STATUS OF MEDICINAL PLANTS CONSUMPTION BY THE PHARMACEUTICAL INDUSTRIES IN GUJARAT STATE

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Introduction

Gujarat State is the western-most part of India. The forest cover in the State is poor but it has fairly rich biodiversity. The State comprises of less than 10% forest land of its geographical area. According to different studies on floral diversity, 2,205 species of angiospermic plants belonging to 905 genera of 156 families, have been recorded so far. Out of 2,205 plant species, 748 plants were identified as medicinally important (Uma Devi, 1988). According to a study conducted by the Forest Department on status of medicinal plants in different forest types and agro-climatic zones, 915 medicinal plants are distributed across the State (Anon., 2002). The World Health Organization (WHO) has estimated that 80% population of developing countries relies upon traditional medicines – mostly plant drugs – for their primary health care needs (Fransworth and Soejarto, 1991). Gujarat has a large number of pharmaceutical industries and huge amount of raw material is required daily for manufacturing of various medicines. The present study was undertaken to estimate the raw material consumption by various pharmaceutical industries in their formulations and to know the increasing pressure on medicinally important trees, shrubs, climbers and herb species.

Material and Methods

Gujarat is one of the industrially developed states and a large number of pharmaceutical industries have also been developed in the State. The Department of Food & Drugs controlls and regulates the pharmaceutical industries. The Commissioner, Food & Drugs Control Administration Gandhinagar had issued licenses for 605 Ayurvedic pharmaceutical industries up to 1998 for the State. The survey of functional pharmaceutical industries was undertaken in 1999, to collect the information regarding raw materials consumption and their procurement. Initially, there was a very poor response from pharmacy owners to furnish any kind of information. But after a continuous efforts to yield significant results, 66 pharmaceutical industries were surveyed in a span of three years.

The information regarding consumption of medicinal plant raw materials annually was gathered but the respondents did not provide information about the method and source of their procurement. The general reply received was that this raw material

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was purchased from the markets like Ahmedabad, Mumbai, Delhi and Dehra Dun. During the survey it was found that out of 605 licensed pharmacies, 330 Ayurvedic pharmacies were in operation. Therefore, 66 pharmacies comprising about 20% of functional units were surveyed and necessary details were collected. The details of surveyed Ayurvedic pharmaceutical industries of Gujarat State are given in Table 1.

The data on medicinal plants was categorized as being of indigenous origin or being imported. The indigenous (wild) medicinal plant species were further classified into naturally grown and cultivated ones. The indigenous (wild) medicinal plant species were also divided into their life forms such as trees, shrubs, climbers and herbs. The details on plant parts used in the pharmaceutical preparations were also gathered for all the industries and the average annual consumption was calculated on the basis of 20% sample survey. The quantities were calculated for every medicinal plant species and average is rounded off to the 100% consumption level. The percentage

Table 1

District-wise functional units of Ayurvedic Pharmaceuticals industries in Gujarat.

Sr. No.	District	No. of Licensed Ayurvedic Pharmacies	No. of Functional Ayurvedic Pharmacies	No. of Surveyed Ayurvedic Pharmacies
1.	Ahmedabad	165	105	09
2.	Rajkot	73	34	03
3.	Vadodara	69	29	02
4.	Valsad	45	22	05
5.	Bhavnagar	39	25	02
6.	Mehsana	37	20	07
7.	Surat	31	06	03
8.	Jamnagar	27	19	-
9.	Junagadh	25	10	04
10.	Kheda	25	16	02
11.	Bharuch	14	10	06
12.	Sabarkantha	12	08	08
13.	Amreli	09	05	02
14.	Surendranagar	09	05	-
15.	Banaskantha	09	05	04
16.	Panchmahals	07	04	04
17.	Kutch	05	05	03
18.	Gandhinagar	03	01	01
19.	Dangs	01	01	01
	Total	605	330	66

of pharmacies which are using a particular medicinal plant or its parts was also calculated. Thus, an estimation of raw materials annually consumed by the Ayurvedic pharmaceutical industries in Gujarat State was made. The surveyed pharmacies were either big, small, seasonal, single-drug manufacturing or multi-drug manufacturing units and were located in different districts of Gujarat.

Results and Discussion

It was observed that 270 medicinal plant species are consumed presently to produce different Ayurvedic formulations. Out of 270 medicinal plant species, 201 species (74%) are indigenous and 69 species (26%) are imported from elsewhere. Indigenous species are locally available in the State. Out of 69 imported species, 25 species (36%) are naturally grown and 44 species (64%) are cultivated.

Out of 201 indigenous plant species of Gujarat, 148 species (74%) are naturally grown and 53 species (26%) are cultivated. The naturally grown indigenous species are further classified into their life forms, where 48 species are tree (32%), 22 species are shrubs (15%), 28 species are climbers (19%) and 50 species are herbs (34%). The plant parts consumed by the number of pharmacies were also estimated. The details of 270 indigenous and imported medicinal plants with their estimated consumption are given in Tables 2 to 8.

The raw materials used in different Ayurvedic medicines are broadly divided into eight categories as mentioned in Table 9. All the 310 herbal raw material obtained from 270 plant species are consumed by the pharmaceutical industries in Gujarat State.

The consumption of vital parts like root, bark, seed, gum and whole plant are most detrimental and threat to the existence of a species. Out of total 270 medicinal plant species consumed in different Ayurvedic formulations, 148 species (55%) are reported from forests of Gujarat. The claim of pharmacies that total raw material is purchased from the markets is not accurate. It is evident that raw materials from indigenous plants are directly or indirectly and legally or illegally collected from forests up to 90% of their total requirement. This collection causes stress on natural resources and has brought many species under threatened category.

It is evident from Table 8 that fruits and seeds of 95 species, roots of 62 species, bark of 36 species, leaves of 24 species, stem and wood of 18 species, flowers of 16 species, exudates of 11 species and whole plant of 48 species are used as drug sources. Annual consumption, percentage of total number of species as well as the percentage constituted by each plant part in the total bulk of herbal drug is clearly indicating the heavy pressure on medicinal plant wealth of Gujarat State.

Conclusions and Recommendations

Following are suggestions for ensuring the uninterrupted steady supply of raw material vis-a-vis conservation of all the medicinal plant species in the forests :

- Collection of endangered and rare species from forests needs to be stopped.
- Endangered and rare species need to be multiplied under *in-situ* and *ex-situ* conditions by applying latest biotechnological methods.

Table 2

Estimated consumption of naturally grown indigenous medicinal plants : Tree species

Sr. No.	Botanical Name	Vernacular Name	Parts Used	Estimated average consumption (kg)	% of Pharmacies consuming
1	2	3	4	5	6
1.	*Emblica officinalis*	Amla	Fruits	1,60,000	59
2.	*Azadirachta indica*	Limdo	Panchang	1,39,000	35
3.	*Terminalia chebula*	Harde	Fruits	1,20,000	51
4.	*Terminalia bellirica*	Baheda	Fruits	81,000	50
5.	*Aegle marmelos*	Bili	Fruits, Roots, Bark	34,000	28
6.	*Acacia catechu*	Khair	Heartwood, Bark	33,000	25
7.	*Cocus nucifera*	Nariyeli	Fruits (Endosperm)	28,000	03
8.	*Sterculia urens*	Kadaya	Gum	25,000	02
9.	*Terminalia arjuna*	Arjun	Stem bark	24,500	32
10.	*Syzygium cumini*	Jambu	Seeds	19,000	15
11.	*Ficus racemosa*	Umardo	Stem bark	18,000	10
12.	*Acacia nilotica*	Deshi Baval	Gum & Bark	17,000	16
13.	*Gmelina arborea*	Sevan	Root, Bark, Stem	11,000	13
14.	*Sapindus laurifolius*	Aritha	Fruits	8,900	15
15.	*Bauhinia variegata*	Kachnar	Stem bark	8,500	19
16.	*Cassia fistula*	Garmalo	Fruits, Leaves	6,000	12
17.	*Tecomella undulata*	Ragat Rohido	Stem bark	5,800	10
18.	*Bambusa arundinacea*	Katris bans	Vanshlochan	5,300	15
19.	*Santalum album*	Chandan	Heartwood	5,200	15
20.	*Stereospermum personatum*	Patala	Roots & Bark	4,200	07
21.	*Oroxylum indicum*	Tetu	Roots & bark	3,900	07
22.	*Butea monosperma*	Kesudo	Roots & Flower	3,700	10
23.	*Bombax ceiba*	Simlo	Mochras (Gum)	3,500	10
24.	*Putranjiva roxburghii*	Putranjiv	Roots & Seeds	2,700	04
25.	*Moringa oleifera*	Mitho Saragvo	Stem bark	2,600	10
26.	*Crateva nurvala*	Vai Varno	Stem bark, Fruits	2,300	10
27.	*Mallotus philippensis*	Kapilo	Fruit hairs	2,200	07
28.	*Pongamia pinnata*	Karanj	Seeds	1,600	09
29.	*Alangium salvifolium*	Ankol	Seeds	1,600	03
30.	*Ailanthus excelsa*	Arduso	Stem bark	1,500	04

Contd...

1	2	3	4	5	6
31.	*Moringa concanensis*	Kadvo saragvo	Stem bark	1,200	03
32.	*Ficus benghalensis*	Vad	Bark & aerial roots	1,200	07
33.	*Casearia esculenta*	Saptarangi	Stem bark	900	02
34.	*Ficus tsiela*	Pipal	Stem bark	900	04
35.	*Ficus religiosa*	Pipalo	Stem bark	850	03
36.	*Thespesia populnea*	Paras piplo	Stem bark	810	04
37.	*Semecarpus anacardium*	Bhilamo	Fruits	800	07
38.	*Albizia lebbek*	Siris	Stem bark	750	06
39.	*Mimusops elengi*	Borsalli	Stem bark	600	06
40.	*Careya arborea*	Kumbhi	Stem bark	250	03
41.	*Dolichandrone falcata*	Mattarsingi	Stem bark	150	02
42.	*Tamarindus indica*	Khati Amali	Fruits	120	03
43.	*Tectona grandis*	Sag	Stem bark & Fruits	100	02
44.	*Melia azedarach*	Bakam Limado	Stem bark	45	02
45.	*Madhuca indica*	Mahudo	Flowers & Fruits	25	02
46.	*Limonia acidum*	Kothi	Fruits	10	02
47.	*Phoenix dactylifera*	Kharek	Fruits	02	02
48.	*Strychnos potatorum*	Nirmali	Seeds	01	02

Table 3

Estimated consumption of naturally grown indigenous medicinal plants: Shrubs

Sr. No.	Botanical Name	Vernacular Name	Parts Used	Estimated average consumption (kg)	% of Pharmacies consuming
1	2	3	4	5	6
1.	*Justicia adhatoda*	Ardusi	Leaves, Whole plant	1,05,000	47
2.	*Commiphora wightii*	Gugal	Gum-Resin	48,500	32
3.	*Holarrhena anti - dysenterica*	Indrajav	Bark & Seed	31,000	34
4.	*Helicteres isora*	Mardasing	Fruits	21,100	07
5.	*Clerodendron serratum*	Bharangmool	Roots	21,000	19
6.	*Embelia tsjeriam-cottam*	Vavding	Fruits	15,500	37

Contd...

1	2	3	4	5	6
7.	*Woodfordia fruticosa*	Dhavdi	Flowers	11,500	10
8.	*Clerodendron multiflorum*	Arani	Roots, leaves	7,900	15
9.	*Vitex negundo*	Nagod	Leaves	6,000	13
10.	*Abutilon indicum*	Atibala	Seeds	2,700	06
11.	*Gardenia resinifera*	Dikamari	Fruits	2,200	06
12.	*Cassia occidentalis*	Kasundro	Leaves & Seeds	1,950	03
13.	*Capparis spinosa*	Kanther	Fruits	1,600	02
14.	*Lawsonia alba*	Menhdi	Leaves, Seeds	750	06
15.	*Baliospermum montanum*	Dantimool	Roots	600	04
16.	*Annona squamosa*	Sitafal	Leaves & Seeds	250	03
17.	*Hibiscus abelmoschus*	Muskdana	Seeds	225	02
18.	*Zizyphus* spp.	Bordi	Roots	50	02
19.	*Calotropsis* spp.	Akado	Roots, leaves	45	02
20.	*Euphorbia nerifolia*	Thor	Whole Plant	45	02
21.	*Salvadora persica*	Khara Pilu	Seeds, leaves, bark	35	02
22.	*Xeromphis spinosa*	Mindhal	Fruits	05	02

Table 4

Estimated consumption of naturally grown indigenous medicinal plants : Climbers.

Sr. No.	Botanical Name	Vernacular Name	Parts Used	Estimated average consumption (kg)	% of Pharmacies consuming
1	2	3	4	5	6
1.	*Tinospora cordifolia*	Galo	Stem, Whole plant	2,50,000	43
2.	*Asparagus racemosus*	Shatavari	Roots	1,70,000	57
3.	*Mucuna prurita*	Kaucha	Seeds	40,000	25
4.	*Leptadenia reticulata*	Dodi/Jivanti	Whole plant	35,000	22
5.	*Pueraria tuberosa*	Vidari-kand	Tuber	28,000	34
6.	*Boerhavia diffusa*	Satodi	Roots	26,100	25
7.	*Hemidesmus indicus*	Anantmool	Roots	11,000	22
8.	*Operculina turpetum*	Nashotar	Roots, Stem	10,250	18

Contd...

1	2	3	4	5	6
9.	*Citrullus colocynthis*	Indrayanmool	Roots	10,130	12
10.	*Sarcostema acidum*	Somlata	Stem, Whole plant	9,200	13
11.	*Celastrus paniculata*	Malkangni	Seeds	7,200	09
12.	*Gymnema sylvestris*	Madhunasini	Leaves	7,000	10
13.	*Abrus precatorius*	Chanothi	Seeds, leaves	6,000	10
14.	*Aristolochia bracteolata*	Kidamari	Fruits	5,085	04
15.	*Ipomoea digitata*	Kshirvidari-kand	Tuber	5,000	03
16.	*Trichosanthus cucumerina*	Patol patra	Leaves,Whole plant	4,035	10
17.	*Argyreia speciosa*	Samudrashosh	Whole plant, Seeds	3,755	16
18.	*Teramnus labialis*	Mash parni	Whole plant	2,800	07
19.	*Dioscorea bulbifera*	Varahikand	Tuber	1,800	04
20.	*Acacia concina*	Shikakai	Fruits	1,265	04
21.	*Gloriosa superba*	Vachhnag	Roots	1,170	07
22.	*Cyclea peltata*	Patha	Roots	1,000	10
23.	*Clematis triloba*	Morvel	Whole plant	110	03
24.	*Clitorea ternatea*	Garni	Seeds	35	03
25.	*Caesalpinia crista*	Kachka	Seeds	25	02
26.	*Trichosanthus tricuspidata*	Kakanasha	Fruits	10	02
27.	*Cissus quadrungularis*	Hadsankal	Stems	10	02
28.	*Luffa echinata*	Kukadvel	Fruits	05	02

Table 5

Estimated consumption of naturally grown indigenous medicinal plants : Herbs

Sr. No.	Botanical Name	Vernacular Name	Parts Used	Estimated average consumption (kg)	% of Pharmacies consuming
1	2	3	4	5	6
1.	*Withania somnifera*	Ashvagandha	Roots	2,29,000	63
2.	*Tribulus terrestris*	Gokharu	Whole plant	84,400	46
3.	*Cyperus rotundus*	Nagarmoth	Roots	45,400	28
4.	*Eclipta alba*	Bhangaro	Whole plant	42,400	41
5.	*Tephrosia purpurea*	Sarpankho	Whole plant	36,900	07

Contd...

1	2	3	4	5	6
6.	*Centella asiatica*	Brahmi	Whole plant	34,800	41
7.	*Enicostema littorale*	Mamejavo	Whole plant	32,800	19
8.	*Plumbago zeylanica*	Chitrak	Roots	32,800	28
9.	*Solanum surattense*	Bhoinringani	Whole plant	28,700	34
10.	*Convolvulus microphyllus*	Shankhpushpi	Whole plant	27,200	28
11.	*Andrographis paniculata*	Kalmegh	Whole plant	23,500	18
12.	*Phyllanthus fraternus*	Bhoin amli	Whole plant	22,000	09
13.	*Datura innoxia*	Dhaturo	Seeds	21,300	07
14.	*Sida cordifolia*	Bala, Makoy	Roots	18,400	24
15.	*Spilanthes acmella*	Marethi	Stem	16,200	03
16.	*Aloe vera*	Kuvarpathu	Leaves pulp	13,200	24
17.	*Achyranthus aspera*	Apamarg	Whole plant	10,700	10
18.	*Fumaria indica*	Pittapapado	Whole plant	9,000	13
19.	*Vetivera zizanioides*	Khas, valo	Roots	8,900	16
20.	*Indigofera tinctoria*	Gali	Leaves	7,000	Q3
21.	*Chlorophytum borivillianum*	Safed musli	Tuber	6,400	16
22.	*Sphaeranthus indicus*	Gorakhmundi	Fruits	6,000	07
23.	*Uraria picta*	Prushnaparni	Roots	4,550	10
24.	*Desmodium gangeticum*	Shaliparni	Roots	4,300	09
25.	*Curculigo orchioides*	Kalimusali	Roots	4,000	10
26.	*Alhagi maurorum*	Javaso	Whole plant	3,300	09
27.	*Vernonia anthelmintica*	Kalijiri	Fruits	3,200	13
28.	*Cassia auriculata*	Aval	Whole plant	2,500	02
29.	*Barlaria prionitis*	Kantasheriyo	Whole plant	2,000	10
30.	*Nelumbo nucifera*	Kamal	Flower, Seed	1,750	12
31.	*Fagonia cretica*	Dhamaso	Whole plant	1,650	06
32.	*Cassia tora*	Kuvadio	Seed	1,200	07
33.	*Mimosa pudica*	Lajamanti	Whole plant	950	04
34.	*Hygrophila auriculata*	Aekharo	Whole plant	800	04
35.	*Phaseolus trilobus*	Moongparni	Whole plant	650	05
36.	*Sida veronicaefolia*	Nagbala	Whole plant	550	03
37.	*Solanum nigrum*	Kakamasi	Fruits	500	04
38.	*Argemone mexicana*	Darudi	Whole plant	500	06
39.	*Desmostachya bipinata*	Darbh	Roots	450	04

Contd...

1	2	3	4	5	6
40.	*Cassia absus*	Chimed	Whole plant	270	03
41.	*Merremia tridentata*	Prasarini	Whole plant	170	02
42.	*Cynodon dactylon*	Dharo	Whole plant	100	02
43.	*Nymphaea stellata*	Uplata, Poyna	Flowers	80	02
44.	*Pedalium murex*	Ubhagokharu	Whole plant	50	02
45.	*Sida spinosa*	Mahabala	Whole plant	45	02
46.	*Solanum indicum*	Ubhi bhoinringani	Whole plant	45	03
47.	*Peristrophe bicalyculata*	Anghedi	Whole plant	50	03
48.	*Ocimum basilicum*	Damaro	Leaves	10	02
49.	*Leucas cephalotes*	Kubo	Whole plant	05	02
50.	*Phyla nodiflora*	Ratveliyo	Leaves	05	02

Table 6

Estimated consumption of cultivated indigenous medicinal plants

Sr. No.	Botanical Name	Vernacular Name	Parts Used	Estimated average consumption (kg)	% of Pharmacies consuming
1	2	3	4	5	6
1.	*Plantago ovata*	Isabgul	Seed husk	1,12,500	04
2.	*Mentha viridis*	Fudino	Whole plant	1,10,400	07
3.	*Zingiber officinale*	Aadu / Sunth	Rhizomes	64,900	60
4.	*Piper longum*	Lindi piper	Fruits, roots	59,100	53
5.	*Cassia angustifolia*	Sonamukhi	Leaves	44,000	33
6.	*Eucalyptus* spp.	Nilgiri	Leaves, oil	42,700	12
7.	*Curcuma longa*	Haldar/Haridra	Rhizomes	30,700	32
8.	*Ocimum sanctum*	Tulsi	Leaves	30,500	34
9.	*Daucus carota*	Gajar	Roots	25,500	12
10.	*Sesamum inicum*	Tal	Seeds, oil	25,400	10
11.	*Saraca asoca**	Sita ashok	Bark	24,500	18
12.	*Cuminum cyminum*	Jiru	Fruits	13,000	28
13.	*Punica granatum*	Dadam	Fruits & bark	12,000	15
14.	*Anethum graveolens*	Suva	Fruits	11,900	18
15.	*Trigonella foenumgraecum*	Methi	Seeds	10,000	10
16.	*Citrus acidus*	Limbu	Fruits	9,800	06
17.	*Rauvolfia serpentina*	Sarpgandha	Roots	8,900	16

Contd...

1	2	3	4	5	6
18.	*Piper chaba*	Chavak	Whole plant	7,650	22
19.	*Momordica charantia*	Karela	Fruits	7,100	09
20.	*Raphanus sativus*	Mula	Seeds	7,050	10
21.	*Ricinus communis*	Erand mool	Roots, leaves	6,500	12
22.	*Psoralea corilefolia*	Bavachi	Seeds	6,200	07
23.	*Alpiania galanga*	Kulinjan	Rhizomes	6,200	06
24.	*Coriandrum sativum*	Dhana	Fruits	5,500	18
25.	*Apium graveolens*	Ajamo	Seeds	4,800	19
26.	*Saccharum officinarum*	Sheradi	Stem	4,750	04
27.	*Vitis vinifera*	Kali draksh	Fruits	4,600	07
28.	*Foeniculum vulgare*	Variyali	Fruits	4,200	12
29.	*Cichorium intybus*	Kasani	Seeds	4,200	09
30.	*Curcuma zedearia*	Kachuro	Rhizomes	4,100	13
31.	*Allium sativum*	Garlic (Lasan)	Stem bulb	3,250	13
32.	*Carica papaya*	Papaiya	Seeds	2,600	06
33.	*Trichosanthus dioica*	Patol	Whole plant	2,150	04
34.	*Hibiscus rosasinensis*	Jasud, Jasavanti	Flowers	1,200	04
35.	*Abroma augusta*	Ulat kambal	Roots	1,050	03
36.	*Amorphophallus campanulatus*	Suran	Corm (Stem)	560	02
37.	*Lepidium sativum*	Asariyo	Seeds	520	04
38.	*Carum carvi*	Shahjiru	Seeds	505	04
39.	*Curcuma aromatica*	Amba haldar	Rhizomes	425	06
40.	*Allium cepa*	Kanda (Onion)	Stem bulb	365	04
41.	*Carum copticum*	Ajmod	Leaves, Seeds	225	03
42.	*Citrus medica*	Bijoru	Fruits	155	04
43.	*Cucumis sativus*	Kakdi	Seeds	110	02
44.	*Nerium indicum*	Karen	Roots	95	03
45.	*Grewia asiatica*	Falsa	Fruits	50	02
46.	*Mangifera indica*	Ambo	Fruits	50	02
47.	*Agave americana*	Ketki	Flowers	50	02
48.	*Hordeum vulgare*	Jav (Barley)	Seeds	25	02
49.	*Piper betel*	Nagarvel	Leaves	25	02
50.	*Cymbopogon martinii*	Rosaghas	Whole plant	15	02
51.	*Trapa bispinosa*	Singoda	Fruits	15	02
52.	*Nicotiana tobacum*	Tamaku	Leaves	10	03
53.	*Brassica nigra*	Sarsav (Mustard)	Seeds	10	02

*It is spurious drug, *Shorea robusta* and *Polyalthia longifolia* species are used as adulterants. The demanded quantity could not be produced due to its scarce distribution.

Table 7

Estimated consumption of Imported wild medicinal plants

Sr. No.	Botanical Name	Vernacular Name	Parts Used	Estimated average consumption (kg)	% of Pharmacies consuming
1.	*Shorea robusta*	Sal, Ralgum	Oleogum resin	32,700	04
2.	*Nardostachys jatamansi*	Jatamansi	Roots	26,700	32
3.	*Aconitum heterophyllum*	Ativish	Roots	26,500	22
4.	*Pterocarpus santalinus*	Rakta chandan	Heartwood	22,300	19
5.	*Symplocos racemosa*	Lodra	Stem bark	21,600	22
6.	*Rubia cordifolia*	Majith	Stem & Root	13,600	31
7.	*Commiphora myrrha*	Hirabol	Gum	12,700	09
8.	*Bergenia ligulata*	Pashanbhed	Stem bark	11,600	16
9.	*Cedrus deodara*	Devdar	Stem bark	8,300	19
10.	*Pistacia integerrima*	Kakadashingi	Gall	7,500	19
11.	*Mesua ferrea*	Nagkeshar	Flowers	7,400	23
12.	*Cinnamomum camphora*	Kapur	Deposition of Cells	4,200	10
13.	*Smilax zeylanica*	Chopchini	Rhizome	4,030	12
14.	*Myrica nagi*	Kaifal	Stem bark	2,750	13
15.	*Garcinia indica*	Kokam	Fruits	2,500	02
16.	*Strychnos nux-vomica*	Zerkochala	Seeds	2,450	10
17.	*Abies spectabilis*	Talishpatra	Leaves	1,420	13
18.	*Cinchona officinalis*	Cinchona	Bark	1,000	02
19.	*Prunus cerasoides*	Padam kast	Wood	770	07
20.	*Aquilaria agallocha*	Kala agar	Wood	490	04
21.	*Dryobalanopsis aromatica*	Bhimsenikapur	Gum	300	02
22.	*Elaeocarpus ganitrus*	Rudraksha	Fruits	200	03
23.	*Juglans regia*	Akharot	Fruits	100	02
24.	*Garcinia morella*	Revanchini	Stem	50	03
25.	*Pistacia lentiscus*	Rumimastaki	Gum	30	03

Table 8

Estimated consumption of imported medicinal plants under cultivation

Sr. No.	Botanical Name	Vernacular Name	Parts Used	Estimated average consumption (kg)	% of Pharmacies consuming
1	2	3	4	5	6
1.	*Piper nigrum*	Kalimari	Fruits	55,200	43
2.	*Glycyrrhiza glabra*	Jethimadh	Roots	46,200	43
3.	*Swertia chirata*	Kariyatu	Whole plant	28,300	31
4.	*Berberis aristata*	Daru-Haldi	Bark	19,500	32
5.	*Picrorhiza kurroa*	Kadu, Kutaki	Roots	19,000	32
6.	*Pluchea lanceolata*	Rasna	Roots	13,200	24
7.	*Cinnamomum zeylanica*	Tamal patra	Leaves, Bark	10,700	46
8.	*Acorus calamus*	Ghoda vaj	Rhizomes	10,500	21
9.	*Ellataria cardamomum*	Elaichi	Seeds	8,600	21
10.	*Inula racemosa*	Pushkarmool	Roots	8,300	24
11.	*Hyoscyanus niger*	Khursaniajamo	Seeds	6,800	07
12.	*Saussurea lappa*	Kąth, uplet	Roots, Whole plant	6,200	12
13.	*Myristica fragrans*	Jaifal	Fruits, Flowers	5,200	24
14.	*Hedychium spicatum*	Kapur kachali	Rhizomes	4,600	18
15.	*Valeriana jatamansi*	Tagarganth	Rhizomes	4,000	18
16.	*Nigella sativa*	Kalonji	Seeds	3,300	07
17.	*Eugenia caryophyllata*	Laving (Clove)	Flowers Bud	3,100	26
18.	*Anacyclus pyrethrum*	Akkalkaro	Whole plant	2,800	18
19.	*Ferula narthrex*	Hing	Gum	2,750	19
20.	*Scindapsus officinalis*	Gajpiper	Fruits	1,450	07
21.	*Jasminum auriculatum*	Jui, Chameli	Whole plant	1,970	03
22.	*Viola odorata*	Banfasa	Whole plant	965	06
23.	*Carum roxburghii*	Bodi ajmod	Fruits	900	02
24.	*Rosa centifolia*	Gulab	Flowers	850	10
25.	*Amomum subulatum*	Elcho	Seeds	800	06
26.	*Citrus aurantifolia*	Santra	Fruits	755	02
27.	*Parmelia perfoliata*	Shaileyak	Whole plant	750	06
28.	*Garcinia pendulata*	Amalvetas	Fruits	700	10

Contd...

1	2	3	4	5	6
29.	*Croton tiglium*	Jamalgota	Fruits	400	06
30.	*Lilium polyphylum*	Kshirkakoli	Bulbs	175	04
31.	*Polygonatum cirrhifolium*	Menda	Root stock	150	06
32.	*Cannabis sativa*	Bhang	Seeds	140	02
33.	*Polygonatum verticillatum*	Mahamenda	Root stock	115	04
34.	*Areca catechu*	Sopari	Seeds	110	03
35.	*Papaver somniferum*	Khaskhas	Seeds	105	02
36.	*Fritillaria roylei*	Kakoli	Bulbs	65	04
37.	*Eulopia campestris*	Salampanjo	Roots	40	03
38.	*Crocus sativus*	Keshar	Stigma	35	04
39.	*Malaxis muscifera*	Rushbhak	Swollen stem	15	03
40.	*Malaxis acuminata*	Jivak	Swollen stem	15	04
41.	*Callicarpa macrophylla*	Priyanguful	Flowers	10	02
42.	*Colchicum luteum*	Suranjan	Roots	10	02
43.	*Lubunga scandens*	Sugandhkokla	Fruits	10	02
44.	*Withania coagulence*	Kaknaj	Roots	10	02

Table 9

Classification of drug sources based on plant parts

Sl. No.	Parts used as drug source	No. of Species Used	% of Species Used	Annual Consumption (kg)	% consumption of plant parts
1.	Whole Plant	48	15	789265	21
2.	Root	62	20	896200	24
3.	Leaf	24	08	254310	07
4.	Fruit & Seed	95	30	1071351	28
5.	Bark	36	12	265355	07
6.	Stem & Wood	18	06	297350	08
7.	Flower	16	05	34132	01
8.	Exudates (Gum resin)	11	04	147480	04
	Total	310	100	3755443	100

- Destructive methods of collection of medicinal plants from the forests need to be abandoned. Non-destructive methods should be developed for collection after imparting training to locals.

- The extent of exploitation from the forests, cultivation of endangered and rare species and the consumption at the pharmaceutical level need to be closely monitored by the forest officials. The check and balance system needs to be developed in this regard.

- The pharmaceutical industries should take initiative to purchase raw materials from both cultivators and legal contractors and avoid indirect collection through their well established organisations like Forest Development Corporation, Marketing Co-operatives and local middlemen and traders net workings.

- The schedule of rates of every raw material (medicinal plants) should be fixed by the government as support price and pharmacy owners should sign agreement for buy-back arrangements with the cultivators and growers of these medicinal plants.

- *In-situ* conservation needs to be emphasized by managing "Medicinal Plant Conservation Area" (MPCA).

- *Ex-situ* conservation needs to be promoted by establishing the germplasm and gene banks of commercially important medicinal plants.

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SUMMARY

The estimation of raw material consumed by the pharmaceutical industries in Gujarat State is studied. Survey in this regard made first time for Gujarat State. The baseline database is created for indigenous and imported as well as indigenous and cultivated, trees, shrubs, climbers, herbs and different crops used in Ayurvedic medicines. The consumption level for all the medicinal plants species is estimated which can be utilized by different authorities for different purposes. The species-specific and plant part-specific consumption status is also studied and discussed.

गुजरात राज्य में औषध निर्माण उद्योगों द्वारा औषधीय पेड़पौधों के उपभोग की स्थिति

ए०पी० सिंह व मिन्नू परबिया

सारांश

गुजरात राज्य में औषध निर्माण उद्योगों द्वारा उपभोग किए जाने वाले कच्चे माल के अनुमान का अध्ययन किया गया है । इस विषय में गुजरात राज्य में किया गया यह पहला सर्वेक्षण है । इससे देशज और आयतित के साथ-साथ देशज और कृषिकृत वृक्षों, क्षुपों, आरोहियों, शाकों और आयुर्वेदिक औषधियों में प्रयुक्त होने वाली अन्य फसलों के विषय में आधारभूत डाटा आधार तैयार किया गया है । सभी औषधीय पादप जातियों के उपभोग स्तर अनुमानित किया गया है जिसे विभिन्न प्रयोजनों के लिए विभिन्न अधिकारियों द्वारा उपयोग में लाया जा सकता है । जाति विशिष्ट और पादपांग विशिष्ट उपभोग स्थिति का भी अध्ययन और विवेचन किया गया है ।

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