MEDICINAL PLANTS SECTOR IN ARUNACHAL PRADESH – AN OVERVIEW

K. HARIDASAN, ANUPAM SARMAH, L.R. BHUYAN AND N.S. BISHT*

State Forest Research Institute,
Itanagar (Arunachal Pradesh).

Introduction

Arunachal Pradesh has been known as a treasure house of medicinal plants. Much of our information on medicinal plants come from the ethnobotanical studies conducted in the State (Rawat and Chowdhury, 1998; Haridasan, 2001). Over 500 species are reported from the State (Haridasan *et al.*, 1995). They are distributed in the wide-ranging agro-climatic zones all over the State. The forests vary from tropical zones in the lower plains and hills to the alpine peaks (Kaul and Haridasan, 1987), where the medicinal plant flora too varies. The State has tropical forests with medicinal plants like *Acorus calamus, Clerodendrum colebrookianum, Gmelina arborea, Oroxylum indicum, Piper mullesua, Terminalia bellirica, T. chebula,* etc.

The subtropical forests in the State shelter species like *Panax* sp., *Rubia cordifolia* and *Swertia chirata.* There are some of the unique medicinal plants like *Aconitum* sp., *Coptis teeta, Gentiana* sp., *Panax sikkimensis, Podophyllum hexandrum, Taxus wallichiana, Valeriana* sp., etc. in temperate forests while in higher vegetation type of alpine flora there are many species like *Aconitum ferox, Fritillaria cirrhosa, Gentiana* sp., *Gymnadaenia orchidis, Picrorhiza kurroa, Rheum emodi,* etc. are found.

Some of the medicinal plants like *Coptis teeta* are endemic (Hegde, 1988) while others like Taxus, Kutki, Aconite, Ginseng are endangered and getting fast depleted. However, they are very popular and have high demand. Some of these plants have been identified as priority species for conservation. Medicinal plants in Arunachal Pradesh are largely exploited from wild sources and there is not much in cultivated conditions (Bhuyan, 2000). The current exploitation is mostly in the districts of West Kameng and Tawang. Recently other districts like Dibang valley, Lower Subansiri and East Siang are also getting prominence as centres of medicinal plant trade. Further, among the prioritized species of medicinal plants by the Planning Commission and National Medicinal Plant Board, more than 19 species are found either wild or in cultivated condition in Arunachal Pradesh (Table 1).

From the experience gained in Arunachal Pradesh by survey and documentation by the State Forest Research Institute (SFRI), a few more species could be considered for cultivation

* Head, Resource Survey and Management Division, Forest Research Institute, Dehra Dun (Uttaranchal).

Table 1

List of priority species developed by Medicinal Plant Board and Planning Commission, Govt. of India

Sr. No.	Species	Local Name
1.	***Aconitum heterophylum* Wall.***	Atees
2.	*Aconitum ferox* Wall.*	Vatsnabh (Vish)
3.	***Aegle marmelos* L. Corr.***	Bael
4.	***Andrographis paniculata* L.***	Kalmegh
5.	***Asparagus racemosus* Willd.***	Shatavari
6.	***Bacopa monnieri* (L.) Pennell.***	Brahmi
7.	***Berberis aristata* DC.**	Indian Berberry
8.	***Cassia angustifolia* Vahl.**	Seena (Sanai)
9.	***Chlorophytum arundinaceum* Baker.** (*C. borivillianum*)	Musli
10.	***Commiphora wightii* (Arn.) Bhandari.**	Guggal
11.	*Coleus barbatus* Benth.	Pashan Bheda
12.	*Convolvulus pluricaulis* Choisy	Shankhapushpi
13.	***Emblica officinalis* Gaertn. ***	Amla
14.	***Embelia ribes* Burm. f.***	Vai Vidang
15.	***Garcinia indica* L.**	Kokum
16.	*Gloriosa superba* L.	Kalihari
17.	***Glycirrhiza glabra* L.**	Liquorice (Mulethi)
18.	***Gymnema sylvestre* R. Br.**	Gudmar
19.	***Nardostachys jatamansi* DC.***	Jatamansi
20.	*Ocimum sanctum* L.*	Tulsi
21.	***Picrorhiza kurroa* Benth.***	Kutki
22.	***Piper longum* L.***	Long pepper (Pippali)
23.	*Phyllanthus amarus* Schum & Thonn. (*P. niruri* L.)*	Bhui Amlaki
24.	***Plantago ovata* Forsk.**	Isabgol
25.	*Rauvolfia serpentina* (L.) Benth. ex Kurz.*	Sarpagandha
26.	***Santalum album* L.**	Chandan
27.	***Saraca asoca* (Roxb.) de Wilde.***	Ashok
28.	***Saussurea costus* C.B. Clark (*S. lappa*)**	Kuth
29.	*Solanum nigrum* L.*	Makoy
30.	***Swertia chirata* Buch-Ham.***	Chirata
31.	***Tinospora cordifolia* Miers.***	Giloe
32.	***Withania somnifera* (L.) Dunal.***	Ashwagandha

Species in bold are identified by both agencies.
*= indicates those found in Arunachal either wild or cultivated.

and development, which are given in Table 2.

The people in the State who belong to over 25 major tribes like Adi, Aka, Apatani, Bangni, Hill Miri, Khamba, Khamti, Khawa, Memba, Miji, Monpa, Mishmi, Nyshi, Nocte, Sherdukpen, Singphos, Sulungs, Tagin, Tangsa and Wanchos etc. have their own healing practices and health care systems where many plant species are used. Their selection along with the proximity to different systems of medicine like Ayurveda, Homoeopathy, Tibetan (Chinese) folk lore and traditional practices has also resulted in identification of such a large number of medicinal plants in the State.

Though the entire State has presence of medicinal plants, the present survey has pointed out certain areas that are specifically rich (Table 3). As a beginning these areas could be thought of for developing medicinal plants in the State.

Cultivation trials

As mentioned earlier there has not been any serious effort in the State to promote the cultivation of medicinal plants of importance. The only efforts are those of the Department of Environment and Forests and the SFRI. The SFRI with its field stations has been engaged in survey and trials on growing medicinal plants. Such attempts have been made at different locations like Chessa, Bomdila, Itanagar, Namsai and Dirang. At Chessa, the Institute has a germplasm collection of over 217 species and has tried their cultivation. Most of the species showed promising growth and performance. However, some introductions from outside, like *Ammi majus, Cephaelis ipecacunha, Cissus guadrangularis, Plantago ovata, Psoralea corylifolia,* etc. did not thrive very well despite the initial good performance. At Itanagar, SFRI has a demonstration plot of medicinal plants with 28 blocks where 30 species are grown (Table 4).

Table 2

Priority species for Arunachal Pradesh that are not included in the above list

	Species	Local name
1.	*Aquilaria agallocha*	Agar
2.	*Clerodendrum colebrookianum*	Naphaphu
3.	*Coptis teeta* Wall.	Mishmi teeta
4.	*Costus speciosus*	Keu
5.	*Illicium griffithii*	Lissi
6.	*Oroxylum indicum*	Bhatghila
7.	*Panax sikkimensis*	Ginseng
8.	*Piper mullesua*	Pipli
9.	*Podophyllum haxandrum* Royle	Bankakri
10.	*Rubia cordifolia* L.	Majith, Tamen
11.	*Taxus wallichiana* = *T. baccata*	Yew
12.	*Terminalia arjuna*	Arjun

Table 3

Medicinal plant priority areas (proposed) in Arunachal Pradesh.

Sl. No.	Location	District	Medicinal plants
1	Dichu Valley	Lohit	*Aconitum, Chelidonium, Coptis, Fritillaria, Taxus, Ginseng, Gymnadaenia, Hypericum, Podophyllum,* etc.
2	Mayodia	Dibang valley	*Coptis teeta, Gaultheria, Taxus.*
3.	Pasighat-Mebo	East Siang	*Acorus calamus, Oroxylum indicum, Piper mullesua, Terminalia bellirica, T. chebula.*
4.	Ziro-Tale valley	Lower Subansiri	*Acorus, Taxus, Gaultheria, Ginseng, hypercium, Podophyllum, Rubia cordifolia,* etc.
5.	Chessa	Papum Pare	*Abroma, Adhatoda, Costus, Gmelina, Oroxylum,* Pipli, *Terminalia bellirica, T. chebula, Tinospora,* etc.
6.	Rupa-Shergaon	West Kameng	*Artemesia, Bergenia, Gaultheria, Illicium, Rubia, Swertia, Taxus.*
7.	Bomdila-Dirang	West Kameng	*Acorus, Artemesia, Gaultheria, Illicium, Rubia, Swertia, Taxus.*
8.	Tawang	Tawang	*Aconitum, Cordiceps, Fritillaria, Ginseng, Picrorhiza, Podophyllum, Taxus.*
9.	Thungri-Pushingla	West Kameng	*Aconitum, Cordiceps, Fritillaria, Picrorhiza, Gentiana, Ginseng, Podophyllum, Taxus, Valeriana,* etc.

Similarly the species cultivated at Namsai and Dirang are also efforts to know the performance of different medicinal plants in cultivated conditions and the potential of growing them for commercial purposes (Table 4).

From the observations made in these experimental plots it has come to light that a very large number of species can be cultivated in the State as the agro-climatic conditions are found suitable. Among these plants are trees like *Gmelina arborea, Illicum griffithii, Oroxylum indicum, Phyllanthus emblica, Saraca indica, Taxus wallichiana, Terminalia arjuna, T. bellirica, T. chebula.* Shrubs that are growing well under cultivation are *Adhatoda zeylanica, Clerodendrum colebrookianum, Euphorbia nerifolia, Phlogacanthus thyrsiflorus, Vitex negundo,* etc. Similarly, the herbaceous plants grown include *Acorus calamus, Andrographis paniculata, Coptis teeta, Curcuma caesia, Kaemferia galanga, Panax sikkimensis, Piper longum, P. mullesua, Rauvolfia serpentina, Withania somnifera,* and others.

There are a few climbers/creepers too that are grown successfully. These include *Cardiospermum helicacabum, Clitoria mariana, Dioscorea floribunda, Gymnema sylvestre, Piper longum, P. nigrum, Rubia cordifolia, Tinospora cordifolia,* etc.

The SFRI has been engaged in developing plantation models. Trials have

Table 4

Species grown in SFRI demonstration plots at different locations.

Itanagar	Bomdila	Namsai
Abrus precatorious	*Acorus calamus*	*Acorus calamus*
Acorus calamus	*Artimesia nilagirica*	*Aquilaria agallocha*
Adhatoda zeylanica	*Berberis* sp.	*Andrographis paniculata*
Aegle marmelos	*Coptis teeta*	*Adhatoda zeylanica*
Aloe vera	*Illicium griffithii*	*Azadirachta indica*
Andrographis paniculata	*Panax sikkimensis*	*Catheranthus roseus = Vinca rosea*
Aquilaria agallocha	*Rubia cordifolia*	*Clerodendrum colebrookianum*
Azadirachta indica	*Swertia chirata*	*Curcuma caesia*
Cardiosperm helicabum	*S. wallichii*	*Gmelina arborea*
Curcuma caesia	*Taxus baccata*	*Justicia gendarusa*
Clitoria mariana	*Valeriana hardwickii*	*Leucas lavandulaefolia*
Dioscoria floribunda	*Zanthoxylum rhetsa*	*Murraya koenghii*
Gymnema sylvestre		*Oroxylum indicum*
Justicia gendarusa		*Phlogacnthus thyrsiflorus*
Kaempferia galanga		*Piper mulleusa*
Mesua ferrea		*P. longum*
Ocimum sanctum		*Rauvolfia tetraphylla*
Oroxylum indicum		*Terminalia bellirica*
Phlogacanthus thyrisiflorous		*T. chebula*
Piper longum		*Tinospora cordifolia*
Piper mullesua		*Vitex negundo*
Rauvolfia tetraphylla		
Rauvolfia serpentina		
Saraca indica		
Sida cordifolia		
Sida acuta		
Tinospora cordifolia		
Vinca rosea		
Vitex negundo		
Withania somenifera		

been conducted as planting in cleared areas, planting as under-crop and inter-crop, multi-tier plantation, etc. The availability of these different habits of medicinal plants like trees, shrubs, herbs and climbers can be suitably exploited for multi-tier plantation that can enhance economic output of a unit area to a great extent. Through its experience the SFRI has short-listed a set of such plants (Table 5) for composite planting. Needless to say the prescription for low altitude and high altitudes will vary.

The medicinal plants can be grown in a variety of lands and conditions

Table 5

Species for multi-tier plantation in Arunachal Pradesh

Species	Local name	Family	Habit
Low altitude (less than 1200 m) :			
Acorus calamus	Boch	Araceae	H
Aegle marmelos	Bel	Rutaceae	T
Andrographis paniculata	Kalmegh	Acanthaceae	H
Aquilaria agallocha	Agar	Thymeliaceae	T
Asparagus racemosus	Satavari	Liliaceae	C
Bacopa monnieri	Brahmi	Scrophulariaceae	H
Dioscorea floribunda	Kham alu	Dioscoreaceae	C
Emblica officinalis	Amla	Euphorbiaceae	T
Gymnema sylvestre	Madhunasini	Asclepiadaceae	C
Oroxylum indicum	Bhat ghila/Jigat	Bignoniaceae	T
Piper longum	Pipli	Piperaceae	C
Piper mullesua	Pipli	Piperaceae	H
Piper nigrum	Golmirch	Piperaceae	C
Rauvolfia serpentina	Sarpagandha	Apocynaceae	S
Saraca indica	Asok	Caesalpiniaceae	T
Terminalia arjuna	Arjun	Combretaceae	T
Tinospora cordifolia	Amrit lata	Memispermaceae	C
Withania somnifera	Aswagandha	Solanaceae	H
High Altitude (more than 1200 m) :			
Aconitum ferox	Bish	Ranunculaceae	H
Berberis aristata	Indian Berberis	Berberidaceae	H
Coptis teeta	Mishmi teeta	Ranunculaceae	H
Fritillaria cirrhosa	Yathung	Liliaceae	H
Gymnadaenia orchidis	Salampancha	Orchidaceae	H
Illicium griffithii	Lissi	Illiciaceae	T
Panax sikkimensis	Ginseng	Araliaceae	H
Picrorhiza kurroa	Kutki	Scrophulariaceae	H
Rubia cordifolia	Manjista	Rubiaceae	C
Swertia chirata	Chiratia	Gentianaceae	H
Taxus wallichiana	Yew	Taxaceae	T

H = Herbs, S = Shrubs, C = Climbers, T = Trees

available like home gardens, field margins, existing tree plantations, wastelands, jhum fallows, etc. The productivity of 'jhum' fallows can thus be increased and can be an aid in jhum rehabilitation. The 1999 State of Forest report shows that Arunachal Pradesh has an area of 190 km^2 as jhum affected lands. This gives an indication of land availability. The community and individuals has also lot of land for plantation of medicinal plants.

Seedling requirement

When medicinal plants are taken up for large-scale plantations, there will be an urgent requirement of nursery seedlings and propagation materials. Those plants that can be grown through seeds are easy to raise using standard nursery techniques. However, there are instances when seeds are not available in sufficient quantity to meet the demand. In such cases, vegetative propagation methods are attempted to raise planting materials. These clonal methods have various advantages. Selected high yielding plants can be grown as plants with true to parent quality. *Clerodendrum colebrookianum, Gmelina arborea, Gymnema sylvestre, Illicium griffithii, Piper longum, P. mullesua, P. nigrum, Rauvolfia serpentina, R. tetraphylla, Taxus baccata, Vitex negundo,* etc. can be easily propagated using branch cuttings. Though not always required, a mist chamber will help in better sprouting and rooting of cuttings. In the case of Ginseng the rhizomes are cut into pieces and propagation trials carried out (Rao *et al.,* 1998). These methods of seedling production are easy to operate even by less educated people and can be mastered with less training. Such nursery ventures can generate rural employment too.

Future prospects

With the ban on timber extraction, the State is facing acute revenue shortage. People are looking towards alternatives. Medicinal plants could be one such alternative at least in some areas. Other NTFPs like bamboo, cane, orchids, broom etc. have also great potential (Shukla and Rao, 1993). Though Arunachal Pradesh has a large number of medicinal plants, many of these plants are not used or under utilized due to want of processing or semi-processing units. There is no pharmaceutical industry based on medicinal plants in the State. With availability of suitable techniques of plantation and processing there can be establishments, which use the abundantly available drug resources and add to the economy and public health care of the State.

Similarly, there is also a serious lack of awareness among the people about the potential and scope of medicinal plants. This is despite the rich traditional knowledge available in the State. The SFRI, in collaboration with some of the local NGOs like 'Herbs for Better Health', 'Roing Native-peoples Committee', Itanagar, 'Future Generations', Ziro and 'Pali Vidyapeeth', Choukham, etc., have been conducting awareness programmes, training, workshops and exhibitions at remote and far flung areas. Many of these events generate good response and people come forward to pursue plantation and sustainable harnessing of medicinal plants.

Such interested people can be helped through the recently established State Medicinal Plant Board (SMPB). The SMPB

can act as an interface with farmers, produces, traders and industry in a scientific way and ensure adequate remuneration. The SMPB can also arrange to provide funding support and technical know-how to interested people.

The rich medicinal plant wealth has also been exposed to various adverse factors and pressures. Habitat degradation and destruction, developmental activities leading to damage to habitat, grazing, natural calamities like forest fires, landslides, floods, etc. also affect the medicinal flora of the area. However, the most important cause of depletion and danger for the medicinal plants come from man-made pressures. Illegal and unscientific collections, over-exploitation and trade have resulted in peril of at least some species. Glaring examples in the recent past are *Aconitum, Picrorhiza* and *Taxus wallichiana,* all of which has a highly reduced population now in Tawang and West Kameng districts.

Thus it is imperative to have conservation initiative for medicinal plants both *ex-situ* and *in-situ*. Some locations in Arunachal Pradesh have been identified as medicinal plant conservation priority areas are given in Table 3. The SFRI has also proposed to make the Dichu valley as a medicinal plant sanctuary and Mayodia as Mishmi-Teeta sanctuary. There are some sacred groves like the one at Tawang, which has a high prevalence of medicinal plants. Such areas can be augmented and prioritised for medicinal plant conservation. SFRI medicinal plant gardens, germplasm banks and plantations are ideal sites for *ex-situ* conservation. These plots are also sites for developing silviculture and plantation technique. A long-term conservation programme needs to be evolved as outlined. An ideal option would be to integrate medicinal plant conservation and development into the State Biodiversity Strategy and Action Plan (SBSAP).

Constraints

The SFRI has identified some constraints in the development of medicinal plant sector. These are as follows :

- Lack of proper survey of medicinal plants and documentation of local health traditions and practices.
- Inadequate information on availability of selected species and resource assessment.
- Lack of Registry/Directory of village/ traditional medicinal men/farmers/ traders/entrepreneurs involved in medicinal plant sector in different parts of the State for networking and co-ordination.
- Lack of scientific farming for authentic source of raw material and bulk availability.
- Inadequate trained and skilled manpower for medicinal plant related activities.
- Inadequate financial support for commercial ventures.
- Absence of NGOs working exclusively on this field and an effective extension service.
- Poor interest in the people regarding conservation issues and scope of

sustainable development due to lack of awareness.

- Lack of marketing avenues and infrastructure. There is also a total absence of processing and manufacturing units.

If these constraints are overcome perhaps it will be possible to revive the local health traditions and thus lead to overall development of the medicinal plant sector, which alone can ensure reaching cheaper and effective health care to rural masses. Such an effort can also boost the economy and develop rural employment and income. This will need a concerted effort from all sectors and complementary plans are needed. An outline of a possible action plan and the prospects in the State are listed below :

- Immediate steps to be taken up to survey the medicinal plants and documentation of folk medicines and herbal healing practices. There is a need to strengthen ethno-botanical studies in this tribal State.

- Take up *ex-situ* and *in-situ* conservation programmes for the threatened species of the region.

- Prepare a directory of all-local herbal healers, folk medicine, practitioners, farmers, traders, manufacturers, institutes and other agencies involved in this sector. Disseminate this information to all concerned.

- Take up projects to popularise these folk practices and farming activities, scientific harvesting, post-harvest storage practices etc. through effective extension with the help of NGOs and village level organizations.

- Linkage with experienced NGOs like FRLHT, Bangalore to provide expertise and helps in evolving programmes suitable to the State.

- Funding support from national and international funding agencies for taking up community related activities on plantation, utilization and promotion of traditional systems of medicine.

- Incorporate and give due share in the SBSAP, Arunachal Pradesh for medicinal plants.

- Dovetail existing programmes of the govt. to suit to the developmental needs of medicinal plants.

- Create a 'medicinal plants cell' in the Department of Environment and Forests to act as nodal agency for farming.

- Establish an R & D institute with field stations at different places exclusively for medicinal plants.

- Adopt villages and identify interested beneficiaries for promoting medicinal plant based activities.

- Identify the Arunachal Pradesh Forest Corporation or similar organization as a nodal agency for marketing and trade of medicinal plants.

We also need to

- Prioritise species suitable for

cultivation in specific areas in consultation with local experts.

- Prepare scientific documents, manuals in common and vernacular languages.
- Prepare a database on medicinal and folk medicinal plants.
- Evolve mechanism to protect traditional rights, IPRs etc. and benefit sharing.
- Establish network of medicinal and ethnobotanical gardens with nursery and research facility.
- Establish medicinal plant germplasm banks and medicinal plant protected areas and conservatories.
- Strengthen the State Medicinal Plant Board and enhance its scope and coverage.
- Promote peoples participation and NGO activity in this sector. Include some of these in school education curricula.

To achieve these there is need for a missionary approach with short term and long term plans. The State Medicinal Plant Board can greatly help in this venture. Schools, colleges, NGOs, people and government has to work hand in hand to make programmes successful. There is a need for attitudinal changes in the government to promote these practices. There is also a perceptible change in the global scenario in health care with increasing reliance and shift to herbal healing. The State can take advantage of this positive change and derive advantage. In a nutshell we need to launch a medicinal plant technology mission immediately as done by national government for some other key sectors.

Conclusion

Arunachal Pradesh has well over 500 species of medicinal plants. Many of them are only ethno-botanically important. However, a few are economically important or important from conservation point of view. There are a few agencies like the SFRI, RRC (Ay) and RRL which are doing research on medicinal plants in the State. Considering the magnitude of work these efforts are meagre. There has been increased interest on medicinal plants for economic development. To optimize their harnessing, greater efforts are required with a coordinated action plan and strategies which are outlined above. The recently constitute State Medicinal Plant Board can catalyse these activities. There is also a need for greater attention to the prioritised species and medicinal plant conservation areas. A network of medicinal plant gardens and protected areas can add to effective conservation. With all these programmes and involvement of people the State is poised to take a quantum leap towards rapid progress in herbal health care.

Acknowledgements

The authors are thankful to the Director, State Forest Research Institute, Itanagar and the authorities of Dept. of Environment & Forests, Govt. of Arunachal Pradesh, Itanagar for extending facilities and encouragement.

SUMMARY

The State of Arunachal Pradesh has been recognized as a rich storehouse for herbal medicine. Through ages, people of the State has been utilizing this plant resource to cure various ailments. But in the recent past large scale exploitation of selected species from wild and destruction of habitat has resulted in the depletion of this biological wealth. In the present study an attempt has been made to assess the current status of the resource, the trend of exploitation along with different initiatives taken for sustainable management of this important plant resource. The constraints and strategy of action plan for development has also been outlined in this paper.

अरूणाचल प्रदेश का औषध – पादप सेक्टर – उपरिदृश्य

के० हरिदासन, अनुपम शर्मा, एन०एस० बिष्ट व एल०आर० भुयान

सारांश

अरूणाचय प्रदेश राज्य को जड़ीबूटियों का दवाइयों के लिए भूरापूरा भण्डार स्वीकार किया गया है । युगों-युगों से इस राज्य के लोग अपनी विभिन्न प्रकार की बीमारियों का उपचार करने के लिए इन पादप संसाधनों को उपयोग में लाते आ रहे हैं । परन्तु विगत काल में जंगलों से बड़े परिमाण पर कुछ चुनी हुई जातियों का समुपयोजन करने तथा प्राकृतावास विनाश के कारण यह जैविकीय सम्पत्ति बेहद कम हो गई है । प्रस्तुत अध्ययन में इस संसाधन की वर्तमान स्थिति, समुपयोजन की प्रवृत्ति तथा उसके साथ-साथ इस महत्वपूर्ण पादपीय संसाधन के दीर्घकाल तक चल सकने वाले प्रबन्ध के लिए की गई विभिन्न पहल के आकलन का प्रयास किया गया है । इसके विकास की कार्ययोजना की बाधाएं तथा समरनीति की रूपरेखा भी इस अभिपत्र में बताई गई है ।

References

Bhuyan, L.R. (2000). Some Commercially important medicinal plants of North-Eastern India. *Arunachal Forest News,* **18**: 78-84.

Haridasan, K. (2001). Ethnobotanical studies in Arunachal Pradesh. A status paper presented in *National seminar on Tradition knowledge base on herbal medicines and plant resources of North-East India: protection, utilization and conservation* held from March 13-15, at Guwahati (Assam) organized by NISCOM, CSIR, New Delhi.

Haridasan, K., G.P. Shukla and B.S. Benewal (1995). Medicinal Plants of Arunachal Pradesh, *S.F.R.I. Information Bulletin No. 5.* State Forest Research Institute, Itanagar.

Hegde, S.N. (1988). *Cooptis teeta* Wall. (Mishmi Teeta) - a rare medicinal plant from Arunachal Pradesh. *Arunachal Forest News,* **6**(1) :27-29.

Hegde, S.N. (1994). Potentials of orchid growing and marketing in Arunachal Pradesh. *Proc. Project design workshop on Orchids and Medicinal Plants.* Gangtok, Sikkim.

Kaul, R.N. and K. Haridasan (1987). Forest types of Arunachal Pradesh - A Preliminary study. *J. Econ. Tax. Bot.,* **9** (2): 379-389.

Rao, A.N., K. Haridasan and N.S. Bisht (1998). Vegetative propagation of *Panax* species (Ginseng) in Arunachal Pradesh. *Indian Forester,* **124** (9) : 702-704.

Rawat, M.S. and S. Chowdhury (1998). *Ethno-medico-botany of Arunachal Pradesh (Nishi and Apatani tribes).* Bishan Singh Mahendra Pal Singh, Dehra Dun.

Shukla, G.P. and Kishore Rao (1993). Status of Minor Forest Produce in Arunachal Pradesh. *Arunachal Forest News,* **11** (2) : 8-18.