

MEDICINAL PLANTS SCENARIO IN DARJEELING HIMALAYAS: CONSERVATION AND CULTIVATION AS ALTERNATIVE CROP

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Introduction

The Darjeeling Himalayas, situated in one of the bio-diversity hot spots of the world (Eastern Himalaya), are a virtual goldmine of medicinal plant biodiversity. This region alone has more than 500 species of relatively well-known plants of medicinal importance. This vast economic resource of the country has largely gone unnoticed and uncared for.

Historically, the inhabitants of Darjeeling hills were under the natural forest ecosystem depending upon indigenous agroforestry, forest and horticultural products along with animal husbandry (Sharma, 1995). As the exploitation of land by planting tea and collecting timber flourished, the economy took a different turn and people turned to various secondary occupations. It not only changed the traditional system, but the land surface of this hill zone too changed drastically in terms of the agricultural practices. This region suffered chronically with the problem of deforestation over-cultivation, soil erosion, land slips, decline in soil fertility, shortage of fuelwood, fodder, timber and of course, over-population.

The monocultural, chemical-intensive, green-revolution inducing agricultural

practice that ultimately leads to barren soils, weakened genetic pool and lost biodiversity is not suitable for the Himalayan region (Taneja and Kothari, 2002). The need is more towards 'eco-friendly' farming systems based on the so-called 'Hill-Agriculture' development. These principles will even serve to maintain soil fertility in the hills (Subba Rao and Rodrigues-Barrueco, 1993).

Agricultural practices in the Darjeeling hills in most of the situation are subsistence-agriculture as characterized by low input low risk and low yields. Traditionally, upland farming system in the Darjeeling hills has been an integration of various land uses, such as forests, agriculture, horticulture, animal husbandry etc. The important crops grown in the Darjeeling hill region include paddy, maize winter and summer, vegetables, soybean, mustard, cardamom and oranges.

As per the cropping pattern, Darjeeling hills may be divided into 3 altitudinal zones, viz. lower hills (300-1,200m), mid-hills (1,200-1,850m) and upper hills (1,850-2,300m) amsl. Similarly there are three major crop season viz. January-June, June-October and October-January with a variety of crops characteristic of each zone and each season (Table 1).

Table 1

Cropping Pattern in Darjeeling Hills

January-June	June-October	October-January
A. Upper hills (1850-2300m) :		
1. Summer Potato	Radish, Carrot, Pea, Beans, Turnip.	Leafy vegetables.
2. Maize	Millet, Soybean, Pea Beans.	Barley.
3. Cauliflower, Pea	Cabbage	Radish, Carrot
B. Mid hills (1200-1850m) :		
1. Maize	Radish, Carrot, Pea, Beans, Millet.	Cauliflower
2. Summer Potato	Radish, Carrot, Pea, Beans, Soybean	Pea, Carrot, Leafy Vegetables.
3. Summer Potato	-do-	Leafy Vegetables, Pea, Beans, Carrot, Radish.
C. Lower hills (300-1200m) :		
1. Maize	Paddy, Vegetables, Millets, Soybean.	Wheat, Winter potato, Beans Tomato, Cauliflower, Cabbage.
2. Ladyfinger	Paddy-Vegetables, Millet, Soybean	Winter Potato, Cabbage, Beans, Cauliflower.
3. Ginger (March-April to November)	Ginger	Beans, Leafy Vegetables (December-March)

It has been estimated that 13% of the total land is utilized for cropping which is very low compared to other zones. The rest of the land surface is either under forest or not available for cultivation. Moreover, because of the typical topographical structure of the land, effective area for cultivation is spectacularly less than the total area.

The conversion of forests and agricultural land into tea gardens has further reduced the cultivable land. The family-wise land holding pattern in the Darjeeling hill area indicates that almost half of the total number of holding area is

of 1 ha, while only 5.22% to 8.16% of the total holding area is of 4 hectares or above (Table 2).

Medicinal plants : An overview

About 70-75% of Indian population is dependent on herbal medicine for primary health care because of its better cultural acceptability, better compatibility with the human body and lesser side effect. Availability and cost effectiveness are the reasons for its popularity. At present, India has about US\$ 1 billion worth of herbal medicine market of which a meagre US\$ 80 million

Table 2

Land holding pattern in the Darjeeling Hills

Subdivision	Size of holding	No. of holdings	% of total holdings	Area (ha)	% of total area
Darjeeling	upto 1 ha	5973	51.25	3535.00	23.92
	1 ha to 2 ha	2874	24.66	3111.00	21.05
	2 ha to 4 ha	2200	18.87	5100.00	34.51
	above 4 ha	608	5.22	3032.00	20.52
Total		11655	100.00	14778.00	100.00
Kurseong	upto 1 ha	1019	43.38	750.00	23.78
	1 ha to 2 ha	855	36.40	1028.00	32.60
	2 ha to 4 ha	350	14.90	750.00	23.78
	above 4 ha	125	5.32	625.00	19.48
Total		2349	100.00	3153.00	100.00
Kalimpong	upto 1 ha	6126	45.62	4105.50	21.42
	1 ha to 2 ha	3315	24.68	4972.50	25.94
	2 ha to 4 ha	2892	21.54	5784.00	30.17
	above 4 ha	1097	8.16	4308.00	22.47
Total		13430	100.00	19170.00	100.00

is earned from export. Even of this small amount export, 80% comprises crude drugs and not the finished products.

Darjeeling Himalayan region has a rich diversity of medicinal plants and rich heritage of traditional medicinal practices. The folk medicine systems like Nepali Jodi-Buti, Lepcha system and the Tibetan medicine is completely based on local plants. Along with the rich biodiversity of this area, the content of endemic elements is also quite high which includes a number of high value medicinal plants.

India is one of the few countries that are capable of producing most of the

important plants used both in modern and traditional systems of medicine (Table 3), due to the availability of wide variations of climate, soil, altitude and latitude (Lambert *et al.*, 1997). Most of the plants used by the drug industries, especially from high altitudes are harvested from the wild. This has led to the depletion of resources and extinction of some of the species (Nautiyal and Purohit, 2000). Of the 814 threatened plant species in India, 113 taxa occur in the Indian Himalayas (Nautiyal *et al.*, 2001).

In the Indian traditional medicine practices, some plants like *Piper longum*, *Berberis aristata*, *Embllica officinalis*,

Table 3

Major Indian medicinal plants used in indigenous systems of medicine.

Botanical name	Sanskrit name
1	2
<i>Abies webbiana</i>	Taleespatra
<i>Achyranthes aspera</i>	Apamarga
<i>Acorus calamus</i>	Vacha
<i>Aloe barbedensis</i>	Kumari
<i>Andrographis paniculata</i>	Bhoonimba (Kalmeg)
<i>Asparagus adscendens</i>	Mushali
<i>Asparagus racemosus</i>	Shatavari
<i>Bauhinia variegata</i>	Kachnar
<i>Bergenia ligulata</i>	Pashan bheda
<i>Boerhavia diffusa</i>	Punarnava
<i>Centella asiatica</i>	Mandukparni
<i>Clerodendrum serratum</i>	Bharangi
<i>Convolvulus pluricaulis</i>	Shankhapushpi
<i>Crataeva nurvala</i>	Varuna
<i>Dioscorea bulbifera</i>	Vidarikand
<i>Embelia ribes</i>	Vidanga
<i>Gymnema sylvestre</i>	Madhunashni
<i>Hedychium spicatum</i>	Shathi
<i>Holarrhena antidysenterica</i>	Kutaja
<i>Mesua ferrea</i>	Nagkesar.
<i>Nardostachys grandiflora</i>	Jatamansi
<i>Ocimum sp.</i>	Tulsi
<i>Phyllanthus amarus</i>	Bhumyamalika
<i>Emblica officinalis</i>	Amalika (Amla)
<i>Picrorhiza kurrooa</i>	Kutki
<i>Piper longum</i>	Pippali
<i>Pluchea lanceolata</i>	Rasna
<i>Psoralea corylifolia</i>	Bakuchi
<i>Rubia cordifolia</i>	Manjistha

Contd...

1	2
<i>Saraca indica</i>	Ashoka
<i>Sausurea costus</i>	Kushtha
<i>Sida sp.</i>	Bala
<i>Symplocos racemosa</i>	Lodhra
<i>Terminalia arjuna</i>	Arjuna
<i>Terminalia chebula</i>	Haritaki (Harad)
<i>Tinospora cordifolia</i>	Guduchi
<i>Tribulus terrestris</i>	Gokshura
<i>Vinca rosea</i>	Tagar
<i>Vitex negundo</i>	Nirgundi
<i>Withania somnifera</i>	Ashwagandha

Terminalia chebula, *T. belerica*, *Holarrhena antidysenterica*, etc. are used in 52 to 219 medicinal preparations (Table 4).

To cash in the scenario, while maintaining the gene-pool, a National Medicinal Plants Board has been established under the Ministry of Health and Family Welfare (by notification dated 24th November, 2000). The objectives of the Board are to formulate strategies for conservation, cultivation, proper harvesting, processing, marketing and Research & Development related to medicinal plants. The Board has so far identified 32 medicinal plants for commercial cultivation (Table 5).

Similarly, the Government of West Bengal has prepared a district-wise priority lists of medicinal plants for profitable cultivation (Anon., 2001). R & D activities on these plants and financial support to the cultivators will be provided by the State Government. The plants identified for the Darjeeling Hills along with the adjoining Terai regions are enumerated in Table 6.

Table 4

Frequency of occurrence of medicinal plants in herbal formulations in India.

Common name	Botanical name	No. of herbal formulations.
Triphala	<i>Terminalia chebula</i>	219
	<i>Terminalia belerica</i>	
	<i>Emblica officinalis</i>	
Yashtimadhu	<i>Glycyrrhiza glabra</i>	141
Pipali	<i>Piper longum</i>	135
Vasaka	<i>Adhatoda vasica</i>	110
Aswagandha	<i>Withania somnifera</i>	109
Mastak (Motha)	<i>Cyperus rotundus</i>	102
Gulacha	<i>Tinospora cordifolia</i>	88
Daruharidra	<i>Berberis aristata</i>	65
Gokshura	<i>Tribulus terrestris</i>	65
Kutaja	<i>Holarrhena antidysenterica</i>	59
Punarnava	<i>Boerhaavia diffusa</i>	52

Most of these plants are available in Darjeeling Himalayan region. The worldwide herbal medicine market is around US\$ 30-60 billion which is likely to touch US \$ 100 billion within the next 5 years. In Germany and France, herbal medicine are sold as prescription drugs and covered by National Health Insurance. Germany has published monographs of 300 medicinal plants. China has generated data for the use of 800 medicinal plants. But, Indian figure is dismal with only few monographs and no organized report (Kamboj, 2000).

The conservation and multiplication of the important medicinal plants should go hand in hand and people concerned should get the economic incentives. This way the plants will be conserved and the villages will become economically self reliant. However, no efforts have so far been made to preserve these germplasm

from different localities, identification and estimation of active compounds and development of agrotechniques for their organized farming. At least one-third of the medicinal plants found in the country are available in Darjeeling Himalayas. So, the time has come to think globally and act locally.

Discussion

It is clear that the limited land holding of the people, nutrient depletion in soil, difficult terrain and a typical mountain climate has subjected the farmers of Darjeeling to an extreme economic constraint. Earning a high return from a limited land holding, maintenance of sustainable conditions, preservation of ecosystem and biodiversity, continuance of organic cultivation, etc. are the challenges being faced by the agriculturists in Darjeeling.

Table 5

Priority list of medicinal plants identified by National Medicinal Plants Board
for commercial cultivation

Sl. No.	Species	Common name
1.	<i>Aconitum heterophyllum</i> Wall.	Atees
2.	<i>Aconitum ferox</i> Wall.	Vatsnabh
3.	<i>Aegle marmelos</i> L.	Bael
4.	<i>Andrographis paniculata</i> L.	Kalmegh
5.	<i>Asparagus racemosus</i> Willd.	Shatavari
6.	<i>Bacopa monnieri</i> (L.) Pennell.	Brahmi
7.	<i>Berberis aristata</i> DC.	Daruharidra
8.	<i>Cassia angustifolia</i> Vahl.	Senna
9.	<i>Chlorophytum borivillianum</i> Sant.	Safed Musli
10.	<i>Commiphora wightii</i> (Arn.) Bhandari	Guggul
11.	<i>Coleus barbatus</i> Benth.	Patharchur
12.	<i>Emblica officinalis</i> Gaertn.	Amla
13.	<i>Saraca asoca</i> (Roxb.) de Willd.	Ashok
14.	<i>Withania somnifera</i> (L.) Dunal.	Ashwagandha
15.	<i>Phyllanthus amarus</i> Schum & Thonn.	Bhumi amla
16.	<i>Santalum album</i> L.	Chandan
17.	<i>Swertia chirata</i> Buch.-Ham.	Chirata
18.	<i>Tinospora cordifolia</i> Miers.	Giloe
19.	<i>Gymnema sylvestre</i> R. Br.	Gudmar
20.	<i>Plantago ovata</i> Forsk.	Isabgol
21.	<i>Nardostachys jatamansi</i> DC.	Jatamansi
22.	<i>Gloriosa superba</i> L.	Kalihari
23.	<i>Garcinia indica</i> Chois	Kokum
24.	<i>Saussurea costus</i> C.B. Clarke	Kuth
25.	<i>Picrorhiza kurrooa</i> Benth. ex Royle	Kutki
26.	<i>Solanum nigrum</i> L.	Makoy
27.	<i>Glycyrrhiza glabra</i> L.	Mulethi
28.	<i>Piper longum</i> L.	Pippal
29.	<i>Crocus sativus</i> L.	Saffron
30.	<i>Rauwolfia serpentina</i> Benth. ex Kurz	Sarpagandha
31.	<i>Ocimum sanctum</i> L.	Tulsi
32.	<i>Embelia ribes</i> Burm. f.	Vai Vidang

Table 6

Selected medicinal plants for profitable cultivation in the Hill and Terai zone of West Bengal

Sl. No.	Botanical Name	Common Name
1.	<i>Swertia chirata</i>	Chirata
2.	<i>Atropa belladonna</i>	Belladonna
3.	<i>Dioscorea alata</i>	Dioscorea
4.	<i>Picrorhiza kurrooa</i>	Kutki
5.	<i>Glycirrhiza glabra</i>	Jasthimadhu
6.	<i>Aconitum heterophyllum</i>	Aconite
7.	<i>Acorus calamus</i>	Bach
8.	<i>Withania somnifera</i>	Ashwa-gandha
9.	<i>Rauwolfia serpentina</i>	Sarpagandha
10.	<i>Taxus baccata</i> subsp. <i>walliachiana</i>	Talispatra
11.	<i>Aristolochia indica</i>	Ishwarmul
12.	<i>Ginkgo biloba</i>	Maidenhair
13.	<i>Gymnema sylvestre</i>	Gurmar
14.	<i>Commiphora mukul</i>	Guggul
15.	<i>Ocimum basilicum</i>	Indian Basil
16.	<i>Tagetes minuta</i>	Wild Marigold
17.	<i>Pelargonium graveolens</i>	Geranium
18.	<i>Chlorophytum borivillianum</i>	Safed Musli

In this scenario, the farmers of this area have no alternative but to adopt some high value-low volume agricultural alternatives. Of the farm-based alternatives mention may be made of floriculture, horticulture and the cultivation of medicinal plants. To some extent the floricultural sector is quite active in some parts of Darjeeling Himalayas. The benefits of floriculture has however, remained confined with the relatively affluent farmers. Moreover, marketing

becomes a problem due to the lack of a flower auction centre, cold storage, air-conditioned transportation facilities, etc. in the vicinity. Apart from this, the highly valued hybrid varieties of planting material have to be imported from abroad to have a competitive edge in the market. These factors become a constraint for the small farmer. The same limitation holds good for the horticultural section.

Besides high economic returns, the cultivation of medicinal plants helps to maintain ecological conditions. This practice may replenish the already dwindling stock of wild plants and help in the conservation of species. In the mountain it has always been a great problem to save the traditional crops like potato, maize, cabbage etc. from the wild animals like Wild boar, Bear, Monkey etc. Medicinal plants have the advantage of being a non-edible item to these animals.

The fragile ecosystem of the Himalayan region with unstable nature of the soil makes it prone to landslides if it is disturbed too much for cultivation processes. Medicinal plant cultivation could be done with minimum disturbance to the soil strata and thereby minimizing the chances of landslips.

A lot of barren land has so far remained unutilized in the grasslands below the snowline at the higher reaches of this region. Such lands could be made use of for the cultivation of high value medicinal plants, viz. *Picrorhiza kurrooa*, *Podophyllum hexandrum*, *Dactylorhiza hatagirea*, *Nardostachys grandiflora*, etc., which grow suitably in such lands.

Above all, these medicinal plants are

indigenous, wild and less susceptible to any diseases or attacks by pests, so the maintenance cost is negligible which suits the farmers.

However, many a medicinal plant of this region is rapidly getting extinct or immensely being threatened. Though

late, the Silviculture Department of the Darjeeling Hill Forests has recently woken up to preserve and maintain some of the medicinal plants in their nurseries (Table 7).

The Directorate of Cinchona and other medicinal plants situated in Mungpoo in

Table 7

Important medicinal plants maintained in the nurseries of
Silviculture (Hills) Division, Darjeeling.

Sl. No.	Botanical name	Local name	Family	Uses
1	2	3	4	5
1.	<i>Artemisia milagarica</i>	Titaly pati	Asteraceae	Leaves used to check nose bleeding
2.	<i>Calotropis procesra</i>	Akanda	Asclepiadaceae	Leaves used in sprain injury
3.	<i>Viscum album</i>	Harchur	Loaranthaceae	Roots used in stomach trouble, plant used in bone fracture
4.	<i>Rauwolfia serpentina</i>	Sarpa-gandha	Apocynaceae	Roots used in fever
5.	<i>Costus speciosus</i>	Betlowry	Costaceae	Tubers used in urinary tract infections
6.	<i>Morinda angustifolia</i>	Haledo	Rubiaceae	Roots used in stomach trouble
7.	<i>Melastoma malabaricum</i>	Chuleshi	Melasomaceae	Leaves used in cough and cold
8.	<i>Drymaria cordatā</i>	Abhijalo	Caryophyllaceae	Leaves used in fever and sinus
9.	<i>Calamus rotang</i>	Bet	Arecaceae	Stem used in liver trouble
10.	<i>Dioscorea prazeri</i>	Ban tarul	Dioscoreaceae	Rhizome used in fever, stomach trouble and birth control
11.	<i>Cassia occidentalis</i>	Thulo tapre	Caesalpiniaceae	Leaves used in scars and wounds
12.	<i>Hydrocotyl javanica</i>	Golpatta	Apiaceae	Leaves used stomach trouble
13.	<i>Asparagus racemosus</i>	Satamuli	Liliaceae	Root used in stomach trouble
14.	<i>Nasturtium officinalis</i>	Simrayo	Caryophyllaceae	Leaves used in high pressure and TB
15.	<i>Swertia chirata</i>	Chireto	Gentianaceae	Leaves and roots used in fever
16.	<i>Heracleum wallichii</i>	Chimping	Apiaceae	Flower and seed used in fever
17.	<i>Urtica dioica</i>	Sisnu	Urticaceae	Leaves used in high blood pressure
18.	<i>Zanthoxylum alatum</i>	Bokeytimur	Rutaceae	Fruit used in gastric problem
19.	<i>Evodia fraxinifolia</i>	Khanakpa	Ruaceae	Fruit used in gastric problem

Contd...

1	2	3	4	5
20.	<i>Dichroa febrifuga</i>	Hill-basak	Saxifragaceae	Leaves used in malaria and other fevers
21.	<i>Astilbe rivularis</i>	Bodoau-khati	Saxifragaceae	Roots used in stomach trouble and as tonic
22.	<i>Rumex nepalensis</i>	Halhalay	Polygonaceae	Roots used as anti-poison
23.	<i>Laportea terminalis</i>	Patley sisnu	Urticaceae	Leaves used in high blood pressure
24.	<i>Girardinia palmate</i>	Bhangre sisnu	Urticaceae	Shoots used in high blood pressure
25.	<i>Polygonum molle</i>	Thotney	Polygonaceae	Shoots used in dysentery
26.	<i>Eupatorium adenophorum</i>	Kalo Banmara	Asteraceae	Leaves used as antiseptic
27.	<i>Lycopodium clavatum</i>	Nagbeli	Lycopodiaceae	Roots used in indigestion
28.	<i>Michelia champaca</i>	Champ	Magnoliaceae	Leaf used as anthelmintic
29.	<i>Stephania glabra</i>	Rukh Tamarke	Menispermaceae	Roots used in diabetes
30.	<i>Cannabis sativa</i>	Ganja	Cannabinaceae	Leaves used as sedative
31.	<i>Hydrocotyl asiatica</i>	Barma butti	Apiaceae	Leaves used in tonsillitis
32.	<i>Aconitum ferox</i>	Bikhumma	Ranunculaceae	Root used as an antidote of poison
33.	<i>Aconitum heterophyllum</i>	Bikhjhar	Ranunculaceae	Root paste used in gout, rheumatism
34.	<i>Rubia cordifolia</i>	Majito	Rubiaceae	Root used in jaundice
35.	<i>Abroma augusta</i>	Ulat kambal	Sterculiaceae	Roots and leaves used in heart disease and high blood pressure
36.	<i>Dioscorea floribunda</i>	Gol tarul	Dioscoreaceae	Tubers used in birth control
37.	<i>Ocimum sanctum</i>	Tulashi	Lamiaceae	Leaves used in cold and cough
38.	<i>Adhatoda vasica</i>	Basak	Acanthaceae	Leaves used in cold, cough and bronchitis
39.	<i>Andrographis paniculata</i>	Kalmegh	Acanthaceae	Leaves used, in fever and as anthelmintic
40.	<i>Datura stramonium</i>	Dhaturo	Solanaceae	Leaves used as anti inflammatory
41.	<i>Achyranthes aspera</i>	Kurro	Achyranthaceae	Roots used in toothache
42.	<i>Piper longum</i>	Pipla	Piperaceae	Fruit used in cough and fever
43.	<i>Vinca rosea</i>	Baramashe	Apocynaceae	Leaves used in diabetes
44.	<i>Cassia occidentalis</i>	Kalo nigro	Caesalpiniaceae	Fruit used in blood dysentery
45.	<i>Emblica officinalis</i>	Amala	Euphorbiaceae	Fruit used in dysentery and constipation
46.	<i>Aloe barbadensis</i>	Ghew Kumari	Liliaceae	Leaves used in hair tonic

Contd...

1	2	3	4	5
47.	<i>Equisetum elongatum</i>	Kurkure jhar	Equisetaceae	Whole plant is used in kidney stones
48.	<i>Panax pseudo-ginseng</i>	Salanay	Araliaceae	Root used as tonic and stimulant
49.	<i>Sapindus mukorosi</i>	Ritha	Sapindaceae	Seeds used in epilepsy
50.	<i>Terminalia chebula</i>	Harra	Combretaceae	Fruits used in tonsillitis
51.	<i>Terminalia belerica</i>	Barra	Combretaceae	Fruits used in stomach upsets
52.	<i>Taxus baccata</i> subsp. <i>wallichiana</i>	Dhyangre salla	Taxaceae	Leaves used in fever and epilepsy
53.	<i>Bauhinia purpurea</i>	Tanki	Caesalpiniaceae	Bark is used in dysentery
54.	<i>Berberis asiatica</i>	Kissie	Berberidaceae	Root is used in jaundice
55.	<i>Woodfordia fruticosa</i>	Dhangera	Lythraceae	Flower is used in diarrhoea
56.	<i>Smilax zeylanica</i>	Kukur-dainy	Liliaceae	Root extract is used in haematuria
57.	<i>Betula cylindrostachys</i>	Saur	Betulaceae	Bark used in hysteria and epilepsy
58.	<i>Curculigo orchoides</i>	Dhotisara	Amaryllidaceae	Rhizome used in kidney trouble
59.	<i>Holarrhena antidysentrica</i>	Khirra	Apocynaceae	Bark is used in dysentery and diarrhoea
60.	<i>Ficus benjamina</i>	Kabra	Moraceae	Leaf paste is used in scabies
61.	<i>Mussaenda frondosa</i>	Dhobini	Rubiaceae	Leaf used in fever, bronchitis
62.	<i>Potentilla fulgens</i>	Banmula	Rosaceae	Root used in toothache and piles
63.	<i>Rhododendron arboreum</i>	Lali Gurans	Ericaceae	Flower used in dysentery
64.	<i>Vitex negundo</i>	Siuli	Verbenaceae	Dried leaves smoked in sinusitis
65.	<i>Rubus moluccanus</i>	Aiselu	Rosaceae	Leaf used as anthelmintic
66.	<i>Dendrocalamus strictus</i>	Malingo	Poaceae	Leaf juice used for easy delivery
67.	<i>Macaranga indica</i>	Malata	Euphorbiaceae	Latex used in scabies and sores
68.	<i>Taraxacum officinalis</i>	Kaney phul	Asteraceae	Root used as liver tonic
69.	<i>Mahonia acanthifolia</i>	Keshari	Berberidaceae	Root used in stomachache
70.	<i>Juniperus communis</i>	Sukpa	Cupressaceae	Fruit used in throat pain
71.	<i>Litsaea citrata</i>	Siltimbur	Lauraceae	Fruit used in headache
72.	<i>Bergenia ciliata</i>	Pakhanbed	Saxifragaceae	Root used in toothache, bronchitis

the Darjeeling District has been doing commendable work towards the commercial cultivation and exploitation of medicinal and aromatic plants like *Cinchona*, *Ipecac*, *Dioscorea*, *Citronella*, *Rauwolfia* etc. Details of areas of cultivation of medicinal plants by this

Directorate are given in Table 8 (Rai and Sharma, 1994).

St. Alphonsus Social and Agricultural Centre (SASAC), an organization of Jesuit missionaries, is involved in the cultivation of medicinal plants, especially *Taxu*

Table 8

Area under medicinal plant cultivation by the Directorate of Cinchona and other medicinal plants

Species	Area (ha)	Plantation sites
Cinchona	3498	Mungpoo, Munsong, Rengo, Latpanchar, Ambotia
Ipecac	2596	Mungpoo, Munsong, Rongo
Dioscorea	45	Munsong, Rongo
Others	26	Mungpoo, Munsong, Rongo

baccata for the rural upliftment in the Kurseong Sub-division of Darjeeling District. The Earth Group, a local NGO from Darjeeling is also involved in economy generation scheme for the rural people through medicinal plant cultivation in Rampuria village of Darjeeling Sub-Division. Federation of Societies of Environmental Protection, another NGO is also involved for the collection and marketing of local herbs for rural upliftment.

The Panchavati Greentech Research Society (PGRS) another Non-Governmental institute endeavoured to take scientific technology from laboratory to the land. At first, groups of beneficiaries were organized into co-operative societies. For the transfer of technology, a medicinal plant having a good market value was selected for cultivation. *Swertia chirata* was found to be suitable in these aspects. However, germination of seed was found to be main hurdle in the propagation of the plant. The workers of PGRS have developed and standardized the technique of seed germination. Subsequently, the technique was simplified and extended over to the co-operative members. The PGRS helped the co-operatives in marketing the product. All

the economic benefits went to the concerned farmers.

Though, only *Swertia chirata* is being utilized at present, the PGRS has selected a few more high-value medicinal plants for future works. These plants will cover all the climatic and vegetation zones of this Himalayan region. As per altitudinal variation, the PGRS has divided this region into three zones – the higher, middle and lower zones. The PGRS will take upon itself the task of developing suitable agro-techniques for the cultivation and technology transfer for extension of these selected plants in phase-wise manner. The plant selected for each zone are :

Lower Zone (130 - 1,500 m) : *Piper longum*, L., *Asparagus racemosus* Willd., *Rauwolfia serpentina* (L.) Benth. ex Kurz., *Gloriosa superba* L., *Costus speciosus* (Koen. ex. Retz.) Sm. and *Withania somnifera* (L.) Dunal

Middle Zone (1,500 - 2,400 m) : *Swertia chirata* Buch.-Ham., *Hippophae rhamnoides* L., *Rubia cordifolia* L., *Digitalis purpurea* L., *Potentilla fulgens* Wall., *Bergenia ciliata* (Har.) Stenb.

Higher Zone (above 2,400 m) : *Dactylorhiza hatagirea* (Don.) Soo, *Podophyllum hexandrum* Royle, *Picrorhiza kurrooa*

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