legal and policy framework include various Acts such as the Forest Act 1927; the Forest Conservation Act 1980; the Indian Wildlife Protection Act 1972, etc. These are in addition to various international treaties like CITES. Ramsar – CMS, etc. directly related to conservation of Biological Diversity, which has come into force on 29th December, 1993, which India ratified and joined on 18th February, 1994. It has been decided that for in-situ conservation, involvement of indigenous people and local ethnic communities is of utmost importance. (Brown 1990).

In Situ Conservation

The recorded forest area of India is about 77.01 million hectares but according to Landsat imagery the area covered by forests is about 64.01 million hectares. Today India has less than 2% of total forest area in the world but supports 15% of world's

population. West Bengal possesses 11% forest of its total landmass where 33% is the minimum requirement for pollution free environment. West Bengal has long history of in situ conservation and of developing in situ conservation methods at different levels, ranging from species to ecosystems.

Habitat Conservation

India has a large network of 85 National Parks and 445 sanctuaries covering about 2.5% of total land surface as well as marine ecosystem, such as Gulf of Mannar and Gulf of Cambay. It has also been proposed to increase these protected areas to 148 National Parks and 519 sanctuaries to reduce the significant gaps in various bio-geographic units. However the critical problem is not merely the conservation of a particular species or habitat, it is the continuation of the very process of evolution of all micro organisms, plants and animals in their totality as integral part of the natural ecosystem. To achieve the objective, the Government of India has designated 8 Biosphere Reserves out of 14 proposed. In West Bengal, Sunderban is one of the Biosphere Reserves. World Heritage Convention has designated 5 natural sites as world Heritage sites. Sunderbans of West Bengal is one of the Heritage sites.

A National Committee on wetlands, Mangrove and Coral Reefs has identified 21 wetlands, 15 mangrove areas and 4 coral reef zones for conservation and scientific management.

Ex-situ Conservation

To complement the in situ conservation, considerable attention has been paid to ex situ methods of conservation. The collection (from within and outside the country), preservation, multiplication and supply of genetic resources (for research only) is done through National Bureau of Plant genetic Resources, New Delhi for wild relatives of crop plants. In addition to 66 Botanic Gardens (including 33 university botanic gardens), the Department of Biotechnology has initiated germplasm facilities. India is the overall coordinator for the establishment of Gene Bank of Medicinal and Aromatic Plants among 6-15 countries.

For large scale multiplication of forest tree species two tissue culture pilot plants have been established at National Chemical Laboratory, Pune and at Tata Energy Research Institute, New

Delhi. Plant Issue Culture laboratories have also been set up in different National Institute.

The West Bengal Scenario

So far, no major conservation measures aiming at conservation of medicinal plants in particular or ensuring sustainable use of the same has been taken in West Bengal. Cultivation of some commercially valuable species has been attempted in some areas mostly by some private entrepreneurs with the motive of searching for lucrative agricultural options. Some research institutions like Bidhan Chandra Krishi Viswavidyalaya has attempted to develop agro-techniques for certain species. Only recently, the state government has started showing interest in the field. It has now become evident that going for medicinal plant cultivation in response to rising demand for certain species can be a lucrative agricultural option in West Bengal. Timely attempt to do so, would not only save some of the species from possible extinction, but also feed the state economy with assured and sustained financial benefit in near future.

Proposed List of Cultivable Medicinal Plants in West Bengal

Out of about 4000 medicinal plants in India, West Bengal possesses about 700 species covering aromatic plants, species and herbal vegetables of which about 75 species are known to be commercially operated either collected from natural sources or from cultivation. Some of them are supposed to be agri-alternative in West Bengal and commercially viable in cultivation.

Suggested Measures and Action Plan

Some suggested measures and action plan which should be taken up to ensure proper sustainable use of medicinal plant parts in India in brief are as follow (the expected actors and required time period is shown within parenthesis against each suggested action):

1. Preparation of a state level inventory of medicinal plant parts in trade in the major markets within the state. Species level scientific identification is extremely necessary in case of each items. Basic minimum

information which are required to be collected on the products are: (i) Trade or local names/Scientific or botanical name. (ii) Source : Cultivated/Wild/Forest/non-forest: (iii) Availability : (Districtwise and forest area-wise in case of forest products). (iv) Known/claimed medicinal properties (v) Current price range. (vi) Demand and availability trend through last five years. (vii) Anticipated conservation status. (viii) Cultivation status within the state. (ix) Agro-techniques (if known). (x) Availability in other parts of India (statewise and major trade centers) (Suggested Actors: Government local NGOs, Universities or other research institutions. Time period : 1 year). Thorough literature survey - areawise (ecosystemwise) and groupwise up to species level and documentation. (Suggested Actors: Government, NGOs, Universities or other research institutions. Time period: 1 year).

2. Rapid documentation of empiric knowledge base of tribal and ethnic communities and rural people of India about medicinal plants and their uses. (Suggested Actors: Government, NGOs, Universities or other research institutions. Time Period : 3 years).
3. Rapid documentation of traditional conservation practices existing among the tribal, ethnic communities and rural people of West Bengal. (Suggested Actors: Government, NGOs, Universities or other research institutions. Time Period : 2 years).
4. Identification of threatened habitat and taxon (Suggested Actors : Government NGOs. Universities or other research institutions. Time Period: 2 years).
5. Preparation of State Herbarium of medicinal plants occurring in India (Suggested Actors : Government, NGOs, Universities or other research institutions. Time Period : 2 years).
6. Preparation of a reference sample collection of medicinal plant parts in trade for the country allowing public access to the collection. (Suggested Actors : Government, NGOs, Universities or other research institutions. Time Period : 2 years).

7. Preparation of a pictorial identification handbook on medicinal plant parts in trade. (Suggested Actors : Government, NGOs, Universities or other research institutions. Time Period : 1 year).
8. Formation of a marketing and development board in West Bengal for medicinal and aromatic plants and phyto pharmaceuticals. Such a Board can interact with growers and user industry to bring stability in their production. demand, price, quality and can also help in fostering international trade. The Board should invite members and representatives from all segments of stakeholders particularly ayurvedic drug manufacturers, herbs and crude drug traders. medical practitioners and botanists. (Suggested Actor : State Government Time Period : Immediate).
9. State level initiatives to introduce and promote cultivation of medicinal plants occurring naturally within the state which are in high demand. (Suggested Actors : Govt., NGOs. Time Period : 5 years).
10. Promoting cultivation throughout the state giving priority to items which can be exported with cultivation certificate authentication only. (Suggested Actors : Govt., NGOs Time Period : 5 years).
11. Developing agro-technique for as many as possible plants. So far agro-technique could be developed for 42 medicinal plants only. (Suggested Actors: Government, NGOs, Universities or other research institutions. Time Period: On-going process, Long Term).
12. Providing scientific identification facilities to public at nominal cost. The facilities should be extended to assess also the quality of the products. Suggested Actors: Government, NGOs, Universities or other research institutions. Time Period: Should be started within 1 year, followed by possible expansion).
13. Initiating scientific research on the alleged medicinal properties of each of the plant parts and anticipated side effects. (Suggested Actors: Central and the State Government, Research Institutions, R&D section of major drug manufacturers, Universities, and NGOs. Time Period.: Long Term).

14. Ensuring uniformity in transit formalities for medicinal plant parts with other Indian states. (Suggested Actors : State Government, Central Govt. Time Period: Immediate).
15. Ensuring uniformity in tax rate for medicinal plant parts with other major markets in India, particularly at par with the New Delhi market. (Suggested Actor: State Government Time Period: Immediate.)
16. Preparation of specific list of banned medicinal plant items for West Bengal market. (Suggested Actor: State Government Time Period : Immediate.)
17. Training enforcement staff regarding existing laws on medicinal plants and identification of restricted species. (Suggested Actor : Central and State Government, NGOs. Time Period : Immediate.)
18. Preparation of single specific list containing items taxable as medicinal plant parts for the country. For taxation, it is essential to include each plant part in one list only, *i.e.*, if any item has been included in the list of dried fruits, it should never be considered as medicinal plant part, and vice versa. Definition under one list is necessary and less confusing in case of any legal settlement. (Suggested Actor: State Government Time Period: Immediate).
19. Publication of a manual regarding laws dealing with medicinal plants, inventory list of herbs and crude drugs in West Bengal market, banned item list, collection & transit formalities within the state, list of registered wholesale traders/exporters/manufacturers and research laboratories equipped to deal with medicinal plants. (Suggested Actors: Government, NGOs. Time Period: 3 years).
20. Establishing infrastructural facilities for ex-situ conservation especially seed bank and medicinal plant nursery. (Suggested Actors: Government NGOs, other research institutions. Time Period : Should be started within 1 year, followed by possible expansion).

Chapter Three

Ayurveda : An Indian System

This elaborate subject is not being discussed in this Chapter. Enormous amount of Literature exists on the subject. Legendary figures in Ayurvedic medicines are Indian Physicians *e.g.*, Atreya, Mahabhorati, Nagarjun Sagar, Vagabhata, Sushruta and others.

The period between 800 B.C. and 1000 A.D. could be considered as the golden age of Indian System of Medicine.

“Ayurvedic medicine”, according to Encyclopedia Britanica “is an example of a well-organized system of traditional health care, both preventive and curative”.

Some useful plants, plant and some other recent information have been presented in this Chapter.

Of 84 Ayurvedic plant species recorded in a table, only 20 species have been recorded as safe, 28 are cultivated, 16 as sporadic. The depleted genera are Artenesia, Asparagus, Cessampelos, Cordia, Curculiga, Gymnema, Hemidesmus, Nardostachys, Nelumbo, Paederia and Rauwolfia.

The indication seems to be bad.

Ayurveda

The backround history of Ayurveda has its origin about 4500 B.C. ' Charaka Samhita' and Susharata Samhita are considered to be most vital documents of Ayurveda.

The evolutionary history and various stages of development are not the subject of discussion in this treatise. As such only broad outline on Ayurveda System is discussed.

Ayurveda–An Indian System

Enormous amount of literature exists on this subject. During the last sixty years voluminous work has been done on various

facts of Ayurveda and on the drugs used in India. The author does not find it necessary, in the present context, to rewrite the history starting from Vedic Period since 4500 B.C., records of which exist.

A brief recapitulation, however, may be relevant which are –

- Most vital documents were compiled by the great Charaka and Sushruta in 'Charaka-Samhita' and 'Sushruta-Samhita'.
- In the seventh century A.D. 'Astanga Hridaya Samhita' give a wide range of information.
- The period between 800 B.C. and 1000 A.D. is considered as golden age on Indian System of medicine.
- The Indian Ayurvedic system of medicines and treatment suffered a stagnation due to prolonged Muslim and the British rule.
- In 1563 Garcia D'orta a Portuguese physician a treatise on Indian medicine.
- The work of several foreigners on Indian Drugs are commendable. Mention may be made of the names of the following:
 - Flemming (1910), Ainslie (1913), Roxburgh (1834), Waring (1868), Mohidin Sheriff (1869), Warden and Hooper (1890-93), George Wall (1889-1904).
 - The Scientists of CSIR are engaged in updating various technologies particularly agro and processing technology resulting in production of derivations like phytochemicals, essential oils, Oleo resins etc.
 - The famous Scientist Dr. (Mrs.) Asima Chatterjee thinks the therapeutic use of Indian medicine dates back to 4500-1600 B.C. *i.e.*, early are of Rig-Veda. This led to evaluation (2500-600 B.C.) of Ayurveda which literally means "Science of Life."
 - Systematic and concerted Scientific research was pioneered in India on indigenous plants by Dr. R.N. Chopra and his colleagues in the school of Tropical Medicine, Kolkata.
 - Encyclopaedia Britannica (Marco, 23,906,1988) writes "Ayurvedic medicine is an example of well-organized system of traditional health care, both preventive and

system of traditional health care, both preventive and curative. It is still a form of health care, both preventive and curative. It is still a form of health care in large part of Eastern World especially in India, where a large number of population use this system exclusively or combined with modern medicines."

- Dr. K.P. Biswas and A. Ghosh's work on medicinal plants has been recoded in the books entitled. "Bharatiya Bonousodhi". This work gives a wealth of information. The work of Nagendra Nath Sen Gupta , K.M. Nadkarni and Dr. Sibakali Bhattacharjee present an indepth information in various work done in medicinal plants of India.

Nadkarni in his book "Indian Materia Medica" describes remedial properties of about 550 plant species. Of these, 90 are tree species, 28 are climbing species, 35 are shrub species and 397 are herb species. Dr. Bhattacharjee in books 'Chiranjib Banousodhi' has discussed plant properties of more than 800 species and has listed more than 3000 local names of medicinal plants of various states of the country.

On the context of these valuable work, it is worthwhile to ascertain the present status of medicinal plants to find out how far this wealth needs protection.

Originated in the Vedic times around 5000 years ago. Ayurvedic formulations which are an ancient health system; use a combination of, selection of around 1200 species about 500 of which are commercially traded. Ayurveda uses medicinal plants in various forms, some of which can be gathered only by destructive harvesting: in 30 per cent cases only the roots are used, in another 13 per cent only the bark and it is only in about 16 per cent that the whole plant is used in other cases, medicines use the fruits, leaves, flowers, rhizome seeds etc. It is commonly thought that medicinal plants are mainly herbs, but in fact about one-third are trees—this has implications for conservation and management of supplies to the industry. The majority of plants used in ayurveda are procured from the wild, though around 10 per cent are cultivated on private lands.

Trades on medicinal plants of India may be described as extremely complex, secretive, traditional, badly organized, highly

under-estimated and unregulated. There is no macro level information available for assessing the nature and full extent of the trade; there are only 'guesstimates' based on local inventories and micro studies. Identification of species and volumes traded is further complicated by the fact that there is no reliable correlation between trade names and botanical names, and names used for particular species may change along the supply chain. Conversely, the same trade name is at times used for several species, especially if they are used for similar purposes. Hence, for the purposes of this study, twelve of the most representative species were selected for detailed research into the conservation, collection, cultivation and trade of medicinal plants. These are *aloe vera*, *Chlorophytum borivillianum*, *Commiphora wightii*, *Embelia ribes*, *Embillica officinalis*, *Nardostachys grandiflora*, *Picorrhiza kurroa*, *Rauwolfia serpentina*, *Saraca indica*, *Swertia chirata*, *Terminalia chebula* and *Withania somnifera*.

Trades on medicinal plants are located in 6 major, 21 medium and 37 minor markets spread across the country. The major centers, located at the heads of the routes taken by the medicinal plants, are big cities including the four metros. Major export take place from Delhi, Mumbai, Chennai and Tuticorin. In terms of total volume of the 12 species traded in 1999–2000, Mumbai tops the list with about 3,300 tonnes, followed by Delhi with about 2,000 tonnes. The survey identified a number of factors that affect the final price. Volumes traded are directly proportional to the prices of the raw material, which in turn are proportional to the abundance/availability of the species. There is also a connection between the part used and prices, so that species that are destructively harvested seem to be more expensive. High altitude species such as *Nardostachys grandiflora*, *Picorrhiza kurroa*, *Swertia chirata* also are high value species. Price also increases with the distance of the source of raw material from the market.

Use of Medicinal Plants in the Ayurvedic Industry

The prescribed reference texts of Ayurveda namely Charak, Sushruta, and Bagbhatta describe use of 1,100, 1,270 and 1,150 medicinal plants respectively in drug formulations (Gupta 1993.) Annex 4 lists some of the most important medicinal plants used in ayurveda and the conditions they are used to treat. Ayurveda uses medicinal plants in various forms: fruits, leaves, flowers, rhizome,

bark, roots and seeds, etc. (see Table 3.1). Sometimes whole plants are used but mostly, some parts are used to prepare the formulations. Estimates suggest that about 16.5 per cent of the usage requires whole medicinal plants while in the rest one or a combination of plant parts is used (FRLGT 1997).

Table 3.1: Analysis of Plant Parts Used in Ayurvedic Industry

| Parts used | Percentage |
|-------------|------------|
| Roots | 29.6 |
| Rhizome | 4.0 |
| Leaves | 5.8 |
| Flowers | 5.2 |
| Fruits | 10.3 |
| Seed | 6.6 |
| Stems | 5.5 |
| Bark | 13.5 |
| Wood | 2.8 |
| Whole plant | 16.5 |

(Source : FRLHT 1997)

India harbours a wide range of medicinal and aromatic plants mostly used in Ayurvedic, Unani, Siddha, Homeopathic, Allopathic and other alternate medicinal practices such as folk medicine, home remedies, household remedies naturopathy, tantra-therapy, Amchi and tribal medicine. The plants used in alternate medicine are awaiting a touch of modern knowledge.

Out of 17,500 flowering plants species known from India, more than 4000 species are used as medicinal plants of which 300 species yield gum and dyes and about 100 species yield essential oils and are used as raw material in drug industry. About 200 drugs are of animal and mineral origin.

Keeping in mind this perspective it can be mentioned that the Rigveda (4500-1600 B.C.) an old repository of human knowledge, quoted 67 plants of medicinal value. The Atharva Veda and the Yajurveda mention 200 and 81 species of plants of therapeutic value. Charak (1000 B.C.) and Sushruta (800 B.C.) quoted 341 and 395 medicinal plants respectively in their Samhitas. Ethnobotanical studies have added about 1680 species of medicinal value in the existing list of medicinal plants in India.

In last 75 years the basic active principles like salicylic acid, alkaloids, saponins, glycosides, steroid compounds have been isolated from higher group of plant except Ephedrin from Ephedra (gymnosperm), Taxol from Taxus (gymnosperm), new alkaloid from Lycopodium, ergot from *civiceps* fungus and other antibiotic from fungi groups. During 1950, only 2000 alkaloid was known to the world. By 1970, the number increased to 4000, and in 2000 A.D. it has been estimated to be about 10,000 alkaloids, of which 5000 are chemically less known.

The discovery of hallucinogenic use of morning glory has stimulated future studies of Datura, Cannabis, and Paper in India. The hallucinogenic drugs are very much in demand in today's world. Very recently steroidal sapogenious substance has also attracted phyto-chemists to give more attention in their research.

Herbal Medicines

The vedic and post-vedic periods since 3500 B.C. saw some celebrated Indian physicians *e.g.*, Atreya, Mahabharati, Nagarjun Sagar, Vagbhata, Sushruta, Charaka, who were legendary fighters of Indian medicine.

Although the traditional Medicines had been replaced to a great extent by chemical and synthetic medicines, herbal medicines are once again gaining ground as the synthetic one are costly and found toxic and proved to be health hazardous.

People suffering from chronic diseases are willing to use traditional medicines that the synthetic ones. Several countries also are looking back towards the "Traditional folklore Medicines". China resisted all imports of modern medicines by use of more and more traditional ones. So herbal wealth of India needs conservation so that traditional species could be used more and more.

In 1948, Col. R.N. Chopra submitted a report recommending revival of traditional Indian Medicine and its synthesis with modern medicines. Such integration were also advocated by the government of India.

Revival of Cultivation of medicinal plants— In recent years several states and private organizations have start cultivation and conservation of medicinal plants in garden and Arbourata. One such endeavour adopted by Orissa State (The Statesman new Service, Feb.6,2001) is worth mentioning.

The first phase of an ambitious “ Medicinal garden” was launched here recently with the District Environment Society, Khurda, making a modest beginning by planting 50 different species of medicinal plants near patrapara village.

The species planted in the first phase area of 40 acres have been procured from the nearby Brebera forests and from the silviculturist, Orissa.

Funded by the forest department, district rural development agency and by a Rajya Sabha MP Mr. B. J. Panda, the plan is to develop Medicinal garden over a total area of 250 acres for plantation in three phases. The area happens to be a degraded Sal forest and is close to the state capital forest department officials said.

Emphasizing on the need to recognize, preserve and develop such plants, they said 8000 species of medicinal plants are used by different medicine systems in the country.

The World Health Organisation (WHO) has estimated that 80% of the population of developing countries on traditional medicine mostly derive from plants for their primary healthcare needs. The demand of medicinal plants is increasing throughout the world. 90% of the drugs used in Indian Systems of Medicine & Homoeopathy (ISM&H) are plant based and collected from wild sources.

Government of India has set-up a national level body called the Medicinal Plants Board in November 2000 for the development and sustainable use of medicinal plants in the country. The Board aims at making the cultivation of medicinal plants and its sustainable management besides co-ordinating all matters related to medicinal plants and to make it a people's movement. The medicinal plant species included in this publication represent high demand plants, which can give good remuneration if a tie up with buyers is arranged.

The Board will undertake the following activities:

1. Promote encouragement for cultivation of selected medicinal plants backed by buy-back arrangement.
2. Encourage States and UTs to register raw drug traders and cultivators so that source of supply of medicinal plant is monitored as a measure to promote quality control, safety and efficacy of drugs.

3. Facilitate measures, which enhance efficiency, cost effectiveness and upgradation of harvesting, drying, grading packaging, transportation and storage of medicinal plants.
4. The following thirty-one (31) species, which are in high demand both in domestic and international markets are to be brought into cultivation status as these constitute a bulk of the ingredients used in the preparation of ISM&H and herbal products. This list will naturally undergo changes from time to time.

Table 3.2

| Sl. No. | Common Name | Botanical Name | |
|---------|--------------|---|-------------------|
| 1. | Amla | <i>Embllica officinalis</i> Gaertn | Perennial tree |
| 2. | Ashok | <i>Saraca asoca</i> (Roxb.) de Wilde | Perennial tree |
| 3. | Ashwagandha | <i>Withania somnifera</i> (Linn.) Dunal | Annual herb |
| 4. | Atees | <i>Aconitum heterophyllum</i> Wall.ex Royale | Biannual herb |
| 5. | Bael | <i>Aegle marmelos</i> (Linn) Corr. | Perennial tree |
| 6. | Bhumi amlaki | <i>Phyllanthus amarus</i> <i>Schum & Thonn.</i> (p.niruri Linn.) | Annjual herb |
| 7. | Brahmi | <i>Bacopa monnieri</i> (L.) pennell | Annual herb |
| 8. | Chandan | <i>Santalum album</i> Linn. | Perennial tree |
| 9. | Chirata | <i>Swertia chirata</i> Buch-Ham | Biannual herb |
| 10. | Giloe | <i>Tinospora cordifolia</i> Miers. | Perennial climber |
| 11. | Gudmar | <i>Gymnema sylvestre</i> R. Br. | Perennial climber |
| 12. | Guggal | <i>Commiphora wightii</i> (Arn.) <i>Bhandari</i> | Annual climber |
| 13. | Isabgol | <i>Plantago ovata</i> Forsk. | Annual herb |
| 14. | Jatamansi | <i>Nardostachys jatamansi</i> DC | Perennial herb |
| 15. | Kalihari | <i>Gloriosa superba</i> Linn. | Annual climber |
| 16. | Kalmegh | <i>Andrographis paniculata</i> Wall. Ex Nees | Annual herb |
| 17. | Kokum | <i>Garcinia indica</i> Chois | Perennial |
| 18. | Kuth | <i>Saussurea costus</i> C.B.Clarke (<i>S.lappa</i>) | Annual herd |
| 19. | Kutki | <i>Picrorhiza kurroa</i> Benth ex Royle | Annual herb |
| 20. | Makoy | <i>Solanum nigrum</i> Linn. | Annual herb |
| 21. | Mulethi | <i>Glycyrrhiza glabra</i> Linn. | Perennial herb |

contd...

Table 3.2 – contd...

| Sl. No. | Common Name | Botanical Name | |
|---------|--------------------------|---|-------------------|
| 22. | Musali Safaid | <i>Chlorophytum arundinaceum</i> <i>Baker (C. borivillianum)</i> | Annual herb |
| 23. | Pashan Bheda (Coleus) | <i>Coleus barbatus</i> Benth. | Annual herb |
| 24. | Pippal | <i>Piper longum</i> Linn. | Perennial climber |
| 25. | Rasaut (Daruhaldi) | <i>Berberis aristata</i> DC. | Perennial shrub |
| 26. | Sarp Gandha | <i>Rauwolfia serpentina</i> Benth. ex Kurz | Perennial herb |
| 27. | Senna | <i>Cassia angustifolia</i> vahi. | Under shrub |
| 28. | Shatavari | <i>Asparagus racemosus</i> Willd. | perennial climber |
| 29. | Tulsi | <i>Ocimum sanctum</i> Linn. | Annual herb |
| 30. | Vai Vidang | <i>Embelia ribes</i> Burm. f. | Perennial shrub |
| 31. | Vatsnabh | <i>Aconitum ferox</i> wall. | Perennial herb |

5. Under general and specialized surveys of the national and international market for medicinal plants and products for identifying niche areas.
6. Motivate and encourage States/Uts to set up State Medicinal Plants Board/Vanaspati Van Societies who can give a focus and direction to medicinal plants related activities.
7. Support manufacturers/NGOs and representative individuals for participation in international fairs, seminars and meetings with a view to create awareness and explore the international market for plant based herbal products.
8. Support R & D studies in the areas of post harvest management including increasing shelf-life introducing better storage techniques and agro-techniques, enhance bio-availability to be taken up through CSIR, NBRI, CIMAP, ICFRE, RRLs, DBT, Horticulture and Forest Departments.
9. Launch efforts to create mass awareness about the importance of medicinal plants in all strata of society, rural and urban.

India is bestowed with a treasure of medicinal plants. The supply base of 90% herbal raw drugs used in the manufacture of

Ayurveda, Siddha, Unani & Homeopathy systems of medicine is largely from the wild. Besides this, plants are also used in various industries producing herbal items other than medicines. This wild source is speedily shrinking day-by-day. Therefore, there is a need for conservation and sustainable use of medicinal plants. Cultivation is clearly a sustainable alternative to the present collection of medicinal plants from the wild. This can be a potential provider of returns to the farmers/cultivators.

Keeping the above concept in view, the Department of Indian Systems of Medicine & Homoeopathy has indentified 31 (thirty-one) potential medicinal plants. In the present booklet brief cultivation practices together with relevant information on these medicinal plants have been presented for the interested growers/cultivators either as a single crop or for intercropping.

(Source : Modified by RBs Rawat, National Medicinal Plant Board)

Table 3.3 : Important Medicinal Plants Used in Ayurveda

| Plant | Sanskrit name | Main indications/effects | Status |
|-------------------------------|---------------|---|--------|
| <i>Acorus calamus</i> | Vacha | Nervine, antispasmodic, sedative, stomachic, expectorant, laxative, diuretic, | |
| <i>Artemisia absinthium</i> | Indhana | Anthelmintic | D |
| <i>Artemisia vulgaris</i> | Nagadamni | Anthelmintic, expectorant | D |
| <i>Asparagus racemosus</i> | Shatavari | Antispasmodic, antidiarrhetic, demulcentPS | |
| <i>Azadirachta indica</i> | Neem | Skin disease, antibacterial | S |
| <i>Bacopa monnieri</i> | Brahmi | Nervine tonic, diuretic, sedative | S |
| <i>Boerhavia diffusa</i> | Purnarnava | Diuretic, expectorant, laxative | |
| <i>Boswellia serrata</i> | Shallaki | Antiarthritic, analgesic, antiinflammatory | PS |
| <i>Buchanania lazan</i> | Plyala | Skin disease, laxative | PS |
| <i>Rutea monosperma</i> | Palasa | Diarrhea, flatulence, anthelmintic | PS |
| <i>Callicarpa macrophylla</i> | Pringu | Joint pain, skin disease, blood disease | S |
| <i>Calotropis gigantea</i> | Alarka | Bronchitis, diarrhoea, cancer | PS |
| <i>Cannabis indica</i> | Bhang | Insomnia, dysmenorrhea | PS |
| <i>Capsicum annum</i> | Katuvira | Rubefacient, stimulant | C |
| <i>Capsicum carvi</i> | Krishnajira | Flatulence, stomachic | C |

contd.....

Table 3.3 – contd...

| Plant | Sanskrit name | Main indications/effects | Status |
|----------------------------------|--------------------|---|--------|
| <i>Carum copticum</i> | Ajwayan | Spastic bowel, flatulence, dyspepsia | C |
| <i>Cassia angustifolia</i> | Markandika | Constipation, liver disease, joint pain | |
| <i>Cassia fistula</i> | Argbhada | Ringworm, constipation, fever, antibacterial | PS |
| <i>Cedrus deodara</i> | Devadaru | Fever, diarrhea, urinary disease | PS |
| <i>Centella asiatica</i> | Manduk- parni | Sedative, alterative, anxiolytic | S |
| <i>Cichorium intybus</i> | Kasni | Emmenagogue, digestive | S |
| <i>Cinnamomum camphora</i> | Karpoor | Diarrhea, nervousness, muscular pain fever | C |
| <i>Crocus sativus</i> | Kumkuma | Nervine sedative, emmenagogue, aphrodisiac | S |
| <i>Cinnamomum zeylanicum</i> | Twak | Dyspepsia, flatulence, diarrhea, menorrhagia. | C |
| <i>Cissampelos pareira</i> | Laghu Patha | Spastic bowel, uterine prolapse, alterative | D |
| <i>Clitoria tematea</i> | Aparajita | Cedema, anthelmintic, demulcent | C/PS |
| <i>Cocos nucifera</i> | Narikela | Fever, pharyngitis, skin disorder, alterative | C/PS |
| <i>Coleus aromaticus</i> | Pashan- bheda | Kidney stones, conjunctivitis, spastic colon | C |
| <i>Cordia obliqua</i> | Shelsh- mantaka | Expectorant, colic, dyspepsia, ulcers, cough | D |
| <i>Coriandrum sativum</i> | Dhanyaka | Flatulence, colic, joint pain, antiseptic | C |
| <i>Crinum deflexum</i> | Sudershan | Emetic, inflammatory conditions | C |
| <i>Cuminum cyminum</i> | Jeeraka | Diarrhea, dyspepsia, antiseptic, hookworm | C |
| <i>Curculigo orchoides</i> | Talamulika | Hemorrhoids, asthma, kidney stones, skin | D |
| <i>Curcuma longa</i> | Haridra | Arthritic pain, anti-inflammatory, skin disease | C |
| <i>Curcuma zedoaria</i> | Shati | Cough, asthma, leukorrhea, tonnesillitis | C/D |
| <i>Cynodon dactylon</i> | Doorwa | Diuretic, styptic, hematuria, hemorrhoids | PS |
| <i>Cyperus rotundus</i> | Mustaka | Anti-inflammatory, flatulence, fever, estrogenic | PS |
| <i>Datura metel</i> | Daturra | Anti-spasmodic, joint pain, asthma, dysmenorrhea | S |

contd.....

Table 3.3 – contd...

| Plant | Sanskrit name | Main indications/effects | Status |
|-----------------------------------|--------------------|---|--------|
| <i>Daucus carota</i> | Garijara | Blood purifier, nervine tonic, jaundice | C |
| <i>Dolichos biflorus</i> | Kulitha | Edama, kidney stone, asthma, dysmenorrhea, tumours | C |
| <i>Eclipta Alba</i> | Bhringaraj | Hepatic, deobstruent and tonic, alliterative, emetic purgative, antiseptic, antiviral | S |
| <i>Elettaria cardamomum</i> | Elaichi Chhoti | Bronchitis, flatulence, dyspepsia, hemorrhoids | C |
| <i>Emblica officinalis</i> | Amalaki | Fruit: cooling, laxative, stomachic, tonic, diuretic | PS/C |
| <i>Evovulus alsinoides</i> | Shankha- pushpi | Anxiety, diarrhoea, bronchitis, memory loss, fever | S |
| <i>Ferula foetida</i> | Hingu | Flatulence, cough, constipation, palpitation, aphrodisiac | C |
| <i>Ficus religiosa</i> | Aswatha | Ulcers, skin disease, diabetes, constipation | PS |
| <i>Ficus racemosa</i> | Udambara | Diarrhoea, hemorrhoids, bleeding, disproders, antiseptic | PS |
| <i>Foeniculum vulgare</i> | Satupuspa | Cough, flatulence, dysmenorrhea, hookworm edema | C |
| <i>Grewia hirsuta</i> | Nagbala | Diarrhoea, wounds, heart disease, fever | S |
| <i>Gmelina arborea</i> | Gambhari | General tonic, to increase strength, antiviral, indigestion | PS/C |
| <i>Gymnema sylvestre</i> | Meshas- tringa | Diuretic, astringent, hypoglycemic, regerant, stomachic | D |
| <i>Hemidesmus indicus</i> | Sariva | Excellent alternative, to increase appetite, cough, skin | D |
| <i>Holarrhena antidysenterica</i> | Kutaja | Diarrhoea, dysentery, amebiasis, anthelmintic | PS |
| <i>Hyoscyamus niger</i> | Yavani | Chronic dementia, hysteria, palpitations, asthma, sedative | C |
| <i>Hyssopus officinalis</i> | Zupha | Cough, asthma bronchitis, amenorrhea | C |
| <i>Ipomoea digitata</i> | Vidari | Cough, hoarseness, respiratory stimulant, tonic | S |
| <i>Justicia adhatoda</i> | Vasaka | Bronchitis, asthma, jaundice, antispasmodic | Ps |
| <i>Linum usitatissimum</i> | Uma | Cystitis, bronchitis, boils, anti-torant, demulcent | C |

contd.....

Table 3.3 – contd...

| Plant | Sanskrit name | Main indications/effects | Status |
|-------------------------------|---------------|--|--------|
| <i>Luffa acutangula</i> | Koshataki | Splenomegaly, emetic, skin disease, expectorant | C |
| <i>Madhuca longifolia</i> | Madhuca | Tonnensillitis, cough, rheumatic joints, diabetes, appetizer | PS |
| <i>Michelia champaca</i> | Champaka | Gastritis, chronic arthritis, emmenagogue, diuretic, colic | S |
| <i>Mimosa pudica</i> | Lajjalu | Menorheagia, hemorrhoids, skin wounds, diarrhea | S |
| <i>Mimusops elengi</i> | Bakula | Tonic, cardiogenic, urogenital disease, snakebite, skin sores | C |
| <i>Morinda citrifolia</i> | Ach | Acne, eczema, hyperlipidemia, bronchitis, diarrhoea | S |
| <i>Moringa oleifera</i> | Sigru | Source of Vitamin c, colds, boils, fever, joint pain, gout | PS/C |
| <i>Mucuna pruriens</i> | Kapika-chchha | Nervine tonic, aphrodisiac, Parkinsonism, hypercholesterolemia | D |
| <i>Narostachys jatamansi</i> | Jatamansi | Nervousness, anxiety, dysmenorrhoea, insomnia, hair tonic | D |
| <i>Nelumbo nucifera</i> | Parijata | Refrigerant, sedative, demulcent | D |
| <i>Nyctanthes arborescens</i> | Parijata | Liver diseases, constipation anthelmintic, antihistaminic | C/PS |
| <i>Ocimum sanctum</i> | Tuasi | Demulcent, expectorant, antispasmodic, anthelmintic | C |
| <i>Paederia foetida</i> | Prasarni | Rheumatic joint pain, edema, bladder stones, inflammation | D |
| <i>Papaver somiferum</i> | Ahiphenam | Anxiety, diarrhoea, aphrodisiac, sedative | C |
| <i>Peucedanum graveolens</i> | Satapushpi | Flatulence, colic, abscesses, digestive | C |
| <i>Phyllanthus fraternus</i> | Bhumia-malaki | Jaundice, liver disease, fever, genitourinary disease, edema | S |
| <i>Picrorrhiza kurroa</i> | Katuki | Hepatitis, asthma, anorexia | C |
| <i>Piper nigrum</i> | Maricha | Dyspepsia cough, pharyngitis, headache, diarrhea | C |
| <i>Plantago ovata</i> | Isaphgol | Constipation, colitis, irritable bowel, cystitis | C |
| <i>Plumbago zeylanica</i> | Chitraka | Abortifacient, warts, rheumatic joint pain | C |
| <i>Premna integrifolia</i> | Agnimantha | Flatulence, fever, arthritis, liver deobstruent | S |
| <i>Prunus amygdalus</i> | Badama | Mental energy, general tonic esp. nerve and kidney, semen | S |

contd.....

Table 3.3 – contd...

| Plant | Sanskrit name | Main indications/effects | Status |
|--------------------------------|---------------|---|--------|
| <i>Pterocarpus sanatalinus</i> | Rakta Chandan | Skin tonic, liver disorders, fever | C/D |
| <i>Punica granatum</i> | Dadima | Anthelmintic (esp. tapeworm), diarrhoea, dyspepsia | C |
| <i>Randia ducmetorum</i> | Madana | Fruit and rind are emetic, diaphoretic and antispasmodic, bark is sedative and nervine calamative | S |
| <i>Rauvolfia serpentina</i> | Sarpa-gandha | Hypertension, anxiety, insomnia, colic | D |

Ayurvedic Formulations

Ayurvedic medicines can be classified as ayurvedic classical formulations and patent and proprietary formulations. The ayurvedic classical formulations include those medicines that are manufactured according to prescriptions given in one of the ancient ayurvedic texts, while the patent and proprietary medicines are the outcome of research and development efforts of manufacturing companies. The concept of combination of ingredients and hence formulations in ayurveda. Table 3.4 indicates the extensive range of formulations in which particular species may occur.

Table 3.4 : Frequency of Occurrence of Medicinal Plants in Herbal Formulations in India

| Common name | Botanical name | No. of herbal formulation | Status |
|----------------|-----------------------------------|---------------------------|--------|
| Harra | <i>Terminalia chebula</i> | Herra, behera and aonla | PS |
| Behera | <i>Terminalia bellerica</i> | together used in 219 | PS |
| Aonla | <i>Emblica officinalis</i> | Formulations | PS |
| Yashtimadhu | <i>Glycyrrhiza glabra</i> | 141 | C |
| Pipali | <i>Piper longum</i> | 125 | C |
| Vasaka | <i>Adhatoda vasica</i> | 110 | PS |
| Ashwagandha | <i>Withania somnifera</i> | 109 | C |
| Mastak (Motha) | <i>Cyperus rotundus</i> | 102 | PS |
| Guduchi | <i>Tinispora cordifolia</i> | 88 | D |
| Daruharidra | <i>Berberis aristata</i> | 65 | D |
| Gokshura | <i>Tribulus terrestris</i> | 65 | D |
| Kutja | <i>Holarrhena antidysenterica</i> | 59 | PS |
| Punamava | <i>Bøerhavia diffusa</i> | 52 | S |

Source: Biotech Consortium India Ltd. 1996

Background to the Unani and Siddha System of Medicine

Unani System

The unani system of medicine was introduced in India by Arabs and Persians from Greece where it originated between 460 BC–377 BC. According to Hippocrates, disease is a normal process and its symptoms the reaction of the body to the disease. The body has four humours namely Blood (Dam), Phlegm (Balgam), Yellow bile (Safra) and Black bile that keep the equilibrium. The humours have specific temperament and the temperament of a person is expressed as being sanguine, phlegmatic, choleric and melancholic according to their level in the body. The System believes in the presence of some self-preservation mechanism in human body. The diagnosis and treatment are based on the concept of temperament and changes in temperament are related to changes in the balance of humours. Drugs are made of herbal, animal and mineral origin. The drugs stimulate and strengthen the defence mechanism and normalize the imbalance.

Table 3.5 : Top 17 medicinal plants consumed by Baidyanath, Jhansi

| Trade name | Botanical name | Status |
|------------------------------|--|--------|
| 1 Amla* | <i>Emblica officinalis</i> | PS |
| 2 Ashok* | <i>Saraca indica</i> | C |
| 3 Babul | <i>Acacia arabica</i> | PS |
| 4 Ghee kunwar* | <i>Aloe vera</i> | C |
| 5 Urad | <i>Phaseolus mungo</i> | PS |
| 6 Harra* (Large and Small) | <i>Terminalia chebula</i> | PS |
| 7 Munkka | | |
| 8 Arjun | <i>Terminalia arjuna</i> | PS |
| 9 Adusa | <i>Adathoda vasica</i> | PS |
| 10 Baheda | <i>Terminalia bellerica</i> | PS |
| 11 Guduchi | <i>Tinospora cordifolia</i> | D |
| 12 Kateri (Large and Small) | <i>Solanum surattense</i> | S |
| 13 Rasna | <i>Pluchea lanceolata/ Polygonum spp./ Dendrophthe facultata</i> | S |
| 14 Shankpushpi | <i>Convolvulus pluricaulis</i> | D |
| 15 Jawasa | <i>Alhaqi maurorum/ pseudalhaqi</i> | D |
| 16 Ashwagandha* | <i>Withania somnifera</i> | D/C |
| 17 Safed musli* | <i>Chlorophytum borivillianun</i> | D |

*Species selected for detailed market study

Siddha System

Siddha means achievement of perfection, saintly figures who achieve excellence through the practice of yoga, promoted the system in Tamil Nadu. The manuscripts are in Tamil. It is believed that eighteen siddhas contributed towards the development of siddha medicine. It is largely therapeutic in nature.

The principles and doctrine of this system are similar to that of ayurveda. The difference is basically linguistic. According to this system, the human body is the replica of the universe, as are the food and drugs, irrespective of their origin. This system also accepts the five-element theory and the tridosha theory as in ayurveda. The diagnosis involves identifying causes by examining pulse, urine, eyes, voice, body colour, tongue and the state of the digestive system (ITCOT 1999).

The study was divided into three phases:

Phase I: An overview of the ayurvedic industry in India, especially in relation to its consumption of raw material (*i.e.*, medicinal plants).

Phase II: Study of pricing, value addition and information flow mechanisms at different points in the supply chain ranging from the primary collector/cultivator to the processing industry.

Phase III: Investigation of the potential application of market based instruments to ensure both supply of sustainably managed medicinal plants to the ayurvedic industry and better returns for primary collectors/cultivators.

Chapter Four

Potential Drug Plants of Undivided India Listed by Kirtikar and Basu

The list of drug plants prepared by Kirtikar and Basu covers large area of undivided India. In marking the 'Status' of various species the author has not corrected any nomenclature of species. The 'Status' column shows making of 'dash' (- sign), which mean not known. The status column shows preponderance of 'Sporadic' species. The legend used in all the lists is as follows:

- S = Sporadic.
- S* = Sporadic with concentrated patches of regeneration.
- T = Threatened (also D = Depleted).
- PS = Presently safe.
- C = Cultivated.

Table 4.1 : List of Medicinal Plants (Kirtikar and Basu)

| Scientific Name | Status | Scientific Name | Status |
|----------------------|--------|----------------------|--------|
| Ranunculaceae | | <i>Adonis</i> | |
| <i>Clematis</i> | | <i>aestivalis</i> | - |
| <i>napaulensis</i> | T | <i>Nigella</i> | |
| <i>triloba</i> | T | <i>sativa</i> | C |
| <i>smilacifolia</i> | S | <i>Ranunculus</i> | |
| <i>gouriana</i> | S | <i>trichophyllus</i> | - |
| <i>graveolens</i> | - | <i>lingua</i> | - |
| <i>Anemone</i> | | <i>sceleratus</i> | PS |
| <i>obtusiloba</i> | T | <i>pensylvanicus</i> | - |
| <i>Thalictrum</i> | | <i>arvensis</i> | - |
| <i>foliolosum</i> | T | <i>muricatus</i> | - |
| | | <i>falcatus</i> | - |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|--------------------------|--------|-----------------------|--------|
| <i>Caltha</i> | | <i>Illicium</i> | |
| <i>palustris</i> | T | <i>griffithii</i> | - |
| <i>Coptis</i> | | | |
| <i>teeta</i> | T | | |
| <i>Delphinium</i> | | Annonaceae | |
| <i>denudatum</i> | T | <i>Ucaria</i> | |
| <i>caeruleum</i> | - | <i>narum</i> | S |
| <i>elatum</i> | - | <i>Artabotrys</i> | |
| <i>brunonianum</i> | - | <i>odoratissimus</i> | C |
| <i>Actaea</i> | | <i>Canangium</i> | |
| <i>spicata</i> | - | <i>odoratum</i> | - |
| <i>Cimicifuga</i> | | <i>Annona</i> | |
| <i>foetida</i> | T | <i>Squamosa</i> | C |
| <i>Paeonia</i> | | <i>reticulata</i> | C |
| <i>emodi</i> | T | <i>Sageraea</i> | |
| <i>Aconitum</i> | | <i>laurifolia</i> | - |
| <i>lucidum</i> | - | <i>Polyalthia</i> | |
| <i>chasmanthum</i> | - | <i>longifolia</i> | PS |
| <i>violaceum</i> | - | <i>simiarum</i> | PS |
| <i>heterophyllum</i> | T | <i>thwaites</i> | - |
| <i>palmatum</i> | T | | |
| <i>deinorrhizum</i> | - | Menispermaceae | |
| <i>balfourii</i> | - | <i>Tinospora</i> | |
| <i>falconeri</i> "var. I | - | <i>malabarica</i> | T |
| <i>spicatum</i> | - | <i>cordifolia</i> | T |
| <i>laciniatum</i> | - | <i>Anamirta</i> | |
| <i>ferox</i> | T | <i>cocculus</i> | - |
| <i>elwesii</i> | - | <i>Tiliacora</i> | |
| <i>lethal</i> | - | <i>acuminata</i> | S |
| <i>napellus</i> | - | <i>Cocculus</i> | |
| | | <i>hirsutus</i> | S |
| Dilleniaceae | | <i>pendulus</i> | S |
| <i>Dillenia</i> | | <i>laurifolius</i> | S |
| <i>indica</i> | PS | <i>macrocarpus</i> | S |
| | | <i>Pachygone</i> | |
| Magnoliaceae | | <i>ovata</i> | - |
| <i>Michelia</i> | | <i>Pericampylus</i> | |
| <i>champaca</i> | PS | <i>glaucus</i> | - |
| <i>nilagirica</i> | PS | <i>Stephania</i> | |
| <i>montana</i> | S | <i>hernandifolia</i> | S |
| | | <i>glabra</i> | - |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|---------------------------|--------|-------------------------------------|--------|
| <i>Cissampelos</i> | | | |
| <i>pareira</i> | S | | |
| <i>Tinospora sinensis</i> | | | |
| <i>Stephania japonica</i> | | | |
| Berberidaceae | | Cruciferae | |
| <i>Berberis</i> | | <i>Nasturtium</i> | |
| <i>petiolaris</i> | - | <i>palustre</i> | S |
| <i>aristata</i> | - | <i>indicum</i> | PS |
| <i>lycium</i> | - | <i>montanum</i> | - |
| <i>asiatica</i> | T | <i>Cardamine</i> | |
| <i>Mahonia</i> | | <i>impatiens</i> | - |
| <i>napaulensis</i> | T | <i>Capsella</i> | |
| <i>Podophyllum</i> | | <i>bursa-pastoris</i> | - |
| <i>emodi</i> | T | <i>Lepidium</i> | |
| Nymphaeaceae | | <i>sativum</i> | S |
| <i>Nymphaea</i> | | <i>draba</i> | S |
| <i>alba</i> | T | <i>crassifolium</i> | S |
| <i>rubra</i> | T | <i>latifolium</i> | - |
| <i>pubescens</i> | T | <i>ruderales</i> | S |
| <i>stellata</i> | T | <i>perfoliatum</i> | S |
| <i>Euryale</i> | | <i>Cochlearia</i> | |
| <i>ferox</i> | T | <i>flava</i> | - |
| <i>Nelumbo</i> | | <i>Crambe</i> | |
| <i>nucifera</i> | T | <i>cordifolia</i> | - |
| <i>Nymphaea nouchali</i> | | <i>Raphanus</i> | |
| Papaveraceae | | <i>sativus</i> | C |
| <i>Argemone</i> | | <i>Brassica</i> | |
| <i>mexicana</i> | PS | <i>oleracea</i> | C |
| <i>Meconopsis</i> | | <i>campestris</i> " var. <i>apa</i> | C |
| <i>aculeata</i> | - | <i>nigra</i> | C |
| <i>napaulensis</i> | T | Capparidaceae | |
| <i>Papaver</i> | | <i>Cleome</i> | |
| <i>somniferum</i> | C | <i>monophylla</i> | - |
| Fumariaceae | | <i>brachycarpa</i> | - |
| <i>Corydalis</i> | | <i>icosandra</i> | PS |
| <i>govaniiana</i> | S | <i>felina</i> | - |
| <i>ramosa</i> | - | <i>heptaphylla</i> | - |
| | | <i>chelidonii</i> | - |
| | | <i>gynandra</i> | - |
| | | <i>Macrura</i> | |
| | | <i>arenaria</i> | - |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-------------------------|--------|-------------------------|--------|
| <i>Crataeva</i> | | Flacourtiaceae | |
| <i>murvala</i> | PS | <i>Flacourtia</i> | |
| <i>Cadaba</i> | | <i>cataphracta</i> | S |
| <i>farinosa</i> | - | <i>ramontchi</i> | S |
| <i>trifoliata</i> | - | <i>sepiaria</i> | S |
| <i>Capparis</i> | | <i>Camellia</i> | |
| <i>spinosa</i> | | <i>thea</i> | PS |
| <i>heyneana</i> | PS | <i>Gordonia</i> | |
| <i>decidua</i> | PS | <i>obtusa</i> | - |
| <i>grandis</i> | S | Dipterocarpaceae | |
| <i>sepiaria</i> | S | <i>Dipterocarpus</i> | |
| <i>zeylanica</i> | S | <i>turbinatus</i> | PS |
| Resedaceae | | <i>tuberculatus</i> | PS |
| <i>Reseda</i> | | <i>alatus</i> | PS |
| <i>odorata</i> | - | <i>pilosus</i> | |
| <i>Oligomeris</i> | | <i>Shorea</i> | |
| <i>subulata</i> | - | <i>robusta</i> | PS |
| <i>Ochradenus</i> | | <i>tumbuggaia</i> | - |
| <i>baccatus</i> | - | <i>Hopea</i> | |
| Violaceae | | <i>odorata</i> | S |
| <i>Viola</i> | | <i>Vateria</i> | |
| <i>serpens</i> | T | <i>indica</i> | S |
| <i>odorata</i> | - | Malvaceae | |
| <i>cinerea</i> | - | <i>Althaea</i> | |
| <i>diffusa</i> | - | <i>officinalis</i> | - |
| <i>patrini</i> | - | <i>rosea</i> | - |
| <i>tricolor</i> | - | <i>ludwigii</i> | - |
| <i>biflora</i> | T | <i>Malva</i> | |
| <i>sylvestris</i> | - | <i>sylvestris</i> | S |
| <i>Ionidium</i> | | <i>rotundifolia</i> | S |
| <i>enneaspermum</i> | S | <i>parviflora</i> | - |
| Cochlospermaceae | | <i>verticillata</i> | - |
| <i>Cochlospermum</i> | | <i>Malvastrum</i> | |
| <i>gossypium</i> | PS | <i>coromandelianum</i> | S |
| Bixaceae | | <i>Sida</i> | |
| <i>Bixa</i> | | <i>veronicaefolia</i> | S |
| <i>orellana</i> | C | <i>rhomboidea</i> | S |
| | | <i>spinosa</i> | S |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|------------------------|--------|----------------------------|--------|
| <i>acuta</i> | S | <i>Kydia</i> | |
| <i>rhombifolia</i> | S | <i>calycina</i> | PS |
| <i>cordifolia</i> | S | | |
| <i>Abutilon</i> | | Bombacaceae | |
| <i>indicum</i> | S | <i>Adonsonia</i> | |
| <i>hirtum</i> | - | <i>digitata</i> | PS |
| <i>theophrasti</i> | S | <i>Cynocardia</i> | |
| <i>glaucum</i> | - | <i>odorata</i> | T |
| <i>asiaticum</i> | - | <i>Hydnocarpus</i> | |
| <i>Malachra</i> | | <i>wightiana</i> | - |
| <i>capitata</i> | S | <i>venenata</i> | - |
| <i>Urena</i> | | <i>anthelmintica</i> | - |
| <i>lobata</i> | S | <i>Taraktogenos</i> | |
| <i>sinuata</i> | S | <i>kurzii</i> | D |
| <i>repanda</i> | S | | |
| <i>Pavania</i> | | Pittosporaceae | |
| <i>odorata</i> | | <i>Pittosporum</i> | |
| <i>zeylanica</i> | - | <i>napaulense</i> | - |
| <i>Hibiscus</i> | | Polygalaceae | |
| <i>furcatus</i> | S | <i>Polygala</i> | |
| <i>micranthus</i> | S | <i>crotalarioides</i> | - |
| <i>cannabinus</i> | S | <i>chinensis</i> | S |
| <i>sabdariffa</i> | S | <i>telephioides</i> | S |
| <i>abelmoschus</i> | S | <i>glomerata</i> | |
| <i>esculentus</i> | S | <i>sibirica</i> | S |
| <i>tiliaceus</i> | S | | |
| <i>rosa-sinensis</i> | C | Frankeniaceae | |
| <i>lampas</i> | S | <i>Frankenia</i> | |
| <i>trionum</i> | S | <i>pulverulenta</i> | - |
| <i>surattensis</i> | S | | |
| <i>manihot</i> | S | Caryophyllaceae | |
| <i>mutabilis</i> | C | <i>Saponaria</i> | |
| <i>Thespesia</i> | | <i>vaccaria</i> | S |
| <i>populnea</i> | PS | <i>Polycarpea</i> | |
| <i>Gossypium</i> | | <i>corymbosa</i> | S |
| <i>herbaceum</i> | S | <i>Vaccaria pyramidata</i> | S |
| <i>arboreum</i> " var. | PS | | |
| <i>barbadense</i> | - | Portulacaceae | |
| <i>hirsutum</i> | S | <i>Portulaca</i> | |
| | | <i>oleracea</i> | S |
| | | <i>quadrifida</i> | PS |
| | | <i>tuberosa</i> | S |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|---------------------|--------|-------------------------|--------|
| Tamaricaceae | | Ternstroemiaceae | |
| <i>Tamarix</i> | | <i>Schima</i> | |
| troupii | S | wallichii | PS |
| dioica | S | monogynum | - |
| aphylla | - | coca | - |
| gallica | S | Malpighiaceae | |
| <i>Myricaria</i> | | <i>Hiptage</i> | |
| elegans | - | benghalensis | C |
| germanica | - | Zygophyllaceae | |
| Elatinaceae | | <i>Tribulus</i> | |
| <i>Bergia</i> | | terrestris | - |
| odorata | - | alatus | - |
| Hypericaceae | | <i>Zygothymum</i> | |
| <i>Hypericum</i> | | simplex | - |
| patulum | T | coccineum | - |
| perforatum | - | <i>Fugonia</i> | |
| humifusum | - | cretica | - |
| sampsoni | - | Geraniaceae | |
| japonicum | T | <i>Geranium</i> | |
| chinense | - | wallichianum | - |
| Guttiferae | | napalense | T |
| <i>Garcinia</i> | | robertianum | - |
| mangostana | C | ocellatum | - |
| indica | - | lucidum | S |
| morella | - | molle | - |
| xanthochymus | S | pratense | - |
| dulcis | - | pusillum | - |
| cornea | - | rotundifolium | - |
| cowa | S | sibiricum | - |
| heterandra | - | Oxalidaceae | |
| <i>Ochrocarpa</i> | | <i>Oxalis</i> | |
| longifolius | S | comiculata | PS |
| <i>Calophyllum</i> | | acetosella | PS |
| inophyllum | S | <i>Biophytum</i> | |
| apetalum | - | sensitivum | PS |
| elatum | - | <i>Averrhoa</i> | |
| <i>Mesua</i> | | carambola | C |
| ferea | PS | bilimbi | - |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|----------------------|--------|----------------------|--------|
| Balsaminaceae | | <i>Clausena</i> | |
| <i>Impatiens</i> | | excavata | T |
| balsamina | C | <i>Bombax</i> | |
| tripetala | S | ceiba | PS |
| chinensis | - | <i>Ceiba</i> | |
| Rutaceae | | pentandra | PS |
| <i>Evodia</i> | | Sterculiaceae | |
| Lunur-ankenda | S | <i>Pterygota</i> | |
| fraxinifolia | PS | alata | PS |
| rutaecarpa | - | <i>Sterculia</i> | |
| <i>Ruta</i> | | foetida | S |
| graveolens | - | urens | S |
| tuberculata | - | balanghas | - |
| <i>Peganum</i> | | rubiginosa | - |
| harmala | - | <i>Pterocymbium</i> | |
| <i>Dictamnus</i> | | javanicum | S |
| albus | - | <i>Scaphium</i> | |
| <i>Zanthoxylum</i> | | affine | - |
| alatum | - | wallichii | - |
| acanthopodium | S | <i>Helicteres</i> | |
| oxyphyllum | S | isora | PS |
| hamiltonianum | - | <i>Peterospermum</i> | |
| budrunga | S | suberifolium | S |
| <i>Toddalia</i> | | acerifolium | PS |
| asiatica | S | heyneanum | - |
| <i>Vepris</i> | | <i>Pentapetes</i> | |
| bilocularis | - | phoenicea | - |
| <i>Skimmia</i> | | <i>Eriolaena</i> | |
| laureola | T | quinquelocularis | S |
| <i>Glycosmis</i> | | <i>Melochia</i> | |
| cochinchinensis | - | corchorifolia | S |
| <i>Acronychia</i> | | <i>Abroma</i> | |
| laurifolia | S | augusta | PS |
| <i>Murraya</i> | | <i>Guazuma</i> | |
| koenigii | PSC | tomentosa | PS |
| paniculata | C | <i>Theobroma</i> | |
| | | cocoa | C |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-----------------------|--------|-------------------------|--------|
| <i>Buettneria</i> | | Erythroxylaceae | |
| herbaca | - | <i>Erythroxylon</i> | |
| | | pentaphylla | S |
| Tilinceae | | wampi | - |
| <i>Grewia</i> | | <i>Limonia</i> | |
| tiliaefolia | S | crenulata | S |
| asiatica | S | <i>Luvunga</i> | |
| sclerophylla | - | scandens | S |
| villosa | - | <i>Paramignya</i> | |
| hirsuta | S | monophylla | S |
| tenax | - | longispina | - |
| umbellata | - | <i>Atalantia</i> | |
| paniculata | - | monophylla | T |
| microcos | - | <i>Citrus</i> | |
| <i>Triumfetta</i> | | medica | C |
| bartramia | S | medica var. proper | C |
| semitriloba NK | - | medica var. limonium | - |
| <i>Corchorus</i> | | medica var. acida | C |
| capsularis | C | medica var. limetta | C |
| olitorius | C | aurantium | |
| trilocularis | C | aurantium var. proper | - |
| fascicularis | - | aurantium var. | |
| depressus | - | bigaradia | - |
| | | aurantium var. bergamia | |
| Elaeocarpaceae | | maxima | C |
| <i>Elaeocarpus</i> | | <i>Feronia</i> | |
| ganitrus | T | elephantum | S |
| oblongus | - | <i>Aegle</i> | |
| serratus | S | mamelos | FS |
| tuberculatus | S | | |
| | | Simaroubaceae | |
| Linaceae | | <i>Ailanthus</i> | |
| <i>Linum</i> | | glandulosa | S |
| usitatissimum | C | excelsa | C |
| perenne | - | malabarica | S |
| strictum | - | <i>Samadera</i> | |
| <i>Reinwardtia</i> | | indica | - |
| trigyna | S | indica var. lucida | - |
| <i>Mugonia</i> | | <i>Picrasma</i> | |
| mystax S | - | quassioides | S |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|---------------------|--------|---------------------|--------|
| <i>javanica</i> | S | <i>Dysoxylum</i> | |
| <i>Brucea</i> | | <i>hamiltonii</i> | S |
| <i>sumatrana</i> | - | <i>malabaricum</i> | S |
| <i>Eurycoma</i> | | <i>Sandoricum</i> | |
| <i>longifolia</i> | - | <i>indicum</i> | - |
| <i>Balanites</i> | | <i>Aglaia</i> | |
| <i>aegyptiaca</i> | T | <i>odoratissima</i> | - |
| <i>roxburghii</i> | - | <i>roxburghiana</i> | - |
| Ochnaceae | | <i>Aphanamixis</i> | |
| <i>Ouratea</i> | | <i>polystachya</i> | PS |
| <i>angustifolia</i> | - | <i>Amoora</i> | |
| <i>Ochna</i> | | <i>cucullata</i> | - |
| <i>pumila</i> | S | <i>Walsura</i> | |
| <i>squarrosa</i> | - | <i>piscidia</i> | - |
| Buseraceae | | <i>heynea</i> | S |
| <i>Boswellia</i> | | <i>trijuga</i> | S |
| <i>serrata</i> | PS | <i>Carapa</i> | |
| <i>glabra</i> | - | <i>moluccensis</i> | T |
| <i>Garuga</i> | | <i>obovata</i> | T |
| <i>pirnata</i> | PS | <i>Soymida</i> | |
| <i>Commiphora</i> | | <i>febrifuga</i> | S |
| <i>mukul</i> | T | <i>Chukrasia</i> | |
| <i>agallocha</i> | D | <i>tabularis</i> | PS |
| <i>stocksiana</i> | - | <i>tooba atach</i> | PS |
| <i>Canarium</i> | | <i>Chloroxylon</i> | |
| <i>commune</i> | - | <i>swietenia</i> | PS |
| <i>strictum</i> | S | Icacinaceae | |
| <i>bengalense</i> | S | <i>Ximenia</i> | |
| Meliaceae | | <i>americana</i> | - |
| <i>Turracea</i> | | Olacaceae | |
| <i>villosa</i> | - | <i>Olax</i> | |
| <i>Naregamia</i> | | <i>scandens</i> | - |
| <i>alata</i> | - | <i>nana</i> | - |
| <i>Azadirachta</i> | | <i>Sarcostigma</i> | |
| <i>indica</i> | PS | <i>kleinii</i> | - |
| <i>Melia</i> | | Celastraceae | |
| <i>azedarach</i> | PS | <i>Euonymus</i> | |
| <i>composita</i> | S | <i>tingens</i> | - |

contd

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-----------------------|--------|----------------------|--------|
| <i>javanicus</i> | S | <i>latifolia</i> | - |
| <i>Kokoona</i> | | <i>vinifera</i> | - |
| <i>zeylanica</i> | - | <i>indica</i> | - |
| <i>Celastrus</i> | | <i>setosa</i> | - |
| <i>paniculata</i> | T | <i>carnosa</i> | - |
| <i>Gymnosporia</i> | | <i>araneosa</i> | - |
| <i>spinosa</i> | - | <i>pedata</i> | S |
| <i>royleana</i> | - | <i>tomentosa</i> | - |
| <i>Elaeodendron</i> | | <i>repens</i> | - |
| <i>glaucum</i> | S | <i>pallida</i> | - |
| <i>Salacia</i> | | <i>Leea</i> | |
| <i>oblonga</i> | - | <i>macrophylla</i> | - |
| <i>reticulata</i> | - | <i>crispa</i> | S |
| Rhamnaceae | | <i>indica</i> | PS |
| <i>Ventilago</i> | | <i>robusta</i> | - |
| <i>maderaspatana</i> | S | <i>aequata</i> | - |
| <i>talyculata</i> | - | Sapindaceae | |
| <i>Berchemia</i> | | <i>Cardiospermum</i> | |
| <i>lineata</i> | - | <i>halicacabum</i> | S |
| <i>Zizyphus</i> | | <i>Aesculus</i> | |
| <i>mauritiana</i> | S | <i>indica</i> | S |
| <i>trinervia</i> | S | <i>hippocastanum</i> | S |
| <i>nummularia</i> | S | <i>Allophylus</i> | |
| <i>sativa</i> | - | <i>serratus</i> | S |
| <i>rugosa</i> | S | <i>Schleichera</i> | |
| <i>oenoplia</i> | S | <i>trijuga</i> | PS |
| <i>Rhamnus</i> | | <i>Sapindus</i> | |
| <i>dahuricus</i> | - | <i>trifoliatus</i> | - |
| <i>wightii</i> | - | <i>mukorossi</i> | S |
| <i>purpureus</i> | - | <i>Litclu</i> | |
| <i>triqueter</i> | - | <i>chinensis</i> | C |
| <i>nipalensis</i> | - | <i>Nephelium</i> | |
| <i>Gonania</i> | | <i>longana</i> | S |
| <i>leptostachya</i> | S | <i>lappaceum</i> | - |
| Viitaceae | | <i>Acer</i> | |
| <i>Vitis</i> | | <i>pictum</i> | - |
| <i>quadrangularis</i> | S | <i>Dodonaea</i> | |
| <i>adnata</i> | - | <i>viscosa</i> | PS |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|----------------------|--------|--------------------|--------|
| Anacardiaceae | | Connaraceae | |
| <i>Rhus</i> | | <i>Connarus</i> | |
| parviflora | - | monocarpus | - |
| semialata | S | <i>Rourea</i> | |
| wallichii | - | santaloides | - |
| insignis | - | bofalaria | - |
| succedanea | - | burhia | - |
| <i>Pistacia</i> | | prostrata | - |
| integerrima | T | albida | - |
| <i>Mangifera</i> | | verrucosa | - |
| indica | S | juncea | - |
| caesia | - | medicaginea | - |
| <i>Anacardium</i> | | trifolium | - |
| occidentale | PS | retusa | - |
| <i>Buchanania</i> | | sericea | - |
| lanzan | PS | <i>Trigonella</i> | |
| <i>Melanorrhoea</i> | | occulta | - |
| usitata | - | foenum-graecum | S |
| wallichii | S | polycerata | - |
| curtisii | - | corniculata | - |
| <i>Lamea</i> | | <i>Melilotus</i> | |
| coromendelica | S | indica | S |
| <i>Semecarpus</i> | | officinalis | S |
| anacardium | PS | alba | - |
| <i>Holigarna</i> | | <i>Cyamopsis</i> | |
| arnottiana | S | tetragonoloba | S |
| longifolia | - | <i>Indigofera</i> | |
| <i>Spondias</i> | | iliniifolia | S |
| pinnata | PS | glandulosa | - |
| Coriariaceae | | enneaphylla | S |
| <i>Coriaria</i> | | aspalathoides | - |
| nepalensis | T | trifoliata | - |
| Moringaceae | | oblongifolia | - |
| <i>Moringa</i> | | tinctoria | - |
| oleifera | C | pulchella | - |
| coneanensis | - | trita | - |
| | | articulata | - |
| | | glabra | - |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|--------------------|--------|--------------------|--------|
| <i>Pseudarthri</i> | | <i>Erythrina</i> | |
| viscid | - | indica | PS |
| <i>Uraria</i> | | <i>Psoralea</i> | |
| picta | - | corylifolia | - |
| lagopoides | S | <i>Colutea</i> | |
| hamosa | - | nepalensis | - |
| <i>Alysicarpus</i> | | <i>Mundulea</i> | |
| longifolius | S | suberosa | - |
| arachis | | <i>Tephrosia</i> | |
| hypogaea | C | parpurea | S |
| <i>Ougenia</i> | | villosa | S |
| oojeinensis | S | petrosa | - |
| <i>Desmodium</i> | | <i>Glycyrrhiza</i> | |
| tihaeofolium | S | glabra | S |
| gangeticum | - | <i>Millettia</i> | |
| polycarpum | S | auriculata | S |
| trifolium | - | pachycarpa | S |
| lasiocarpum | - | <i>Adinobotrys</i> | |
| retroflexum | S | atropurpureus | - |
| pulchellum | | <i>Sesbania</i> | |
| <i>Abrus</i> | | aegyptiaca | C |
| preparatorius | T | aculeata | C |
| <i>Cicer</i> | | grandiflora | C |
| arietinum | C | <i>Astragalus</i> | |
| <i>Lathyrus</i> | | tribuloides | - |
| sativus | C | hamosus | S |
| aphaca | - | multiceps | - |
| pratensis | | strobiliferous | - |
| <i>Pisum</i> | | <i>Tavorniera</i> | |
| sativum | C | cuneifolia | - |
| <i>Glycine</i> | | <i>Lens</i> | |
| soja | - | esculenta | C |
| <i>Teranmus</i> | | <i>Athagi</i> | |
| labialis | - | camelorum | - |
| <i>Mucuna</i> | | <i>Zornia</i> | |
| monosperma | - | diphylla | S |
| gigantea | - | <i>Smithia</i> | |
| prurita | T | conferta | S |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|--------------------|--------|-----------------------|--------|
| <i>sensitiva</i> | — | <i>Pongamia</i> | |
| <i>Ornocarpum</i> | | pinnata | PS |
| sennoides | — | <i>Derris</i> | |
| lunatus | — | scandens | S |
| aconitifolius | — | elleptica | PS |
| adenanthus | — | uliginosa | |
| catiangu | — | <i>Sophora</i> | |
| <i>Clitoria</i> | | tomentosa | — |
| ternatea | C | mollis | S |
| <i>Dolichos</i> | | griffithii | — |
| biflorus | — | "var. roxburghii | — |
| lablab | C | suberosa | — |
| <i>Rhynehosia</i> | | <i>Butea</i> | |
| minima | — | monosperma | PS |
| <i>Cajanus</i> | | superba | S |
| cajans | C | <i>Canavalia</i> | |
| <i>Atylosia</i> | | virosa | — |
| searabaeoides | S | ensiformis | — |
| <i>Cylista</i> | | <i>Pueraria</i> | |
| seariosa | — | tuberosa | — |
| <i>Flemingia</i> | | <i>Phaseolus</i> | |
| strobilifera | — | trilobus | — |
| chappar | S | radiatus | C |
| grahamiana | — | mungo | C |
| congesta | S | | |
| tuberosa | — | Caesalpinaceae | |
| nana | — | <i>Caesalpinia</i> | |
| <i>Dalbergia</i> | | crista | S |
| sisso | PS | jayabo | — |
| multiflora | — | nuga | — |
| lanceolaria | S | sapan | — |
| volubilis | S | pulcherrima | C |
| spinosa | S | sepiaria | — |
| famarindifolia | S | digyna | S |
| laifolia | T | coriaria | — |
| <i>Pterocarpus</i> | | <i>Delonix</i> | |
| santalinus | T | elata | C |
| indicus | D | <i>Wagatea</i> | |
| marsupium | T | spicata | — |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|---------------------|--------|-----------------------|--------|
| <i>Cassia</i> | | Mimosaceae | |
| <i>fistula</i> | PS | <i>Neptunia</i> | |
| <i>occidentalis</i> | PS | <i>oleracea</i> | - |
| <i>sophera</i> | PS | <i>Xylia</i> | |
| <i>obtusifolia</i> | - | <i>dolabriformis</i> | S |
| <i>auriculata</i> | S | <i>Entada</i> | |
| <i>obovata</i> | - | <i>scandens</i> | S |
| <i>alata</i> | PS | <i>Adenanthera</i> | |
| <i>glauca</i> | - | <i>pavonia</i> | T |
| <i>absus</i> | - | <i>Prosopis</i> | |
| <i>mimosoides</i> | - | <i>spicigera</i> | PS |
| <i>pumila</i> | - | <i>Dichrostachys</i> | |
| <i>angustifolia</i> | T/C | <i>cinerea</i> | - |
| <i>javanica</i> | - | <i>Leuceæna</i> | |
| <i>tora</i> | PS | <i>glauca</i> | PS |
| <i>Cynometra</i> | | <i>Mimosa</i> | |
| <i>mimosoides</i> | - | <i>pubica</i> | PS |
| <i>cauliflora</i> | - | <i>runicaulis</i> | PS |
| <i>Hardwickia</i> | | <i>Acacia</i> | |
| <i>pinnata</i> | PS | <i>farnesiana</i> | S |
| <i>Saraca</i> | | <i>nilotica</i> | PS |
| <i>indica</i> | C | <i>leucophloea</i> | |
| <i>Ceratonia</i> | | <i>catechu</i> | PS |
| <i>siliqua</i> | - | <i>ferruginea</i> | - |
| <i>Haematoxylon</i> | | <i>senegal</i> | - |
| <i>campechianum</i> | - | <i>modesta</i> | - |
| <i>Tamarindus</i> | | <i>rugata</i> | - |
| <i>indica</i> | PS | <i>caesia</i> | - |
| <i>Humboldtia</i> | | <i>pennata</i> | S |
| <i>vahliaana</i> | S | <i>suma</i> | S |
| <i>Bauhinia</i> | | <i>Albizzia</i> | |
| <i>tomentosa</i> | - | <i>lebbeck</i> | PS |
| <i>racemosa</i> | PS | <i>odoratissima</i> | PS |
| <i>retusa</i> | PS | <i>julibrissin</i> | - |
| <i>vahlia</i> | PS | <i>amara</i> | - |
| <i>purpurea</i> | PS | <i>procera</i> | PS |
| <i>variegata</i> | PS | <i>stipulata</i> | PS |
| <i>malabarica</i> | - | <i>Pithecellobium</i> | |
| <i>macrostachya</i> | - | <i>bigeminum</i> | PS |
| | | <i>dulce</i> | PS |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-------------------|--------|----------------------|--------|
| Rosaceae | | gallica | - |
| <i>Prunus</i> | | alba | CS |
| amygdalus | S | indica | - |
| persica | S | banksiae | - |
| armeniaca | - | multiflora | - |
| cerasus | - | <i>Cydonia</i> | |
| avium | CS | vulgaris | - |
| cerasoides | S | <i>Pyrus</i> | |
| communis | - | malus | C |
| domestica | - | communis | - |
| insititia | - | <i>Eriobotrya</i> | |
| cornuta | - | japonica | C |
| mahaleb | - | <i>Cotoneaster</i> | |
| undulata | - | nummularia | S/r |
| triflora | - | bacillaris | - |
| <i>Prinsepia</i> | | microphylla | S |
| utilis S | S | var. buxifolia | - |
| <i>Rubus</i> | | Saxifragaceae | |
| moluccanus | - | <i>Bergenia</i> | |
| saxatilis | - | ligulata | - |
| fruticosus | - | <i>Dichora</i> | |
| <i>Geum</i> | | febrifuga | S |
| urbanum | - | <i>Ribes</i> | |
| alatum | - | orientale | S |
| <i>Potentilla</i> | | nigrum | - |
| nepalensis | S | <i>Kalanchoe</i> | |
| supina | - | pinnata | - |
| anserina | S | spathulata | - |
| fruticosa | S | laciniata | - |
| reptans | - | <i>Sedum</i> | |
| fragarioides | - | asiaticum | S |
| kleiniana | S | multicaule | - |
| sericea | S | Droseraceae | |
| <i>Agrimonia</i> | | <i>Drosera</i> | |
| eupatoria | S | lunata | - |
| <i>Rosa</i> | | indica | - |
| damascena | C | burnmanni | T |
| centifolia | - | | |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|------------------------------|--------|----------------------------|--------|
| Hamamelidaceae | | Myrtaceae | |
| <i>Exbacklandia populnea</i> | S/C | <i>Myrtus</i> | |
| Rhizophoraceae | | <i>communis</i> | + |
| <i>Rhizophora</i> | | <i>Melaleuca</i> | |
| <i>mucronata</i> | PS | <i>leucadendron</i> | C |
| <i>Ceriops</i> | | <i>Luffa</i> | |
| <i>candolleana</i> | PS | <i>aegyptiaca</i> | C |
| <i>Kandelia</i> | | <i>acutangula</i> | C |
| <i>candel</i> | T | var. <i>amara</i> | - |
| Combretaceae | | <i>echinata</i> | - |
| <i>Terminalia</i> | | <i>Benincasa</i> | |
| <i>catappa</i> | S | <i>hispida</i> | C |
| <i>belerica</i> | PS | <i>cerifera</i> | - |
| <i>chebula</i> | S | <i>Momordica</i> | |
| <i>citrina</i> | S | <i>charantia balsamina</i> | - |
| <i>arjuna</i> | PS | <i>dioica</i> | C |
| <i>tomentosa</i> | PS | <i>cochinchinensis</i> | C |
| <i>paniculata</i> | - | <i>tuberosa</i> | - |
| <i>pyrifolia</i> | - | <i>Cucum</i> | |
| <i>bialata</i> | - | <i>trigonus</i> | - |
| <i>oliveri</i> | - | <i>melo</i> | CPS |
| <i>myriocarpa</i> | PS | "var. <i>momordica</i> | - |
| <i>coriacea</i> | | "var. <i>utilissimus</i> | - |
| <i>pallida</i> | D | <i>prophetarum</i> | - |
| <i>Calycopteris</i> | | <i>sativus</i> | - |
| <i>floribunda</i> | D | <i>Citrullus</i> | |
| <i>Anogeissus</i> | | <i>colocynthis</i> | - |
| <i>latifolia</i> | PS | <i>vulgaris</i> | C |
| <i>Quisqualis</i> | | "var. <i>fistulosus</i> | - |
| <i>indica</i> | C | <i>Coccinia</i> | |
| Lecythedaceae | | <i>indica</i> | S |
| <i>Barringtonia</i> | | <i>Cucurbita</i> | |
| <i>racemosa</i> | - | <i>maxima</i> | C |
| <i>acutangula</i> | PS | <i>pepo</i> | C |
| <i>speciosa</i> | - | <i>Bryonopsis</i> | |
| <i>Careya</i> | | <i>laciniosa</i> | C |
| <i>arborea</i> | PS | <i>Melothria</i> | |
| | | <i>maderaspatana</i> | S |
| | | <i>perpusilla</i> | - |

contd..

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|----------------------|--------|----------------------|--------|
| heterophylla | S | Bupleurum | - |
| <i>Blastania</i> | | <i>Eucalyptus</i> | |
| garcini | - | citriodora | PS |
| <i>Kedostris</i> | | globulus | - |
| rostrata | - | <i>Psidium</i> | |
| <i>Corallocarpus</i> | | guyava | C |
| epigaeus | - | <i>Jambosa</i> | |
| <i>Zanonia</i> | | jambos | PS |
| indica | - | <i>Syzygium</i> | |
| Datisceae | | operculatum | S |
| <i>Datisca</i> | | cumini | PS |
| cannabina | - | spicatum | - |
| Cactaceae | | hemispherican | - |
| <i>Opuntia</i> | | <i>Pimenta</i> | |
| coccinellifera | - | acris | - |
| monacantha | - | Melastomaceae | |
| stricta | - | <i>Mdemecylon</i> | |
| nigricans | - | umbellatum | - |
| dillenii | S | amplexicaule | S |
| Ficoidaceae | | angustifolium | - |
| <i>Trianthema</i> | | <i>Melastoma</i> | |
| portulacastrum | S | malabathricum | S |
| pentandra | - | decemfidum | - |
| decandra | - | <i>Osbeckia</i> | |
| <i>Mollugo</i> | | nepalensis | S |
| hirta | S | crinita | S |
| oppositifolia | - | <i>Ammannia</i> | |
| pentaphylla | - | baccifera | |
| cerviana | PS | auriculata | S |
| nudicaulis | - | Lythraceae | |
| <i>Giesekia</i> | | <i>Woodfordia</i> | |
| pharmacoides | - | fruticosa | S |
| Umbelliferae | | <i>Lawsonia</i> | |
| <i>Hydrocotyle</i> | | inermis | PS |
| asiatica | PS | <i>Lagerstroemia</i> | |
| javanica | PS | speciosa | - |
| <i>Eryngium</i> | | indica | c |
| caeruleum | - | <i>Sonneratia</i> | |
| | | caseolaris | D |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-----------------------|--------|-------------------|--------|
| Punicaceae | | jucundum | - |
| <i>Punica</i> | | <i>Apium</i> | |
| granatum | C | graveolens | - |
| Onagraceae | | <i>Carum</i> | |
| <i>jussieua</i> | | carvi | C |
| suffruticosa | S | bulbocastanum | - |
| repens | - | roxburghianum | - |
| <i>Trapa</i> | | copticum | C |
| bispinosa | S | <i>Pimpinella</i> | |
| Samydaceae | | heyneana | C |
| <i>Casearia</i> | | sexifraga | - |
| graveolens | S | diversifolia | - |
| esculenta | S | stocksii | - |
| toментosa | - | <i>Seseli</i> | |
| Cariaceae | | indicum | S |
| <i>Carica</i> | | <i>Pycnocycla</i> | |
| papaya | C | aucheriana | - |
| Passifloraceae | | <i>Foeniculum</i> | |
| <i>Passiflora</i> | | capillaceum | C |
| foetida | C | <i>Prangos</i> | |
| edulis | - | pabularia | - |
| <i>Adenia</i> | | <i>Angelica</i> | |
| palmata | C | glauca | - |
| Cucurbitaceae | | <i>Ferula</i> | |
| <i>Trichosanthes</i> | | narthex | C |
| palmata | C | jaeschkeana | - |
| cordata | C | toctida | - |
| dioica | C | <i>Peucedamum</i> | |
| nervifolia | C | graveolens | - |
| cucumerina | - | grande | - |
| anguina | C | dhana | - |
| wallichiana | - | aucheri | - |
| <i>Gymnopetalum</i> | | nagpureense | - |
| cochinchinense | - | <i>Heracleum</i> | |
| <i>Laganaria</i> | | wallichii | - |
| vulgaris | C | <i>Zosimia</i> | |
| falcatum | - | orientalis | - |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|--------------------------------|--------|-------------------------------|--------|
| <i>Coriandrum sativum</i> | C | <i>Hymenodictyon excelsum</i> | PS |
| <i>Nothopanax fruticosum</i> | - | <i>Paederia foetida</i> | T |
| <i>Hedera helix</i> | C | <i>Pavetta indica</i> | PS |
| <i>Cuminum cyminum</i> | - | <i>Randia dumetorum</i> | S |
| <i>Daucus carota</i> | C | <i>uliginosa</i> | S |
| <i>Psammogeton bitematum</i> | - | <i>Rubia cordifolia</i> | S |
| | | <i>Vangueria spinosa</i> | S |
| | | <i>Morinda citrifolia</i> | PS |
| Alangiaceae | | <i>Ophiopogon serpentinum</i> | - |
| <i>Alangium lamarckii</i> | S | <i>Cuises officinalis</i> | - |
| | | <i>Oldenlandia corymbosa</i> | S |
| Caprifoliaceae | | <i>Psychotria ipecacuana</i> | S |
| <i>Sambucus eburus</i> | - | <i>Ophiorrhiza mungo's</i> | S |
| <i>javanica</i> | S | <i>Ixora parviflora</i> | C |
| <i>Viburnum foetidum</i> | S | <i>coccinea</i> | C |
| <i>Lonicera glauca</i> | - | <i>Mussaenda frondosa</i> | PS |
| | | | |
| Rubiaceae | | Valerianaceae | |
| <i>Sarcocephalus missionis</i> | - | <i>Nardostachys jatamansi</i> | T |
| <i>cordatus</i> | - | <i>Valeriana hardwickii</i> | - |
| <i>Anthocephalus chinensis</i> | PS | <i>officinalis</i> | - |
| <i>Adina cordifolia</i> | PS | | |
| <i>Nauclea sessilifolia</i> | PS | Asclepiaceae | |
| <i>Mytragyna parvifolia</i> | | <i>Hemidesmus indicus</i> | T |
| <i>Uncaria gambir</i> | - | | |

contd. ...

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|---------------------|--------|-----------------------|--------|
| <i>Cryptolepis</i> | | <i>Leptadenta</i> | |
| <i>buchanani</i> | T | <i>reticulata</i> | - |
| <i>Cryptostegia</i> | | <i>Tylophora</i> | |
| <i>grandiflora</i> | S | <i>fasciculata</i> | - |
| <i>Periploca</i> | | <i>asthmatica</i> | - |
| <i>aphylla</i> | S | <i>tenuis</i> | - |
| <i>Secamone</i> | | <i>Cosmostigma</i> | |
| <i>emetica</i> | S | <i>racemosum</i> | - |
| <i>Glossonema</i> | | <i>Dregea</i> | |
| <i>varians</i> | S | <i>valubilis</i> | S |
| <i>Oxystelma</i> | | <i>Caropegia</i> | |
| <i>esculentum</i> | S | <i>bulbosa</i> | S |
| <i>Calotropis</i> | | <i>tuberosa</i> | - |
| <i>gigantea</i> | PS | <i>Caralluma</i> | |
| <i>procera</i> | PS | <i>edulis</i> | - |
| <i>Asclepias</i> | | <i>Boucerosia</i> | |
| <i>curassavica</i> | PS | <i>aucheriana</i> | - |
| <i>Pentatropis</i> | | | |
| <i>cynanchoides</i> | - | Loganiaceae | |
| <i>microphylla</i> | - | <i>Fagraea</i> | |
| <i>Pergularia</i> | | <i>racemosa</i> | S |
| <i>extensa</i> | - | <i>Strychnos</i> | |
| <i>Daemia</i> | | <i>colubrina</i> | S |
| <i>cordata</i> | - | <i>nux-vomica</i> | T |
| <i>Holostemma</i> | | <i>potatorum</i> | T |
| <i>annulare</i> | - | <i>bourdillonii</i> | - |
| <i>Cynanchum</i> | | <i>cinnamomifolia</i> | - |
| <i>amottianum</i> | - | <i>Cyrtophyllum</i> | |
| <i>Sarcostemma</i> | | <i>peregrinum</i> | - |
| <i>brevistigma</i> | - | | |
| <i>brunonianum</i> | - | Gentianaceae | |
| <i>intermedium</i> | - | <i>Exacum</i> | |
| <i>stocksii</i> | - | <i>tetragonum</i> | S |
| <i>Gymbema</i> | | <i>bicolor</i> | - |
| <i>sylvestre</i> | T | <i>pedunculatum</i> | S |
| <i>Marsdenia</i> | | <i>lawii</i> | - |
| <i>roylei</i> | - | <i>Enicostemma</i> | |
| <i>volubilis</i> | - | <i>littorale</i> | - |
| | | <i>Erythraea</i> | |
| | | <i>roxburghii</i> | - |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|------------------------|--------|-----------------------|--------|
| <i>Hapaea</i> | | <i>Rotula</i> | |
| dichotoma | - | acquatica | - |
| <i>Canscora</i> | | <i>Heliotropium</i> | |
| diffusa | S | eichwaldi | - |
| decussata | S | tuberculosisum | |
| <i>Gentiana</i> | | strigosum | PS |
| tenella | - | brevifolium | - |
| kurroo | - | indicum | - |
| decumbens | S | <i>Trichodesma</i> | |
| dahurica | - | indicum | - |
| <i>Swertia</i> | | africanum | PS |
| purpurascens | - | zeylanicum | - |
| paniculata | - | <i>Cynoglossum</i> | |
| chirata | T | glochidiatum | PS |
| angustifolia | T | <i>Macrotomia</i> | |
| angustifolia Vr | - | benthami | - |
| decussata | - | perennis | - |
| alata | - | <i>Onosma</i> | |
| lawii | - | echioides | - |
| <i>Limnanthemum</i> | | bracteatum | |
| nymphaeoides | PS | <i>Caccinia</i> | |
| <i>Menyanthes</i> | | glauca | - |
| trifoliata | - | <i>Lithospermum</i> | |
| | | officinale | - |
| Hydrophyllaceae | | arvense | - |
| <i>Hydrolea</i> | | | |
| zeylanica | - | Convolvulaceae | |
| | | <i>Argyreia</i> | |
| Boraginaceae | | speciosa | S |
| <i>Cordia</i> | | fulgens | - |
| obliqua | PS | <i>Lettsomia</i> | |
| wallichii | - | aggregata | S |
| rothii | PS | <i>Calonyction</i> | |
| vestita | - | bona-nox | - |
| macleodii | - | muricatum | - |
| <i>Ehretia</i> | | <i>Quamoclit</i> | |
| aspera | - | pinnata | PS |
| microphylla | - | coccinea | - |
| <i>Coldenia</i> | | vulgaris | - |
| procumbens | - | | |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|--------------------|--------|--------------------|--------|
| <i>Erycibe</i> | | Solanaceae | |
| paniculata | - | <i>Solanum</i> | |
| <i>Rivea</i> | | nigrum | PS |
| ornata | PS | dulcamara | T |
| <i>Ipomoea</i> | | spirale | - |
| hederacea | S | verbascilolium | PS |
| uniflora | - | ferox | S |
| paniaelata | - | indicum | S |
| batatas | C | melongena | C |
| pes-tigridis | PS | xanthocarpum | S |
| reniformis | - | trilobatum | - |
| obscura | - | gracilipes | - |
| sepiaria | - | torvum | S |
| reptans | C | incanum | - |
| campanulata | - | sarattense | S |
| pes-caprae | PS | <i>Physalis</i> | |
| dissecta | - | minima | S |
| tuberosa | - | minima var. indica | PS |
| dasysperma | - | angulata | - |
| hispida | - | peruviana | S |
| <i>Operculina</i> | | capsicum | - |
| turpethum | - | frutescens | - |
| <i>Merremia</i> | | annuum | PS |
| vitifolia | PS | minimum | - |
| tridentata | - | <i>Withania</i> | |
| <i>Convolvulus</i> | | somniafera | T |
| arvensis | PS | coagulans | - |
| glomeratus | - | <i>Nicandra</i> | |
| spinosus | - | physaloides | - |
| <i>Evolvulus</i> | | <i>Lycium</i> | |
| alsinoides | PS | barbarum | - |
| <i>Cressa</i> | | ruthenicum | - |
| cretica | - | <i>Atropa</i> | |
| <i>Cuscuta</i> | | belladonna | T |
| reflexa | PS | <i>Datura</i> | |
| hyalina | - | stramonium | S |
| chinensis | - | fastuosa var al. | C/S |
| | | metal | S |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-------------------------|--------|-------------------------|--------|
| <i>Scopolia</i> | | roxburghii | - |
| <i>lurida</i> | - | <i>Moniera</i> | |
| <i>Physoclaina</i> | | <i>cuneifolia</i> | - |
| <i>praealta</i> | - | <i>Artanema</i> | |
| <i>Hyoscyamus</i> | | <i>sesamoides</i> | -- |
| <i>niger</i> | T | <i>Curanga</i> | |
| <i>muticus</i> | - | <i>amara</i> | S |
| <i>reticulatus</i> | - | <i>Veronica</i> | |
| <i>Nicotiana</i> | | <i>anagallis</i> | S |
| <i>tabacum</i> | C | <i>beccabunga</i> | - |
| <i>rustica</i> | - | <i>Striga</i> | . |
| Scrophulariaceae | | <i>lutea</i> | - |
| <i>Torenia</i> | | <i>orobanchoides</i> | |
| <i>asiatica</i> | PS | <i>Sopubia</i> | |
| <i>Vandellia</i> | | <i>delphinifolia</i> | - |
| <i>pysidaria</i> | PS | <i>Pedicularis</i> | |
| <i>pedunculata</i> | - | <i>pectinata</i> | - |
| <i>Bonnaya</i> | | <i>siphonantha</i> | - |
| <i>reptans</i> | PS | Orobanchaceae | |
| <i>Scoparia</i> | | <i>Cistanche</i> | |
| <i>dulcis</i> | PS | <i>tubulosa</i> | - |
| <i>Picrorrhiza</i> | | <i>Orobanche</i> | |
| <i>kurrooa</i> | T | <i>aegyptiaca</i> | T |
| <i>Verbascum</i> | | Lentibulariaceae | |
| <i>thapsus</i> | S | <i>Utricularia</i> | |
| <i>Celsia</i> | | <i>bifida</i> | s |
| <i>coromandeliana</i> | S | Bignoniaceae | |
| <i>Linaria</i> | | <i>Oroxylum</i> | |
| <i>ramosissima</i> | PS | <i>indicum</i> | PS |
| <i>Schweinfurthia</i> | | <i>Tecomella</i> | |
| <i>sphaerocarpa</i> | - | <i>undulata</i> | C |
| <i>Lindenbergia</i> | | <i>Dolichandrone</i> | |
| <i>urticaefolia</i> | PS | <i>spathacea</i> | S |
| <i>Stemodia</i> | | <i>falcata</i> | - |
| <i>viscosa</i> | - | <i>Heterophragma</i> | |
| <i>Limnophila</i> | | <i>roxburghii</i> | |
| <i>gratissima</i> | - | <i>Stereospermum</i> | |
| <i>gratioloides</i> | - | <i>Chelonoides</i> | PS |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|---------------------------------------|--------|----------------------|--------|
| <i>suaveolens</i> | PS | <i>Haplanthus</i> | |
| <i>Radermachera</i> | | <i>verticillaris</i> | - |
| <i>xylocarpa</i> | - | <i>tentaculatus</i> | - |
| <i>Amphicome</i> | | <i>Gymnostachyum</i> | |
| <i>emodi</i> | NK | <i>febrifugum</i> | - |
| <i>Tecoma</i> | | <i>Phlogacanthus</i> | |
| <i>stans</i> | C | <i>thyrseiflorus</i> | PS |
| <i>Crescentia</i> | | <i>Crossandra</i> | |
| <i>cujete</i> | C | <i>undulaefolia</i> | - |
| Pedaliaceae | | <i>Asystasia</i> | |
| <i>Martynia</i> | | <i>gangetica</i> | - |
| <i>annua</i> | S | <i>Lepidagathis</i> | |
| <i>Pedaliium</i> | | <i>cristata</i> | S |
| <i>murex</i> | - | <i>trinervis</i> | S |
| <i>sesamum</i> | C | <i>hamiltoniana</i> | - |
| <i>indicum</i> | C | <i>Justica</i> | |
| Acanthaceae | | <i>gendarussa</i> | PS |
| <i>Auriculatus</i> | | <i>procumbens</i> | - |
| <i>ciliatus</i> | - | <i>Adhatoda</i> | |
| <i>Blepharis</i> | | <i>vasica</i> | PS/C |
| <i>edulis</i> | S | <i>Rhinacanthus</i> | |
| <i>sindica</i> | | <i>communis</i> | - |
| <i>Acanthus</i> | | <i>nasuta</i> | - |
| <i>ilicifolius</i> | PS | <i>Ecboium</i> | |
| <i>Barleria</i> | | <i>linneanum</i> | - |
| <i>prionitis</i> | T | <i>Graptophyllum</i> | |
| <i>noctiflora</i> | - | <i>pictum</i> | - |
| <i>cristata</i> | T | <i>Rungia</i> | |
| <i>cristata</i> var. <i>dichotoma</i> | - | <i>repens</i> | - |
| <i>strigosa</i> | T | <i>parviflora</i> | S |
| <i>courtallica</i> | - | <i>Dicliptera</i> | |
| <i>longiflora</i> | - | <i>roxburghiana</i> | S |
| <i>Neuracanthus</i> | | <i>Peristrophe</i> | |
| <i>sphaerostachys</i> | - | <i>bicalyculata</i> | - |
| <i>Andrographis</i> | | <i>Cardanthera</i> | |
| <i>paniculata</i> | T | <i>uliginosa</i> | S |
| <i>echiodes</i> | - | <i>Asteracantha</i> | |
| | | <i>longifolia</i> | S |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-----------------------|--------|------------------------|--------|
| <i>Ruellia</i> | | <i>agnus-castus</i> | - |
| <i>prostrata</i> | S | <i>pubescens</i> | - |
| <i>suffruticosa</i> | - | <i>leucoxydon</i> | - |
| <i>Daedalacanthus</i> | | <i>Clerodendrum</i> | |
| <i>roseus</i> | S | <i>inermis</i> | S |
| <i>Strobilanthes</i> | | <i>phlomidis</i> | C/S |
| <i>callosus</i> | S | <i>serratum</i> | S |
| | | <i>speciosum</i> | PS |
| | | <i>siphonanthus</i> | S |
| | | <i>Avicennia</i> | |
| Verbenaceae | | <i>officinalis</i> | PS |
| <i>Lantana</i> | | <i>tomentosa</i> | - |
| <i>indica</i> | PS | | |
| <i>aculeata</i> | PS | | |
| <i>Lippia</i> | | | |
| <i>nodiflora</i> | PS | | |
| <i>Verbena</i> | | Labiatae | |
| <i>officinalis</i> | C | <i>Ocimum</i> | |
| <i>Callicarpa</i> | | <i>canum</i> | C |
| <i>arborea</i> | S | <i>basilicum</i> | C |
| <i>lanata</i> | - | <i>gratissimum</i> | - |
| <i>macrophylla</i> | S | <i>sanctum</i> | c |
| <i>cana</i> | - | <i>Geniosporum</i> | |
| <i>Stachytarpheta</i> | | <i>prostratum</i> | - |
| <i>indica</i> | S | <i>Orthosiphon</i> | |
| <i>Tectona</i> | | <i>stamineus</i> | S |
| <i>grandis</i> | PS | <i>Coleus</i> | |
| <i>Premna</i> | | <i>amboinicus</i> | C |
| <i>integrifolia</i> | S | <i>Anisochilus</i> | |
| <i>tomentosa</i> | - | <i>carnosus</i> | - |
| <i>latifolia</i> | PS | <i>Lavandula</i> | |
| <i>esculenta</i> | - | <i>bipinnata</i> | - |
| <i>herbacea</i> | S | <i>Pogostemon</i> | |
| <i>Gmelina</i> | | <i>plectranthoides</i> | S |
| <i>arborea</i> | PS/C | <i>purpurascens</i> | S |
| <i>asiatica</i> | - | <i>parviflorus</i> | - |
| <i>Vitex</i> | | <i>Colebrookia</i> | |
| <i>trifolia</i> | - | <i>oppositifolia</i> | S |
| <i>negundo</i> | PS | <i>Mentha</i> | |
| <i>peduncularis</i> | PS | <i>viridis</i> | - |
| <i>glabrata</i> | - | <i>piperita</i> | C |
| | | <i>sylvestris</i> | C |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|---------------------------------|--------|-----------------------------------|--------|
| <i>arvensis</i> | C | <i>Brunella</i> | |
| <i>Lycopus europaeus</i> | - | <i>vulgaris</i> | S |
| <i>Origanum majorana</i> | - | <i>Marrubium vulgare</i> | - |
| <i>vulgare</i> | - | <i>Anisomeles indica</i> | S |
| <i>Thymus serpyllum</i> | - | <i>malabanca</i> | - |
| <i>Hyssopus officinalis</i> | - | <i>Stachys parviflora</i> | - |
| <i>Micromeria capitellata</i> | S | <i>Leonurus sibiricus</i> | S |
| <i>Calamintha dinopodium</i> | S | <i>Roylea elegans</i> | - |
| <i>Melissa parviflora</i> | S | <i>Otostegia limbata</i> | - |
| <i>Perowskia abrotanoides</i> | - | <i>aucherii</i> | - |
| <i>atriplicifolia</i> | - | <i>Leucas cephalotes</i> | - |
| <i>Meriandra strobilifera</i> | - | <i>zeylanica</i> | - |
| <i>bengalensis</i> | - | <i>aspera</i> | PS |
| <i>Salvia moorcroftiana</i> | - | <i>linifolia</i> | - |
| <i>lanata</i> | C | <i>urticeaefolia</i> | - |
| <i>plebeia</i> | - | <i>stelligera</i> | - |
| <i>aegyptiaca</i> | - | <i>Leonotis nepetaefolia</i> | - |
| <i>cabulica</i> | - | <i>Eremostays vicaryi</i> | - |
| <i>spinosa</i> | - | <i>acanthocalyx</i> | - |
| <i>officinalis</i> | - | <i>Hyptis suaveolens</i> | S |
| <i>Nepeta elliptica</i> | S | <i>Ajuga bracteosa</i> | |
| <i>ciliaris</i> | - | <i>Zataria multiflora</i> | - |
| <i>ruderalis</i> | - | <i>Ziziphora clinopodioides</i> | - |
| <i>glomerulosa</i> | - | <i>tenuior</i> | - |
| <i>Dracoccephalum modavicum</i> | - | <i>Hymenocrater sessilifolius</i> | - |
| <i>Lallemantia royleana</i> | - | | |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-----------------------|--------|-----------------------|--------|
| <i>Tenacrium</i> | | lanata | PS |
| stocksianum | - | <i>Acyranthes</i> | |
| scordium | - | aspera | PS |
| | | bidentata | PS |
| Plantaginaceae | | <i>Alternanthera</i> | |
| <i>Plantago</i> | | sessilis | PS |
| major | C | | |
| lanceolata | - | Chenopodiaceae | |
| amplexicaulis | - | <i>Chenopodium</i> | |
| ovata | C | album | PS |
| psyllium | - | botrys | - |
| ciliata | - | ambrosiodes | PS |
| lagocephala | - | <i>Beta</i> | |
| | | vulgaris | C |
| Nyctaginaceae | | <i>Spinacia</i> | |
| <i>Boerhavia</i> | | oleracea | C |
| diffusa | PS | <i>Kochia</i> | |
| repens | PS | indica | - |
| <i>Pisonia</i> | | sedoides | - |
| aculeata | - | scoparia | - |
| morindaefolia | - | <i>Arthrocnemum</i> | |
| <i>Mirabilis</i> | | indicum | - |
| jalapa | S | <i>Salicornia</i> | |
| | | brachiata | - |
| Amaranthaceae | | <i>Suaeda</i> | |
| <i>Celosia</i> | | fruticosa | PS |
| argentea | S | monoica | - |
| "var. cristata | | <i>Salsola</i> | |
| <i>Digere</i> | | kali | - |
| arvensis | S | foetida | - |
| <i>Amaranthus</i> | | <i>Basella</i> | |
| spinosus | PS | rubra | C |
| paniculatus | - | <i>Haloxylon</i> | |
| gangeticus | PS | salicomium | - |
| "var. tristis | - | recurvum | - |
| viridis | - | | |
| blitum | - | Phytolaccaceae | |
| "var. oleracea | | <i>Phytolacca</i> | |
| <i>Aerva</i> | | acinosa | S |
| tomentosa | PS | | |

contid.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|------------------------|--------|----------------------------|--------|
| Polygonaceae | | | |
| <i>Calligonum</i> | | scutatus | - |
| <i>polygonoides</i> | S | <i>Rumex maritimus</i> L. | PS |
| <i>Pteropyrum</i> | | <i>Rumex vesicarius</i> L. | - |
| <i>olivierii</i> | | Aristolochiaceae | |
| <i>Polygonum</i> | | <i>Bragantia</i> | |
| <i>aviculare</i> | - | <i>wallichii</i> | - |
| <i>plebejum</i> | S | <i>tomentosa</i> | - |
| <i>viviparum</i> | - | <i>Aristolochia</i> | |
| <i>glabrum</i> | - | <i>bracteata</i> | - |
| <i>persicaria</i> | - | <i>indica</i> | T |
| <i>barbatum</i> | PS | <i>tagala</i> | T |
| <i>hydropiper</i> | S | Piperaceae | |
| <i>punctatum</i> | - | <i>Piper</i> | |
| <i>molle</i> | S | <i>longum</i> | C |
| <i>chinense</i> | - | <i>cluba</i> | - |
| <i>ientale</i> | - | <i>sylvaticum</i> | |
| <i>virginianum</i> | - | <i>betle</i> | PS |
| <i>sphaerostachyum</i> | - | <i>nigrum</i> | C |
| <i>serrulatum</i> | - | <i>attenuatum</i> | - |
| <i>Fagopyrum</i> | | <i>sarmentosum</i> | - |
| <i>cymosum</i> | - | <i>aurantiacum</i> | - |
| <i>esculentum</i> | PS | Chloranthaceae | |
| <i>talaricum</i> | - | <i>Chloranthus</i> | |
| <i>Rheum</i> | | <i>officinalis</i> | - |
| <i>spiciforme</i> | - | <i>brachystachys</i> | |
| <i>emodi</i> | T | Myristicaceae | |
| <i>webbianum</i> | - | <i>Myristica</i> | |
| <i>nobile</i> | T | <i>malabarica</i> | - |
| <i>Oxyria</i> | | <i>fragrans</i> | PS |
| <i>digyna</i> | - | Lauraceae | |
| <i>Rumex</i> | | <i>Cinnamomum</i> | |
| <i>maritimus</i> | - | <i>tamala</i> | C |
| <i>dentatus</i> | PS | <i>obtusifolium</i> | C/S |
| <i>nepalensis</i> | PS | <i>iners</i> | - |
| <i>vesicarius</i> | PS | <i>zeylancum</i> | C |
| <i>acetosella</i> | - | <i>macrocarpum</i> | - |
| <i>acetosa</i> | - | <i>glanduliferum</i> | S |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|------------------------------------|--------|----------------------|--------|
| parthenoxylon | - | Santalaceae | |
| camphora | C | Santalum | |
| cassia | - | album | C |
| pauciflorum | - | <i>Osyris</i> | |
| javanicum | - | arborea | - |
| <i>Machilus</i> | | Euphorbiaceae | |
| macrantha | S | <i>Euphorbia</i> | |
| <i>Actinodaphne</i> | | hypericifolia | - |
| hookeri | S | hirta | S |
| <i>Litsea</i> | | thymifolia | - |
| chinensis | S | microphylla | - |
| lyantha | S | tirucalli | C |
| stocksii | | neriifolia | C |
| <i>Lindera</i> | | nivulia | C |
| neesiana | S | antiquorum | C |
| <i>Cassytha</i> | | royleana | C/PS |
| filiformis | PS | thomsoniana | - |
| <i>Litsea glutinosa</i> Lot. Pers. | PS | jhelioscopia | - |
| <i>Litsea monopetala</i> (Rc) | PS | dracunculoides | - |
| Elaeagnaceae | | longifolia | - |
| <i>Elaeagnus</i> | | granulata | - |
| hortensis | - | sanguinea | - |
| umbellata | S | turcomanica | - |
| latifolia | - | <i>Buxus</i> | |
| <i>Hippophae</i> | | sempervirens | T |
| rhamnoides | S | <i>Bridelia</i> | |
| salicifolia | - | retusa | S |
| Loranthaceae | | montana | S |
| <i>Dendrophthoe falcata</i> | | <i>Cleistanthus</i> | |
| cochinchinensis | PS | collinus | S |
| <i>Loranthus</i> | | <i>Andrachne</i> | |
| elasticus | - | cordifolia | - |
| falcatus | PS | <i>Phyllanthus</i> | |
| <i>Viscum</i> | | reticulatus | S |
| album | S | maderaspatensis | S |
| monoicum | S | urinaria | S |
| orientale | - | simplex | S |
| articulatum | - | niruri | S |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-----------------------|--------|-------------------------|--------|
| <i>Cicca</i> | | <i>Acalypha</i> | |
| <i>disticha</i> | S | <i>fruticosa</i> | - |
| <i>Glochidion</i> | | <i>indica</i> | PS |
| <i>hohenackeri</i> | - | <i>hispidata</i> | - |
| <i>zeylanicum</i> | S | <i>paniculata</i> | - |
| <i>Flueggea</i> | | <i>Trewia</i> | |
| <i>virosa</i> | S | <i>nudiflora</i> | PS |
| <i>leucopyrus</i> | - | <i>Mallotus</i> | |
| <i>Sauropus</i> | | <i>philippinensis</i> | PS/S |
| <i>quadrangularis</i> | | <i>Macaranga</i> | |
| <i>Breynia</i> | | <i>peltata</i> | S |
| <i>rhamnoides</i> | S | <i>indica</i> | S |
| <i>patens</i> | S | <i>Laportea</i> | |
| <i>Putranjiva</i> | | <i>crenulata</i> | PS |
| <i>roxburghii</i> | PSC | <i>Boehmeria</i> | |
| <i>Antidesma</i> | | <i>nivea</i> | PS |
| <i>bunius</i> | T | | |
| <i>zeylanicum</i> | - | Platanaceae | |
| <i>Jatropha</i> | | <i>Platanus</i> | |
| <i>glandulifera</i> | - | <i>orientalis</i> | S |
| <i>nana</i> | - | Juglandaceae | |
| <i>multifida</i> | PS | <i>Juglans</i> | |
| <i>curcas</i> | S | <i>regia</i> | C/D |
| <i>gossypifolia</i> | S | Myricaceae | |
| <i>Aleurites</i> | | <i>Myrica</i> | |
| <i>moluccana</i> | C | <i>Myrica esculenta</i> | D |
| <i>Bischofia</i> | | Casuarinaceae | |
| <i>javanica</i> | S | <i>Casuarina</i> | |
| <i>Aporosa</i> | | <i>equisetifolia</i> | C |
| <i>lindleyana</i> | - | Cupuliferae | |
| <i>Croton</i> | | <i>Betula</i> | |
| <i>reticulatus</i> | S | <i>utilis</i> | S |
| <i>oblongifolius</i> | PS | <i>alnoides</i> | - |
| <i>caudatus</i> | - | <i>Quercus</i> | |
| <i>tiglium</i> | S | <i>incana</i> | PS |
| <i>Chrozophora</i> | | <i>lamellosa</i> | S |
| <i>rottleri</i> | PS | <i>pachyphylla</i> | |
| <i>prostrata</i> | - | | |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|----------------------------------|--------|-----------------------|--------|
| <i>Corylus</i> | | kumaonensis | - |
| columna | - | soongarica | - |
| <i>Quercus infectoria</i> Oliver | | <i>Crocus</i> | |
| Salicaceae | | sativus | C |
| <i>Salix</i> | | <i>Belamecanda</i> | |
| tetrasperma | S | chinensis | C |
| acmophylla | - | Amaryllidaceae | |
| caprea | - | <i>Agave</i> | |
| alba | - | americana | C |
| babylonica | C | angustifolia | - |
| <i>Populus</i> | | vera-cruz | - |
| nigra | - | <i>Homonoia</i> | |
| ciciata | S | riparia | S |
| Ceratophyllaceae | | <i>Ricinus</i> | |
| <i>Ceratophyllum</i> | | communis | C |
| demersum | S | <i>Baliospermum</i> | |
| <i>Elettaria</i> | | montanum | T |
| cardamomum | C | axillare | T |
| <i>Alpinia</i> | | <i>Tragia</i> | |
| galanga | T | involutrata | S |
| alihugas | S | <i>Sapium</i> | |
| calcarata | - | indicum | - |
| malaccensis | S | insigne | S |
| speciosa | - | sebiferum | S |
| <i>Maranta</i> | | <i>Excoecaria</i> | |
| arundinaceae | C | agallocha | PS |
| <i>Canna</i> | | acerifolia | - |
| indica | C | <i>Sebastiania</i> | |
| <i>Musa</i> | | chamelaea | - |
| sapientum | C | <i>Huru</i> | |
| textilis | C | crepitans | - |
| Haemodoraceae | | <i>Manihot</i> | |
| <i>Sansevieria</i> | | utilissima | C |
| roxburghiana | C | <i>Hippomane</i> | |
| Irid | | mancinella- | |
| <i>Iris</i> | | Urticaceae | |
| ensata | - | <i>Hunulus</i> | |
| nepalensis | C | lupulus | - |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|---------------------|--------|----------------------|--------|
| <i>Cannabis</i> | | <i>Pouzolzia</i> | |
| <i>sativa</i> | C | <i>indica</i> | PS |
| <i>Streblus</i> | | <i>Antiaris</i> | |
| <i>asper</i> | S | <i>toxicaria</i> | - |
| <i>Morus</i> | | <i>Artocarpus</i> | |
| <i>indica</i> | C | <i>hirsuta</i> | - |
| <i>alba</i> | C | <i>integrifolia</i> | C |
| <i>nigra</i> | - | <i>lakoocha</i> | C |
| <i>Ficus</i> | | <i>Urtica</i> | |
| <i>gibbosa</i> | S | <i>parviflora</i> | - |
| <i>bengalensis</i> | S | <i>dioica</i> | S |
| <i>benjamina</i> | S | <i>pilulifera</i> | - |
| <i>retusa</i> | S | <i>Curculigo</i> | |
| <i>rumphii</i> | S | <i>orchioides</i> | - |
| <i>religiosa</i> | PS | <i>Crinum</i> | |
| <i>lacor</i> | - | <i>asiaficum</i> | C |
| <i>heterophylla</i> | PS | <i>latifolium</i> | - |
| <i>asperrima</i> | - | <i>defixum</i> | - |
| <i>hispida</i> | PS | <i>Polianthes</i> | |
| <i>cunia</i> | S | <i>tuberosa</i> | C |
| <i>ribes</i> | - | | |
| <i>palmata</i> | PS | Taccaceae | |
| <i>glomerata</i> | - | <i>Tacca</i> | |
| <i>carica</i> | - | <i>pinnatifida</i> | S |
| <i>amottiana</i> | - | <i>aspera</i> | - |
| <i>dalhousiae</i> | - | Bromeliaceae | |
| <i>talboti</i> | - | <i>Ananas</i> | |
| <i>tsiela</i> | - | <i>sativus</i> | C |
| <i>Holoptelea</i> | | Dioscoreaceae | |
| <i>integrifolia</i> | PS | <i>Dioscorea</i> | |
| <i>Celtis</i> | | <i>pentaphylla</i> | T |
| <i>australis</i> | S | <i>oppositifolia</i> | T |
| <i>cinnamomea</i> | S | <i>bulbifera</i> | T |
| <i>Terma</i> | | <i>triphylla</i> | S |
| <i>orientalis</i> | PS | <i>alata</i> | T |
| <i>Girardinia</i> | | var. <i>globosa</i> | - |
| <i>reticulata</i> | - | <i>sativa</i> | S |
| <i>Girardinia</i> | | | |
| <i>zeylanica</i> | - | | |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-----------------------|--------|------------------------|--------|
| Liliaceae | | <i>Fritillaria</i> | |
| <i>Smilax</i> | | <i>imperialis</i> | - |
| <i>glabra</i> | - | <i>roylei</i> | - |
| <i>lanceaeifolia</i> | - | <i>cirrhosa</i> | - |
| <i>zeylanica</i> | T | <i>Colchicum</i> | |
| <i>prolifera</i> | T | <i>luteum</i> | C |
| <i>merophylla</i> | T | <i>Gloriosa</i> | |
| <i>Asparagus</i> | | <i>superba</i> | T |
| <i>filicinus</i> | - | <i>Polyanthes</i> | |
| <i>racemosus</i> | T | <i>tuberosa</i> | C |
| <i>adscendens</i> | - | Pontederiaceae | |
| <i>gonoclados</i> | - | <i>Monochoria</i> | |
| <i>officinalis</i> | | <i>vaginalis</i> | S |
| <i>Yucca</i> | | Xyridaceae | |
| <i>gloriosa</i> | - | <i>Xyris</i> | |
| <i>aloifolia</i> | - | <i>indica</i> | - |
| <i>Aloe</i> | | <i>anceps</i> | - |
| <i>vera</i> | T | <i>pauriflora</i> | - |
| <i>Polygonatum</i> | | Commelinaceae | |
| <i>multiflorum</i> | - | <i>Commelina</i> | |
| <i>Asphodelus</i> | S | <i>obliqua</i> | S |
| <i>tenuifolius</i> | - | <i>suffruticosa</i> | S |
| <i>Chlorophytum</i> | | <i>nudiflora</i> | S |
| <i>arundinaceum</i> | S | <i>benghalensis</i> | PS |
| <i>Allium</i> | | <i>salicifolia</i> | - |
| <i>ascalonicum</i> | - | <i>Aneilema</i> | |
| <i>cepa</i> | C | <i>scapiflorum</i> | - |
| <i>sativum</i> | C | <i>Cyanotis</i> | |
| <i>schaenoprasum</i> | - | <i>tuberosa</i> | - |
| <i>tuberosum</i> | - | <i>axillaris</i> | - |
| <i>ampeloprasum</i> | - | <i>Floscopa</i> | |
| <i>Urginea</i> | S | <i>scandens</i> | S |
| <i>indica</i> | - | Flagellariaceae | |
| <i>coromandeliana</i> | - | <i>Flagellaria</i> | |
| <i>Scilla</i> | | <i>indica</i> | S |
| <i>indica</i> | C | Juncaceae | |
| <i>Lilium</i> | | <i>Luzula</i> | |
| <i>giganteum</i> | C | <i>campestris</i> | S |
| <i>wallichianum</i> | - | | |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|----------------------|--------|-----------------------|--------|
| Palmae | | <i>Travancoricus</i> | |
| <i>Areca</i> | | <i>rheedii</i> | – |
| <i>catechu</i> | PS | <i>ziminalis</i> | – |
| <i>nagensis</i> | – | <i>Nipa</i> | . |
| <i>Loxococcus</i> | | <i>fruticans</i> | T |
| <i>rupicola</i> | – | Pandanaceae | |
| <i>Pinanga</i> | | <i>Pandanus</i> | |
| <i>dicksonii</i> | S | <i>tectorius</i> | S |
| <i>lrachis</i> | – | <i>tascinalatus</i> | |
| <i>Arenga</i> | | Typhaceae | |
| <i>saccharifera</i> | – | <i>Typha</i> | |
| <i>obtusifolia</i> | PS | <i>angustata</i> | S |
| <i>Nallichia</i> | | <i>elephantina</i> | PS |
| <i>disticha</i> | – | <i>laxmanni</i> | – |
| <i>Caryota</i> | | Araceae | |
| <i>urens</i> | T | <i>Cryptocoryne</i> | |
| <i>mitis</i> | – | <i>spiralis</i> | PS |
| <i>Phoenix</i> | | <i>Pistia</i> | |
| <i>dectylifera</i> | PS | <i>stratiotes</i> | PS |
| <i>sylvestris</i> | PS | <i>Lagenandra</i> | |
| <i>pusilla</i> | – | <i>ovata</i> | PS |
| <i>Nannorhophos</i> | | <i>Arisaema</i> | |
| <i>ritchiana</i> | – | <i>speciosum</i> | – |
| <i>Copernicia</i> | | <i>tortuosum</i> | – |
| <i>cerifera</i> | – | <i>leschenaultii</i> | – |
| <i>Corypha</i> | | <i>Sauromatum</i> | |
| <i>umbraculifera</i> | – | <i>guttatum</i> | – |
| <i>Borassus</i> | | <i>Typhonium</i> | |
| <i>flabellifer</i> | | <i>trilobatum</i> | PS |
| <i>Lodoicea</i> | | <i>Amorphophallus</i> | |
| <i>seychellarum</i> | – | <i>campanulatus</i> | C |
| <i>Elaeis</i> | | <i>prainii</i> | – |
| <i>guineensis</i> | – | <i>Synantheras</i> | |
| <i>Cocos</i> | | <i>sylvatica</i> | – |
| <i>nucifera</i> | PS | <i>Plesmonium</i> | |
| <i>schizophylla</i> | – | <i>margaritifera</i> | C |
| <i>yatai</i> | – | <i>Remusatia</i> | |
| <i>Calamus</i> | | <i>vivipara</i> | C |
| <i>rotang</i> | T | | |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-------------------------|--------|---------------------|--------|
| <i>Colocasia</i> | | <i>Cymbidium</i> | |
| esculenta | C | aloifolium | T |
| antiquorum | c | <i>Vanda</i> | |
| <i>Alocasia</i> | | roxburghii | T |
| indica | C | spathulata | - |
| macrorrhiza | PS | tessellata | T |
| montana | - | <i>Saccolabium</i> | |
| denudata | - | papillosum | T |
| <i>Homalomena</i> | | <i>Acampe</i> | |
| aromatica | - | wightiana | T |
| rubescens | - | <i>Zeuxine</i> | |
| indapsus | - | strateumatica | T |
| officinalis | - | <i>Orchis</i> | |
| <i>Rhaphidophora</i> | | latifolia | - |
| pertusa | PS | <i>Habenaria</i> | |
| <i>Lasia</i> | | commelinifolia | T |
| heterophylla | S | <i>Curcuma</i> | |
| <i>Pothos</i> | | angustifolia | S |
| scandens | PS | aromatica | C |
| cathecarti | PS | zedoaria | S |
| <i>Acorus</i> | | caesia | - |
| calamus | S | amada | C |
| gramineus | D | longa | C |
| Alismaceae | | <i>Kaempferia</i> | |
| <i>Sagittaria</i> | | galanga | T |
| sagittifolia | PS | angustifolia | S/T |
| Hydrocharitaceae | | rotunda | - |
| <i>Vallisneria</i> | | <i>Gastrochilus</i> | |
| spiralis | PS | pandurata | - |
| Orchidaceae | | <i>Hedychium</i> | |
| <i>Desmotrichum</i> | | spicatum | S |
| fimbriatum | - | <i>Amomum</i> | |
| <i>Dendrobium</i> | | xanthioides | - |
| ovatum | T | subulatum | C |
| <i>Eulophia</i> | | aromaticum | S |
| campestris | - | costatum | - |
| nuda | - | <i>Zingiber</i> | |
| | | officinale | C |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-----------------------|--------|----------------------|--------|
| zerumbet | S | multiflorum | C |
| cassumunar | S | (su. pubescens) | C |
| <i>Costus</i> | | humilis | - |
| Speciosus | | <i>Nyctanthes</i> | |
| Plumbaginaceae | | arbor-tristis | CS |
| <i>Plumbago</i> | | <i>Schrebera</i> | - |
| zeylanica | S | swietenoides | - |
| rosea | S | Salvadoraceae | |
| indica | - | <i>Azima</i> | |
| Sapotaceae | | tetracantha | - |
| <i>Acrus</i> | | <i>Salvadora</i> | |
| sapota | S | persica | S |
| <i>Madhuca</i> | | Asteraceae | |
| indica | - | <i>Sonchus</i> | |
| longifolia | S/PS | arvensis | S |
| <i>Mimusops</i> | | brachyotes | S |
| elengi | C | <i>Pluchia</i> | |
| hixandra | S | lanceolata | S |
| <i>Mamikara</i> | | <i>Vernonia</i> | |
| kanki | - | cinera | PS |
| <i>Sarcos stoma</i> | | anthelmentica | PS |
| brevistina | - | <i>Elephantopus</i> | |
| Erenaceae | | scaber | PS |
| <i>Diospyros</i> | | <i>Gnangea</i> | |
| embryopleis | S | maderaspetara | S |
| Symplocaceae | | <i>Eupatorium</i> | |
| <i>Symplocos</i> | | ayapara | C |
| racemosa | S | triplinerve | S |
| Styraceae | | <i>Blumea</i> | |
| <i>Styrax</i> | | lacera | S |
| benzoin | S | <i>Anacyelus</i> | |
| Oleaceae | | pyrethrum | S |
| <i>Jasminum</i> | | <i>Artimesia</i> | |
| arborescens | - | vulgaris | S |
| grandiflorum | CS | <i>Carthamus</i> | |
| sambac | C | tinctorius | C |
| | | <i>Crysanthemum</i> | |
| | | coronarum | C |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-------------------------|--------|----------------------|--------|
| <i>Eclipta</i> | | solanea | PS |
| alba | PS | <i>Plumeria</i> | |
| prostrata | | acutifolia | C |
| <i>Enhydra</i> | | rubra | C |
| fluctuans | PS | <i>Ervatania</i> | |
| <i>Saussurea</i> | | coronaria | C |
| lappa | T | | |
| <i>Guisotia</i> | | Polypodiaceae | |
| abisinica | PS | <i>Cinbotium</i> | |
| <i>Xanthium</i> | | barometz | - |
| strumarium | PS | <i>Stenoloma</i> | |
| <i>Wedelia</i> | | chinensis | - |
| calendulacea | PS | <i>Adiantum</i> | |
| <i>Sphaeranthus</i> sp. | PS | lunulatum | T |
| | | eaudatum | T |
| Agocynaceae | | eapillus-veneris | T |
| <i>Carissa</i> | | aethiopicum | - |
| carandus sp. | S | venustum | - |
| <i>Aganosma</i> | | pedatum | - |
| caryophyllata | C | flabellulatum | - |
| dichotoma | C | <i>Cheilanthes</i> | |
| <i>Alstonia</i> | | tenuifolia | S/D |
| scholaris | PS | <i>Pteris</i> | |
| <i>Ichnocarpus</i> | | aquilina | T |
| frutescens | PS | <i>Asplenium</i> | |
| <i>Holarrhene</i> | | adiantum-nigrum | T |
| antidysentetica | PS | ruta-muraria | S/P |
| <i>Rauwolfia</i> | | trichomanes | - |
| serpentina | - | falcatum | - |
| <i>Nerium</i> | | <i>Athyrium</i> | |
| odorum | C | filix-foemina | T |
| indicum | C | <i>Actiniopteris</i> | |
| <i>Wrightia</i> | | dichotoma | - |
| tomentosa | PS | <i>Aspidium</i> | |
| tinctoria | S | polymorphum | T |
| <i>Thevetia</i> | | <i>Drynaria</i> | |
| neriifolia | C | quercifolia | PS |
| <i>Vallis</i> | | <i>Pleopeltis</i> | |
| haynei | PS | lanceolata | - |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|-----------------------------------|--------|-----------------------|--------|
| <i>Lygodium</i> | | <i>ostreatus</i> | - |
| <i>flexuosum</i> | PS | <i>igniarius</i> | - |
| <i>japonicum</i> | - | <i>Polyporus</i> | |
| Osmundaceae | | <i>anthelminticus</i> | - |
| <i>Osmunda</i> | | <i>officinalis</i> | - |
| <i>regalis</i> | D | <i>Boletus</i> | |
| Ophioglossaceae | | <i>crocutus</i> | |
| <i>Ophioglossum</i> | | <i>Mytilia</i> | |
| <i>vulgatum</i> | T | <i>lapidescens</i> | |
| <i>Helminthostachys</i> | | <i>Auricularia</i> | |
| <i>zeylanica</i> | T | <i>sambucina</i> | PS |
| <i>Cotrychium</i> | | Lichen | |
| <i>lunaria</i> | - | <i>Parmelia</i> | |
| <i>tematum</i> | - | <i>kamstchadalis</i> | |
| Equisetaceae | | <i>perlata</i> | PS |
| <i>Equisetum</i> | | <i>perforata</i> | |
| <i>debile</i> | T | Cyperaceae | |
| Polypodiaceae | | <i>Kyllinga</i> | |
| 1. <i>Actiniopteris australis</i> | | <i>triceps</i> | S |
| (I.f.) L. | - | <i>monocephala</i> | |
| 2. <i>Adiantum capillus</i> | | <i>Fimbristylis</i> | |
| <i>veneris</i> L. | - | <i>junciformis</i> | |
| 3. <i>Adiantum incisum</i> Forsk. | - | <i>Juncellus</i> | |
| syn | | <i>inundatus</i> | |
| <i>Adiantum philippense</i> | - | <i>Cyperus</i> | |
| <i>Adiantum venustum</i> | - | <i>scariosus</i> | |
| Polypodiaceae | | <i>rotundus</i> | |
| <i>Drynaria quercifolia</i> | S | <i>sculentus</i> | PS |
| Marsileaceae | | <i>longus</i> | |
| <i>Marsilea minata</i> | PS | <i>articulatus</i> | |
| Salviniaceae | | <i>iria</i> | |
| <i>Azolla pinnata</i> | S | <i>Scirpus</i> | |
| <i>Salvinia cucullata</i> Roxb. | S | <i>grossus</i> | PS |
| Fungi | | <i>articulatus</i> | |
| <i>Agaricus</i> | | <i>kysoor</i> | |
| <i>campestris</i> | S | <i>maritimus</i> | |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|--------------------------------------|--------|---------------------------------|--------|
| Poaceae | | <i>Eleusine</i> | |
| <i>Oryza</i> | | <i>coracena</i> | |
| <i>sativa</i> | | <i>indica</i> | |
| <i>Hygroryza</i> | | Gymnospermae (Coniferae) | |
| <i>aristata</i> | | <i>Cycas</i> | |
| <i>Coix</i> | | <i>rumphii</i> | D |
| <i>lachryma-jobi</i> | | <i>revoluta</i> | D |
| <i>Polytoca</i> | | <i>Ephedra</i> | |
| <i>barbata</i> | | <i>gerardiana</i> | DC |
| <i>Zea</i> | | <i>Gnetum</i> | |
| <i>mays</i> | | <i>scandens</i> | D |
| <i>Saccharum</i> | | <i>Cupressus</i> | |
| <i>officinarum</i> | | <i>sempervirens</i> | S |
| <i>arundinaceum</i> | | <i>Juniperus</i> | |
| <i>munja</i> | | <i>communis</i> | T |
| <i>spontaneum</i> | | <i>recurva</i> | T |
| <i>Manisuris</i> | | <i>macropoda</i> | T |
| <i>granularis</i> | | <i>Taxus</i> | |
| <i>Vetiveria</i> | | <i>baccata</i> | T |
| <i>zizanioides</i> | | <i>Pinus</i> | |
| <i>Amphilophis</i> | | <i>longifolia</i> | FS |
| <i>odorata</i> | PS | <i>gerardiana</i> | - |
| <i>Cymbopogon</i> | | <i>excelsa</i> | FS |
| <i>jwarancusa</i> | | <i>Cedrus</i> | |
| <i>schoenanthus</i> | | <i>deodara</i> | FS |
| <i>nardus</i> | | <i>Abies</i> | |
| <i>citratu</i> | | <i>webbiana</i> | FS |
| <i>Heteropogon</i> | | Poaceae | |
| <i>contortus</i> | | <i>Phragmites</i> | |
| <i>Avena</i> | | <i>maxima</i> | FS |
| <i>fatua</i> | | <i>Dactyloctenium</i> | |
| <i>sativa</i> | | <i>aegypticum</i> | FS |
| <i>satvia</i> var. <i>orientalis</i> | | <i>Triticum</i> | |
| <i>Desmostachya</i> | | <i>aestivum</i> | C |
| <i>bipinnata</i> | PS | <i>durum</i> | C |
| <i>Cynodon</i> | | <i>spelta</i> | C |
| <i>dactylon</i> | | <i>amyleum</i> | C |

contd.....

Table 4.1 : contd....

| Scientific Name | Status | Scientific Name | Status |
|---------------------|--------|----------------------|--------|
| <i>Hordeum</i> | | frumentacea | PS |
| vulgare | C | crus-galli | PS |
| <i>Paspalum</i> | | <i>Setaria</i> | |
| scrobiculatum | PS | italica | C |
| <i>Pennisetum</i> | | plicata | S |
| spicatum | PS | viridis | S |
| compressum | PS | <i>Sorghum</i> | |
| <i>Thysanolaena</i> | | halepense | C |
| maxima | PS | vulgare | C |
| <i>Panicum</i> | | <i>Bambusa</i> | |
| miliaceum | PS | arundinacea | C/PS |
| miliare | PS | <i>Dendrocalamus</i> | |
| antidotale | PS | stricatus | C/PS |
| <i>Echinochloa</i> | | | |
| colona | PS | | |

LEGEND : C = Cultivated; P.S. = Presently Safe ; S = Sporadic; T = Threatened;
D = Not known; S* = Sporadic (gregarious at places)

Chapter Five

Some Potential Drug Plants of India

Comments on the list of Dr. Sibakali Bhattacharyya

It is a list that covers the plants of the temperate and tropical regions. The conifers such as *Abies*, *Tsuga*, *Picea* occur in hills at particular heights and gregariously. Most of other species all over are sporadic in occurrence though a few species have gregarious growth over a small area; in legend such species are marked S*.

Most of the species listed by Bhattacharyya are sporadic in occurrence. He has not listed a great number of species, but most of the species listed are common.

On the whole the species listed are facing a crisis. Bhattacharyya's book — "Chiranjib Vanausodhi" has discussed more than 800 diseases; and has listed more than 3000 local names of medicinal plants.

Table 5.1 : Drug Plants — List Prepared by S. Bhattacharyya

| Scientific Name | Status | Scientific Name | Status |
|--------------------------------|--------|-------------------------------|--------|
| <i>Abies webbiana</i> | PS | <i>A. vulgaris</i> | S |
| <i>Acacia pennata</i> | PS | <i>Arundinella nepalensis</i> | PS |
| <i>Achyranthes aspera</i> | S | <i>Aster trinervius</i> | S |
| <i>Ageratum conyzoides</i> | S | <i>Azadirachta indica</i> | PS/C |
| <i>Albizia lebbek</i> | S | <i>Bambusa arundinacea</i> | C/PS |
| <i>A. procera</i> | PS | <i>Bauhinia purpurea</i> | C/PS |
| <i>Alpinia malaccensis</i> | S | <i>B. variegata</i> | C/PS |
| <i>A. nigra</i> | S | <i>Bischofia javanica</i> | PS |
| <i>Alstonia scholaris</i> | PS | <i>Bombax ceiba</i> | PS/C |
| <i>Aphanamixis polystachya</i> | S | <i>Caianthe arborea</i> | PS |
| <i>Argemone maxicana</i> | S | <i>Callicarpa macrophylla</i> | S |
| <i>Artemisia nilagirica</i> | S | <i>Candamine hirsuta</i> | S |

contd.....

Table 5.1 contd....

| Scientific Name | Status | Scientific Name | Status |
|--------------------------------|--------|----------------------------------|--------|
| <i>Careya arborea</i> | S | <i>O. nepalensis</i> | T |
| <i>Carica papaya</i> | CPS | <i>O. stellata</i> | S |
| <i>Chukrasia tabularis</i> | PS | <i>Paederia foetida</i> | T |
| <i>Cassia tora</i> | S | <i>Peperomia pellucida</i> | S |
| <i>Cinnamomum tamala</i> | C | <i>Pinus roxburghii</i> | PS/C |
| <i>Cissampelos pareira</i> | S | <i>Piper betle</i> | C |
| <i>Alocasia esculenta</i> | C | <i>Pongamia pinnata</i> | PS |
| <i>Croton caudatus</i> | S | <i>Populus ciliata</i> | C |
| <i>Cynodon dactylon</i> | PS | <i>Pothos cathartii</i> | C |
| <i>Cyperus rotundus</i> | PS | <i>P. scandens</i> | C |
| <i>Erythrina stricta</i> | CPS | <i>Pouzolzia hirta</i> | S |
| <i>Eurya japonica</i> | | <i>Rhododendron arboreum</i> | S |
| <i>Fagopyrum esculentum</i> | S | <i>Rungia parviflora</i> | S |
| <i>Ficus semialata</i> | S | <i>Sabia lanceolata</i> | S |
| <i>F. fistulosa</i> | S | <i>Saccharum spontaneum</i> | S/PS |
| <i>F. gibbosa</i> | S | <i>Salix tetras perma</i> | S |
| <i>F. hispida</i> | PS | <i>Schima wallichii</i> | PS |
| <i>F. rumpii</i> | S | <i>Schleichera oleosa</i> | C/PS |
| <i>Garuga pinnata</i> | S | <i>Spondias pinnata</i> | PS |
| <i>Gnaphalium luteo-album</i> | S | <i>Sterculia villosa</i> | S |
| <i>Holmskioldia sanguinea</i> | S | <i>Stereospermum chelonoides</i> | S |
| <i>Homonia riparia</i> | S | <i>Streblus asper</i> | S |
| <i>Imperata cylindrica</i> | PS | <i>Tamarix dioica</i> | S |
| <i>Lannea coromandelica</i> | PS | <i>Themeda aruninacca</i> | PS |
| <i>Leea aequata</i> | S | <i>Thysanolaena maxima</i> | PS |
| <i>L. asiatica</i> | S | <i>V. negundo</i> | S |
| <i>L. inidca</i> | S | <i>Wendlandia tinctoria</i> | S |
| <i>Lygodium flexuosum</i> | S | <i>Woodfordia fruticosa</i> | S |
| <i>Maesa chisia</i> | S | <i>Wrightia tomentosa</i> | S |
| <i>M. indica</i> | S | <i>Aegle mermelos</i> | C/PS |
| <i>M. ramentiaca</i> | S | <i>Alpinia galanga</i> | T |
| <i>Mallotus philippinensis</i> | S | <i>Altemanthera sessillis</i> | S |
| <i>Mangifera indica</i> | C | <i>Butea parviflora</i> | PS |
| <i>Mikania macrantha</i> | S | <i>Calotropis gigantea</i> | S |
| <i>Mimosa pudica</i> | S | <i>Cassia fistula</i> | S |
| <i>Oroxylum indicum</i> | PS/S | <i>Commelina bengalensis</i> | S |
| <i>Osbeckia chinensis</i> | S | <i>Euphorbia hirta</i> | S |
| <i>Osbeckia crinata</i> | S | <i>Holarrhena pubescens</i> | PS |

contd....

Table 5.1 contd....

| Scientific Name | Status | Scientific Name | Status |
|------------------------------------|--------|-----------------------------------|--------|
| <i>Hymenodictyon excelsum</i> | S | <i>Ardisia crispa</i> | S |
| <i>Hyptis suaveolens</i> | S* | <i>A. Solanacea</i> | S |
| <i>Jasminum sambac</i> | C | <i>Asplenium nidus</i> | T |
| <i>Jatropha curcas</i> | S* | <i>Baliospermum montanum</i> | T |
| <i>Justicia adhatosa</i> | S | <i>Bidens pilosa</i> | T |
| <i>Lantana camara</i> | S* | <i>B. tripartita</i> | S |
| <i>Lepidagalhis incurva</i> | S | <i>Blechnum orientale</i> | T |
| <i>Leucus aspera</i> | S | <i>Boehmeria macrophylla</i> | S |
| <i>Ludwigia parviflora</i> | S | <i>B. nivea</i> | S |
| <i>Luvunga scandens</i> | S | <i>Breynia retusa</i> | S |
| <i>Melocanna bambusoides</i> | C/PS | <i>Buddleja asiatica</i> | S |
| <i>Micromelum pubescens</i> | S | <i>Butea monoperna</i> | S/PS |
| <i>Pharagmites karka</i> | S | <i>Buttneria grandiflora</i> | S |
| <i>Phlagocanthus thyrsoiflorus</i> | S | <i>Caesalpinia cucullata</i> | S |
| <i>Scoparia dulcis</i> | S | <i>Casearia vareca</i> | S |
| <i>Setaria palmifolia</i> | S | <i>Canarium bengalense</i> | T |
| <i>Dipterocarpus turbinatus</i> | S | <i>C. strictum</i> | S |
| <i>Engelhardtia spicata</i> | S | <i>Cassia occidentalis</i> | S |
| <i>Erythrina variegata</i> | S | <i>Celastrus paniculata</i> | S |
| <i>Ficus cunia</i> | S | <i>Chasalia euriviflora</i> | S |
| <i>F. glomerata</i> | S | <i>Celtis australia</i> | S |
| <i>F. plamata</i> | S | <i>Chionanthus intermedia</i> | S |
| <i>Phoenix sylvestris</i> | S/PS | <i>Chioranthus elatior</i> | S |
| <i>Quercus lamellosa</i> | S | <i>Christalla perasitica</i> | S |
| <i>Oxalis corniculata</i> | S | <i>Chroniolaena odorata</i> | S |
| <i>Urena lobata</i> | S | <i>Cinnamomum bejolghata</i> | S |
| <i>S. theaeifolia</i> | S | <i>C. glanduliferum</i> | S |
| <i>Tsuga dumosa</i> | S | <i>Cissus repens</i> | S |
| <i>Abutilon indicum</i> | S | <i>Citrus onlimetta</i> | C |
| <i>Acronychia laurifolia</i> | S | <i>C. medica</i> | C |
| <i>A. Pedunculata</i> | S | <i>Clausena excavata</i> | S |
| <i>Aglaea hiernu</i> | S | <i>Clerodendrum colebookianum</i> | S |
| <i>Ailanthus excelsa</i> | PS | <i>C. serratum</i> | S |
| <i>Altingia excelsa</i> | T | <i>C. viscosum</i> | S |
| <i>Ampelopteris prolifera</i> | S | <i>Cocculus hirsutus</i> | T |
| <i>Anisomeles indica</i> | S | <i>Combretum acummatum</i> | S |
| <i>Antidesma buniliis</i> | T | <i>C. pilosum</i> | S |
| <i>Aporusa octandra</i> | S | <i>C. roxburgia</i> | S |

contd.....

Table 5.1 contd....

| Scientific Name | Status | Scientific Name | Status |
|-----------------------------------|--------|---------------------------------|--------|
| <i>Cordia dictiotoma</i> | S | <i>Ichnocarpus frutescens</i> | S |
| <i>C. joufra</i> | S | <i>Indigofera tinctoria</i> | S |
| <i>C. tiglium</i> | S | <i>Ipomoea cymosa</i> | S |
| <i>Curculigo orchioides</i> | T | <i>I. purpurea</i> | S |
| <i>Dalbergia lanceolaria</i> | S | <i>Justicia vasiculosa</i> | S |
| <i>D. pinnata</i> | S | <i>Knema linifolia</i> | S |
| <i>D. stipalacea</i> | S | <i>Kaulfussia aesulifolia</i> | S |
| <i>Derris indica</i> | S | <i>Lindenbergia indica</i> | S |
| <i>Desmodium gangeticum</i> | S | <i>Lindera neesiana</i> | S |
| <i>D. leterocarpum</i> | S | <i>L. glutinosa</i> | S |
| <i>D. pulchellum</i> | S | <i>L. Lancifolia</i> | S |
| <i>Dichroa febrifuga</i> | S | <i>Lyonia ovalifolia</i> | S |
| <i>Dimocarpus longan</i> | | <i>Mahonia nepaulensis</i> | T |
| <i>Dioscorea bulbifera</i> | T | <i>Melastoma malabathricum</i> | T |
| <i>Drymaria cordata</i> | T | <i>Melodina monogynus</i> | S |
| <i>Dryopteris barbegera</i> | T | <i>Michetiaontana</i> | |
| <i>D. odontoloma</i> | S | <i>Miliusa roxburghiana</i> | S |
| <i>Elaeocarpus floribundus</i> | T | <i>Millettia auriculata</i> | S |
| <i>Elsholtzia blande</i> | S | <i>Phyllanthus</i> | S |
| <i>Engelhardtia spicata</i> | S | <i>Pmaderas patensis</i> | S |
| <i>Erioglossum rubiginosum</i> | S | <i>Picrasma javanica</i> | T |
| <i>Evodia fraxinifolia</i> | S | <i>Pimpinella diversifolia</i> | S |
| <i>Flacourtia jangomas</i> | S | <i>P. sylvaticum</i> | S |
| <i>Floscopa scandens</i> | S | <i>P. thomsonii</i> | S |
| <i>Forrestia mollissima</i> | S | <i>Pithecolobium angulatum</i> | S |
| <i>Fragaria vesca</i> | S | <i>P. begeminium</i> | S |
| <i>Gardenia campanulata</i> | S | <i>p. montanum</i> | S |
| <i>Geranium nepatense</i> | S | <i>Pityrogramma calomelonos</i> | NK |
| <i>Glochidion lanceolarium</i> | S | <i>Plantago erosa</i> | T |
| <i>Glycosmis arborea</i> | S | <i>Pogostemon bingalense</i> | S |
| <i>Goniotalamus sesquipedalis</i> | S | <i>P. pubescens</i> | S |
| <i>Grewia hirsuta</i> | S | <i>Polygala urillata</i> | S |
| <i>G. laerigata</i> | S | <i>Polygala longifolia</i> | S |
| <i>Haldina cordifolia</i> | S | <i>Polygonatum mulliflorum</i> | S |
| <i>Hedera nepalensis</i> | T | <i>Polygonum barbatum</i> | S |
| <i>Hedyotis seandens</i> | S | <i>P. chinense</i> | S |
| <i>Hovenia dulcis</i> | S | <i>P. Orientale</i> | S |
| <i>Hydnocarpus kurzii</i> | S | <i>P. rude</i> | S |

contd.....

Table 5.1 contd....

| Scientific Name | Status | Scientific Name | Status |
|---------------------------------|--------|--------------------------------|--------|
| <i>P. tomentosum</i> | S | <i>Phrynum capitatum</i> | S |
| <i>Premna latifolia</i> | S | <i>Phyllanthus reticulatus</i> | S |
| <i>Prunus ceraoides</i> | S | <i>P. urinaria</i> | S |
| <i>P. salicina</i> | S | <i>Rourea minor</i> | S |
| <i>P. undulata</i> | S | <i>Sambucus javanica</i> | S |
| <i>Psychotria monticola</i> | S | <i>Sanicula europea</i> | S |
| <i>Pteridium aquilinum</i> | T | <i>Sapindus mukorossi</i> | S |
| <i>Pteris ensiformis</i> | T | <i>Sapindus varak</i> | S |
| <i>Pterospermum acerifolium</i> | S | <i>Saprosma ternatum</i> | S |
| <i>Quercus lamellose</i> | S | <i>Senecio quinquelobus</i> | S |
| <i>Rhamnus nepalensis</i> | S | <i>S.scandens</i> | S |
| <i>Mitragyna rotundifolia</i> | S | <i>Sida rhombifolia</i> | S |
| <i>Mucuna imbricata</i> | S | <i>Smilax glaucophylla</i> | S |
| <i>M.puriens</i> | S | <i>S. lancaefolia</i> | S |
| <i>Mussaenda glabra</i> | S | <i>S. ocalifolia</i> | S |
| <i>Myristica angustifolia</i> | S | <i>Solanum nigrum</i> | S |
| <i>Myxopyrum smilacifolium</i> | S | <i>S.xanthocarpum</i> | S |
| <i>Naravelia zeylanica</i> | S | <i>S. torvum</i> | S |
| <i>Nephrolepis cordifolia</i> | S | <i>Sphenomoris chusane</i> | S |
| <i>Ochna squarrosa</i> | S | <i>Spitanthes paniculata</i> | S |
| <i>Olax nana</i> | S | <i>Stephania japonica</i> | S |
| <i>O. scandens</i> | S | <i>Strobilanthes caleisus</i> | S |
| <i>Oldenlandia auriculata</i> | S | <i>Styrax serrulatum</i> | S |
| <i>Olea dioica</i> | S | <i>Symplocos racemosa</i> | S |
| <i>Oleandra wallicnii</i> | S | <i>S. malaccense</i> | S |
| <i>Ophiopogon intermedius</i> | S | <i>Ternsnalia</i> | S |
| <i>Ophiorrhiza mungos</i> | S | <i>T.chabula</i> | S |
| <i>Oreocnide integrifolia</i> | S | <i>T. citrina</i> | S |
| <i>Osmanthus fragrans</i> | S | <i>Tetracer sarmentosa</i> | T |
| <i>Olax corniculata</i> | S | <i>Tetratigma serrulatum</i> | — |
| <i>P. scandens</i> | S | <i>Thaspi avense</i> | — |
| <i>Pajanelia longifolia</i> | S | <i>Tiliacora racemosa</i> | S |
| <i>Pandanus furcatus</i> | S | <i>Toddalia asiatica</i> | S |
| <i>Parameria gladulifera</i> | S | <i>Trachelaspermum lucidum</i> | S |
| <i>Pavettia indica</i> | S | <i>Trema cannabina</i> | S |
| <i>Persea bombycina</i> | S | <i>T. orientalis</i> | S |
| <i>Persicaria chinensis</i> | S | <i>T. nudiflora</i> | S |
| <i>Phonebe lanceolata</i> | S | <i>Triumfetta rhomboidea</i> | S |

contd.....

Table 5.1 contd....

| Scientific Name | Status | Scientific Name | Status |
|----------------------------------|--------|-----------------------------------|--------|
| <i>Tropidia curculioides</i> | S | <i>Hedyotis scandens</i> | S |
| <i>Uncaria lobata var glauca</i> | S | <i>Lindera candata</i> | S |
| <i>Valliaris solanacea</i> | S | <i>Diospyros toposia</i> | S |
| <i>Ventilago madraspatana</i> | S | <i>Hydrocotyle nepalensis</i> | S |
| <i>Verbascum thapsus</i> | S | <i>Michelia doltsopa</i> | S |
| <i>Vivurnum colebrookianum</i> | S | <i>Mucuna bracteata</i> | S |
| <i>V. foetifum</i> | S | <i>Sterculia urens</i> | S |
| <i>Viola biflora</i> | S | <i>Swertia pulchella</i> | S |
| <i>Viola patrinii</i> | S | <i>Vittis peduncularis</i> | S |
| <i>Vitex glabrata</i> | S | <i>Zanthoxylum armatum</i> | S |
| <i>Anthoxylum acanthopodium</i> | S | <i>Clerodendrum phlomoides</i> | S |
| <i>Abroma agusta</i> | S | <i>Ligustrum spicatum</i> | S |
| <i>Acacia dealbata</i> | S | <i>Dichroa febrifuga</i> | S |
| <i>Argyreia nervosa</i> | S | <i>Evodia meliaeifolia</i> | S |
| <i>Artemisia indica</i> | S | <i>Juniperus pseudosabina</i> | T |
| <i>Bauhinia acuminata</i> | S | <i>Picea smithiane</i> | T |
| <i>B. racemosa</i> | S | <i>Prunus aeraissoides</i> | T |
| <i>Bridelia stipularis</i> | S | <i>R. hodgsonii</i> | T |
| <i>Dendrocnide sinuata</i> | S | <i>Rhus hooden</i> | S |
| <i>Derris ferruginea</i> | S | | |
| <i>Desmodium elegans</i> | S | | |
| <i>Elephantopus scaber</i> | S | <i>Acanthopanax trifoliatum</i> | S |
| <i>Garcinia xanthochymus</i> | S | <i>Aconitum ferox</i> | T |
| <i>Garuga gamblei</i> | S | <i>Aconitum sp.</i> | T |
| <i>Glochidion lanceolarium</i> | S | <i>Actcnodapmine angustifolia</i> | S |
| <i>Hydrocotyle sibthorpiodes</i> | S | <i>Adiantum flabellulaum</i> | T |
| <i>Myrica asculenta</i> | S | <i>A. pedatum</i> | T |
| <i>Olea diocica</i> | S | <i>Anisomeles indica</i> | S |
| <i>Paveta indica</i> | S | <i>Aquilaria malacensis</i> | T |
| <i>Polygala arillata</i> | S | <i>A. platanifolia</i> | |
| <i>Polygonum perfoliatum</i> | S | <i>A. lagata</i> | |
| <i>Rhus semialata</i> | S | <i>Caryota urens</i> | T |
| <i>Alpinia nigra</i> | S | <i>Cephalotaxus griffithii</i> | T |
| <i>Andropogon citratus</i> | C | <i>Chisocheton cumingianus</i> | S |
| <i>Anidesma acuminatum</i> | T | <i>Coptis teeta</i> | T |
| <i>Artimisea indica</i> | S | <i>Cymbidium aloifolium</i> | T |
| <i>Aesculus assamica</i> | S | <i>Elaeocarpus</i> | S |
| <i>Capparis spinosa</i> | S | <i>Galium aparine</i> | S |
| | | <i>Garcinia cowa</i> | S |

contd.....

Table 5.1 contd....

| Scientific Name | Status | Scientific Name | Status |
|--------------------------------|--------|-------------------------------|--------|
| <i>G. acuminata</i> | S | <i>Kydia calicina</i> | S |
| <i>G. lancifolia</i> | S | <i>Lagerstroemia speciosa</i> | PS |
| <i>Gymnema acuminatum</i> | T | <i>Litsaea cubeba</i> | C |
| <i>Gynocardia odorata</i> | S | <i>Melia dubia</i> | S |
| <i>Juglans regia</i> | T | <i>Piper</i> | C |
| <i>Panax pseudoginseng</i> | T | <i>Longum</i> | C |
| <i>Podophyllum hexandrum</i> | T | <i>P. nigrum</i> | C |
| <i>Polyalthia</i> | T | <i>P. peepuloides</i> | C |
| <i>Simiarum</i> | S | <i>Plumeria acutifolia</i> | C |
| <i>Rhynchosstylis retusa</i> | T | <i>Polyalthia longifolia</i> | C |
| <i>Skimmia anquetilla</i> | T | <i>Potentilla fruticosa</i> | S |
| <i>Adiantum caudatum</i> | T | <i>Piper betle</i> | C |
| <i>Scheffera venulosa</i> | S | <i>Santalum album</i> | C |
| <i>Taxus wallichiana</i> | T | <i>Syzygium cumini</i> | C |
| <i>Valeriana wallichii</i> | T | <i>Tectona grandis</i> | C |
| <i>Psidium guava</i> | C | <i>Terminalia bellerica</i> | PS |
| <i>Rhododron barbatum</i> | T | <i>T. myriocarpa</i> | PS |
| <i>Tamarindus indica</i> | C | <i>Toona ciliata</i> | C |
| <i>Alnus nepaleusis</i> | C | <i>Zingiber officinale</i> | C |
| <i>Cannabis sativa</i> | C | <i>Embilica officinalis</i> | C |
| <i>Anthocephalus chinensis</i> | S | <i>Momordica charantia</i> | C |
| <i>Ocimum sanctum</i> | C | <i>Nyctanthes arbortistis</i> | C |
| <i>Aleurites moluccana</i> | C | <i>Saraca indica</i> | C |
| <i>Allamanda cathartica</i> | C | <i>Terminalia arjuna</i> | C |
| <i>Alocasia fornicata</i> | C | <i>Agave americana</i> | C |
| <i>Amomum dealbatum</i> | C | <i>Camellia sinensis</i> | C |
| <i>A. subulatum</i> | C | <i>Curcuma angustifolia</i> | C |
| <i>Carica papaya</i> | C | <i>Magnolia grandiflora</i> | C |
| <i>Colocasia esculenta</i> | C | <i>Mimosops elengi</i> | C |
| <i>D. sissoo</i> | C | <i>Melia composita</i> | S |
| <i>Dillenia indica</i> | S | <i>Morus laevigata</i> | C |
| <i>Gloriosa superba</i> | T | <i>Mesua ferrea</i> | C |
| <i>Gmelina arborea</i> | C | <i>Michelia baillonii</i> | — |
| <i>Hiptage bengalensis</i> | C | <i>Michelia champaca</i> | C |
| <i>Impatiens balsamina</i> | S | <i>Moringa oleifera</i> | C |
| <i>Kleinhovia hospita</i> | S | | |

Chapter Six

Potential Drug Plants of India

Comments on the list of Medicinal Plants Prepared by R.N. Chopra and Indian Council of Medical Research

R.N. Chopra's List

It is not an elaborate one, but a glimpse of the remarks on status of various species may be had. This will show the preponderance of species which are cultivated or threatened or depleted. Only about 23 per cent of the species are presently safe.

This shows the depth of depletion of species.

I.C.M.R.'s List

The Council described 900 species of plants of which 350 were published in the first volume in 1976 and 550 species were described in 1987.

The Status column shows that cultivated and sporadically occurring species form a good percentage of species.

Legends has been the same as in other list which are:

- S = Sporadic
- S* = Sporadic with concentrated regeneration.
- C = Cultivated
- T = Threatened
- D = Depleted
- PS = Presently safe.

Table 6.1 : Chopra and Charka's Work on Potential Drug Plant

| Scientific name | Status | Local Name/Parts used |
|---|--------|----------------------------------|
| <i>Abroma augusta</i> | S | Abroma bark |
| <i>Acacia arabica</i> | PS | Indian acacia |
| <i>Acacia catechu</i> | PS/S | Black catechu |
| <i>Acalypha indica</i> | S | Indian acalypha |
| <i>Aconitum chasmanthum</i> | | Aconite |
| <i>Adhatoda vasica</i> | PS | Vasaka |
| <i>Aegle marmelos</i> | PS | Bael. Bela fructus |
| <i>Allium sativum</i> | PS | Garlic allium |
| <i>Alpinia barbadensis</i> | — | Aloes |
| <i>Alpinia officinarum</i> | S | Alpinia. Galangal. |
| <i>Alstonia scholaris</i> | S | Alstomia bark. Dita bark |
| <i>Andrographis paniculata</i> | T | Kalmegh |
| <i>Anethum graveolens</i> | T | Dill |
| <i>Anethum sowa</i> | T | Sowa |
| <i>Arachis hypogea</i> | C | Groundnut |
| <i>Areca catechu</i> | C | Betel nut |
| <i>Aristolochia indica</i> | T | Aristolochia |
| <i>Artemisia marima</i> | S | Santonin. Artemisia santonica |
| <i>Astragalus strobiliforus</i> | T | Tragacanth |
| <i>Atropa acuminata</i> | T | Indian belladonna |
| <i>Atropa belladonna</i> | T | Belladonna |
| <i>Bacopa monniac</i> (<i>Herpestis monicra</i>) | S | Herpestis santoniea |
| <i>Berberis aristata</i> | T | Berberis root |
| <i>Baoerhaavia repens</i> | S | Punarnaba |
| <i>Brassica integrifolia</i> | C | Sinapis |
| <i>Brassica juncea</i> | C | Brown mustard |
| <i>Butea monosperma</i> | PS | Butea seed |
| <i>Calatropis procera</i> | PS | Calatropis |
| <i>Camellia sinnsis</i> | PS | Tea plant |
| <i>Cannabis sativa</i> | PS | Cannabis |
| <i>Capsicum frutescens</i> | PS | Capsicum |
| <i>Carica papaya</i> | PS | Papaya |
| <i>Carum carvi</i> | C | Caraway |
| <i>Cassia angustifolia</i> | C | Senna |
| <i>Cassia fistula</i> | PS | Cassia fruit |
| <i>Centella asiatica</i> | PS | Hydrocotyle |
| <i>Cephaelise pecacuanha</i> | T | Ipecae |

contd.....

Table 6.1 contd....

| Scientific name | Status | Local Name/Parts used |
|---|--------|-------------------------|
| <i>Chenopodium album</i> | PS | Wormseed |
| <i>Chenopodium ambrosioides</i> var. <i>anthelminicum</i> | PS | American worm seed |
| <i>Chrysanthemum</i> <i>cinerariaefolium</i> | C/D | Pyrethrum |
| <i>Cinchona ledgeriana</i> <i>C. Succirubra</i> and other species and hybrids | C | Cinchona |
| <i>Cinnamomum camphora</i> | C | Camphor |
| <i>Cinnamomum zeylanicum</i> | C | Cinnamon |
| <i>Cissampelos pareira</i> | D/T | Cissampelos |
| <i>Citrullus colocynthis</i> | C | Colocynth |
| <i>Citrus aurantium</i> | C | Bitter-orange ped |
| <i>Citrus medica</i> var. <i>limon</i> | C | Lemon peel |
| <i>Cocos nucifera</i> . | C | Coconut |
| <i>Coffea arabica</i> | C | Coffee plant |
| <i>Colchicum luteum</i> | D/T | Colchicum corm and seed |
| <i>Coriandron sativum</i> | C | Coriander |
| <i>Crocus sativa</i> | C | Saffron |
| <i>Cuminum cyminum</i> | C | Cumin |
| <i>Curcuma longa</i> | C | Turmeric |
| <i>Cymbopogon flexuosus</i> | PS | Lemon grass |
| <i>Datura fastuosa</i> | PS | Datura |
| <i>Datura metel</i> | PS | Datura |
| <i>Datura stramonium</i> | PS | Datura |
| <i>Derris ferruginea</i> | PS | Derris. Tuba root |
| <i>Digitalis lanata</i> | D/T | Digoxin |
| <i>Digitalis purpurea</i> | D/T | Digitalis leaf |
| <i>Dryopteris filix mas</i> | D/T | Male fern. Aspidium |
| <i>Elettaria cardamomum</i> | C | Cardamom fruit |
| <i>Ephedra gerardiana</i> . | | |
| <i>E. nebrodensis</i> | D/T | Ephedra |
| <i>Eucalyptus globulus</i> | PS | Eucalyptus |
| <i>Eugenia caryophyllus</i> | C | Clove |
| <i>Eupatorium ayapana</i> | C | Ayapana |
| <i>Ferula northex</i> (<i>Ferula factida</i>) | C | Asaioetida |
| <i>Foeniculum vulgare</i> | C | Fennel |
| <i>Gaultheria fragrantissima</i> | D/T | Wintergreen |

contd.....

Table 6.1 contd....

| Scientific name | Status | Local Name/Parts used |
|--|--------|-----------------------|
| <i>Glycyrrhiza glabra</i> | D/T | Liquorice |
| <i>Hemidesmus indicus</i> | D/T | Indian sarsaparilla |
| <i>Holarrhena antidysenterica</i> | PS | Kurchi bark |
| <i>Hydnocarpus wightiana</i> | D/T | |
| <i>Hyoscyamus muticus</i> | D/T | Hyoscyamus |
| <i>Hyoscyamus niger</i> | D/T | Hyoscyamus leave |
| <i>Ipomoea hederacca</i> | C | Kaladana |
| <i>Ipomoea turpethum</i> | C | Turpeth |
| <i>Juniperus macropoda</i> | D/T | Juniper |
| <i>Linum usitatissimon</i> | C | Linseed |
| <i>Lobelia nicotiatifolia</i> | - | Lobelia |
| <i>Melia azadirachta</i> | PS | Nim |
| <i>Mentha arvensis</i> | C | Peppermint |
| <i>Mentha piperita</i> | C | Peppermint |
| <i>Moringa olcifera</i> | C | Moringa |
| <i>Myristica fragrans</i> | D/T | Nutmeg |
| <i>Papaver somniferum</i> | C | Opium |
| <i>Picrasma quassioides</i> | D/T | Quassia |
| <i>Picrorhiza Kurrooa</i> | D/T | Picrorhiza |
| <i>Pimpinell anisum</i> | C | Anise |
| <i>Pinus excelsa</i> | PS | Colophony |
| <i>Pinus Khasya</i> | PS | Colophony |
| <i>Pinus longifolia</i> | PS | Colophony |
| <i>Piper cubela</i> | C | Betel |
| <i>Piper ovata</i> | C | Isabgul |
| <i>Podophyllum hexandrum</i> (<i>Podophyllum emodi</i>) | D/T | Indian podophyllum |
| <i>Polygala chinensis</i> | S | Indian senega |
| <i>Prunus amygdaius</i> | S | Almond oil |
| <i>Psoralea corylifolia</i> | S | Babchi |
| <i>Ptcrocarpus marsupium</i> | D/T | Kino |
| <i>Rauwolfia serpentina</i> | D/T | Rauwolfia |
| <i>Rheum emodi;</i> <i>R. webbianum</i> | D/T | Rhubarb |
| <i>Ricinus communis</i> | PS | Castor oil |
| <i>Rosa damascena</i> | CS | Rose |
| <i>Rosmarimus officinalis</i> | CS | Rosemary |
| <i>Santichom album</i> | PS | Sandal wood |

contd.....

Table 6.1 contd....

| Scientific name | Status | Local Name/Parts used |
|---|--------|-----------------------|
| <i>Saraca indica</i> | C | Asoka bark |
| <i>Saussurea lappa</i> | D/T | Saussurea |
| <i>Sesamum indicum</i> | C | Sesame oil |
| <i>Strophantinus Kombi</i> | D/T | Strphanthus |
| <i>Strycnos nux-domina</i> | D/T | Nux vomica |
| <i>Swertia chirata</i> | D/T | Chiretta |
| <i>Terminalia chebula</i> | S | Myrobalam |
| <i>Thymus vulgaris</i> | C | Thyme |
| <i>Tinospora cordifolia</i> | D/T | Tinospora |
| <i>Trachyspermum animi</i> (<i>Carum copticum</i>) | C | Ajowan |
| <i>Tylophora asthmatica</i> | S | Antamul |
| <i>Urginea indica</i> | S | Indian squill |
| <i>Valeriana wallichii</i> and other species | D/T | Valerian |
| <i>Vernonia anthelmintica</i> | D/T | Vernonia |
| <i>Vitex peduncularis</i> | D/T | Vitex leaf |
| <i>Withania somnifera</i> | S/C | Ashwagandha |
| <i>Zingiber officinale</i> | C | Ginger |

Status of Plants (Medicinal)

Listed by Indian Council of Medical Research:

The Council described 900 species (350 in their first volume published in 1976 and 550 in their second volume published in 1987)

Table 6.2

| Scientific Name | Status | Scientific Name | Status |
|---------------------------------|--------|-------------------------------------|--------|
| <i>Abrus precatorius</i> | S | <i>Carica papaya</i> | C |
| <i>Aloe indica</i> | C/T | <i>Curcuma lonja</i> | C |
| <i>Areca catechu</i> | C | <i>Daucus carota</i> | C |
| <i>Azadirachta indica</i> | PS | Plants with uterine activity | |
| <i>Arotobotrys odoratissima</i> | C/S | <i>Abroma augusta</i> | S |
| <i>Butea frondosa</i> | PS | <i>Anona squamosa</i> | C |
| <i>Caesalpinia bonducella</i> | S | <i>Aristolochia bracteata</i> | T |
| <i>Canscora decussata</i> | S | <i>Boxbax ceiba</i> | PS |

contd....

Table 6.2 contd.....

| Scientific Name | Status | Scientific Name | Status |
|---|--------|--|--------|
| <i>Cyperus rotundus</i> | PS | <i>Gynandropsis pentaphylla</i> | S/PS |
| <i>Gloriosa superba</i> | T | Plants with anti-ateros Clerotic activity | |
| <i>Gossypium arboreum</i> | S | <i>Acorus clamus</i> | C/D |
| <i>Acacio farnestnata</i> | PS | <i>Achyranthes aspera</i> | S/PS |
| <i>Achyranthes aspera</i> | S | <i>Alpinia galanga</i> | S |
| <i>Aconitum sp.</i> | T | <i>Aphanamixis polystachia</i> | S |
| <i>Acorus calamus</i> | T/C | <i>Anagallis arvensis</i> | S |
| <i>Aegle marmelos</i> | PS | <i>Argemone maxicana</i> | PS |
| <i>Artemisia vulgaris</i> | S | <i>Aradirachta indica</i> | PS |
| <i>Callophyllum inophyllum</i> | S | <i>Capparis decidua</i> | PS |
| <i>Calotropis procera</i> | PS | <i>Bryophyllum calicinm</i> | S |
| <i>Catharanthus roseus</i> | C | <i>Carissa carandus</i> | S |
| <i>Cestrum diurnum</i> | C | <i>Cassia fistula</i> | P |
| <i>C. nocterrum</i> | C | <i>C. occidentalis</i> | P |
| <i>Cissampelos pareira</i> | S | <i>Crotalaria juncea</i> | C |
| <i>Cissus quadrangularis</i> | S | <i>Cucurbita maxima</i> | C |
| <i>Coceulus hirsutus</i> | S | <i>C. longa</i> | C |
| <i>Cocos nucifera</i> | C/PS | <i>Desmodium gangeticum</i> | S |
| <i>Crotalaria juncea</i> | S | <i>Ervatania coronaria</i> | C/PS |
| <i>Daucus carota</i> | C/PS | Plants with anti-fungal activity | |
| <i>Euphorbia rerifolia</i> | S | <i>Astera cantha longifolia</i> | S |
| <i>Evolvulus alsinoides</i> | PS | <i>Cassia fistula</i> | PS |
| Plants with Anti-Cancer activity | | <i>Cocos nucifera</i> | PS |
| <i>Arbus precatorius</i> | S | <i>Desmodium gangeticum</i> | S |
| <i>Albizzia lebbeck</i> | PS | Plants with anti-ateros Clerotic activity | |
| <i>Alstonia scholaris</i> | S/PS | <i>Aphanamixis polystachia</i> | S |
| <i>Aphanamixis polystachia</i> | S | <i>Caesalpinia bonducella</i> | S |
| <i>Anacardium occidentale</i> | C | <i>C. sepiaria</i> | S |
| <i>Anona squamosa</i> | C | <i>Capparis decidua</i> | S |
| <i>Argemone maxicana</i> | S | <i>Cassia auriculata</i> | C |
| <i>Asparagus racemosus</i> | T | Plants with Anti-bacterial activity | |
| <i>Bacopamonnien</i> | S | <i>Acorus calamus</i> | T |
| <i>Calotropis gigantea</i> | S | <i>Achyranthes aspera</i> | S |
| <i>Cedrus deodara</i> | C | <i>Alpinia galanga</i> | S |
| <i>Datura metel</i> | S | <i>Eclipta alba</i> | PS |
| <i>Erythrina suberosa</i> | S | | |
| <i>Glycosmis arborea</i> | S/PS | | |
| <i>Euphorbia hira</i> | S/PS | | |

contd.....

Table 6.2 contd....

| Scientific Name | Status | Scientific Name | Status | | |
|--|----------------------------|---|---------------------------------|-------------------------|------|
| <i>Emblica officinalis</i> | PS | Plants with Diuretic and Anti-uro lithiatic activity | | | |
| <i>Gmelina arborea</i> | PS | | | | |
| <i>Grewia hirsuta</i> | S | | <i>Achyranthes aspera</i> | S/PS | |
| <i>Grewea tilialia</i> | S | | <i>Azadirachta indica</i> | PS | |
| | | | <i>Barleria prionitis</i> | S | |
| Plants with Anti-protozoal | | <i>Boerhaavia diffusa</i> | PS | | |
| <i>Acacia nilotica</i> | PS | <i>Cassia occidentalis</i> | PS | | |
| <i>Alangium salvifolium</i> | S | <i>Crataeva nurvala</i> | S | | |
| <i>Albizia lebeck</i> | PS | Plants with anti-asthmatic and Antihistamic Activity | | | |
| <i>Asparagus racemosus</i> | T | | | | |
| <i>Atropa belladonna</i> | T | | <i>Allium sepa</i> | C/PS | |
| <i>Berberis aristata</i> | S | | <i>Clerodendrum serratum</i> | S | |
| <i>Toona ciliata</i> | C/PS | | <i>Curcuma longa</i> | C/PS | |
| <i>Centella asiatica</i> | PS | Plants with Anti-helmentic activity | | | |
| <i>Cinchona sp.</i> | C/PS | | | | |
| <i>Clerodendrum speciosum</i> | S/PS | | <i>Aegle marmelos</i> | PS | |
| <i>Curcuma longifolia</i> | C/PS | | <i>Alangium lamarkii</i> | S | |
| <i>Euphorbia hirta</i> | C/PS | | <i>Aphana mixis polystachia</i> | S/T | |
| <i>Ficus racemosa</i> | S | <i>Butea frondosa</i> | PS | | |
| <i>Celastrus paieulatus</i> | S | <i>Capparis decidua</i> | S | | |
| <i>Cynodon dactylon</i> | PS | <i>Datura metel</i> | S | | |
| <i>Cyperus nivens</i> | PS | Plants with Respiratory activity | | | |
| <i>Diospyros preragrina</i> | PS | | | | |
| <i>Dryneria quercifolia</i> | S | | <i>Alpinia galanga</i> | S | |
| <i>Embelia ribes</i> | S | <i>Brassica oleracea</i> | C | | |
| <i>Ficus religiosa</i> | PS | Plants with Astringent activity | | | |
| Plants with Insecticidal activity | | | <i>Caesalpinia bonducella</i> | S | |
| | <i>Acorus calamus</i> | | C/T | <i>Capparis decidua</i> | S |
| | <i>Anona squamosa</i> | | C | <i>Carum coptis</i> | C/PS |
| | <i>Euphorbia nerifolia</i> | | PS | <i>Cassia fistula</i> | S/PS |
| | | | | | |

Chapter Seven

Technology on Trade and Commerce, Imports and Exports

This Chapter records various facts on Cultivation, Marketing Economics of cultivation, Trade and Commerce, Conservation, Sustainable harvest of rare medicinal plants, besides presenting lists of major plants required by Indian Pharmaceutical Industries on raw drug materials and a broad outline on export and import of medicinal plants.

A paper cutting (Times of India dt. 12.11.05) on drug market which reveals India's position may be relevant to quote which may be read at the ultimate page of this Chapter.

The author finds it very convenient and relevant to quote the opinion of several technologists on the following issues relating to "Medicinal plants" which are on:

- Cultivation and Marketing.
- Economics of cultivation
- That desert biodiversity on Medicinal plants.
- Trade and Commerce.
- Cultivation and Conservation
- Marketing strategy and Trade.
- Marketing Trade.
- Sustainable harvest.
- Introduction of Nitrogen fixing Medicinal plants.
- Rare and less known Medicinal plants.

• N.S. BISHT et al write on " Cultivation and Marketing of Medicinal plants of Pithoragarh". A summary is given below:

The status of collection, cultivation and marketing of medicinal and aromatic plants was studied in Pithoragarh District of Uttaranchal. The primary information was collected as per structural questionnaires from collectors/cultivators belonging to twelve villages spread over two blocks namely Munsiyari and Didihat. The important species being collected were observed to be Jhula, Reetha and Tejpat. The cultivators seem to be growing greater quantities of Atees, Gudhvach, Indrayan, Jambo, Jatamansi, Kalajeera, Kutki, Pashanbhed, Reetha, Sameva and Tejpat. The most favoured market channel was observed to be producer, Middlemen, Trader and Consumer which was being adopted by 50% collectors and 90% cultivators. The producer's share in consumer's rupee in case of collection varied between 45–76. 47% for different species with an average of 56.22%. Similarly the producer's share in consumer's rupee for cultivated species varied between 32.67%– 89% with an average of 60.88%. The paper also discusses the recent changes introduced by Uttaranchal Govt. in marketing of these medicinal and aromatic plant species.

- Mohit Gera et al writes on " Economics of Cultivation" of some medicinal plants a Summary of which is as follows:

Agro technologies for cultivation of a number of medicinal plant species have been developed but large-scale cultivation on farmland is yet to begin. Amongst other causes for this gap, lack of reasonably correct information on economics of cultivation of these species is one important cause. The economics of cultivation of five medicinal plant species, *viz.*, Kalmegh, Buch, Safed musli, Ashwagandha and Akarkara was studied on farmer's field in Haryana. The net benefits calculated for each species were also subjected to sensitivity analysis in relation to fall in price by 25%, 50%, 75% increase in wage rate by 10%, 20% 30% and increase in rental value of land by 20%, 40%, and 60%. The results showed that maximum net benefits of Rs. 36,140 and Rs. 19,016 per acre could be received by cultivation of safed musli and Kalmegh respectively. The cultivation of Kalmegh and Ashwagandha were observed to be more resilient to the adverse factors of price fall, increase in wage rate and rental value of land, compared to other species. On the basis of initial investment involved and resilience to adverse market conditions, the cultivation of Kalmegh and Ashwagandha is recommended for small farmers. The large farmers who can afford greater risk

may cultivate Bush and Safed mulsi and Akarkara for higher returns.

- K.K. Chaudhuri et al summarise their work on " Thar Desert Biodiversity for medicinal plant" as follows:

The Thar Desert is the world's seventh largest desert and is most inhospitable eco-region in the Indo-Pacific region. It is spread over in the four states of India, and in Pakistan and cover. an area of about 2,38,700 km². There are as many as 157 species of plants with medicinal value. Medicinal value and usefulness of several species is yet to be studied and established. The diversity of the medicinal flora typical of desert ecosystem has immense future prospects. The prominent families to which the majority of the medicinal plants of the arid zone belong are : Fabaceae, Asclepiadaceae, Malvaceae, Acanthaceae, Amaranthaceae, Convolvulaceae, Lamiaceae (Labiatae). The present study is aimed at indexing of all medicinal flora occurring in the Western Rajasthan of Indian desert and their uses for the benefit of the researchers to undertake studies on the prospects and potential of commercial exploitation.

- R.B.S. Rawat et al summarise their work on " Trade and Commerce opportunities of medicinal plant in India".

About 5,000 plant species have been documented for medicinal value and phyto-chemically studied. Of these,1,100 are used in different systems of medicine, 600-700 are used in indigenous industries, but only about 150 have been commercially exploited. Besides domestic use, export potential of these plants is huge and given a quality upgradation of such drugs, competitiveness and globalization is ensured. There is, however need for doing scientific work on their pharmacology, phytochemistry and clinical experiments to develop the export potential fully. Important plant species being utilized at present, their world prices, and other potential species have been listed. Shift towards use of herbal drugs worldwide has been noted. There is good scope in developing this sector. Trade and commerce requirements relating to export and marketing in various foreign marketing e.g., Canada, Hungary, France, UK, USA have been discussed with a view to developing trade in these countries in medicinal products. Various measures, which handicap expansion, have been pointed out. These are : agricultural

practices like harvesting and propagation, processing high yield varieties, quality control, marketing, training of personnel, equipment and knowledge about latest advances in technology etc. where efforts need to be focused.

- Dhan Singh et al on " Marketing Strategies and Trade" of medicinal plants write as follows:

Medicinal plants have attracted considerable interest in recent years. Commercial enterprises and local dwellers are regularly exploiting natural heritage of these medicinal plants. There is an urgent need of conservation of these valuable medicinal plants through cultivation. Poor marketing structure in the country is the primary challenge towards its pronotion and cultivation. In Uttaranchal, attention has been given to conservation/cultivation and its open trading system by the government. The present paper highlights the cultivation and open trading aspects of medicinal plants in the State.

- S. Chandola writes on " Some rare and less known medicinal plants of Uttaranchal as follows: (Source : Ind for March 2005)

Valuable species have been removed for so long and so intensively from the wild that they have come to the brink of extinction. The market forces, however have been so strong that substitute have emerged to satisfy the demand, and over time the substitute has assumed the importance of the original drug. The present paper deals with correct identity of Akarkara (*Anacyclas pyrethrum*), Chirayta (*Swertia chirata*), Kuth (*Saussurea costus*), Salam Mishri (*Eulophia dabia*), *Gentiana kurroo* has been rediscovered after a lapse of 50 years. It is time now to educate ourselves and to adopt the latest benefits of modern science to retrieve the true herbs species from final annihilation. Serious species Recovery Programmes need to be initiated for the highly threatened plants.

- Manmohan Yadav on " Marketing trade of medicinal plants" writes as follows :

Increasing consumer awarness and preference for herb-based natural products including herbal medicines, has resulted in an unexpected surge in the demand for Medicinal and Aromatic Plants (MAPs) and thus over-exploitation of the medicinal

wealth present in the forests. The markets for most Non-Timber Forest Products including NAPs are highly unorganized and secretive and thus suffer from various market imperfections mainly due to the lack of information about the demand and supply of the products being traded to the disadvantage to the collectors and cultivators and sustainable resource availability. The situation thus calls for the need of information which is reliable and readily available to the various stakeholders of medicinal plants trade including the policy makers and implementing agencies. A conceptual framework for such a Market Information System (MIS) with its various stakeholders, type of information, and the output to be generated is discussed in this paper. The suggested MIS is at a conceptual framework and has to be tested in the field at a division level before it is refined and finalized for its actual implementation. The design and implementation of such MIS on Forest Management Unit (FMU) level can help solve many impediments in the development of the MAPs sector on a sustainable and equitable basis.

• W.D. Thomas et al write on "*Sustainable harvest of medicinal plants*" as follows :

Urbanisation and scientific rediscovery is increasing the demand for herbal products, whose overharvest threatens 30% of the traded species. Sustainable harvest traditions are eroding due to (a) poor prices paid to the raw drug gatherers, (b) competition between, (c) market insecurity, (d) many youth gatherers and (e) vehicular mobility to new collection areas. To revive traditions through equitable benefit sharing, Gram Mooligai (*i.e.*, Village Herbs) Company Limited (GMCL) was established, with gatherer's groups as shareholders in Tamil Nadu state in Southern India. Sustainable Biometric experiments could not continue or help in predicting yield but participant observations and "memory harvesting" revealed that focal species have become rare amongst 25% of their earlier collection areas. Major pressures other than harvest include (a) scarce or untimely rainfall, (b) habitat encroachments and (c) grazing. To earn more better price and sustained business demand, GMCL gathers maximized not quantity but quality through thumb rules ("do's and don'ts") of sustainable harvesting practices: (a) appropriate habitat area (b) maturity timing (c) less

damaging methods (d) proper post-harvest treatment (e) user (buyer,co-harvester) agreements.

- R.C. Sundriyal writes on "Cultivation and Conservation " of medicinal plants in the Himalayas as follows:

This paper highlights strategy for large scale cultivation and long-term conservation of medicinal plants involving different stakeholders in the Himalaya. It is emphasized that the focus of the cultivation could be protection of endangered species and/or achieving the target of higher income by raising and cultivating market demanding species. The paper discusses selection of potential Medicinal and Aromatic Plants (MAPs) broadly recommended for the region and ways and means of domestication, value addition, product formulation, processing, conservation, infrastructure, and R&D support desired for cultivation of medicinal plants. Designs for marketing and possible funding sources are also given. It is highlighted that if cultivation of MAPs is planned properly, it could emerge as a potential sector to support large number of people with high revenue generation.

- A.K. Parandial et al write on "Introduction of nitrogen fixing medicinal plants" a summary of which follows :

The Garhwal Himalayas are one of the richest floristic zones for the medicinal plants of Indian subcontinent. It provides matchless wealth of more than 300 rare and endangered species of medicinal plants having therapeutic properties. The over-exploitation of these precious material from the Himalayan forest ecosystem over last few decades have not only pushed these towards extinction but also enhanced the problem of soil erosion, land degradation and loss of biodiversity in the area. Introduction of nitrogen fixing plants may provide an important tool for the ecorestoration attempts in this area. Advocating nitrogen fixing plants having medicinal uses may provide wider acceptability among the local populace from economic as well as soil conservation point of view. The adoptability of indigenous species may be useful for planting and rejuvenating the degraded sites in different altitudinal zones of the Himalayan ecosystem. In the present article an attempt has been made to enumerate the existing nitrogen fixing species of medicinal values at various altitude for the conservation of degraded sites in Garhwal Himalayas.

(Source : Ind. Forester of all opinion : March 2005)

Table : 7.1 : Major Plants Required by Indian Pharmaceutical Industries

| Ingredient | Source of supply (August 1999) | | | Consumption (Tonnes) |
|--|--------------------------------|--|------------|----------------------|
| | Cultivation | Wild | Imported | |
| Ajwain (<i>Carum copticum</i>) | 100% | | | 200 |
| Akkalkadha (<i>Anacycus phrethrum</i>) | | | 100% | 50 |
| Cardamomum green (<i>Elettariacardamomum</i>) | 66% | | 33% | 60 |
| Cardamomum big (<i>Amomum subulatum</i>) | | Assam | | NA |
| Aloes (<i>Aloe vera</i>) | | Maharashtra Tamil Nadu | | 200 |
| Amala green (<i>Emblica officinalis</i>) | 50% South | 50%MP/UP Maharashtra | | 10,000 |
| Anantmool (<i>Hemidesmus indicus</i>) | | TN,AP | | 200 |
| Baheda (<i>Terminalia belerica</i>) | | Maharashtra MP | | 500 |
| Bhringraj (<i>Eclipta alba</i>) | | MP, UP, TN, Maharashtra, W. Bengal | | 500 |
| Brahmi (<i>Bacopa monnieri</i>) | | Tamil Nadu, West Bengal | | 700 |
| Kankol (<i>Piper cubeba</i>) | | | 150 tonnes | NA |
| Chitrak (<i>Plumbago Zeylanica</i>) | | Maharashtra, Tamil Nadu | | 500 |
| Dalchini (<i>Cinnamomum Zeylanicum</i>) | | | 100% | 250 |
| Daruhaldi (<i>Berberis aristata</i>) | | Nainital, Kulu | | 500 |
| Deodar (<i>cedrus deodara</i>) | | Nainital, Kulu | | 200 |
| Gajjippali (<i>Scindapsus officiale</i>) | | | 100% | 400 |
| Guggul (<i>Commiphora wightii</i>) | | 10% Gujarat, Rajasthan | 90% | 500 |
| Harda (<i>Terminalia chebula</i>) | | Maharashtra, MP | | 500 |
| Nutmen/mace (<i>Myristica fragrans</i>) | 20% | Kerala | 80% | 500 |

contd...

Table : 7.1 – contd...

| Ingredient | Source of supply (August 1999) | | Consumption Imported (Tonnes) |
|--|--------------------------------|--|-------------------------------|
| | Cultivation | Wild | |
| Jambhul beej (<i>Eugenia jambolana</i>) | | Maharashtra, Gujarat, UP, MP, TN | 300 |
| Jatamansi (<i>Nardostachys grandiflora</i>) | | Nepal, Assam, Kulu | 200 |
| Jeshthimadh (<i>Glycyrrhiza glabra</i>) | | 100% | 5000 |
| Kadu kutuki (<i>Picrorrhiza kurroa</i>) | | Kulu (HP), Nepal, Assam | 200 |
| Kesar (<i>Crocus sativa</i>) | | Jammu and Kashmir | 5 |
| Clove (<i>syzygium aromaticum</i>) | 13% Kerala | 87% | 150 |
| Black pepper (<i>piper nigrum</i>) | Kerala | | 150 |
| Ginger (<i>Zingiber officinale</i>) | 50% Assam Kerala | 50% | 500 |
| Ashwagandha (<i>Withania somnifera</i>) | 50%MP | 50% MP | 500 |
| Nagkesar (<i>Mesua ferrea</i>) | | | 200 |
| Pipramool (<i>Piper longum</i>) | AP, Maharashtra | | 200 |
| Safed müsli (<i>Chlorophytum arundinaceum</i>) | 40% MP MH. | 40% MP MH. | 20% |
| Shatavri (<i>Asparagus racemosus</i>) | 50% MP, UP | 50% MP, UP | 500 |
| Vayvidang (<i>Embelia ribes</i>) | | Maharashtra, MP | 200 |
| Kuchla (<i>Strychnos Nux vomica</i>) | | Assam, AP, Bihar | 1000 |
| Kalmegh (<i>Andrographis paniculata</i>) | | MP, UP, Bihar | 250 |
| Senna | 60% TN 20% Gujarat | | 1000 |

Source : Mr. Anand Puranik, Chemexcil, Mumbai, Personal communication.

Table 7.2 : Raw Drug Material Imported to India

| Botanical Name | Trade Name |
|-----------------------------------|----------------------------|
| <i>Anacyclus pyrethrum</i> | Akkaikadha |
| <i>Asperagus adscendens</i> | Musli white |
| <i>Atropa belladonna</i> | Belladona |
| <i>Cinnamomum zeylanica</i> | Daichini |
| <i>Commiphora wightii</i> | Guggul |
| <i>Curcuma zedoaria</i> | Kapurkachri |
| <i>Elettaria cardamomum</i> | Cardamomum green |
| <i>Garcinia indica</i> | Kokum |
| <i>Glycyrrhiza glabra</i> | Jeshthimadhu |
| <i>Hemidesmus indicus</i> | Sariva |
| <i>Myristica fragrans</i> | Nutmeg/mace |
| <i>Piper cubeba</i> | Kankol |
| <i>Psyllium husk</i> | Isabgol |
| <i>Rauwolfia serpentina</i> | Sarpgandha |
| <i>Saussurea lappa</i> | Kusth |
| <i>Swertia chirata</i> | Chirata |
| - | Ayurvedic and Unani herbs |
| - | Saps and extracts of Opium |
| <i>Azadiracta indica extracts</i> | Extracts of Neem |

Source : Planning Commission 2000

Medicinal plant species which are also imported.

1. *Glycyrrhiza glabra*
2. *Pimpinella anisum*
3. *Thymus vulgaris*
4. *Opercutina terpertum*
5. *Cuscuta epithymum*
6. *Smilax ornata*
7. *Smilax china*
8. *Lavandula strechas*

(Source : Ind. For. March 2005 : R.B.S. Rawat)

Table 7.3 : Top Twenty Medicinal Plants Traded in India in Value Terms

| Trade Name | Botanical Name |
|-------------------------|-----------------------------------|
| 1. Atis | <i>Aconitum heterophyllum</i> |
| 2. Meetha telia/Bachnag | <i>Aconitum violaceam</i> |
| 3. Safed musli* | <i>Chlorophytum borivillianum</i> |
| 4. Guggul* | <i>Commiphora wighti</i> |
| 5. Mamira/Mishmi-bitter | <i>Coptis teeta</i> |
| 6. Salam Panja/Salep | <i>Dectylorhiza hatagirea</i> |
| 7. Vidanga/Baibiranga* | <i>Embelia ribes</i> |
| 8. Nagkesar | <i>Mesua nagassarium</i> |
| 9. Rampatri/Bombay Maçe | <i>Myristica malabarica</i> |
| 10. Jatamansi* | <i>Nardostachys grandiflora</i> |
| 11. Gaozaban | <i>Onosma bracteatum</i> |
| 12. Kutki* | <i>Picrorrhiza kurroa</i> |
| 13. Kakra-singi | <i>Pistacia integrimma</i> |
| 14. Sarpa gandha* | <i>Rauwolfia serpentina Benth</i> |
| 15. Manjistha | <i>Rubia cordifolia</i> |
| 16. Chandana/Sandalwood | <i>Santalum album</i> |
| 17. Chobchini gulabi | <i>Smilax glabra</i> |
| 18. Chirāyṭa* | <i>Swertia chirata</i> |
| 19. Taggar/Mushkabata | <i>Valeriana-hardwikii</i> |
| 20. Banafsha | <i>Viola pilosa</i> |

*Species selected for detailed market study

(Source : Amruth, December 1999)

Table 7.4 : Number of Licensed Pharmacies in Indian System of Medicine

| State/Union Territory | Number of licensed pharmacies (April 1999) | | | | Number of licensed pharmacies Holding loan licences* | | | |
|------------------------|--|------------|------------|--------------|--|----------|----------|------------|
| | Ayur-veda | Unani | Siddha | Total | Ayur-veda | Unani | Siddha | Total |
| Andhra Pradesh | 556 | 222 | - | 778 | 4 | - | - | 4 |
| Assam | 39 | - | - | 39 | - | - | - | - |
| Bihar | 228 | 21 | - | 249 | - | - | - | - |
| Delhi | 78 | 24 | - | 102 | 1 | - | - | 1 |
| Goa | 5 | - | - | 5 | 1 | - | - | 1 |
| Gujarat | 892 | - | - | 892 | 125 | - | - | 125 |
| Haryana | 210 | 3 | - | 213 | - | - | - | - |
| Himachal Pradesh | 54 | - | - | 54 | - | - | - | - |
| Jammu & Kashmir | 10 | - | - | 10 | - | - | - | - |
| Karnataka | 241 | - | - | 241 | 20 | - | - | 20 |
| Kerala | 962 | - | - | 962 | 9 | - | - | 9 |
| Madhya Pradesh | 225 | 12 | - | 237 | 11 | - | - | 11 |
| Maharashtra | 757 | - | - | 757 | 243 | - | - | 243 |
| Orissa | 160 | - | - | 160 | - | - | - | - |
| Punjab | 149 | - | - | 149 | 2 | - | - | 2 |
| Rajasthan | 388 | 4 | - | 392 | - | - | - | - |
| Tamilnadu | 218 | 8 | 323 | 549 | 17 | 3 | 6 | 26 |
| Tripura | 1 | - | - | 1 | - | - | - | - |
| Uttar Pradesh | 2,575 | 217 | - | 2,792 | 2 | - | - | 2 |
| West Bengal | 620 | 22 | - | 642 | 21 | - | - | 21 |
| Chandigarh | 2 | - | - | 2 | - | - | - | - |
| Dadra and Nagar Haveli | 10 | - | - | 10 | - | - | - | - |
| Daman and Diu | 1 | - | - | 1 | 1 | - | - | 1 |
| Pondicherry | 24 | - | 94 | 118 | 1 | - | - | 1 |
| Total | 8,405 | 533 | 417 | 9,355 | 458 | 3 | 6 | 467 |

Source : Website of Department of Indian Systems of Medicine and Homeopathy.

Table 7.5 : Plants Considered in Market Study by TRAFFIC (India)

| | Trade Name | Botanical Name |
|----|-------------------|-----------------------------------|
| 1 | Atis | <i>Aconitum heterophyllum</i> |
| 2 | Agar | <i>Aconitum melasensis</i> |
| 3 | Daruhaldi | <i>Berberis</i> spp. |
| 4 | Safed musli* | <i>Chlorophytum borivillianum</i> |
| 5 | Guggul* | <i>Commiphora wightii</i> |
| 6. | Mameera | <i>Coptis teeta</i> |
| 7 | Salabmisri | <i>Orchis latifolia</i> |
| 8 | Kutki* | <i>Gentiana kurroa</i> |
| 9 | Kalihari | <i>Gloriosa superba</i> |
| 10 | Kapoorkachri | <i>H. spicatum</i> |
| 11 | Pushkarmool | <i>Inula racemosa</i> |
| 12 | Jatamansi* | <i>Nardostachys grandiflora</i> |
| 13 | Kutki* | <i>Picrorrhiza kurroa</i> |
| 14 | Vankakadi | <i>Picrorrhiza hexandrum</i> |
| 15 | Lal chandan | <i>Pterocarpus santalinus</i> |
| 16 | Sarpghandha | <i>Rauwolfia serpentina</i> |
| 17 | Kuth | <i>Sassurea lappa</i> |
| 18 | Chirayata | <i>Swertia chirata</i> |
| 19 | Talispatra | <i>Taxus wallichiana</i> |

(Source : Mr. Manoj Mishra, TRAFFIC-India: personal communication)

Notification prohibiting the export of medicinal plants

Ministry of Commerce, Government of India

Notification No. 24(RE-98)/1997-2002

New Delhi, Dated 14 October 1998

S.O.(E) Attention is invited to para 4 of Notification No. 2(RE098)/1997-2002 dated the 13th April, 1998 relating to export of plants, plant portion and their derivatives and extracts obtained from the wild.

The export of under-mentioned 29 plants, plant portions and their derivatives and extracts as such obtained from the wild except the formulations* made therefrom, is prohibited.

Cycas beddomei (Beddomes cycad)
Vanda coerulea (Blue vanda)
Saussurea sp.
Paphiopedilium species (Ladies slipper orchids)
Nepenthes khasiana (Pitcher plant)
Renanthera imschootiana (Red Vanda)
Rauwolfia serpentina (sarpagandha)
Ceropegia species
Frerea indica (Shindal Mankundi)
Podophyllum hexandrum (*emodi*) (Indian *Podophyllum*)
Cyathea species (Tree Ferns)
Cycadaceae species
Dioscorea deltoidea (Elephant's foot)
Euphorbia species (Euphorbias)
Orchidaceae species (Orchids)
Pterocarpus santalinus (Red Sanders)
Taxus wallichiana (Common Yew or Birmi leaves)
Aquilaria malaccensis (Agarwood)
Aconitum species
Coptis teeta
Coscinium Fenestratum (Calumba wood)
Dactylorhiza hatagirea
Gentiana kurroo (Kuru, kutki)
Gentum species
Kamphergia galenga
Nardostachys grandiflora
Panax pseudoginseng
Picrorrhiza kurroa
Swertia chirata (Charayatah)

Major medicinal plant species exported from India

| Plant name | Plant part exported |
|-----------------------------|---------------------|
| <i>Plantago ovata</i> | Seed and husk |
| <i>Cassia angustifolia</i> | Leaf and pod |
| <i>Rheum australe</i> | Rhizome |
| <i>Inula racemosa</i> | Rhizome |
| <i>Rauwolfia serpentina</i> | Roots |
| <i>Hedychium spicatum</i> | Rhizome |
| <i>Zingiber officinale</i> | Rhizome |
| <i>Colchium luteum</i> | Rhizome and seed |
| <i>Acorus calamus</i> | Rhizome |
| <i>Adhatoda vasica</i> | Whole plant |
| <i>Juglans regia</i> | Bark |
| <i>Punica granatum</i> | Flower, root, bark |
| <i>Barbris aristata</i> | Root |
| <i>Juniperus communis</i> | Fruit |
| <i>J. macropoda</i> | Fruit |
| <i>Heracleum candicans</i> | Rhizome |
| <i>Picrorrhiza kurroa</i> | Root |
| <i>Aconitum species</i> | Root |
| <i>Saussurea lappa</i> | Rhizome |
| <i>Swertia chirata</i> | Whole plant |
| <i>Podophyllum emodi</i> | Rhizome |
| <i>Valeriana wallichii</i> | Rhizome |

(Source : Handa 1992.)

- Medicinal plants having export potential

Plantago ovata (Isabgul), *Catharethus rosea* (SadaBahar), *Aloe vera*, *A. barbadensis* (Kumari), *Garcinia cambogia* (Kokum), *Gymnema sylvestre* (Madhunasi), *Ocimum sanctum* (Tulsi), *Picrorrhiza kurroa* (Kutki), *Phyllanthus nirula*; *Pamarus* (Bhumianalaki), *Holarrhena pubescens* (Kutaja).

- Species banned for export.

The Director Genral, Foreign Trade (DGFT) under the foreign Trade Development Act-1992 prohibits the export of the following :

Aconitum sp., *Aquilaria malaccensis*, *Ceropegia sp.*, *Coptis teeta*, *Consciniuim fenestratum*, *Cyathea sp.*, *Cycas beddomei*, *Dactylorhiza hatagirea*, *Dioscorea deltaidea*, *Frereia indica*, *Gentiana kurroa*, *Gnetum sp.*, *Kaempferia galanga*, *Nardostachys jatamansi*, *Nepenthes khasiana*, *Orchidaceae sp.*, *Panax pseudoginseng*, *Paphiopedilium sp.*, *Picrorhiza kurroa*, *Podophyllum hexadrum*, *Pterocarpus santalinus*, *Rauwolfia serpentina*, *Renauthera imschootiara*, *Saussurea costus*, *Swertia chirata*, *Taxus wallichiana*, *Vanda coerulea*.

• Collection strictly banned in Uttaranchal

Paris polyphylla, *Nardostachys jatamansi*, *Microstylis muscifera*, *Lilium polyphyllum*, *Habenaria intermedia*, *H. edgeworthii*, *Gentiana kurroa*, *Frillilaria royleu*, *Eulophia dabia*, *Dactylorhiza hatagirea*, *Arenebia benthamii*, *Juglans regia* (Akhrot), *Aconitum heterophyllum* (Alees), *Acorus calamus* (Bach), *Podophyllum hexandrum* (Bankakri), *Viola serpens* (Banafsha), *Swertia chirata* (Chirayata), *Jurinea sp.* (Dhop jad), *Dioscorea sp.*, *Rheum emodi* (Dolis), *Angelica glauca* (Gandrayan), *Stephania glabra* (Ginjari), *Morechella esculenta*, *Myrica esculenta* (Kaiphah), *Lilium heterophyllum* (Kakolisir), *Berberis aristata* (Kilmora), *Picrorhiza kurroa* (Kutki), *Malaxis muscifera* (Lahusunia), *Polygonatum cirrhifolium* (Mahamaida), *Aconitum ferox* (Meetha), *Skimmia laurata* (Nairpati), *Didymoparpus pedicellate* (Patharlong), *Onosma sp.* (Ratanyot), *Hebenaria intermeda* (Ridhi-vridhi), *Eulophia campestris* (Salam mishri), *Velleriana wallichi* (Sameva), *Ephedra Gerardiana* (Somlata), *Taxus baccata* (Thuer).

Table 7.6 : Medicinal Plants in Short Supply

| Botanical Name | Common Name | Quantity required (Tonnes/ annum) | Period of shortage of supply (Years) |
|---------------------------------|----------------|-----------------------------------|--------------------------------------|
| | Ashtvarga | 0.095 | 23 |
| <i>Acacia catechu</i> | Khair chhal | 2.40 | 5 |
| <i>Aconitum heterophyllum</i> | ativisha | 0.55 | 15 |
| <i>Alpinia galanga</i> | Kosthakulinjan | 0.22 | 4 |
| <i>Aquilaria agallocha</i> | Krishnageru | 0.17 | 12 |
| <i>Artemisia maritima</i> | Kimani ova | 0.33 | 5 |
| <i>Artocarpus heterophyllus</i> | Phanas ambe | 0.055 | 5 |
| <i>Baliospermum montanum</i> | Dantimool | 0.32 | 3 |
| <i>Berberis aristata</i> | Daruhaldi | 2.70 | 6 |
| <i>Cedrus deodara</i> | Devdar | 2.20 | 10 |
| <i>Commiphora wightii</i> | Guggul | 2.30 | 5 |
| <i>Convolvulus arvensis</i> | Harenvel | 0.156 | 6 |
| <i>Curculigo orchioides</i> | Kalimusli | 2.25 | 4 |
| <i>Curcuma zedoaria</i> | Kapurkachri | 0.225 | 5 |
| <i>Dioscorea bulbifera</i> | Dukkarkand | 0.175 | 7 |
| <i>Embelia ribes</i> | Vaidang | 3.40 | 3 |
| <i>Gentiana kurroo</i> | Triman | 0.22 | 4 |
| <i>Hemidesmus indicus</i> | Chavak | 1.20 | 3 |
| <i>Indula racemosa</i> | Pokharmool | 0.65 | 6 |
| <i>Mallotus phillippinensis</i> | Kapila | 0.155 | 12 |
| <i>Mesua ferrea</i> | Nagkesar kala | 0.65 | 6 |
| <i>Myrica esculenta</i> | Kaiphal | 0.225 | 5 |
| <i>Myristica fragrans</i> | Jaiphal | 0.33 | 3 |
| <i>Nardostachys grandiflora</i> | Jatamansi | 0.66 | 5 |
| <i>Nelumbo nucifera</i> | Kamalphool | 0.31 | 8 |
| <i>Picrorrhiza kurroa</i> | Kutaki | 1.55 | 5 |
| <i>Piper cubeba</i> | Kankol | 0.335 | 5 |
| <i>Piper longum</i> | Pippali | 1.25 | 5 |
| <i>Piper longum</i> | Pippalmool | 0.85 | 5 |
| <i>Piper nigrum</i> | Shvet miri | 0.09 | 13 |
| <i>Pistacia chinensis</i> | Kakdashingi | 0.45 | 10 |
| <i>Plumbago zeylanica</i> | Chitrak tal | 3.50 | 5 |
| <i>Pterocarpus santalinum</i> | Raktchandan | 1.025 | 18 |
| <i>Rubia cordifolia</i> | Manjishtha | 1.15 | 4 |
| <i>Saraca indica</i> | Ashok chhal | 6.80 | 4 |
| <i>Saussurea lappa</i> | Koshtha | 0.43 | 5 |
| <i>Smilax china</i> | Chopchini | 0.55 | 5 |

contd...

Table 7.6 – contd...

| Botanical Name | Common Name | Quantity required (Tonnes/ annum) | Period of shortage of supply (Years) |
|-------------------------------|--------------|-----------------------------------|--------------------------------------|
| <i>Solanum indicum</i> | Motiringani | 1.15 | 5 |
| <i>Swertia chirata</i> | Kirata | 2.50 | 7 |
| <i>Tecoma undulata</i> | Raktrida | 0.30 | 6 |
| <i>Valeriana wallichii</i> | Tagar | 0.275 | 5 |
| <i>Vetiveria zinzanioides</i> | Vala | 1.15 | 4 |
| <i>Wagatia spicata</i> | Vakeri bhate | 0.12 | 4 |
| <i>Wrightia tinctoria</i> | Andrajava | 0.418 | 5 |

The data refers to Sandu Brothers, Mumbai, Who are manufacturers

Source: Planning Commission 2000

Table 7.7 : Estimation of Raw Material Demand of Threatened Species

| Notified species | Annual consumption (kg.) |
|--------------------------|--------------------------|
| Aconitum species | 11,671 |
| Acorus species | 109,760 |
| Aquilaria malaccensis | 48,599 |
| Artenesia species | 795 |
| Atropa species | 1,629 |
| Aristolochia species | 6,459 |
| Colchicum luteum | 1,637 |
| Coscinum fenestratum | 3,300 |
| Costus speciosus | 2,186 |
| Commiphora wightii | 68,383 |
| Didymocarpus pedicellata | 1,527 |
| Ephedra species | 84 |
| Gloriosa superba | 1,414 |
| Hyoscyamus niger | 1,055 |
| Hydnocarpus species | 72,645 |
| Orchidaceae species | 1,438 |
| Pterocarpus santalinus | 15,873 |
| Nardostachys grandiflora | 14,228 |
| Rheum emodi | 235 |
| Rauwolfia serpentina | 11,083 |
| Strychnos potatorum | 23,425 |
| Swertia chirata | 23,185 |
| Taxus baccata | 23,636 |

China may Pip India in Race for US Drug Market

China is fast catching up and may soon overtake India in the number of DMFs (drug master fillings) to the US Food and Drug Administration. The number of DMF fillings being made by Chinese players has started picking up, and is growing at a fast pace.

DMFs refer to the submission of data that includes technical, clinical and safety information about an API (Active Pharmaceutical Ingredient) to US FDA, and are followed by the abbreviated new drug application (ANDA) filling.

The data submitted by the companies is reviewed by US FDA and only after the companies get an approval from the authority can their active pharmaceutical ingredients be marketed in US. In the first half of 2005, China's share in the total new filling to US FDA was nearly 9% with 37 new filling during the period, up from a share of 8.1% for last year (49 filings).

The pace at which the filling have been growing over the past two years is something to look out for, industry analysts stated. It will soon be filing for ANDA or abbreviated new drug application in US FDA, which is the next step after DMFs, they added.

Commenting on the pace of DMFs by China, Dr. Swati Piramal, director (strategic alliances & communications), Nicholas Piramal India said: "Yes it is fast and something to watch out for".

There has also been a surge in the number of fillings by Indian Companies, with India's share of new filling at around 33% in the first half of this year. Last year, the share was 32.8% with 198 new fillings. Over the last couple of years, several second/third tier companies have aggressively scaled up their ANDA/DMF fillings the US market.

While China may yet trail behind India on issues of quality, chemistry skills and regulatory issues, analysts believe that the gap is likely to narrow going forward, especially in basic products that do not involve advanced chemistry knowledge, experts pointed out.

Meanwhile, there is a section within the industry which felt otherwise. Ramesh Adige, executive director of Ranbaxy Laboratories, said: "The Indian pharma industry is miles ahead in

its new fillings and China is just about getting there. I believe this gap will sustain for another five years."

Nimish Mehta, assistant VP (research) Edelweiss Capital, felt that though China has shown an increase in DMF fillings, it is not very major. "This is because Indian companies are targeting companies whose patents are expiring so these are relevant, which may not be the case in the former country," he said.

Major Indian Plant entering Global Commerce

| Scientific Name | Scientific Name |
|------------------------------|--|
| <i>Acorus calamus</i> | <i>Panax</i> sp. |
| <i>Agave sisala'na</i> | <i>Rheum</i> sp. |
| <i>Aloe vera</i> | <i>Saussaria</i> sp. |
| <i>Aloe</i> sp. | <i>Dicorhiza</i> sp. |
| <i>Ammi majas</i> | The following have pretty high demand |
| <i>A. visnaga</i> | |
| <i>Atropa acuminata</i> | <i>Tinospora cordifolia</i> |
| <i>Atropa belladonna</i> | <i>Pulchea macniosa</i> |
| <i>Berberis vulgaris</i> | <i>Asparagus racemosus</i> |
| <i>Catharanthus roseus</i> | <i>Centella asiatica</i> |
| <i>Datura metel</i> | <i>Cassia angustifolia</i> |
| <i>D. stramonium</i> | <i>Terminalia chebula</i> |
| <i>Digitalis</i> sp. | <i>Aloe vera</i> |
| <i>Ephedra</i> sp. | <i>Withania sommifera</i> |
| <i>Derboisia</i> sp. | <i>Acontium balfourin</i> |
| <i>Glycyrriliza glabra</i> | <i>A.dienorrhizum</i> |
| <i>Hyoscyanus niger</i> | <i>A. falconeri</i> |
| <i>Papavar sommiferum</i> | <i>A. ferox</i> |
| <i>Rawalfia serpentina</i> | <i>A. heterophyllum</i> |
| <i>R. tetraphylla</i> | <i>A. violaceum</i> |
| <i>Rheum emodi</i> | <i>Acorus calamus</i> |
| <i>R. officinalis</i> | <i>Aguilaria malacensis</i> |
| <i>Swertia chirata</i> | <i>Angelica glauca</i> |
| <i>Taxus baceata</i> | <i>Atropa acuminata</i> |
| <i>Wrginea maritima</i> | <i>Berberis khahmiriana</i> |
| <i>Valeriana officinalis</i> | <i>Swertia chirata</i> |
| <i>V. wallichii</i> | <i>Saussaria</i> sp. |
| <i>Curcuma</i> sp. | <i>Polygonatum</i> sp. |
| <i>Gentiana</i> sp. | <i>Rauwalfia</i> sp. |
| <i>Inula</i> sp. | <i>Dioscorea</i> sp. |
| <i>Ilex khasianum</i> | Vulnerable species |
| <i>Podophyllum</i> sp. | |
| <i>Coptis teeta</i> | <i>Berberis</i> sp. |
| <i>Angelica glance</i> | <i>Curculigo</i> sp. |
| <i>A. benthami</i> | <i>Hedycium</i> sp. |
| Endangered species | <i>Paeoni</i> sp. |
| | <i>Rheum</i> sp. |
| <i>Beberis</i> sp. | <i>Clerodendrum</i> sp. |
| <i>Herecleum</i> sp. | |

Chapter Eight

Status Assessment of Tree Flora

There is definitely some discrepancy about the number. But herbs definitely surpass the number of trees and also in their quality and efficacy; it has been mentioned that herbs have at least four times the number of tree species in their occurrence. Similar study on herb and shrub flora should be the first step to assess their status.

In this chapter the author has picked up results of inventory of trees of some states which have commercial values mostly (not specifically having medicinal properties). The purpose is to record the depth of work of the foresters on the status of tree species. In this report the occurrence of trees per hectare only has also been mentioned. One can assess the exact status of each species having known the area of occurrence, type of forests and the area coverage.

For example the occurrence and status of some trees having medicinal values can be assessed from the data presented.

Quantitative Status (density per hectare) Assessment of Tree Flora made by Forest Survey of India, (FSI):

While no statistical-base quantitative assessment of herb/shrub/climber flora which form 90 per cent of medicinal of India, has been done on a wide and acceptable scale, the FSI, has already done extensive and intensive work on such assessment of tree flora all over the country for the last 35 years.

On the basis of this survey it is possible to evaluate the status of a species in a particular area. Such figures also show the valverability/rarely/or the exact status of a species.

Only a few examples are presented as floras (figures relates to 1970s and 1980s).

West Bengal:**a) Darjeeling Hills of West Bengal:**

A token survey was carried out in Singalila area and following species were listed:

| | |
|--------------------------------|---------------------|
| <i>Rhododendron</i> sp. | 67.40 stems per ha. |
| <i>Lithocarpus pachyphylla</i> | 24.00 stems per ha. |
| <i>Tsuga dumosa</i> | 20.50 stems per ha. |
| <i>Castanopsis</i> sp. | 17.70 stems per ha. |
| <i>Abies densa</i> | 14.50 stems per ha. |
| <i>Lithocarpus lineata</i> | 12.50 stems per ha. |
| <i>Acer campbellii</i> | 5.00 stems per ha. |

Other species are – *Alnus nepalensis*, *Simingtonia populnea*, *Cinnamomum* sp. etc.

b) Kalimpong Hills of West Bengal:

According to a token survey carried out over small area the following species were listed.

| | |
|--------------------------------|------------------|
| <i>Machilus gammieana</i> | 22stems per ha. |
| <i>Lithocarpus lineata</i> | 15stems per ha. |
| <i>Alchimondra cathcartii</i> | 15 stems per ha. |
| <i>Lithocarpus pachyphylla</i> | 10 stems per ha. |
| <i>Nyssa javonica</i> | 9 stems per ha. |
| <i>Castanopsis</i> sp. | 8 stems per ha. |
| <i>Acer campbellii</i> | 8 stems per ha. |
| <i>Cinnamomum</i> sp. | 8 stems per ha. |
| <i>Lithocarpus lamellosa</i> | 7 stems per ha. |

Overall density per hectare is 275 trees.

c) Purulia District of West Bengal:

The forests of purulia district grow over barren red lateritic soil, 80% of the crop are of 5 cm. to 9 cm. diameter

| | |
|-----------------------------|----------------------|
| <i>Shorea robusta</i> | 232 stems per ha. |
| <i>Terminalia tomentosa</i> | 23.750 stems per ha. |

| | |
|--------------------------------|--------------------------|
| <i>Semecarpus anacardium</i> | 17.000 stems per ha. |
| <i>Mallotus philippinensis</i> | 15.750 stems per ha. |
| <i>Diospyros</i> sp. | 36.5867.40 stems per ha. |
| <i>Holarrhena</i> sp. | |
| <i>Pterocarpus marsupium</i> | |

Miscellaneous Stratum:

| | |
|----------------------------------|--------|
| <i>Holarrhena antidysentrica</i> | 41.059 |
| <i>Anogeissus latifolia</i> | 13.16 |
| <i>Bauhinia purpurea</i> | 9.73 |
| <i>Cochlospermum gossypium</i> | 10.00 |
| <i>Lanea coromendelica</i> | 17.89 |
| <i>Mallotus philippinensis</i> | 36.58 |
| <i>Terminalia tomentosa</i> | 51.06 |
| <i>Shorea robusta</i> | 43.32 |
| <i>Embllica officinalis</i> | 13.16 |
| <i>Pterocarpus marsupium</i> | 10.26 |
| <i>Gmelina arborea</i> | 8.94 |
| <i>Saccopetalum tomentosa</i> | 7.30 |
| <i>Croton oblongifolius</i> | 6.84 |
| <i>Buchanania lanzan</i> | 5.79 |

Sikkim State

Figures of south Western Sikkim are only available:

Prime species are: *Symplocos theifolia*, (Frequency occurrence is 90, and stems per ha. is 69); has the maximum density, this species is of immense medicinal value of importance (Frequency given in the brackets.).

Species are *Castanopsis* sp. (Fr. Oct.90, and 13 Stems/ha.) *Machilus odorattissima* (F-66 and 8/ha). *Eurya Japonica* (F-80 8/ha.) *Macaranga* sp. (F-28,7/ha.), *Lithocarpus lamellosa* (*Quercus*). *Acer campbellii* (F-50, 8/ha.), *Litsaea* sp. (F-90,3/ha.), *Machilus gammeana* (F-70).

Bihar State (Sal bearing tract):

Survey area 53,000 km. In Chhotanagpur hills.

Forest type 4 : 5 BC, (C)-Northern Tropical Dry peninsular Sal forests. Stems per hectare:

| | |
|------------------------------|--|
| Sal (poor quality) | 450 Stems/ha. (In Sal Forests) |
| <i>Boswellia serrata</i> | 22/ha. (In Sal Forests). 111/ha. (In <i>Boswellia</i> forests). |
| <i>Acacia catechu</i> | 132/ha. (In <i>Acacia</i> forests). |
| <i>Miscellaneous species</i> | 63/ha. |

Species are *Terminalia tomentosa*, *Anogeissus latifolia*, *Lannea coromandelica*, *Buchanania lanzan*, *Syzygium cumini*, ficus species, *Diospyros melanoxylon*, *Ougenia oojeinensis*, *Boxbax ceiba*, *Madhuca latifolia*, *lagerstroemia parviflora*, *Adina cordifolia*, *Butea monosperma*, *Schleighera oleosa* and *pterocarpus marsupium*.

Melghat Forests of Maharashtra State:

These forests are close to the forests of Akola, Buldhana of Nimar and Belul districts of Madhya Pradesh.

The forests fall under southern tropical Dry Deciduous Teak type (5A/C1b) and southern tropical Dry Mixed Deciduous forest type (5A/C₃) as per Champion and Seth's forest Types of India. Teak forests occur extensively with *Dendrocalamus* as understorey, where *Dendrocalamus* is absent *Lantana* and *Cymbopogon martini* and other tall grasses from the ground vegetation.

Melghat Tiger Reserve:

Quantitative survey carried out by Forest Survey of India and Tiger Project authorities, shows the occurrence of 277 trees per. ha. dominant sp. as follows:

High Frequency (%) species are:

| | |
|----------------------|----|
| <i>Tectona</i> | 10 |
| <i>Anogeissus</i> | 70 |
| <i>Lagerstroemia</i> | 70 |
| <i>Wrightia</i> | 6 |
| <i>Emblica</i> | 60 |

| | |
|----------------|----|
| Dalbergia | 10 |
| Flacourtia | 60 |
| Boswellia | 60 |
| Acacia catechu | 70 |
| Bamboo | 50 |

Southern Tropical Dry Deciduous forests: (Average ht.20.27 m.).

Some species are:

| | |
|----------------------|--------------------------|
| Tectona grandis | Lanea coromendelica |
| Terminalia tomentosa | Qugenia oojeinensis |
| Wrightia tinctoria | Cassia fistula |
| Bauhinia racemosa | Terminalia belerica |
| Mitragyna parviflora | Schleichera oleosa |
| Casaeria elliptica | Zizyphus xylopyra |
| Garuga pinnata | Boxbax ceiba |
| Flacourtia indica | Lagerstroemia parviflora |
| Embllica officinalis | Anogeissus latifolia |
| Boswellia serrata | Acacia sundra |
| Miliusa tomentosa | Terminalia Arjuna |
| Madhuca latifolia | Adina cordifolia |
| Albizzia procera | Chloroxylon swietenia |
| Grewia lilaefolia | Diospyros melanoxylon |
| Bridelia retusa | Sherbera swietenoides |

Some Species of Woody climbers are:

| | |
|-----------------------|------------------------|
| Butea superba | Millettia auriculata |
| Celastrus paniculatus | Zizphus rugosa |
| Capparis zeylanica | Cayratia auriculata |
| C. trifolia | Dregea vollubilis |
| Hemidesmus indicus | Mucuna prurita |
| Bauhinia vahlii | Pueraria tuberosa |
| Combretum ovalifolium | Acacia pinnata |
| Cissampelos pariera | Ampelocissus latifolia |
| Cissia repanda | Canavalia gladiata |
| Crytolepts buchanani | Argyreia sericea |

Some herbs are (of Melghat):

| | |
|---------------------------------|--------------------------------|
| <i>Cleome viscosa</i> | <i>Triumfetta pentandra</i> |
| <i>T. rhomboidea</i> | <i>Bioshytum sensitivum</i> |
| <i>Cardiopermum helicacabum</i> | <i>Polygala elongata</i> |
| <i>Hybanthus aspaspermus</i> | <i>Bidens biternata</i> |
| <i>Spoubia delphinifolia</i> | <i>Hemigraphis latebrosa</i> |
| <i>Rungia elegans</i> | <i>Lavendula burmanii</i> |
| <i>Galinsoga parviflora</i> | <i>Cryptolepis buchamani</i> |
| <i>Ipomoea quomoclii</i> | <i>Argyreia sericea</i> |
| <i>I. pestigris</i> | <i>J. obscura</i> |
| <i>Crinum sp.</i> | <i>Euphorbia prunifolia</i> |
| <i>Urena lobata</i> | <i>Chlorophyllum tuberosum</i> |
| <i>I. laxiflorum</i> | <i>Desmodium gangeticum</i> |
| <i>Pogostemon bengalensis</i> | <i>Orthosiphon rubicundus</i> |
| <i>S. alba</i> | <i>Sida acuta</i> |
| <i>Leea edgworthii</i> | <i>S. orientalis</i> |
| <i>P. monoica</i> | <i>Pinpinela lateriflora</i> |
| <i>S. stricta</i> | <i>Spermacoca hispida</i> |
| <i>Lepidagathis cristatia</i> | <i>Dipteracanthus patulus</i> |
| <i>Conyza stricta</i> | <i>L. trinervis</i> |
| <i>Hemidesmus indicus</i> | <i>Tridax procumbens</i> |
| <i>Achyranthes aspera</i> | <i>Trichodesma indicum</i> |
| <i>Phyllanthus debilis</i> | <i>Celocia argentea</i> |
| <i>Habenaria platyphylla</i> | <i>P. virgatus</i> |
| <i>D. hispida</i> | <i>Dioscorea belophylla</i> |
| <i>D. pentaphylla</i> | <i>D. bulbifera</i> |
| <i>Plectranthus rugosus</i> | <i>Uraria refescens</i> |
| <i>Anisomeles indica.</i> | |

Some herbs growing in Agricultural lands (Melghat):

| | |
|--------------------------|---------------------------|
| <i>Argemone mexicana</i> | <i>Sida acuta</i> |
| <i>Cassia fumila</i> | <i>Spermacoce stricta</i> |

| | |
|---------------------|----------------------------|
| Ageratum conyzoides | Lansea procumbens |
| Vernonia sp. | Echinostemma hyssopifolium |
| Solanum migrum | Justicia simplex |
| Leucas cephalotes | Celocia sp. |
| Phyllanthus sp. | Merdania nudiflora |
| Hibiscus lobatus | Psoralea corylifolia |
| Aminania baccifera | Oldenlandia corymbosa |
| Caesulia axillaries | Tridax sp. |
| Mollugo pentaphylla | Merremia gangetica |
| Striga angustifolia | lepidagathis cristata |
| Achyranthes sp. | Euphorbia sp. |

Some Shrubs (Melghat) are :

Lantana camara, sida-5 sp., *Grewia*-5 sp., *Alysicarpus*-8 sp., *Bhima*-6 sp. *Justicia*-5 sp. *Leucas*-6 sp., *Commelina*-5 sp. *Commelina*-5 sp., *Flimbristylis*-6 sp., *eragrostis*-9 sp. *Desmodium*-5 sp., *Indigofera*-8 sp., *Bauhinia*-5 sp. *Cassia*-7 sp., *Ipomoea*-10 sp., *Euphorbia*-6 sp., *Ficus*-7 sp., *Cyperus*-7 sp. *Brachiaria*-5 sp.

| | |
|--------------------------------|-------------------------------|
| <i>Echinochloa frumentacea</i> | <i>Paspalidium flavidum</i> |
| <i>P.scrobiculatum</i> | <i>Brachiaria enciformis</i> |
| <i>Coix aquatica</i> | <i>Eleusine aegyptica</i> |
| <i>Eragrostis ciliaris</i> | <i>E. tenalla</i> |
| <i>Setaria intermedia</i> | <i>S. pallidaefusca</i> |
| <i>Apluda mutica</i> | <i>Themeda quadrivalvis</i> |
| <i>Chloris dolichostachys</i> | <i>Panicum miliare</i> |
| <i>Eleusine coracana</i> | <i>Setaria italica</i> |
| <i>Chloris mirgata</i> | <i>Cynodon dactylon</i> |
| <i>Echinochloa colona</i> | <i>Iseilema laxum</i> |
| <i>Sporobolus diander</i> | <i>Heteropogon contortus</i> |
| <i>Schmia nervosum</i> | <i>Capillipidium assimele</i> |

Some Trees of Mewasi, Maharashtra:

The forests of Mewasi fall under southern Dry Deciduous forests, according to Champion and Seth's Classification of forest

types; Where *Tectona grandis* predominates. But there are wide areas, where miscellaneous crop predominates with a small proportion of Teak.

Stems per ha. Of different species, in the 3(three) categories of forests are latulated below:

Table 8.1

| Species | No. of stems per hectare | | |
|---------------------------------|--------------------------|---------------|--------------|
| | Teak & Misc Forests | Misc. Forests | Teak Forests |
| <i>Tectona grandis</i> | 24.6 | 5.1 | 36.8 |
| <i>Terminalia crenulata</i> | 9.0 | 10.5 | 6.3 |
| <i>Pterocarpus marsupium</i> | 2.3 | 0.5 | - |
| <i>Dalbergia latifolia</i> | 4.3 | 1.4 | 3.6 |
| <i>Qugenia oodienensis</i> | 2.6 | 3.1 | 2.13 |
| <i>Diospyros melanoxylon</i> | 3.3 | 0.5 | 3 |
| <i>Bridelia refusa</i> | 5.3 | 2.8 | 1.0 |
| <i>Anogeissus latifolia</i> | 11.6 | 3.1 | 8.5 |
| <i>Lagerstroemia parviflora</i> | 5.9 | 2.5 | 3.6 |
| <i>Boswellia serrata</i> | 5.3 | 3.7 | 4.2 |
| <i>Lannea coromandelica</i> | 12.6 | 4.2 | 6.3 |
| <i>Garuga pinnata</i> | 5.0 | 3.7 | 0.8 |
| <i>Schleichera oleosa</i> | 4.3 | 0.5 | 0.4 |
| <i>Terminalia belerica</i> | 1.9 | 3.1 | 0.4 |
| <i>Adina cordifolia</i> | 2.6 | 0.5 | 1.0 |
| <i>Mitragyna parviflora</i> | 1.3 | 2.5 | 0.4 |
| <i>Albizia procera</i> | 0.6 | 0.8 | - |
| <i>Butea monosperma</i> | 15.0 | 16.5 | 6.3 |

Other Inventory Results in Arunachal Pradesh

The forests have been thoroughly surveyed in the eastern and western districts. The survey shows a rich assemblage of species of moderate density. The area, however, has been suffering depletion due to shifting cultivation and large scale Army settlements.

(a) East Kameng District:

Broad-leaved stratum: 168 economically important species have been identified (229 trees per hectare). Occurrence of species per hectare are furnished below:

Nepal (Western)

Table 8.2 : Stems/ha. of Important Species in different Forest types

| Species | Forest types | | | | | |
|--|----------------|----------------|--------------------|--------------------------------|-------------------------------|------------------------------|
| | Chir | KIL Deodar | Firspruce Tsuga | Conifers mixed with H.W. | High level broad leaved | Low level broad leaved |
| Chir (<i>Pinus oxburghii</i>) | 109.136 | - | - | - | - | - |
| Kail (<i>Pinus allichiana</i>) | 0.021 | 214.228 | 15.015 | 31.672 | 1.975 | - |
| Deodar (<i>Cedrus deodara</i>) | - | 2.532 | - | - | - | - |
| Fir (<i>Abies pindrow</i>) | - | 4.630 | 132.862 | 33.183 | 3.094 | - |
| Spruce (<i>picea smithyana</i>) | - | 6.622 | 18.223 | 13.246 | 0.399 | - |
| Tsuga (<i>Tusga dumosa</i>) | - | 4.630 | 6.506 | 8.450 | 0.211 | - |
| Thuner (<i>Taxus baccata</i>) | - | - | 19.165 | 5.325 | 1.824 | - |
| Cyprus (<i>surai</i>)(<i>Cupressus toralosa</i>) | - | 5.6958 | 34.001 | - | - | - |
| Allo oaks (<i>Quercus sp.</i>) | 6.040 | 35.254 | 24.807 | 43.335 | 125.997 | 0.693 |
| Bhojpatar (<i>Betula sp.</i>) | - | 9.461 | 30.381 | 22.808 | 8.970 | - |
| Kanjai (<i>Bischofia javanica</i>) | - | - | 3.638 | 56.584 | 3.232 | - |
| Sai (<i>shorea robusta</i>) | 5.298 | - | - | 23.644 | 0.080 | 178.580 |
| Sain (<i>Terminalia sp.</i>) | - | - | - | 2.060 | - | 21.631 |
| Dhawra | - | - | - | 0.501 | - | 25.638 |
| Up land hardwoods | 17.882 | 16.992 | 56.248 | 45.651 | 237.572 | 10.718 |
| Low land hardwoods | 11.623 | - | - | 4.786 | 3.130 | 166.784 |
| Total conifers | 109.157 | 238.300 | 225.772 | 114.429 | 8.988 | 8.862 |
| Total broad leaved | 40.843 | 61.707 | 115.074 | 149.369 | 379.001 | 404.044 |
| Grand total | 150.000 | 300.007 | 340.846 | 263.798 | 387.989 | 412.906 |

Castanopsis indica \ *Castanopsis* sp.-14.108, *Altingia excelsa*-7.233; *Ficus* dp.-6.566; *Quercus* sp.-6.464; *Sygygium* sp.-6.361; *Alnus nepalensis*-4.668; *Canarium* sp. 4.66; *Macaranga indica*-4.412; *Dysoxylum binecteriferum* 4.104; *Amoora* sp.-2.719; *Canarium resiniferum*-2.616; *Magnolia* sp. 2,462; *Trema orientalis*-2.360; *Engelhardtia spicata*-2.155; *Michelia*, sp. -4.925.

Bamboo startum: 9 species are prominent e.g.,- *Castanopsis*, *Altingia*, *Bischofia*, *Macaranga*, *Sterculia*, *Quercus Aostonia*, *Michelia*, *Sehia* (Per hectare occurrence of each species is between 2 to 3).

Altogether 168 species of trees have been recorded along with their occurrence per hectare. Of these species most widely occurring trees have been depicted. The occurrence of *Ficus*, *Gmelina*, *Glochidion*, *Artocarpus*, *Antidesma*, *Cordia*, *Dillenia*, *Dysoxylum*, *Erythrina*, *Eugenia*, *Terminalia* species and species of several other trees indicate a bio-ecological bonanza for bird and animal fauna to survive.

(b) West Kemeng District:

The surveyed area represents many tree species. About 39.438 stems per hectre have been left unidentified. The area commands a beautiful landscape having about 35.756 stems of *Rhododendron* per hectare. Besides, the occurrence of *Terminalias* (3.779), *Eurya* (5.394), *Acer*, *Betula*, *Amoora*, *Canarium*, *Aquillaria*, *Castanopsis*, *Ehretia*, *Carya*, *Eriobotrya*, *Eugenia*, *Feronia*, *Ficus Gmelina*, *Juglans*, *Machilus*(5.943), *Magnolia*, *Michelia* (3.325), *Morus*, *Myristica*, *Spondius* etc. species make the area biologically very interesting.

Boadcleaved stratum: (Number of stems per hectare is 223. 678).

| | | | |
|---------------------------------|-------|------------------------------|--------|
| <i>Phoebe</i> sp. | 3.359 | <i>Quercus griffithii</i> | 13.631 |
| <i>Acer</i> sp. | 2.972 | <i>Quercus lineata</i> | 4.490 |
| <i>Schima wallichii</i> | 2.972 | <i>Quercus</i> sp. | 16.892 |
| <i>Sygygium cumini</i> | 2.907 | <i>Castanopsis indica</i> | 7.623 |
| <i>Dysoxylum binecteriferum</i> | 2.132 | <i>Abies pindrow</i> | 6.718 |
| | | <i>Alnus nepalensis</i> | 8.491 |
| <i>Eugenia</i> sp. | 2.100 | <i>Eurya japonica</i> | 5.394 |
| <i>Terminalia</i> sp. | 3.773 | <i>Machilus odoratissima</i> | 3.585 |

Tripura State

Most important families are:

| | |
|---------------|-----------------------|
| Fabaceae | 44 genera, 94 species |
| Poaceae | 49 genera, 91 species |
| Rubiaceae | 38 genera, 78 species |
| Euphorbiaceae | 35 genera, 69 species |

Principal tree species (according to percentage) are:

| | |
|----------------------|-----|
| Albizzia procera | 7.3 |
| Vitex peduncularis | 5.2 |
| Bombax ceiba | 1.5 |
| Schima wallichii | 4.4 |
| Dillenia pentagyna | 0.4 |
| Terninalia belerica | 1.4 |
| Gmelina arborea | 2.9 |
| Lannea coromendelica | 4.4 |
| Shorea robusta | 4.5 |
| Artocarpus chaplasi | 1.5 |
| Toona ciliata | 6.0 |

Assam State**a) Evergreen forests:**

| | |
|---------------------------|-------|
| Ammora wallichii | 2.40 |
| Dipterocarpus macrocarpus | 29.50 |
| Shorea assamica | 10.32 |
| Mesua ferrea | 13.24 |
| Mangolio pterocarpa | 7.00 |
| Cinnamomum glanduliferum | 2.17 |
| Vatica lancaefolia | 4.70 |
| Terminalia myriocarpa | 1.60 |
| T. chebula | 4.60 |
| t. belerica | 1.08 |

b) Evergreen forests:

| | |
|--------------------------|-------|
| Kayea assamica | 68.08 |
| Dysoxylum sp. | 6.35 |
| Echinocarpus assamicus | 3.70 |
| Canarium sp. | 4.31 |
| Pterocarpus lancaefolium | 6.25 |
| Mesua ferrea | 2.69 |
| Terminalia chebula | 2.57 |
| Amoora wallichii | 1.50 |

c) Nowgoang area: Stems per hectare are:-

Lagerstoremia speciosa-4.6, Bombax ceiba-2.1, Albizzia procera-3.0, Castanopsis sp.-4.6, Syzygium praecox-1.6, Vitex peduncularis- 1.6, Terminalia belerica-2.6, Lannea coromendelia-2.0, Shorea robusta-5.2, Cassia fistula-6.0, Lagerstroemia speciosa-8.0, E. Parviflora-4.9, Bombx ceiba-2.1, Albizzia procera-2.2, Mansonia dipikae-1.6 Pterospermum acerifolium-1.9, Toona ciliata-2.2, Ulmus lancaefolia 4.0

Nagaland State

North Nagaland:

The forests are of tropical Evergreen and Semi-evergreen with many sub-types, juli forests have patches of bamboo and reeds.

| Types of Forests | No. of stems per ha. |
|--------------------------------------|----------------------|
| Evergreen and Semi-evergreen forests | 205 |
| Pure Bamboo shrubs: | 69 |
| Bamboo and Miscellaneous shrub | 85 |
| Reed strata | 44 |

Principal Species with Stems per hectare:

Dipterocarpus macrocarpus-10.54, Lagerstroemia speciosa-0.09, Gmelina arborea-0.53, Dysoxylum procerum-4.44, Tetrameles nudiflora-0.69, Terminalia belerica - 1.75, Pterospermum lancaefolium - 6.14, Canarium resinifolium - 6.24, Castanopsis indica - 6.58, Terminalia myriocarpa- 1.17, Syzygium

cumini- 2.00, *Vatica lancaefolia* -5.17, *Endospermum chinensis*-2.29, *Magnolia/ Michelia sp.*- 2.29, *Schima wallichii* -2.44, *Phoebe goalparensis*- 0.14, *Shorea assamica*- 6.68, *Mesua ferrea*-6.49, *Artocarpus chaplasha* 0.68, *Bischofia javanica*- 2.78, *Michelia champaca* - 1.70.

Assam State

North Cachar (Cachar hills):

Stems per hectare: (Less common trees):

| | | | |
|--------------------------------|-----|-----------------------------|------|
| <i>Amoora wallichii</i> | 0.1 | <i>Schima wallichii</i> | 6.2 |
| <i>Lagerstoemia parviflora</i> | 3.6 | <i>Phoebe cooperiana</i> | 0.0 |
| <i>Phoebe goalparensis</i> | 0.5 | <i>Mesua ferrea</i> | 0.1 |
| <i>Ailanthus grandis</i> | 0.3 | <i>Dillenia indica</i> | 5.9 |
| <i>Tetrameles nudiflora</i> | 1.1 | <i>Kydia calycina</i> | 2.9 |
| <i>Chukrassia velutina</i> | 0.5 | <i>Garuga pinnata</i> | 2.1 |
| <i>Morus lavaegata</i> | 0.3 | <i>Artocarpus sp.</i> | 1.6 |
| <i>Terminalia sp.</i> | 8.2 | <i>Boxbax ceiba</i> | 0.4 |
| <i>Michelia sp.</i> | 0.3 | <i>Artocarpus lakoocha</i> | 0.8 |
| <i>Gmelina arborea</i> | 2.1 | <i>Adina oligocephana</i> | 1.9 |
| <i>Cinnamomum sp.</i> | 0.1 | <i>Albizia odoratissima</i> | 0.2 |
| <i>Terminalia myriocarpa</i> | 0.0 | <i>Bauhinia sp.</i> | 12.2 |
| <i>Castanopsis indica</i> | 0.9 | <i>Carega arborea</i> | 5.7 |
| <i>Pterospermum</i> | 0.5 | <i>Ficus sp.</i> | 1.5 |

Meghalaya State

This survey pertains to a very small area in the foot hills of Southern slopes where *shorea robusta* occurs. Meghalaya has varied species occurring in Sub-tropical and Sub-temperate climate. Most of the species of medicinal value.

Trees Per hectare

| | | | |
|---------------------------------|--------|-----------------------------|-------|
| <i>Tectona grandis</i> | 135.22 | <i>Terminalia tomentosa</i> | 5.12 |
| <i>Ougenia oojenensis</i> | 13.67 | <i>Anogeissus latifolia</i> | 12.72 |
| <i>Lagerstroemia parviflora</i> | 11.31 | <i>Boswellia serrata</i> | 3.52 |
| <i>Lananea coromendelica</i> | 5.36 | <i>Madhuca latifolia</i> | 1.41 |
| <i>Adina cordifolia</i> | 2 | <i>Mitragyna parviflora</i> | 2.24 |
| <i>Wrightia tinctoria</i> | 13.36 | <i>Grewia tiliaefolia</i> | 7.98 |
| Other species | 62.68 | <i>Shorea robusta</i> | 33.90 |
| <i>Bauhinia sp.</i> | 12.28 | <i>Terminalia sp.</i> | 8.22 |
| <i>Callicarpa sp.</i> | 7.08 | <i>Dillenia indica</i> | 5.97 |

| | | | |
|------------------|------|--------------|-------|
| Schima wallichii | 6.22 | albizzia sp. | 5.83 |
| Careya arborea | 5.75 | Others | 87.75 |

In addition following species have also been recorded:

Broad-leaved stratum-168 economically important species have been identified - (229 trees per hectare). Occurrence of species per hectare are furnished below:

Castanopsis indica/Castanopsis sp. -14.10; altingia excelsa-7.23; ficus sp.-6. 56; quercus sp.-6.46; sygygium sp.-6.361; alnus nepalensis-4.66; Canarium sp. -4.66; Macaranga indica-4.41; Dysoxylum binecteniferum-4.10; amoora sp. -3.33; Calicarpa arborea-3.33; Terminalia myriocarpa- 3.28; Albizzia sp.-2.719; Canarium resiniferum- 2.61; Magnolia sp.-2.46; Trema orientalis -2.36; engelhardtia spicata-2.15; Mesua ferrea-2.15; Michelia sp. -4.92

Bamboo Stratum- 9 species are prominent e.g.,- Castanopsis, Altingia, Bischofia, Macaranga, Sterculia, Quercus Alstonia, Michelia, Schima (per hectare

Altogether 168 species of trees have been recorded alongwith their occurrence per hectare. Of these species most widely occurring trees have been depicted. The occurrence of Ficus, Gmelina, glochidion, Artocarpus, Antidesma, Cordia, dillenia, dysoxylum ,Erythrina, Eugenia, Terminalia species and species of several other tress indicate a bioecological bonanza for bird and animal fauna to survive.

Arunachal State

Lohit and Tirap Forests of Arunachal Pradesh:

Principal species of economic importance are:

Mesua ferrea, Dipterocarpus macrocarpus, shorea assamica, Michelia champaca, amoora wallichii, Mansonia dipikae, Canarium resinifolium, Kydia calycina, Pterospermum acerfolium, Bischofia javanica, Schima wallichii, ailanthus garndis, Gmelina arborea, Treminalia citrina.

Stems per hectare:

| | | |
|-------------------|--------------------------------|---------------|
| Dipterocarpus sp. | Shorea forests | 226 stems/ha. |
| | In mixed miscellaneous Forests | 150 stems/ha. |

| | |
|-----------------|---------------|
| In Lohit forest | 215 stems/ha. |
| In Changlang | 185 stems/ha. |
| Khonsa | 294 stems/ha. |

So far volume per hectare are concerned, *Terminalia myriocarpa*, *Castanopsis* sp., *dillenia indica*, *toona ciliata*, *cinnamomum cecedodaphne* and *chukrasia tabularis* show prominence, besides that of most other principal economic species.

West Bengal State

Kalimpong Hills of West Bengal:

According to a token survey carried out over small area the following species were listed:

| | |
|--------------------------------|--------------|
| <i>Machilus gammieana</i> | 22 stems/ha. |
| <i>Lithocarpus lineata</i> | 15 stems/ha. |
| <i>Alchimundra cathcartii</i> | 15 stems/ha. |
| <i>Lithocarpus pachyphylla</i> | 10 stems/ha. |
| <i>Nyssa javonica</i> | 9 stems/ha. |
| <i>Castanopsis</i> sp. | 8 stems/ha. |
| <i>Acer campbellii</i> | 8 stems/ha. |
| <i>Cinnamomum</i> sp. | 8 stems/ha. |

Meghalaya State

This survey pertains to a very small area in the foot hills of Southern slopes where *shorea robusta* occurs. Meghalaya has varied species occurring in sub-tropical and sub-temperate climate. Most of the species of medicinal value:

Trees per hectare

| | |
|---------------------------------|----------|
| <i>Tectona grandis</i> | 135.2293 |
| <i>Terminalia tomentosa</i> | 5.1211 |
| <i>Ougenia oojeinensis</i> | 13.6774 |
| <i>Anogeissus latifolia</i> | 12.7263 |
| <i>Lagerstroemia parviflora</i> | 11.3199 |
| <i>Boswellia serrata</i> | 3.5248 |
| <i>Lansea coromendelica</i> | 5.3636 |
| <i>Madhuca latifolia</i> | 1.4197 |
| <i>Adina cordifolia</i> | 2.9277 |

| | |
|-----------------------------|---------|
| <i>Mitragyna parviflora</i> | 2.2456 |
| <i>Grewia tiliaefolia</i> | 7.9847 |
| <i>Wrightia tinctoria</i> | 13.3636 |
| Other species | 62.6827 |

In addition following species have also been recorded:

| | |
|-------------------------|-------|
| <i>Shorea robusta</i> | 33.90 |
| <i>Bauhinia sp.</i> | 12.28 |
| <i>Terminalia sp.</i> | 8.22 |
| <i>Callicarpa sp.</i> | 7.08 |
| <i>Dillenia indica</i> | 5.97 |
| <i>Schima wallichii</i> | 6.22 |
| <i>Albizia sp.</i> | 5.83 |
| <i>Careya arborea</i> | 5.75 |
| Others | 87.75 |

Trees presently not under threat:

| | |
|---|---|
| <i>Acacia arabica</i> (Babul) | <i>Aegle marmelos</i> (Boel) |
| <i>Alstonia scholaris</i> (Chatni) | <i>Albizia lebbek</i> (Sirish) |
| <i>Anona squamosa</i> (Atal) | <i>Areca catechu</i> (Supari) |
| <i>Azadirachta indica</i> (Neem) | <i>Anthocephalus chinensis</i> (Kadam) |
| <i>Artocarpus heterophylla</i> (Kanthal) | <i>Anona reticulata</i> (Nona) |
| <i>Bauhinia racemosa</i> (Seta kanchan) | <i>Bauhinia variegata</i> (Rakta kanchan) |
| <i>Bauhinia purpurea</i> (Deba Kanchan) | <i>Bombax ceiba</i> (Semul) |
| <i>Butea monosperma</i> (Palash) | <i>Carica papaya</i> (Papaya) |
| <i>Cassia fistula</i> (amaltus) | <i>Dalbergia sissoo</i> (Sisam) |
| <i>Dipterocarpus sp.</i> (Garjan) | <i>Delonix regia</i> (Krishnachura) |
| <i>Dillenia pentagyna</i> (Tantari) | <i>Eucalyptus tereticornis</i> (Blue gum) |
| <i>Erythrina indica</i> (Madar) | <i>Emblica officinalis</i> (Amloni) |
| <i>Fixus bengalensis</i> (Bat) | <i>Ficus religiosa</i> (Aswathwa) |
| <i>Ficus glomerata</i> (Jagna dumur) | <i>Ficus hispida</i> (Kak dumur) |
| <i>Ficus cunea</i> (Jaya dumur) | <i>Grewia sp.</i> (Phalsa) |
| <i>Holarhena antidysenterica</i> (Kurchi) | <i>Moringa olifera</i> (Sajina) |
| <i>Nyctanthes arbor-tistris</i> (Siwli) | <i>Nerium odorum</i> (Rakta Karabi) |
| <i>Stereospermum personatum</i> (Parari) | |
| <i>Sterblus asper</i> (Seora) | <i>Vitex negundo</i> (Nishinda) |
| <i>Ziziphus sp.</i> (Kul) | <i>Trema orientalis</i> (Kuail) |
| <i>Thespesia populnea</i> (Pipli) | <i>Tamarix sp.</i> (Barha) |
| <i>Toona ciliata</i> (Toon) | <i>Tectona grandis</i> (Teak) |
| <i>Tamarindus indica</i> (Tentul) | <i>Termarindus indica</i> (Arjuna) |

Syzygium cuminii (Kalo jam)
Prosopis cinararia
Diospyros melanoxylon (Kend)

Prosopis spicigera
Putranjiva roxburghii (Putranjiva)

Trees occurring sporadically which may be vulnerable unless felling restricted:

| | |
|--|--|
| <i>Acacia Suma</i> (Somi) | <i>Acacia catechu</i> (Khair) |
| <i>Ailanthus excelsa</i> (Mahanimba) | <i>Anacardium occidentale</i> (Kaju) |
| <i>Anogeissus latifolia</i> (Dhaw) | <i>Bassia latifolia</i> (Mahua) |
| <i>Boswellia serrata</i> (Salai) | <i>Capparis deciduas</i> |
| <i>Citrus sp.</i> | <i>Careya arborea</i> (Kumbi) |
| <i>Gmelina arborea</i> (Gamar) | <i>Feronia elephantum</i> |
| <i>Flacourtia sepiaria</i> | <i>Hopea odorata</i> |
| <i>Hydnocarpus sp.</i> (Chalmugra) | <i>Melia azadirach</i> (Goraneem) |
| <i>Michelia Montana</i> (Champ) | <i>Michlia niligerica</i> (Champ) |
| <i>Mahonia nepalensis</i> | <i>Oroxylum indicum</i> (Sona) |
| <i>Ougenia oojeinensis</i> (anjan) | <i>Premna sp.</i> (Ginari) |
| <i>Phoenix sp.</i> (Khejur) | <i>Pongamia pinnata</i> (Karanj) |
| <i>Pterygota alata</i> (Narikeli) | <i>Terminalia chebula</i> (Haritaki) |
| <i>Spondius mangifera</i> | <i>Salix tetrasperma</i> |
| <i>Knema augustifolia</i> | <i>Kigelia pinnata</i> |
| <i>Mellotus philippinensis</i> (Rohini) | <i>Morus alba</i> (Tut) |
| <i>Polyalthia semiarum</i> (Labsi) | <i>Bischofia javanica</i> (Kanjal) |
| <i>Aglaiia roxburghii</i> | <i>Adansonia digitata</i> (Kalpataru) |
| <i>Mangium salvaefolium</i> | <i>Artocarpus lakoocha</i> (Dewa) |
| <i>Barringtonia acutaugula</i> (Hizal) | <i>Crataeva nurvula</i> (Barin) |
| <i>Lannea coromendelica</i> (Jeol) | <i>Symplocos racemosa</i> (Lodhra) |
| <i>Trewia nudiflora</i> (Pitali) | <i>Flacourtia catafracta</i> (Baichi) |
| <i>Ochrocarpus longifolius</i> | <i>Garuga pinnata</i> (Giga) |
| <i>Disoxylum hamiltonii</i> (Gab) | <i>Cordia dichotoma</i> (Bahanari) |
| <i>Evodia Lunnuankenda</i> | <i>Evodia fraxinifolia</i> |
| <i>Diospyros embriopteris</i> (Gab) | <i>Mesua ferrea</i> (Nageswar) |
| <i>Michelia champaca</i> (Champ) | <i>Antiaris toxicaria</i> |
| <i>Boswellia serrata</i> (Salai) | <i>Aglaiia roxburghii</i> (Priangn) |
| <i>Capparis deciduas</i> | <i>Adarnsonia digitata</i> (Kalpataru) |
| <i>Citrus sp.</i> | <i>Mangium salvaefolium</i> |
| <i>Careya arborea</i> (Kumbi) | <i>Artocarpus lakoocha</i> (Dewa) |
| <i>Cochlospermum gossypium</i> (Galgali) | <i>Barringtonia acutaugula</i> (Hizal) |
| <i>Gmelina arborea</i> (Gamar) | <i>Crataeva nurvula</i> (Barin) |

| | |
|---|---|
| <i>Feronia elephantum</i> | <i>Lannea coromandelica</i> (Jeol) |
| <i>Flacourtia sepiaria</i> | <i>Gardenia gummifera</i> (Blurur, Neriheriger) |
| <i>Hopea odorata</i> | <i>Symplocos racemosa</i> (Lodhra) |
| <i>Hydnocarpus sp.</i> (Chalmugra) | <i>Trewia nudiflora</i> (Pitali) |
| <i>Melia azadirach</i> (Goraneem) | <i>Gynocordia odorata</i> (Bandre, Chalmugra) |
| <i>Michelia montana</i> (Champ) | <i>Flacourtia catafracta</i> (Baichi) |
| <i>Michelia niligerica</i> (Champ) | <i>Ochrocarpus longifolius</i> |
| <i>Mahonia nepalensis</i> | <i>Garuga pinnata</i> (Giga) |
| <i>Ougenia oojeinensis</i> (Panjan) | <i>Aphanamyxis polystachya</i> (Tikiaraj) |
| <i>Premna sp.</i> (Ginari) | <i>Disoxylum hamiltonii</i> (Gab) |
| <i>Phoenix sp.</i> (Khejur) | <i>Cordia dichotoma</i> (Bahanari) |
| <i>Pongamia pinnata</i> (Karanj) | <i>Elaeocarpus tuberculatus</i> (Rudraksha) |
| <i>Pterospermum acerifolium</i> (Kanak champa) | <i>Evodia lunuankenda</i> (Rudrakshya) |
| <i>Pterygota alata</i> (narikeli) | <i>Evodia fraxinifolia</i> |
| <i>Terminalia chebula</i> (Haritaki) | <i>Diospyros embriopteris</i> (Gab) |
| <i>Spondius mangifera</i> | <i>Mesua ferrea</i> (Nageswar) |
| <i>Salix tetasperma</i> | <i>Michelia champaca</i> (Champ) |
| <i>Knema augustifolia</i> | <i>Antiarix toxicaria</i> |
| <i>Keigelia pinnata</i> | <i>Elaeocarpus ganitr</i> |
| <i>Mallotus philippinensis</i> (Rohini) | <i>Juniperus sp.</i> |
| <i>Morus alba</i> (Tut) | <i>Pterocarpus marsupium</i> (Peasal) |
| <i>Polyalthia semiarum</i> (Labsi) | <i>Strichnos nux-vomica</i> (Kuchila) |
| <i>Bischofia javanica</i> (Kanjal) | |
| <i>Elaeocarpus ganitrus</i> (Rudrakshya) | <i>Juniperus sp.</i> |
| <i>Pterocarpus marsupium</i> (Peasal) | <i>Strichnos nux-vomica</i> (Kuchila) |
| <i>Strichnos potatorum</i> (Nirmala) | |
| <i>Cochlospermum gossypium</i> (Galgali) | |
| <i>Pterospermum acerifolium</i> (Kanak champa) | |
| <i>Gardenia gummifera</i> (Blurur, Neriherigar) | |
| <i>Gynocordia odorata</i> (Bandre, Chalmugra) | |
| <i>Aphanamyxis polystachia</i> (Tikiara) | |
| <i>Elaeocarpus tuberculatus</i> (Rudraksha) | |

Trees (need immediate protection - a few selected species):

| | |
|---|---------------------------------|
| <i>Balasamodendron mukul</i> | <i>Bixa orillana</i> |
| <i>Camphora officinarum</i> | <i>Callophyllum inophyllum</i> |
| <i>Caryota urens</i> | <i>Ceiba pentandra</i> |
| <i>Cerbera manghas</i> | <i>Juglans regia</i> |
| <i>Cupressus sempervirens</i> | <i>Betula utilis</i> |
| <i>Aquillana agallocha (Aguru)</i> | <i>Commifera mukul (Guggal)</i> |
| <i>Taxus baccata</i> | <i>Juniperus communis</i> |
| <i>Schrebera switeniodes (Ghanta parul)</i> | |

Some sporadically / occurring trees need protection :

- Acacia suma (Somi)*
- Acacia catechu (Khair)*
- Ailanthus excelsa (Mahanimba)*
- Anacardium occidentale (Kaju)*
- Anogeissus latifolia (Dhaw)*
- Bassia latifolia (Mahua)*

Chapter Nine

Status Assessment of Shrub Flora

The author has drawn a broad survey assessment of the shrub vegetation of the country having medicinal properties.

The legend drawn shows the Status of each species. It may be seen that maximum number of species has been marked as 'S' *i.e.*, of Sporadic occurrence. Sporadic occurrence may be in 'Single' or in 'groups' of several individuals. The second group *i.e.*, groups of several individuals have been marked with asterisk as S*. But it is to realize that this assessment is made on a broad basis as authentic figure will emerge only after a statistically sound plant analysis design and field study.

The list is comprehensive and gives a view of the common and important shrubby medicinal plants of India. So it may be easy to draw a conservation strategy.

Results of Study Over the Country

The distribution of few shrubs as a result of analysis shows the following:

- I. Few shrubs have wide distribution.
- II. Several shrubs are conspicuous all over the country.
- III. Few shrubs are gregarious in their occurrence.
- IV. Most of the shrubs are confined to forested regions.
- V. Moist localities have more of shrubs than other habitats.
- VI. Ground cover of shrub layer has many tree species as regeneration.

The degree and duration of the shade have a positive bearing on the composition and density of shrub crop. Heavy shade results in a very limited number of shrub flora. The intensity of crop is concerned with photosynthesis and food production, it also effects

flower and fruit production. Specific insect and avifaunal species are concerned with shrubs for food and pollination. At least eight shrub genera form an imperative source of larvae food of the moths and butterflies. Over-exploitation of tree crops in all the three storeys in the forests cause considerable physical damage to the shrubs; these shrubs are essential for soil binding and create a micro climate for the survival of young plant regeneration; besides, they help litter formation and conservation of water.

Shrubs and young regeneration of other plant species suffer irreparable losses due to repeated grazing and fire. These two factors are directly responsible for eradication of plant species where only those with underground stem survive. The author's research reveal that only about 40 to 50 per cent of the species survive such depredation; also the density of occurrence of species is affected. Vast tracts of forest where grazing and fire occurs have now very coarse grass and a few are hardy shrub species.

About ninety species of shrubs are conspicuous in the temperate hills of India some of which have colourful flowers; some also grow in profusion. Special mention may be made of rhododendron and roses. In the plains, however, more than one hundred conspicuous shrub species occur but they do not bear conspicuous flowers. In eastern India there are at least a hundred species of fodder shrubs; it is about two thirds in other parts of the country. There are at least forty genera of shrubs yielding edible fruits which attract avifauna, animals and men alike.

A survey made by the author all over the country has revealed that only fifty species of shrubs are commonly found. Lantana, Eupatorium, Clerodendrum, Calotropis, Cassia, Carissa, Capparis, etc, are found conspicuous and are occurring in profusion all over the country. It should be considered as an ominous indication of systematic disappearance of species primarily due to anthropogenic factors. The number of shrub species in the country is about 4500 (tree species about 1200); but wide occurrence of only 50 species is hardly to be believed which is too meagre.

Status of Medicinal Shrubs

Vast shrub resources of this country have not been studied from medicinal, aesthetic and environmental points of view. This country has shrub flora occurring on wide range of alkaline, saline,

estuarine sandy soils in varied climatic conditions. The time is ripe to select typical shrubs that have conspicuous flowers wide range of foliage patterns and shapes and plant them in arboreta, parks and gardens. Some shrubs are indispensable ingredients of parks, gardens, residential quarters premises and in environmental planting to arrest air pollution.

An attempt has been made to list some common and conspicuous shrubs occurring all over the country (Statewise) and to mark some common medicinal plants. Although some of these shrubs are obnoxious weeds (Eupatorium, Cleistanthus, Lantana, Calotropis, Euphorbia, Jatropha etc. Quite a good number of these shrubs occur on dry rocky and sandy areas (Euphorbia, Opuntia, Agave, etc.) which provide shade, protect soil, shelter birds and bear fruits for man and animal besides, providing plants of medicinal values. Vast avifaunal species in the country side also derive a lot of food and seek shelter in such shrub flora.

India has about 265 species of woody (Lianas) and herbaceous climbers; of these about 125 are woody climbers and the rest are herbaceous.

Of these, a hundred species are used as medicinal plants. Climbers which are trailers and the herbaceous ones which depend fully on the host plants for support have no bright future as their existence depend normally on host plants.

Some woody climbers such as *Tinospora*, *Pureria*, *Entada*, *Vitis*, *Mucuna* etc. require strong host plants for their support and survival and therefore, removal of associate trees bring their obvious depletion.

Quite a large number of herbaceous climbers grow in forest margins, waste places and on marginal lands; they very frequently face biotic hazards and therefore, their existence as a result become increasingly threatened; the biotic pressure is in the form of heavy grazing by animals growth of human population and their dependence on forests and demand of land for settlements.

A list of commonly available climbers are presented with comments on their status:

Over-exploited-may face depletion:

- *Paederia foetida* (Gandhal) -Very sporadic:

- *Tinospora cordifolia* (Gulancha): Over-exploited by forest dwellers, it being a good fodder species (enhance milk formation in cow and also for collection for medicinal purposes. It is typically a forest species. Other plants are:
 - *Cuculus villosa* (jaligamni) (These plants grow in forest margin, as such they are directly or indirectly destroyed due to lopping and pilferage of host trees.).
 - *Stephania hamandifolia* (Nimutha)
 - *Cissampelos pareira*
 - *Cyclea burmani* • *Asparagus Sp.*
 - *Vallis solane* (Haparmati) • *Dioscorea sp.*
 - *Tylophora indica* (Antomal) • *Tribulus terrestris*
 - *Gymnema sylvestre* (Chlagalbeti) • *Gnetum sp.*
 - *Jasminum multifloram* (Kanda)
 - *Aganosma dichotoma* (Madhabilata) • *Aristolochia indica*
 - *Tinospora malabarica* • *Smilax macrophylla*
 - *Calamus viminalis* (Bet)

Shrub Flora (With association of herbs) of Waste Places (Sporadic):

Table 9.1

| Species | Status | Species | Status |
|--|--------|--|--------|
| <i>Sida vernicoefolia</i> (joka) | S | <i>Sida rohmoidea</i> (Pila Barela) | S |
| <i>Sida cordifolia</i> (Barela) | S | <i>Urena lobata</i> (Ban Okra) | S |
| <i>Urena sinuala</i> | S | <i>Clitoria turnatea</i> | C |
| <i>Acalypha indica</i> (Muktajhuri) | S | <i>Centella asiatica</i> | S |
| <i>Evolvulus asinoides</i> | S | <i>Merremia emerginata</i> | S |
| <i>Solanum nigrum</i> | S | <i>Solanum ferox</i> | S |
| <i>Solanum indicum</i> | S | <i>Solanum xanthocarpum</i> | S |
| <i>Solanum torvum</i> | S | <i>Solanum surattense</i> | S |
| <i>Physalis peruviana</i> | S | <i>Withania somnifera</i> | C/D |
| <i>Scoparia dulcis</i> | S | <i>Picrorrhiza kuroa</i> | C/D |
| <i>Chenopodium album</i> | S | <i>Abutilon indicum</i> (Paleri) | S |
| <i>Heliotropium indicum</i> (Srihaslini) | S | <i>Flemingia sp.</i> | S |
| <i>Zornia diphylla</i> | S | <i>Trianthema portulacastrum</i> | S |
| <i>Musaenda frondosa</i> (Nagballi) | C | <i>Gangrea maderaspetana</i> , (Namuti) | S |
| <i>Lorathus sp.</i> | S | <i>Argemone mexicana</i> (Sealkanta) | S |

contd.....

Table 9.1 contd...

| Species | Status | Species | Status |
|---|--------|---|--------|
| <i>Capsella bursapasteris</i> | S | <i>Cleome gynandra</i> | S |
| <i>Clemoe isosandra</i> | S | <i>Polygala chinensis</i> (Muradu) | S |
| <i>Polygala crotalarioides</i> (Nilkanti) | S | <i>Polycarpea corymbosa</i> | S |
| <i>Portulaca oleracea</i> (Barnunia) | S | <i>Portulaca quadrifida</i> (Chota nunia) | S |
| <i>Malvastrum sp.</i> | S | <i>Torenia asiatica</i> | S |
| <i>Vandellia sp.</i> | S | <i>Justicia ganderussa</i> (Jagat madan) | S |
| <i>Rungia parviflora</i> (Piri) | S | <i>Achyranthus aspera</i> (Apang) | S |
| <i>Pogostemon parviflorus</i> | S | <i>Boerhaavia diffusa</i> (Punamava) | S |
| <i>Amaranthus spinosus</i> (Kanta note) | S | <i>Amaranthus gangeticus</i> (note) | S |
| <i>Amaranthus viridis</i> | S | <i>Xanthium strumerium</i> (Ban Okra) | S |
| <i>Canabis sativa</i> | C | <i>Rumex dentatus</i> | S |
| <i>Rumex maritimus</i> | S | <i>Cyanotis sp.</i> | S |
| <i>Phyllanthus reticulatus</i> (Panjuli) | S | <i>Phyllanthus simplex</i> | S |
| <i>Ipomoea fistilosa</i> | | <i>Calotropis gigantea</i> (Akanda) | S |
| <i>Datura stamonium</i> (Sadadhanara) | S | <i>Datura stramonium</i> (Sadadhanara) | S |
| <i>Clerodendrum serratum</i> | S | <i>Glycosmis arborea</i> | S |
| <i>Martinia diandra</i> (Baghnakhi) | S | <i>Grewia sp.</i> (Phalsa) | S |
| <i>Moringa olifera</i> (Sajina) | C | <i>Nyctanthes arbortistris</i> (Siwli) | C |
| <i>Nerium odorum</i> (Rakta karabi) | C | <i>Streblus asper</i> (Seora) | S |
| <i>Vitex negundo</i> (Nishinda) | S | <i>Ziziphus sp.</i> (Kul) | S |
| <i>Trema orientalis</i> (Kuail) | S | <i>Thespesia populnea</i> (Pipli) | C |
| <i>Tamarix sp.</i> (Barjha) | S | <i>Toona ciliata</i> (Toon) | C |
| <i>Tectona grandis</i> (Teak) | CPS | <i>Tamarindus indica</i> (Tentul) | C |
| <i>Terminalia indica</i> (Arjuna) | CPS | <i>Syzygium cuminii</i> (Kalo jam) | C |
| <i>Prosopis spicigera</i> | PS | <i>Prosopis cinararia</i> | S/PS |
| <i>Putranjiva roxburghii</i> (Putranjiva) | CPS | <i>Diospyros melanoxylon</i> (Kend) (Parari) | S |
| <i>Holarrhena antidysenterica</i> (Kurchi) | PS | <i>Stereospermum personatum</i> (Parari) | PS |
| <i>Phyllanthus urinaria</i> (Hazarmani) | S | <i>Phyllanthus niruri</i> | S |

contd.....

Table 9.1 contd...

| Species | Status | Species | Status |
|--|--------|---|--------|
| <i>Cenopodium ambrosioides</i> | S | <i>Wedelia calendula</i> (Bhimraj) | S |
| <i>Euphorbia hirta</i> (Swadaparui) | S | <i>Malachra capitata</i> | S |
| <i>Atylosia scarabioides</i> | S | <i>Sophora</i> sp. | S |
| <i>Mallugo hirta</i> | S | <i>Oldenlandia herbacea</i> | S |
| <i>Elephantopus scaber</i> (Shaydalan) | S | <i>Celosia argentea</i> | S |
| <i>Polygonum orientale</i> | S | <i>Oxalis corniculata</i> (Amrul) | S |
| <i>Oxalis acetosella</i> | S | <i>Martynia diandra</i> (Bagh nakhi) | S |
| <i>Pandanus tectorius</i> (Keya) | V | <i>Pandanus roxburgiana</i> (Keya) | D. |
| <i>Breynia rhamnoides</i> | S | <i>Breynia patens</i> | S |
| <i>Datura stramonium</i> (Sadadhatura) | C | <i>Ervatamia coronaria</i> (Tagar) | |
| <i>Japropa gossypifolia</i> (Bag veranda) | S | <i>Thevetia nerifolia</i> (Halde karabi) | |
| <i>Caesalpinia pulcherrima</i> (Krishnachura) | C | <i>Hibiscus mutabilis</i> (Sthalpadma) | |
| <i>Barleria cristata</i> (Swata jhanti, Kalajhanti) | C | <i>Lawsonia inermis</i> (Mehendi) | |
| | | <i>Ricinus communis</i> (Aronda) | |
| Sporadic (not threatened) | | | |
| <i>Mimosa pudica</i> (Lajjabati) | S | <i>Cassytha filiformis</i> (silinga) | S |
| <i>Capparis spinosa</i> | S | <i>Croton tiglium</i> | S |
| <i>Mimosa rubicaulis</i> (Dhuna) | S | <i>Ipomoea reptans</i> (Kalmi Sag) | S |
| <i>Ageratum conyzoides</i> | S | <i>Blumea lacera</i> (Kukhim) | S |
| <i>Eclipta alba</i> | S | <i>Taraxacum officinate</i> | S |
| <i>Biophytum sensitivum</i> (Ban naranga) | S | <i>Helectris isora</i> (Avikush, Athmum) | S |
| <i>Sphaeranthus indica</i> (Maharashrabani) | S | <i>Justicia adhatoda</i> (Vasak) | C |
| <i>Chrosophora cincera</i> (Tut kukusima) | S | <i>Morinda tinctoria</i> (Abecheek) | S |
| <i>Lindenbergia urticaefolia</i> (Haldebasanta) | S | <i>Coffea bengalensis</i> (Bancoffee) | S |
| <i>Andrographis paniculata</i> (Kalmegh) | D | <i>Murraya exotica</i> (Kamini) | C/S |
| <i>Oldenlandia corymbosa</i> (Khetkapra) | S | <i>Ixora coccinia</i> (Rangan) | C |
| <i>Capparis decidua</i> | P/S | <i>Butea crispa</i> (Banchalida) | C |

contd.....

Table 9.1 contd...

| Species | Status | Species | Status |
|--|--------|---|--------|
| <i>Abrus precatorius</i> (Kunch) | S | <i>Murra koengii</i> (Curry leaf) | C/PS |
| <i>Hiptage bengalensis</i> (Madhabilata) | S | <i>Justicia adhatoda</i> (Vasak) | C/PS |
| <i>Jasminum grandiflorum</i> (Chameli) | C | <i>Morinda citrifolia</i> (Anch) | S |
| <i>Argyreia speciosa</i> (Rishya gandhri) | S | <i>Coffea</i> sp. | S |
| <i>Marsdenia volibilis</i> (Nach chikni) | S | <i>Ixora passiflora</i> (Gandhale, Rangan) | C |
| <i>Hemidesmus indicus</i> (Anatamul) | D | <i>Laportia crenulata</i> (Chutra) | S |

Temperate areas (Threatened):

| Species | Status | Species | Status |
|---|--------|-----------------------------------|--------|
| <i>Delphinium denudatum</i> (Nilbishi) | D | <i>Cimicifuga foetida</i> (Jimti) | D |
| <i>Paeonia emodi</i> (udsalaj) | D | <i>Illicium griffithii</i> | D |
| <i>Digitalis purpurea</i> | C | <i>Swertia chrata</i> | D |
| <i>Geranium nepalense</i> | D | <i>Solanum dalcamara</i> | D |
| <i>Viscum</i> sp. | D | <i>Fritillaria</i> sp. | D |
| <i>Lilium gigatum</i> | D | <i>Vivumum foetidum</i> | S |
| <i>Hypericum patulum</i> | D | <i>Cinchona succirubra</i> | C |
| <i>Lonicera glauca</i> | D | <i>Osbeckia nepalensis</i> | D |
| <i>Cinchona ledgerina</i> | C | | |

Shrubs of Temperate Hills (under no threat)

| | | | |
|--|---|---------------------------------------|---|
| <i>Melastoma matabathricum</i> | S | <i>Woolfodia fruticosa</i> (Dhaiphal) | S |
| <i>Berberis aristata</i> (Daru haridra) | C | <i>Memecylon edule</i> | S |
| <i>Pogostemon plectranthoides</i> | S | <i>Pogostemon parviflorus</i> | S |
| <i>Colebrookia oppositifolia</i> | S | <i>Anisomeles indica</i> | S |
| <i>Hypericum patulum</i> | S | <i>Hypericum</i> sp. | D |
| <i>Vivumum foetidum</i> | S | <i>Lonicera glauca</i> | S |
| <i>Cinchona succirubra</i> | C | <i>Cinchona ledgerina</i> | C |
| <i>Osbeckia nepalensis</i> | S | <i>Osbeckia crinita</i> | S |

Stray shrubs in tropics under no threat:

| | | | |
|---|------|-------------------------------------|---|
| <i>Cassia tora</i> (Chakmudl) | S/PS | <i>Cassia sophera</i> | S |
| <i>Cassia occidentalis</i> (Kal kasundi) | S/PS | <i>Euphorbia nerifolia</i> (Snowii) | S |

contd.....

Table 9.1 contd...

| Species | Status | Species | Status |
|--------------------------------------|--------|-----------------------------------|--------|
| <i>Gossipium herbaceum</i> | C | <i>Eupatorium odoratum</i> | S |
| <i>Lantana camara</i> | PS | <i>Leonurus sibiricus</i> | S |
| <i>Hiptis suaveolens</i> | SPS | <i>Boerhoevia diffusa</i> | S |
| <i>Boerhaavia repens</i> | S | <i>Artemisia vulgaris</i> | D |
| <i>Curcuma longa</i> | C | <i>Indigofera pulchella</i> | S |
| <i>Indigofera linifolia</i> | S | <i>Indigofera trifolia</i> | S |
| <i>Indigofera sp.</i> | S | <i>Demodium gangeticum</i> | S |
| <i>Desmodium polycarpum</i> | S | <i>Desmodium pulchellum</i> | S |
| <i>Desmodium sp.</i> | S | <i>Crotalaria verrucosum</i> | S |
| <i>Crotalaria juncea</i> | C | <i>Crotalaria albida</i> | S |
| <i>Crotalaria sp.</i> | C | <i>Alysicarpus longifolius</i> | S |
| <i>Uraria picta</i> (Sankajota) | S | <i>Urariaogopoides</i> (Chakulia) | S |
| <i>Psoralea corylifolia</i> (Buchki) | S | <i>Costus speciosus</i> | D |
| <i>Alpinia glalanga</i> | S | <i>Alpinia allughus</i> | S |
| <i>Curculigo orchiuoides</i> | S | <i>Tacca pinnatifida</i> | D |
| <i>Tragia involucrate</i> | S | <i>Pouzolzia indica</i> | S |
| <i>Sanseveria roxburghiana</i> | C | <i>Curcuma amgustifolia</i> | S |

Presently safe species, not threatened (Tropics)

| | | | |
|--|---|---|---|
| <i>Mimosa Pudica</i> (Lajjabati) | S | <i>Ervatamia coronaria</i> (Tagar) | C |
| <i>Cassytha filiformis</i> (Silinga) | S | <i>Thevetia nerifolia</i> (Halde karabi) | C |
| <i>Capparis spinosa</i> | S | <i>Hibiscus mutabilis</i> (Sthal padma) | C |
| <i>Croton tiglium</i> | S | <i>Hibiscus albomoschus</i> (Latkasturi) | C |
| <i>Mimosa rubicaulis</i> (Dhuna) | S | <i>Ricinus communis</i> (Aronda) | C |
| <i>Jasminum gradiflorum</i> (Chameli) | C | <i>Calotropis gigantia</i> (Akanda) | S |
| <i>Argyreia speciosa</i> (Rishya gandhri) | S | <i>Datura fastuosa</i> (Dhatura) | S |
| <i>Ipomoea reptans</i> (Kalmi Sag) | C | <i>Nerium odorum</i> (Rakta karabi) | C |
| <i>Capparis decidua</i> | S | <i>Hibiscus cosa-sinnensis</i> (Jaba) | C |
| <i>Arbus precatorius</i> (Kunch) | S | <i>Lawsonia inermis</i> (Mehendi) | S |
| <i>Hiptage bengalensis</i> (Madhabilata) | S | <i>Punica grnatum</i> (Darimba) | C |
| <i>Datura metal</i> (Dhatura) | S | | |

contd.....

Table 9.1 contd...

| Species | Status | Species | Status |
|--|--------|---|--------|
| Cucurbitaceous Climbing Shrubs: | | | |
| e.g., Cucumis, Momordica, Luffa, Lageneria, Trichosanthes and Beniscasa, others are: | | | |
| Marsdenia volubilis (Nach chikni) | | | |
| Hemidesmus indicus (Anantamul) | | | |
| Croton caudatus | | | |
| Stray Shrubs under no Threat: | | | |
| <i>Cassia tora</i> (Chakmundi) | S | <i>Woodfordia fruticosa</i> (Dhaiphal) | S |
| <i>Cassia occidentalis</i> (Kal kasundi) | S | <i>Memecylon edule</i> | S |
| <i>Gossipium herbaceum</i> | S | <i>Pogostemon parviflorus</i> | S |
| <i>Lantana camara</i> | PS | <i>Anisomeles indica</i> | S |
| <i>Hiptis suaveoens</i> | S | <i>Neraim odorum</i> (Rakta Karabi) | |
| | | <i>Hibiscus rosa-sinensis</i> (Jaba) | C |
| <i>Cassia sophera</i> | S | <i>Hibiscus albomoschus</i> (Latkasturi) | C |
| <i>Euphorbia nerifolia</i> (Snowii) | C | <i>Punica granatum</i> (Darimba) | C |
| <i>Eupatorium odoratum</i> | PS | <i>Datura metal</i> (Dhatura) | S |
| <i>Leonurus sibiricus</i> | PS | <i>Calotropis procera</i> (Akanda) | |
| <i>Boerhaavia diffusa</i> | S | <i>Datura fastuosa</i> (Dhatura) | S |
| <i>Boerhaaria repens</i> | S | <i>Jatropha gossypifolia</i> (Bag venda) | S |
| <i>Clerodendrum serratum</i> | S | <i>Barleria cristata</i> (Swata jhanti, Kalajhanti) | C |
| <i>Martinia diandra</i> (Baghnakhi) | S | | |
| <i>Artemisia vulgaris</i> | D | <i>Pandanus roxburghiana</i> (Keyal) | S |
| <i>Glycosmis arborea</i> | S | <i>Breynia patens</i> | S |

Special Groups of Plants:

– *Aromatic plants:*

| | |
|---|----------|
| <i>Mimusops elengii</i> (Bakul) | Common |
| <i>Vetiveria zizanioides</i> (Vetiver) | Common |
| <i>Jasminum grandiflorum</i> (Jasmine) | Sporadic |
| <i>Pandanus odoratissima</i> (Screw-pine) | Sporadic |
| <i>Myristica fragrans</i> (Nulmig) | Rare |

Table 9.1 contd...

| Species | Status | Species | Status |
|---|--------|--------------------------------------|--------|
| <i>Syzygium aromaticum</i> (Clove) | | Rare | |
| <i>Cinnamomum camphora</i> (Camphor) | | Rare | |
| <i>Aquilaria agallocha</i> (Aloewood) | | Rare | |
| <i>Santalum album</i> (Sandle wood) | | Very localized (Protected) | |
| – Cosmetic plants (Mostly cultivated) | | | |
| <i>Lawsonia inermis</i> (Henna) | | C | |
| <i>Sesamum indicum</i> (Sesame) | | C | |
| <i>Hibiscus rosa-sinensis</i> (Hibiscus) | | C | |
| <i>Acacia catechu</i> (Areca nut) | | C | |
| <i>Sapindus trifoliatus</i> (Soap-nut) | | C | |
| <i>Curcuma longa</i> (Turmeric) | | C | |
| <i>Mallotus philippinensis</i> (Indian Kamella) | | PS | |
| <i>Citrus indica</i> (Lime) | | C | |
| <i>Crocus sativus</i> (Saffron) | | C | |
| <i>Piper betel</i> (Supari) | | C | |
| <i>Indigofera tinctoria</i> (True indigo) | | S | |
| <i>Hemidesmus indicus</i> (Sarsaparila) | | D | |
| – Sacred Plants (common) | | | |
| Species | Status | Species | Status |
| <i>Ficus bengalensis</i> (Banyan) | PS | <i>Ocimum sanctum</i> (Holibasil) | C/PS |
| <i>Butea monosperma</i> (Palash) | PS | <i>Cocos nucifera</i> (Coconut) | C/PS |
| <i>Aegle marmelos</i> (Boel) | PS | <i>Cannabis sativa</i> (Indian hemp) | C |
| <i>Ficus religiosa</i> (Sacred fig) | PS | <i>Syzygium cuminii</i> (jamun) | PS |
| <i>Azadirachta indica</i> (Margosa) | PS | * <i>Nelumbium speciosum</i> (Lotus) | D |
| <i>Elaeocarpus ganitrus</i> (Rudrakshya) | D | | |
| <i>Catheranthus roseus</i> (Nayantara) | C | | |
| – Culinary Plants (mostly cultivated) | | | |
| <i>Moringa olifera</i> (Drum stick) | C | <i>Tamarindus indica</i> (Tamarind) | C |
| <i>Allium sativum</i> (Garlic) | C | <i>Zingiber officinale</i> (Ginger) | C |
| <i>Mangifera indica</i> (Mango) | C | <i>Cinnamomum tamala</i> (Tejpata) | C |

contd.....

Table 9.1 contd...

| Species | Status | Species | Status |
|--|--------|---------------------------------------|--------|
| <i>Borassus flabellifer</i> (Palmyra) | C | <i>Bassia latifolia</i> (Mahua) | PS |
| <i>Nigella sativa</i> (Kalijira) | C | <i>Cuminum cyminum</i> (Cumin) | C |
| <i>Solanum melonginum</i> (Egg plant) | C | <i>Carum acpticum</i> (Joan) | C |
| <i>Carum roxburgiana</i> (Randhuni) | C | <i>Foeniculum capillaceum</i> (Mouri) | C |
| <i>Ferula asafetida</i> (Hing) | C | <i>Piper nigrum</i> (Black piper) | C |
| <i>Cinnamomum zeylanicum</i> (Chinamon) | C | | |
| <i>Coriandrum sativum</i> (Corriander) | C | | |
| <i>Elettaria cardamomum</i> (Cardamom) | C | | |

– Other Plants of Tropics Temperate Areas :

| | | | |
|--|---|-------------------------------|---|
| <i>Zingiber officinale</i> | C | <i>Zingiber cassumaner</i> | S |
| <i>Commelina obliqua</i> | S | <i>Pathos scandens</i> | C |
| <i>Scindapsus officinalis</i> (Rajipal) | C | * <i>Amomum subulatum</i> | C |
| * <i>Elleterla cardamom</i> | C | * <i>Rauwolfia serpentina</i> | D |
| <i>Tephrosia purpurea</i> | S | <i>Tephrosia villosa</i> | S |
| * <i>Curcuma Zedoraria</i> (Kkangi) | C | * <i>Curcuma amada</i> | C |
| * <i>Curcuma aromatica</i> (Halud) | C | * <i>Cannabis sativa</i> | C |
| <i>Polygonum plebejum</i> | S | <i>Polygonum glabrum</i> | S |
| <i>Polygonum barbatum</i> | S | <i>Polygonum hydropiper</i> | S |
| <i>Polygonum orientale</i> | S | | |

Distribution zones of Conspicuous shrub Flora in India:

Madhya Pradesh:

| | |
|----------------------------------|------------------------------|
| <i>Holarrhena antidysenerica</i> | <i>Acacia catechu</i> |
| <i>Butea monosperma</i> | <i>Lantana monosperma</i> |
| <i>Phoenix sylvestris</i> | <i>Osbeckia aspericaulis</i> |
| <i>Helicteres isora</i> | <i>Barleria prionitis</i> |
| <i>Dichrostachys cinerea</i> | <i>Zizyphus sp.</i> |
| <i>Vitex negundo</i> | |

Table 9.1 contd...

| Species | Status | Species | Status |
|------------------------------|--------|------------------------------|--------|
| Maharashtra: | | | |
| <i>Calotropis procera</i> | | <i>Cassia auriculata</i> | |
| <i>Indigofera gerardiana</i> | | <i>Zizyphus mauritiana</i> | |
| <i>Lantana camara</i> | | <i>Carissa carandas</i> | |
| <i>Zizyphus sp.</i> | | <i>Cassia sp.</i> | |
| <i>Plectranthus rugosus</i> | | <i>Cleistanthus collinus</i> | |
| <i>Gymnosporia spinosa.</i> | | | |
| Manipur: | | | |
| <i>Desmodium cephalotes</i> | | <i>Pueraria hirsute</i> | |
| <i>Priotropis cytisoides</i> | | <i>Buddleia sp.</i> | |
| <i>Cycas siamensis</i> | | <i>Phoenix humilis.</i> | |
| Orissa: | | | |
| <i>Barleria prionitis</i> | | <i>Zizyphus sp.</i> | |
| <i>Calotropis procera</i> | | <i>Adhaoda vasica</i> | |
| <i>Anona squamosa</i> | | <i>Cassia sp.</i> | |
| <i>Combretum decandrum</i> | | <i>Zizyphus mauritiana</i> | |
| <i>Jatropha glandulifera</i> | | <i>Vitex negundo</i> | |
| Punjab: | | | |
| <i>Capparis decidua</i> | | <i>Tamarix dioica</i> | |
| <i>Zizyphus nummularia</i> | | <i>Prosopis juliflora</i> | |
| <i>Salvadora oleoides</i> | | <i>Calotropis proceram</i> | |
| <i>Butea monospera</i> | | <i>Adhatoda vasica</i> | |
| <i>Murraya koenigii</i> | | <i>Lantana camara</i> | |
| <i>Acacia arabica</i> | | <i>Carissa opaca</i> | |
| <i>Capparis sepiana</i> | | <i>Dodonaea viscosa</i> | |
| Rajasthan: | | | |
| <i>Acacia arabica</i> | | <i>Prosopis juliflora</i> | |
| <i>Zizyphus nummularia</i> | | <i>Cassia mimosoides</i> | |
| <i>Calotropis procera</i> | | <i>Capparis deciduas</i> | |
| <i>Mimosa rubicaulis</i> | | <i>Butea monospera</i> | |
| <i>Acacia catechu</i> | | <i>Euphorbia nivulla</i> | |

contd.....

Table 9.1 contd...

| Species | Status | Species | Status |
|---|--------|-----------------------------|--------|
| <i>Lantana camara</i> | | <i>Prosopis spicigera</i> | |
| <i>Acacia leucophloea</i> | | <i>Phoenix sylvestris</i> | |
| <i>Solanum seafortianum</i> | | | |
| Tamil Nadu: | | | |
| <i>Ixora parviflora</i> | | <i>Suaeda</i> sp. | |
| <i>Zizyphus nummularia</i> | | <i>Cassia auriculata</i> | |
| <i>Carissa carandas</i> | | <i>Dodonaea viscosa</i> | |
| <i>Gardenia gummifera</i> | | <i>Cassia siamea</i> | |
| <i>Acacia leucophloea</i> | | <i>Calotropis procera</i> | |
| <i>Zizyphus</i> sp. | | <i>Opuntia</i> sp. | |
| <i>Randia dumetorum</i> | | <i>Hypericum mysorensis</i> | |
| <i>Lantana camara</i> | | <i>Phoenix sylvestris</i> | |
| <i>Rubus</i> sp. | | | |
| Uttar Pradesh: | | | |
| <i>Adhatoda vasica</i> | | <i>Zizyphus</i> sp. | |
| <i>Moghania</i> sp. | | <i>Carissa</i> sp. | |
| <i>Butea monosperma</i> | | <i>Zizyphus nummularia</i> | |
| <i>Lantana camara</i> | | <i>Phoenix decidua</i> | |
| <i>Scindapsus officinalis</i> (Gajapepul) | | | |
| <i>Dodonaea viscosa</i> | | | |
| <i>Jatropha gossypifolia</i> | | | |
| <i>Morinda tinctoria</i> | | | |
| <i>Randia dumetorum</i> | | | |
| Assam: | | | |
| <i>Eupatorium</i> sp. | | <i>Lantana camara</i> | |
| <i>Phoenix humilis</i> | | <i>Litsaea umbrosa</i> | |
| <i>Rubus ellipticus</i> | | <i>Osbeckia</i> sp. | |
| <i>Randia dumetorum</i> | | | |
| Bihar: | | | |
| <i>Phoenix sylvestris</i> | | <i>Butea monosperma</i> | |
| <i>Carissa carandas</i> | | <i>Carissa opaca</i> | |

contd.....

Table 9.1 contd...

| Species | Status | Species | Status |
|---------------------------------|--------|----------------------------------|--------|
| Delhi: | | | |
| <i>Calotropis procera</i> | | <i>Capparis deciduos</i> | |
| <i>Cassia mimosoides</i> | | <i>Zizyphus mauritiana</i> | |
| <i>Z. nummularia</i> | | <i>Prosopis species</i> | |
| Gujarat: | | | |
| <i>Calotropis procera</i> | | <i>Zizyphus mauritiana</i> | |
| <i>Capparis deciduas</i> | | <i>Cassia auriculata</i> | |
| <i>Butea monosperma</i> | | <i>Cassia mimosoidessopis</i> | |
| <i>Mimosa rubicaulis</i> | | <i>Acacia arabica</i> | |
| <i>A. leucophloea</i> | | <i>Euphorbia royleana</i> | |
| <i>Zizyphus nummularia</i> | | <i>Prosopis juliflora</i> | |
| <i>Acacia catechu</i> | | <i>Helicteres isora</i> | |
| <i>Suaeda fruticosa</i> | | <i>Premna coriacea</i> | |
| Himachal Pradesh: | | | |
| <i>Acacia caesia</i> | | <i>Berberis sp.</i> | |
| <i>Carissa spinarum</i> | | <i>Flacourtia indica</i> | |
| <i>Berberis aristata</i> | | <i>Desmodium gangeticum</i> | |
| <i>Prinsepia utilis</i> | | <i>Colebrookea oppositifolia</i> | |
| <i>Indigofera geradiana</i> | | <i>Woodfordia fruticosa</i> | |
| <i>Cotoneaster microphylla</i> | | <i>Plectranthus rugosus</i> | |
| <i>Adhatoda vasica</i> | | <i>Berberis chitria</i> | |
| <i>Dodonaea viscose</i> | | <i>Agave Americana</i> | |
| <i>Rhus continues</i> | | <i>Zanthoxylum alatum.</i> | |
| Jammu & Kashmir: | | | |
| <i>Calotropis procera</i> | | <i>Adhatoda vasica</i> | |
| <i>Acacia modesta</i> | | <i>Clerodendrum viscosum</i> | |
| <i>Lantana camara</i> | | <i>Viburnum foetens</i> | |
| <i>Arisaema helleborifolium</i> | | <i>Desmodium tiliaefolium</i> | |
| <i>Deutzia corymbosa</i> | | <i>Jasminum humile</i> | |
| <i>Rubus lasiocarpus</i> | | <i>Berberis lycium</i> | |
| <i>Robinia pseudo-acacia</i> | | <i>Pistacia integerrima</i> | |

contd.....

Table 9.1 contd...

| Species | Status | Species | Status |
|-----------------------------|--------|------------------------------|--------|
| <i>Rosa moschata</i> | | <i>Rubus ellipticus</i> | |
| <i>Plectranthus rugosus</i> | | <i>Artemisia vulgaris</i> | |
| <i>Indigofera pulchella</i> | | <i>Daphne sp.</i> | |
| <i>Parrotia sp.</i> | | | |
| Kerala: | | | |
| <i>Cassia mimosoides</i> | | <i>Euphorbia tirucalli</i> | |
| <i>Randia dumetorum</i> | | <i>Cocos nucifera</i> | |
| <i>Pandanus sp.</i> | | <i>Phoenix sylvestris</i> | |
| <i>Lantana camara</i> | | | |
| Karnataka: | | | |
| <i>Acacia leucophloea</i> | | <i>Butea monosperma</i> | |
| <i>Azadirachta indica</i> | | <i>Dichrostachys cinerea</i> | |
| <i>Lantana camara</i> | | <i>Rhus wallichii</i> | |
| <i>Calotropis procera</i> | | <i>Zizyphus sp.</i> | |

Chapter Ten

Status Assessment of Herb Flora

The author has drawn a broad survey assessment of the herb vegetation of the country having medicinal properties.

The legend drawn shows the status of each species. It may be seen that maximum number of species has been marked as 'S' *i.e.*, of Sporadic occurrence. Sporadic occurrence may be in 'Single' or in 'groups' of several individuals. The second group *i.e.*, groups of several individuals have been marked with asterisk as S*. But it is to realize that this assessment is made on a broad basis as authentic figure will emerge only after a statistically sound plant analysis design and field study.

The list is comprehensive and gives a view of the common and important shrubby medicinal plants of India. So it may be easy to draw a conservation strategy.

Status of Herbs

The word "Weed" (meaning troublesome, undesirable and aggressive plants) is a misnomer to an ecologist or a conservationist. Human knowledge and ingenuity may not reach perfection to unearth various properties and utility properties in them, yet they remain resourceful. A quantitative assessment of the flora in the region presents a distressing feature of the herb Flora of the region. Relentless biotic pressure from men for extension of cultivation, fire, grazing and other natural factors as flood, erosion etc. have, (i) eradicated many species from their original home, (ii) affected the diversity of genera and species, (iii) ousted soft species in favour of coarse and resistant species particularly of few selected species of herbs and mainly shrubs, (iv) diluted the species both in number of species and in wide spread and regenerating, while innumerable species recorded in old flora are hardly found growing in profusion.

Quantitative assessment of herb flora has revealed reduction of at least 50 per cent of the species from their natural home and the existing ones have been very much diluted and some receded. Over exploitation of all species of *Orchids*, *nymphaea*, *nelumbium*, *Primula*, *Androsace*, *Areneria*, *Meconopsis*, *Rheum*, *Coptis*, *Aconitum*, *Nardostachys*, *Anaphalis*, *Swertia*, *Selaginella* etc. and other medicinal and decorative species are also responsible for ruthless eradication of such species.

Shifting cultivation for centuries have reduced vast forested tracts into grassland or Shrub land and reduction in number of genera and species. Even the plants recorded by Sri Hooker in mid nineteenth century (130 years ago) are not to be seen in those areas where biotic interference has been a regular feature.

The feature of landscape is fast changing. Shifting cultivation continues all over eastern India from foot hills to an altitude of 2000 m. As such flora is sub-tropical, lower temperate hills has been getting persistent blow; besides, the cultivation of Rubber, Coffee, Cocoa, Tea, Teak and Eucalyptus and other species as pure crop (Monoculture) over assessment would only reveal correct picture. Several orchids, ferns, fern allies medicinal and flowering plants of this region have already been recorded as rare and endangered and a bleak future is indicated.

Moist situation in the foot hills and temperate hills, account for richness of species. The ecotone regions in the foot hills and middle hills are obviously the richest zone of various flora and faunal crop and deserve immediate preservation. Diversity of plants will mean diversity of insects birds and animals.

Many shrub and herbs have been exploited heavily for fodder, besides grazing animals (Wild Life and domesticated animals) take a heavy toll of such vegetation. Most of the plant of *Urticaceae* form good fodder and are heavily exploited. Besides, many species of ferns, *Monocots*, *Flemengia*, *Desmodium*, *Saxifraga*, *Pouzolzia*, *Pilea*, *Elatostemma*, *Polygonum*, *Fagopyrum*, *Rumex*, *Limnophylla*, *Lippia*, *Phyla* are also grazed. Several monocot herbs (*Floscopa*, *Grasses*, *Sedges*, *Commelina*, *Cyanotis*, *Costos*, *Alpinia*, *Hypoxis*, *Cautleya* etc.) are heavily grazed for fodder.

Ecological studies on herbs cannot be done in isolation. Herbs shrubs and trees that regenerate along with grasses and sedges form an inseparable plant community. Each influences the other

single or the groups. Tree species regeneration are mixed with herbs and shrubs at different stages of their growth and such regeneration forms about 50 per cent of the total species at any site either in shrub or herb layer. As such here-shrub associations shrubs-tree association or herb-tree associations are often conspicuous. More conspicuous of course are obnoxious shrub layers of *viz.*, Clerodendrum, many climbers forming tangle Capparis, Cassia, many species of Labiatae, Phlogacanthus, Woodfordia and very many other species. Such tough and resistant herb layers are hardly found among the shrubs. Some semblance may be observed in thick mat forming *borreria hispida* (Rubiaceae) which cover extensive plantation areas in Terai and Duars of North Bengal and various eastern Indian states.

Study of insect and animal association, action may interaction in grassland or hermland is a separate subject and should be undertaken in full detail.

In the heavy shades of tropical and sub-tropical forests there is meager occurrence of dicot herbs. Comparatively however, there are abundance of grasses, sedges and some monocot herbs (Zingiber, Curcuma, Alpinia, Dioscorea, Commelina, Globba, Smilax etc.) On the whole, species of shrub-flora is richer in such tropical region than the herbs, while in temperate hills herbs-flora is richer, monocot, however, maintains same proportion.

Herbs are light demander. Alpine grass lands have vast number of herbaceous flora which display a vast array of colours.

Herbs render shelter to snakes lizards, frogs and many other ground dwelling animals. They afford protection to soil; in fact, they form the last line of defence against direct hit from sunrays and rains and protect soil from erosion and retention of moisture.

Status of Medicinal Herbs

Of all life forms of plants in India, the number of herb species outnumber others. Roughly, the number of shrub species is about double the number of tree species, while the number of herbs is about four times the shrubs.

Herb has been defined as "Plants with no woddy stems above the ground." Others define it as "A plant the stem of which dies every year" or as, "A plant with no persistent parts above the ground, as distinct from shrubs and trees". It has been defined in

many other books ranking it with weeds which are not valued for beauty, that grow wild and hinder the growth of superior species, it has been found to grow where it is not desired and where it grows luxuriantly and plentifully. But little about their values as medicinal plant have been discussed.

No plants are weeds. Each species, has a part to play, either singly or as a member of the community. Each maintains a mutual harmony in it's niche and each niche plays a positive role in moulding the environment. Some herbs may be troublesome, most aggressive, harmful or annoying to man or to his agriculture and are termed as weeds. The herbaceous weeds grow luxuriantly; they are resistant, have a high reproductive capacity, gregarious, have a high level of seed dormancy, are quick growing often poisonous, deep rooted, annual or perennial and abundantly seed bearing. Several herbs are parasitic, some are hosts of fungal and bacterial diseases, some are hosts of nematodes and some are associated with insects. Many are delicious food for animals and man alike; many are useful as medicinal plants. Some weeds are guardians of soil. They provide protective cover against erosive action of rain drops and run off. They are also used as mulch in cultivated land.

The herbs come in profusion in swamps, marshes and on other sites which accumulate water in rains. In permanent ponds, weeds also predominate. Aquatic life burst into activities and complete their life cycle within a short span. Succession of plants and animals goes on simultaneously on vertical and horizontal strata. Herbs (submerged, floating, emergent) growing in profusion have diversified animal periphyton of insects, amphipods, mites, snails, etc. The floral and faunal complex attract aquatic birds. The ponds, marshes and swamps become roosting sites and feeding ground for many species of birds. Heron feed on shallow water, grebe, cormorants and terns feed on fish in open water, the egrets, bitterns eat fish in shallow water, cranes and coots are omnivorous, rails, ibises, stilts and snipes probe around in mud, but various ducks eat seeds, roots and soft parts of weeds. In India the aquatic flora consist of 171 to 200 species of plants belonging to 90 genera and 39 families.

But of late the areas of water bodies have been found dwindling rapidly. Marshes and lowlying lands are being brought under human settlements.

Besides the aquatic sites, herbs also grow on road sides, rice field, dry cultivated land and in various types of forests. In spite of their wide range of occurrence relentless biotic pressure, flood and erosion have reduced the number of species and many have been threatened to the verge of extinction. Over exploitation of medicinal, decorative and other commercial species has been responsible for shrinkage of many species. Shifting cultivation has also led to the complete eradication of many species. Many herbs have also been over-exploited for fodder purpose.

The environmental role of trees, shrubs and herbs should be studied in conjunction with grasses, sedges, palms, epiphytes, parasites etc. as all these lifeforms constitute in separable components of the plant communities to mould the environment and enrich the medicinal plant resources.

Herbs form eighty per cent of the medicinal plant species. They need meticulous protection. There are many diffused and inconspicuous herbs which have showy flowers. Many herbs grow in grasslands, many in tall reeds and many in alpine grasslands. Innumerable herbs growing in temperate hills have also showy flowers. Many species of canes, yams, lily, asparagus, etc. which form a number of medicinal plants are being over-exploited. There are many species of aroids besides wild banana, ginger, turmeric, cardamom which grow over extensive areas and form conspicuous physiognomy of the forest floor. Such resources are being damaged by fire and grazing also.

The enumeration of the essential qualities of herb layer remains incomplete unless some mention are made of climbers, ferns and epiphytes.

Large woody climbers, another lifeform and a biotic association are remarkable because of their fantastic forms. They add complexities to the vertical structure of forests. There are, however, delicate climbers, shrubby climbers, woody climbers and stranglers apart from root climbers like some climbing palms. There are about six hundred climbers the half of which are shrubby climbers.

Epiphytes, however, are another lifeform that derive support from host plant. Some have remarkable adaptation to hold water. They consume water in a restricted way and many conserve water in their tubers. Base of overlapping leaves of some ferns forms a

special niche where soil, water and humus are held and nitrogen accumulates. Arboreal ants colonise, lay their eggs and drag seeds that grow in the niche. Insectivorous birds gather to eat ants and eggs; birds also gather and gradually a faunal association grows. Epiphytes are chief components of the vertical structure of our forests.

The trees, shrubs and herbs, the Trinity of environment yield substantial quality of medicinal drugs besides protecting the environment. No amount of administrative and legislative and protective measures to save the country from environmental disaster would be effective and lasting without creation of a dense cover of vegetation all over the country.

Medicinal Herbs and Their Conservation

Lists of medicinal (herbs, shrubs, climbers and trees) have been prepared from the view point of their conservation status. The lists must not be taken as checklists of plants of India for only a few and common species have been selected. The readers are requested to refer to Chaudhuri's work on herbs, shrubs, trees and climbers of India mentioned under reference which gives a present day view of the plants of India in general and Eastern India in particular.

Conservation related status are given category wise (Numbers indicate status as detailed below):

- Widespread and presently not threatened (Spordic) (S)
- Occur at selected spots and cultivated (C)
- Occur sporadically and require protection (presently safe) (PS).
- Depleted (D).

The study of vegetation reveals that more herbs occur in waste places and in marginal lands and along the edges of various forest types. Evergreen, semi-evergreen wet type of forests have comparatively few dicot species than monocot in terms of numbers of individuals.

Situation of Herb in India

A study undertaken by the author reveals the following:

- (i) Few herbs have a wide range of distribution.
- (ii) Most of the herbs are confined to forested areas and/or are sporadic indistribution.

- (iii) Gregariously occurring herbs are few.
- (iv) Moist localities have more number of species than drier and arid localities.
- (v) Temperate locations have more of gregarious herbs.

Table 10.1 : Wide distribution of some herbaceous species all over India

| Scientific Name | Status | Scientific Name | Status |
|--|--------|--|--------|
| <i>Sida veronicifolia</i> (Joka) | S | <i>Euphorbia hirta</i> (Swadaparui) | S* |
| <i>Sida cordifolia</i> (Barelela) | - | <i>Atylosia scarabioides</i> | S |
| <i>Urena sinucata</i> | S | <i>Mallugo hirta</i> | S |
| <i>Acalypha indica</i> (Muktajhuri) | S* | <i>Elephantopus scaber</i> (Shaydalan) | S |
| <i>Evolvulus asinoides</i> | S* | <i>Polygonum orientale</i> | S |
| <i>Solanum nigrum</i> | S | <i>Oxalis acetosella</i> | S |
| <i>Solanum indicum</i> | S | <i>Ageratum conyzoides</i> | S* |
| <i>Solanum Torvum</i> | S | <i>Eclipta alba</i> | S* |
| <i>Physalis peruviana</i> | S | <i>Capparis decidua</i> | S |
| <i>Scoparia dulcis</i> | S | <i>Abrus precatorius</i> (Kunch) | T |
| <i>Cenopodium album</i> | S | <i>Hiptage bengelensis</i> (Madhabilata) | S |
| <i>Heliotropium indicum</i> (Srihaslini) | S | <i>Jasminum grandiflorum</i> (Chameli) | S |
| <i>Zomia diphylla</i> | S | <i>Argyreia speciosa</i> (Rishya gandhri) | S |
| <i>Musaenda frondosa</i> (Nagballi) | S | <i>Marsdenia volubilis</i> (Nach chikni) | S |
| <i>Loranthus sp.</i> | S | <i>Hemidesmus indicus</i> (Anantamul) | T |
| <i>Capsella bursapasteris</i> | S | <i>Cucurbeiceous climbing</i> shrubs | S |
| <i>Cleome isosandra</i> | S | <i>Oxalis corniculata</i> (Amrul) | S |
| <i>Polygala crotalarioides</i> (Nilkanti) | S | <i>Martynia diandra</i> (Bagh nakhi) | S |
| <i>Portulaca oleracea</i> (Barmunia) | S | <i>Blumea lacera</i> (Kuksim) | S |
| <i>Malvastrum sp.</i> | S | <i>Taraxacum officinale</i> | S |
| <i>Vandellia sp.</i> | S | <i>Sida rohmoidea</i> (Pila Barela) | S |
| <i>Rungia parviflora</i> (Pini) | S | <i>Urena lobata</i> (Ban Okra) | S |
| <i>Pogostemon parviflorus</i> | S | <i>Clitoria tumatea</i> | S |
| <i>Amaranthus spinosus</i> (Kanta note) | S* | <i>Centella asiatica</i> | S |
| <i>Amaranthus viridis</i> | S* | <i>Merremia emerginata</i> | S |
| <i>Cannabis sativa</i> | C | <i>Solanum ferox</i> | S |
| <i>Rumex maritimus</i> | S | <i>Solanum xanthocarpum</i> | S |
| <i>Phyllanthus reticulatus</i> (Panjuli) | S | <i>Solanum surattense</i> | S |
| <i>Phyllanthus urinaria</i> (Hazarmani) | S | <i>Withania somnifera</i> | T |
| <i>Cenopodium ambrosioides</i> | S | | |

contd...

Table 10.1 – contd...

| Scientific Name | Status | Scientific Name | Status |
|--|--------|--|--------|
| <i>Picrorrhiza kurtoa</i> | T | <i>Chrosophora cinera</i> | |
| <i>Abutilon indicum</i> (Paleri) | S | (<i>Tut kukusima</i>) | S |
| <i>Flemesgia</i> sp. | S | <i>Lindenbergia urticaefolia</i> | |
| <i>Trianthema portulacastrum</i> | S | (<i>Haldebasanta</i>) | S |
| <i>Gangrea maderaspetane</i> | | <i>Oldenlandia corymbosa</i> | |
| (<i>Namuti</i>) | S | (<i>Khetkapra</i>) | S |
| <i>Argemone mexicana</i> | | <i>Wedelia calendula</i> (<i>Bhimraj</i>) | S |
| (<i>Sealkanta</i>) | S* | <i>Malachra capitata</i> | S |
| <i>Cleome gynandra</i> | S | <i>Saphora</i> sp. | S |
| <i>Polygala chinensis</i> (<i>Muradu</i>) | S | <i>Oldenlandia herbacea</i> | S |
| <i>Polycarpea corymbosa</i> | S | <i>Celosia argentea</i> | S |
| <i>Portulaca quadrifida</i> | | <i>Oxalis corniculata</i> | S* |
| (<i>chota numia</i>) | S | <i>Rubus</i> sp. | S |
| <i>Torenia asiatica</i> | S | <i>Embelia ribes</i> | T |
| <i>Justicia ganderussa</i> | | <i>Calamintha</i> sp. | S |
| (<i>Jagat madan</i>) | PS | <i>Achyranthes bidentata</i> | S |
| <i>Achyranthes aspera</i> (<i>Apang</i>) | S* | <i>Clematis nepalensis</i> | |
| <i>Boerhaavia diffusa</i> (<i>Punamava</i>) | S* | (<i>Churahar</i>) | T |
| <i>Amaranthus gangeticus</i> (<i>note</i>) | S* | <i>Clematis smilacifolia</i> | T |
| <i>Xanthium strumerium</i> | | <i>Thalictrum foliolosum</i> | |
| (<i>Ban Okra</i>) | S* | (<i>Mamira</i>) | T |
| <i>Rumex dentatus</i> | S | <i>Nasturtium palustre</i> | S |
| <i>Cyanotis</i> sp. | S | <i>Viola</i> sp. | S |
| <i>Phyllanthus simplex</i> | S | <i>Plantago ovata</i> (<i>Isabgul</i>) | S |
| <i>Phyllanthus niruri</i> | S | <i>Verbascum thapsus</i> | S |
| <i>Aerva lanata</i> (<i>Chaya</i>) | S | <i>Polygonum molle</i> | S |
| <i>Chenopodium album</i> (<i>Bestak</i>) | S | <i>Coptis teeta</i> (<i>Mismitita</i>) | T |
| <i>Alocasia indica</i> (<i>Mankachu</i>) | S | <i>Impatiens</i> sp. | S |
| <i>Amorphophallus campanulatus</i> | | <i>Potentilla</i> sp. | S |
| (<i>01</i>) | S | <i>Maesa indica</i> | S |
| <i>Commilina bengalensis</i> | | <i>Brunella vulgaris</i> | S |
| (<i>Kanachira</i>) | S | <i>Blepharis edulis</i> (<i>Ulangan</i>) | S |
| <i>Acanthus ilicifolius</i> | | <i>Clematis triloba</i> | S |
| (<i>Harakuchkata</i>) | S | <i>Clematis gouriana</i> | S |
| <i>Andrographis paniculata</i> | | <i>Corydalis govaniiana</i> (<i>Bhutkishi</i>) | S |
| (<i>Kalmegh</i>) | T | <i>Viola serpens</i> | S |
| <i>Asterocantha longifolia</i> (<i>Khirok</i>) | S | <i>Geranium</i> sp. | S |
| <i>Biophytum sensitivum</i> | | <i>Plantago major</i> | S |
| (<i>Ban naranga</i>) | S | <i>Rubia cordifolia</i> (<i>Monjista</i>) | S |
| <i>Sphaeranthus indica</i> | | <i>Polygonum chinense</i> | S |
| (<i>Mahashrabani</i>) | S | | |

Legend : S = Sporadic; S* = Sporadic, but has concentrated patches; PS = Presently same; - = Not known; T = Threatened; C = Cultivated

Table 10.1 – contd...

Statewise Common and Conspicuous Herb Flora of India

(* Sign preceding botanical name by species indicates very useful medicinal plants)

Andhra Pradesh

Alysicarpus sp.
Crotalaria willdenowiana
Vernonia cinera
Ipomoea pes-caprae
Indigofera anneaphylla
 * *Crotalaria hirta*
Xanthium indicum
Tephrosia tenuis
Indigofera cordifolia
Acanthospermum hispidium

Assam

Ageratum conyzoides
Inula cappa
Mikania micrantha
Alpinia nutans

Andamans

Acanthus ilicifolius
Blumea virens
Desmodium triflorum
Jatropha curcas

Bihar

* *Cassia occidentalis*
 * *Calotropis procera*
 * *Cassia tora*
 * *Abutilon indicum*
Triadax procumbens
 * *Desmodium triflorum*
Croton bonplandianum
 * *Amaranthus spinosus*
 * *Abrus precatorius*
Euphorbia hirta
Asclepias pseudosansa
 * *Atylosia scaraboeoides*

Delhi

* *Achyranthes aspera*
 * *Casia occidentalis*
 * *Crotalaria medicaginea*
 * *Indigofera cordifolia*

Atylosia sp.
Tephrosia purpurea
Alysicarpus monilifer
Indigofera aspalathoides
 * *Boerhavia* sp.
 * *Achyranthes aspera*
Cassia occidentalis
Crotalaria prostata
 * *Boerhavia diffusa*
Celosia argentea

* *Centella asiatica*
Melastoma malabathricum
Ipomoea sp.

Cucurbita sp.
Cassia tora
Centella asiatica

Vernonia cinerea
 * *Leucas aspara*
 * *Alysicarpus* sp.
 * *Tephrosia purpurea*
Berleria cristata
 * *Atylosia* sp.
Argemone maxicana
Borreria articulata
Corchorus trilocularis
 * *Alysicarpus monilifer*
Indigofera linifolia
Mucuna sp.

Ageratum conyzoides
 * *C. tora*
Degera muricata
 * *Tephrosia purpurea*

contd...

Table 10.1 – contd...

| | |
|---------------------------------|---------------------------------|
| Rhynchosia capitata | Eclipta prostrata |
| Ipomoea hispida | Borreria articulata |
| * Tephrosia tenuis | * Justicia diffusa |
| Gujarat | |
| * Alysicarpus longifolius | Enicostema verticillatum |
| <i>Heylandia latebrosa</i> | * <i>Alysicarpus</i> sp. |
| Clemome viscosa | Digera muricata |
| Indigofera cordifolia | Rhynchosia capitata |
| Vicoa indica | * Eclipta procumbens |
| * Tridax procumbens | * Borreria articulata |
| Crotalaria medicaginea | * Barleria cristata |
| <i>Trichodesma indicus</i> | <i>Ipomoea</i> sp. |
| Andaman | |
| Ipomea pes-caprae | Cardiospermum halicacabum |
| Euphorbia thymifolia | Tephrosia purpurea |
| * Zornia diphylla | Cressa cretica |
| * Crotalaria burhia | Phynchosia halicacabum |
| Euphorbia hypericifolia | * Phaseolus aconitifolius |
| <i>Rhynchosia</i> sp. | <i>Evolvulus alsionoides</i> |
| Commelina benghalensis | * Clitoria ternatea |
| <i>Vernonia cinerea</i> | <i>Aerva</i> sp. |
| <i>Boerhavia diffusa</i> | |
| Himachal Pradesh | |
| * <i>Atylosia scarabaeoides</i> | * <i>Crotalaria</i> sp. |
| * Cassia tora | Euphorbia hirta |
| Jammu & Kashmir | |
| * Cassia tora | * Tephrosia purpurea |
| Euphorbia jorta | |
| Kerala | |
| * Mimosa pudica | * Desmodium triflorum |
| Sphaeranthus sp. | * Achyranthes aspera |
| * Crotalaria alata | * <i>Atylosia scarabaeoides</i> |
| * Desmodium floribundum | * Moghonia chappar |
| * <i>Cassia tora</i> | * <i>Crotalaria</i> sp. |
| * <i>Phaseolus</i> sp. | <i>Sesbania aculeata</i> |
| Karnataka | |
| * Alysicarpus vaginalis | * Desmodium diffusum |
| * Indigorera linifolia | * Tephrosia purpurea |
| <i>Euphorbia hirta</i> | * <i>Plectranthus</i> sp. |
| * Indigofera enneaphylla | * Tephrosia tinctoria |
| * Clitoria ternatea | * Pueraria phaseoloides |

contd...

Table 10.1 – contd...

| | |
|---------------------------|---------------------------------|
| Madhya Pradesh | |
| Trimufetta bartramia | * Urena lobata |
| * Alysicarpus vaginalis | * Desmodium triflorum |
| * Xanthium indicum | * Centella asiatica |
| Caesulia axillaris | *Phaseolus radiatus |
| * Sesbania bispinosa | * Alysicarpus tetragonolobus |
| * <i>Moghania</i> sp. | * <i>Cassia tora</i> |
| * <i>Zornia diphylla</i> | * <i>Atylosia</i> sp. |
| Euphorbia hirta | * Indigofera cordifolia |
| * Alysicarpus rugosus | * Borreria articulata |
| * Corchorus trilocularis | * Indigofera linifolia |
| Maharashtra | |
| * Crotalaria retusa | * Aerva lanata |
| * Alysicarpus vaginalis | * Cassia tora |
| * Indigofera cordifolia | * I. linifolia |
| Phaseolus trilobus | Polygala erioptera |
| * Tephrosia purpurea | Tephrosia tenuis |
| * <i>Amaranthus</i> sp. | * <i>Desmodium diffusum</i> |
| Xanthium indicum | * Crotalaria prostata |
| * Desmodium triflorum | Heylandia latebrosa |
| * Crotalaria prostata | * Desmodium triflorum |
| Heylandia latebrosa | * rotalaria sericea |
| * Indigofera glandilosa | * Achyranthea aspera |
| * <i>Atylosia</i> sp. | * <i>Crotalaria alata</i> |
| * C. burhia | * Alysicarpus rugosua |
| * Alysicarpus longifolius | * Sesbania bispinosa |
| * Crotalaria juncea | Atylosia scarobaeoides |
| Argemone mexicana | * Crotalaria vestita |
| * Indigofera hebeptata | * Alysicarpus tetragonolobus |
| Manipur | |
| * <i>Crotalaris</i> sp. | * <i>C. medicaginea</i> |
| * <i>Desmodium</i> sp. | * <i>Indigofera enneaphylla</i> |
| Orissa | |
| * Cassia occidentalis | Croton bonplandianum |
| * Indigofera enneaphylla | * Desmodium triflorum |
| * Cassia tora | * Tridax procumbens |
| * <i>Crotalaria</i> sp. | <i>Triumfetta bartramia</i> |
| Ageratum conyzoides | Eranthemum Purpurascens |
| * Acyranthes aspera | * Alysicarpus vaginalis |

contd...

Table 10.1 – contd...

| | |
|------------------------------------|----------------------------------|
| Punjab | |
| * <i>Achyranthes aspera</i> | * <i>Alysicarpus</i> sp. |
| <i>Rhynchosia capitata</i> | * <i>Indigofera linifolia</i> |
| * <i>Vicoa indica</i> | * <i>Casia tora</i> |
| * <i>Boerhavia repens</i> | * <i>Crotalaria medicaginea</i> |
| <i>Xanthium indicum</i> | * <i>Tephrosia purpurea</i> |
| * <i>Atylosia scarabaeoides</i> | <i>Vernonia cinerea</i> |
| <i>Chenopodium album</i> | <i>Euphorbia hirta</i> |
| <i>Trigonella polycerata</i> | * <i>Artemisia</i> sp. |
| * <i>Indigofera cordifolia</i> | * <i>I. linifolia</i> |
| Rajasthan | |
| * <i>Achyranthes aspera</i> | * <i>Alysicarpus longifolia</i> |
| * <i>Cassia tora</i> | * <i>Crotalaria medicaginea</i> |
| * <i>Indigofera enneaphylla</i> | * <i>I. linifolia</i> |
| * <i>I. cordifolia</i> | * <i>Tephrosia purpurea</i> |
| * <i>T. tenuis</i> | * <i>Xanthium indicum</i> |
| * <i>Amaranthus blitum</i> | * <i>Crotalaria burhia</i> |
| * <i>C. albida</i> | * <i>Eclipta alba</i> |
| <i>Alysicarpus vaginalis</i> | <i>Argemone mexicana</i> |
| * <i>Boerhavia repens</i> | * <i>Crotalaria filipes</i> |
| * <i>Tridax procumbens</i> | <i>Justicia diffusa</i> |
| * <i>Aerva tomentosa</i> | * <i>Crotalaria umbellata</i> |
| <i>Heylandia latebrosa</i> | * <i>Phaseolus radiatus</i> |
| * <i>Boerhavia diffusa</i> | <i>Dicoma tomentosa</i> |
| * <i>Mimosa pudica</i> | * <i>Zorina diphylla</i> |
| <i>Tribulus terrestris</i> | * <i>Desmodium rotundifolium</i> |
| * <i>Alternanthera echinata</i> | |
| Tamil Nadu | |
| <i>Rhynchosia Psuedo-cajan</i> | * <i>Tephrosia</i> sp. |
| <i>Xanthium indicum</i> | * <i>Indigofera enneaphylla</i> |
| * <i>I. linifolia</i> | <i>Stylosanthes</i> sp. |
| * <i>Atylosia scarbeoides</i> | * <i>Desmodium floribundum</i> |
| * <i>Tephrosia purpurea</i> | <i>Stylosanthes fruticosa</i> |
| * <i>Alysicarpus vaginalis</i> | <i>Croton banpladianum</i> |
| <i>Euphorbia thymifolia</i> | * <i>Leucas hyssopifolia</i> |
| * <i>Indigofera trifoliata</i> | * <i>Achyranthes aspera</i> |
| * <i>Atylosia</i> sp. | * <i>Crotalaria prostrata</i> |
| * <i>Indigofera viscosa</i> | * <i>Pogstemon mollis</i> |
| * <i>Mimosa pudica</i> | <i>Polygala crotalarioides</i> |
| <i>Euphorbia trigona</i> | * <i>Alysicarpus monilifer</i> |
| * <i>Indigofera trigonelloides</i> | <i>Mollugo</i> sp. |

Table 10.1 – contd...

| | |
|-------------------------------|---------------------------|
| Stachytrapheta indica | * Jatropha curcas |
| Ageratum conyzoides | * Sida acutangula |
| Rhynchosia rufescens | |
| Tripura | |
| Carex condensata | * Hyptis brevipes |
| * Desmodium trifolium | * Ocimum sanctum |
| * Atylosia scarabaeoides | * Tridax procumbens |
| Uttar Pradesh | |
| * Alysicarpus sp. | * Cannabis sativa |
| * Euphorbia hirta | * Leucas aspera |
| * Phyllanthus maderaspatensis | * Atylosia sp. |
| * Vicoa indica | * Atylosia sp. |
| Heylandia latebrosa | * Indigofera linifolia |
| * Tephrosia villosa | * Cassia tora |
| * Crotalaria medicaginea | * Desmodium triflorum |
| Vernonia cinerea | * Tridax procumbens |
| * Zornia diphylla | * Xanthium indicum |
| * Aerva lanata | * Alysicarpus monilifer |
| Boerhavia repens | Justicia diffusa |
| Cassia occidentalis | * Chenopodium sp. |
| Spiraea canescens | Stellaria sp. |
| Stellaria decumbens | * Indigofera heterantha |
| * Polygonum cirrhifolium | |
| West Bengal | |
| * Centella asiatica | * Moghania sp. |
| * Leucas aspera | Vernonia cinerea |
| Argemone mexicana | * Atylosia scarabaeoides |
| * Cassia tora | * Clitoria ternatea |
| Croton bonplandianum | * Datura metel |
| Digera muricata | Euphorbia hirta |
| * Leucas aspera | Mikania micrantha |
| * Desmodium triflorum | * Alysicarpus monilifer |
| Borreria acticulata | * Vicoa indica |
| * Tephrosia purpurea | * Tridax procumbens |
| * Acanthus ilicifolius | * Sesuvium Portulacastrum |
| * Cassia occidentalis | Phyla nodiflora |
| * Tephrosia villosa | Ipomoea pes-caprae |
| * Achryanthes aspera | Triflorum repens |
| * Polygonum sp. | Inula cappa |
| * Cannabis sativa | * Pueraria sp. |

Chapter Eleven

Uses of Some Medicinal Plants of Selected Areas and Their Status

The aim and objective of this treatise is not enumerate the qualities of medicinal plants of the country. At the same time it is an imperative necessity to aware the people about the efficacy of some of the innumerable drug plants of the country.

As such the author has pickup some common plants of multifacet qualities and of some selected areas of the country and enumerated various uses.

The areas are:

- Medicinal plants of Arid and Desert areas.
- Plants of Sundarbans mangrove.
- Bankura district of West Bengal.
- Plants of Satpura plateau.

The status of each species of the areas has been mentioned.

Medicinal Properties of Some Selected Plant Species

This subject has been dealt with very elaborately by all the frontline authorities on the subject. As such the information presented in their work is not being repeated. Sibakali Bhattacharyya has dealt with various aspects of each sp. In his work (in 10 volumes) entitled "Chiranjib Vanusodhi", the author seems to cover this subject elaborately. Works of other authorities also give similar information.

In order to have a broad idea about the subject the present author has enumerated some information in diagrams for easy access to the subject by ordinary readers. These are some diagrammatic and some non-diagrammatic presentations of several very important and common plants.

There is perhaps a lacuna in the work of the frontline workers which is the omission in their work about mentioning the "remedy of a disease by a specific plant" (mention has been made of several plants as medicinal agents for particular disease). So a patient does not know what plant would be best to remedy the disease he are suffering from. The present authors are not sure if a plant or plants can be pinpointed to remedy a particular diseases.

Table 11.1

| Scientific name | Common name | Medicinal Uses |
|-----------------------------|-------------|--|
| <i>Bombax ceiba</i> | Semul | Dried stem and bark used in impotency, Gastro-intestinal disorder, Cough and female diseases. |
| <i>Butea monosperma</i> | Palash | Seeds and gum used in eradication of Intestinal worm, Sexual impotency, Restoration of menstrual cycle, Prevent pregnancy. |
| <i>Mimosa pudica</i> | Lajwati | Seed used in sexual impotency checking flow of semen through urine, Strong anthelmintic. |
| <i>Allum sativum</i> | Rasun | Dyspepsia, hicough, Infantile convulsions, Nervous affections. |
| <i>Basella rubra</i> | Pui Sag | Genitourinary tract, Headache, Insomnia. |
| <i>Rauwolfia serpentina</i> | - | In bites of poisonous reptiles and insects, corneal opacity, Cholders in painful bowel affection, High blood pressure, Insomnia. |
| <i>Piper nigrum</i> | Golmorich | Anthelmintic, Asthma, Throat disease, Piles, Night blindness, Carminative, Aphrodisiac, Purgative, Toothache. |
| <i>Euphorbia hirta</i> | | Dysentery, Colic pain, Bowel complaint, Increase flow of mith in women, Diarrhoea. |
| <i>Embllica officinalis</i> | Amloki | Carminative, Laxative, Tonic, Antipyretic, Bilioussness, Urinary Discharge, Leprosy, Anaema, Ophthalmia, Aphrodasiac Asthma. Bronchitis. |
| <i>Jatropha curcas</i> | Bharenda | Anthelmintic, Chronic dysentery Urinary discharge, Anaema, Fistula, |

contd....

Table 11.1 contd....

| Scientific name | Common name | Medicinal Uses |
|--------------------------------|--------------|---|
| | | Bad gum, Eczema, Wing worm. |
| <i>Cynodon dactylon</i> | Durba graze | Dysentery, Wound, Pyrrhoea, Piles. |
| <i>Phoenix sylvostris</i> | Khejur | Bronchitis, Haemoptysis, Worm, Cough. |
| <i>Piper cubeca</i> | Kababchini | Dysentery, Asthma, Gout. |
| <i>Aegel marmelos</i> | Bel | Cough, Cold, Dysentery, Scurvy, Typhoid, constipation. |
| <i>Santalum album</i> | Chandan | Fever, Cough, Gonorrhoea, Epilepsy, Pox, Whooping Cough. Stomachic, tonic anthelminitic, Kalazar. |
| <i>Andrographis paniculata</i> | Kalmegh | Bronchitis, Leprosy, Blood Purifier, Heart trouble, Asthma, Vomitting, Loss of memory, Leucoderma, Diuretic Bronchitis, Asthma, Gonorrhoea. |
| <i>Vites negunda</i> | Nisindha | Astringent, stomachic, Anthelmintic, for growth of hair. Eve disease. Leucoderma. Bronchitis, Asthma. |
| <i>Ocimum basilicum</i> | Bhutulsi | Stomachic, Anthelmentic, Cough, Gonorrhoea, Diarrhoea, Scorpoon sting, Snake bite. |
| <i>Ocimum sanctum</i> | Tulsi | Stomachic, Antipyretic, Heart disease, Leucoderma, Bronchitis expectorant. |
| <i>Curculigo orchiodes</i> | Shyam mushli | Sexual impotency, Veneral and Urinary diseases, Asthma, Jaundice, (Dried tuberous roots). |

Some Common Diseases and Their Remedy from Plants

Many plants and their parts are source for remedy of a single disease and also many more diseases. It could not be ascertained from the works of the researchers as to which species or what parts are most effective in the remedy.

Some More Diseases and Plants Used as Remedy

Anti-coagulant:

Justica adhatoda, *Allium sativum*, *Azadiachta indica*, *Camellia sinensis*.

Cardiovascular (Hypertensive and Cardio tonics):

Aegle marmelos (root, bark), *Allium pepa*, *Allium sativum*, *Arachis hypogea*, *Asclepias curassavica*, *Cururbita maxima*, *Piper aurantiacum*, *Rauwolfia serpentina* (root), *Terminalia arjuna* (bark).

Aphrodisiac :

Allium sepa, *Allium sativum*, *Aasparagus racemosus*, *Glycyrrhiza sp.*, *Hibiscus-rosa-sinensis* *Myristica fragans*, *Mucuna puriens*, *Strychnos nux-vomica*, *Tinospora cordifolia*.

Antiarthritis, Antiinflammatory :

Acorus calamus, *Allium sativum*, *Boswellia sarrata*, *Calophyllum innophyllum*, *Capsicum sp.* *Curcuma longa*, *Eclipta abla*, *Solanum nigrum*, *Withania somnifera*, *Xanthium strumerium*, *Zingiber officinale*.

Antiasthmatic :

Acalyha indica, *Acorus calamus*, *Justicia adhatoda*, *Albizzia lebbek*, *Ephedra sp.*, *Ocimum sanctum*, *Vitex negundo*, *Terminalia belerica*, *Piper longum*, *Saussurea lappa*, *Picrorhiza Kurroa*, *Lobelia sp.*, *Hedycium sp.*

Antidiabetic :

Aegle marmelos, *Allium sativum*, *Anona squamosa*, *Asteracantha longifolia*, *Azadirachta indica*, *Blumea sativum*, *Cinnamomum tamala*, *Crucuma longa*, *Embllica officinalis*, *Gymnema sylvestre.*, *Momordica charantia*, *Zingiber officinale*, *Swertia chirata*, *Syzygium cumini* (seed), *Musa paradisiaca*.

Bronchitis (Respiratory disorder) :

Picrohiza kurroa (Kutki)-dried rhizome; *Zingiber officinale* (Adark)-dried rhizome, *Myrica nagi* (Kaifal)-Dried root & bark; *piper longum* (bari papal)-Fruits; *Glycyrrhiza glabra*-(Muleltee)-dried roots; *Pistacia integerrima* (Kakrusungi)-Galls; *Desmondium gangeticum* (Salparni)-Leaf, stem; *Mesua ferrea* (naG-Kashar)-Fruit, Seed; *Withania somnifera* (Anwagandha)-Dried roots.

Liver disease :

Acacia catechu, *Azadirachta indica*, *Andropogon paniculata*, *Asteracantha longifolia*, *Andrographis paniculata*, *Allium sativum*. *Boerhaavia diffusa*, *Cynodon dactylon*, *Capparis spinosa* (Climbing shrub); *Embllica officinalis*.

Memory stimulant :

Acorus calmus, *Bacopa monnrieri*, *Centrella asiatica*, *Celastrus paniculata* (Climber), *Glycyrrhiza glabra*.

Hyper acidity :

Acorus calamus, Asparagus racemosa, Emblica officinalis, Glycyrrhiza glabra, Zingiber officinale.

Viral Diseases:

Among the viruses that infect human being, most common are HIV (Human Immunodeficiency Virus), HBV (Hepatitis-B Virus), IV (Influenza Virus), PV (Polio Virus), MV (Measles Virus) and some other viruses. Of these HIV cause AIDS (Acquired Immuno Deficiency Syndrome), appears lethal. An HIV attacks four lymphocytes of the human immune system. Plants Kill HIV directly are papaver (Opium), Wild snake, Periwinkle, Croton, Anemone, Gourd, Licorice (Jastimadhu, Castor (Aranila), Pine cone, King Bitter (Kalmesh)etc. Plants having components to interfere replications.

Galactagogue :

Plants containing several compounds which induce milk production in greater volume and secretion of the same in the human beings are termed galactagogues.

Number of plants species recognized as experimentally proven species are *Alstonia Schloaris* (Chattni), Oat, Fig. (Dummor), Fenugreek (Methi), Lettace (Jeera), Barley, Onion.

Various Qualities of Medicinal Plants

No elaborate information has been presented. The issue is very elaborate but the subject under discussion has a limited field. However some information are presented in the following paragraphs some of which are plants used in poliomyelites, Massage oil, specific diseases of women, beauty and care and also on ayurvedic uses.

It is just a broad view of the subject.

- **Creative value of some widely known plants.**

Adhatoda vasica - Expectorant and antiasthmatic.

Aegle marmelos

Plantago ovata

Ailanthus malabarica

} - Chronic diarrhoea & dysentery.

Bacopa monnieri

- For memory

Centella asiatica

- For intelligence

Melia azadirachta - Antiperiodic and many other diseases.

(Source : Ind. For. April 2004 : A.K. Bhattacharjee)

• **Suggested for poliomyelites-Oral drug.**

| | | |
|-------------------------------|---|------------------|
| <i>Asparagus racemosus</i> | - | Dried roots |
| <i>A. descendens</i> | - | " |
| <i>Bombax ceiba</i> | - | Dried bark |
| <i>Mucuna pariens</i> | - | Seeds |
| <i>Pueraria tuberosa</i> | - | Dried tuber |
| <i>Withania somnifera</i> | - | Dried roots |
| <i>Butea monospermat</i> | - | Gums |
| <i>Orchis latifolia</i> | - | Dried rhizome |
| <i>Curculigo orchioides</i> | - | Dried roots |
| <i>Salaginella bryopteris</i> | - | Leaves |
| <i>Cassia fistula</i> | - | Fruits and seeds |
| <i>Parmelia tinctorium</i> | - | (Lichen)-Thallus |
| <i>Tinospora cordifolia</i> | - | Dried stem |
| <i>Tribulus terrestris</i> | - | Dried fruits |
| <i>Bambusa bamboos</i> | - | Secretions |
| <i>Cotula anthelmoides</i> | - | Stem |
| <i>Gardenia gummifera</i> | - | Gum |

• **Herbal massage oil-Curative to Children.**

| | | |
|----------------------------|---|------------------------|
| <i>Tribulus terrestris</i> | - | Dried fruits |
| <i>Pedaliium sp.</i> | - | Dried fruits |
| <i>Cotula anthemoides</i> | - | Dried stem and leaves |
| <i>Gardenia gummifera</i> | - | Gum |
| <i>Colchicum tuteum</i> | - | Dried corn |
| <i>Myrica nagi</i> | - | Dried root bark |
| <i>Embelia ribes</i> | - | Dried fruits |
| <i>Mesua ferrea</i> | - | Flower, bud and fruits |
| <i>Onsoma echoides</i> | - | Dried flower |
| <i>Myristica fragrans</i> | - | Dried fruit |
| <i>Carum coptieum</i> | - | Seeds |
| <i>Odina woodier</i> | - | Gums. |

- **Species recommended for Women's Menorrhagia**

| | | |
|---------------------------|---|------------------|
| <i>Symplocos racemosa</i> | - | Dried stem bark |
| <i>Cocculus villosus</i> | - | Leaves |
| <i>Bombax ceiba</i> | - | Stem bark |
| <i>Rhus coriaria</i> | - | Galls |
| <i>Mesua ferrea</i> | - | Fruits and seeds |
| <i>Myrica nagi</i> | - | Root bark |
| <i>Picrorhiza kurroa</i> | - | Dried rhizome |

- **Species recommended for women's Leucorrhoea**

| | | |
|---------------------------|---|-----------------|
| <i>Symplocos racemosa</i> | - | Dried stem bark |
| <i>Paeraria tuberosa</i> | - | Tuber |
| <i>Butea monosperme</i> | - | Gum |
| <i>Sida acuta</i> | - | Seeds |
| <i>Withania somnifera</i> | - | Roots |

- **Plants used in Beauty and Care**

| | |
|--------------------------|----------------------|
| <i>Argemone maxicana</i> | Aloe vera |
| <i>Musa sp.</i> | Bixa orellana |
| <i>Medicago sp.</i> | Terminalia arjuna |
| <i>Prunus sp.</i> | Asparagus racemosus |
| <i>Rubus sp.</i> | Terminalia bellirica |
| <i>Ribes sp.</i> | Allium Sepa. |
| <i>Rumex sp.</i> | Vitis sp. |
| <i>Viola sp.</i> | Melilotus sp. |
| <i>Plantago sp.</i> | |
| <i>Glycine sp.</i> | |
| <i>Zyziphus sp.</i> | |

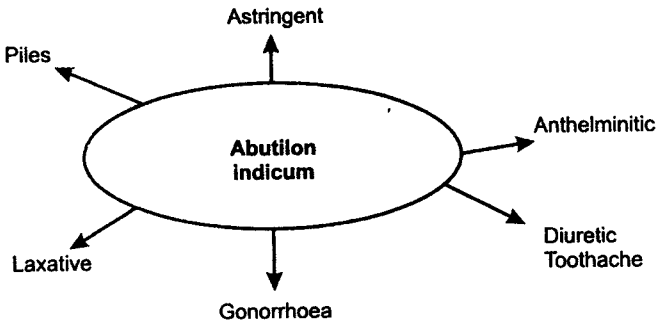
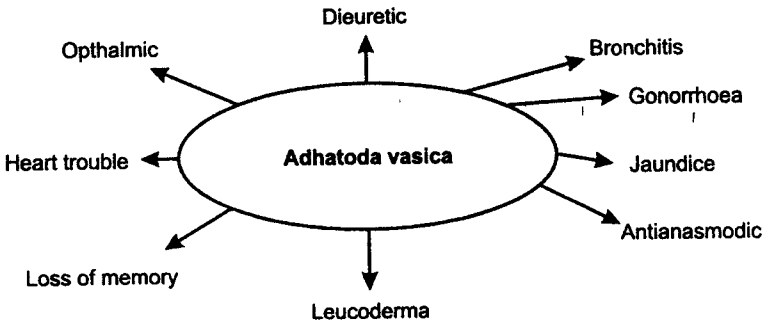
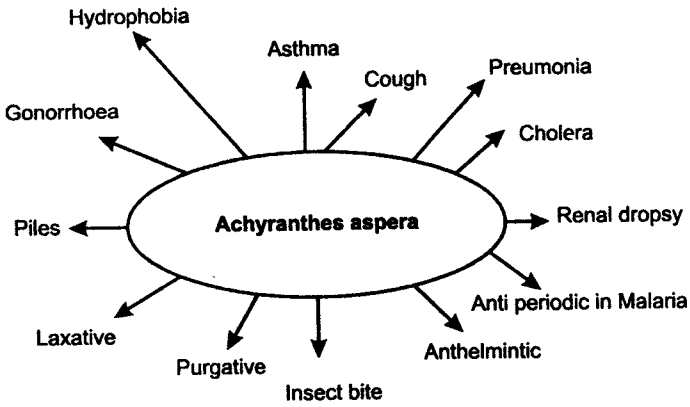
- **Some Ayurvedic medicinal plants.**

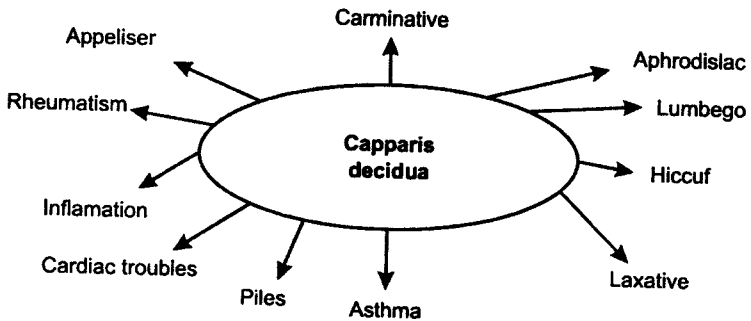
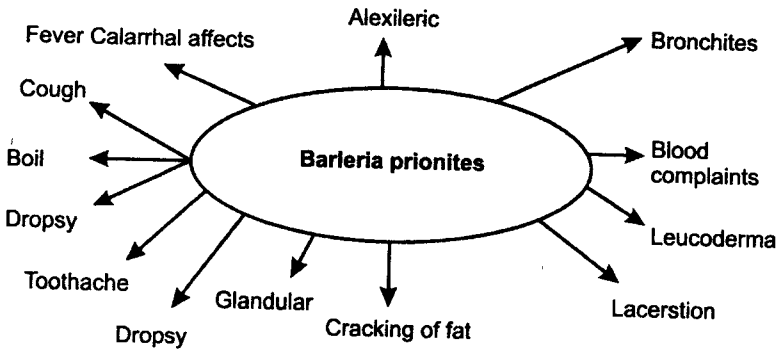
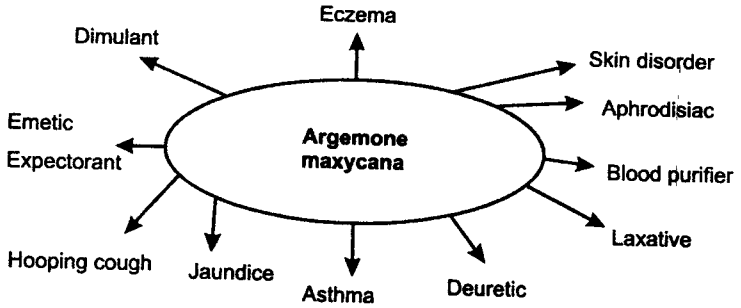
| | | |
|------------------------|----------------------------|-----------------------|
| <i>Acacia cubeba</i> | <i>Aristolochia Sp.</i> | <i>Bauhinia Sp.</i> |
| <i>A. farniciana</i> | <i>Artocarpus Sp.</i> | <i>Berberis Sp.</i> |
| <i>Acoras calamus</i> | <i>Aspoaragus racemosa</i> | <i>Saxifraga Sp.</i> |
| <i>Aloe vera</i> | <i>Azadirachata indica</i> | <i>Bombax ceiba</i> |
| <i>Alpinia galanga</i> | <i>Bacopa Sp.</i> | <i>Calotropis Sp.</i> |

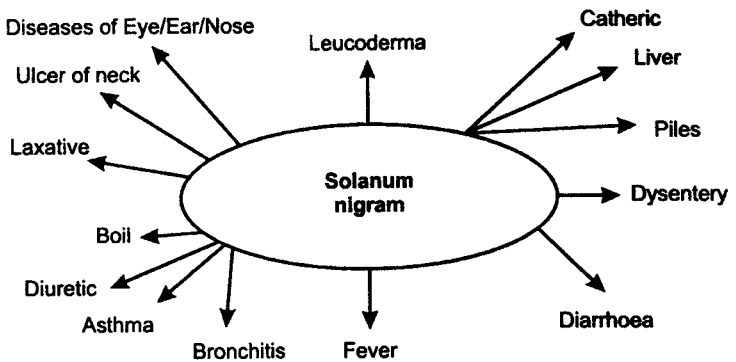
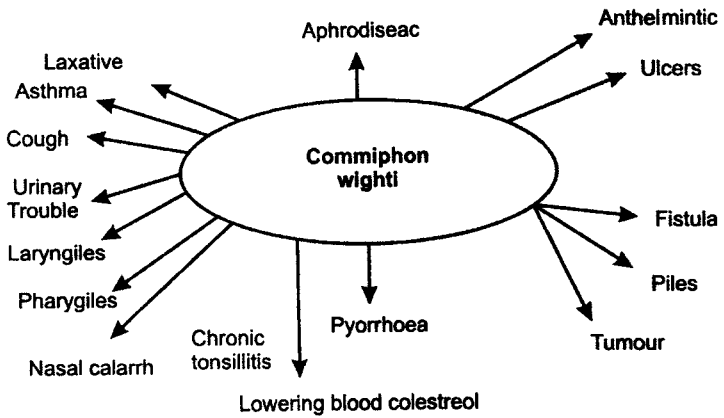
| | | |
|------------------------------|-----------------------------|------------------------------|
| <i>Altingia excelsa</i> | <i>Balanites</i> Sp. | <i>Calophyllum mophyllum</i> |
| <i>Areca catechu</i> | <i>Balliospermum</i> Sp. | <i>Bachanania lanzan</i> |
| <i>Argimone maxicana</i> | <i>Atropa acuminata</i> | <i>Butea monosperma</i> |
| <i>Carum</i> Sp. | <i>Coptis teeta</i> | <i>Tribullus terrestris</i> |
| <i>Carica occidentalis</i> | <i>Cordia myxa</i> | <i>Taxus baccata</i> |
| <i>Cassia occidentalis</i> | <i>Costus speciosus</i> | <i>Terminalia arjuna</i> |
| <i>C. tora</i> | <i>Corton oblongifolius</i> | <i>Rauwolfia serpentina</i> |
| <i>C. fistula</i> | <i>C. tigilium</i> | <i>Sida cordifolia</i> |
| <i>C. absus</i> | <i>Curculigo orchioides</i> | |
| <i>Chenopodium</i> Sp. | <i>Curcuma longa</i> | |
| <i>Cinnamomum zeylanicum</i> | <i>C. zeodaria</i> | |
| <i>Cissus vuadrangularis</i> | <i>Cynodon dactylon</i> | |
| <i>Calotropis</i> Sp. | <i>Cyperus rotundus</i> | |
| <i>Clitorea ternate</i> | <i>Dillenia indica</i> | |
| <i>Coccinia indica</i> | <i>Digitalis purpurea</i> | |
| <i>Eclipta alba</i> | <i>Dioscorea bulbifera</i> | |
| <i>Zizyphus jijuba</i> | <i>Vernonia cinera</i> | |
| <i>Zanthophyllum alatum</i> | | |

• **Species having High valued domestic need.**

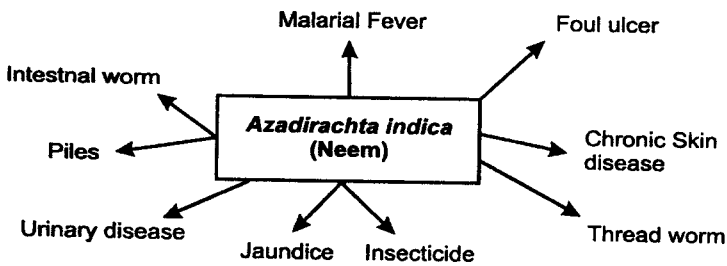
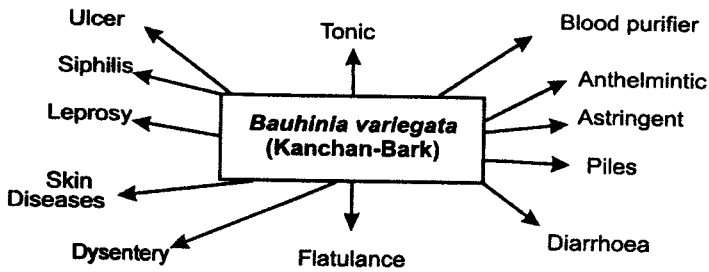
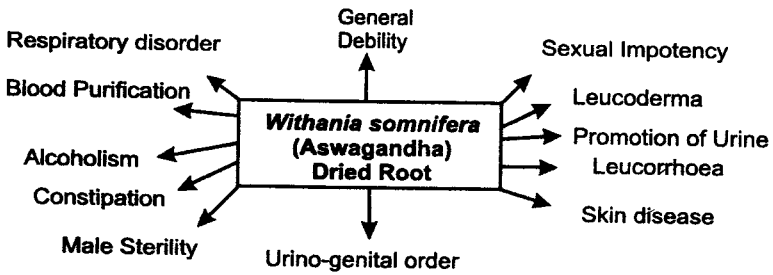
Emblca officinalis (Amla), *Withiana so nifera*, *Allicum sativum* (Lahsun), *Curcuma longa* (Haridra), *Picrorhiza carroa* (Kutki), *Tinospora cordifolia* (Gulduchi), *Ocimum sp.* (Tulsi), *Zingiber officinalis* (Adark), *Azadirachta indica* (Neem), *Convolvulus pluricaulis/ Evolvulus alsinoides* (Sankhapushpi), *Asparagas racemosus* (Shatavari), *Commiphora mukul* (Guggul), *Aconitum ferox* (Valsanbh), *Garcinia cambagia* (Kokum), *Plantago ovata* (Isabgul), *Holarrhena pubescens* (Kutaya), *Andrographis paniculata* (Kalmegh), *Saussura lappa* (Kushth), *Saraca asoca* (Asoka), *Justicia adhatoda* (Vasak).

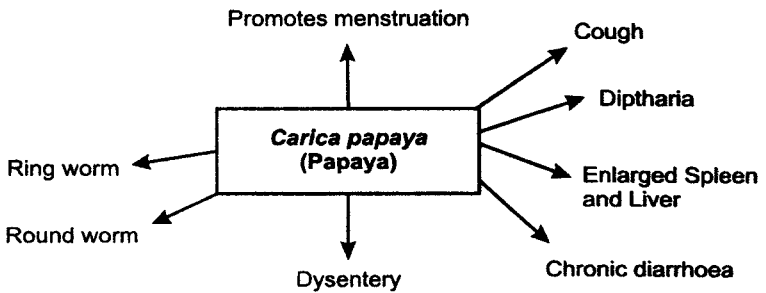
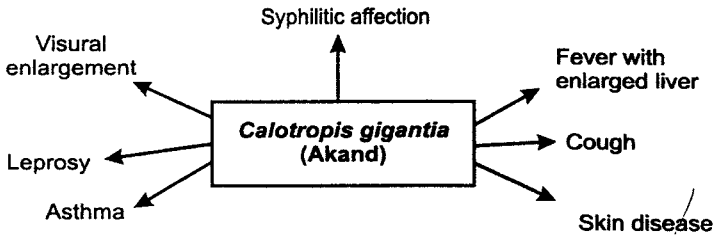
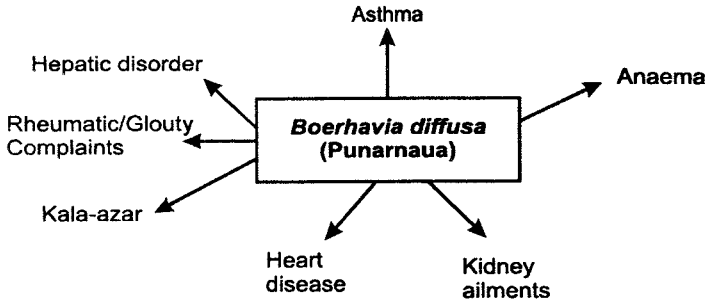


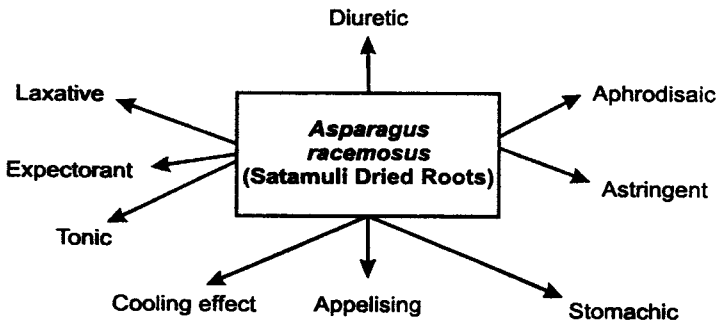
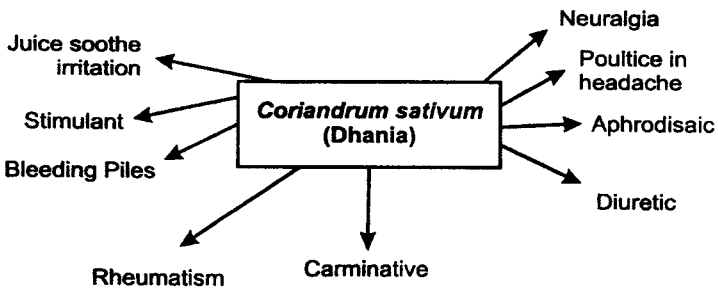
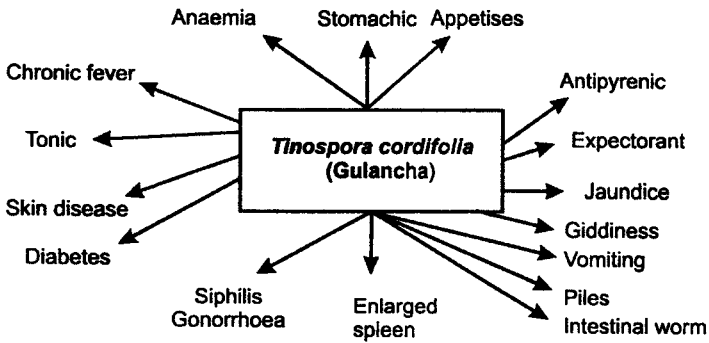


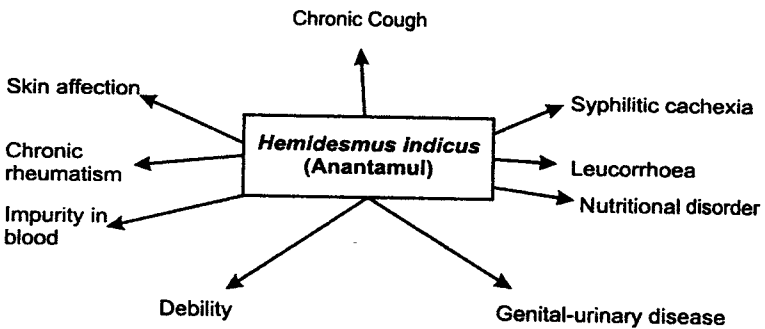
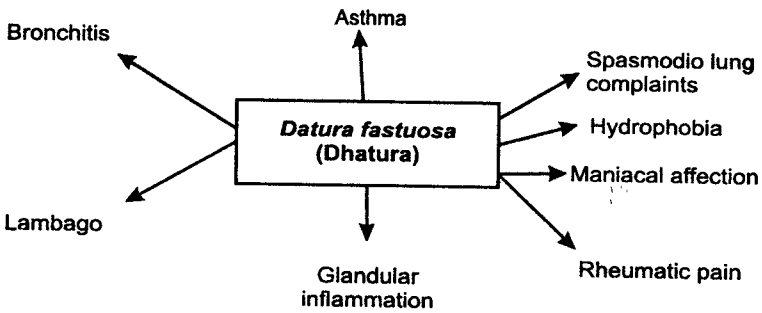
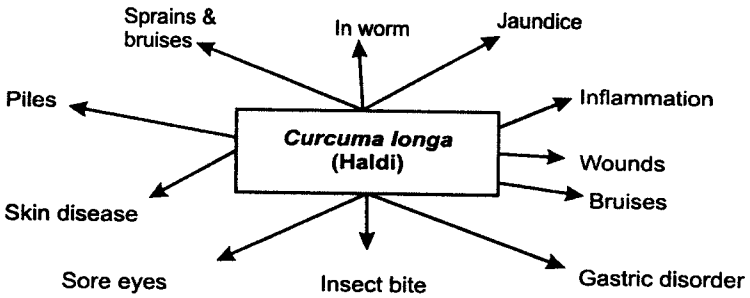


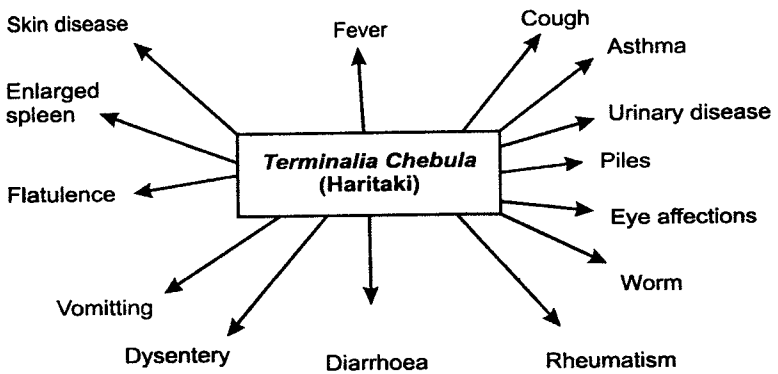
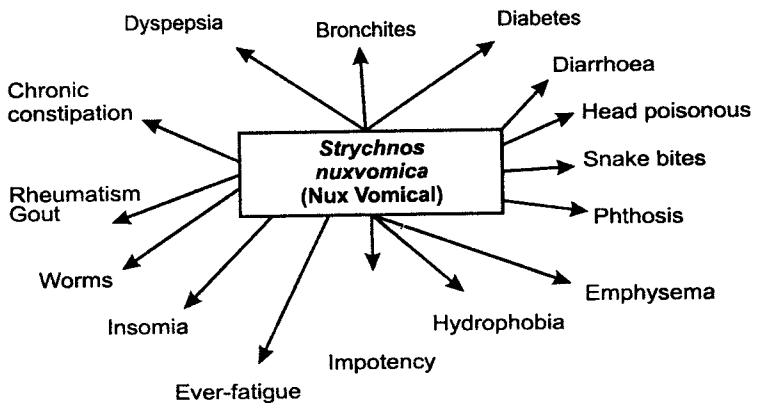
Loss of Qualities of Some Medicinal Plants of India
(Diagrammatic Presentation)

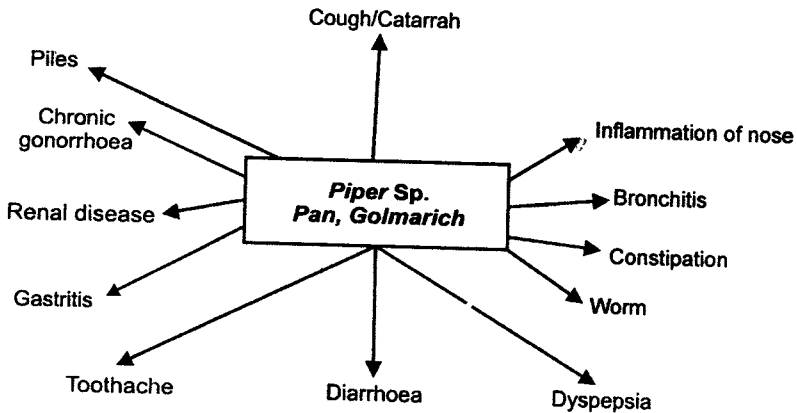
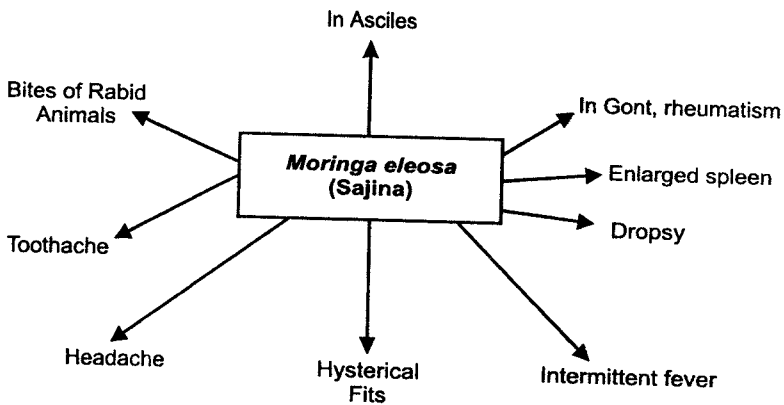
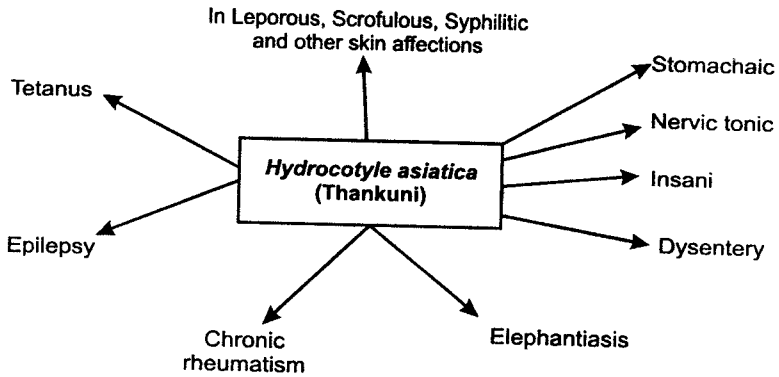






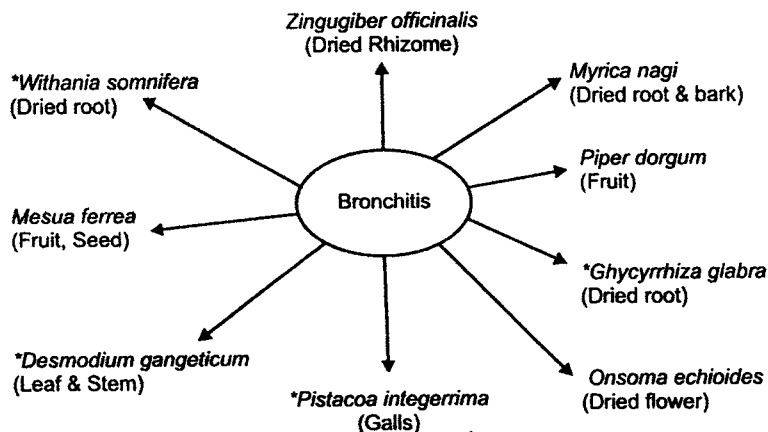
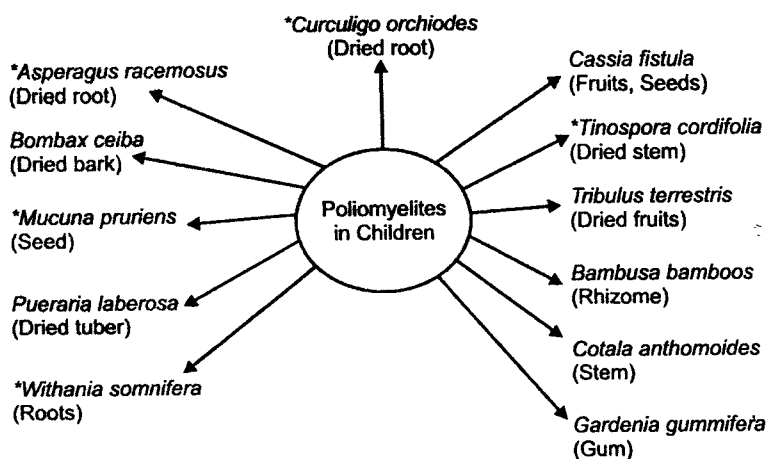




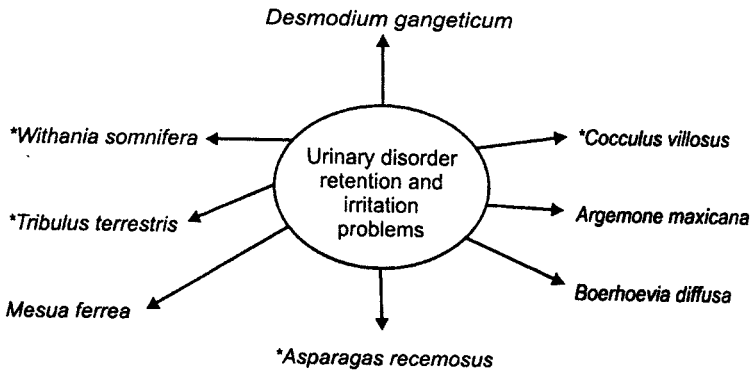
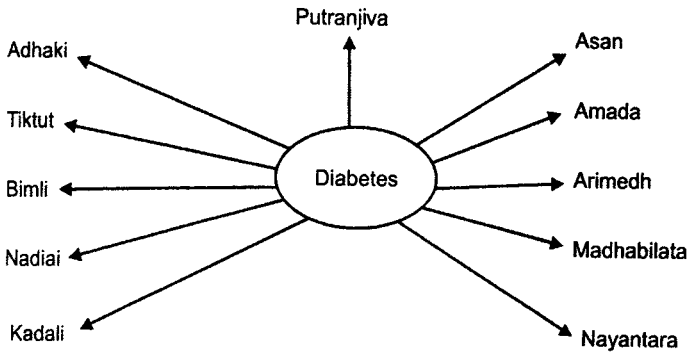
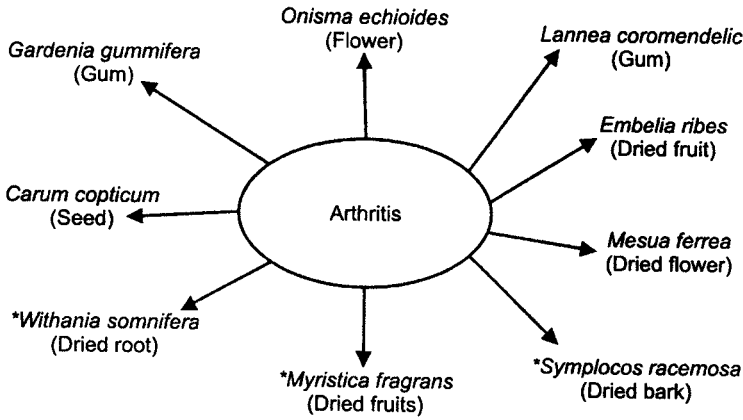


Some Common Diseases and Their Remedy from Plants

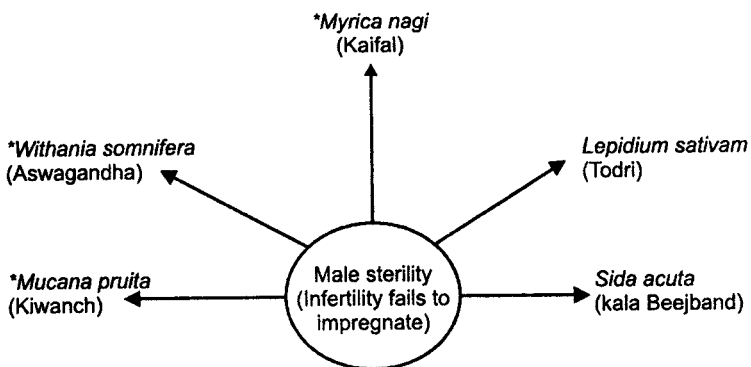
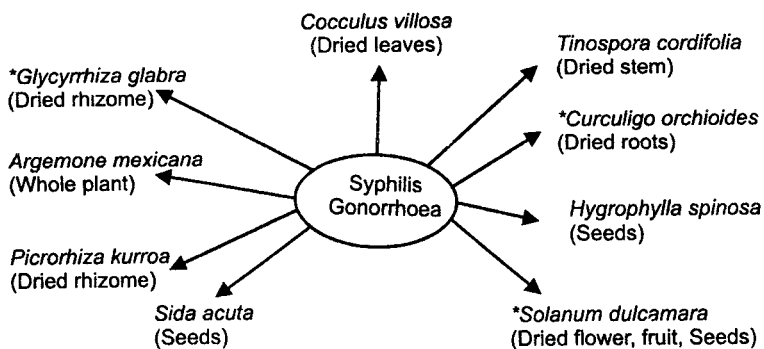
Many plants and their parts are source for remedy of a single disease and also many more diseases. It could not be ascertained from the works of the researchers as to which species or what parts are most effective in the remedy.

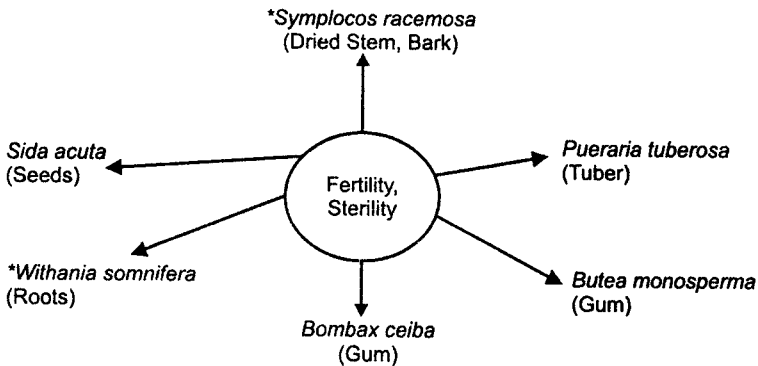
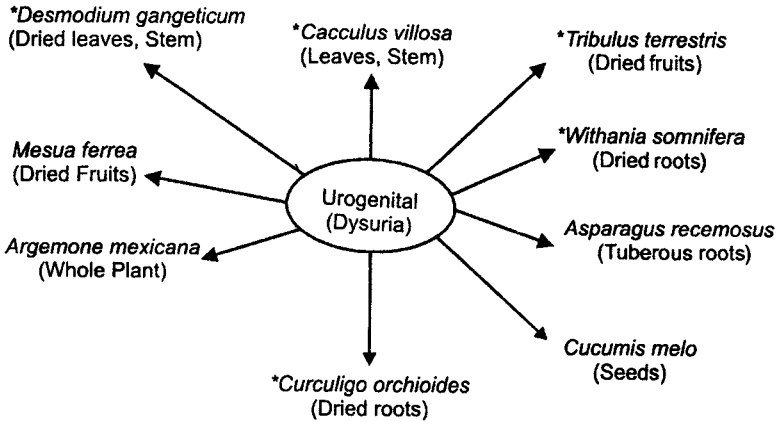
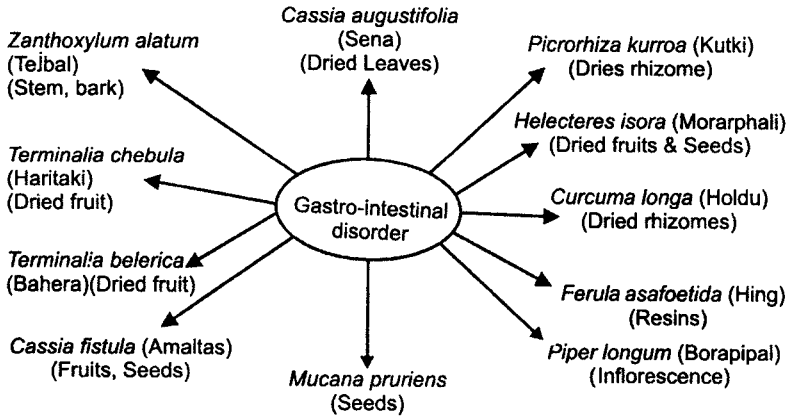


* Not common, rare



* Not common, rare





Medicinal Plants from Arid and Desert Areas

Thar desert of India is the seventh largest desert of the world and one of the most inhospitable eco-geographical region of India. It is spread over the states of Punjab, Haryana, Rajasthan and Gujarat. It covers 12 per cent of India's geographical area; besides 26 per cent area is semi arid. The hot desert area of Rajasthan has 17.44 million human and 23.33 million livestock population (2001 census). The average annual rainfall is only 100 mm to 500 mm, occurring erratically between July and September. Maximum area is covered by sand dunes ; the rest by gravel plains. The vegetation is very scanty. The forest cover is less than 3 per cent which is depleting fast due to increase human and livestock population. Of the total number of plant species 45 species are considered to be rare and/or either endangered. The area has a large number of plants of economic importance and medicinal use.

K.K. Chaudhuri (Ind. For. March,2005) records 157 medicinal plants belonging to 124 genera and 62 families. 27 species are monotypic which shows the vulnerability of these species.

Important cultivated species are–*Bacopa monnieri*, *Boerhaavia diffusa*, *Plantago ovata*, *Plumbago zeylanica*.

Of the total 157 medicinal plant species, 42 are cultivated, 115 are wild. 110 species face ruthless collection depleting the very sustainable existence.

Of 157 plant species, 85 are herbs, 51 shrub, 21 trees. There is only one pereninal Sedge and a climber and annual grass.

Though most of these listed plants have been included in the list of midicinal plants of India, recorded so far, the list prepared by Chaudhuri is presented with some modification as some of the properties of plants used by local people differ from recorded used. (*Source* : K.K. Chaudhari, Ind. For. March, 2005).

Table 11.2 : Medicinal Plants of Arid and Desert Areas

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|----------------------------|---------------------|---------------------|--|--------|
| <i>Abrus precatorius</i> | Ratti, Chirmi | Seed | Sore throat, cough, chronic inflammation of mucus membrane of eyeball & eyelid. | S |
| <i>Abutilon indicum</i> | Kanghi, Tara-kanchi | Whole plant | Astringent, anthelmintic, diuretic alexiteric, toothache, demulcent tonic, rheumatism, piles, laxative, gonorrhoea. | S |
| <i>Abutilon indicum</i> | Kanghi | Seed | Tonic, gonorrhoea, bladder stone. | S |
| <i>Acacia nilotica</i> | Babool | Leaves, Bark gum | Eye sores in children, sexual impotency, diseases of urino-genital system. Astringent, demulcent, asthma, PS diarrhoea. | PS |
| <i>Acacia genegal</i> | Kumatia | Gum | Emollient, demulcent, burns, sore nipples, haemorrhage, intestinal mucous, food for diabetes | PS |
| <i>Achyranthes aspera</i> | Andhi-jaro, Apamarg | Whole plant | Asthma, Cough, cholera renal dropsy, gonorrhoea, eye dis. Piles, laxative, purgative anthelmintic, anti-periodic in malaria, insect bite, pneumonia hydrophobia. | PS |
| <i>Adhatoda zeylanica</i> | Adua | Whole plants' | Diuretic bronchitis gonorrhoea, jaundice, anti-spasmodic, ophthalmic, heart trouble, loss of memory, leucoderma. | S |
| <i>Aegle marmelos</i> | Bel | Root, Leaves, Fruit | Abdominal pain, heart palpitation urinary troubles, laxatives, febrifuge, ophthalmic, deafness, dysentery. | PS |
| <i>Aerva persica</i> | Bui | Flower | Information. Swelling demulcent, diuretic | PS |
| <i>Ageratum conyzoides</i> | Doachunry | Leaves, root | Styptic, sores cuts; Root: antilithic | PS |

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Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|-----------------------------------|-----------------------------------|-------------|--|--------|
| <i>Alianthus excelsa</i> | Ardu | Bark | Appetizer, arthelmintic, dysentery chronic bronchitis | PS |
| <i>Alhagi pseudalhaqgi</i> | Jawasa | Whole plant | Laxative, diuretic, expectorant, piles, rheumatism | |
| <i>Alternanthera sessilis</i> | Bhaji | Whole plant | Lactagogue, febrifuge, eye wash galactagogue. | PS |
| <i>Amaranthus viridis</i> | Jangli chauli | Leaves | Emollient, Laxative. | PS |
| <i>Argemona mexicana</i> | Satyanashi | Whole plant | Eczema, skin disorders, blood purifier, laxative, emetic, expectorant, demulcent, jaundice, asthma diuretic, leucoderma, liniment of head, aphrodisiac, whooping cough. | PS |
| <i>Aristolochia bracteorolata</i> | Kiramar, Hukka-bel | Whole plant | Anthelmintic, emmenagogue purgative, fever, joint pain, uncer, eczema. | S |
| <i>Asparagus racemosus</i> | Satawari | Root | Aphrodisiac, laxative, expectorant, galactagogue, tuberculosis, leprosy, epilepsy, night blindness, diseases of kidney, liver blood, eye and throat. | T |
| <i>Azadirachata indica</i> | Neem | Whole plant | Anthelmintic, Diuretic, blood and skin diseases, leprosy, insecticidal, ophthalmia, biliousness,. | PS |
| <i>Bacopa monnieri</i> | Brahmi | Whole plant | Nerve tonic, memory promoter, epilepsy, insanity. | S/T |
| <i>Balanites aegyptiaca</i> | Hingotio, Hingota | Whole plant | Purgative, anthelmintic, alexipharmic anti-dysentric, analgesic, leucoderma, ulcers, skin diseases, whooping cough, boils, leucoderma, skin. | T |
| <i>Barleria cristata</i> | Raktajhinti | Whole plant | Inflammation, fever bronchitis biliousness, tympanitis | S |
| <i>Barleria prionitis</i> | Bajra-danti, Kala bans, Chapri | Whole plant | Alexiteric, Bronchitis, blood complanists, leucoderma, laceration, cracking of feet, fever, catarrhal affection, cough, diarrhoea, toothache, boils glandular swellings, dropsy. | S |

contd...

Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|---------------------------------|----------------------|---------------------------------|---|--------|
| <i>Bergia suffruticosa</i> | Kankaio, Karbuji | Leaves | Sores, broken bones. | S |
| <i>Blepharis linaraefolia</i> | Bhangari, Bili-Khoja | Seed | Earache, tonic, increase milk production. | S |
| <i>Boerhavia diffusa</i> | Purarnava | Whole plant | Astringent, biliousness, anaemia, night blindness, leucoderma, inflammation blood purifier, diuretic, laxative, expectorant, intestinal inflammation, fever. | PS |
| <i>Boswellia serrata</i> | Salar, Salaran | Bark, fruit, gum | Biliousness, dysentery, skin diseases, ulcer, blood purifier, leucoderma, piles, antipyretic, astringent, emmenagogue, rheumatism, vaginal discharge, diabetes, bronchitis. | PS |
| <i>Butea monsperma</i> | Palas, Dhak | Root, bark, leaves, flower, gum | Night blindness, elephantiasis aphrodisiac, laxative, dysentery, stomach worms, piles astringent, tonic, eye diseases, diuretic, chronic diarrhoea, round worm. | PS |
| <i>Cadaba fruticosa</i> | Dabi, Kodhab | Root, Leaves | Anthelmintic, emmenagogue, antiseptic, purgative, urinary obstruction. | S |
| <i>Callogonium polygonoides</i> | Phog, Phogda | Root Leaves | Washing eyes, sore gum. | PS |
| <i>Calotropis procera</i> | Madar | Whole plant | Toothache, stomachache, appetizer, piles, asthma, tonic. | PS |
| <i>Copparis deciduas</i> | Ker | Whole plant | Carminative, aphrodisiac, appetizer emmenagogue, alexipharmic, lumbago, rheumatism, hiccup analgesic, diaphoretic, laxative, anthelmintic, ulcer, cough, asthma, piles, cardiac troubles, inflammation. | PS |

contd...

Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|----------------------------------|----------------------|--------------|---|--------|
| <i>Caraluma edulis</i> | Pimpa | whole plant | Anthelmintic, leprosy, blood diseases. | S |
| <i>Cardiospermum halicacabum</i> | Chirphuta | Root, Leaves | Diaphoretic, diuretic, gonorrhoea, rheumatism, lumbago, emmenagogue. | S |
| <i>Caropegia bulbosa</i> | Khapparkada | Tubers | Digestive tonic. | S |
| <i>Cassia auriculata</i> | Anwal, Tarawar | Whole plant | Skin diseases, astringent, anthelmintic diabetes, urinary disorders, conjunctivitis. | S |
| <i>Cassia occidentalis</i> | Anwal | Whole plant | Skin diseases, astringent, anthelmintic. | PS |
| <i>Cassytha filiformis</i> | Amebel | Whole plant | Diuretic, dysentery, ulcer, tonic, gonorrhoea, rickets, leucorrhoea. | PS |
| <i>Celosia argentea</i> | Surh Garke | Leaves, Seed | Antipyretic, aphrodisiac, liver tonic, gonorrhoea. | PS |
| <i>Chenopodium album</i> | Bathua | Whole plant | Appetizer, anthelmintic, diuretic, laxative, aphrodisiac, abdominal pain, eye disease, piles, tonic, diseases of blood, heart and spleen. | PS |
| <i>Chenopodium ambrosioides</i> | | Whole plant | Carminative, emmenagogue, pectoral complaints, amenorrhoea, nervous affection. | PS |
| <i>Chrozophora rottleri</i> | Shadevi | Whole plant | Emetic, corrosive. | PS |
| <i>Citrullus colocynthis</i> | Tumba, Indrayan | Root, Fruit | Purgative, jaundice, rheumatism, urinary disease | C |
| <i>Cleome gynandra</i> | Safed bagro, Karalia | Seed, Leaves | Anthelmintic cough sores, rubefacient intermittent fever, muscular pain, rheumatism, headache, intestinal. | PS |

contd...

Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|---------------------------------|--------------------------------|--------------|---|--------|
| <i>Cleome vahliana</i> | Madhi, Khiramar, Noli, Nodi | Seed, Leaves | Carminative, anthelmintic, rubefacient, vesicant, piles, round worms, leucoderma, skin diseases, earache, fever, dysentery, paratyphoid, bronchitis, gonorrhoea. | S |
| <i>Cleome viscosa</i> | Handi-bagro, piihulhul | Whole plant | Laxative, anthelmintic, diuretic, ulcer leprosy, malaria, piles, lumbago. | S |
| <i>Clerodendrum phlomidis</i> | Arni | Root, leaves | Laxative, alexipharmic, anaemia diabetics, chyluria, bronchitis, dyspepsia, inflammation, piles. | S |
| <i>Chloria ternalea</i> | Gokari | Root, Seed | Laxative, diuretic, alexiteric, anthelmintic, brain tonic, corneal ulcer elephantiasis, leucoderma. | S |
| <i>Cocculus hisutus</i> | Chhireta | Root, Leaves | Alexipharmic, antipyretic, laxative, soporific, venereal pain. | S |
| <i>Cocculus pendulus</i> | Poilawan | Leaves | Skin diseases. | S |
| <i>Commelina benghalensis</i> | Bukana | Whole plant | Emollient, leprosy. | PS |
| <i>Commelina obliqua</i> | Kanjuna | Root | Vertigo, laxative. biliousness, fever. | PS |
| <i>Commiphora wightii</i> | Guggal | Gum | Laxative, aphrodisiac, alternative, anthelmintic, biliousness, ulcers, fistula, piles, pyorrhea, chronic, tonsillitis, pharyngitis, chronic bronchitis, chronic nasal catarrh, laryngitis, phthisis, urinary troubles, asthma, cough & cold, tumours, leucoderma, lowering blood cholesterol. | T |
| <i>Convolvulus microphyllus</i> | Santri | Whole plant | Laxative, brain tonic. | S |

contd...

Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|----------------------------|---------------------|--------------|--|--------|
| <i>Corchorus depressus</i> | Chamkas, bahuphali | Whole plant | Sexual impotency, weakness, fever, demulcent, dysentery, laxative, appetizer, anthelmintic, antiperiodic carminative, dyseopsia, catarrh, liver, disorder. | C |
| <i>Corchorus olitorius</i> | Champghas | Seed, leaves | Alternative, alexiteric, diuretic, tumours, gonorrhoea, cystitis, dysuria. | C |
| <i>Corchorus tridens</i> | Kag-nasha | Whole plant | Gonorrhoea, tonic. | |
| <i>Cordia gharaf</i> | Godela | Bark, Fruit | Astringent, headache, constipation, stomach worms piles toothache. | S |
| <i>Cressa cretica</i> | Lana | Whole plant | Aphrodisiac, stomachic, asthma diurtic, leprosy, biliousness, appetizer, tonic. | S |
| <i>Crotalaria burhia</i> | Shinyo | Whole plant | Hydrophobia, swelling. | S |
| <i>Curumus prophetarum</i> | Khat-Kachirio | Root, Fruit | Indigestion fever, purgative emetic. | S |
| <i>Cuscuta hyaline</i> | Amar bel, akash bel | Whole plant | Purgative, itch, protracted fevers, sores, chest pain. | PS |
| <i>Cuscuta reflexa</i> | Akash-bel | Whole plant | Aphrodisiac, diuretic, paralysis, heart & spleen disease, lumbago, emmenagogue, sedative, biliousness. | PS |
| <i>Cynodon dactylon</i> | Dub | Whole plant | Astringent, diuretic, dropst, cut, wound, genital urinary disorder. | PS |
| <i>Cyperus rotundus</i> | Motha, Mothee | Root-tuber | Diuretic, emmenagogue, anthelmintic, diaphoretic, astringent, stimulant, stomach disorder, bowel irritation | PS |
| <i>Dactyloctenium Sp.</i> | Malra, Manchi, Kuri | Seed | Bellyache after chilbirth, kidney pain. | PS |

contd...

Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|---------------------------------|-----------------------------|---------------------|--|--------|
| <i>Datura innoxia</i> | Dhatara | Root, leaves, seed | Toothache, insanity, catarrhal, cerebral complaints, skin diseases, lumbago, fever, asthma, hydrophobia malarial fever. | S |
| <i>Datura stramonium</i> | Dhatara | Leaves, Seed, Fruit | Antispasmodic, narcotic, anodyne, sedative, intoxicant, carbuncles. | S |
| <i>Dicoma tomentosa</i> | Vajradanti, Choloharnacharo | Whole plant | Pyorrhoea, febrifuge, febrile attacks. | S |
| <i>Digera muricata</i> | Khanjuru | Whole plant | Astringent, laxative, biliousness, urinary discharge | S |
| <i>Echinops echinatus</i> | Unt-Kanta, Unt-Katalo | Whole plant | Alterative, diuretic, nervetonic hysteria, dyspepsia, ophthalmi, cough, scrofula, seminal debility. | S |
| <i>Eclipta alba</i> | Bhangro | Whole plant | Emetic, purgative antiseptic, tonic, hepatic and spleen enlargement, jaundice, catarrh, skindiseases, hair dye. | PS |
| <i>Ehretia aspera</i> | Tombolan | Fruit | Venerealdiseases. | |
| <i>Enicostema hyssopifolium</i> | Chota-chirayata | Whole plant | Blood purifier, dropsy, rheumatism, abdominalucier, hernia, sewllings, itches, malaria. | S |
| <i>Eruca sativa</i> | Taramira | Leave, seed | Stimulant stomachic. diuretic, antiscarbtuic, aphrodisiac. | S |
| <i>Euphorbia caducifolia</i> | Thor | whole plant | Carminative, purgative, laxative, appetizer, alexipharmic, rubefacient, expectorant, cutaneous eruptions, cough, earache, bronchitis, tumpur, delirium, leucoderma, piles, spleen enlargement, anaemia, ulcers, fever. | S |

contd...

Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|-----------------------------|----------------------------------|---------------------|--|--------|
| <i>Euphorbia hirta</i> | Dudhali | Leaves | Dysentery, worms. colic, bowel complaints, cough, asthma, vermifuge, diseases of urino-genital tract, diarrhoea, leucorrhoea, menorrhagia. | PS |
| <i>Evolvulus alsinoides</i> | Shankhpushpi, Phooli | Leaves | Bronchitis, asthma, fever, diarrhoea, tonic, vermifuge, dysentery. | S |
| <i>Fagonial retica</i> | Jawasiao, Dhamso | Whole plant | Astringent febrifuge, tonic, small pox, dropsy, delirium, asthma, cough, fever, dysentery, skin diseases, abortion. | S |
| <i>Ferretia hamiltonii</i> | Hiran-chanbba | Whole plant | Rheumatism, Cooling. | S |
| <i>Feronia limonia</i> | Kaitha | Leaves, seed, Fruit | Cough, dysentery, alexiteric, heart diseases, aphrodisiac, leucorrhoea, ophthalmia, biliousness. | S |
| <i>Ficus benghalensis</i> | Bargad | Whole plant | Biliousness, ulcer, erysipelas, vaginal complaints, fevers, liver troubles, diabetes, cooling tonic. | PS |
| <i>Ficus religiosa</i> | Peepal | Whole plant | Leucorrhoea, biliousness, ulcer, diseases of vagina and uterus, alexipharmic | PS |
| <i>Furmaria indica</i> | Pithpaparo | Whole plant | Diuretic, diaphoretic, aperients, antispasmodic CNS depressant. | S |
| <i>Glinus lotoides</i> | Hata, Badka, Matter Gandhi-butti | Whole plant | Diuretic, purgative, boils. wounds, indigestion, bilious attacks. | S |
| <i>Grewia tenax</i> | Gangeran, Gangir, Gahgi | Wood. Root | Cough, pain, diarrhoea. | S |
| <i>Haloxylon recurvum</i> | Khar | Whole plant | Ulcer. | S |

contd...

Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|--------------------------------|------------------------|--------------|---|--------|
| <i>Heliotropium ellipticum</i> | Arkali | Whole plant | Laxative, diuretic. | S |
| <i>Hoppea dichotoma</i> | Ramjetta | Root | Piles, Snake bite. | S |
| <i>Indigofera linifolia</i> | Sidio bakario | Flower | Febrile eruptions, amenorrhoea. | S |
| <i>Indigofera oblongifolia</i> | Khuara | Whole plant | Root : Appetizer, rheumatism; Whole plant: spleen and liver problems. | S |
| <i>Indigofera tinctoria</i> | Neel | Whole plant | Laxative, expectorant, alexipharmic, anthelmintic, leucoderma, abdominal complaints, heart disease. | S |
| <i>Ipomea headeracea</i> | Kirpan-beli | Seed | Laxative, carminative, fever, abdominal & liver troubles, leucoderma. | S |
| <i>Justica procumbens</i> | Kagner | Whole plant | Biliousness, intoxication, fever, diuretic, enriches blood, leprosy, mental and blood diseases | S |
| <i>Lepidagathis trinervis</i> | Unt-Katalio | Seed | Cooling drink, tonic. | S |
| <i>Leucas aspera</i> | Chota-halkusar | Leaves | Chronic rheumatism, psoriasis, skin diseases, swellings. | S |
| <i>Leucas caphalotes</i> | Vdapata | Whole plant | Diaphoretic, stimulant, laxative, bronchitis, jaundice, dyspepsia, paralysis, leucoderma, urinary discharge, fever, scorpion sting. | S |
| <i>Malva parviflora</i> | Khumbasi | Leaves, Seed | Nerve tonic, profuse menstruation, wounds & swellings; Seed: demulcent in cough, bladder uncler. | PS |
| <i>Merremia tridentatea</i> | Parasarini | Whole plant | Laxative tonic, rheumatism, piles urinary disorders. | S |
| <i>Mimosa himata</i> | Shiah-Kannta, Jinjanio | Seed | Stimulant, Weakness. | S |

contd...

Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|------------------------------|-------------------------------------|---------------------|--|--------|
| <i>Moringa oleifera</i> | Sanjna | Whole plant | Aphrodisiac, alexiteric, analgesic, anthelmintic, ulcers, heart troubles, ophthalmia, muscular and spleen diseases. | PS/C |
| <i>Ocimum americanum</i> | Ban-tulsi | Whole plant | Fever, parasitical skin diseases cold, cough. | PS |
| <i>Ocimum canum</i> | Bapchi | Leaves, Seed | Fever, parasitic diseases, expectorant, anti-catarrhal, nasal haemorrhage, anti-rheumatism. | PS |
| <i>Oxilis corniculata</i> | Khatari, Khatii-buti | Whole plant | Appetizer, dysentery, diarrhoea, refrigerant, stomachic, anti-scorbutic, piles, skin diseases. | S |
| <i>Oxystelma esculentum</i> | Dudhialak | Whole plant | Diuretic, laxative, aphrodisiac, leucoderma, bronchitis, expectorant, anthelmintic, gonorrhoea. | S |
| <i>Pacicum antidotale</i> | Gramma, Garmano | Whole plant | Small pox, wound, | S |
| <i>Pedaliium murex</i> | Baragokhru | Root, Leaves, Fruit | Anti-Biliousness, gonorrhoea, dysuria, anti-spasmodic, aphrodisiac, diuretic, demulcent, emmenagogue. | S |
| <i>Peganum harmal</i> | Harmal, Isband Gandhio | Whole plant | Emmenagogue, galactagogue, aphrodisiac, abortifacient, toothache; Seed: expectorant, anthelminitic, lumbago, Colic, kurinary troubles, ophthalmia, rheumatism, bronchitis. | S |
| <i>Pentratropis spiralis</i> | Kauathodi | Whole plant | Whole plant: leucoderma, biliousness, piles, cough, inflammation; Root: astringent, gonorrhoea. | S |
| <i>Pergularia demia</i> | Ganderio-ki-bel, Utran, Manda-singi | Whole plant | Anthelminitic, expectorant, catarrhal affections, infantile diarrhoea, asthma, rheumatism, carbuncle, purgative, blood pressure. | S |

contd...

Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|------------------------------------|------------------------------|--------------|--|--------|
| <i>Periploca aphylla</i> | Barri | Whole plant | Tumkours, swellings, purgative. | S |
| <i>Phaseolus trilobus</i> | Jangli-Moth, Arak-Munhani | Leaves | Sedative, intermittent fever. | S |
| <i>Phyllanthus fraternus</i> | Kanocha, Gugaria | Whole plant | Diuretic, Dropsical affections, gonorrhoea, genito-urinary diseases, sores, stomachic, dysentery. | S |
| <i>Phyllanthus maderaspatensis</i> | Hazarmani | Leaves, Seed | Expectorant, diaphoretic, carminative, laxative, diuretic, bronchitis, earache, ophthalmia, liver tonic. | S |
| <i>Phyllanthus niruri</i> | Bhonyaabali | Whole plant | Stomachic, dysentery, dropsy, ulcer, wounds, ringworm. | S |
| <i>Physalis peruviana</i> | Baripopatan | Whole plant | Diuretic. | S |
| <i>Plantago ovata</i> | Isabgol | Seed | Astringent, tonic, biliousness, cough, dysentery, leprosy. | S |
| <i>Polycarpea corymbosa</i> | Dholphuli | Whole plant | Strangury, urinary calculi, ulcer. | S |
| <i>Plumbago zeylanica</i> | Chittrak | Root, Bark | Dysentery, leucoderma, piles, inflammation, rheumatism, bronchitis, anaemia, liver and intestinal complaints. | S |
| <i>Portulaca oleracea</i> | Lunkha | Leaves, Stem | Alexipharmic, laxative, diarrhoea, asthma, ulcer, blisters, boils, dysentery, leprosy, piles, kidney and spleen diseases, burning sensation. | S |
| <i>Portulaca quadrifida</i> | Lunki | Whole plant | Alternative, laxative, asthma, cough, urinary, discharge, ulcers. eye & skin diseases. | S |
| <i>Prosopis cineraria</i> | Khejri | Bark, Pods | Rheumatism, astringent. | PS |

contd...

Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|------------------------------------|----------------------|---------------------|---|--------|
| <i>Pulicaria crispa</i> | Buhrna, Dhola-lizru | Whole plant | Headache, bruises. | S |
| <i>Salvadora oleoides</i> | Mitho-jal | Whole tree | Vesicant, purgative, cough, aphrodisiac, laxative, carminative, bronchitis, spleen enlargement, piles. | PS |
| <i>Salvadora persica</i> | Khara-jal | Leaves, fruits | Rheumatism, scurvy, astringent, anthelmintic, diuretic, analgesic, liver tonic, carminative, deobstruent, aphrodisiac. | PS |
| <i>Salvia aegyptiaca</i> | Tukham malanga | Whole plant | Diseases of eye, diarrhoea, gonorrhoea, haemorrhage. | S |
| <i>Sarcostemma acidium</i> | Khira-Khimp, Samlata | Stem, root | Emetic, Dog-bite, snake-bite. | S |
| <i>Schweinfurthia papilionacea</i> | Sanipat | Leaves, fruits | Typhoid, bleeding nose. | S |
| <i>Scoparia dulcis</i> | | Whole plant | Emollient, astringent, emetic, menorrhagia, excessive menstruation. | S |
| <i>Sesamum indicum</i> | Til | Root, Seed, seedoil | Aphrodisiac, spleen troubles, piles bleeding, menorrhoea, diuretic, diaphoretic, cooling, hair growth, diarrhoea, lungs diseases, small-pox syphilis. | S |
| <i>Sida acuta</i> | Bal | Root, leaves | Aphrodisiac, demulcent in gonorrhoea, astringent, nervous and urinary trouble. | S |
| <i>Sida cordifolia</i> | Bariar | Whole plant | Astringent, cooling, tonic emollient aphrodisiac, urinary troubles, blood disease, bleeding piles. | S |
| <i>Sida ovata</i> | Bal, Dhab | Seed, root | Lumbago, tonic, cooling effect. | S |
| <i>Sida rhombifolia</i> | Bariara | Root, leaves | Aphrodisiac, tonic febrifugs, nervous and urinary troubles, strangury, heart diseases, piles, rheumatism. | S |

contd...

Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|-----------------------------|-------------------------------|--------------------------------|--|--------|
| <i>Sisymbrium irio</i> | Asalio, Khub Khala | Leaf, Seed | Cooling and refreshing drink. | S |
| <i>Solanum indicum</i> | Nar-kanta | Root, Fruits | Astringent, anthelmintic, digestive cardiac troubles, bronchitis, leucoderms, fever. | S |
| <i>Solanum nigrum</i> | Makoi, Chirpoti | Whole plant | Diseases of eye, ear, nose, ulcer on the neck, laxative, boils, headache, aphrodisiac, alternative, diuretic, inflammation, asthma, bronchitis, fever, diarrhoea, hydrophobia, leucoderma, cathartic, liver enlargement, piles, dysentery. | S |
| <i>Solanum surattense</i> | Ringni, Kateli Bhoringi | Whole plant | Expectorant cough, asthma, chest pain, catarrhal fever, vomiting, rheumatism, cough, toothache, burning feet. | S |
| <i>Sporobolus helvolus</i> | Kharia | Whole plant | Malaria. | S |
| <i>Tamarix aphylla</i> | Lal-jhau, Farash | Bark | Astringent, aphrodisiac, eczeme. | PS |
| <i>Tecomella undulata</i> | Rohiro, Rugtrora | Bark, Seed, young branches. | Eczema, abdominal & liver complaints, laxative, anthelmintic, abscess, ulcer, blood & eye diseases. | PS |
| <i>Tephrosia purpurea</i> | Sarphoka, Biyani, Dhamasia | Whole plant | Dyspepsia, chronic diarrhoea, enlarged liver, colic, stomach, troubles., alexipharmic, uncens, wounds, spleen complaints, anthelmintic, antipyretic, leprosy, asthma, bronchitis gonorrhoeas, lung troubles. | PS |
| <i>Tinospora cordifolia</i> | Amrita gulbel | Root, Fruit | Emetic, visceral obstruction, rheumatism, jaundice | T |
| <i>Tribulus terrestris</i> | Gokhru, Kanti | Whole plant | Aphrodisiac, alternative, diuretic, emmenagogue, purgative, bronchitis, asthma, dropsy, rheumatism, skin diseases, leprosy. | T |

contd...

Table 11.2 – contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|-------------------------------|-----------------------|--------------------------|---|--------|
| <i>Vallisneria spiralis</i> | Sawala, Syala | Whole plant | Diuretic, anthelmintic, nephritic troubles, haemorrhage in kidney & uterus, jaundice. | S |
| <i>Vernonia cinerea</i> | Sandri, Sahadevi | Whole plant | Diaphoretic, strangury, promotes perspiration, spasm of bladder, conjunctivitis, anthelmintic, alexipharmic. | S |
| <i>Viola cinerea</i> Boiss | Banafsha | Whole plant | Fever. | S |
| <i>Withania coagulans</i> | Paneer-bandh | Fruit, seed | Asthma, biliousness, strangury, emmenagogue, diuretic, ophthalmia, lumbago, liver troubles, piles. | T |
| <i>Withania somnifera</i> | Asgandha, Chirpotan | Root, tubes, seed leaves | Alternative, aphrodisiac, abortifacient, tonic, narcotic, bronchitis, psoriasis, ulcers, senile debility, rheumatism. | T |
| <i>Wrightia tinctoria</i> | Kerni | Whole plant | Aphrodisiac, biliousness, piles, skin, diseases, dropsy, aphrodisiac, anthelmintic, amoebic, dysentery. | S |
| <i>Ziziphus mauritiana</i> | Bor, Bordi | Root, Bark, fruit | Ulcer, wounds fever, diarrhoea, digestive, blood purifier. | S |
| <i>Ziziphus nummularia</i> | Jari-bar | Leaves, fruit | Cough, cold, skin diseases, astringent cooling, biliousness, sores, ulcerated gums. | S |
| <i>Zygophyllum simplex</i> | Lunwo, Alathi | Leaves | Ophthalmia, leucoderma, anthelmintic. | S |
| <i>Arisaema griffithii</i> | L. Tangchit; N. Larua | Rhizome | Extract of rhizome used to relieve pain during urination | T |
| <i>Arisaema nepenthoides</i> | L. Panyal | Rhizome | Flour of rhizome used to make rotis. | T |
| <i>Rapidoiphora decursiva</i> | L. Tafu | Stem, Leaf | Boiled stem, cut into pieces and dried used in preparing chi. Leaves used as fodder. | S |

contd...

Table 11.2 - contd...

| Scientific Name | Local Name | Parts Used | Medicinal Uses | Status |
|------------------------------|------------------------------------|---------------|---|--------|
| <i>Schizostachyum munroi</i> | L. Payonh; N. Gopae | Culums | Long culums used for flutes, for making rope as phip (hollow straw for drinking chi) and to make poalong baskets. Considered sacred. | S |
| <i>Thysanolaena maxima</i> | L. Paashyuam; N. Kucho, Umlisho | | Used locally for making brooms and also collected for market sale. | S |
| <i>Yushania maling</i> | L. Phyun; Malingo | Clums | Slender bamboo culms used to lay roofs and for basketry. | S |
| <i>Cyathea spinulosa</i> | L. Pula | | Used to make planter-pots for culturing orchids and other green house- plants. | T |
| <i>Angiopteris evecta</i> | L. Pakjig, N. Gaaykhure | Rhizome, Stem | Dried rhizome and stem made into flour that is then used to make rotis and in preparing chi. | T |

Table 11.3 : Medicinal plants of Sundarbans Mangrove

| Sundarbans | Part's used | Medicinal uses | Status |
|-----------------------------|--------------|---|--------|
| <i>Acanthus sp.</i> | Fruit, Seed | The crushed fruit make a good blood purifier and dressing for boils and snake bite. The seeds have anthelmintic properties. Useful in asthma and dysopepsia. | PS |
| <i>Ammania baccifera</i> | Entire plant | Used as purgative. | PS |
| <i>Avicennia sp.</i> | Seeds, Resin | Seeds made into paste to relieve small pox ulceration. Resinous exude used for birth control purpose. | PS |
| <i>Bruguiera eriopelata</i> | Fruit | Lotion from fruits used for eye. Fruit is chewed as betel nut. Young radical used as vegetable. | S |
| <i>Caesalpinia nuga</i> | Roots | Roots diuretic, used in the treatment of stone. | R |
| <i>Cerbera odollum</i> | Bark, Nut | Bark and nuts as purgative and narcotic. | S |
| <i>Cerbera sp.</i> | Fruit | Fruit when rubbed give relief from pain of rheumatism. The sap has purgative property. Sap when extremely applied always the poisonous effect of fish stings. | S |
| <i>Ceriops. sp.</i> | Bark, Seed | Obstetric and haemorrhage cases are treated with an infusion of Ceriops bark. Seeds Yield, edible oil and fat, but not commercially used. | PS |
| <i>Ceriops tagal</i> | Root | Roots used as substitute of quinine. | PS |
| <i>Derris indica</i> | Seed | Seed powder used for bronchitis and whooping cough. | PS |
| <i>Derris sp.</i> | Stem, Root | Stems and root contain poisonous chemical to kill fish. | PS |
| <i>D. triplicata</i> | Entire plant | Entire plant used as antispasmodic and stimulant. | PS |

contd...

Table 11.3 – contd...

| Sundarbans | Part's used | Medicinal uses | Status |
|----------------------------------|--------------|---|--------|
| <i>Excoecaria sp.</i> | Heart wood | Heart wood and pneumatophores give scent, but not commercially used. | PS |
| <i>Hibiscus tiliaceous</i> | Leaf, Root | Decoction from leaves useful as hair restorers, expectorant and for treatment of obstinate cases of urine. Roots used in preparation of embrocations. | S |
| <i>Ipomoea pes-carpae</i> | Leaf | Leaves used for rheumatism and as astringent. | S |
| <i>Kandelia sp.</i> | Bark | Bark forms an ingredient in a mixture given for diabetes. | |
| <i>Lumnitzera sp.</i> | Bark, Root | An infusion of the bark of <i>R. mucronata</i> is given for haematuria. Stilt roots some times used as anchor. Root decoction used in blood pressure. | S |
| <i>Sonneratia sp.</i> | Fruit | Fruit made into poultices for sprain and the fermented juice is used to check haemorrhage. Fruits are edible. | S |
| | Gall & Twig | Galls and twigs used as astringent and | |
| <i>T. gallica</i> | – | for dysentery. | S |
| <i>Tamarix dioica</i> | Bark | Used as tonic and skin diseases. | S |
| <i>Thespesia lampus</i> | Root, Fruit | Roots and fruits used for gonorrhoea and syphilis. | S |
| <i>Thespesia sp.</i> | Seed, Leaf | An ointment made from seeds kill lice. The leaves furnish a specific active principle for relieving headache. | S |
| <i>Trianthema portulacastrum</i> | Entire plant | For heart disease and anaemia. | S |
| <i>Xylocarpus mekongensis</i> | Bark | Used for dysentery diarrhoea as febrifuge. | S |

contd...

Table 11.3 – contd...

| Sundarbans | Local Name | Part's Used | Medicinal uses | Status |
|----------------------------------|-------------------------------|-----------------|---|--------|
| Sikkim | | | | |
| <i>Aconitum bisma</i> | N. Bikhma | Root | Extracted root taken against malaria | R |
| <i>Mahonia nepaulensis</i> | L. Termokung, Kherum | Wood | Yellow wood used as Dhoop during rituals | S |
| <i>Drymaia cordata</i> | N. Abhijal | Leaf | Mixed leaves with <i>Fragaria indica</i> taken against jaundice. 2-3 doses claimed to be sufficient cure . | PS |
| <i>Hibiscus-rosa sinensis</i> | N. Javakusum | Flower | Paste of red flowers taken orally to counteract excessive menstrual bleeding. | PS |
| <i>Prunus cerasoides</i> | K. Kamki, N. Payung | Fruit, Leaf | Ripe fruits edible. Leaves used as fodder | PS |
| <i>Rubus ellipticus</i> | L. Kisimpat, N. Aniselo | Root, Fruits | Root paste taken orally against dry cough. Diluted paste of tender stems taken against stomach ache. Fruits edible. | PS |
| <i>Rubus foliosus</i> | L. Chhelum | Fruits | Fruits edible | S |
| <i>Rubus nepalensis</i> | L. Salum | Fruits | Fruits edible | PS |
| <i>Astilbe rivularis</i> | N. Burokhati | Leaf | Paste of leaves taken orally against menstrual dysfunction (backaches & excessive bleeding) | S |
| <i>Bergenia ciliata</i> | L. Tasjiprok, N. Pakhanbed | Root | Extracted root taken orally against food-poisoning & to relieve labour pains | S |
| <i>Dichroa febrifuga</i> | L. Gebokhanak; | Root | Extracted root taken orally against dysentery | PS |
| <i>Tnchosanthes tricuspidata</i> | L. Khampthoro; N. Indrani | Fruits | Fruits edible and used in pickles | PS |

contd...

Table 11.3 – contd...

| Sundarbans | Local Name | Part's Used | Medicinal uses | Status |
|-------------------------------------|------------------------------------|-----------------|---|--------|
| <i>Nardostachys grandiflora</i> | L. Panpu, N. Jatamasi | Root | Powdered root taken with water against epilepsy. Roots burnt in ghee as Dhooop | T |
| <i>Saussurea gossypiphora</i> | L. Yackhhephabo | Inflorescence | Paste of dried inflorescence applied on burns | T |
| <i>Lyonia ovalifolia</i> | L. Taksolnak; N. Angen | Leaf | Juice of leaves applied externally on skin-diseases of the rainy season. Poisonous to cattle. | PS |
| <i>Diploknema butyraceae</i> | L. Nyol; N. Chiuri | Fruit | Fruits edible | S |
| <i>Budleja paniculata</i> | L. Pandamkung; N. Bhimsenpati | Leaf | Tablets of leaves mixed with riceflouract as fermentine agent giving chia bitter taste | PS |
| <i>Datura metel</i> | L. Kujuphmyun- gman N. Dhatura | Fruits, Seed | Fruits & Seeds taken against dog-bite | S |
| <i>Picrorrhiza scrophulariflora</i> | L. Humle; N. Kutki | Root | Powdered root taken against headaches & fevers | T |
| <i>Phytolacca acinosa</i> | N. Jaringo | Leaf | Green leaves used as vegetable. Boiled extract taken orally against food-poisoning. | S |
| <i>Aconogonum mulla</i> | L. Kandemdong, N. Thotnay | Stem | Juicy stem edible. Also used in chutneys. | S |
| <i>Rheum australe</i> | L. Chhucha | Root | Roots infused as tea | T |
| <i>Houttuynia cordata</i> | N. Gandhejhar | Leaf | Juice of leaves with curd taken against dysentery | T |
| <i>Daphne bholua</i> | L. Nambongkantuh; N. Kagajejhar | Root | Juice of root taken orally against food poisoning. | S |

contd...

Table 11.3 – contd...

| Sundarbans | Local Name | Part's Used | Medicinal uses | Status |
|--------------------------------|--------------------------------------|-----------------|---|--------|
| <i>Edgeworthia gardenari</i> | L. Kuntkung; A. Argali | Bark | Bark used in making rope and for making paper. | S |
| <i>Litsea cubeba</i> | N. Sittimur | Leaf | Oil extracted from macerated leaf relieves skin itch. | PS |
| <i>Viscum articulatum</i> | L. Singthut; N. Kabra | Plant | Thick paste of plant used as cast for bone-setting. Powdered plant mixed with rice flour and taken orally during delivery lessons pain & bleeding . | S |
| <i>Elatostema platphyllum</i> | L. Kanchelbhi | Leaf | Extract of boiled leaves taken for deworming. Leaves also used as vegetable. | PS |
| <i>Girardinia diversifolia</i> | L. Kujusrung; N. Bhangre sinsu | Leaf, Stem | Boiled leaves used as vegetable. Fibra from stem used to make gunny like cloth for traditional garments. | PS |
| <i>Ficus glaberrima</i> | L. Ringjukung | Leaf | Tender leaves used as vegetable and in pickle. | S |
| <i>Ficus lacor</i> | L. Sikungkung; N. Kanakpa | Leaf | Tender leavels wet-grount to chutney. Leaves used as fodder. | S |
| <i>Juglans regia</i> | L. Kalkung; N. Okhar | Bark | Paste of bark used as leech-repellent. | S |
| <i>Dactylorhiza hatagirea</i> | L. Ambulkapa; N. Panchamle | Root | Paste of root applied to heal fractures. Root brunt as dhoop. | T |
| <i>Paphiopedilum venustum</i> | L. Barif | Leaf | Juice of crushed green leaves applied on snakebite. | T |
| <i>Amomum subulatum</i> | N. Ainlaichi | Seed, Flower | Ripe seeds taken against gastric problems. Flowers used as vegetable. Outer sheath of flower used in making deep red dye. | PS |

contd...

Table 11.3 – contd...

| Sundarbans | Local Name | Part's Used | Medicinal uses | Status |
|-------------------------------|-------------------------|---------------|--|--------|
| <i>Costus speciosus</i> | L. Kafer | Leaf | Burnt leaves mixed with water and made into pellets, which are then taken orally with tea or chi to increase fertility and for conception. | S |
| <i>Dioscorea glabra</i> | L. Kiew; N. Bantarul | Root | Rootstock used as vegetable. | T |
| <i>Campylandra aurantiaca</i> | L. Barfi; N. Nakima | Inflorescence | Inflorescence used as vegetable. | T |
| <i>Calamus erectus</i> | N. Bent-ko-tuso | Stem | Inner pith of stem used as vegetable. | T |

Table 11.4 : Medicinal Plants of Bankura District (Alluvial and Lateritic Area)

| Scientific Name | Local Name | Part's Used | Medicinal Uses | Status |
|--------------------------------|-------------|------------------|--|--------|
| <i>Abutilon indicum</i> | Potari | Leaves | Inflammation and wounds. | S |
| <i>Acacia nilotica</i> | Babla | Bark, Gum | Diarrohea, Dysentery and Diabetes. | PS |
| <i>Acalypha indica</i> | Mutka jhuri | Entire plant | Bronchites, Asthma and Piles. | PS |
| <i>Achyranthus aspera</i> | Apang | Entire plant | Purgative, Piles, Boils, Colic pain. | PS |
| <i>Adhatoda vasica</i> | Basak | Leaves | Cough, Bronchites, asthma, tonic. | S |
| <i>Aerva lanata</i> | Chaldhoa | Entire plant | Anthelmentic, Diuretic. | PS |
| <i>Aganosma Caryophyllata</i> | Malati | Leaves & flowers | Leaves in biliousness, glowers in eye. | S |
| <i>Ageratum conyzides</i> | Uchunti | Leaves | Cuts and sores. | PS |
| <i>Alternanthera sessiles</i> | Sinche | Young shoot | Nutritious, febrifuge. | PS |
| <i>Amaranthus spinosus</i> | Kata-notey | Leaves & root | Boils and abcess. | PS |
| <i>Ambroma augusta</i> | Ulatkambal | Root-bark | Female diseases. | S |
| <i>Andrographis paniculata</i> | Kalmegh | Leaves & roots | Tonic, dysentery and dyspepsia. | T |
| <i>Aneilema nufiflorum</i> | Kenduli | Entire plant | Leprosy. | S |
| <i>Anisomeles ovata</i> | Gobura | Entire plant | Tonic. | S |
| <i>Anona squamosa</i> | Ata | Leaves | Insecticide & Lice remover. | C |
| <i>Agremone maxicana</i> | Shial kanta | Seeds & roots | Skin disease, seeds-laxative. | S |
| <i>Aristolochia indica</i> | Ishwarmul | Root & leaves | Tonic, Leucoderma, skin disease. | T |
| <i>Asparagus racemosus</i> | Satamuli | Root | Refrigerant, dysentery, diuretic. | T |

contd...

Table 11.4 – contd...

| Scientific Name | Local Name | Part's Used | Medicinal Uses | Status |
|------------------------------------|--------------|----------------------------|--------------------------------|--------|
| <i>Barleria prionitis</i> | Kantajanti | Toot & leaves swellings | Tooth-ache, Boils, granular | S |
| <i>Bidens biternata</i> | | Root | Amoebic dysentery | S |
| <i>Biophytum sensitivum</i> | Naranga | Leaves, Seeds | Laxative | S |
| <i>Boerhaavia diffusa</i> | Punarnaba | Entire plant | Anaemia, Jaundice | S |
| <i>Buttneria herbacea</i> | Kamraj | Seeds | Laxative | S |
| <i>Caesalpinia bonduc</i> | Nata | Seeds | Malaria | S |
| <i>Cajanus cajan</i> | Arhar | Leaves, Seeds | Jaundice | C |
| <i>Calotropis gigantea</i> | Akanda | Leaves | Tonsillites | S |
| <i>Capparis zeylanica</i> | Kelekara | Leaves, Fruits | Eczema, boils, piles | S |
| <i>Cassia occidentalis</i> | Kalkasunde | Leaves | Tonic, rat-bite | PS |
| <i>Catharanthus roseus</i> | Nayantara | Leaves | Diabetes | CT |
| <i>Centratherum anthelminticum</i> | Somraj | Seeds | Anthelmintic,, digestive | C |
| <i>Chenopodium album</i> | Behtosak | Shoots, Leaves | Laxative, anthelmintic | S |
| <i>Cinnamomum tamala</i> | Tajpat | Leaves | Stimulant, carminative, throat | S |
| <i>Clerodendrum viscosum</i> | Ghetu | Leaves & root | Skin disease, tumour | S |
| <i>Clitoria ternatea</i> | Aparajita | Seeds & root | Purgative, diuretic | C |
| <i>Commelina benghalensis</i> | Kansira | Plant & latex | Laxative, leprosy, ear-ache | S |
| <i>Commelina paludosa</i> | Jata Kansira | Plant | Skin disease | S |

contd...

Table 11.4 – contd...

| Scientific Name | Local Name | Part's Used | Medicinal Uses | Status |
|------------------------------|------------|------------------------------|--|--------|
| <i>Corchorus olitorius</i> | Mithapat | Plant | Tonic, diuretic | C |
| <i>Coriandrum sativum</i> | Dhane | Leaves & Frutis | Stimulant, carminative, Tonic | C |
| <i>Crotalaria juncea</i> | Atashi | Seeds | Blood purifier | C |
| <i>Croton bonplandianum</i> | Bantulsi | Leaves | Blood coagulation, antiseptic | S |
| <i>Curculigo orchoides</i> | Talmuli | Roots | Diabetes, jaundice | T |
| <i>Cynodon doctylon</i> | Durba | Entire plant | Cuts & wounds, hysteria & Epilepsy | PS |
| <i>Daemia extensa</i> | Dudhilata | Leaves | Expectorant, rheumatism carbuncle | S |
| <i>Desmodium polycarpum</i> | Bancharal | Entire plant | Tonic, cold and cough | S |
| <i>Dioscorea bulbifera</i> | Banalu | Rhizome | Dysentery, piles & ulcers | T |
| <i>Eclipta alba</i> | Kesute | Leaves | Tonic, jaundice, hair dye | S |
| <i>Elephantopus scaber</i> | Hastipada | Roots | Diabetes | S |
| <i>Emilia sonchifolia</i> | Sudhimudi | Plant | Febrifuge | S |
| <i>Enhydra fluctuans</i> | Hingche | leaves | Laxative, antibiotoxic, skin & nerve | PS |
| <i>Eugenia jambolana</i> | Kalo-jam | Leaves & Fruits | Dysentery, carminative | C |
| <i>Euphorbia hirta</i> | Barakarni | Latex | Dysentery, cough, asthma, childrens worm | S |
| <i>Euphorbia tirucalla</i> | Sijlanka | Milky juice | Rheumatism & burn | C |
| <i>Ficus bengalensis</i> | Bat | Aerial root scorpion bite | Purgative, leprosy, piles. | PS |
| <i>Glycosmis pentaphylla</i> | Ashshora | Wood | Snake-bite | S |

contd...

Table 11.4 – contd...

| Scientific Name | Local Name | Part's Used | Medicinal Uses | Status |
|-----------------------------------|----------------|------------------|--|--------|
| <i>Gnaphalium luteo-album</i> | | Leaves | Astringent | S |
| <i>Helicteres isora</i> | Atmora | Fruit | Flatulence of Children | S |
| <i>Heliotropium indicum</i> | Hatisur | Leaves | Boils & wounds | S |
| <i>Hemidesmus indicus</i> | Anantamul | Root | Tonic, Scorpion-bite | T |
| <i>Holarrhena antidysenterica</i> | Kurchi | Bark & seed | Dysentery, fever, intestinal worms | PS |
| <i>Hydrophila spinosa</i> | Kulekhara | Entire plant | Jaundice, rheumatism, Urine-genital diseases | PS |
| <i>Ipomoea aquatica</i> | Kalmisak | Entire plant | Nervous & general debility | PS |
| <i>Ipomoea pes-tigridis</i> | Langulidlata | Root | Purgative, Boils & carbuncles | PS |
| <i>Ipomoea quamoclit</i> | Tarulata | Leaves | Carbuncle & bleeding piles | PS |
| <i>Jatropha gossypifolia</i> | Lal-bheranda | Shoot & Leaves | Boils, carbuncles, Dental disease | PS |
| <i>Justicia gendarusa</i> | Jagat-madan | Leaves & shoot | Rheumatism, ear-ache | PS |
| <i>Lawsonia inermis</i> | Mehindi | Leaves & bark | Skin disease, leprosy | S |
| <i>Leonotis nepetaefolia</i> | Hejurchei | Leaves & flowers | Tonic, ring worm & skin disease | S |
| <i>Leonurus sibiricus</i> | Raktadrona | Entire plant | Febrifuge | S |
| <i>Leucas aspera</i> | Shetadrona | Leaves | Scabies, insecticide | S |
| <i>Lindenbergia indica</i> | Besanti | Shoot | Bronchitis | S |
| <i>Martynia diandra</i> | Bag-noch | Leaves & Fruits | Tuberculosis glands, epilepsy | S |
| <i>Mirabilis jalapa</i> | Sandhyamani | Leaves & root | Boils, inflammation, purgative | S |
| <i>Murraya Koenigii</i> | Curry leaf | Leaves | Tonic, Stomachic dysentery | S |
| <i>Nerium odorum</i> | Karabi (White) | Root | Skin-disease | C |

contd...

Table 11.4 - contd...

| Scientific Name | Local Name | Part's Used | Medicinal Uses | Status |
|--------------------------------|----------------|----------------|--|--------|
| <i>Nymphoides cristata</i> | Pañseuli | Leaves | Boils, fever | PS |
| <i>Ocimum canum</i> | Bantuli | Leaves | Parastical skin-diseese | S |
| <i>Oldenlandia corymbosa</i> | Khetapara | Entir plant | Jaundice & diseases of liver | S |
| <i>Oxalis corniculata</i> | Amrul | Entire plant | Cooling, stomachic, scurvey | S |
| <i>Passiflora foetida</i> | Jhumkalata | Leaves | Asthma, Headache | S |
| <i>Phaseolus radiatus</i> | Maskalai | Seeds | Paralysis, rheumatism, cough, fever | C |
| <i>Physalis minima</i> | Banterpari | Leaves | Ear-ache | S |
| <i>Plumbago zeylanica</i> | Chitamul | Root | Apetizer, skin-disease | S |
| <i>Polycarpon loeflingae</i> | Gima sak | Leaves | Expectorant | S |
| <i>Portulaca oleracea</i> | Bāra-nonoya | Plant | Scruvy & Liver disease | S |
| <i>Pterocarpus marsurpium</i> | Pitsal | Gums & leaves | Diarrhoea, boils, sores | PS |
| <i>Ricinus communis</i> | Rehri | Leaves & root | Leaves in ear-ache, root in gonorrhoea | PS |
| <i>Santalum album</i> | Chandan | Heart wood | Inflammation, headache | T |
| <i>Scoparia dulcis</i> | Ban-dhoney | Plant | Emetic | S |
| <i>Sesbania sesban</i> | Jayanti | Leaves | Pain of bones & joints, athelmintic | C |
| <i>Sida cordifolia</i> | Berela | Leaves | Cut and bruises | S |
| <i>Sida rhombifolia</i> | Lal-berela | Leaves & root | Swelling, rheumatism | S |
| <i>Smilax zeylanica</i> | Kumarika | Roots | Veneral diseases, rheumatism | T |
| <i>Solanum surattense</i> | Kantikari | Roots & fruits | Expectorant, Asthma, sorethroat | S |
| <i>Solanum sisymbriifolium</i> | Shet-Kantikari | Leaves | Pain, abnormal menstrual cycle | S |

contd...

Table 11.4 – contd...

| Scientific Name | Local Name | Part's Used | Medicinal Uses | Status |
|---------------------------------|------------|----------------------|---|--------|
| <i>Solanum nigrum</i> | Kakmachi | Entire plant | Liver disease, piles, dysentery & skin disease | S |
| <i>Solanum ferox</i> | Rambegum | Roots & fruit | Cough, asthma, fever expectorant | S |
| <i>Spermacoce hispida</i> | | Plant | Stimulant, tooth-ache | T |
| <i>Strychnos nux-vomica</i> | Kuchila | Seeds | Poisonous, used in homeopathy | T |
| <i>Symplocos recemosa</i> | Lodh | Bark | Cooling, astringent, menorrhagea, Ulcer, eye disease | C |
| <i>Tagetes erecta</i> | Genda | Leaves | Piles, boils, carbunles. | C |
| <i>Tamarindus indica</i> | Tentul | Fruit | Refrigerant, digestive, carminative | C |
| <i>Tephrosia purpurea</i> | Bannil | Plant | Tonic, anthelmintic | S |
| <i>Terminalia chebula</i> | Haritaki | Fruit | Astringent, Laxative carious teeth, bleeding of gums. | C |
| <i>Thevetia nerifolia</i> | Kalkephul | Seeds | Highly poisonous | C |
| <i>Tinospora cordifolia</i> | Gulancha | Seeds & root | Chronic diarrhoea & dysentery | T |
| <i>Trachelospermum fragrans</i> | Bansful | Plant | Fever & Dysentery | S |
| <i>Tragia involucrata</i> | Bichati | Root & Fruits | Pains, external application in leprosy & boldness | S |
| <i>Trainthema monogyna</i> | Set-punne | Plant | Diuretic, oedoma & dropsy | S |
| <i>Tribulus terrestris</i> | Gokhru | Fruits | Tonic & kidney diseases | T |
| <i>Tridax procumbens</i> | Tridaksha | Leaves | Haemostatic | S |
| <i>Vitex negundo</i> | Buan | Leaves | Tonic, acute rhumatism & swelling | PS |
| <i>Waltheria indica</i> | Khardudhi | Plant | Cold & cough | C |
| <i>Ziziphus mauritiana</i> | Kul | Leaves, Fruit & root | Dysentery | PS |

contd...

Table 11.4 – contd...

| Scientific Name | Local Name | Part's Used | Medicinal Uses | Status |
|--|------------|-----------------------------------|--|--------|
| Medicinal and Ethnobotanical plants to mark the value of Tripura forests: | | | | |
| <i>Abelmoschus esculentus</i> | Bhindi | Capsule | Urinary and skin diseases | S |
| <i>Abrus precatorius</i> | Kunch | Seed | Purgative and Lonnie | T |
| <i>Abutilon indicum</i> | Patter | Whole plant | Expel worm | S |
| <i>Acalypha indica</i> | Muklajhu | Leaf | Nasal and wounds | S |
| <i>Achyranthes aspera</i> | Apang | Plant, leaf, root, seed | Wounds, cough | S |
| <i>Aegle marmelos</i> | Bel | Root and leaf | Rabies, heart, diarrhoea, dysentery | C |
| <i>Agave americana</i> | | Stem and leaf | Toothache | C |
| <i>Ageratum conyzoides</i> | Pichas | Leaf | Eye, wounds, fever eczema | S |
| <i>Albizia lebbek</i> | | Leaf and bark | Blood, skin, piles | PS |
| <i>A. procera</i> | | Whole plant | Skin | PS |
| <i>Ammania baccifera</i> | | Whole plant | Fever and child diseases | S |
| <i>Andrographis paniculata</i> | Kalmegh | Stem and leaf | Stomachache, fever ulcer, skin disease | T |
| <i>Annona squamosa</i> | Sitaphal | Bark, root, leaf and fruit | Diarrhoea, Dysentery, Hysteria | C |
| <i>Argemone maxicana</i> | Satavnasi | Juice, root and seed | Skin eye, and expel worm | S |
| <i>Asclepias curassavica</i> | Dhudi | Latex and root, tuber, root, leaf | Leucoerma and asthma, stomach ache, piles kidney, liver, urinary, fever. | S |
| <i>Azadirachta indica</i> | Neem | All plant parts | Toothache, skin, eye, diabetes, fever, insecticide. | PS |

contd...

Table 11.4 – contd...

| Scientific Name | Local Name | Part's Used | Medicinal Uses | Status |
|----------------------------------|------------|-----------------------------------|--|--------|
| <i>Baliospermum montanum</i> | Danti | Root and seed | Pain, piles, wounds, jaundice, purgative | T |
| <i>Bauhinia purpurea</i> | | Root, leaf bark, flower | Fever, headache, diarrhoea, rheumatism, curative | PS |
| <i>Bauhinia racemosa</i> | | Leaf | Diarrhoea, dysentery | PS |
| <i>Bauhinia variegata</i> | | Root, bark, flower | Skin, diarrhoea, worms, tuberculosis | PS |
| <i>Biophytum sensitivum</i> | Lajbanti | Plant & seed | Stomachache | S |
| <i>Boerhaavia diffusa</i> | Punarnava | Root and leaf | Female disorders, liver, blood and heart | S |
| <i>Bombax ceiba</i> | Semul | Resin, gum and flower | Diarrhoea, female disorders | PS |
| <i>Butea monosperma</i> | Palas | Root, bark, leaf, flower and seed | Eye, blood, diarrhoea, dysentery, piles, worm | PS |
| <i>Caesalpinia bonduc</i> | | Bark, leaf, seed, seedoil | Fever, toothache, diarrhoea, ear and bleeding | S |
| <i>Calotropis gigantea</i> | | Root, juice, root and leaf | Toothache; antidote, asthma, cough | S |
| <i>Cardiospermum halicacabum</i> | | Whole plant | Rheumatism | S |
| <i>Careya arborea</i> | Kumbhi | Bark, dried calyx, leaf | Stomachache, diarrhoea, eye | PS |
| <i>Cassia fistula</i> | Amaltas | Leaf, fruit, seed | Wormicide, skin, toothache, fever | PS |
| <i>Cassia tora</i> | | Root bark | Antidote, skin, wormicide, cough | PS |

contd...

Table 11.4 – contd...

| Scientific Name | Local Name | Part's Used | Medicinal Uses | Status |
|------------------------------|-------------|---------------------------|--|--------|
| <i>Centella asiatica</i> | | Whole plant, leaf | Leprosy, cholera, boil, cough | S |
| <i>Cissampelos pareira</i> | | Root and leaf | Skin, wounds, diarrhoea, sore | S |
| <i>Cissus quadrangularis</i> | Harjori | Whole plant stem | Scurvy, asthma, bone fracture, stomachache. | C |
| <i>Cleome gynandra</i> | | Root, bark root | Wounds, headache, cough, cholera | S |
| <i>Clitoria ternatea</i> | | Root | Swelling, leprosy | C |
| <i>Cordia dichotoma</i> | | Bark, fruit, leaf, kernel | Pain, chronic ulcer, headache | T |
| <i>Curculigo orchioides</i> | | Rhizome and roots | Asthma, jaundice, piles, cuts, female disorders | T |
| <i>Cucumis sativum</i> | Khirra | Fruit and seed | Skin, piles, indigestion | C |
| <i>Curcuma longa</i> | Haldi | Rhizome | Indigestion rheumatism | C |
| <i>Cuscuta reflexa</i> | | Plant | Purgative, fever, bodyache, stomach | S |
| <i>Datura metel</i> | Kaladhatura | Leaf, fruit | Antidote, skin, headache | S |
| <i>D. stramonium</i> | Datura | Leaf, seed | Asthma, teeth, mouth, skin | S |
| <i>Dioscorea bulbifera</i> | | Tuber | Ulcer, piles, dysentery, constipation | T |
| <i>Diospyros montana</i> | Bislendu | Leaf and Fruit | Fish poison, swelling | S |
| <i>Eclipta prostrata</i> | | Leaf | Jaundice, headache, fever | S |
| <i>Elephantopus scaber</i> | | Plant and root | Antidote, headache, urinary | S |
| <i>Emblica officinalis</i> | | Leaf, fruit, seed | Purgative, hair growth, eyes, dysentery | C/PS |
| <i>Euphorbia hirta</i> | Dodhi | Plant, latex, leaf | Asthma, disorders of women, eye, burns, pain | S |
| <i>Ficus bengalensis</i> | | Root, bark, fruit | Gonorrhoea, liver, dysentery, diabetes piles, toothache, nasal | PS |

contd...

Table 11.4 – contd...

| Scientific Name | Local Name | Part's Used | Medicinal Uses | Status |
|---------------------------------|------------|---------------------|--|--------|
| <i>F. hispida</i> | | Fruit | Asthma, constipation | PS |
| <i>F. religiosa</i> | | Bark juice | Bone fracture, asthma | PS |
| <i>Flacourtia indica</i> | | Leaf, fruit | Toothaches, disorder of women | S |
| <i>Flemingia microphyla</i> | | Root | Ulcer, swelling, leprosy | S |
| <i>Gardenia latifolia</i> | | Leaf | Wounds of cattle | S |
| <i>Garuga pinnata</i> | | Stem, leaf | Eye, asthma | PS |
| <i>Gmelina arborea</i> | | Leaf, root bark | Worm, gonorrhoea | C |
| <i>Helicteres isora</i> | | Leaf, fruit | Stomachache, diabetes, dysentery | S |
| <i>Hemidesmus indicus</i> | Anantamul | Whole plant | Asthma, tonsil, stomachache | T |
| <i>Holarrhena pubescens</i> | | Bark | Diarrhoea, stomachache, dysentery, indigestion | PS |
| <i>Holoptelea integrifolia</i> | | Leaf | Boild | S |
| <i>Hyptis suaveolens</i> | Bantulsi | Whole plant, leaf | Skin, Stomachache, cold | S |
| <i>Ichnocarpus frutescens</i> | | Whole plant | Urinary, fever, skin, fractures | S |
| <i>Ipomoea aquatica</i> | Kalmi | Plant, flower | Women's disorder, eye | PS |
| <i>Justicia adhatoda</i> | Bhasake | Whole plant, leaf | Toothache, diarrhoea, dysentery, cough, asthma | S |
| <i>Lagerstroemia parviflora</i> | | Bark, Leaf and seed | Purgative, astringent | PS |
| <i>Lowsonia inermis</i> | Mendhi | Root and leaf | Jaundice, hairgrowth | C |
| <i>Limonia acidsima</i> | Kaith | Stem bark | Skin and antidote | S |

contd...

Table 11.4 – contd...

| Scientific Name | Local Name | Part's Used | Medicinal Uses | Status |
|---------------------------------|----------------|---------------------|---|--------|
| <i>Linum usitatissimum</i> | Alsi | Seed, mucilage | Urinary, rheumatism, cough and cold | S |
| <i>Mallotus philippinensis</i> | Rohini | Fruit, seed | Pain, skin, cuts, wouods | PS |
| <i>Mangifera indica</i> | Am | Karnal, fruit, seed | Urinary, purgative, diarrhoea, nasal | C |
| <i>Melochia corchorifolia</i> | Bilpal | Leaf | Dysentery | S |
| <i>Mimosa pudica</i> | | Root, leaf | Dysentery, piles | S |
| <i>Mimusops elengi</i> | | Flowers | Fever, headache, pain | C |
| <i>Mtragyna parviflora</i> | | Bark | Fever, pain, diarrhoea | S |
| <i>Momordica charantia</i> | Kerala | Leaf, flower | Skin and diabetes | C |
| <i>M. dioica</i> | Sangli, kerala | Root | Skin, piles, liver | C |
| <i>Moringia olifera</i> | | Leaf, flower, seed | Skin, pyorrhoea and pain | C |
| <i>Mucuna pruriens</i> | | Root, pod | Dysentery, wormicide | S |
| <i>Murraya koenigii</i> | | Sed and leaf | Cuts, diarrhoea | C |
| <i>Nelumbo nucifera</i> | | Roof, flower, seed | Diarrhoea, dysentey, cholera | T |
| <i>Ocinum sanctum</i> | Tulsi | Root, leaf | Antidote, fever, cough, cold, earache, skin | C |
| <i>Parthenium hysterophorus</i> | | Plant, root | Tonic, dysentery, skin | S |
| <i>Pongamia pinnata</i> | Karank | Seed and oil | Skin | PS |
| <i>Portulaca oleracea</i> | | Skin | Burns | S |
| <i>Pterospermum acerifolium</i> | | Leaf | Wounds | S |

contd...

Table 11.4 – contd...

| Scientific Name | Local Name | Part's Used | Medicinal Uses | Status |
|---------------------------------|------------|--------------------|--|--------|
| <i>Raphanus sativus</i> | | Root | Stomachache, skin, heart, cholera | C |
| <i>Sida cordifolia</i> | | Root, Stem, leaf | Cuts, boil, gonorrhoea | S |
| <i>S. rhombifolia</i> | | Root, leaf | Fever, heart, burns, piles | S |
| <i>Semecarpus anacardium</i> | | Bark, seed, fruit | Liver, skin, pain, antidote | C |
| <i>Solanum migran</i> | | Leaf, fruit | Dysentery, skin, eye, kidney, heart, liver, cold, cough, eye, asthma, skin, pyrrhoea | S |
| <i>Syzygium cuminii</i> | Jamun | Bark, fruit, seed | Diarrhoea, urinary, diabetes | C |
| <i>Tamarindus indica</i> | Imli | Leaf and seed | Eye, boil | C |
| <i>Tectona grandis</i> | | Wood, flower, seed | Pain, headache, eye | PS |
| <i>Tephrosia purpurea</i> | Sorphonka | Whole plant, root | Asthma, piles, warts, weakness | S |
| <i>Terminalia arjuna</i> | Arjun | Bark, leaf | Aulidote, pain, monk, earache | PS |
| <i>Terminalia bellerica</i> | Bohera | Fruit | Stomachache, rheumatism, piles | PS |
| <i>T. chebula</i> | Horra | Fruit | Purgalue, asthma, cough | C |
| <i>Tinospora cordifolia</i> | Gurbel | Whole plant | Tonic, eye, fever | T |
| <i>Tridax produmbens</i> | | Whole plant, leaf | Bleeding, cold, diarrhoea, dysentery | S |
| <i>Tricumfetta rotundifolia</i> | | Seed, oil | Skin | S |
| <i>Vernonia cinera</i> | | Root, seed | Fever, skin, insecticide | S |
| <i>Vitex negundo</i> | | Branches, leaf | Fever, headache, ear wounds, swelling, asthma | PS |
| <i>Woodfordia fruticosa</i> | | Leaf, flower | Dysentery, cough, skin eye. | PS |

Table 11.5 : Medicinal Plants of Buxa Tiger Reserve

| Species | Part's Used | Medicinal Uses | Status |
|--------------------------------|----------------------------|---|--------|
| <i>Abrus precatorius</i> | Seed | As a purgative and tonic | S |
| <i>Abutilon indicum</i> | Whole plant | Expel worms | S |
| <i>Acacia catechu</i> | Bark | Stomachache | PS |
| <i>Acalypha indica</i> | Leaf | Nasal and wounds | S |
| <i>Achyranthes aspara</i> | Plant, Root, Leaf and seed | Wounds, Ear, Cough Asthma, Stomachache, Disorders of women and Piles | C |
| <i>Agave americana</i> | Stem and Leaf | Toothache | S |
| <i>Ageratum conyzoides</i> | Leaf | Eye, Wounds, Eczema and Fever | PS |
| <i>Albizzia lebbek</i> | Leaf and Bark | Blood, skin, piles, Antidole | PS |
| <i>A. procera</i> | Whole plant | Fodder skin | C |
| <i>Allium cepa</i> | Bulb | Malaria, Asthma, Ear, Eye, Menses, Child diseases and Skin. | C |
| <i>A. sativum</i> | Blue and Clove | Eye, Heart, Asthma, Ear, Paralysis, Pain and Rheumatism | S |
| <i>Ammannia baccifera</i> | Whole plant | Fever and Child diseases | T |
| <i>Andrographis paniculata</i> | Stem and Leaf | Stomachache, Fever, Skin diseases and Ulcer | S |
| <i>Argemone maxicana</i> | Juice, Root & Seed | Skin, Eye and Expel worms | S |
| <i>Asclepias curassavica</i> | Latex and Root | Leucoderma and astha | S |
| <i>Asparagus recemosus</i> | Tuber, Root, Leaf and Pulp | Stomachache, Piles, Kidney, Liver, Urinary, Fever and Disorder of women | T |

contd...

Table 11.5 – contd...

| Species | Part's Used | Medicinal Uses | Status |
|-----------------------------------|----------------------------------|--|--------|
| <i>Azadirachta indica</i> | All parts of plant | Toothche, Skin, Antidote, Eye, Diabetes, Urinary, Fever and insecticides | C |
| <i>Baliospermum montanum</i> | Root and seed | Pain, Skin, Piles, Wounds, Splen, Jaundice and Purgative | T |
| <i>Bauhinia purpurea</i> | Root, Leaf, Bark and Flower | Fever, headache, Diarrhoea Rheumatism and Purgative | PS |
| <i>B. racemosa</i> | Leaf | Diarrhoea and Dysentery | PS |
| <i>B. variegata</i> | Root, Bud, Bark and Flower | Skin, Diarrhoea, Worms, Tuberculosis and Wounds | PS |
| <i>Bergia ammannioides</i> | Whole plant | Bone fracture and Menstrual disorders | T |
| <i>Biophytum sensitivum</i> | Plant and seed | Stomach ache | S |
| <i>Boerhavia diffusa</i> | Root and Leaf | Disorder of womem liver, Antidote, Blood and Heart. | S |
| <i>Bombax ceiba</i> | Resin, Gum & Flower | Diarrhoea whole plant disorders women | PS |
| <i>Butea monosperma</i> | Root, Bark, Leaf Flower and Seed | Eye, Blood, Diarrhoea, Dysentery, Piles, Worms and skin diseases | PS |
| <i>Caesalpinia bonduc</i> | Bark, Leaf, Seed and Seedoil | Fever, Toothache, Diarrhoea, Ear and Bleeding. | S |
| <i>C. pulcherrima</i> | Leaf and Flower | Wounds Febrifuge | C |
| <i>Calotropis gigantean</i> | Root, Latex, Leaf and Flower | Wormicide, Fever, Cholera, antidote, Cough and Cold. | S |
| <i>C. procera</i> | Root, Juice, Rhizome and Leaf | Toothache, Antidote, Asthma and Cough | S |
| <i>Cardiospermum Helicsacabum</i> | Whole plant | Rheumatism | S |
| <i>Careya arborea</i> | Bark, Dried calyz and Leaf | Stomach ache, Diarrhoea Eye and Swelings | PS |
| <i>Cassia fistula</i> | Leaf, Fruit & Seed | Wormsicide, Skin, Toothache | PS |

contd...

Table 11.5 - contd...

| Species | Part's Used | Medicinal Uses | Status |
|------------------------------|-------------------------|--|--------|
| <i>C. tora</i> | Root, Leaf & Seed | Fever Antidote, Cuts, Skin, Wormicide and Cough | S |
| <i>Centella asiatica</i> | Whole plant and leaf | Leprosy, Brain tonic, Cholera, Boils and Cough | S |
| <i>Cissampelos pareira</i> | Root and Leaf | Skin, Wounds, Urinary, Diarrhoea, Sore and Sinuses | S |
| <i>Cissus quadrangularis</i> | Whole Plant and Stem | Scurvy, Disorder of Women, Asthma, Wormicide and Swellings | C |
| <i>Cleome gynandra</i> | Root bark, Root | Wounds, Headache, cough, cholera and Fish poison | S |
| <i>Clerodendrum indicum</i> | Root and Leaf | Asthma, Wormicide and Swelling | S |
| <i>Clitoria ten atea</i> | Root | Welling and Leprosy | C |
| <i>Cordia dichotoma</i> | Bark, Fruit, Leaf Kemal | Pain, As a tonic, Ulcers, Headache and Wormicide | S |
| <i>Curculigo orchioides</i> | Rhizome and Root | Asthma, Jaundice, Piles, Cuts and Wounds, Disorder of women and child diseases | T |
| <i>Curcuma longa</i> | Rhizome | Indigestion, Rheumatism, Fever and Disorder of Women | S |
| <i>Cuscuta reflexa</i> | Plant | As a purgative, Fever, Body-ache and Stomach-ache | S |
| <i>Dalbergia sisoo</i> | Leaf | Eye | PS |
| <i>Datura metal</i> | Leaf, Fruit | Antidote, skin and Headache | S |
| <i>D. stramonium</i> | Leaf and Seed | Asthma, Women disorder, Teeth, Mouth and Skin | |
| <i>Delonix regia</i> | Seed gum | Phorrhoea | C |
| <i>Dioscorea bulbifera</i> | Tubers | Ulcer, Piles, Dysentery & constipation | T |
| <i>Eclipta prostrata</i> | Leaf | Jaundice, Hair growth, Headache & Fever | S |
| <i>Ehretia laevis</i> | Root, Leaf, Seed | Sex disorders and Fodder | S |
| <i>Elephantopus scaber</i> | Plant and Root | Antidote, Heart and Urinary | S |

contd...

Table 11.5 – contd...

| Species | Part's Used | Medicinal Uses | Status |
|--------------------------------|------------------------------------|--|--------|
| <i>Emblica officinalis</i> | Leaf, Fruit & Seed | Purgative, Hair growth, Eye, Scurvy, Diarrhoea, Dysentery, Antidote and as a Cool. | C/PS |
| <i>Eulphorbia hirta</i> | Plant, White juice, latex & leaf | Asthma, Disorder of women, Eye, Antidote, Burns and Pain | S |
| <i>Ficus bengalensis</i> | Root, Bark, Juice and Fruit | Gonorrhoea, Liver, Dysentery, Diabetes, Pain, Skin, Piles, toothache and Nasal. | PS |
| <i>F. hispida</i> | Fruit | Asthma and Constipation | PS |
| <i>F. racemosa</i> | Plant, Bark, Leaf, and fruit juice | Anicancer, Wounds, Piles, Diarrhoea and Dysentery | S |
| <i>F. religiosa</i> | Bark, Juice, Leaf and Fruit | Bone fracture, Antidote, Asthma, Disorder of women, Toothache | PS |
| <i>Flacourtia indica</i> | Bark Root, Fruit and seed | Skin, Dysentery, Rheumatism and speen | S |
| <i>Gmelina arborea</i> | Leaf, Root & Bark | Worm(expel), Gonorrhoea and antidote | C |
| <i>Gymnema sylvestre</i> | Root and Leaf | Stomach ache, Urinary | T |
| <i>Helicteres isora</i> | Whole plant, Root and Leaf | Asthma, Urinary, Tonsils, Stomach ache and Blood | S |
| <i>Hemidesmus indicus</i> | Wole plant, Root and Leaf | Asthma, Urinary, Tonsils, Stomach ache and Blood | T |
| <i>Holarrhena pubescens</i> | Bark and Seed | Diarrhoea, Stomach ache, Dysentery and indigestion | PS |
| <i>Holoptelea integrifolia</i> | Leaf | Boils | S |
| <i>Hyptis suaveolens</i> | Whole plant & leaf | Skin, stomach ache and cold | S |
| <i>Ichnocarpus frutescens</i> | Whole plan & Root | Urinary, Fever, Skin and Fractures | S |
| <i>Ipomoea aquatica</i> | Plant, Bud & Flower | Women disorder and Eye | PS |
| <i>Justicia adhotoda</i> | Whole plant, Leaf | Toothache, Tuberculosis, Diarrhoea, Dysentery, Cough, Asthma and Skin diseases | S |

contd...

Table 11.5 – contd...

| Species | Part's Used | Medicinal Uses | Status |
|---------------------------------|--|--|--------|
| <i>Kydia calycina</i> | Bark and Leaf | Mouth | S |
| <i>Lagerstroemia parviflora</i> | Bark, Leaf & Seed | Purgative, Astringen & to induce sleep | PS |
| <i>Lannea coromandelica</i> | Stem bark & Fruit | Cuts, Mouth, Toothache and Wounds | PS |
| <i>Luffa acutangula</i> | Leaf | Eye diseases in children | C |
| <i>Mallotus philippensis</i> | Fruit and Seed | Pain, Skin, Expel worm, Cuts, Wounds and as a Purgative | PS |
| <i>Minosa pudica</i> | Root and Leaf | Dysentery and piles | S |
| <i>Mitragyna parviflora</i> | Bark | Fever, Pain and Diarrhoea | S |
| <i>Moringa oleifera</i> | Leaf, Flower and Seed | Skin, Urinary, Pyorrhoea and Pain | C |
| <i>Mucuna pruriens</i> | Root, Pod & Seed | Dysentery, Urinary, Wormicide | S |
| <i>Murraya koenigii</i> | Leaf | Cuts, Diarrhoea and Dysentery | C |
| <i>Nelumbo nucifera</i> | Root, Flower & Seed | Diarrhoea, Dysentery, Cholera and Eye | T |
| <i>Nyctanthes abhortristis</i> | Bark, Leaf, Inflorescence, Flower, Fruit and Seed | Eye, Fracture, Fever, Hair growth, skin and cough | C |
| <i>Ocimum sanctum</i> | Root and Leaf | Antidote, Fever, Cough, Cold, Earache, Headache and Skin | C |
| <i>Ougeinia oojeinensis</i> | Bark and Wood | Fish-poison, Diarrhoea, Dysentery and Stomachache | S |
| <i>Parthenium hysterophorus</i> | Plant and Root | As a tonic, Dysentery and Skin | S |
| <i>Pongamia pinnata</i> | Seed and Oil | Skin | PS |
| <i>P. oleracea</i> | Stem | Burns (Skin) | S |
| <i>Pterospermum acerifolium</i> | Leaf | Wounds | S |

contd...

Table 11.5 – contd...

| Species | Part's Used | Medicinal Uses | Status |
|-----------------------------|----------------------------------|--|--------|
| <i>Ricinus communis</i> | Root, Leaf and Seedoil | Women disorders, Pain, Jaundice | PS |
| <i>Semecapus anacardium</i> | Bark, Fruit and Seed oil | Wormicide and as a purgative, Liver, Skin, Paiss and Antidote | C |
| <i>Sida cordifolia</i> | Root, Stem & Leaf | Cuts, Urinary, Boils and Gonorrhoea | S |
| <i>S. rhombifolia</i> | Root & Leaf | Fever, Heart, Burns and Piles | S |
| <i>Solanum nigrum</i> | Leaf and Berry | Dysentery, Skin, Eye, Kidney, Heart and Lever | S |
| <i>S. surattense</i> | Root, Stem, Leaf, Fruit and Seed | Cough, Cold, Eye, Asthma, Skin and Pyorrhoea | S |
| <i>Stellaria media</i> | Bark, Fruit & Seed | Diarrhoea, Urinary and Diabetes | S |
| <i>Syzygium cumini</i> | Wood, Flower oil & seed | Pain, Headache, Eye, Skin, and Expel the worms | C/PS |
| <i>Tephrosia purpurea</i> | Whole plant & Root | Asthma, Piles, Warts and Weakness | S |
| <i>Terminalia arjuna</i> | Bark, Twigs & Leaf | Antidote, Hear, Pain, Mouth and Earache, Stomachache, Rheumatism | C/PS |
| <i>T. bellirica</i> | Fruit | Diarrhoea, Astringen, Piles, Kidney and Eye | C/PS |
| <i>T. chebula</i> | Fruit | Purgative Brain tonic, Asthma, Cough and Mouth | C/PS |
| <i>Thespesia populnea</i> | Wood Plant & Leaf | Heart, Skin and Syphilis | s |
| <i>Tinospora cordifolia</i> | Whole plant & Stone | Tonic, Eye and Fever | T |
| <i>Tridax procumbens</i> | Whole plant & Leaf | Bleeding, Cold, Diarrhoea, Dysentery, Insecticide and Wound | S |
| <i>Ventilego caliculata</i> | Bark | Skin, Urinary and as coolant | S |
| <i>Vernonia cinerea</i> | Root, Plant& Seed | Fever, Urinary, Skin and Insecticide | S |

contd...

Table 11.5 – contd...

| Species | Part's Used | Medicinal Uses | Status |
|-----------------------------|---------------------------------|---|--------|
| <i>Vitex negundo</i> | Branches & Leaf | Fever, Headache, Ear, Wounds Swelling and Asthma | PS |
| <i>Woodfordia fruticosa</i> | Leaf & Flower | Dysentery, Cough, Skin and Eye | S |
| <i>Wrightia tinctoria</i> | Bark, Leaf, & Seed | Stomachache, Fever, Piles, Skin, Fishpoison and Toothache | |
| <i>Xanthium indicum</i> | Root and Fruit | Eye, Headache and Smallpox | S |
| <i>Zingiber officinalis</i> | Root or Rhizome | Cough, Stomachache, Eye Expel worms and High blood pressure | C |
| <i>Ziziphus mauritiana</i> | Root, Bark Lead, Fruit and Seed | Typhoid, Stomachache, Cuts and Wounds | C |
| <i>Z. oenoplia</i> | Root | Wounds | C |

Medicinal Plants in Satpura Plateau of Madhya Pradesh

Madhya Pradesh is veritable treasure house of healing herbs which are being used in Indian System of Medicine like Ayurveda, Siddha and Unani. The plants, shrubs, roots of immense medicinal value are abundantly found in Satpura, Vindhya, Amarkantak, Pachmarhi and Patakot areas. Madhya Pradesh has 1,35,164 km² of forests which account for 30.48% of total geographical area of the state. These forests have been source of invaluable medicinal plants since the time man realized the preventive and curative properties of plants and started using them for human health care. Our old traditional Indian Systems of Medicine (ISM), one of the most ancient medicine practices known to the world, derive maximum formulations from plants and plant extracts that exist in the forests. About 400 plants are used in regular production of Ayurvedic, Unani, Siddha and tribal medicine. About 75% are from tropical and 25% from temperate forests. 30% of preparations are roots, 14% bark, 16% whole plants, 5% flowers, 10% fruits, 6% leaves, 7% seeds, 3% wood, 4% rhizomes, 6% stems, only less than 20% (including species) are cultivated (Anon., 1997).

General forest degradation processes adversely affect the resource base of medicinal plants. The rural poor, whose dependence on these products is very heavy, are the worst sufferers. The problem is compounded by market demand driven harvesting without any concern for regeneration and conservation. In the process, essential regenerative components of a plant like roots, tubers, fruits, seeds, flowers and bark are indiscriminately collected, leading to degradation and depletion and even demise of particular species. Many important medicinal plants like *Rauvolfia serpentina*, *Curcuma caesia*, *Chlorophytum* spp., *Dioscorea* spp., *Gloriosa superba*, *Gymnema sylvestre* etc. are becoming rare and some of them are critically endangered. It is estimated that 10% of all plant species are currently endangered in India.

The Satpura Plateau is a remarkable place, not only because of the large tribal population and dense forests, but also because it has a lot of rare and useful natural resources including some rare species of medicinal plants, which are used for curing different kinds of diseases. Tribals and forests are symbiotically related. The tribal communities in Satpura plateau occupy forested region. They

have lived in isolation but in harmony with nature. They draw their sustenance largely from the forests. Even in areas where forests do not exist, they visit distant forests periodically and try to get their traditional requirement. They have very close linkage with the forest, which they regard as their mother deity. A perusal of literature reveals that some work has been done on ethnomedicinal plants of Madhya Pradesh (Rai and Pandey, 1997; Pandey and Bisaria, 1998; Pandey, 2000; Rai *et. al.*, 2000).

Herbal Garden

Some critical, endangered, vulnerable and low risk threatened species of medicinal plants of the region are *Curcuma caesia*, *Dioscorea deltoidea*, *Gloriosa superba*, *Rauvolfia serpentina*, *Curculigo orchoides*, *Celastrus paniculatus*, *Baliospermum montanum*, *Uraginea indica*, *Tylophora indica*, *Hedychium spicatum*, *Gymnema sylvestre*, *Curcuma angustifolia* and *Clerodendrum serratum*. A few of the medicinal plants of Satpura Plateau, which are becoming extinct, need immediate attention for conservation.

Table 11.6 : Medicinal Plants conserved in Herbal Garden in CFRHRD, Chhindwara

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|------------------------------|-------------|--------------------------|---|--------|
| <i>Abelmoschus Moschatus</i> | Muskdana | Seeds, roots | Seed used as cardiac tonic and aphrodisiac; source of ambrette fragrance (musk odour). It contains ambratolide. | C |
| <i>Abroma augusta</i> | Ulta Kambal | Seeds, roots and leaves | Root is abortifacient and uterine tonic. Leaf paste is used in ringworms. Roots contain choline betaine and stigmasterol. | S |
| <i>Abrus precatorius</i> | Ratti | Seeds, roots and leaves | The roots and leaves are astringent, sweet and emetic. Seeds are abortifacient and aphrodisiac, it contains glycyrrhizin and abrin. | T |
| <i>Abutilon indicum</i> | Kanghi | Roots, leaves and seed | The plants possess diuretic, demulcent and laxative. Paste of leaves useful in boils. It contains flavours & gossypetin. | S |
| <i>Acacia catechu</i> | Khair | Bark and wood | The bark is used in conjunctivitis, stomachache and diarrhoea. It contains catechin and guym resin. | S* |
| <i>Acacia concinna</i> | Shikakai | Pods | Pods are used as hair tonic. It contains Kinmonnosides saponins. | S |
| <i>Acacia nilotica</i> | Babul | Bark, tender shoots, gum | Bark is useful in diarrhoea, dysentery, bronchitis and cough. Tender shoots are used as tooth brush. Gum constitutes galactose, arabinose, rhamnose. | S* |
| <i>Achyranthes aspera</i> | Apamarg | Roots, leaves and seeds | Expectorant, diuretic, bronchial troubles and abortifacient. Also useful in painful delivery. It contains achyranthine, betaine acdysterone and glycosides. | S |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|------------------------------------|-------------|------------------------|--|--------|
| <i>Acorus calamus</i> | Bach | Rhizome | The paste of rhizome is given for stammering in children. It contains beta-asarone, calamol, chalamene and acotamine. | T |
| <i>Adhatoda vasica</i> | Vasaka | Leaves and young twigs | Cough and bronchial troubles. Leaf decoction is used in inflammation. It contains vasicine, Vasicinol, adhatodine. | C |
| <i>Aegle marmelos</i> | Bel | Fruit and leaves | The fruit is taken in dysentery and constipation. It contains abscisic acid, marmelosin, marmin and vitamins. | C/PS |
| <i>Ageratum conyzoides</i> | Osari | Leaves | Leaves are used in wounds and sores. It contains conyzorigum, chromone and essential oil. | S |
| <i>Albizzia lebbek</i> | Kala siris | Bark, flowers and seed | Bark is astringent, expectorant; flowers are useful in cough; seeds are used in inflammations. It contains saponin labbekanin and tannins. | S |
| <i>Albizia procera</i> | Safed siris | Bark, Seeds | Bark is astringent, expectorant; flowers are useful in cough; seeds are used in inflammation, it contains saponinprocero-genin. | S |
| <i>Aloe vera</i> | Gwar Patha | Leaves | Used in burn, eruptions, stomach troubles and acidity. It contains aloin and aloe-emodin. | T/C |
| <i>Alpinia galanga</i> | Kulanjan | Rhizome | Used as tonic deodorant and disinfectant. It yields an essential oil rich in camphor. It contains essential oil rich in cineol. | T |
| <i>Amorphophallus campanulatus</i> | Surankand | Taber | The corn is irritant, astringent, carminative in liver tonic. Tubers contain protease inhibitors, trypsin chymotrypsin. | C |
| <i>Andrographis paniculata</i> | Kalmegh | Whole plant | The herb is useful in malaria and liver disorders. It contains andrographolide. | T |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|------------------------------|--------------|-------------------------|---|--------|
| <i>Annona squamosa</i> | Sitaphal | Fruits and seeds | The paste of leaves is used to kill lice. Fruits is as tonic. It contains anonaine, higenamine, reticuline and squamosin. | C |
| <i>Argemone mexicana</i> | Piliktari | Roots, leaves and latex | Used in skin diseases & leprosy. Latex is useful in dropsy, jaundice, and conjunctivitis. It contains allocryptopine, berberine and maxicanic acid. | S* |
| <i>Argyreia nervosa</i> | Samudra sokh | Leaves | Used in gonorrhoea and chronic ulcers. It contains ergoline, isoergine and ergine alkaloids. | S |
| <i>Artemisia maritime</i> | Bhim Kapoor | Leaves and flowers | Flower tops are used as anthelmintic; decoction of plant is useful in fever. It yields essential oil rich in cinol. | T |
| <i>Asparagus officinalis</i> | Satavar | Roots | Roots are used as tonic. It contains satavarin, sarasopogenin disogenin and glucosides. | PS |
| <i>Azadirachta indica</i> | Neem | All parts | Leaf paste is useful in skin diseases, twigs are used in toothache, seeds as insecticide. It contains azadirachtin, nimbin, mimbicidin and fatty acids. | PS |
| <i>Bacopa monnieri</i> | Brahmi | The whole plant | The whole plant is used as intellect promoting, cooling, carminative and cardiotoxic. It contains baccoside, brahmine. | T |
| <i>Barleria cristata</i> | Katsaraya | Leaves and roots | Leaves and roots are used for cough and inflammations. It contains epigenin & neringenin. | T |
| <i>Bauhinia purpurea</i> | Lal Kanchnar | Leaves and roots | It is used in rheumatism, swelling, leprosy, glandular diseases and animal bites. Flowers contain astragal, isoquercetin and quercetin. | S |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|--------------------------------|---------------|-------------------------|--|--------|
| <i>Bauhinia vahili</i> | Mahul patta | Roots, leaves and seeds | Roots decoction is taken in fever. Seeds aphrodisiac. Glycosides of quercitol and kaempferol and proteins | S |
| <i>Bauhinia varigata</i> | Kachnar | Leaves, bark and pods | The bark decoction is taken in tuberculosis. Useful in diarrhoea and worms. It contains quercetin. | S |
| <i>Bixa orellana</i> | Sinduri | Seeds | Seeds are used as astringent, gonorrhoea; leaves in snakebite. It is cultivated to obtain annatto dye (Bixin) | C* |
| <i>Boerhavia diffusa</i> | Punarnava | Root and leaves | Roots decoction is taken in jaundice, bronchitis and in kidney stone. It contains punarnavine-1&2. | S* |
| <i>Bryonia lanciniosa</i> | Shivlingi | Seeds | Seeds are taken in sterility and to get male child. Seed oil is a source punicic acid. | T |
| <i>Buchnaia lanzan</i> | Chironji | Seeds | Seeds are used as cardiac tonic. It contains protein, fat, fibre, Carbohydrates, minerals etc. Seeds yields fatty oil. | PS |
| <i>Bursera panicillata</i> | Lavender tree | Bark and wood | Wood oil is highly valued perfumes. It contains various terpenes with linalool as major constituents. | PS |
| <i>Butea monosperma</i> | Palas | Seeds, bark | Seeds are used in skindisease. Bark is aphrodisiac and anthelmintic. It contains butin, monospermoside and palasonin. | PS |
| <i>Caesalpinia crista</i> | Gataran | Seeds | Seed power is taken in stomach disorders. It contains caesalpin-F and bonduceline. | S |
| <i>Callistemon lanceolatus</i> | Bottle brush | Leaves | Used for skin ailments. Leaves yield essential oil rich in cineol. | S |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|------------------------------|------------|------------------------|--|--------|
| <i>Calotropis procera</i> | Aak | Flower, leaf latex | The flower are used in cough and asthma, latex is used in toothache. It contains cardanolides named gigantol, uscharidin, calotropin etc. | S |
| <i>Cannabis sativa</i> | Bhang | Leaves and seeds | It is used to treat depression, bladder inflammation and nervous disorders. It contains cannabin. | C |
| <i>Cardiospermum</i> | Kalphuti | Leaves and seeds | Used against rheumatism, arthritis and obesity. Leaves and roots are diuretic. It contains saponins. | S |
| <i>Carissa carandus</i> | Karonda | Fruits and roots | Unripe fruit-astringent, ripe; colling; root-bitter and anthelmintic. Roots yield carissone, fruits ascorbic acid. | S |
| <i>Carum bulbocastamum</i> | Kala zira | Seeds | Seeds are laxative and anthelmintic. It yields a volatile oil rich in cuminaldehyde. | S |
| <i>Cassia angustifolia</i> | Seenā | Leaves | Leaves are used as laxative and for intestinal troubles. It contains sennosides. | S |
| <i>Cassia tora</i> | Chakoda | Seeds and leaves | The seed paste is applied on skin diseases. It contains glucoside, amino acid, fatty acids, emodin and sitosterol etc. | S* |
| <i>Catharanthus roseus</i> | Sadabahar | Roots and leaves | Leaf decoction in antidiabetic. Root of the plant are used to treat cancer. It contains vincristine, vinblastine, ajmalicine, vinceine and reserpine group of alkaloids. | C |
| <i>Celastrus paniculatus</i> | Mankangni | Seeds, bark and leaves | Seeds are useful in abdominal disorders and for sharpening memory and intellect. It contains malkanguniol, celapanine and paniculatdol. | T |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|-----------------------------------|------------------|--------------------------|---|--------|
| <i>Centella asiatica</i> | Manddok parni | Leaves | The plant is used as nervine tonic, carminative, cooling and diureic. It contains cenotic, centellic acids, Asiatic acid, brahminoside, asiaticoside. | S |
| <i>Chlorophytum borivillianum</i> | Safed mulsii | Roots | Roots are used as toinic and aphrodisiac. It contains glycosides, polysaccharides and saponins. | T |
| <i>Cissus quadrangularis</i> | Hadjori | Fleshy stem | Used to join bone fractures in animals and in human being also. It contains beta-sitosterol, amyirin, amyron and terpenoids. | S |
| <i>Citrullua colocynthis</i> | Indrayan | Leaves and fruits | Fruits are cooling, carminative, antipyretic and useful in tumours and leucoderma. It contains colocynthin, citrullol. | C |
| <i>Cleome gynandra</i> | Hur hur | Leaves and fruits | Popultice of fresh leaves are used on swellings. Flowers are used in anemia. It contains cleomin. | S |
| <i>Clerodendrum seraum</i> | Bharangi | Leaves | Leaves are useful in cough, bronchitis, intermittent fever and skin diseases. Saponin from roots, bark-catechin and luteolinc. | S |
| <i>Clerodendrum phomidis</i> | Bharangi | Leaves | It is used in fever, cough, bronchitis, and cholera. Also used as antifertility drug. Leaves contain sctellarein. | S |
| <i>Clitoria ternatea</i> | Aparajita | Roots, flowers and seeds | Root is used as diuretic, also used in snake poison. Seed and root contain tennin, seeds contain a fixed oil. | C |
| <i>Commiphora mukul</i> | Guggul | Oleo-gum resin | The olio-gum resin is used in treatment of arthritis and obesity. It contains guggulusterols-I, II, III and sterones. | T |
| <i>Costus speciosus</i> | Keokand | Rhizome | It is used to treat cough, dyspepsia, skin diseases, worms and snake bite. It contains diosgenin. | T |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|-------------------------------|------------------|-----------------------|--|--------|
| <i>Curculigo orchoides</i> | Kali Musli | Roots | Roots are used as tonic and aphrodisiac. Roots contains glycosides, polysacchride, starch, yuccagenin and sapogenin. | |
| <i>Curcuma amada</i> | Ama haldi | Tuber | Useful in sprain and brusies. Rhizome is taken in stomach pain. It yields essential oil rich in ocimene and terpene. | C |
| <i>Curcuma angustifolia</i> | Tikhur | Tuber | Rhizome is fragrant used as tonic, aphorodisiac. Useful in bronchitis, fever ans asthma. It yields cineole rich essential oil. | C |
| <i>Curcuma caesia</i> | Kali haldi | Tuber | Rhizome is useful in sprain, asthma bronchitis leucoderma. It yields camphor rich essential oil. | C |
| <i>Cuscuta reflexa</i> | Amar bel | Leaflets | Plants is purgative used in sores and fall of hairs. Plants contain cuscutalin and cuscutin. | S |
| <i>Cymbopogon flexuosus</i> | Lemon grass | Leaves | The oil is used in perfumery and synthesis of Vitamin A. Vitral is major constituents. | CPS |
| <i>Cymbopogon martini</i> | Palamarosa grass | Leaves, inflorescence | The oil is used for pain in joints. It is rich source of geraniol. | C |
| <i>Cymbopogon winterianus</i> | Citronela grass | Leaves | The oil is used is insect replent preparations. It is rich source of citronellal. | C |
| <i>Cynodon dactylon</i> | Dobghass | Whole plant | Useful in skin, gastro-urinary diseases. It checks bleeding from cuts and wounds. It contains tricin and flavone gltcosides. | PS |
| <i>Cyperus scariosus</i> | Gondla | Tubers | The tubers are used in diarrhoea, cough and renal troubles. It contains cyperine, aromadendrene and rotundine. | S |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|----------------------------|--------------|-------------------|---|--------|
| <i>Datura metel</i> | Dhatura | Leaves and fruits | Leaves are used in swelling and rheumatism; flowers in asthma. It is rich source of hyoscine, scopolamine alkaloid. | T |
| <i>Datura stramonium</i> | Kala Dhatura | Leaves and fruits | Smoke of seeds inhaled in asthma. It is narcotic and antispasmodic. It contains byoscin and hyocyamine alkaloids. | T |
| <i>Dioscorea daemia</i> | Baichandi | Tubers | Tubers are used in stomach disorders, diarrhoea and piles. Fruits are used as germicidal. It contains betulin, lupeol and tannin. | T |
| <i>Dioscorea daemia</i> | Tendu | Barks, fruit | It is used in stomach disorders, diarrhoea and piles, fruits are used as germicidal. It contains betulin, lupeol and tannin. | T |
| <i>Eclipta alba</i> | Bhringaj | Leaves | Plant is used in chronic skin diseases. It is used to blacken hairs. It has stigmasterol, Egyptian and amyryn. | S |
| <i>Embelia ribes</i> | Bihdidang | Seeds | Seeds are useful in worms and abdominal disorders. It contains embelin, embolic acid. | T |
| <i>Emblica officinalis</i> | Amla | Fruits | Fruits are useful in diabetes, anemia jaundice, tridosha flatulence and grayness of hairs. It is rich source of Vitamin C | PS |
| <i>Eucalyptus globulus</i> | Nilgiri | Leaves and oil | Useful in cold and cough. Its oil is rich source of cineole. | C/PS |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|------------------------------|--------------|-----------------------|---|--------|
| <i>Eucalyptus citriodora</i> | Nilgiri | Leaves and oil | Oil is used as insect repellent and rich source of citronellal. | C/PS |
| <i>Eucalyptus hybrid</i> | Nilgiri | Leaves and oil | The oil is used in cough and cold and contains cineole, terpineol and phellandrene. | C/PS |
| <i>Evolvulus alsinoides</i> | Shankpuspi | Whole plant | Useful in bronchitis, asthma, epilepsy, improving memory and general debility. It contains evolvine and tricontane. | S |
| <i>Gloriosa superba</i> | Kalihari | Tubers and seeds | The rhizome are useful in inflammations, labour pain and delivery of baby. It is rich source of colchicines. | C/PS |
| <i>Gmelina arborea</i> | Khamer | Bark and roots | It is astringent, bitter, digestive, cardiotoxic, diuretic and laxative. It contains gmelinol and luteolin acid. | T |
| <i>Gymnema sylvestre</i> | Gudmar | Leaves | Leaves are useful in diabetes, liver disorders and jaundice. It contains gymnemic acid. | T |
| <i>Hedychium spicatum</i> | Kapoorkachri | Rhizome | Rhizome is used in bronchitis, indigestion, eye diseases and as blood purifier. Rhizome yield volatile oil. | T |
| <i>Helicteris isora</i> | Marodphalli | Root, bark and fruits | The root and bark is used in diarrhoea and dysentery. Seeds contain diosgenin. | S |
| <i>Hemidesmus indicus</i> | Anantmool | Roots | Roots are used as tonic and in skin diseases. It contains hyperoside, isoquercetin, rutin, hemidesmin 1 and 2. | T |
| <i>Hibiscus rosasinesis</i> | Gurhal | Flowers, leaves | Flowers are hypoglycaemic, aphrodisiac and used in diabetes, and menstrual disorder. It contains beta-sitosterol. | C |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|----------------------------------|------------|----------------------|--|--------|
| <i>Holarrhena antidysentrica</i> | Kutaja | Bark and seeds | Useful in amoebic dysentery, diarrhoea and asthma. It contains, conessimine, conescine, concuressine and curchisine. | PS |
| <i>Hyptis suaveolens</i> | Vantulsi | Leaves and seeds | Leaf decoction is used as eye lotion and in fever. It is used in headahe and malaria. It yields a menthol rich essential oil | S* |
| <i>Iopomea digitata</i> | Bidrikand | Roots | Roots are used as tonic aphrodisiac and purgative. Rhizomes yield taraxerol and sitosterol. | S |
| <i>Ipomea nil</i> | Kaladana | Seeds and roots | The seeds are used as anthelmintic are purgative. It contains lysergol, panniclavine. | S |
| <i>Jasminum grandiflorum</i> | Mongra | All parts | Flowers are useful in skin diseases, headache, eye troubles and in scorpion strings. It yields fragrant oil used in perfumery. | C |
| <i>Jasminimum sambac</i> | Mongra | All parts | Whole plant imparts cooling sensation, used in insanity and weakness; useful in headache and eye troubles. It yields fragrant oil used in perfumery. | C |
| <i>Jatropha curcas</i> | Ratanjot | Seeds, oil and latex | The latex is purgative and good for wounds. The oils used in rheumatism. It contains curin, apigenin and vitaxin. | S* |
| <i>Jatropha gossypifolia</i> | Chandrijot | Seeds and oil | The latex is purgative and good for wounds. The oils used in rheumatism. It contains fatty oil. It contains jatrophone. | S* |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|------------------------------|---------------|--------------------------|--|--------|
| <i>Lantana camara</i> | Laltern | Leaves and roots | The leaves are used in eczema. The decoction of root is used in dysentery. It contains essential oil rich in camerene. | S* |
| <i>Lavandula officinalis</i> | Lavander | Leaves and oil | It is stimulant. It provides a fragrant oil used in cosmetics. It contains linalool, linaly acetate. | C |
| <i>Lawsonia inermis</i> | Mehandi | Leaves | The paste of leaves applied on hairs to get rid of dandruff. It contains laxathones & lownone. | C |
| <i>Lepidium sativum</i> | Chandrasur | Seeds, roots and leaves | Seeds are used in sprains and leprosy, lumbago, scurvy, asthma and cough. Plants contain glucotropoeolin. | S |
| <i>Leucas aspera</i> | Gumma | Leaves and flowers | It is used to treat cough and cold. Leaf juice is used in psoriasis, skin eruptions and swellings. It contains oleanolic acid, solic acid and fatty acids. | S |
| <i>Limonia acidissima</i> | Kaitha | Fruits | Fruits used as astringent, stomachic and stimulant. Used as remedy of insect bites. It has bergapten, marmesin, marmin. | S |
| <i>Madhuca longifolia</i> | Mahua | Leaves, flower and seeds | The bark is used for ulcers and bleeding gums. Flowers are taken as tonic. Seeds contain fatty oils and mowrin saponins. | S |
| <i>Melia azedarach</i> | Bachin | All parts | Used as insect repellent. Leaf juice anthelmintic and diuretic. Seeds yield a fatty oil. It contains bakayanin, margosine. | PS |
| <i>Mentha aruensis</i> | Japanese mint | Whole herb and oil | The oil is antiseptic, carminative and stimulant. Find useful in headache. It contains menhol as major constituent. | C |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|--------------------------------|------------|--------------------|---|--------|
| <i>Mimusops elengi</i> | Moulsri | Bark and fruit | Bark is useful in diarrhoea and dysentery and fruits is as tonic. Seeds contain sapogenins. | C |
| <i>Moringa oleifera</i> | Sahjan | Leaves and fruits | Leaves are used in scurvy, flowers are as tonic, seeds are antipyretic, oil in rheumatism. It contains moringine, moringinine and fatty oils. | C |
| <i>Mucuna pruriens</i> | Kewanch | Seeds | Seeds are aphrodisiac and nervine tonic. It contains L-DOPA, glutathione, gallic acid, prurienidine and glycosides. | S |
| <i>Murraya koenigii</i> | Mithi neem | Leaves | Leaves are aromatic and used in preparation of curries. The bark is used in eruptions. It contains koenigin and volatiles. | C |
| <i>Neritum indicum</i> | Kaner | Roots and leaves | Roots used in ulcera and decoction of leaves used to reduce swellings. It contains neriodorin, and nerioderin. | C |
| <i>Nyctanthes arbortristis</i> | Prijata | Leaves and flowers | Leaves useful in fever, rheumtism and sciatica. It contains nyctanthin. | C |
| <i>Ocimum basilicum</i> | Raam tulsi | Leaves and seeds | Carminative, diuretic, stimulant and used in gonorrhoea. It is source of eugenol and inalool. | S |
| <i>Ocimum sanctum</i> | Tulsi | Leaves and seeds | Leaves are useful in cold, cough headache and bronchial troubles and in snake bite. It contains eugenol, carvacrol etc. | C |
| <i>Sida acuta</i> | Bala | Whole herb | Herb is used to cure nervous, fever and urinary disorders. It contains ephedrine, vasicinone, vasicine and choline alkaloids. | S* |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|-----------------------------|-------------|--------------------------|--|--------|
| <i>Sida cordifolia</i> | Atibala | Whole herb | Used for rheumatism, diabetes, and neurological disorders. It is used as tonic and aphrodisiac. It contains ephedrine, betaine and choline alkaloids. | S* |
| <i>Sida rhombifolia</i> | Mahabala | Whole herb | The plant is cardiotonic and useful in ulcers, skin diseases, rheumatism, sciatica and diabetes. It contains ephedrine, vasicinol and choline alkaloids. | S |
| <i>Smilax perfoliata</i> | Ramdaton | Roots | It is used in seminal emissions spermatorrhoea and weakness. Dioseginin is the major active constituents. | T |
| <i>Solanum nigrum</i> | Makoy | Fruits, leaves and seeds | It is useful in jaundice, cough, bronchitis, asthma, diarrhoea, fever ulcers and skin diseases. It contains solanine & saponins. | S |
| <i>Solanum khasianum</i> | Akarkara | Roots and flowers | The plant is used as anti inflammatory, antiarthritic and a source of steroidal hormones. It contains solalsodine. | T/C |
| <i>Sphaeranthus indicus</i> | Gorakhmundi | Fruits, leaves | The plant possesses anthelmintic, aphrodisiac and stomachic properties. It contains sphaeranthine. | S |
| <i>Spilanthus calva</i> | Bhatkatai | Roots and flowers | Useful in tooth pain and ulcers in mouth. It contains spilanthol. | S |
| <i>Sterculia urens</i> | Kullu | Seeds and gum | Gum is used as laxative and in dental fixture. It contains strcurensis & polysaccharides. | S |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|-----------------------------|------------|--------------------|---|--------|
| <i>Syzygium cumini</i> | Jamun | Fruits and leaves | Useful in diabetes, diarrhoea and dysentery. It contains quercetin and jamboline | PS |
| <i>Tagetes erecta</i> | Genda | Leaves and flowers | Leaf juice is used in earache. It yields an essential oil rich in tagatone and other terpenes. | C |
| <i>Tagetes patula</i> | Genda | Leaves and flowers | Leaf juice is used in earache. It yields an essential oil rich in pipertenone, tagatone etc. | C |
| <i>Tephrosia purpurea</i> | Sarponkha | Whole plant | The plant is useful in constipation, worms, diarrhoea. It contains rutin and purpurin. | S |
| <i>Terminalia arjuna</i> | Arjuna | Bark | The bark is taken in cardiac disorders. Bark contains arjuline, arjunosides and tannin. | PS |
| <i>Terminalia bellerica</i> | Baahera | Fruits | It is one important ingredient of tirphala and useful in piles and fever. It contains beta-sitosterol, gallic acid & menitol. | PS |
| <i>Terminalia chebula</i> | Harra | Fruits | The fruits powder is taken in constipation. The roasted fruits are useful in cough. It contains chebulin, terpenes and saponins. | PS |
| <i>Thuja occidentale</i> | Thuja | Leaves and cones | Useful in cough, fever, rheumatism and gout. It is astringent, digestive, laxative, diuretic and carminative. It yields thujone rich essential oil. | T |
| <i>Thuja orientalis</i> | Morpanki | Leaves and fruits | It is useful in rheumatism, amenorrhoea and carcinoma. It yields an essential oil rich in terpenes and 3 carene. | T |

contd...

Table 11.6 - contd...

| Scientific Name | Local Name | Part's Used | Uses and active chemical constituents | Status |
|------------------------------|--------------|------------------|--|--------|
| <i>Tinospora cordifolia</i> | Gurbel | Stem and leaves | It is used as tonic, antiperiodic and aphrodisiac. It contains tinosporin, tinsoporol and tinosporic acid. | T |
| <i>Tribulus terrestris</i> | Chota Gokhru | Fruit | Fruits are aphrodisiac, tonic, diuretic and inflammatory. It contains diosgenin and steroidal saponin. | T |
| <i>Tridax procumbens</i> | Akdandi | Leaves | The juice of leaves applied in cuts and wounds including ulcers. | S |
| <i>Tylophora indica</i> | Anantmool | Leaves and roots | Leaves are taken in asthma and bronchial diseases. It contains tylophorone and tylophorinine. | T |
| <i>Urginea indica</i> | Jangali pyag | Bulb | It is used in heart trouble, cough, bronchitis. It contains scillarenes and glucosides. | S |
| <i>Ventilago caliculata</i> | Keoti | Seeds | Oil is used in rheumatism. Oil is eaten by tribal population. It contains fatty acids. | S |
| <i>Vetiveria zizanioides</i> | Khus | Roots | It is stimulant, diaphoretic and refrigerant. Useful in sprain and rheumatism. It contains essential oil rich in vetivone. | PS |
| <i>Vitex negundo</i> | Nirgundi | Leaves | The leaves are used in body pain and rheumatism. It contains artematin and casticin. | PS |
| <i>Withania somnifera</i> | Ashwa-gandha | Roots and leaves | Roots are taken to improve vigour and stamina. Useful in general weakness and rheumatism. It contains withanolides and withaferin. | PS |

Table 11.7 : List of Medicinal plant becoming extinct and vulnerable in this region

| Sl.No | Botanical Name | Vernacular Name | Parts used in various diseases |
|-------|-----------------------------------|-----------------|--|
| 1 | <i>Acorus calamus</i> | Bach | Rhizome are used as tonic and stammering. |
| 2 | <i>Argyrea spaciola</i> | Samudra Sokh | Leaves are applied for boils and tumour. |
| 3 | <i>Aristolochia indica</i> | Ishwarmool | Roots are used for sanke bite. |
| 4 | <i>Boerhavi diffusa</i> | Punannava Lal | Roots cure corneal ulcer and cough. |
| 5 | <i>Celastrus paniculatus</i> | Malkangni | Seeds are used to improve memory and skin diseases. |
| 6 | <i>Chlorophytum borivillianum</i> | Safed Musli | Roots are used as tonic. |
| 7 | <i>Citrullus colocynthus</i> | Indryan Badi | Leaves smoke for asthma and for blackening hair. |
| 8 | <i>Curcuma angustifolia</i> | Tikhur | Rhizomes are good source of starch, nutritive |
| 9 | <i>Curcuma caesia</i> | Kali Haldi | Rhizomes are used for sprains and brusies. |
| 10 | <i>Dioscorea deltoidea</i> | Katalu | Tuber is used as tonic. |
| 11 | <i>Eclipta alba</i> | Bhring Raj | Roots are used with ajwain for enlargement of liver. |
| 12 | <i>Embelia ribes</i> | Baividang | Seeds are used to kill pare worms and round worms. |
| 13 | <i>Gloriosa superba</i> | Kalihari | Roots are used for white patches (Leucoderma) |
| 14 | <i>Glymnema sylvestris</i> | Gummar | Leaves are used for diabetes with other drugs. |
| 15 | <i>Hedychium spicatum</i> | Kapoor kachri | Root is given for stomach ache. |
| 16 | <i>Litsea sebiferapers</i> | Maidalakdi | Bark for joining broken bones. |
| 17 | <i>Plumbago zeylanica</i> | Chitrak | Roots are used for rheumatism. |
| 18 | <i>Rauwolfia tetraphylla</i> | Chota Chand | The root is given for epilepsy. |
| 19 | <i>Rauwolfia serpentina</i> | Sarpagandha | Roots of the plant are given in hypertension. |
| 20 | <i>Smilax zeylanica</i> | Ram Datoon | Roots is taken for spermatorrhoea, weaknees. |
| 21 | <i>Tephrosia purpurea</i> | Sarpunkha | Roots are used as laxative and to treat worms. |
| 22 | <i>Tylophora indica</i> | Antamool | Leaves are used for asthma. |
| 23 | <i>Urginea indica</i> | Jangli Pyaj | Rhizomes are used in bronchitis. |

Conservation Strategies

Due to manifold human interferences, the valuable medicinal and aromatic plants are becoming extinct. Commercial exploitation has resulted in the eradication of several important MAPs from their natural habitat. The state of Madhya Pradesh is one of the major mega diversity centers in the country, which gives us greater responsibility to make efforts towards conservation of our richest biodiversity for future generations. In recent years, the conservation of medicinal plant has gained proper attention as their medicinal values are becoming more and more popular. At the initiative of the Chief Minister, the state Government has constituted the 'Madhya Pradesh State Bio-diversity Board' to protect its rich biological wealth and make it a substantial source of income for the rural and tribal communities. Some of the useful suggestions for the conservation of our biodiversity may be as follows:

1. Development of area specific agro-techniques for cultivation of MAPs as crop to take off pressure from natural wild stock.
2. Documentation of the location and ecological status of bioresources.
3. Development of awareness programme for sustainable use and conservation of valuable MAPs among rural people.
4. Domestication of MAPs.
5. Documentation of indigenous knowledge of utilization of medicinal plants.
6. Conservation in herbal/botanical gardens (ex-situ conservation).
7. In-situ conservation of MAPs by protecting their natural habitats by people participation.
8. Periodical workshop, training programmes for farmers and entrepreneurs to appraise recent development and advantage of cultivation of MAPs.

Satpura Plateau of Madhya Pradesh with diverse agro-climatic conditions, large biodiversity and strategic geographical location

is likely to emerge as a leading producer and supplier of medicinal plants. The paper gives a resume of activities undertaken in recent years by Centre for Forestry Research and Human Resource Development, Chhindwara as a part of endeavour towards conserving the medicinal plant wealth and promoting the cultivation of medicinal plant. Training programmes on conservation and cultivation of medicinal plants have also been carried out as a part of Human Resource Development activity. Agrotechniques have been developed for the cultivation of *Abelmoschus moschatus*, *Acorus calamus*, *Andrographis paniculata*, *Rauvolfia serpentina*, *Withania somnifera*, *Cymbopogon flexuosus*, *Cymbopogon moartinii* and *Mentha arvensis*.

Source: A.K. Pandey *et al.*, in the Indian Forester, Vol 131 No. 7, July 2005–Modified from.

Chapter Twelve

Potential Drug Plants of Laterite and Arid Zones

In two separate lists important medicinal plant species have been listed. The list of Arid zone in particular may be considered as of ethnological importance.

The lists show that most of the plants are sporadic which shows absence of regeneration and lack of gregariousness of species. The species represent the large arid zone or drought prone zone of India.

Ethno Medicinal Plants in the Indian Arid Zone

Whatever be the assessment of the authors of the list it is a fact that most of the species occur sporadically and the inflated list must not give an impression that the area is rich in medicinal plants. Very few are presently safe. Only a few sporadic species occur in gregarious patches. Of the few species listed by Kumar *et. al.*, Aloe, Asparagus, Glycyrrhiza, Nardostachys are very much depleted, besides Vanda, Strichnos, Nelumbium, Gloriosa, Gymnema, Dioscorea, Costus, Bryonia are threatened in the area.

Droughts, over-exploitation and grazing are derogatory factors to their survival.

In the arid zone of Jaisalmer, Barmer, Bikaner and Jodhpur 682 species have been reported of which 131 sp. have been found to be of ethno-medicinal value. Of these, 41 species are collected and sold in the arid zone.

Some of the species are (There are other 60 sp.):

Acacia nilotica, Justicia adhatoda, Aloe vera, Asparagus racemosus, Azadirachta indica, Butea monosperma, Capparis decidua, Cassia angustifolia, Cassia fistula, Cassia tora, Citrallus lanatus, Clerodendrum indicum, Commiphora wightii, Cuscuta reflexa, Emblica officinalis, Evolvulus alsinoides, Glycyrrhiza

glabra, *Indigofera cordifolia*, *Ipomoea digitata*, *Jatropha curcus*, *Lawsonia enermis*, *Mucuna pruriens*, *Moringa oleifera*. *Nardostachya jatamansi*.

(Source: Modified from S. Kumar *et al.*, Ind. For. Jany. 2005)

Table 12.1 : Ethno-medical Plants of Arid Zone

| Scientific Name | Local Name | Status |
|------------------------------------|------------|--------|
| <i>Anthemis pyrethrum</i> | Akor kora | S* |
| <i>Argomone maxicana</i> | Atkuti | C |
| <i>Amorphophathus campanulatus</i> | Atopinda | PS |
| <i>Acacia nilotica</i> | Babla | S |
| <i>Alangium lamarckii</i> | Dhela | S |
| <i>Adiantum lunulatum</i> | Dodhar | S |
| <i>Asclepias rosea</i> | Dudhiani | S |
| <i>Acacia farnesiana</i> | Gabur | PS |
| <i>Amaranthus gangeticus</i> | Gandhari | PS |
| <i>Alternanthera sessilis</i> | Garundi | T |
| <i>Aristolochina indica</i> | God | C |
| <i>Areaca catechu</i> | Gua | C |
| <i>Anogeissus latifolia</i> | Hesel | PS |
| <i>Amaranthus spinosus</i> | Janum arak | PS |
| <i>Acacia intsia</i> | Kondro | S |
| <i>Agave americana</i> | Konga | C |
| <i>Aurea lanata</i> | Lopon arak | S |
| <i>Anona squamosa</i> | Mandargon | C |
| <i>Antidesma diandrum</i> | Matha arak | T |
| <i>Agle marmetos</i> | Sinjo | C |
| <i>Andropogon muricatus</i> | Siram | S* |
| <i>Alstonia scholaris</i> | Chatnichal | S |
| <i>Abrus precatorius</i> | Kawet | S |
| <i>Adina cordifolia</i> | Karam | S |
| <i>Artocarpus integrifolia</i> | Kanthar | C |
| <i>Asparagus racemosus</i> | Kadar nari | T |
| <i>Anthocephalus chinense</i> | Kadam | PS |
| <i>Borassus flabelliformis</i> | Andiatale | S |
| <i>Bursera serrata</i> | Amru | S |
| <i>Butea monosperma</i> | Daremurap | PS |
| <i>Bombax ceiba</i> | Edel | PS |
| <i>Barringtonia acutiangula</i> | Hinjor | PS |
| <i>Bassia latifolia</i> | Koera | PS |

contd...

Table 12.1 – contd...

| Scientific Name | Local Name | Status |
|----------------------------------|-----------------|--------|
| <i>Brassica campestris</i> | Lutnifuri | C |
| <i>Bryonia lacinosa</i> | Pond Kahubloke | T |
| <i>Basella alba</i> | Purgi | C |
| <i>Blumea wightii</i> | Bondoc | S |
| <i>Bowsellia serrata</i> | Salga | PS |
| <i>Bridelia stipularis</i> | Saudisaba | S |
| <i>Buchanania latifolia</i> | Tarop | PS |
| <i>Boerhaavia repens</i> | Ohok arak | S* |
| <i>Buttneria herbacea</i> | Ramraj | S |
| <i>Bauhinia retusa</i> | Jhinjit | S |
| <i>Bonnaya veronicaefolia</i> | Kadar Akaona | S |
| <i>Calotropis procera</i> | | S |
| <i>C. gigantea</i> | | S |
| <i>Cuscuta chinensis</i> | Alagiri | S |
| <i>Capparis horrida</i> | Asaria | S |
| <i>Combretum decandrum</i> | Aten | S |
| <i>Cephalandria indica</i> | Atokundri | S |
| <i>Clerodendrum siphonanthus</i> | Bam | S |
| <i>Calamus rotang</i> | Bet | T |
| <i>Cassia tora</i> | Bheda deren | S* |
| <i>Caesulia axillaries</i> | Bhelaonja | S |
| <i>Coriandrum sativum</i> | Dhania | C |
| <i>Cynodon dactylon</i> | Dhubighas | PS |
| <i>Crataeva nurvula</i> | Ekasira | S |
| <i>Cannabis sativa</i> | Ganja | C |
| <i>Coix lachryma jobi</i> | Gargodi | S |
| <i>Croton oblongifolius</i> | Gote | S* |
| <i>Cissus quadrangularis</i> | Hadjora | C |
| <i>Cleome viscosa</i> | Hurhura | S |
| <i>Citrus medica</i> | Jambir | C |
| <i>Caram ajowan</i> | Jawar | C |
| <i>Cucurbita moschela</i> | Kehnda | C |
| <i>Celastrus paniculatas</i> | Kujri | S |
| <i>Careya arborea</i> | Kumbir | S |
| <i>Commelina bengalensis</i> | Orak siranre | S |
| <i>Capsicum frutescens</i> | Maric | C |
| <i>Cajanus indicus</i> | Raher | C |
| <i>Casearia tomentosa</i> | Ride | S |
| <i>Clerodendrum serratum</i> | Soramluter | A |

contd...

Table 12.1 – contd...

| Scientific Name | Local Name | Status |
|--------------------------------|-----------------|--------|
| <i>Colocasia antiquorum</i> | Saru | C |
| <i>Crinum Zeylanicum</i> | Sikiom | S |
| <i>Cyperus tegelum</i> | Sura ghas | S |
| <i>Cisampelos pareira</i> | Tejomala | S |
| <i>Canavalia ensiformis</i> | Tihon | S |
| <i>Curcuma angustifolia</i> | Paroda | S |
| <i>Costus speciosa</i> | Orop | T |
| <i>Cordia myxa</i> | Bucchal | C |
| <i>Cotylendon laciniata</i> | Hemsagor | C |
| <i>Casearia tomentosa</i> | | C |
| <i>Cryptolepis buchanani</i> | Ufri | C |
| <i>Dillenia scabrella</i> | Agaire | S |
| <i>Dragia volubile</i> | Andia kongal | S |
| <i>Dioscorea crispate</i> | Bayan | T |
| <i>Datura alba</i> | Datra | S |
| <i>Dioscorea pentaphylla</i> | Durason | T |
| <i>Diospyrus montana</i> | Gada Terel | S |
| <i>Desmodium triflorum</i> | Hudin catomaral | S |
| <i>Dioscorea daemonum</i> | Kolo | T |
| <i>Dillenia indica</i> | Kor Kot | PS |
| <i>Diospyros embryopteris</i> | Makar kenda | S |
| <i>Dolichos lablab</i> | Malhan | C |
| <i>Dioscorea oppositifolia</i> | Piska | T |
| <i>Dolichos biflorus</i> | Pond horee | S |
| <i>Dillenia pentagyna</i> | Sahar | S |
| <i>Dalbergia latifolia</i> | Satsayar | C |
| <i>Delphinus gangetica</i> | Suhako | S |
| <i>Desmodium gangeticum</i> | Toyobal | S |
| <i>Dioscorea damonum</i> | Koloda | T |
| <i>Diospyrus montana</i> | Gada terel | S |
| <i>Emblica officinalis</i> | Arakmeral | C |
| <i>Embelia robusta</i> | Bhabri | S |
| <i>Entada scandens</i> | Bidhanta | S |
| <i>Euphorbia antiquorum</i> | Etkec | S |
| <i>Elleteria cardamom</i> | Elachi | C |
| <i>Enhydra fluctuans</i> | Hemca arai | S |
| <i>Eleusine coracana</i> | Kodo | C |
| <i>Eriosma chinensis</i> | Konden | S |
| <i>Emilia sonchifolia</i> | Kutai lutur | S |

contd...

Table 12.1 – contd...

| Scientific Name | Local Name | Status |
|---------------------------------|---------------|--------|
| <i>Erythrina indica</i> | Marar baha | S |
| <i>Erhetia laevis</i> | Pusipan | S |
| <i>Euphorbia hirta</i> | Pusitua | S |
| <i>Euphorbia thymifolia</i> | Nanha pusitua | S |
| <i>Elaeodendron roxburghii</i> | Niuri | S |
| <i>Ficus bangalensis</i> | Bare | PS |
| <i>Fimbristylis monostachya</i> | Bindinutha | S* |
| <i>Flemingia conjesta</i> | Binbui | S |
| <i>Ficus religiosa</i> | Hesak | PS |
| <i>Ferrula asafoetida</i> | Hin | C |
| <i>Feronia elephantum</i> | Katbel | S |
| <i>Ficus glomerata</i> | Loa | S |
| <i>Flacourtia ramontchi</i> | Marlec | S |
| <i>Gymnema hirsutus</i> | Andia moron | D |
| <i>Grewia sapida</i> | Barka paker | S |
| <i>Grislea tomentosa</i> | Dhai | S |
| <i>Gardenia turgida</i> | Dhundukif | S |
| <i>Gmelina arborea</i> | Goda kasmar | C |
| <i>Gardenia latifolia</i> | Popro | C |
| <i>Gloriosa superba</i> | Selepsomanom | D |
| <i>Grewia polygama</i> | Setaandga | S |
| <i>Grewia villosa</i> | Tarsekolap | S |
| <i>Gynandropsis pentaphylla</i> | Seta kata | S |
| <i>Gossypium arboreum</i> | Kaskom | S |
| <i>Hippocratea arborea</i> | Bandlotanari | S |
| <i>Hymenodictyon excelsum</i> | BhorKond | S |
| <i>Holarthema pubescens</i> | Birhal | PS |
| <i>Hygrophila spinosa</i> | Gukia | S* |
| <i>Heliotropium indicum</i> | Hate sunda | S |
| <i>Helicteres isora</i> | Petcambra | S |
| <i>Heteropogon contortus</i> | Sauri | PS |
| <i>Hygrophila spinosa</i> | Sirauna | S |
| <i>Hibiscus cannabinus</i> | Soupal | S |
| <i>Helianthus annus</i> | Surujmukhi | C |
| <i>Ichnocarpus frutescens</i> | Dudhilota | S |
| <i>Indigofera pulchella</i> | Hutar | S |
| <i>Ipomoea quamoclit</i> | Kidinibaha | S |
| <i>Ipomoea batatas</i> | Sakarkenda | C |
| <i>Ixora parviflora</i> | Merom | C |
| <i>Justicia adhatoda</i> | Basok | S |

contd...

Table 12.1 – contd...

| Scientific Name | Local Name | Status |
|---------------------------------|---------------|--------|
| <i>Jatropha curcas</i> | Bhernla | S* |
| <i>Jasminum arborescens</i> | Hundbaha | |
| <i>Limnophila roxburgiana</i> | Akarbaha | S |
| <i>Leucas chephaloides</i> | Andiadhu | S |
| <i>Luffa acutangula</i> | Atojhinga | C |
| <i>Lygodium flexuosum</i> | Badgocak | C |
| <i>Loranthus vestitus</i> | Baru banda | S |
| <i>Leea macrophylla</i> | Dhalka hetkan | S |
| <i>Leucas cephalotes</i> | Dhurup arak | S |
| <i>Lannea coromendelina</i> | Doka | S |
| <i>Leea hirta</i> | Duria hatkan | S |
| <i>Lipidium sativum</i> | Halim | S |
| <i>Leea aspera</i> | | S |
| <i>Luffa acutangula</i> | Porol jinglia | C |
| <i>Lagerstroemia parviflora</i> | Sekre | PS |
| <i>Linum usitatissimum</i> | Tisi | C |
| <i>Lowsonia alba</i> | Mendisakam | C/PS |
| <i>Mezoneurum cuculatum</i> | Baghin | S |
| <i>Martynia diandra</i> | Baglauca | S |
| <i>Mimosops elengi</i> | Bar | C |
| <i>Mucuna pruriens</i> | Etka | S |
| <i>Millettia auriculata</i> | Hehel | S |
| <i>Marshalia quadrifolia</i> | Maran catom | S |
| <i>Mentha sativa</i> | Pudin arak | C |
| <i>Mallotus philippinensis</i> | Rora | S |
| <i>Mimosa rubicaulis</i> | Sega | S |
| <i>Monochoria plantaginea</i> | Setapan | S |
| <i>Morinda tinctoria</i> | Tampurcaili | S |
| <i>Mangifera indica</i> | U1 | C |
| <i>Maringa oleosa</i> | Munga chal | C |
| <i>Michelia champaca</i> | Champ | C |
| <i>Musa paradisiaca</i> | Kaera | |
| <i>Nelumbium speciosum</i> | Poraeni | D |
| <i>Nerium odorum</i> | Rajbaha | C |
| <i>Nyctanthes arbor-tristis</i> | Saparom | C |
| <i>Nigella indica</i> | Kalia jira | C |
| <i>Nardostachys jatamansi</i> | Nagranter | D |
| <i>Oroxylum indicum</i> | Banahalak | S |
| <i>Ocimum basilicum</i> | Bharbhari | C |

contd...

Table 12.1 – contd...

| Scientific Name | Local Name | Status |
|---|---------------|--------|
| <i>Ochna squarrosa</i> | Birchampa | S |
| <i>Ocimum basilicum</i> var. <i>thysiflorum</i> | Dimbu Baha | C |
| <i>Ougenia dalbergioides</i> | Rot | S |
| <i>Opuntia dillenii</i> | Sapin | S |
| <i>Ocimum sanctum</i> | Tursi | C |
| <i>Oldenlandia biflora</i> | Khat pipra | S |
| <i>Panicum foetida</i> | Adagathia | S |
| <i>Psidium guava</i> | Amsopori | C |
| <i>Pollinia eriopoda</i> | Backom | S |
| <i>Pentapetes phoenicia</i> | Barebaha | S |
| <i>Phyllanthus lanceolarius</i> | Baria kandhum | S |
| <i>Polygonum plebejum</i> | Bhaya bhagua | S |
| <i>Polygala chinensis</i> | Gaighurarak | S |
| <i>Plumeria acutifolia</i> | Gulanj baha | C |
| <i>Panicum miliare</i> | Gundli | S |
| <i>Physalis minima</i> | Handikundi | S |
| <i>Panicum crusgalli</i> | Iri | S |
| <i>Plantago ispaghala</i> | Isabgul | C |
| <i>Paspalum scrobiculatum</i> | Janhe | S* |
| <i>Polycarpaea corymbosa</i> | Janhenanjom | S |
| <i>Panicum flavidium</i> | Jerajanhe | S* |
| <i>Phoenix sylvestris</i> | Khajur | CPS |
| <i>Pandanus odoratissimus</i> | Kiabaha | S |
| <i>Phoenix acualis</i> | Kita | S |
| <i>Plumbago zeylanica</i> | Kitauri | S |
| <i>Pongamia pinnata</i> | Koranj | CPS |
| <i>Polygala crot alarioides</i> | Lilkathi | S |
| <i>Piper longum</i> | Pipuljo | C |
| <i>Phaseolus mungo</i> | Ramra | C |
| <i>Pueraria tuberosa</i> | Tirra | S |
| <i>Polygala chinense</i> | Gaighura | S |
| <i>Paspalum sp.</i> | | S |
| <i>Pterospermum acerifolium</i> | Mackunda | C |
| <i>Randia uliginosa</i> | Darependa | S |
| <i>Racinus communis</i> | Eradom | C |
| <i>Ruellia suffruicosa</i> | Caulia | S |
| <i>Randia dumetorum</i> | Loto | S |
| <i>Smilax ovalifolia</i> | Atkir | S |
| <i>Sorghum vulgare</i> | Bajra | C |
| <i>Spatholobus roxburghii</i> | Bandonari | S |

contd...

Table 12.1 – *contd...*

| Scientific Name | Local Name | Status |
|-------------------------------|------------------|--------|
| <i>s.l.e. chera oleosa</i> | Baru | S |
| <i>Solanum melongina</i> | Bengar | C |
| <i>Solanum stramonifolium</i> | Bengar betahel | C |
| <i>Scindapsus officinalis</i> | Dare japak | C |
| <i>Sapindus detergens</i> | Darka rista | S |
| <i>Shorea robusta</i> | Datauni | S |
| <i>Solanum xanthocarpum</i> | Edheranginjanum | S |
| <i>Stephegyne parvifolia</i> | Gore | S |
| <i>Syzygium cumini</i> | Kod | S |
| <i>Strichnos potatorum</i> | Kuela | D |
| <i>Symplocos racemosa</i> | Lodam | D |
| <i>Syzygium caryophyllata</i> | Lorphul | C |
| <i>Spermacoce hispida</i> | Pitua arak | S |
| <i>Scirpus rotundus</i> | Putki | S |
| <i>Smilax ovalifolia</i> | Raepan | S |
| <i>Soymidia febrifuga</i> | Ruhen | S |
| <i>Streblus asper</i> | Sahra | S |
| <i>Sterculia colorata</i> | Sesebaha | S |
| <i>Semecarpus anacardium</i> | Soso | S |
| <i>Scirpus monstachyus</i> | Sukri mutha ghas | S |
| <i>Salix tetrasperma</i> | Surukue | S |
| <i>Sterculia urens</i> | Telhec | S |
| <i>Sygyzium operculatum</i> | Totnopai | S |
| <i>Spondius mangifera</i> | Ambra | C |
| <i>Solanum jacquini</i> | Rangim janum | S |
| <i>Sida humilis</i> | Joka sakam | S |
| <i>Terminalia tomentosa</i> | Atnak | S/PS |
| <i>Terminalia chebula</i> | Hortoki | S |
| <i>Themeda gigantea</i> | Kus | S |
| <i>Terminalia bellerica</i> | Lopon | S |
| <i>Tetranthera monopetala</i> | Pojo | S |
| <i>Tragia involucrata</i> | Sondhaeni | S |
| <i>Trigonella foenum</i> | Milhi | S |
| <i>Thespesia lampas</i> | Bonkapasi | S |
| <i>Triumfetta rhomboidea</i> | Bhidijenetep | S |
| <i>Terminalia arjuna</i> | Kauha chal | C/PS |
| <i>Urena sinuata</i> | Bhidijanatep | S |
| <i>Urtica pentandra</i> | Khetpipra | S |
| <i>Vernonia cinera</i> | Bangaura | S |

contd...

Table 12.1 – contd...

| Scientific Name | Local Name | Status |
|-------------------------------|------------------|--------|
| <i>Vitex alata</i> | Bar | S |
| <i>Vanda roxburghii</i> | Dare banki | D |
| <i>Viscum attenuatum</i> | Dare katom janga | S |
| <i>Vitis latifolia</i> | Icewer | S |
| <i>Zingiber zerumbet</i> | Mahabari | C |
| <i>Vernonia anthelmintica</i> | Saukha | S |
| <i>Vigna vexillata</i> | Soroan | S |
| <i>Vitex peduncularis</i> | Sim kata arak | S |
| <i>Vitex negundo</i> | Sinduari | S |
| <i>Ventilego calyculata</i> | Bonga sarjom | S |
| <i>Vitis tomentosa</i> | Ghora ladaure | S |
| <i>Wrightia tomentosa</i> | Atkura | S |
| <i>Woodfordia fruticosa</i> | Gadaical | S |
| <i>Wendlandia tinctorium</i> | Tilgai | S |
| <i>Zingiber officinalis</i> | Adhe | C |
| <i>Zehneria umbellata</i> | Atda | S |
| <i>Zizyphus jujuba</i> | Janum | S |
| <i>Zizyphus oenoplia</i> | Kuriframa | S |
| <i>Zehneria umbellata</i> | Kundri | S |
| <i>Zizyphus rugosus</i> | Sekra | S |
| <i>Zingiber cassumunar</i> | Orsoren | S |
| <i>Zizyphus xylopyra</i> | Kaera | S |

NB, Legends : S = Sporadic; S* = gregarious patches; C = cultivated; PS = Presently sage; T = Threatened

Table 12.2 : Laterite areas of West Bengal, Bihar and Jharkhand

| Scientific Name | Status | Scientific Name | Status |
|------------------------------|--------|-----------------------------|--------|
| <i>Abelmoschus moschatus</i> | S | <i>Achyranthes pavonina</i> | S |
| <i>Abrus precatorius</i> | S | <i>Adiantum lunulatum</i> | - |
| <i>Abrus pulchellus</i> | S | <i>Aegle marmelos</i> | C/PS |
| <i>Abutilon indicum</i> | S | <i>Aerva javanica</i> | S |
| <i>Abutilon theophrasti</i> | S | <i>Aerva lanata</i> | S |
| <i>Acacia farnesiana</i> | S | <i>Agave americana</i> | C |
| <i>Acacia pennata</i> | S | <i>Agave cantala</i> | C |
| <i>Acacia rugata</i> | S* | <i>Agave sisalana</i> | C |
| <i>Acalypha indica</i> | S* | <i>Ageratum conyzoides</i> | S* |

contd...

Table 12.2 – contd...

| Scientific Name | Status | Scientific Name | Status |
|------------------------------------|--------|------------------------------------|--------|
| <i>Ahlaia odoratissima</i> | S | <i>Bixa orellana</i> | C |
| <i>Alangium salvifolium</i> | S | <i>Blumea lacera</i> | S* |
| <i>Albizia amara</i> | S | <i>Boerhavia diffusa</i> | S* |
| <i>Alocasia indica</i> | C | <i>Breynia vitis</i> | S |
| <i>Aloe barbadensis</i> | C | <i>Bryonopsis laciniosa</i> | S |
| <i>Alstonia scholaris</i> | PS | <i>Bryophyllum pinnatum</i> | S |
| <i>Alternanthera sessilis</i> | S* | <i>Buchanania lanzan</i> | PS |
| <i>Amaranthus viridis</i> | S* | <i>Buettneria herbacea</i> | S |
| <i>Ambroma augusta</i> | S | <i>Butea superba</i> | S |
| <i>Amorphophallus campanulatus</i> | C | <i>Caesalpinia bonduc</i> | S |
| <i>Amorphophallus sylvaticus</i> | C | <i>Calotropis gigantean</i> | S |
| <i>Ampelocissus latifolia</i> | S | <i>Capparis zeylanica</i> | S |
| <i>Andrographis paniculata</i> | T | <i>Cardiospermum halicacabum</i> | S |
| <i>Anisochilus camposus</i> | S | <i>Carissa carandas</i> | C |
| <i>Anisomeles indica</i> | S | <i>Carissa spinarum</i> | C |
| <i>Annona reticulata</i> | C | <i>Cassia absus</i> | S |
| <i>Annona squamosa</i> | C | <i>Cassia alata</i> | S* |
| <i>Antidesma acidum</i> | T | <i>Cassia angustifolia</i> | C |
| <i>Argemone mexicana</i> | S | <i>Cassia fistula</i> | PS |
| <i>Aristolochia India</i> | T | <i>Cassia mimosoides</i> | S |
| <i>Artabotrys odoratissimus</i> | C | <i>Cassia occidentalis</i> | S* |
| <i>Artemisia vulgaris</i> | S | <i>Cassia tora</i> | S* |
| <i>Asparagus adscendens</i> | T | <i>Casuarina equisetifolia</i> | C |
| <i>Asparagus officinalis</i> | T | <i>Catharanthus roseus</i> | C |
| <i>Asparagus racemosus</i> | T | <i>Cayratia trifolia</i> | S |
| <i>Atalantia missionis</i> | S | <i>Ceiba pentandra</i> | C |
| <i>Atylosia scarabaeoides</i> | S | <i>Celastrus paniculatus</i> | S |
| <i>Averrhoa carambola</i> | C | <i>Celosia agrotea</i> | S |
| <i>Azadirachta indica</i> | C/PS | <i>Centella asiatica</i> | S |
| <i>Azanza lampas</i> | S | <i>Centratherum anthelminticum</i> | S |
| <i>Bacopa monnieri</i> | S | <i>Cereus pterogonus</i> | S |
| <i>Barleria cristata</i> | S | <i>Ceriscoides turgida</i> | S |
| <i>Barleria lupulina</i> | S | <i>Cheilanthes tenuifolia</i> | T |
| <i>Barleria prionitis</i> | | <i>Cinnamomum camphora</i> | C |
| <i>Barleria strigosa</i> | S | <i>Cinnamomum tamala</i> | C |
| <i>Bauhinia acuminata</i> | PS | <i>Cinnamomum Zeylanicum</i> | C |
| <i>Bauhinia racemosa</i> | PS | <i>Cissus adnata</i> | S |
| <i>Bauhinia vahlii</i> | PS | <i>Cissus quadrangularis</i> | S |
| <i>Belamcanda chinensis</i> | S | <i>Citrullus colocynthis</i> | C |

contd...

Table 12.2 – contd...

| Scientific Name | Status | Scientific Name | Status |
|---------------------------------|--------|---------------------------------|--------|
| <i>Cleistanthus collinus</i> | S | <i>Desmodium gangeticum</i> | S |
| <i>Cleome icosandra</i> | S | <i>Desmodium motorium</i> | S |
| <i>Clerodendrum indicum</i> | S | <i>Desmostachya bipinnata</i> | PS |
| <i>Clerodendrum phlomoides</i> | S | <i>Dicliptera bupleuroides</i> | S |
| <i>Clerodendrum serratum</i> | S | <i>Dillenia indica</i> | C |
| <i>Clerodendrum viscosum</i> | S* | <i>Dillenia pentagyna</i> | PS |
| <i>Clitoria ternatea</i> | C | <i>Dioscorea alata</i> | T |
| <i>Coccinia grandis</i> | C | <i>Dioscorea bulbifera</i> | T |
| <i>Coccinia indica</i> | C | <i>Dioscorea esculenta</i> | |
| <i>Cochlospermum religiosum</i> | PS | <i>Var. spinosa</i> | T |
| <i>Coleus amboinicus</i> | C | <i>Dioscorea pentaphylla</i> | T |
| <i>Colocasia esculenta</i> | C | <i>Dioscorea triphylla</i> | T |
| <i>Colocasia nymphaeifolia</i> | C | <i>Diospyros melanoxylon</i> | S |
| <i>Commelina benghalensis</i> | S | <i>Ecbolium viride</i> | C |
| <i>Commiphora mukul</i> | T | <i>Eclipta prostrata</i> | S |
| <i>Costus speciosus</i> | T | <i>Ehretia laevis</i> | S |
| <i>Cotula anthemoides</i> | S | <i>Elaeocarpus ganitrus</i> | C |
| <i>Crataeva nurvala</i> | S | <i>Elephantopus scaber</i> | S |
| <i>Crinum asiaticum</i> | C | <i>Elettaria cardamomum</i> | C |
| <i>Crotalaria burhia</i> | C | <i>Emblica officinalis</i> | C/PS |
| <i>Crotalaria pallida</i> | C | <i>Enydra fluctuans</i> | PS |
| <i>Crotalaria prostrata</i> | S | <i>Erythrina variegata var.</i> | |
| <i>Crotalaria retusa</i> | S | <i>Orientalis</i> | PS |
| <i>Cryptolepis buchanani</i> | S | <i>Eulophia nitida</i> | S |
| <i>Curculigo orchiodes</i> | T | <i>Eupatorium triplinerve</i> | S |
| <i>Curcuma amada</i> | C | <i>Euphorbia antiquorum</i> | S |
| <i>Curcuma aromatica</i> | C | <i>Euphorbia hirta</i> | S |
| <i>Curcuma caesia</i> | C | <i>Euphorbia nerifolia</i> | S |
| <i>Curcuma longa</i> | C | <i>Euphorbia thymifolia</i> | S |
| <i>Curuma zedoaria</i> | T | <i>Euphorbia thymifolia</i> | S |
| <i>Cymbopogon citrates</i> | C | <i>Euphorbia tirucalli</i> | S |
| <i>Cymbopogon martini</i> | C | <i>Euphorbia longam</i> | S |
| <i>Cyperus kyllinga</i> | PS | <i>Ficus glomerata</i> | S/PS |
| <i>Cyperus rotundus</i> | PS | <i>Flacourtia indica</i> | S/PS |
| <i>Cyperus triceps</i> | PS | <i>Flacourtia jangomas</i> | S/PS |
| <i>Dalbergia sissoo</i> | PS | <i>Flemingia chappar</i> | S |
| <i>Dalbergia volubilis</i> | S | <i>Flemingia strobilifera</i> | S |
| <i>Datura innoxia</i> | S | <i>Garcinia xanthocymus</i> | S |
| <i>Datura metel</i> | S | <i>Gardenia gummifera</i> | S |
| <i>Datura stramonium</i> | S | <i>Gardenia latifolia</i> | S |

contd...

Table 12.2 – contd...

| Scientific Name | Status | Scientific Name | Status |
|---------------------------------|--------|--------------------------------|--------|
| <i>Gardenia resinifera</i> | S | <i>Leucas plukenetii</i> | S |
| <i>Gendarussa vulgaris</i> | S | <i>Limnophila indica</i> | S |
| <i>Gloriosa superba</i> | T | <i>Limonia acidissima</i> | S |
| <i>Gossypium herbaceum</i> | S | <i>Lippia javanica</i> | S |
| <i>Grangea maderaspatana</i> | S | <i>Litsea glutinosa</i> | S |
| <i>Grewia helicterifolia</i> | S | <i>Ludwigia octovalvis</i> | PS |
| <i>Grewia subinaequalis</i> | S | <i>Lygodium pinnatifidum</i> | S |
| <i>Gymenema sylvestre</i> | T | <i>Mangifera indica</i> | PS |
| <i>Gynandropsis gynandra</i> | S | <i>Maranta arundinacea</i> | S |
| <i>Habenaria commelinifolia</i> | T | <i>Marsilea minuta</i> | S |
| <i>Hedyotis corymbosa</i> | S | <i>Martynia annua</i> | S |
| <i>Helicteres isora</i> | S | <i>Melastoma malabathricum</i> | S |
| <i>Heliotropium indicum</i> | S | <i>Mellilotus alba</i> | S |
| <i>Hemidesmus indicus</i> | S | <i>Mentha piperita</i> | C |
| <i>Hibiscus vitifolius</i> | S | <i>Mentha spicata</i> | C |
| <i>Holarrhena pubescens</i> | PS | <i>Mesua ferrea</i> | S |
| <i>Hybanthus enneaspermus</i> | S | <i>Meyna laxiflora</i> | S |
| <i>Hygrophila schulli</i> | S | <i>Michelia champaca</i> | S |
| <i>Hyptis suaveolens</i> | PS | <i>Mimosa pudica</i> | S |
| <i>Ichnocarpus frutescens</i> | S | <i>Mimosa rubicaulis</i> | S |
| <i>Indigofera tinctoria</i> | S | <i>Mimusops elengi</i> | C/S |
| <i>Ipomea sp</i> | S | <i>Mimusops hexandra</i> | S |
| <i>Ipomoea aquatica</i> | PS | <i>Mollugo spergula</i> | S |
| <i>Ipomoea paniculata</i> | S | <i>Momordica dioica</i> | C |
| <i>Ipomoea pes-tigridis</i> | S | <i>Morinda citrifolia</i> | PS |
| <i>Ipomoea quamoclit</i> | S | <i>Morus alba</i> | C |
| <i>Jatropha gossy ifolia</i> | PS | <i>Mucuna pruriens</i> | S |
| <i>Justicia adhatoda</i> | PS | <i>Murraya koenigii</i> | PS |
| <i>Kaempferia galanga</i> | S | <i>Murraya paniculata</i> | PS |
| <i>Kalanchoe pinnata</i> | S | <i>Myristica fragrans</i> | S |
| <i>Kirganelia reticulata</i> | S | <i>Nelumbo nucifera</i> | T |
| <i>Lannea coromandelica</i> | S | <i>Nerium odorum</i> | S |
| <i>Lantana camara</i> | PS | <i>Nyctanthes arbortristis</i> | S |
| <i>Lawsonia inermis</i> | S | <i>Nymphaea alba</i> | T |
| <i>Leea asiatica</i> | S | <i>Nymphaea nouchali</i> | T |
| <i>Leea macrophylla</i> | S | <i>Nymphaea stellata</i> | T |
| <i>Leonotis nepetaefolia</i> | S | <i>Ocimum basilicum</i> | C |
| <i>Leonurus sibiricus</i> | S | <i>Ocimum canum</i> | S |
| <i>Leucas cephalotes</i> | S | <i>Ocimum gratissimum</i> | S |

contd...

Table 12.2 – contd...

| Scientific Name | Status | Scientific Name | Status |
|-----------------------------------|--------|------------------------------------|--------|
| <i>Ocimum kilimandscharicum</i> | C | <i>Rauvolfia serpentina</i> | C |
| <i>Ocimum sanctum</i> | C | <i>Rauvolfia tetraphylla</i> | C/D |
| <i>Ocimum tenuiflorum</i> | S | <i>Rhomboidea</i> | |
| <i>Opuntia dillenii</i> | S | <i>Ricinus communis</i> | S |
| <i>Oroxylum indicum</i> | S | <i>Rivea hypocrateriformis</i> | S |
| <i>Oxalis corniculata</i> | S | <i>Rungia pectinata</i> | S |
| <i>Paederia scandens</i> | S | <i>Sansevieria cylindrical</i> | C |
| <i>Pandanus amaryllifolius</i> | S | <i>Sansevieria roxburghiana</i> | C |
| <i>Pandanus fascicularis</i> | S | <i>Santalum album</i> | C/T |
| <i>Passiflora suberosa</i> | S | <i>Sapindus laurifolius</i> | S |
| <i>Pedaliium murex</i> | S | <i>Saraca asoca</i> | C |
| <i>Pentapetes phoenicea</i> | S | <i>Schleichera oleosa</i> | S |
| <i>Pergularia daemia</i> | S | <i>Scindapsus officinalis</i> | C |
| <i>Phlogacanthus thyrsoformis</i> | S | <i>Scoparia dulcis</i> | S |
| <i>Phyllanthus fraternus</i> | S | <i>Selaginella rupestris</i> | S |
| <i>Phyllanthus acidus</i> | C | <i>Semecarpus anacardium</i> | S |
| <i>Phyllanthus urinaria</i> | S | <i>Sesbania grandiflora</i> | C |
| <i>Phyllanthus virgatus</i> | S | <i>Sesbania sesban</i> | C |
| <i>Physalis minima</i> | S | <i>Sida acuta</i> | S |
| <i>Pimenta dioica</i> | S | <i>Sida cordifolia</i> | S |
| <i>Piper longum</i> | C | <i>Sida humillilis</i> | S |
| <i>Piper nigrum</i> | C | <i>Sida rhombifolia</i> Linn. Var. | S |
| <i>Piper retrofractum</i> | S | <i>Sida rhombifolia</i> | S |
| <i>Plesmonium margaritifera</i> | S | <i>Smilax ovalifolia</i> | S |
| <i>Plumbago indica</i> | S | <i>Solanum indicum</i> | S |
| <i>Plumbago zeylanica</i> | S | <i>Solanum nigrum</i> | S |
| <i>Plumeria acuminata</i> | C | <i>Solanum sisymbriifolium</i> | S |
| <i>Polygala crotalarioides</i> | S | <i>Solanum surattense</i> | S |
| <i>Portulaca oleracea</i> | S | <i>Solanum torvum</i> | S |
| <i>Premna herbacea</i> | S | <i>Solena amplexicaulis</i> | S |
| <i>Premna latifolia</i> | S | <i>Sonchus oleraceus</i> | S |
| <i>Pterocarpus marsupium</i> | C | <i>Sphaeranthus indicus</i> | S |
| <i>Pterocarpus santalinus</i> | C | <i>Stachytropha jamaicensis</i> | S |
| <i>Pterospermum acerifolium</i> | C | <i>Stephania japonica</i> | S |
| <i>Pueraria tuberosa</i> | S | <i>Stereospermum suaveolens</i> | S |
| <i>Punica granatum</i> | C | <i>Streblus asper</i> | S |
| <i>Putranjiva roxburghii</i> | C | <i>Strychnos nux-vomica</i> | T |
| <i>Quisqualis indica</i> | PS | <i>Sunedrella nodiflora</i> | S |
| <i>Randia spinosa</i> | C | <i>Symplocos sp</i> | S |

contd...

Table 12.2 – contd...

| Scientific Name | Status | Scientific Name | Status |
|-----------------------------------|--------|------------------------------|--------|
| <i>Syzygium operculatum</i> | S | <i>Uraria lagopodioides</i> | S |
| <i>Syzygium aromaticum</i> | S | <i>Uraria picta</i> | S |
| <i>Tamarindus indica</i> | C | <i>Urena lobata</i> | S |
| <i>Tectona grandis</i> | C | <i>Urena sinuta</i> | |
| <i>Tephrosia purpurea</i> | S | <i>Vallis solanacea</i> | S |
| <i>Teramnus labialis</i> | S | <i>Ventilago denticulate</i> | S |
| <i>Terminalia arjuna</i> | C | <i>Vernonia cinerea</i> | S |
| <i>Terminalia bellirica</i> | C | <i>Vetiveria zizanioides</i> | S |
| <i>Terminalia chebula</i> | C | <i>Vigna trilobata</i> | S |
| <i>Thevetia peruviana</i> | S | <i>Vitex negundo</i> | PS |
| <i>Tinospora cordifolia</i> | T | <i>Wedelia chinensis</i> | S |
| <i>Tinospora sinensis</i> | S | <i>Withania somnifera</i> | C/D |
| <i>Tragia involucrate</i> | S | <i>Woodfordia furticosa</i> | S |
| <i>Trianthema portulacastrum</i> | S | <i>Xanthium strumarium</i> | S |
| <i>Tribulus terrestris</i> | T | <i>Yucca gloriosa</i> | C |
| <i>Trichosanthes tricuspidata</i> | S | <i>Zingiber cassumunar</i> | S |
| <i>Tridax procumbens</i> | S | <i>Zingiber officinale</i> | C |
| <i>Triumfetta rhomboidea</i> | S | <i>Zingiber zerumbet</i> | S |
| <i>Tylophora indica</i> | S | <i>Zizyphus nummularia</i> | S |
| <i>Typhonium trilobatum</i> | S | <i>Zizyphus oenoplia</i> | S |

(Source: Modified from the publication of Govt. of West Bengal, Deptt. of Forests, Research Wing and other sources)

The work records 375 species in South Bengal; also covers laterite areas of Orissa and Jharkhand.

Legends : P = Planted; C = Cultivated; W = Wild; S = Sporadic; PS = Presently sage; D = Depleted; T = Threatened

N.B. of 375 species listed 55 sp. are cultivated, 58 species are planted and the rest 262 species are wild.

Comment

A list of 375 species have been prepared of which approximately 262 species one sporadic. Only a few among the sporadic species occur in large patches. As such about 78% of the species face arduous biotic and abiotic pressure.

Chapter Thirteen

Potential Medicinal Plants of North-East India

The primary vegetation over bulk areas have been disturbed and modified and in some places destroyed by seismic activities, frequent landslides and resultant erosion. The activity of Man has led to the irreversible transformation in the landscapes and has resulted in colossal loss of biodiversity. Human influences have pushed many species to the brink of extinction and have caused havoc to natural fragile ecosystem. There has been decrease of forest cover of about 1800 sq. km. between 1991 and 1999 (F.S.I. 2000). Quality of forests has deteriorated to scrub.

North East India—a bowl of plant diversity has been identified as Hot Spots and Mega-diversity area due to its unique ecological setting and the center of meeting point of temperate and tropical flora. palaeo-arctic flora of Tibetan high land and wet-evergreen and rain forests flora of South East Asia and Yunan.

A perusal of the book entitled “Biodiversity Characterization” at Landscape Level in North-East India using “Satellite Remote Sensing and Geographic Information System” by Indian Institute of Remote Sensing, Deptt. of Space, Govt. of India 2002, may reveal that-

- Most of the States have extensive area under Shifting cultivation with short cycle.
- Heavily eroded area all over.
- Deforestation going on our large areas.
- Increase of human population and demand for space and forest produce.
- Cultivation made on steep slope.

- Going poorer in biodiversity.
- Heavy mining operation.

(Source: Wildlife Institute of India, 2003)

The aforesaid publication of Indian Institute of Remote Sensing has recorded some information on the medicinal plants of India.

Although all the States have their record of medicinal plants the figure of R.S. Institute being the latest has been summarized as follows:

Arunachal Pradesh

About 419 species have been recorded to have medicinal use, some of which are, *Abies webbiana*, *Aconitum ferox*, *Alstonia scholaris*, *Aristolochia platanifolia*, *Artemisia vulgaris*, *Coptis teeta*, *Pongamia pinnata*, *Terminalia bellirical*. The author has discussed the status of some of the plants in later in this Chapter.

Assam

228 species have been listed of which importance of *Alstonia scholaris*, *Zanthoxylum nitidum*, *Andrographis paniculata*, *Oroxylum indicum*, *Clerodendrum indicum*, *Jatropha curcas*, *Costus speciosus*, *Melastoma melabathricum* have been mentioned specifically.

Manipur

85 species have been mentioned of which special mention has been made of *Clerodendrum serratum*.

Meghalaya

74 species have been mentioned of which special mention has been made of *Clerodendrum serratum*.

Mizoram

83 species have been mentioned of which special mention has been made of *Alstonia scholaris* and *Lycopodium calvatum*.

Nagaland

86 species have been mentioned of which special mention has been made of *Alpinia galanga*.

Tripura

73 species have been mentioned of which special mention has been made of *Azadirachta indica* and *Moringa oleifera*.

Sikkim

70 species have been mentioned of which special has been made of *Gmelina arborea* and *Pieris ovalifolia*.

Besides, the foresters have listed medicinal plants occurring in various divisions in the respective working plans. The ethnobiologists have also listed plants used by the ethnic tribals of various states. Obviously the list would be a elaborate one to discuss on these plants. So a few important species have been selected for the present reward.

The status is represented by legend/abbreviations.

P.S. = Presently safe C = Cultivated

D = Depleted S = Sporadic

The legend sporadic (S) has to be properly evaluated. It means at the species occur here and there, sometimes in patches, but not abundantly. This legend also indicates that the species may be eaten at undesirable habits.

The legend 'Cultivated' C indicates that protection has given to the species considering the medicinal importance and rarely of the species.

In reality the herbs and shrubs in India find protection in inaccessible areas only and to some extent in the protected areas. At other places biotic factors play a derogatory role in their depletion. These depleted plants at last find shelter on the marginal lands, human habitation premises and sporadically here and there only to survive as they have been eradicated from the habitats where they once flourished.

Observation on potential drug plants of India, listed by Chopra, Kirtikar and Bose and others has been made by the present in their book entitled "Biodiversity Engangered" (2002).

Trees (Need protection- A few selected species)

Balsamodendron mukul

Bixa orillana

Camphora officinarum
Callophyllum inophyllum
Caryota urens
Ceiba pentandra
Juglans regia
Cupressus sempervirens
Betula utilis
Aquillaria malaccensis
Taxus baccata
Juniperus communis
Screbera switeniodes (Ghanta parul).

Medicinal Plant Trees Quantitative Studies

An extract from voluminous field survey (quantitative data *i.e.*, per ha..sp. number) on a few areas is reproduced. From the data any body can form a reliable figure on the status of a few tree species having medicinal values. Similarly, type studies, on statistical basis, have to be done on herbs, shrubs, climbers etc. to determine the status of medicinal plants of India and N.E. India.

Sikkim

Figures of South-Western Sikkim are only available.

Prime species are- *Symplocos theifolia* (Frequency occurrence is 90) and stems (per ha. are 69) has the maximum density; this species is of immense medicinal value.

13.1 : Scores Recorded by Remote Sensing Institute

| Botanical Name | Status | Botanical Name | Status |
|---------------------------------|--------|---------------------------------|--------|
| <i>Abies webbiana</i> | PS | <i>Bacopa monniera/monniera</i> | T |
| <i>Abroma augusta</i> | S | <i>Balanites aegyptiaca</i> | T |
| <i>Abrus precatorius</i> | T | <i>Baliospermum montanum</i> | T |
| <i>Abutilon indicum</i> | S | <i>Baliospermum oxillare</i> | T |
| <i>Acacia arabica</i> | PS | <i>Balsamo dendron mukui</i> | T |
| <i>Acacia catechu</i> | PS | <i>Bambusa arundinacea</i> | C/S* |
| <i>Acacia farnesiana</i> | PS | <i>Bambusa balcooa</i> | C |
| <i>Acacia leucophloea</i> | PS | <i>Bambusa bambos</i> | C |
| <i>Acacia suma</i> | PS | <i>Bambusa spinosa</i> | |
| <i>Achyranthes aspera</i> | PS | <i>Bambusa tulda</i> | C |
| <i>Aclypha indica</i> | S | <i>Bambusa vulgaris</i> | C |
| <i>Acorus calamus</i> | T | <i>Barleria cristata</i> | S |
| <i>Adenanthera pavonina</i> | S | <i>Barleria prionitis</i> | S |
| <i>Adhatoda vasica</i> | PS | <i>Barleria strigosa</i> | S |
| <i>Adiantum capillus</i> | T | <i>Barringtonia acutangula</i> | S |
| <i>Adiantum caudatum</i> | T | <i>Barringtonia racemosa</i> | S |
| <i>Adiantum lunulatum</i> | T | <i>Basella alba</i> | C/PS |
| <i>Adina cordifolia</i> | PS | <i>Basella rubra</i> | C/PS |
| <i>Aegle marmelos</i> | PS | <i>Bassia longifolia</i> | C/PS |
| <i>Aeschynomene aspera</i> | S | <i>Bauhinia purpurea</i> | C/PS |
| <i>Aeschynomene indica</i> | S | <i>Bauhinia racemosa</i> | PS |
| <i>Aganosma caryophyllata</i> | S | <i>Bauhinia variegata</i> | PS |
| <i>Aonitum ferox</i> | T | <i>Berberis aristata</i> | T |
| <i>Areca triandra</i> | S* | <i>Berberis asiatica</i> | T |
| <i>Argemone mexicana</i> | S | <i>Betula utilis</i> | S |
| <i>Argyrea speciosa</i> | S | <i>Bixa orellana</i> | C |
| <i>Aristolochia indica</i> | T | <i>Blepharis edulis</i> | S |
| <i>Artemisia maritima</i> | S | <i>Blumea lacera</i> | PS |
| <i>Artemisia vulgaris</i> | S | <i>Boerhaavia diffusa</i> | PS |
| <i>Artocarpus heterophyllus</i> | C | <i>Bombax eeiba</i> | PS |
| <i>Artocarpus lokoocha</i> | S | <i>Borax flabellifer</i> | PS |
| <i>Arum trilobatum</i> | S | <i>Boswellia serrata</i> | PS |
| <i>Arundo donax</i> | PS | Botanical Name | Status |
| <i>Asparagus racemosus</i> | T | Botanical Name | Status |
| <i>Asterocantha longifolia</i> | S | <i>Brassica campestris</i> | C |
| <i>Astragalus candolleanus</i> | S | <i>Brassica juncea</i> | C |
| <i>Astragalus leucocephalus</i> | S | <i>Brassica napus</i> | C |
| <i>Averrhoa carambola</i> | C | <i>Bryonia laciniosa</i> | T |
| <i>Azadirachta indica</i> | C | <i>Buchanania lanzan</i> | S |

contd...

Table 13.1 – *contd...*

| Botanical Name | Status | Botanical Name | Status |
|---------------------------------|--------|---------------------------------|--------|
| <i>Butea monosperma</i> | PS | <i>Celosia cristata</i> | C |
| <i>Cadrella toona</i> | PS | <i>Centella asiatica</i> | PS |
| <i>Caesalpinia bonducella</i> | S | <i>Cephalandra indica</i> | T |
| <i>Caesalpinia pulcherrima</i> | C | <i>Chenopodium album</i> | S |
| <i>Cajanus indicus</i> | C | <i>Chenopodium ambrosioides</i> | S |
| <i>Calamus vininalis</i> | S | <i>Cicer arietinum</i> | C |
| <i>Callicarpa macrophylla</i> | PS | <i>Cimicifuga foetida</i> | S |
| <i>Calophyllum inophyllum</i> | S | <i>Cinnamomum camphora</i> | C |
| <i>Calotropis gigantia</i> | PS | <i>Cinnamomum zeylanicum</i> | C |
| <i>Calotropis procera</i> | PS | <i>Cinnamomum tamala</i> | C/S |
| <i>Camellia drupifera</i> | S | <i>Cissus quadrangularis</i> | S |
| <i>Camellia japonica</i> | S | <i>Citrullus vulgaris</i> | C |
| <i>Camellia kissi</i> | S | <i>Citrus aurangifolia</i> | C |
| <i>Camellia sinensis</i> | C | <i>Citrus decumana</i> | C |
| <i>Camellia thea</i> | C | <i>Citrus limetoides</i> | C |
| <i>Camellia theifera</i> | C | <i>Citrus limon</i> | C |
| <i>Canabis sativa</i> | PS | <i>Citrus maxima</i> | C |
| <i>Canscora decussata</i> | S | <i>Citrus medica</i> | C |
| <i>Capparis decidua</i> | S | <i>Citrus reticulata</i> | C |
| <i>Capparis zeylanica</i> | S | <i>Citrus sinensis</i> | C |
| <i>Capsicum annum</i> | C | <i>Cleome pentaphylla</i> | S |
| <i>Capsicum frutescens</i> | C | <i>Clerodendrum indicum</i> | S/PS |
| <i>Cardispermum halicacabum</i> | S | <i>Clerodendrum serratum</i> | PS |
| <i>Careya arborea</i> | S | <i>Clerodendrum viscosum</i> | PS |
| <i>Carica papaya</i> | C | <i>Clitoria ternatea</i> | C |
| <i>Carissa caradas</i> | C | <i>Coccinia indica</i> | S |
| <i>Carthamus tinctorius</i> | C | <i>Cocculus hirsutus</i> | PS |
| <i>Carum carvi</i> | C | <i>Cochlospermum religiosum</i> | PS |
| <i>Carum copticum</i> | C | <i>Cocos nucifera</i> | C |
| <i>Cassi sophera</i> | S | <i>Coix aquatica</i> | PS |
| <i>Cassia alata</i> | S | <i>Coix gigantea</i> | PS |
| <i>Cassia fistula</i> | S | <i>Coix lachryma jobi</i> | PS |
| <i>Cassia occidentalis</i> | S | <i>Commelina benghalensis</i> | S |
| <i>Cassia tora</i> | S | <i>Commelina salicifolia</i> | S |
| <i>Catharanthus roseus</i> | C | <i>Convolvulus arvensis</i> | |
| <i>Cedrus deodara</i> | C | <i>Coptis teeta</i> | T |
| <i>Ceiba pentandra</i> | C | <i>Corchorus capsularis</i> | C |
| <i>Celastrus paniculatus</i> | S | <i>Cordia dichotoma</i> | S |
| <i>Celosia argentea</i> | C | <i>Coriandrum sativum</i> | C |

contd...

Table 13.1 – contd...

| Botanical Name | Status | Botanical Name | Status |
|----------------------------------|--------|---------------------------------|--------|
| <i>Costus speciosus</i> | T | <i>Echinochloa frumentacea</i> | PS |
| <i>Crocus sativus</i> | C | <i>Eclipta alba</i> | PS/S |
| <i>Crotalaria juncea</i> | C | <i>Elaeocarpus ganitrus</i> | T |
| <i>Croton tiglium</i> | S | <i>Elephantopus scaber</i> | S |
| <i>Cucumis melo</i> | C | <i>Elettaria cardamomum</i> | C |
| <i>Cucumis sativa</i> | C | <i>Embelia ribes</i> | S |
| <i>Cucumis utilisissimus</i> | C | <i>Emblica officinalis</i> | CPS |
| <i>Cuminum cyminum</i> | C | <i>Enhydra fluctuans</i> | PS |
| <i>Curculigo orchioides</i> | T | <i>Ephedra gerardiana</i> | T |
| <i>Curcuma amada</i> | S | <i>Ephedra vulgaris</i> | T |
| <i>Curcuma aromatica</i> | C | <i>Eriodendron anfractuosum</i> | C |
| <i>Curcuma domestica</i> | C | <i>Ervatamia coronaria</i> | C |
| <i>Curcuma longa</i> | C | <i>Erythrina variegata</i> | PS |
| <i>Curcuma zedoraria</i> | C | <i>Eupatorium ayapana</i> | S |
| <i>Cuscuta reflexa</i> | S | <i>Eupatorium triplinerve</i> | PS |
| <i>Cymbopogon jwarancusa</i> | S | <i>Euphorbia hirta</i> | PS |
| <i>Cymbopogon schoenanathus</i> | C | <i>Euphorbia neriifolia</i> | CPS |
| <i>Cynodon dactylon</i> | PS | <i>Euphorbia prostrata</i> | |
| <i>Cyperus rotundus</i> | PS | <i>Evolvulus alsinoides</i> | PS |
| <i>Dalbergia sissoo</i> | PS | <i>Evolvulus nummularius</i> | PS |
| <i>Damemia extensa</i> | S | <i>Feronia elephantum</i> | PS |
| <i>Datura metal</i> | PS | <i>Feronia limonia</i> | PS |
| <i>Daucus carata var. sativa</i> | C | <i>Ferula foetida</i> | C |
| <i>Delonix regia</i> | PS | <i>Ficus bengalensis</i> | PS |
| <i>Dendrocalamum hamiltonii</i> | PS | <i>Ficus carica</i> | PS |
| <i>Dendrocalamus falcata</i> | PS | <i>Ficus cunia</i> | PS |
| <i>Dendrocalamus strictus</i> | PS | <i>Ficus heterophylla</i> | PS |
| <i>Desmodium gangetcum</i> | S | <i>Ficus hispida</i> | PS |
| <i>Desmodium triflorum</i> | S | <i>Ficus infectoria</i> | S |
| <i>Desmostachya bipinnata</i> | PS | <i>Ficus racemosa</i> | S |
| <i>Dillenia indica</i> | PS | <i>Ficus religiosa</i> | PS |
| <i>Dioscorea bulbifera</i> | T | <i>Ficus rumkphii</i> | S |
| <i>Dioscorea Jacquemontii</i> | T | <i>Flacourtia cataphracta</i> | S |
| <i>Dioscorea pentaphylla</i> | T | <i>Flacourtia indica</i> | S |
| <i>Dioscorea triphylla</i> | T | <i>Flacourtia jangomas</i> | S |
| <i>Diospyros peregrina</i> | T | <i>Fleurya interrupta</i> | S |
| <i>Dolichos biflorus</i> | C | <i>Foeniculum vulgare</i> | C |
| <i>Dolichos lablab</i> | C | <i>Fritillaria cirrhosa</i> | T |
| <i>Drynaria quercifolia</i> | PS | <i>Fritillaria roylei</i> | T |

contd...

Table 13.1 – contd...

| Botanical Name | Status | Botanical Name | Status |
|-----------------------------------|--------|-------------------------------|--------|
| <i>Fumaria indica</i> | S | <i>Ipomoea batatas</i> | C |
| <i>Fumaria parviflora</i> | S | <i>Ipomoea quamoclit</i> | C |
| <i>Garcinia indica</i> | S | <i>Ipomoea reptans</i> | C |
| <i>Garcinia mangostana</i> | S | <i>Jasminum auriculatum</i> | C |
| <i>Garcinia morella</i> | S | <i>Jasminum gandiflorum</i> | C |
| <i>Garcinia pedunculata</i> | S | <i>Jasminum heyneana</i> | C |
| <i>Garcinia tintoria</i> | S | <i>Jasminum multiflora</i> | C |
| <i>Gardenia gummifera</i> | S | <i>Jasminum pubescens</i> | C |
| <i>Gardenia lucida</i> | T | <i>Jasminum sambac</i> | C |
| <i>Glycosmis pentaphylla</i> | PS | <i>Juglans regia</i> | T |
| <i>Gmelina arborea</i> | PS | <i>Juniperus communis</i> | T |
| <i>Gomphrena globosa</i> | PS | <i>Juniperus macropoda</i> | T |
| <i>Gossypium herbaceum</i> | PS | <i>Jussiaea repens</i> | PS |
| <i>Grangea maderaspatana</i> | S | <i>Justicia gendarussa</i> | C/PS |
| <i>Grewia asiatica</i> | PS | <i>Kalanchoe pinnata</i> | C |
| <i>Grewia tillaeifolia</i> | - | <i>Laccifer lacca</i> | C |
| <i>Gymnema sylvestre</i> | T | <i>Lagenaria vulgaris</i> | C |
| <i>Gynandropsis gynandra</i> | PS/S | <i>Lanea grandis</i> | PS |
| <i>Gynocardia odorata</i> | S | <i>Laportea crenulata</i> | PS |
| <i>Habenaria edgeworthii</i> | T | <i>Lathyrus sativus</i> | C |
| <i>Habenaria latilabria</i> | T | <i>Lawsonia inermis</i> | C |
| <i>Heacteres isora</i> | PS | <i>Leucas cephalotes</i> | S |
| <i>Heliotropium indicum</i> | S | <i>Lilium polyphyllum</i> | C |
| <i>Hemidesmus indicus</i> | D | <i>Lilium tigrinum</i> | C |
| <i>Hemigraphis hirta</i> | D | <i>Limnanthemum cristatum</i> | PS |
| <i>Hibiscus abelmoschus</i> | PS | <i>Linum usitatissimum</i> | C |
| <i>Hibiscus esculentus</i> | C | <i>Lippia nodiflora</i> | PS |
| <i>Hibiscus mutabilis</i> | C | <i>Lobelia inflata</i> | C |
| <i>Hiptage benghalensis</i> | C | <i>Loranthus falcatus</i> | S |
| <i>Hiptage madablata</i> | C | <i>Loranthus longiflorus</i> | S |
| <i>Holarrhena antidysenterica</i> | PS | <i>Luffa acutangula</i> | C |
| <i>Hordeum vulgare</i> | C | <i>Luffa amara</i> | C |
| <i>Hydnocarpus kurzii</i> | S | <i>Luffa echinata</i> | C |
| <i>Hydnocarpus wightiana</i> | S | <i>Madhuca indica</i> | C |
| <i>Hygroyza aristata</i> | PS | <i>Mallotus philippinesis</i> | PS |
| <i>Hyoscyamus niger</i> | T | <i>Mangifera indica</i> | C |
| <i>Ichnocarpus freutescens</i> | S | <i>Marsilea minuta</i> | PS |
| <i>Imperata cylindrical</i> | PS | <i>Marsilea quadrifolia</i> | PS |
| <i>Indigofera tinctoria</i> | S | <i>Melia azadirachta</i> | PS |

contd...

Table 13.1 – contd...

| Botanical Name | Status | Botanical Name | Status |
|---------------------------|--------|---------------------------------|--------|
| Melilotus indica | S | Nyctanthes arbortristis | C |
| Melothria heterophylla | S | Nymphaea nouchali | T |
| Mentha spicata | C | Nymphaea rubra | T |
| Merremia tridentata | S | Nymphaea sp. | T |
| Mesua ferrea | PS | Nymphaea stellata | T |
| Michelia champaca | PS | Ochrocarpus longifolius | S |
| Mimosa pudica | S | Ocimum basilicum | C |
| Mimusops elengi | C | Ocimum kikimandscharicum | C |
| Mimusops hexandra | | Ocimum sanctum | C |
| Mirabilis jalapa | C | Oldenlandia corymbosa | S |
| Mollugo hirta | S | Oroxylum indicum | S |
| Mollugo sperula | S | Oryza fatua | C |
| Momordica charantia | C | Oryza sativa | C |
| Momordica cochinchinensis | C | Ougeinia oojeinensis | S |
| Momordica muricata | C | Oxalis acetosella | S |
| Morinda citrifolia | S | Oxalis corniculata | S |
| Morinda tinctoria | S | Paederia foetida | T |
| Moringa oleigera | C | Pandanus odoratissimus | S |
| Morus alba | C | Pandanus tectorius | S |
| Morus atropurpurea | - | Panicum frumentacea | S |
| Morus indica | C | Paris polyphylla | |
| Morus laevigata | C | Paspalum scrobiculatum | PS |
| Mucuna prurita | | Pergularia extensa | S |
| Murraya koenigii | C | Peripoca aphylla | - |
| Murraya paniculata | S | Phalogacanthus thyriflorus | S |
| Musa paradisiaca | C | Phaseolus radiatus var. attrea | C |
| Musa sapientum | C | Phaseolus radiatus var. grandis | C |
| Myrica nagi | T | Phaseolus radiatus | C |
| Myristica fragrans | T | Phaseolus sublobatus | C |
| Myristica malabarica | S | Phoenix aculis | PS |
| Nardostachys jatamansi | T | Phoenix dactylifera | PS |
| Nauclea cordifolia | S | Phoenix patudosa | PS |
| Nelumbo nucifera | T | Phoenix sylvestris | PS |
| Nephelium longana | S | Phragmites karka | PS |
| Nerium indicum | C | Phyllanthus simplex | S |
| Nerium odorum | C | Phyllanthus niruri | S |
| Nicotiana plumbaginifolia | S | Physalis minima | S |
| Nicotiana tabacum | C | Pintacia integerrima | T |
| Nigella sativa | C | Pinus longifolia | C |

contd...

Table 13.1 – *contd...*

| Botanical Name | Status | Botanical Name | Status |
|-----------------------------------|--------|---------------------------------|--------|
| <i>Piper aurantiacum</i> | C | <i>Purnus cerasoides</i> | T |
| <i>Piper betle</i> | C | <i>Putranjiva roxburghii</i> | C |
| <i>Piper cubeba</i> | T | <i>Pyrus communis</i> | C |
| <i>Piper longum</i> | T | <i>Quamoclit pinnata</i> | C |
| <i>Piper nigrum</i> | T/C | <i>Quisqualis densiflora</i> | C |
| <i>Pisum sativum</i> | C | <i>Quisqualis indica</i> | C |
| <i>Plumbago zeylanica</i> | S | <i>Randia dumetorum</i> | S |
| <i>Plumeria acutifolia</i> | C | <i>Ranunculus sceleratus</i> | S |
| <i>Plumeria rubra</i> | C | <i>Raphanus sativus</i> | C |
| <i>Podophyllum hexandrum</i> | C/D | <i>Rauwolfia canescens</i> | |
| <i>Podophyllum emodi</i> | C/D | <i>Rauwolfia serpentina</i> | T |
| <i>Poinciana pulcherrima</i> | C | <i>Rauwolfia tetraphylla</i> | I |
| <i>Poinciana regia</i> | C | <i>Rheum emodi</i> | D |
| <i>Polyalthia suberosa</i> | S | <i>Rhododendron arboreum</i> | T |
| <i>Polyanthes tuberosa</i> | C | <i>Rhus succedanes</i> | S |
| <i>Polyasthia longifolia</i> | C | <i>Richinus communis</i> | C |
| <i>Polygonatum cirrhifolium</i> | C/D | <i>Rosa damascena</i> | C |
| <i>Polygonatum oppositifolium</i> | C/D | <i>Roscoea purpurea</i> | S |
| <i>Polygonatum verticillatum</i> | S | <i>Rubia cordifolia</i> | S |
| <i>Polygonum hydropiper</i> | S | <i>Saccharum benagense</i> | PS |
| <i>Polygonum orientale</i> | S | <i>Saccharum officinarum</i> | C |
| <i>Polypodium quercifolium</i> | S | <i>Saccolabium papillosum</i> | S |
| <i>Pongamia pinnata</i> | S | <i>Salvadora oleoides</i> | |
| <i>Portulaca oleracea</i> | S | <i>Salvadora persica</i> | |
| <i>Portulaca quadrifida</i> | S | <i>Sansevieria roxburghiana</i> | C |
| <i>Potamogeton indicus</i> | PS | <i>Santalum album</i> | C |
| <i>Premna integrifolia</i> | S | <i>Sapindus trifoliatus</i> | S |
| <i>Premna latifolia</i> | S | <i>Saraca indica</i> | C |
| <i>Prunus amygdalus</i> | T | <i>Sarcostemma acidum</i> | S |
| <i>Prunus communis</i> | C | <i>Saussurea appa</i> | T |
| <i>Prunus persica</i> | C | <i>Schleichera oleosa</i> | S |
| <i>Prunus puddum</i> | C | <i>Schleichera trijuga</i> | S |
| <i>Psoralea corylifolia</i> | C | <i>Scindapsus officinalis</i> | C |
| <i>Psoralea corylifolia</i> | S | <i>Semecarpus anacardium</i> | C |
| <i>Pterocarpus marsupium</i> | C | <i>Sesbania grandiflora</i> | C |
| <i>Pterocarpus santalinus</i> | C | <i>Sesbania sesbams</i> | C |
| <i>Pterospermum suberifolium</i> | S | <i>Setaria italica</i> | C |
| <i>Pueraria tuberosa</i> | S | <i>Shrebera swiettenioides</i> | S |
| <i>Punica grantum</i> | C | <i>Shorea robusta</i> | |

contd...

Table 13.1 – *contd...*

| Botanical Name | Status | Botanical Name | Status |
|----------------------------------|--------|----------------------------------|--------|
| <i>Sida cordifolia</i> | S | <i>Tamarix dioica</i> | S |
| <i>Sida rhomboidea</i> | S | <i>Tamarix gallica</i> | S |
| <i>Smilax glabra</i> | T | <i>Tamarix indica</i> | S |
| <i>Smilax indica</i> | | <i>Tamarix troupii</i> | S |
| <i>Solanum indicum</i> | S | <i>Taxus baccata</i> | T |
| <i>Solanum khasianum</i> | C | <i>Tectona grandis</i> | C |
| <i>Solanum melongena</i> | C | <i>Tephrosia purpurea</i> | S |
| <i>Solanum nigrum</i> | S | <i>Terminalia arjuna</i> | C |
| <i>Solanum torvum</i> | S | <i>Terminalia bellerica</i> | PS |
| <i>Solanum xanthocarpum</i> | S | <i>Terminalia chebula</i> | S |
| <i>Sorghum vulgare</i> | C | <i>Terminalia citrina</i> | S |
| <i>Soymida febrifuga</i> | | <i>Thalictrum foiosolum</i> | T |
| <i>Sphaeranthus indicus</i> | S | <i>Thespesia populnea</i> | S |
| <i>Spinacia oleracea</i> | C | <i>Thevetia nerifolia</i> | C |
| <i>Spondias dulcis</i> | S | <i>Thevetia peruviana</i> | C |
| <i>Spondias mangifera</i> | S | <i>Tinospora cordifolia</i> | T |
| <i>Stephania glabra</i> | S | <i>Tinospora malabarica</i> | T |
| <i>Stephania hernandifolia</i> | S | <i>Tinospora tomenstosa</i> | T |
| <i>Stereospermum suaveolens</i> | PS | <i>Trachyspermum ammi</i> | T |
| <i>Stereospermum tetragonum</i> | PS | <i>Tragia involucrata</i> | S |
| <i>Streblus asper</i> | S | <i>Trapa bispinosa</i> | PS |
| <i>Strychnos nuxcomica</i> | S | <i>Trewia nudiflora</i> | S |
| <i>Strychnos potatorum</i> | | <i>Trianthema monogyna</i> | S |
| <i>Swertia chirata</i> | T | <i>Trianthema portulacastrum</i> | S |
| <i>Sylvinia cucullata</i> | S | <i>Tribulus terrestris</i> | T |
| <i>Symplocos laurina</i> | T | <i>Trichosanthes anguina</i> | C |
| <i>Symplocos racemosa</i> | T | <i>Trichosanthes bracteata</i> | C |
| <i>Syzygium aromaticum</i> | | <i>Trichosanthes dioica</i> | C |
| <i>Syzygium cumini</i> | S | <i>Trichosanthes palmate</i> | C |
| <i>Syzygium fruticosa</i> | S | <i>Trigonella corniculata</i> | C |
| <i>Syzygium operculatum</i> | S | <i>Trigonella foenum-graecum</i> | C |
| <i>Tabernaemontana coronaria</i> | C | <i>Triticum aestivum</i> | C |
| <i>Tacca aspera</i> | S | <i>Tylophora asthmatica</i> | T |
| <i>Tacca integrifolia</i> | S | <i>Tylophora indica</i> | S |
| <i>Tamarindus indica</i> | C | <i>Typha elephantina</i> | PS |
| <i>Tamarix aphylla</i> | S | <i>Typha latifolia</i> | PS |
| <i>Tamarix articulata</i> | S | <i>Typhonium trilobatum</i> | S |

Chapter Fourteen

Research and Cultivation

The chapter gives list of more than 50 Institutions engaged in Research and Cultivation of medicinal plants in India.

Not a single publication of the institution or cultivation authorities has made any assessment on the status of medicinal plants in India pertaining to density, frequency and regeneration status of various species.

It is suggested that these organizations set up research units for field survey of herb, shrub, climbers and grasses on statistical background. Research in this field is still very inadequate.

Table 14.1 : List of Some Institutions/Organisations Engaged in Research/Cultivation of Medicinal Plants

| Sl. No. | Name of Institution | Agro-technique available |
|---------|---|---|
| 1. | Department of Agricultural Botany and Crop Physiology, Jawaharlal Nehru Krishi Vishwa Vidyalyaya, JABALPUR-482 004 (MP) | – |
| 2. | Regional Research Laboratory, BHUBANEWSWAR-751 013 (Orissa) | – |
| 3. | Centre for Advanced Study in Botany, University of Madras, CHENNAI-600 025 | Gymnema sylvestre (madhunashni) Andrographis Peniculata (Kalmegh) |
| 4. | Kerala Agricultural University, Aromatic & Medicinal Plants Research Station, Asamannoor P.O. Odakkali, KERALA-683 549 | Saraca asoca (Ashok) |
| 5. | National Botanical Research Institute Rana Pratap Marg, LUCKNOW-226 001 | |

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Table 14.1 – contd...

| Sl. No. | Name of Institution | Agro-technique available |
|---------|---|---|
| 6. | Division of Floriculture, Medicinal & Agricultural Science and Technology, Shalimar, SRINAGAR- 191 121 | <i>Inula racemosa</i> (Pushkarmool), <i>Swertia chirata</i> (Chirayata) |
| 7. | Nagarjun Medicinal Plants Garden, Dr. Punjabrao Deshmukh Krishi Vidyapeeth, P.O. Krishinagar, AKOLA-4 (Maharashtra). | <i>Embelia ribes</i> (Vidanga) |
| 8. | Tropical Botanical Garden and Research Institute (TBGRI), Karimancode, P.O. Palode,, Thiruvanthapuram- 695 562 (KERALA) | |
| 9. | Deptt. Horticulture & Project, Narender Dev University of Agriculture & Technology, Narander Nagar, P.O. Kumarganj, FAIZABAD-224 229 | |
| 10. | Central Institute of Medicinal and Aromatic Plants (CIMAP) P.O. CIMAP, LUCKNOW-226 015 | |
| 11. | Division of Plant Science & Ecology Regional Research Laboratory JORHAT-785 006 (Assam) | <i>Chlorophytum</i> <i>arundinaceum</i> (Musali Safaid) |
| 12. | Head, Department of Agro-forest and Environment, H.P. Krishi Viswa Vidyalyaya, PALAMPUR-176 062 (H.P.) | |
| 13. | Department of Natural Products, Education & Research, Sector-67, S.A.S. Nagar, MOHALI-160 062 (Punjab) | <i>Bacopa mannieri</i> (Brahmi), <i>Asparagus</i> <i>adscendens</i> |
| 14. | Jamia Hamdard, Hamdard Nagar, NEW DELHI-110 062 | <i>Tinospora cordifolia</i> (Guduchi) |
| 15. | High Altitude Plant Physiology Research Centre, H.N. B. Garhwal University, Post Box -14, Srinagar, GARHWAL-246 174 | <i>Picrorrhiza kurroa</i> , <i>Aconitum</i> <i>heterophyllum</i> (Atees) <i>Nardostachys</i> <i>Jatamansi</i> (Jatamansi) |
| 16. | Herbal Garden, Herbarium & Research Institute in ISM, Manali-Pathankot Highway, Government of H.P., JOGINDER NAGAR District Mandi- 176 061 (HP) | <i>Bacopa monnieri</i> (Brahmi) |
| 17. | NWFP, Division Tropical Forest Research Institute, P.O. RFRC, Mandla Road, JABALPUR-482 021 (MP) | |

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Table 14.1 – contd...

| Sl. No. | Name of Institution | Agro-technique available |
|---------|--|---|
| 18. | Deptt. of Botany, J.N. Vyas University, JODHPUR- 342 001 | Commiphora wightii (Guggal) |
| 19. | Director, State Forest Research Institute, Polopathar, JABALPUR- 482 008 (MP) | |
| 20. | Horticulture (M& AP), University of Agricultural Sciences, G.K.V.K., Campus, BANGALORE-560 065 | |
| 21. | Head, NWFP, forest Research Institute (ICFRE), P.O. New Forest, DEHRADUN-248 006 (Uttaranchal) | |
| 22. | Insttl of Himalayan Bioresource Technology, Palampur Post Box No. 6, HIMACHAL PRADESH-176 062 | |
| 23. | NBPGR, Pusa Campus, New Delhi-110 012 | Asparagus racemosus (Satavari) |
| 24. | NBPGR, Regional Station, Distt. Nainital BHOWALI-263 132 (UP) | |
| 25. | NBPGR Regional Station, Phagli, SHIMLA- 171 004 | Aconitum palmatum (Partivisha), Aconitum ferox (Vatsnab) |
| 26. | Regional Research Laboratory (Jorhat) Branch, Ita Nagar, P.O. Naharlagun NAHARLAGUN-791 110 (Arunachal Pradesh) | |
| 27. | Director, Indian Inst. Of Horticultural Research, BANGALORE-560 089 | — |
| 28. | Department of Agronomy, College of Agriculture, G.B. Pant University of Agriculture & Technology, PANT NAGAR-263 145 (UP). | |
| 29. | Director, Regional research Laboratory (CSIR), Canal Road, JAMMU-TAWI-180 001 (J&K) | |
| 30. | Mahatma Phule Krishi Vidyapeeth, Rahuri, Distt. Ahmednagar, MAHARASHTRA | |
| 31. | NBPGR, Regional Station New Kench's Trace, Shillong, SHILLONG-793 013. (Meghalaya). | |

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Table 14.1 – contd...

| Sl. No. | Name of Institution | Agro-technique available |
|---------|--|--|
| 32. | Deptt. of Horticulture, S.K.N. College of Agriculture, Rajasthan Agriculture University, JOBNER- 303 329 (Rajasthan). | |
| 33. | Pt. Jawaharlal Nehru College of Agriculture & Research Institute KARAIKAL-609 603 (Pondicherry) | |
| 34. | J.L. Nehru Ayurvedic Medicinal Plants Garden, Kothrud, PUNE (Maharashtra) | Asparagus racemosus (Shatavari) |
| 35. | Uttan, Centre for Sustainable Development & Poverty Alleviation 18-A, Auckland Road, Civil Lane ALLAHABAD | Phyllanthus amarus (Bhumi amlaki), Asparagus racemosus (Shatavari), Bacopa Monnieri (Brahmi), Withania Somnifera (Ashwagandha) |
| 36. | Survey of Medicinal Plants Unit Regional Research Institute of Unani Medicine, Post Box 70, Aligarh-202 001. | |
| 37. | Guggal herbal form Mangliawas CCRAS, Ajmer (Rajasthan). | |
| 38. | Department of Botany, J.N. Vyas University, Jodhpur- 342 001 Rajasthan. | |
| 39. | Department of Plants Breeding, Vhaudhary Charan Singh Agriculture University Haryana, Hissar- 125 004. | |
| 40. | CEDMAP, 60, Jail Road, Jahangirabad, Bhopal (Madhya Pradesh). | |

(Source : National Medical Plants Board. Ministry of Health & Family Welfare, Government of India).

Research and Development Centres:

Following are R & D centers in India:

1. Council of Scientific and Industrial Research:
 - R.R.L. at Jorhat.
 - R. R. L. at Bhubaneswar.
2. Central Institute of medicine and Aromatic plants at Lucknow.

- I.C.A.R. Research:
- National Bureau of Plant Genetic Research.
- Indian Horticultural Research Institute.
- Cental Arid Zone Research Institute, Jodhpur.
- Central plantation Crop Research Institute, Kasaragod.

3. Universities:

- G.B. Plant University of Agriculture and Technology.
- Punjab Agricultural University, Ludhiana.
- Tamilnadu Agricultural University, Coimbatore.
- Kerala Agricultural University, Oddakali.
- Gujarat Agricultural University, Anand.

4. Others:

- Indian Council Of Forestry Research and Education, Dehradun.
- Cinchona Departmet

Medicinal plant directorates of West Bengal and Tamilnadu carry out research. to a limited edient or several servies.

The research should pinpoint the following points :

- Which part or parts are used: Is froot or root bark leaf, lower, fruit or any other part.
- Which time of the year such parts are to be collected to get best efficacy.

Cultivation

Details of cultivation have not been brought under the discussion. Only some important aspects have been discussed. Some aspects are-

- National Medical Board gives priority in cultivation of the following speices :

Emblica officinalis, Saraca asoca, Withania somnifera, Aconitium heterophyllum, Aegle marmelos, Phyllanthus amarus, Bacopa morneri, Santalum album, Swertia chirata, Tinospora cordifolia, Gymnema sylvestre, Commifera wightii, Plantago ovata, Nardostachys jatamansi, Glorosa superba, Andrographis paniculata, Garcinia indica, Saussurea costus,

Picrorrhiza kurroa, *Glycyrrhiza glabra*, *Solanum nigrum*, *Chlorophytum boviisillianum*, *Cotus barbatus*, *Piper longifera*, *Belenis artolata*, *Crocus sativus*, *Rauwolfia serpentina*.

- **Cultivation of Aromatic Plants:**

Pandanus fasciculatus, *Aquilaria malaccensis*, *Cardamum*, *Clove*, *Eucalyptus*, *Fennel*, *Cinnamomum*, *Coriandrum*, *Jasmine*, *Rose*, *Pepper*, *Vetiver*, *Nutmeg*, *Citronella*, *Belladonna*, *Anonilium*, *Acuminata*, *Gloriosa superba*, *Rauwolfia serpentina*, *Cephalis*, *Amnimajus*, *Pyrethrum*, *Chrysanthemum*, *Cinerariae olium*, *Cinchona officinalis*, *C. micrantha*, *C. robusta*, *C. ledgerira*, *Aloe vera*, *Dioscorea floribunda*, *D. composita*, *Solanum khasianum*, *Costus speciosus*, *Datura innoxia*, *Datura metel*, *Datura stramonium*, *Solanum khasianum*, *Cassia absus*, *Cassia fistula*, *Celastrus zeylanicus*, *Cissus quadrangularis*, *Coptis teeta*, *Cordia myxa*, *Croton obongiflorus*, *Curculigo orchioides*, *Cyperus rotundus*, *Digitalis purpurea*, *Elettaria cardamum*, *Tribullus terrestris*, *Taxus baccara*, *Solanum surattensis*.

- **Medicinal Plants Cultivated in Nilgiri (T. Sekar Ind. For 2004 January) :**

Plants Cultivated at Dodabela

Resemarinus officinalis-labiatae - Skui, Uses eczema, dandruff, bronchitis, rheumatism.

Thymus vulgaris

| | | |
|------------------------------|-------------|--------------|
| <i>Pelagonium graveolens</i> | Geraniaceae | Perfume |
| <i>Oreganum vulgare</i> | Lamiaceae | Food flavour |
| <i>Petroselinum crispum</i> | Umbellifera | Sedative |
| <i>Salvia officinalis</i> | Lamiaceae | Tonsillitis |
| <i>Tanacetum parthenum</i> | Asteraceae | Migrane |

- **Cultivation of other Species all over the Country.**

Piper longum, *Cardamon*, *Clove*, *Nutmeg*, *Cinnamom*, *Ginger*, *Termuric*, *Mentha arvensis*, *Mentha piperata*, *Cymbopogon*, *C. martini*, *Vetiveria zizamioides*, *Eucalyptus cotriodora*, *Santalum album*, *Oseimum gratissimum*, *Jasminum sp.*, *Geraneum sp.*, *Saussurea sp.*, *Cyperus rotundus*, *Skimmia laurala*, *Artopha belladonna*, *A. acuminata*, *Cloriosa superba*, *Colchicum autumnate*, *Caltha ranthus*, *Rauwolfia serpentina*, *Cephaelis ipececauhna*, *Ammi majus*, *Pyrethrum*,

Crysanthmum cenariaefolium, *Cinchona officinalis*, *C. muramilka*, *C. robusta*, *C. calisya*, *C. ledgerina*, *Digitalis sp.*, *Carthmus sp.*, *Datura metal*, *Solanum bhasianum*, *Costas speciosus*, *Dioscorea prazeri*, *D. deltoidea*.

- **Eastern Himalayan sp. which have immense prospects for large scale cultivation (R.C. Sundruyal, Ind. For. Jan, 2005)**

Aconitum ferox, *A. hetrophyllum*, *Acorus catamus*, *Amonum subulatum*, *Androgrophis culata*, *Aquilaria malaccensis*, *Cinnamomum zeylanicum*, *Coptis teeta*, *Dioscorea flroribunda*, *Gymnaderia orclidis*, *Illicicum griffithii*. *Oroxylum indicum*, *Panax pseudo ginseng*, *Picororhiza kurroa*, *Piper lomgum*, *Rubia cordifolia*, *Taxus baccata*, *Swertia cirata*, *Tinospora cordifolia*, *Whitharia somnifera*.

- The contribution of Dr. Wallich, Dr. Wight, Dr. Birdwood, Dr. Baden Powel, Dr. Kanailal Dey, Sir George King, Dr. Kirtikar, Major Basu, Dr. Chopra, Dr. Nadkarni, Kaviraj Braja Chandra Gupta are praise worthy.
- Dr. Chopra mentioned indiscriminate exploitation of plants like *Rauwolfia*, *Belledona* and many other medicinal plants.
- Dr. Chopra feels that cultivation of *Digitalis*, *Belladona*, *Hyoseyamus*, *Pyrethrum*, *Seena*, *Wattle*, *Derris*, *Geranium*, *Peppermint*, *Datura* and several other species has been very positive and encouraging step.
- Since 1947 India has made tremendous progress in agrotechnology, process-technology, standardization quality control, research and development.
- Leading Indian research centers have started to seek patentable genes using the latest genetic engineering techniques. More than 400 useful plants have been identified.

It is an undisputed fact that India is one of the richest in medicinal plants possessing diverse medicinal properties. Various qualities of medicinal plants for remedy of various diseases. The history on researches on medicinal plants and various information related to the subject has not been discussed in this work as such information are available in various literatures.

The most acceptable work of the authorities on the subject namely Kirtikar and Bose, Ashima Chatterjee, R.N. Chopra, K.P. Biswas, Sibakali Bhattacharya and a few others who have done indepth research on the qualities of medicinal plants their chemistry and applications are available in various literatures. Nevertheless these literatures hardly mention about the present status of medicinal plants of this country. They do not even mention about the threats the medicinal plants are facing depletion these days.

Wide Scale Cultivation is the Remedy for Rapid Depletion of Species

The supply base of ninety percent herbal raw drugs used in the manufacture of Ayurveda, Siddha, Unani and Homoeopathy systems of medicine is mainly from the forests. Besides this, plants are also used in various industries producing herbal items other than medicines. This wild source is speedily sinking day by day.

Therefore, there is need for conservation and sustainable use of medicinal plants. Cultivation is clearly a sustainable alternative to the present collection of medicinal plants from the wild. This can be a potential provider of returns to the farmers/cultivators.

Keeping the aforesaid view of R.B.S. Rawat of National Medicinal Plants Board, the author thinks there is need for a very wide scale projects for cultivation of at least 300 species of medicinal plants in India.

Chapter Fifteen

Conservation Strategy

Conservation Strategy

The Indian Forest Act, 1972 took care of increasing demand for wild medicinal plants in the organized manufacturing sector. Under this Act the export of *Rauwolfia serpentina* has been banned.

The following plants have been over exploited :

Clausena excavata, Atylosia scarabaeoides, Andrographis paniculata, Helecteres isora, Centrella asiatica, Jatropha curcas, Anisomeles ovata, Scoparia dulcis, Plumeria acutifolia, Vitis repanda, Nyctanthes arbortristis, Phyllanthus niruri, Echinocloa colona, Feronia elephantum, Abrus precatorius, Erycibe panieulata, Recellia suffruticosa, Vernonia anthelmintica, Acorus calamus, Orchis laxiflora, Asparagus racemosus, Polygala crota lariodis.

Dhan Singh *et al.* (Ind. For. March 2005) writes that commercial enterprises and local dwellers are regularly exploiting natural heritage of medicinal plants in Uttaranchal. So, there is an urgent need of conservation of these valuable plants through cultivation. Poor marketing structure in the country is the primary challenge towards its promotion and cultivation.

Uttaranchal Strategy

There is no prohibition in the collection of the following species:

Azadirachta indica (Neem), *Boerhaavia diffusa* (Punarnava), *Calotropis* sp. (Aak), *Cymbopogon martini* (Agyadhas), *Eclipta alba* (Mrigraj), *Fumaria vallantii* (Shahtaria), *Hibiscusrosa sinensis* (Jaba), *Mentha viridis* (Pudina), *Mimosa pudica* (Lajjavati), *Nymphaea* sp. (Padma), *Ocimum sanctum* (Tulsi), *Phaseolus trilobus*

(Moongparni), *Phyllanthus niruri* (Bhuinaonla), *Ricinus communis* (Arand), *Rosa sp.* (Golab), *Sida cordifolia* (Bala), *Abutilon indicum* (Alivala), *Solanum nigran* (Makay), *Tephrosia purpurea* (Sarpunkha), *Tribulus terrestris* (Chota gokhra). These are all growing wild but there is no inventory.

(Anil Kumar et., al. Ind. For. 2004 Jan.)

Summary of the Responsibilities of the Various Ministries and Departments of Government of India Regarding Medicinal Plants

| Ministry/Department | Subject/Area of Work |
|--|---|
| Department of Indian Systems of Medicine | Preparation of list of medicinal plants in ISM. Documentation of local health traditions and Indian System of medicine and homeopathy. Encouragement to ex-situ cultivation. Development of agro technologies. |
| Department of Bio-technology. | Tissue culture and preservation of medicinal plants. |
| Department of Science and Technology | Bio-technologies, agro-technologies, CSIR germplasm preservations, etc. |
| Ministry of Agriculture | Ex-situ propagation of medicinal plants. Development of agro-technologies. Tissue culture and preservation of medicinal plants. |
| Ministry of Environment and Forests | Conservation of medicinal plants. Identification and notification of threatened species and advice to the Ministry of Commerce to regulate their export. Documentation of ethno-botanical use of medicinal plants. Studies on ethno-biology, survey and identification of plants including medicinal plants by Botanical Survey of India. |
| Ministry of Commerce | Regulation of export of medicinal plants, plant products or their derivatives as per the advice of MoEF. |
| State Governments | Collection of medicinal plants from the wild. Ex-situ cultivation of priority species. |

Summary of Responsibilities Handled by Different Wings of the Ministry of Environment and Forests Regarding Medicinal Plants

| Division of MoEF | Areas of responsibility |
|---|--|
| Conservation Strategy Division | <p>Convention of Biological Diversity (CBD). Medicinal plant conservation and protection of traditional knowledge.</p> <p>Intellectual Property Rights and community benefitsharing as required under the CBD and the proposed national legislation on biological diversity.</p> <p>Coordinating the activities of TBGRI, FRLGT, Govind Ballabh Plant Institute for Himalayan Environment and Development and the Botanical Survey of India in the area of medicinal plants.</p> |
| Forest Wing | The regulations under the Indian Forest Act 1927 and National Forest Policy 1988. ICFRE is engaged in research relating to medicinal plants. |
| National Afforestation and Eco Development Board (NAEB) | A scheme of NAEB on non-timber forest produce (NTFR) to promote in situ regeneration of forest produce, which includes conservation of medicinal plants to increase their production and replenish the stock. |
| | Local community involvement and value addition. |

Towards Sustainable Management of Medicinal Plants

It is clear that in order to move towards a system of sustainable management of medicinal plants, a number of aspects need to be addressed. Some of these are summarized below.

- Better information on the current status and potential production of medicinal plants, both those that are cultivated and those that are collected from the wild, is required as a baseline from which to estimate trends in production. This is necessary before strategies for sustainable production can be developed. Current information on production potential, means for, and limits of sustainable extraction, number of units manufacturing products and their raw material requirement, use by local vaidyas, etc. needs to be brought together.
- Supply chain information is currently poor, and notoriously difficult to obtain given the non-transparent

nature of the trade. Collectors are generally not aware of the market prices of plants beyond the price paid by the local agent, and have no bargaining power. In fact, it appears that at each stage of the chain, the various actors involved have little knowledge of prices paid further along the chain. Improving the information may help the collectors to get a better share of the final price of the plants, thereby increasing their stake in sustainable management.

- There is potential for organization of collectors at the local level. Promising models for local organization of medicinal plant collectors are already being developed and may serve to reduce the risk in business and degree of dependency upon traders to which collectors are currently vulnerable. Such organization might also provide possibilities for mutually enforced codes of collection and for associated marketing benefits. Development of local institutions, with external facilitation and micro-credit assistance provided to primary collectors will support the development of micro-enterprises. This may enhance the bargaining power of primary collectors and shorten the supply chain—although it is likely that local agents will still have a role to play. The Small Industrial Development Bank of India (SIDBI) has several such schemes of extending micro-credit facilities for enterprise development. Small-scale value addition options, which can be carried out at primary collector's level and community level, will yield better results and ensure sustainable management and development of resources.
- The legal and administrative structure pertaining to medicinal plants can also play an important role in sustainable management. Regulatory mechanisms that control the extent and nature of extraction can ensure that plants are sustainably harvested, while government support prices (or other incentives) can help ensure a fair share for the primary collector/cultivator.
- Means for ensuring quality are of concern to the industry and to consumers. There is a need for some system of quality control to be developed. Apart from ensuring the

quality of raw material of correct botanical specifications, it is also necessary that the ingredients listed on ayurvedic products is actually used in the specified proportions.

- Another quality related aspect pertains to the preservation of the harvested raw material. Many species are harvested during the monsoon period and the moisture in the atmosphere makes the harvested raw material susceptible to fungal attacks. Currently there are practically no facilities or methods available at the collector level that prevent the raw drug from getting a fungal attack. The raw material either gets thrown away or, as is often the case, infected raw material is used in the final formulation. Any research undertaken on the preservation of the raw drug will hence go a long way in quality- and waste-control.
- The increasing involvement of casual untrained labour in the collection of medicinal plants from the wild is resulting in the use of unscientific harvest practices that are damaging to the plant as well as the environment. There is a need to not only impart scientific training to harvesters but also to educate them about the short-term and long-term advantages of following harvest practices that do not damage the plants in the long run.
- Support to small and marginal farmers to undertake cultivation of low-risk medicinal plants cannot only help bring marginal lands under cultivation but also increase production as well as improve returns to these farmers. This will, at least in some cases, reduce pressure on forest areas to meet income needs of the dependent communities.

Medicinal Plants: Needs More of Conservation and Preservation:

There should be a number of herbaria where most of the species of medicinal plants will be preserved in sheets and listed. Various herbaria viz. sibpur Botanical Garden at Howrah under B.S.I., Indian council of Forest Research and Education, Dehra Dun; Central Drug Research Institute, Lucknow; Drug Research Laboratory in Jammu and Kashmir have a good collection of medicinal plants of India. Fruits and seeds of all species are to be properly preserved in formalin and in other chemicals. This needs

proper planning. The regional herbaria of B.S.I. can be a good resource base, as correct identification of species is of prime importance.

It is worthwhile in this connection to mention about vast literature and preserved materials and manuscripts written on palm leaves in the past which were mutilated by the invaders. The conquerors have introduced their own system of medicines as they were hostile towards the systems by the alien rulers. For about a thousand years Indian research, as a result, suffered a set back.

Appendix

List of some important publications.

Sl.No.

1. **A report of medicinal plants of Kachchh (Gujarat) - CCRAS, 61-65, Institutional Area, Janakpuri, New Delhi-58, 1998.**
2. **Contribution of medico-botany of east Godavari and west Godavari district of Andhra Pradesh -CCRAS, 61-65, Institutional Area, Janakpuri, New Delhi-58, 1989.**
3. **Glimps of medico-botany of Bastar district (Madhya Pradesh) - CCRAS , 61-65, Institutional Area, Janakpuri, New Delhi-58, 1990.**
4. **Medico-Botanical exploration of Puri district (Orissa)- - CCRAS, 61-65, Institutional Area, Janakpuri, New Delhi-58, 1989.**
5. **Medico-Ethno-Botany of Sonebhadra district- CCRAS, 61-65, Institutional Area, Janakpuri, New Delhi-58, 1993.**
6. **Medico-Ethno-Botanical exploration of Sikkim Himalayas- CCRAS, 61-65, Institutional Area, Janakpuri, New Delhi-58, 1991.**
7. **Medical Plants of Nagpur and Wardha forest division (Maharashtra)- CCRAS,61-65, Institutional Area, Janakpuri, New Delhi- 58, 1999.**
8. **Observation of Medico-Botany of Andaman- Nicobar Islands- CCRAS, 61-65, Institutional Area, Janakpuri, New Delhi -58, 1980.**
9. **Preliminary techno Economical Survey of natural resources and herbal wealth of Laddakh-CCRAS, 61-65, Institutional Area, Janakpuri, New Delhi-58, 1978.**
10. **Tribal pocket of Nilgiris recording of the field study on medicinal flora and health practices-CCRAS, 61-65, Institutional Area, Janakpuri, New Delhi-58, 1976.**
11. **Uttarkhand vanoushadhi Darshika- CCRAS,61-65, Institutional Area, Janakpuri, New Delhi-58, 1977.**

12. **Cultivation of Guggulu-CCRAS**, 61–65, Institutional Area, Janakpuri, New Delhi-58, 1999.
13. **Experimental Cultivation of Saffron (Kumkum)-CCRAS**, 61–65, Institutional Area, Janakpuri, New Delhi-58, 1995.
14. **Pharmacognosy of Indigenous drugs-CCRAS**, 61–65, Institutional Area, Janakpuri, New Delhi-58, 1999.
15. **Phytochemical investigation of certain medical plants used in Ayurveda-CCRAS**, 61–65, Institutional Area, Janakpuri, New Delhi-58, 1990.
16. **Database on medicinal plants used in Ayurveda Volume-I,II& III- CCRAS**, 61–65, Institutional Area, Janakpuri, New Delhi-58, 2000.
17. **Album ISM medicinal plants -PLIM, 111-A.C.G.O. Complex-1**, Kamla Nehru Nagar Ghaziabad, 1997.
18. **Album of crude drugs- PLIM, 111-A.C. G.O. Complex- 1**, Kamla Nehru Nagar, Ghaziabad, 1999.
19. **Plants drugs of Ayurvedic pharmacopoeia of India Volume-1-PLIM,111-A.C.G.O. Complex-1**, Kamla Nehru Nagar Ghaziabad, 2001.
20. **A contribution of medicinal plants of Aligarh (Uttar Pradesh) -1 CCRUM**, 61–65, Institutional Area, Janakpuri, New Delhi - 58.
21. **Medicinal plants of Gwalior forests division-CCRUM**, 61–65, Institutional Area, Janakpuri, New Delhi -58.
22. **Medicinal Plants of Andhra Pradesh Part-1-CCRUM**, 61–65, Institutional Area, Janakpuri, New Delhi-58.
23. **Medicinal Plants of North Arcot district, Tamil Nadu-CCRUM**, 61–65, Institutional Area, Janakpuri, New Delhi-58.
24. **Potential antimalarial herbal drugs from south eastern Indian -CCRUM**, 61–65, Institutional Area, Janakpuri, New Delhi-58.
25. **A guide to important medicinal plants used in Homoeopathy Volume-1-HPL,111-A C.G.O. Complex-1**, Kamla Nehru Nagar Ghaziabad, 1996.
26. **A guide to important medicinal plants used in Homoeopathy Volume-II-HPL, III-A C.G.O. Complex -1** Kamla Nehru Nagar Ghaziabad, 1997.
27. **A photographic album on medicinal plants used in Homoeopathy, Volume-I- HPL , III-A C.G.O. Complex -1**, Kamla Nehru Nagar Ghaziabad. 1998.
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29. **A compendium of active principles/phytochemicals of medicinal plants used in Homoeopathy, Volume-I- HPL, III-A C.G.O. Complex-1, Kamla Nehru Nagar Ghaziabad, 2001.**
30. **A check list of Homoeopathic medicinal plants of India- CCRH,61-65, Institutional Area, Janakpuri, New Delhi- 58, 1996.**
31. **Common Indian plants used in Homoeopathy - CCRH, 61-65, Institutional Area, Janakpuri, New Delhi-58, 1998.**
32. **A series of 25 medicinal plants by D.N. Tiwari, et.al. -Uttan Centre for Sustainable Development & Poverty Alleviation 18-A, Auckland Road, Allahabad-2001.**

(*Source* : National Medical Plants Board)

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