

# Priorities for Medicinal Plants Research and Development in Pakistan

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Medicinal and Aromatic  
Plants Program in Asia (MAPPA)  
IDRC/SARO



The International Development Research Centre  
Le Centre de recherches pour le développement international  
El Centro Internacional de Investigaciones para el Desarrollo

**ARCHIV  
110243**

# **Priorities for Medicinal Plants Research and Development in Pakistan**

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1999

ARCHIV  
633.88.003  
W5

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Design & production: *Christopher Samuel*  
*Artstock, New Delhi, India.*

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# Foreword

It is reported that more than 1,500 plant species with medicinal properties have been used in Pakistan. Local practitioners of Unani and Folk medicine are reported to be regularly using at least 30 species for the treatment of common ailments. There is a great potential in effectively utilizing these valuable plant resources to improve the primary health care system of the rural communities, especially in the northern mountain regions of the country. Similarly, there are opportunities for rural and tribal peoples to harness the economic potential of these plants through a sustainable system of utilization.

This report provides an overview of the medicinal plants sector in Pakistan and identifies major issues, focussing on priority areas for research and development. The conservation and development activities in medicinal plants are currently facing a number of constraints such as lack of information database and exchange, coordination & collaboration and R&D fund. A holistic approach of study, research and development is required.

The report suggests that further studies are needed to gain an in-depth understanding of the social and institutional context of the market, needs and interests of the key stakeholders and development of a centralized system of information base. It also recommends stronger national coordination and collaboration among different agencies from both formal and non-formal sectors with participation of the private sector where possible.

We hope that the actions and interventions suggested in the report will facilitate the development of a sustainable and viable medicinal plants sector in Pakistan.

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# Acknowledgments

The authors, on behalf of the International Development Research Centre (IDRC) sincerely acknowledge the support of a number of individuals and institutions in completing this report. Specifically, we would like to thank the Pakistan Agricultural Research Council (PARC) for its encouragement and support to conduct this review. The Director of the National Agricultural Research Council (NARC) deserves special thanks for his interest and support to this work.

We are grateful to International Development Research Centre (IDRC), Canada for funding this study through its Medicinal and Aromatic Plants Program in Asia (MAPPA). We specially thank Mr. Roger Finan, Regional Director, SARO and Dr. Madhav Karki, the Regional Program Coordinator, MAPPA for their interest, guidance and support. Dr. Karki has reviewed the document and provided very useful technical suggestions. We thank Ms. Radhika Johari for her meticulous editorial assistance.

We would like to thank all the scientists, officials and other individuals who provided us with information generously and freely without whose cooperation, the report would not have taken this form. We hope that the opportunities highlighted by this report and information contained therein will benefit every one of them.

Finally, we hope that the information compiled in this report will be a valuable reference to the researchers, development planners and conservation workers. Any omissions and shortcomings found in the report are, of course, our own.

Trevor Williams  
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# Executive Summary

This report reviews the current status of the medicinal plants sector in Pakistan, focusing on priority areas for research and development. It reveals the existence of a strong classical traditional medicine sector, based predominantly on the Unani system of medicine, which dates back to the Indus valley civilization. This traditional medicine sector provides an important source of employment, though as yet unquantified, and health care, especially in rural and tribal areas of the country.

Long standing research on medicinal plants in Pakistan also points to a rich resource base, spread over a wide range of ecological zones, with estimates of numbers of plant species with medicinal properties varying from 3,200 species at the upper end of the spectrum to 1,000 at the lower end. Of these species, approximately 500 are known for their active constituents from research conducted in Pakistan and elsewhere, and around 250 to 300 species are known to have entered the herbal markets of Pakistan.

However, despite the strengths and opportunities for the development of the medicinal plants sector described above, it is clear that Pakistan's comparative advantage in producing materials for export, as well as for the domestic market, has not been fully exploited. This is largely due to the fact that at present, there is no clearly definable medicinal plants sector, resulting in the absence of a coordinated approach as well as of clear, result-oriented policies affecting the sector. Such policies relate to areas including regulations and trade practices, the promotion of innovative conservation measures and the sustainable utilization of medicinal plants.

Constraints exist at all levels of the sector. These are discussed in the report and include a fragmented information base; an uncoordinated approach to collection and marketing of medicinal plants; export constraints; training and educational constraints; institutional and funding constraints, and lack of prioritization with regard to species.

What is clearly required is an in depth understanding of the social context of the market, and the contributions, interests and roles of the key stakeholders involved in the medicinal plants sector. These include the central government and its research organizations; provincial governments and their extensions; the private sector dealing with Unani medicine and the practice of traditional medicine, and the collectors, that is, rural and tribal communities. If this base is broadened to include international and regional information networks, on one hand, and relevant non-governmental organizations involved with the collectors and users of medicinal plants on the other, new and effective partnerships could emerge. These would make an invaluable contribution towards achieving the goals of poverty alleviation, environmental and biodiversity conservation and rationalization and an increased share of international trade in raw materials relating to medicinal plants, which would require the implementation of government policies and incentives.



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The Government of Pakistan has in place a number of organizations and initiatives aimed at strengthening and coordinating various aspects of the sector, supplemented by non-government and private sector initiatives. However, stronger coordination of the sector at the national level is not by itself sufficient unless appropriate multidisciplinary strategic action has already been taken at the research and development level.

This report outlines a number of such actions and interventions, which would greatly facilitate progress towards establishing a viable and sustainable medicinal plants sector in Pakistan.

**Priorities  
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## Chapter 1

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# Cultural Background, Health Systems and the Resource Base

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## Chapter 1

# Cultural Background, Health Systems and the Resource Base

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Although modern day Pakistan contains the major archaeological sites of the Indus civilization, originating from around 4500 BC, the cultural fabric of the country owes much to two events. Firstly, the period of Aryan invasions between 4000 and 3500 BC not only created ethnic transformations, but also links to the civilizations of Mesopotamia, Egypt and Greece. Further, international trade relations began to emerge during this period between the region and China, India and the Mediterranean. Secondly, the Muslim conquest of the Indian subcontinent, commencing from 1221 AD, led to divergences in religions and cultures, which continued to co-exist until partition.

The traditional Indian system of medicine, known as Ayurveda, which evolved during the period commencing from around 2500 BC, had been codified and documented by 600 BC. Ayurveda came to be associated with the Hindu peoples, while the Muslim peoples of the subcontinent adopted a different traditional system known as Unani. Unani traces its origins to Greek medicine, which was adopted by the Arabs and thereafter spread to both Europe as well as to India. It had already been enriched by contacts with Chinese and Indian medicine, and with its major spread in India under the Muslim rulers, it became incorporated within the Ayurvedic system. In fact both systems, Ayurveda and Unani, benefited from and complemented each other (Bala, 1982).

The roots of the Unani system go back to the materia medica of numerous early civilizations, many of which are documented. These include the Ebers Papyrus of Egypt (1500 BC) which contains a list of drugs, mostly plant-based; Assyrian and Babylonian pharmacy tablets dating from 650 BC listing 250 herbs; writings of Greeks such as Theophrastus, Pliny the Elder and Galen, and many Arab texts including Avicenna (written by Sheikh Bu Ali Sina, the father of modern Unani), and texts by Ibu al-Baitar (1197-1241 AD). The latter travelled widely through the Mediterranean and Southwest Asia and consolidated many earlier texts, producing a list of 2000 drugs of which 1700 were herb-based (see Hamdard, 1969 for a detailed treatment of this subject).

Western or allopathic medicine was introduced to British India, primarily in order to combat epidemic diseases. However, traditional medicinal systems continued to co-exist for many decades, and after the independence of Pakistan they remained the major system of health care, especially in rural areas. Although the government of Pakistan has actively promoted allopathic medicine it has come to the realization that the traditional systems also have a key role to play, particularly with regard to primary health care.

The dominant traditional system of medicine in Pakistan is the Unani system. This report will therefore focus primarily on this subject. However, it should be noted that there are also numerous and diverse uses of plants as home remedies. Homeopathy is becoming increasingly recognized and accepted as a system of health care. In a few northern areas, *Amchies* and *Sanyasis* (as opposed to the *Hakims* practising Unani) are the hereditary practitioners of somewhat secret medicinal systems which are basically Ayurvedic in nature. Interestingly, tribal peoples in Pakistan do not appear as in India to have developed major systems of medicine, utilizing instead the Unani system of medicine (Cherla and Holley, 1997). However, they have contributed a valuable knowledge base of local plants, though the efficacy of these has not yet been scientifically studied.

## 1.1 The Plant Resource Base

Although the complete flora of Pakistan is not yet known, it is estimated that there are about 6000 species of higher plants (Stewart, 1972). Estimates of numbers of medicinal plant species vary greatly from 3200 species at the higher end of the spectrum (FAO, 1987) to 1000 at the lower end. (Ahmad, 1996). In part this reflects historical work conducted on flora which has basically focussed on taxonomy, with descriptions and plant uses frequently not being stated. This was the case during the period from 1947 to the mid-1960s, during which reports on detailed medicinal usages were incomplete and random. Accumulation of data on medicinal plant usages only began with the implementation of more intensive surveys, conducted on the basis of provinces.

The detailed surveys were conducted under the auspices of several authorities. Examples include surveys carried out in Sind by the Pakistan Agricultural Research Council (PARC), in Baluchistan by the Pakistan Science Foundation (PSF) and in Azad Kashmir by the Pakistan Association for the Advancement of Science. Check lists and references still widely used include those produced by the Pakistan Forest Research Institute (1965). Notable institutions involved in the design and implementation of the surveys include the National Herbarium of PARC which has responsibility for the flora of Pakistan, as well as some of the universities in Pakistan. In response to conservation interests, surveys focusing on specific localities as opposed to widespread surveys, have accelerated in very recent years. An example of such a survey is that of Zaidi (1997).

A number of the more recently conducted studies and surveys stem from the realization that floristic studies alone are inadequate and that considerably more ethnobotanical knowledge is required. This is all the more apparent due to the fact that the *hakims* or traditional practitioners of Unani are primarily concerned with the supply of medicinal plants as opposed to their occurrence and distribution in various regions or ecological zones. (Shinwari, 1996).

Data is not therefore readily available on which species require conservation; their locations, and which species require the use of alternative strategies to reduce over exploitation.

## 1.2 The Medicinal Plants Supply

There are no coordinated methods in use for the collection and sale of medicinal plants. Requirements for specific plants or plant parts are broadcast by wholesalers, using local names to the collectors, who are traditionally nomadic tribes who graze their animals in the mountains during the summer and in the plains during the winter. Collection of medicinal plants provides an additional source of income for the collectors who appear to be predominantly women according to a study carried out in Chitral (Khan et al. 1996).

The dealers are unconcerned about the fact that collectors are untrained with regard to harvesting procedures. This is manifested in increasing tendencies to over-collect on a totally unsustainable basis, and ignorance of the need for seasonal collection of particular materials. In addition, adulteration in order to increase bulk is exceedingly common.

The increasing shortage of medicinal plant supplies was highlighted during a national conference organised by the National Institute of Health, Islamabad in 1991, as well as during a national training workshop on Ethnobotany organised by PARC (National Herbarium), WWF and ICIMOD in 1996. The causes for this were variously attributed to over collecting, over grazing, and cutting of trees for fuelwood, as well as over population in some areas.

Although statistics on the degree of endangerment of species across different provinces, ecologies and climates do not exist, it is clear that medicinal plants come from a wide range of localities. A total of over 700 species of the flora of Pakistan are reported to be endangered (Chaudhri and Qureshi 1991).

Despite the lack of statistics, there is overwhelming agreement among experts in the country that the most threatened ecosystems are temperate forests in the upland areas. One example taken from the Swat region vividly illustrates this as seen in Table 1. Malik *et al.* (1990) also highlight the rapid loss of arid forest ecosystems in protected areas in Baluchistan. The other ecosystems under threat with regard to medicinal plants are desert areas.

Table 1. Medicinal Plants in the Forest Ecosystems of Swat (250-3900m)

Total number of medicinal species	350
Number endangered	5
Number threatened	16
Number vulnerable	18
Number rare	10

(Data from Ahmad and Sirajuddin 1996)

Of the actual species under varying degrees of threat, only 30 percent are included in the Pharmacopoeia. This highlights the point that many species according to ethnobotanic surveys are in fact used, but their efficacy has never been scientifically tested.

### 1.3 Collections of Medicinal Plants

The Unani-based system in Pakistan did not actively promote the establishment of a series of medicinal plant gardens to provide supplies of raw materials for herbal drugs. Instead there has been virtually complete dependence on collection from the wild for local use, consumption by drug companies and even for export purposes.

A number of plantations exist but these are related to research interests and are far from comprehensive. For example, collections exist at the Forest Research Institute, Peshawar and at the Pakistan Council of Scientific and Industrial Research (PCSIR) Laboratories, Peshawar. In addition, some plantations are associated with teaching institutions—universities as well as *hakim* training centres.

Nonetheless, these are all far from comprehensive and amount to little more than specimen collections. Further, they are not well maintained since they have depended on the duration of particular research projects, and all of the collections suffer from lack of funding. In addition, the concept of genetic variation patterns within species' gene pools has hardly been appreciated. For instance, under an externally-funded project, the Forest Research Institute studied the need to regenerate some important indigenous and exotic medicinal plants in the wild forests of the North

West Frontier Province during the period from 1985 to 1991. Twelve species were involved of which one was tested using three provenances; one using two provenances and the remaining ten using a single provenance (Kalim, *et al.* 1992). Studies conducted in most institutions, involving phytochemical analysis, also tend to rely on single provenances.

Yet it is widely known that in the wild, populations existing in particular ecological systems may have diverse contents of active principles. An eco-geographical approach is needed with regard to sampling for research; for maintenance of materials in collections; for evaluation and use and for conservation.

## 1.4 Conservation of the Resource Base

Pakistan has established reserve areas, mainly national parks, covering 10% of the total land area. However, due to the fact that management and resources available for these areas are very limited, over exploitation of medicinal plants continues. Recent funds granted to the Government by the Global Environment Facility are enabling IUCN - Pakistan and the Forest Research Institute to jointly develop management plans, initially for a very limited number of areas. Consequently much more remains to be done.

In a few cases involving hill forests in the Northern areas, agreements are being made, through the provincial forest departments, and community groups, to declare the areas as protected, whereby no extraction of medicinal plants is to be permitted for a period of 6 years. Consequently some degree of regeneration should occur.

In this regard, it is clear that resource tenure rights have to be clarified and that management of resources by local communities and NGOs should be fully incorporated into management plans and strategies for medicinal plants supply.

In sum, it is apparent that *ex situ* conservation of the medicinal plants resource base does not exist, and that *in situ* conservation is not yet effective.

## 1.5 Understanding the Wider Resource Base

Many of the medicinal plants indigenous to Pakistan are also distributed in other countries, where research is ongoing. Pakistani scientists have much to gain by exposure to the wider literature available, for example, on methodologies for evolving commercial varieties of *Plantago ovata*, *Papaver somniferum*, *Rauwolfia serpentina*, *Rosa damascena*, *Vetiveria zizanioides*, *Hyoscymus niger*, several *Mentha* sp., several *Ocimum* sp., and other species in India. In Nepal, plants for the extraction of essential oils involving value addition to the materials have been established at the village level. Tissue culture for propagation has been developed in various laboratories, some with direct relevance to Pakistan.

However, the most strategic need will be for Pakistan to develop research techniques for the evaluation of priority species gene pools so that the best materials can be used in adapting techniques developed elsewhere, or in devising new local techniques for the utilisation of the resource base, while at the same time aiding its conservation. In this respect, tissue culture for conservation and utilisation has been well researched elsewhere with regard to important medicinal plant species such as *Aconitum heterophyllum*, *Nardostachys jatamansi*, *Orchis latifolia*, *Picrorrhiza kurroa* and *Rheum emodi*.



## Chapter 2



# Economic Background





## Chapter 2

### Economic Background

No economic analysis exists to date for the marketing chain from collection to consumption systems. All available data relate to quantities traded in markets at a specific time and their approximate values. Table 2 itemizes availability and quantities of medicinal plants, based on old data. However, the relative proportions have remained almost constant.

Table 2 Medicinal Plants Availability and Quantities

(annual consumption 1978, ■ = sizable quantities available during the mid-1980s)

Plant	Vernacular Name	Annual Consumption (00 kg)	Indigenous or Imported
<i>Acacia concinna</i>	Shikakai	Large quantity	India
■ <i>A. nilotica</i>	Kikar	Large	P, S
<i>Aconitum</i>	Atees bitter	7.4	K, N, P
<i>heterophyllum</i>	Atees sweet	7.4	India
<i>Acorus calamus</i>	Warch or ghorbach	37	B, N / India
■ <i>Adhatoda vasica</i>	Beng-bansa	-	P
<i>Adiantum capillus-veneris</i>	Persoshan	37	K,P
■ <i>Aloe indica</i>	Kasuwar gandal	-	P, S
<i>A. vera</i> (extract)	Mosabbar	1036	Tanzania/Aden
■ <i>Althaea officinalis</i>	Risha Khatmi	74	K,N,P
<i>Anacyclus pyrethrum</i>	Aqarqarah	37	Morocco
■ <i>Apium graveolens</i>	Aimod	-	B,S
<i>Artemisia scapiflorum</i>	Mosli Siyah	74	India/Singapore
<i>A. maritima</i>	Afsantive	-	N
<i>A. absinthium</i>	Afsantive	-	Pakistan
■ <i>A. brevifolia</i>	Afsantive	-	K,N

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Plant	Vernacular Name	Annual Consumption (00 kg)	Indigenous or Imported
<i>Asparagus adscendens</i>	Musli Sufaid	74	India
		185	N,P
<i>A. officinalis</i>	Haliyun	222	Pakistan
<i>A. racemosus</i>	Satawar	55.5	India
■ <i>Berberis lycium</i>	Sunblu, Sumlu	37	B,K,N,P
■ <i>B. vulgaris</i>	Zarishk Shirin	37	B,K,N
<i>Bombax malabaricum</i>	Simbal	37	India
■ <i>Brassica juncea</i>	Raii	74	P,S
■ <i>Buxus papilosa</i>	Shamshad	-	Malakand and Hazara
<i>Coccinia glauca</i>	Gaozaban	370	Iran
■ <i>Calotropis procera</i>	Aska	18.5	B,P,S
■ <i>C. gigantea</i>	Aska	-	B,P,S
<i>Carthamnus tinctorius</i>	Tukhamigartum	-	P
<i>Carum carvi</i>	Zira Sufaid	740	Pakistan/Iran
■ <i>C. bulbocastorum</i>	Zira Siah	-	N
<i>C. copticum</i>	Ajwan	740	P,S
		370	India
■ <i>Cassia absus</i>	Chaksu	185	P (Plantations)
<i>C. angustifolia</i>	Sennahindi	370	S/India
■ <i>C. fistula</i>	Amaltas	370	P,S
■ <i>C. obovata</i>	Kasordhi	-	P,S
<i>Celastrus paniculata</i>	Malkangni	74	India/Pakistan
<i>Centaurea behen</i>	Behman surkh	74	
	Behman sufaid	111	

Plant	Vernacular Name	Annual Consumption (00 kg)	Indigenous or Imported
<i>Cichorium intybus</i>	Tukhme Kasni	148	India/Pakistan
<i>Citrullus colocynthis</i>	Tumba	111	P,S
<i>Colchicum luteum</i>	Suranjan	370	Iran/ Afghanistan (but also in P)
■ <i>Commiphora mukul</i>	Guggulu	185	B,S
<i>Cordia dichotoma</i>	Lasurian	370	Pakistan
■ <i>C. latifolia</i>	Sapistan	-	P,S
<i>Coriandrum sativum</i>	Dhania	740	P
<i>Cucumis melo</i>	Kuchri	185	India/Pakistan
<i>Curcuma amoda</i>	Amba Haldi	37	India
<i>Cydonia Vulgaris</i>	Bhidana	74	India/Spain/Iran
■ <i>Delphinium denudatum</i>	Jodwar	-	K,N
■ <i>Dioscorea deltoides</i>	Kanis	-	K,N
<i>Embelia ribes</i>	Baobarang	148	N,P
■ <i>Embelica officinalis</i>	Amla	-	P,S
■ <i>Ephedra gerardiana</i>	Asmani	-	K,N
■ <i>E. rebradeis</i>	Nan-oman	-	B,N
<i>Euphorbia resinifera</i>	Farfiyun	3.7	India/Pakistan
■ <i>Fagonia cretica</i>	Dhamasa	-	Widespread
■ <i>Ferula foetida</i>	Hing	370	Afghanistan (but also in B.)
<i>Ficus carica</i>	Anjir	3700	-----
■ <i>Foeniculum vulgare</i>	Sonf	-	N,P
<i>Fumaria parviflora</i>	Pit Papar	185	N,P

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Plant	Vernacular Name	Annual Consumption (00 kg)	Indigenous or Imported
<i>Glycyrrhiza glabra</i>	Malathi	1036 (Extract only)	China
■ <i>Greuria asiatica</i>	Phalsa	-	P,S
<i>Holarrhena antidysenterica</i>	Indirjo	-	India
<i>Hygrophila spinosa</i>	Talmikhana	74	India
<i>Hyoscyamus niger</i>	Ajwan-e-Khurasanni	185	B,K,N
<i>Illicium anisatum</i>	Bakiankhatai	111	China
<i>I. grifithii</i>	Saunfa	740	Pakistan
■ <i>Lallemantia royleana</i>	Tukhami balangh	-	P,S
<i>Lamprachaenium microcephalum</i>	Brahmi dandi	37	Pakistan
<i>Lavendula stoechas</i>	Ustukhudus	414	Bahrain
■ <i>Lawsonia alba</i>	Hena	-	P,S
■ <i>Lepidium sativum</i>	Halon	-	P
<i>Linum usitatissimum</i>	Alsi	148	Cultivated
<i>Lochnera rosea</i>	Ratanjot	185	Pakistan
<i>Lycopus europaeus</i>	Julnim	37	K
■ <i>Mallotus philippinensis</i>	Kamila	37	K,N,S
■ <i>Malva sylvestris</i>	Tukhami-khubazi	-	P
<i>Matricaria chamomilla</i> ( <i>Anthemidis floris</i> )	Babuna	37	B,P
<i>Melia azadirachta</i>	Tukhm Bakain	18.5	B,P
<i>Melia azedrach</i>	Nim	As much as possible	N,P,S
■ <i>Mentha piperata</i>	Janghi podina	-	K,N

Plant	Vernacular Name	Annual Consumption (00 kg)	Indigenous or Imported
<i>Mimosa pudica</i>	Lajwanti	37	India/Bangladesh
<i>Morus alba</i>	Shehtoot	37	Cultivated
<i>Myristica fragrans</i>	Jaiful	148	India/Pakistan
<i>Myrtus communis</i>	Habul-Aas	148	B,K,N, also cultivated
<i>Nelumbium speciosum</i>	Kauldode	185	Pakistan
<i>Nepeta ruderalis</i>	Badrangboya	37	B
■ <i>Nigella sativa</i>	Kalonji	111	P
<i>Nymphaea alba</i>	Gul Nilofar	222	P,S
■ <i>Ocimum basilicum</i>	Takhan-e-fang mushk	-	B,S (cultivated)
■ <i>O. pilosum</i>	Tukhan-e-rehan	-	N
<i>Onosma echioides</i>	Ratanjot	185	N
■ <i>Peganum hermala</i>	Hermal	-	B,S
■ <i>Peucedanum graveolens</i>	Sowa	370	B,P
<i>Piper cubeba</i>	Kababchini	37	Singapore
<i>Pistacia integerrima</i>	Kakar Singhi	74	N,P
■ <i>Plantago major</i>	Bartung	111	China/India (but also in B,P)
■ <i>P. ovata</i>	Isabaghol	740	B,P,S
<i>Polygonum viviparum</i>	Anjbar	370	India
■ <i>Pongamia glabra</i>	Karanjawa	-	S
■ <i>Psoralea corylifolia</i>	Babchi	Large quantity	India
■ <i>Punica granatum</i>	Anar-dana	-	Cultivated in B,N,P
<i>Quercus infectoria</i>	Maju	148	Iran

Priorities for Medicinal Plants Research and Development in Pakistan

Plant	Vernacular Name	Annual Consumption (00 kg)	Indigenous or Imported
■ <i>Rhazya stricta</i>	Rangobul	-	B,N,P,S
■ <i>Rheum emodi</i>	Revandchini	-	K,N
■ <i>Rhododendron campanulatum</i>	Cherailu	-	K,N
■ <i>Ricinus communis</i>	Arind	-	B,S
■ <i>Rosa damascena</i>	Gul-surkh	-	Cultivated in B,P,S
■ <i>R. moschata</i>	Jangli-gulab	-	K,N,P
<i>Rumex maritimus</i>	Beechbund	74	P
<i>Salvia plebeia</i>	Kammarkas	As much as possible	B,P,S
■ <i>Salvadora persica</i>	Pilu	-	B,P,S
<i>Sapindus trifoliatus</i>	Ritha	As much as possible	India/Bangladesh
■ <i>S. mukrossi</i>		-	P,S
■ <i>Saussurea lappa</i>	Kuth	37	K,N
<i>Semecarpus anacardium</i>	Bhilawan	111	India
■ <i>Sesamum indicum</i>	Til	-	N,P,S
■ <i>Skimmia laureola</i>	Nair	-	K,N,P
<i>Sida cordifolia</i>	Bekh bandlal	74	N,P
<i>Solanum nigrum</i>	Tukham Mako	74	All provinces
<i>Strychnos nux-vomica</i>	Kuchla	740	China/Sri Lanka
<i>Swertia chirata</i>	Chirata shirin	370	N,P
<i>Terminalia chebula</i>	Halila	370	India/Sri Lanka
<i>Tinospora cordifolia</i>	Giloe	As much as possible	P
■ <i>Tribulus terrestris</i>	Gokru-khurd	-	S

Plant	Vernacular Name	Annual Consumption (00 kg)	Indigenous or Imported
■ <i>Thymus serpyllum</i>	Ban-ajwain	-	B,N
<i>Valeriana hardwickii</i>	Bekh Kabir	-	Pakistan
■ <i>Valeriana wallichii</i>	Mushkbala	-	K,N,P
■ <i>Viola odorata</i>	Banafsha	370	K,N,P
■ <i>V. serpens</i>	Banafsha	-	K,P
<i>Vitis vinifera</i>	Munaqqa	740	Pakistan
■ <i>Withania coagulens</i>	Painr dodii	-	B,S
■ <i>W. somnifera</i>	Asgan	-	India (also in B,N,P,S)
<i>Zanthoxylum alatum</i>	Timmer	3700	N,P
<i>Ziziphus sativa</i>	Unab	370	Iran/ Afghanistan (also in B,K,N,P)

- 1) Data from Ikram and Fazal 1978, and from manuscripts available at PCSIR, and PFI, Peshawar.
- 2) B= Baluchistan, K= Kashmir, N= NWFP (North West Frontier Province), P= Punjab, S= Sind

Of considerable concern is the fact that many of the species listed in Table 2 with an asterisk attached to their names were plentiful in the 1980s but are now rare or becoming extinct, irrespective of habitat. These include *Dioscorea deltooides* from exposed habitats, and *Podophyllum emodi* from coniferous forests.

The origins of species is of great interest because large quantities of individual medicinal plants come from Afghanistan, for example *Colchicum luteum*, *Ferula foetida* and *Glycyrrhiza glabra*. All three species are also indigenous to Pakistan but local supplies are inadequate or unavailed of by traders. Other plants are imported from India, Sri Lanka, China, Bahrain, Iran, Yemen, Morocco, Tanzania and Spain. The amounts imported are not clear, with the exception of species which are not found at all in Pakistan. Much of the importing is across borders and takes place in the informal sector.

In some cases, the imports are long-standing and traditional. Scientific knowledge has never been applied with regard to substituting local species for imports. Thus, for instance, *Paeonia officinalis* is still imported despite the fact that *P. emodi* which is a good substitute, is locally available and has the same medicinal properties (Qureshi and Ahmad, 1996).

## 2.1 Herbal Markets

Most traders are reluctant to disclose volumes of trade for fear that information will be passed on to the tax authorities (Khan, 1985). However, it is known that trade in herbal materials is monopolised by wholesale drug dealers in most of the markets, with the remaining shopkeepers and dispensers relying on the wholesalers for their supplies (Appendix 1).

A survey of the drug markets carried out by the Pakistan Forest Institute in Peshawar gathered information on 250 plants and their volumes traded. Consumption of some imported medicinal plants in *Pansar* markets (Peshawar and Mardan in NWFP; Rawalpindi, Lahore, Faisalabad, Multan and Bhawalpur in Punjab; Hyderabad and Karachi in Sind) are shown in Tables 3, 4, 5 and 6.

In addition to the species shown in the tables, the following could be added to illustrate the dependence on imports - to Table 3: *Zizyphus vulgaris* from Afghanistan; to Table 4: *Terminalia chebula* from India; to Table 6: *Prunus cydonia* from Spain, *Rubia Cordifolia* from Iran, *Alpinia galanga* from India and Bangladesh, *Pimpinella anisum* from Iran, *Nepeta ruderalis* and *Lavendula stoechas*, both from Iraq and Iran, *Plumbago Zeylanica* from China, *Cuscuta reflexa* from India and *Hygrophila spinosa* from Afghanistan.

Table 3 Consumption of Crude Drugs in Pansar Markets of Pakistan

A. More than 200 tons sold :

Species	Local Name	Part Used	Quantity Consumed t/annum	Approximate Value in 000 (Rs)	Source
<i>Glycyrrhiza glabra</i>	Mulathi	Roots	2506	16289	Major source of supply is Afghanistan; material is sent to Karachi
<i>Carum copticum</i>	Ajwain	Seeds	274	2466	Sindh, Swat & Hazara
<i>Valeriana wallichii</i>	Mushk-e-	Roots	282	4760	Swat, Dir & Hazara.
<i>Punica granatum</i>	Anardana	Seeds	349	593	Haripur & Hazara are the main centres for collecting.
<i>Cuminum cyminum</i>	Zeera safaid	Fruits	267	3471	Baluchistan.
<i>Onosma bracteatum</i>	Gaozaban	Leaves	370	2960	Iran.
<i>Carum bulbocastanum</i>	Kalazeera	Fruits	297	14850	Chitral & Gilgit Agency.

(Data from Khan 1991)



Table 4 Consumption of Crude Drugs in Pansar Markets of Pakistan

B. 100-200 tons sold :

Species	Local Name	Part Used	Quantity Consumed /annum	Approximate value in 000(Rs)	Source
<i>Viola serpens</i>	Banafsha	Leaves	127	825	Swat & Hazara
		Flowers	118	7080	
<i>Adiantum capillus-veneris</i>	Personshan	Whole Plant	175	1225	Swat, Hazara Dir, etc.
<i>Ferula foetida</i>	Hing	Gum	183	16470	Gilgit & Afghanistan.
<i>Polygonum amplexicaule</i>	Anjabar	Roots	116	754	Swat, Hazara & Rawalpindi.
<i>Rheum emodi</i>	Revand Chini	Roots	126	630	Swat, Hazara & Peshawar.

(Data from Khan 1991)

Table 5 Consumption of Crude Drugs in Pansar Markets of Pakistan

C. Less than 100 tonnes sold :

Species	Local Name	Part Used	Quantity Consumed /annum	Approximate value in 000(Rs)	Source
<i>Artemisia quettensis</i>	Afsantine	Twigs	54	162	Parachinar
<i>Peganum harmala</i>	Hermal	Seeds	98	294	NWFP, Punjab & Baluchistan.
<i>Sisymbrium irio</i>	Khakshir	Seeds	81	810	NWFP & Punjab.
<i>Cichorium intybus</i>	Kasni	Seeds & Roots	53	795	Punjab.
<i>Saussurea lappa</i>	Kuth	Roots	50	150	Azad Kashmir.

(Data from Khan 1991)

Table 6 Consumption of Crude Drugs in Pansar Markets of Pakistan

D. Less than 50 tons sold :

Species	Local Name	Part Used	Quantity Consumed /annum	Approximate value in 000(Rs)	Source
<i>Swertia chirata</i>	Chirata	Leaves	33	330	Swat & Hazara
<i>Berberis lycium</i>	Darhald	Roots	43	744	Swat, Hazara & Dir.
<i>Hyoscyamus niger</i>	Khurasani ajwain	Seeds	30	840	Peshawar & Quetta.
<i>Centella asiatica</i>	Barmi booti	Whole Plant	9	135	Hazara, Swat & India.
<i>Ocimum Basilicum</i>	Tukhm-e-frangmushk	Seeds	2	120	Quetta & Iran.
<i>Carthamus tinctorius</i>	Tukham-e-gartum	Seeds	11	66	Punjab.
<i>Aconitum napellus</i>	Atis	Corms	31	120	NWFP especially Swat & Hazara.

(Data from Khan, 1991)

## 2.2 Manufacturers

There are about 15 major manufacturers (*Dawakana*) of drug preparations following the Unani system. Drugs are made up according to Unani recipes, and packaged and sold through shopkeepers and dispensaries.

The formulations may be complex as shown in Table 7 or relatively simple as shown in Table 8.

Table 7 Formulation for Mufforeh Mo'fadil

Plant	Local Name	Quantity
<i>Cuscuta reflexa</i>	aftimum	30g
<i>Aquilaria agallocha</i>	agar	10g
<i>Nepeta hindostana</i>	badranj boya	20g
<i>Pterocarpus santalinus</i>	burada sandal surkh	40g

Plant	Local Name	Quantity
<i>Santalum album</i>	burada sandal safaid	40g
<i>Onosma bracteatum</i>	berg gaozaban	10g
<i>Bambusa arundinacea</i>	banglochan	40g
<i>Papaver somniferum</i>	tukhm khashkhash	20g
<i>Ocimum basilicum</i>	tukhm franjmushk	20g
<i>Cichorium intybus</i>	tukhm hasni	25g
<i>Doronicum hookeri</i>	daranaaj agrabi	10g
<i>Zingiber zerumbet</i>	narhachur	20g
<i>Cinnamomum cassia</i>	sazai Hindi	20g
<i>Coriandrum sativum</i>	kishniz khushk	25g
<i>Armenian bole</i>	gil Armani	20g
<i>Viola odorata</i>	gul banafshah	30g
<i>Rosa damascena</i>	gul-i-surkh	30g
<i>Camphora officinarum</i>	hafur	5g
<i>Corallium rubrum</i>	bussud ahmar mahlul	10g
<i>Vateria indica</i>	kahruba-i-shamai	25g
<i>Pearls, ground</i>	marwarid mahlul	10g
Honey	shehed	850g
White sugar syrup	gieram shakar safaid	850g
Sodium benzoate	nitrun bunjawi	3g
<i>Ambra grassea</i>	ambar	10g
Musk	mushk	600g
<i>Crocus sativus</i>	zofran	5g
<i>Aqua Onosma bracteatum</i>	arg gaozaban	20ml
Silver foil	warag nugra	10g

Dosage : 5g in the morning as a cardiac stimulant/cephalic tonic/anodyne antipalpitant/cure for melancholia.

Source: Hamdard Pharmacopoeia

Table 8 Formulation for Ma'jun Anjir

Plant	Local name	Quantity
<i>Terminalia chebula</i>	poast halila zard	125g
<i>Ipomoea turpethum</i>	turbud safaid	50g
<i>Convolvulus scanmonia</i>	saqmunia	50g
<i>Cassia angustifolia</i>	sani-i-makki	50g
<i>Rosa damascena</i>	gul-i-surkh	50g
<i>Ficus carica</i>	anjir zard	50g
<i>Vitis vinifera</i>	mawaiz munaqqa	250g
White sugar syrup	giwam shakar safaid	

Dosage : 10g at night with milk for persistent constipation.

Source : Hamdard Pharmacopoeia

## 2.3 Constraints and Interventions in Marketing and Manufacturing Herbal Drugs

It is widely opined that a number of preparations available to *hakims* and on sale in dispensaries are below standard and often do not work. There are several reasons for this: adulteration at the collecting level; non-availability and therefore omission of a particular ingredient from a preparation of which it forms a component; and poor storage (unhygienic, poor ventilation, infestation by microorganisms). Quality is therefore a vital consideration.

In addition to preparation and sale of herbal formulations, some of the large companies are well aware of the constraints involved and are trying to overcome them. A leading company in this field is Hamdard which has a Pharmaceutical Advisory Committee and which has established the prominent and widely known Unani Institute of Health and Tibbi Research in Karachi. It is headed by Hakim Mohammed Said. Another smaller company which manufactures remedies, Quirshi, also tries to maintain quality standards.

The government is aware of the constraints but lacks the manpower to address them. The Ministry of Health through a programme on traditional medicine is keen to introduce traditional medicine for primary health care into villages but the situation is complex and the programme under-funded.

The sheer scale of education and training required at the practitioners level can be appreciated when it is estimated that there are over 50,000 *hakims*, many of whom are poorly educated.

Despite a lack of certain materials and adulteration, a few examples do illustrate the levels of profit accruing along the chain. Qureshi and Ahmad (1996) cite the case of *Viola odorata* flowers. These are picked by the collectors, dried and transported to the wholesalers in the town. One kilogram is purchased for Rs. 150. The wholesalers then sell the product to retailers at the rate of Rs. 350/kg, and finally the retailers sell it at a rate of Rs. 5/10g (Rs. 500/kg). The collector is not always involved in this activity for the sole purpose of a cash return. In remote areas such as upland valleys, Zaidi (1996) notes that local people collect medicinal plants for home use with a certain amount being taken to the market to be exchanged for provisions rather than for cash sale.

## 2.4 Exports of Medicinal Plants.

In the last 15 years, Pakistan has exported limited quantities of medicinal plants. Table 9 lists nine important species. However the quantities described are outdated since they apply to 1978.

Table 9 Crude Drugs Exported from Pakistan

Sl. No.	Name of Plant	Part Used	Total Quantity in kg
1.	<i>Acacia arabica</i>	Gum	857,075
2.	<i>Carum copticum</i>	Fruits	9,900
3.	<i>Cuminum cyminum</i>	Fruits	687,950
4.	<i>Ephedra sp.</i>	Twigs	64,950
5.	<i>Foeniculum vulgare</i>	Fruits	316,650
6.	<i>Papaver somniferum</i>	Seeds	731,200
7.	<i>Rheum emodi</i>	Roots	143,000
8.	<i>Ricinus communis</i>	Seeds	6,937,000
9.	<i>Valeriana wallichii</i>	Rhizomes	346,320

(Data from Ikram and Hussain 1978)

Of the species described above, *Ephedra* has been the most exploited and export is therefore restricted by the CITES Convention. *Rheum emodi* and *Valeriana wallichii* are also grossly over-collected. Other species erratically entering the exports arena are *Lawsonia alba*, *Glycyrrhiza glabra*, *Rosa damascena* and *Plantago ovata*. Exports are made sporadically to Dubai, France, Germany, Hong Kong, Korea, India, Italy, Japan, Saudi Arabia, Singapore, Sri Lanka, Switzerland, UK and USA. and are largely channelled through the Karachi market. Around ten companies are involved with the export of medicinal plants (Menon and Shahani, 1988).

### Constraints Related to Exports

Export of herbal products from Pakistan is constrained by quality considerations, which often fail to conform to the standards required by importing countries. The materials are very rarely screened for active ingredient contents. Further, where materials are collected from the wild, investigations for adulteration need to be carried out.

From time to time it has been proposed that cultivation would ensure higher quality for export. However, most attempts in the past which have resulted in production from cultivation relate to aromatic plants and flavourings/spices.

Cultivation of plants for herbal drugs in Pakistan, related to exports, has to date involved *Plantago ovata*, *Mentha piperata*, *Ocimum basilicum*, *Dioscorea sp.*, *Ricinus communis*, as well as flavourings such as coriander, garlic, and tumeric (Ahmad 1996). The Government's Export Promotion Bureau often combines statistics of medicinal plants with those of aromatics. Analysis of the statistics is not therefore very meaningful.

## 2.5 Constituents of Medicinal Plants

Whereas around 250 to 300 species enter the herbal markets in Pakistan, approximately 500 are known for their active constituents, either from research done in Pakistan or in other countries.

Research has been carried out by PCSIR Laboratories in particular, as well as by some universities. The pharmaceutical industry has always been interested in plant sources from which finished allopathic drugs can be prepared or parts extracted to provide chemical constituents which form components of other drugs. Similarly, homeopathic factories emphasize constituents.

A limited number of Pakistani drug companies do exist, notable examples being Hamdard, Kurram Chemical Company, Rawalpindi, and Marker Alkaloids, Quetta. However, companies in Pakistan are largely representatives of Western companies, mostly involved in packaging and labelling drugs as opposed to local research and development. There have been no government incentives to change this situation.

One institution which, however, has adopted an innovative approach is the Institute of Chemistry under the University of Karachi, headed by Prof. Atta-ur-Rahman. Due to foreign funding, the Institute has been able to focus on commercially viable products using plant extracts, for example, essential oils from the spices mentioned above; constituents of *Datura*, *Dioscorea* and *Catharanthus*, and about 17 other compounds. It has also become involved with pilot plant development.

What is missing however is detailed and specific export market knowledge of who wants what, where and what prices are likely to be obtained. This is largely an international responsibility and some agency should be in a position to broker such deals to benefit developing countries. However, this is an issue for the government to raise with international organizations such as UNIDO and WHO.

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## **Chapter 3**

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# **The Traditional Health Care System**

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## Chapter 3

### The Traditional Health Care System

The Unani system has been passed down over the centuries largely in the form of oral tradition. The practitioner is known as a *Hakim Tabbib*, meaning healer, and is the holder of a specialized body of knowledge.

In Pakistan there are over 50,000 *hakims*. However, there is great variation amongst them: some are full-time professionals; others are simply knowledgeable about remedies for household and village use. The latter are known as *Yuri Dosaks* (often women), whose skills, involve diagnosis of illness from an assessment of the pulse and general appearance. Additionally, at the village level there are *Dais* (singular *da*) who function as local midwives, as well as bonesetters. They are unqualified practitioners.

There are 22 colleges in Pakistan providing education and training for *hakims*. Most offer a four year post—secondary school course. However, many of the *hakims* are not trained in this way.

The practitioners are complemented by dispensers. However they are usually "C grade" pharmacists focusing on allopathy, and the system is not well regulated.

In rural areas the choice between selecting an allopathic doctor and a *hakim* depends on the availability of the practitioner; the availability of allopathic drugs and experience resulting from the benefit derived from either system.

There is certainly a tendency for the older segments of the population to favour traditional medicine. However, studies do not provide the data required to elucidate why certain traditional remedies are preferred over others. In part, this must relate to common knowledge regarding the medicinal plants occurring in a particular locality versus specialist knowledge of *hakims* who possess a much broader knowledge base regarding the usage of medicinal plants.

In the Unani system there is an inherent belief, following Galen, in the "temperament" of the drug-hot, cold, moist-and the "temperament" of the patient.

#### 3.1 Government Interventions

The Ministry of Health follows a system for registering medical practitioners through the :

1. Medical /Dental Council (for allopathic medicine)
2. Pharmaceutical Council (for pharmacists)
3. Unani Council (for traditional *hakims*), and
4. Homeopathic Council (for homeopaths).

However, of the 50,000 known *hakims*, only a small number is registered with the Council. There is no policy to prevent the "untrained" *hakims* from practising.



The Ministry of Health also has the stated aim of developing a traditional pharmacopoeia, though the only one currently available has been produced by Hamdard. Further, the Ministry insists that all herbal remedies be free of steroids as well as allopathic formulations, and in recognition of the need for authentication of the plant contents of herbal remedies, is as far as possible, promoting the listing of ingredients on packaging, as well as batch numbers inferring shelf life. While a start has been made in this area, there is a long way to go yet.

With regard to authentication, the question of whether or not the efficacy conforms to the standards of allopathy in the West is somewhat irrelevant in situations where poor people cannot afford pharmaceuticals, a point stressed by Lambert *et al.* (1997). These authors also point to the fact that "seemingly effective treatments exist for skin ailments, minor pain, infections, anaemia, other nutritional disorders and many more complaints that are mundane rather than life-threatening".

Nearly 150 of the most commonly used herbal drugs in Pakistan have been standardized and knowledge of their constituents documented through the efforts of PCSIR. Whereas the policy of the Ministry of Health which is not only of national but of international significance (Budeker 1995), is aimed at the promotion of traditional medicine, it is also imperative that it is safely utilized. In terms of local policy, a report for FAO produced in 1995 stated that Pakistani firms are not prepared to respond to the needs of an evermore conscious market (Saeed 1995). Hence the basic information provided by research is frequently not disseminated.

Shelf life is extremely important since Unani medicines incorporate herbal, animal and mineral ingredients. Depending on the type of preparation, the storage containers are also important:

"Itriphals" contain *Emblica officinalis*, *Terminalia bellerica* and *T. chebula* as the major ingredients and require glass containers since astringency blackens metal. Pills and tablets, containing resins need coating and storage in airtight containers. Preparations containing volatile substances, for example, camphor, need to be kept in airtight containers. The Hamdard Pharmacopoeia provides guidelines in this regard although these are certainly not applied fully by local druggists.

### **3.2 Constraints to Promoting Traditional Medicine**

A number of scientists informed the authors that one of the weakest areas with regard to traditional medicine is that of diagnosis of diseases. This is an area beyond that of developing a vigorous medicinal plant sector in the country and is largely a question of education. The programme on traditional medicine carried out by the Ministry of Health lacks the funding and manpower to provide this. Consequently, workshops and seminars required to broaden the outlook of *hakims* and homeopaths in rural areas, and small booklets on prescriptions, are curtailed unless outside funding is made available.

The question of quality control is another area which needs to be pursued. So far the government has not vigorously promoted quality control in practice, despite the fact that indigenous drug manufacture is governed by the Drugs Act. Standardization of indigenous drugs, which is essential, is an area in which the Hamdard Foundation has taken a lead.

The wider availability of high quality standard preparations would go a long way to increasing confidence at the local level in the blending of diagnosis and therapeutics.

Nonetheless, quality considerations commence at the initial stage of collection of herbs. There is a lack of promotion and dissemination of scientific information available on collecting, harvesting methods, packing, storing and even grading material. Government institutions may well recognize this but the real lack of zealous extension from the agriculture and forestry lands to the village farmer level represents the major constraint. Concomitantly, this explains why technologies such as cultivation are not fully disseminated from the research institute level.

Policy development at the government level could change the current situation. However, from the perspective of medicinal plants, this would have to span the Ministries of Agriculture, Environment and Forests, Science, Education and Health.

### 3.3 New Development Directions

Internationally, it has become widely recognized that extractive systems can only be sustainable if they are managed by local people. The traditional local associations or cooperatives are presently evolving into forest societies and community organizations with responsibilities for management, regulation and conservation.

In Pakistan, the Aga Khan Rural Support Programme has developed a participatory approach in the northern areas of Chitral. This type of approach has been adopted as part of the Pakistan National Conservation Strategy.

However, major gaps currently exist between the research being conducted on medicinal plants and rural development initiatives. Although the latter are being considered by conservationists, too much emphasis at present is being placed on the documentation of ethnobotany and not enough on prioritizing and using medicinal plants as a means of poverty alleviation. Some of the institutions conducting research have become involved in biodiversity surveys for conservation in association with the funding body, IUCN-Pakistan, which acts for the Ministry of Environment and Forests. However, while recommendations have been made, it remains to be seen whether or not these are fully put into effect by the local authorities.

Institutional innovations for community development are a recent phenomenon which are still being discussed. There are still however a number of resource constraints. Possibilities and constraints were discussed as recently as May 1997 during a conference held in Islamabad, organized by the Organization for Islamic Conference Standing Committee on Scientific and Technological Cooperation (COMSTECH). However, schemes for community development must not only aim to revitalize the local economy, but also to save biodiversity, provide the poor with increased incomes, protect and capitalize on indigenous knowledge and respect and integrate traditional medicine into the mainstream.

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## Chapter 4

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# Information and Coordination

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Major progress has been made over the past 35 years in documenting the medicinal plants of Pakistan. Simultaneously, reference specimens are currently available in a number of herbaria—the National Herbarium in Islamabad has become a focal repository for such collections.

However, concurrent documentation of the usages of the medicinal plant species has not fared so well. This is due in part to the fact that a completed National Unani Pharmacopoeia is not available, although considerable credit has to be given to Hamdard for at least partially filling this major gap. To some degree, the gaps in information are due to uses being listed in research reports, frequently without any validation whatsoever, or without stated dosages or methods of treatment.

The problem has been exacerbated over the past five years due to the fact that national interest in biodiversity has led to yet more and more listings of putative ethnobotanical uses without any attempt being made to investigate and verify beyond statements made during interviews, and no details being provided with regard to dosages, length of treatment etc. As a result, while hundreds of species are being added to the lists, especially with regard to home remedies, the essential details are lacking. In some cases attempts are being made to rectify this situation. For instance, a survey carried out by PFRI, Peshawar, in the northern mountainous regions identified plant species already known for their active principles. In addition, other species were sampled and sent to the Institute of Chemistry, University of Karachi for assessment (Zaidi 1997).

#### 4.1 General Constraints to Information Flow

Nearly all government institutions involved with medicinal plant research are constrained by lack of funding and manpower since staff vacancies tend to remain frozen. Their objective is to continue programmes initiated up to decades ago, without introducing new strategic planning methods to address urgent development and conservation needs, including poverty alleviation. At the same time, adequate mechanisms for the adoption of available technologies at the farmer or village level do not exist.

The limited number of recent national workshops, in areas such as cultivation technologies or upgradation of the knowledge of *hakims* regarding medicinal plants, have not to date led to major changes.

Moreover, when one particular institution acts as a focal point for regional networks, relevant information does not always flow to other institutions within the country. An example is the FAO Asian Network on Medicinal and Aromatic Plants.

Furthermore, in order to develop a clear national policy, research institutions need to not only develop strategic planning but also to appreciate the constraints which result in slow action in the development field.

## 4.2 Marketing and Socio-Economic Information

Existing marketing data, which is in any case outdated, relates solely to prices in markets and amounts of raw materials required. New studies are therefore needed in this area. Markets are clearly imperfect in terms of price setting due to the restricted flow of information. Each transformation point needs to be understood with reference to the stakeholders involved, their functions and the horizontal and vertical market linkages.

Studies have to deal with the whole chain of transactions from collectors through petty traders, private agents, wholesale dealers and finally consumers. No such studies are available in Pakistan.

Furthermore, there are no adequate socio-economic studies relating to the participants, showing the extent of their reliance on their input to the chain of transactions and the manner in which their immediate dependents gain through their input. The collectors are almost certainly the poorest of the poor and any development interventions should attempt to improve their lot through their active participation as custodians of biodiversity. The collectors receive minimum wages and this situation will not improve until they have better access to information on prices, quality requirements, and timing of demand to enable them to plan their collecting activities. Almost certainly, strengthening the existing linkages between actors in the early stages of a production to consumption system would increase bargaining power for collectors and local traders.

A number of studies from Nepal, including one conducted by Olsen-Smith (1996), would be invaluable for Pakistani researchers.

Much of the trade and marketing, including movement of herbal products across borders, take place in the informal sector. It is not clear whether or not there are actual enforceable regulations for particular products. Most regulatory and policy interventions have concentrated on exports and little has been done to address the domestic market or the question of equity among diverse actors in the production to consumption system.

## 4.3 Information on Priorities

There is no priority listing agreed on by the majority of researchers as to which are the most important medicinal plants on which to focus. Although the national pharmaceutical industry concentrates on about 20 species, the consideration is, primarily commercial. Priority setting has to include a number of criteria including the threat of genetic erosion; value to the overall economy, including local people; value in local and traditional health care systems and sustainable use extending into the future, amongst others.

This lack of priority listing stems from the lack of a central computerised information database incorporating commercial values, status regarding degrees of overexploitation in the wild, health care needs, rural community development needs and information on patterns of variation within species. Some proposed interventions are outlined later in this report.

#### 4.4 Access of Researchers to Information

For a number of reasons, most institutions researching medicinal plants do not appear to have links, except in passing, to ongoing activities in other countries. India for instance has two important computerised databases. One is the bimonthly "Medicinal and Aromatic Plants Abstracts", under the auspices of the Council of Scientific and Industrial Research, which scans 600 journals from 55 countries. Another Indian national database, IMMEDPLANT, covers activities of research institutions relating to medicinal plant taxonomy, phytochemistry, pharmacognosy, agro-technology and traditional medicine.

The FAO regional network has been mentioned earlier. In addition, there is also a UNESCO network as well as the Asia-Pacific Information Network on Medicinal and Aromatic Plants, established in 1987. Although Pakistan is a member of the latter network, information flow to national institutions is not as efficient as it could be.

A more recent network, the IDRC Medicinal Plants Network, now known as the Medicinal and Aromatic Plants Program in Asia, with headquarters at the regional office of the International Development Research Centre (Canada) in New Delhi, focuses on research and networking with special reference to targeting the very poor; the well-being of women and poverty alleviation. It has only recently established links with Pakistan in 1996, when a workshop on the role of bamboo, rattan and medicinal plants in mountain development was held in Pokhara, Nepal.

The IDRC network has issued a Code of Conduct for researchers involved in the study of various aspects of medicinal plants. (See Appendix 2), and a declaration concerning mountain development (see Appendix 3). Both provide useful guidelines for institutions in Pakistan for developing strategic planning methods in relation to medicinal plants. The declaration shown in Appendix 3 stresses the need for networking and information dissemination in the region, just as the regional political grouping, SAARC, stresses the same for genetic resources of useful plants.

#### 4.5 Information on Toxicology

There is a need to ensure that plants used as drugs by rural people are not toxic in any way. Whereas for Unani preparations, this is not an urgent concern since tradition has over time resulted in standard preparations, it is especially true for those plants, which are widely used as home remedies and for which ethnobotanical studies are producing ever-expanding lists of species. However, until methods of use and preparation are firmly integrated with ethnobotanical data, and until validation and recommendations for standard preparations are made for these herbs, there is a moral need to emphasize safety concerns pending toxicological studies.

There is a WHO publication, entitled "Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines," published in 1993, which will be of great value to Pakistani institutions. A fuller discussion on this subject is to be found in Bajaj and Williams (1996).

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## **Chapter 5**

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# **Towards a Sustainable Medicinal Plants Sector in Pakistan**

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## Chapter 5

### Towards a Sustainable Medicinal Plants Sector in Pakistan

This report has shown that there is long-standing research on medicinal plants in Pakistan and a growing, albeit fragmented, information base. This, coupled with a strong classical traditional medicine sector which provides employment (although as yet unquantified) and health care (especially in rural areas), reveals that there are clear opportunities to focus future efforts on the following areas:

- Poverty alleviation of rural and tribal communities which are involved in harvesting and collecting medicinal plants through the development of well designed partnerships between science and development;
- Environmental and biodiversity conservation - with efforts linked to incentives for sustainable management, rehabilitation of degraded ecosystems and genetic conservation of priority medicinal plant gene pools, and;
- Rationalization and increased share of international trade in raw medicinal plants, which will require government policies and incentives.

The medicinal plant sector spans:

- The Government of Pakistan and its research organizations;
- Provincial Governments and their extensions; and
- The Private Sector dealing with Unani preparations and traditional medicine practice.

If this base is broadened to include internationally and regionally available information, on the one hand, and relevant non-governmental organizations involved with the communities which collect and use the plants on the other, then new and effective partnerships will emerge.

However, at present, there is no definable medicinal plants sector. A number of important research and development activities could ultimately lead to changed perceptions of different stakeholder groupings. They may also lead to clearer policies which affect the sector, such as regulations on trade practices and promotion of innovative conservation and utilization of medicinal plants. Activities have to be proposed and implemented on a multidisciplinary front, and a number of proposals are offered below.

#### 5.1 Consolidation of the Plant Resource Information Base

Not only is there wide floristic diversity of medicinal plants in Pakistan but herbs enter the sectors of traditional medicine; industry, as raw materials, whether or not they are pharmacologically active, or as essential oils, tannins, gums and other substances; the food industry for cooking and colourants; and the cosmetic industry.



There is therefore an urgent need to consolidate information on all known taxa of medicinal plants of Pakistan's flora in an interactive database which includes distribution; rarity; ecological data; their use in medicine whether or not this is validated; active principles identified; which types of preparations are used in medicine; dosages etc. used and pharmacopoeial references. To these have to be added estimated degrees of genetic erosion of populations and conservation efforts *in situ* and *ex situ*. A considerable amount of relevant data exists but is mostly scattered. Consolidation would thus identify gaps in knowledge and permit a strategic focus on future field surveying. A focal point for this information-gathering could be the National Herbarium as has previously been suggested at national meetings. With the availability of suitable funding, the task could be completed in 18 months.

To illustrate the value of a database, the status of medicinal plants should be considered. In Swat, out of a total of 350 species, 5 species are endangered, 16 are threatened and 18 are vulnerable (Ahmad and Sirajuddin 1996). Information is not readily available as to whether or not these are all under threat elsewhere. Certainly, some are common in other parts of the country. Only with the availability of reliable data, and interpretation of this data, can valid conservation targets, other than broad *in situ* conservation of ecosystems be set. However, if populations of species are so impoverished, rehabilitation action will be needed (see 5.5).

## **5.2 Assessing Markets**

The production to consumption system flows vertically from the collectors to the final consumers. A series of actions occurs for any natural product - it may be processed, spoilage prevention is needed and the "raw" or "processed" product may be consumed, marketed for direct consumption or used as an input to a manufactured product. At each stage, the produce is bought and sold. For medicinal plant products the interaction between the various actors involved appears to be more significant than the degree of processing.

The market is also heterogenous. Medicinal plant products are sold in small local markets in the same areas where large traders amass their supplies for industry, and occasionally for export. Many cross national borders in an "informal" way.

Existing data on quantities available in markets at any particular time do little to help clarify the complex commerce of medicinal plants. Up-to-date analysis is required even though the informal market is very difficult to evaluate. Nonetheless, this informal market has to recognize conservation imperatives, and attempts made in this direction will only result from estimates of the informal market. Analysis of market information could lead to clear attempts to stem adulteration, as well as priority setting for ensuring sustainable supplies of raw materials. The current unsustainable harvesting practices, mostly unregulated, are due not only the poor knowledge of the collectors of the plants and their ecologies, but also to the inadequate dissemination of price information.

For a suitable study to be conducted, a limited number of raw materials would have to be tracked and these would have to be selected on the basis of their being indicative of much larger groupings of herbs.

Concurrently with the analysis of market transformation points, socio-economic implications would require assessment in relation to benefits accruing to communities and the relative roles of gender, on-farm/off-farm incomes etc.

It is estimated that such a study would take a 2 year period to complete. It would need a steering committee and an expert on modern participatory socio-economic research.

### 5.3 Urgent Salvaging of Priority Genetic Resources and their Evaluation

Many important medicinal plants have dwindling populations. It is therefore, critical that materials are collected and conserved in the most appropriate way, using seed storage in the national genebank where possible, and vegetative storage in *ex situ* collections for study, evaluation and selection of superior types. Some of the material will be valuable and appropriate for enrichment planting, especially in forested areas.

The key to success will be the sampling strategy used, and this must focus on populations rather than taxa. The National Plant Genetic Resources Institute is the obvious focal point for this work until such time as the forest research organizations are equipped for conducting genetic resources work. There will be a need to firstly identify priority species, and secondly priority areas.

#### Priority Species

A number of major medicinal plants are already recorded as being scarce or rare, or becoming increasingly so. They include in the northern parts *Podophyllum emodi*, *Rheum emodi*, *Valeriana wallichii*, *Artemisia* species, *Acorus calamus*, *Saussurea lappa*, *Paeonia emodi*, *Ephedra* species, *Carthamus tinctorius*, *Dioscorea* species, *Hyoscyamus niger*, *Pterocarpus marsupium*, *Atropa acuminata* and *Colchicum luteum*. Of these, *Artemisia*, *Ephedra* and *Valeriana* are of major importance to the pharmaceutical industry in the country. All are of major value in traditional medicine.

Most medicinal species which are also fruit trees are not under threat since these are maintained or protected by local people. Others, already domesticated as crops such as cumin, anise and safflower are also to be considered somewhat differently from wild species. However, their supply can be erratic as in the cases of *Pimpinella anisum* in Punjab, and *Cuminum cyminum* in Baluchistan, North West Frontier Province (NWFP) and Punjab. For these and other species, the need for genetic resources evaluation is urgent and should be prioritized as part of the national genetic resources programme.

In many parts of Pakistan, plants used for their roots are becoming increasingly scarce, for example, *Cissampelos pareira* and *Withania somnifera* in Punjab and Sind, and *Murraya koenigii* and *Sphaeranthus indicus* in Punjab. Certain species are similarly becoming rarer, for example, *Fumaria parviflora* in Baluchistan. So too are many arid zone medicinal species.

#### Priority Areas

In terms of guaranteeing sustainability of herbal supplies and meeting conservation needs, the undisputed priority areas are forest areas in the northern part of the country (North West Frontier Province (NWFP), and Azad Kashmir). These undoubtedly include the Kalash and Kafirstan valleys of Chitral; the Bogaranang/Sirren valleys; Kaghan valley and the Swat, Dir and Kurram valleys. These are also areas where poverty alleviation is an important issue in relation to tribal people.

A second priority area would include the drier forested areas of Baluchistan, while a third priority region would encompass certain parts of the Cholistan and Tharparker deserts.

## Proposed Action

The National Plant Genetic Resources Programme, in collaboration with other institutions working in areas such as validation of active principles when evaluating germplasm, should develop a phased project for donor funding over a three year period. This should include activities such as collecting, conservation and evaluation.

### 5.4 Urgent Implementation of Cultivation

There is no national overview in the country with regard to which species should be cultivated, though numerous suggestions have been made at the institutional level and even promoted through research and development in this respect. Although trials have been carried out by the Forestry Institute since the 1960s, few recommendations have actually been adopted. Conservationists, for example Naim (1996), are also concerned about this issue. Appendix 4 lists examples of species for which appropriate cultivation technologies are already available. This would probably apply to at least 40 species occurring in Pakistan, including traditional methods of cultivating mint, anise and other aromatic herbs and spices.

Cultivation will result in improved supplies of raw materials, provide an alternative to collecting plants from the wild, and will also lead to standardization.

Promotion of cultivation is intrinsically linked to the following activities:

1. Evaluation of genetic resources and identification of suitable genotypes for cultivation (this is an integral component of 5.3 above)
2. Development of farming systems compatible with local food cropping systems, with an emphasis on promoting income generation for a broad section of local communities.
3. Application of multiple cropping/agroforestry and other types of farming systems to suit agro-ecological aspects of the target medicinal plants. This would include the provision of partial shade and support, and sequential harvesting of crops over a 3 to 8 or 10 year period, (See also Gohar 1994 and Shinwari 1993 who emphasize the point that agroforestry should concurrently address constraints of fuelwood shortages and multipurpose use.)
4. Selection of species with known medium to high market value. At prevailing rates, production of *Podophyllum emodi* would result in prices per ton which are twice that of *Saussurea* and six times that of *Valeriana*. Depending on market prices and harvesting cycles, mixed (sequential) cropping would be essential. Species currently thought to be appropriate for cultivation are shown in Table 10. This table is an attempt to list those species emphasized in scattered research reports which would form a core group in a priority setting.

5. Farming and rural communities have a major role to play in accepting, promoting and sustaining cultivation practices. Thus all programmes in this regard need to be devised within a framework of rural development since cultivation, storage, post-harvest protection and marketing are all integral aspects to be considered.

Table 10 Tentative Priority Species for New or Enhanced Cultivation

\* Further research and development work required for cultivation :

A. Species widely used

- \* *Aconitum napellus*
- \* *Artemisia quettensis*
- Atropa acuminata*
- Berberis lycium*
- Carthamus tinctorius*
- \* *Carum bulbocastanum* (syn. *Bunium persicum*)
- Carum copticum*
- Colchicum luteum*
- Dioscorea deltoidea*
- Glycorrhiza glabra*
- Hyoscyamus niger*
- Podophyllum emodi*
- Rheum emodi*
- Saussurea lappa* (syn. *S. costus*)
- Solanum khasianum*
- Valeriana wallichii* (syn. *V. jatamansi*)

B. Other priority species, which are over exploited for local medicine.

- Angelica* species
- Jurinea macrocephala*
- Picrorrhiza kurroa*

## Propagation for cultivation

Cultivation is only successful when high quality planting materials is available. Hence cultivation not only provides an alternative raw material production system, thus reducing the heavy over-exploitation of many important commercial medicinal species, but also improves quality supply.

Some species can be readily propagated using seeds, but in most cases, the adoption of this technique would result in heterogenous populations. Vegetative propagation leads to more reliable stands and yields. In some cases, for example *Podophyllum* and *Saussurea*, where ramlets are slow growing, tissue culture techniques would have to be promoted. The National Plant Genetic Resources Institute has facilities for research and development in this area. Tissue culture techniques exist elsewhere for *Atropa acuminata*, *Dioscorea deltoidea*, *Mentha* sp, *Picrorrhiza kurroa*, *Rheum emodi* and many other species of interest which occur in Pakistan.

## **Proposed Action**

Depending on the priorities determined under section 5.3, as well as market demands, a project should be developed involving the participation of suitable NGOs to cultivate and market important species. This is likely to attract donor funding for a three year period, renewable for an additional two years.

### **5.5 *In Situ* Conservation and Continued Upgrading of Forestry Practices to Conserve Species Occurring in Specific Ecosystems.**

This report has described strategies used in forest management, related to the new focus on biodiversity conservation whereby certain areas would be deemed as strict reserves where harvesting of non-timber forest products would be prohibited for a period of several years to allow for some regeneration. Such efforts are only to be applauded. However, it is equally important to ensure that these efforts are paralleled by clarification of resource tenure rights, with adequate and acceptable provisions being made in relation to fuelwood, fodder and extraction of medicinal plants. This involves the active participation of local community organizations and NGOs. Additionally, it must be recognized that a number of scientists have expressed the opinion that *in situ* conservation of ecosystems in Pakistan is unlikely to be adequate for the future protection of large segments of biodiversity.

In a number of cases, efforts would need to be supported by rehabilitation of a number of non-timber forest products using local germplasm. Community involvement in this regard, coupled with education, provides a pro-active approach to conservation, especially in light of self-evident future benefits. Responsibility in this area should lie within the existing cooperative efforts between PFI, Provincial Forest Departments, and national efforts focusing on biodiversity, in association with IUCN and WWF. Conservation is a national responsibility as outlined in Agenda 21 and the UN Convention on Biological Diversity.

It is important to recognize that regeneration of medicinal species within ecosystems, and cultivation of selected genotypes in agricultural systems are separate strategies requiring appropriate coordinated planning. In the former case, the objective has to be to maintain as much local natural genetic variation as possible. In the latter case, production is likely to be limited to specific segments of the overall pattern of variation of the gene pool. It is thus vital that *ex situ* conservation complements both rehabilitation of ecosystems as well as attempts at cultivation, as mentioned in section 5.3 above.

### **5.6 *Ex Situ* Conservation for Medium to Long-Term Benefits.**

The importance of the national genebank cannot be overstated since the institution which maintains it has state-of-the-art facilities for seed storage and tissue culture. Salvaging genetic resources (5.3 above) and evaluating them (5.3 and 5.4) require methodologies and facilities which already exist and which need to be applied to medicinal plants.

For example, it is widely known that the handling of seeds, from their initial collection in the field, has a profound effect on subsequent germination and sustaining viability. Many previous experiments conducted on germination of seed lots for medicinal plants are meaningless without

the availability of data on seed moisture content, methods of temporary storage, drying etc. Similarly, collecting vegetative materials, (rhizomes, corms, cuttings etc.), especially when used for experimentation, requires sampling data to extrapolate results regarding population variability, since biased sampling can lead to incomplete results. Many published papers in this area lack the sampling data.

For *ex situ* conservation, it is to be expected that a large proportion of priority species will possess orthodox seeds, that is, seeds which can be dried and conserved at low temperatures in a genebank. Collections of growing plants can also be built up in *ex situ* field genebanks. For the species likely to be accorded priority, the Karakoram Agricultural Research Institute for the Northern Areas, is the obvious choice of location for a major *ex situ* collection. Other locations will be required in different agro-ecological zones as medicinal plant conservation and utilization is expanded, and these will require full documentation related to any materials in the national genebank or in protected areas.

## 5.7 Policy and Education

Clearer government policy is likely to emerge as a result of the actions proposed in sections 5.1 to 5.6 being vigorously pursued. However, under the present national funding climate, outside donor funding should be mobilized to initiate the proposed strategic actions, and national funding sought to strengthen or sustain specific inputs by individual institutions.

Though not itemized in this report, there are urgent requirements for education on a broad front. There is a major need to train the collectors and traders of medicinal plants to ensure better quality, and this should involve practitioners of traditional medicine. At present, orders placed for raw materials are based on vernacular names, and this point alone presents problems in cases where the same vernacular can apply to more than one species, or where species have similar vernacular names.

Since the education required is on such a broad front, it will have to be tackled on a large-scale basis. For instance, once an integrated database is made available, numerous pamphlets can be generated containing appropriate information relevant to the recipient. These can interface with conservation imperatives and projects, as well as the specific interests of diverse Ministries. Furthermore, a community participation approach to cultivation, will need an educational component. NGOs such as the AKRSP, which has been active in the Northern Areas and in Chitral since 1982, as well as Sarkad RS Corp which is working in other provinces, will be vital in developing appropriate priority interventions in specific priority areas. If training experience is gained within such a framework, it is likely to be more widely replicable.

It is not clear as to the extent of the need for collections of medicinal plants primarily for educational purposes. However, due consideration will have to be given to this issue in a number of diverse climatic areas. Further, the greater the linkages with demonstrations of new streamlined supply systems, the more successful these collections will be, especially in areas where several local languages are used and where literacy rates are very low.

## **5.8 Future Prospects**

There will almost certainly be a need for stronger coordination of the medicinal plants sector at the national level. However, the establishment of a national committee, inter-ministerial dialogue or whatever mechanism is deemed necessary, is more likely to be successful if appropriate strategic action (as proposed above) has already been taken at the research and development level.

The objective is not simply to forge links and collaboration between interested research parties in the country but also to encourage sustainable development through the adoption of strategies involving income generation, conservation and target-oriented use of the resource base as determined by socio-economic and health considerations.

In the meantime, it would be prudent for the relevant government authorities to address the following issues: the validity of CITES recommendations and listings of plants or derivatives restricted for export; wider participation in regional networks and maybe membership in others such as the G-15 Genebanks for Medicinal and Aromatic Plants (GEBMAP); the policy environment of non-timber forest products and community rights; investment in the private pharmaceutical sector and expanded education and information flow to *hakims*. The addressing and clarification of any-one of the above tasks, all of which require attention on the domestic front, will facilitate progress towards a viable and sustainable medicinal plants sector in Pakistan.

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## **Major Herbal Drug Dealers in Pakistan**

(from Marwat, 1996)

### **DIR AND SWAT, NWFP**

1. Messrs. Haji Tehmas Khan, Drug Dealers, Main Bazaar Dir., NWFP.
2. Ahsami Dar-Ul-Advia, New Bazaar, Dir., NWFP.
3. Messrs. HAJI Fareedoon, Drug Dealers, Main Bazaar, Dir., NWFP.
4. Messrs. Haji Faiz-Ulla Brawal Banda, Dir., NWFP.
5. Messrs. Habib- Ullah Khan, Dir Commission Shop, Batkhella, NWFP.
6. Messrs. Abdullah Jan and Rahmat Gul, Madyan Road, Mingora, Swat, NWFP.
7. Messrs. Abdullah Jan and Rehmat and Co., Madyan Road, Mingora, Swat, NWFP.
8. Messrs. Hakim Dilber Khan, Swati Ghee Depot, Madyan Road, Mingora, Swat, NWFP.
9. Messrs. Syed Ali Mirza Abasin Kohistan Trading Co., Madyan Road, Mingora, Swat, NWFP.
10. Messrs. Asghar Ali Swat Trading Co., Kanju Road, Mingora, Swat, NWFP.
11. Messrs. Inam Gul Drug Dealer, Bahrain Road, Bahrain, Swat, NWFP.
12. Messrs. Pir Mada & Co., Bahrain, Swat, NWFP.
13. Messrs. Toti Gul, Bahrain Road, Bahrain, Swat, NWFP.
14. Messrs. Danish and Sons, Madyan, Swat, NWFP.
15. Messrs. Haji Shahjan, Anwar & Co., Madyan, Swat, NWFP.
16. Messrs. Muhammad Safdar, Punjab House, Madyan, Swat, NWFP.
17. Messrs. Halim Khan, Bazaar Timmergarah, Dir, NWFP.
18. Haji Mohsin Khan Khal, Dir, NWFP.
19. Messrs. Daya Singh, Main Bazaar, Pir Baba, Buner, NWFP.

## Priorities for Medicinal Plants Research and Development in Pakistan

20. Messrs. Fazal-Khaliq Modern Industries, International Traders, Modern House, Mingora, Swat, NWFP.

### **PESHAWAR, NWFP**

21. Messrs. Haji Ahmed & Sons, Dalgran, Peshawar, NWFP.
22. Messrs. Muhammad Younas, People Mandi, Peshawar, NWFP.
23. Messrs. Nazir Gul, Shopkeeper, People Mandi, Peshwar, NWFP.
24. Messrs. Saeed Sons, People Mandi, Peshawar, NWFP.
25. Messrs. Malik & Co., Namak Mandi, Peshawar, NWFP.
26. Messrs. Qamar Traders, Namak Mandi, Peshawar, NWFP.
27. Messrs. Maumoor & Co., Meva Mandi, Peshawar, NWFP.
28. Messrs. Afghan Trading Co., Meva Mandi, Peshawar, NWFP.
29. Messrs. Haji Loung Khan, Munawar Khan, Dalgran, Peshawar, NWFP.
30. Messrs. Muhammad Ayaz & Co., People Mandi, Peshawar, NWFP.
31. Messrs. Haji Abdur Rehman & Sons, Dalgran, Peshawar, NWFP.
32. Messrs. Haji Rehman Gul, Dalgran, Peshawar, NWFP.
33. Messrs. Abdur Rehman and Abdur Rahim Siddiqui, People Mandi, Peshwar, NWFP.

### **RAWALPINDI, PUNJAB**

34. Anis Brothers, Naswari Bazaar, Ganj Mandi, Rawalpindi, Punjab.
35. Khalid Rashid & Co., Naswari Bazaar, Ganj Mandi, Rawalpindi, Punjab.
36. Mosa Javeed & Sons, Naswari Bazaar, Ganj Mandi, Rawalpindi, Punjab.
37. United Karyana Store, Naswari Bazaar, Rawalpindi, Punjab.
38. National Karyana Stores, Naswari Bazaar, Ganj Mandi, Rawalpindi, Punjab.
39. Golden Store, Naswari Bazaar, Rawalpindi, Punjab.

**LAHORE, PUNJAB**

40. Batala Trading Co., Akbari Mandi, Lahore, Punjab.
41. Muhammad Store, Akbari Mandi, Lahore, Punjab.
42. Java Pansari Store, Akbari Mandi, Lahore, Punjab.
43. Ch. Farzand Ali, Paper Mandi, Lahore, Punjab.
44. Sheikh Ali Muhammad & Ghulam Sarwar, Akbari Mandi, Lahore, Punjab.
45. Asad Traders, Akbari Mandi, Lahore, Punjab.
46. Atiq Karyana Store, Akbari Mandi, Lahore, Punjab.
47. Kausar Karyana Store, Akbari Mandi, Lahore, Punjab.
48. Sheikh Noor Hussain, Akbari Mandi, Lahore, Punjab.
49. Abdul Majeed & Saeed Ahmed, Akbari Mandi, Lahore, Punjab.
50. Khursheed Ali Karyana, Akbari Mandi, Lahore, Punjab.
51. Arif Brothers, Akbari Mandi, Lahore, Punjab.
52. Zahoor Sons, Akbari Mandi, Lahore, Punjab.
53. Jameel Traders, Akbari Mandi, Lahore, Punjab.
54. Madina Traders, Akbari Mandi, Lahore, Punjab.
55. Hidayat & Co., Akbari Mandi, Lahore, Punjab.

**FAISALABAD, PUNJAB**

56. Messrs. Jamal Din \* Ilam Din, Goal Karyana Bazaar, Faisalabad, Punjab.
57. Sheikh Ibrahim & Sons, Goal Karyana Bazaar, Faisalabad, Punjab.
58. Sabri Karyana Store, Gaol Karyana Bazaar, Faisalabad, Punjab.
59. Rajpoot Karyana Store, Gaol Karyana Bazaar, Faisalabad, Punjab.
60. Saeed Brothers, Gaol Karyana Bazaar, Faisalabad, Punjab.
61. Haji Mehar Din, M. Abdullah, Goal Karyana Bazaar, Faisalabad, Punjab.

## **MULTAN PUNJAB**

62. Messrs. Batala Karyana Store, Haram Gate, Multan, Punjab.
63. Messrs. Muhammad Hussain, Abdul Rehman, Beroon Gate, Multan, Punjab.
64. Haji Usman & Sons, Bazaar Chauri Saray, Multan, Punjab.
65. Haji Mushtaq Ahmad, Bazaar Chauri Saray, Multan, Punjab.
66. M. Bashir, M. Safeer, Bazaar Chauri Saray, Multan, Punjab.
67. Abdul Aziz Karyana, Bazaar Chauri Saray, Multan, Punjab.
68. Mehraj Din, Mushtaq Ahmed, Gur Mandi, Multan, Punjab.
69. Waheed & Co., Harm Gate, Multan, Punjab.
70. Abdul Shakoor & Sons, Bazaar Chauri Saray, Multan, Punjab.

## **BAHAWALPUR, PUNJAB**

71. Boor Muhammad & Manzoor Ahmed Pansari Store, Chock Bazaar, Bahawalpur, Punjab.
72. Molvi Hidayat Muhammad & Sons, Machli Bazaar, Bahawalpur, Punjab.
73. Asif Zia Karyana Merchant, Fateh Khan Bazaar, Bahawalpur, Punjab.
74. Chaudhri Karyana Merchant, Fateh Khan Bazaar, Bahawalpur, Punjab.
75. Maqbool Ahmed Karyana Merchant, Fateh Khan Bazaar, Bahawalpur, Punjab.
76. Abdul Rashid & Abdul Basit, Fateh Khan Bazaar, Bahawalpur, Punjab.
77. Javed Karim Bazaar, Jamay Masjid, Bahawalpur, Punjab.
78. Umer Din Abdul Ghani, Fateh Khan Masjid, Bahawalpur, Punjab.
79. Haji Umer Din Muhammad Ishaq, Bazaar Fateh Khan, Bahawalpur, Punjab.
80. Abdul Rashid, Muhammad Munir Merchant, Bazaar Fateh Khan, Bahawalpur, Punjab.
81. Syed Mangay Shah, Bazaar Jamay Masjid, Bahawalpur, Punjab.

## SUKKUR, SIND

82. Yousaf Brothers, Karyana Bazaar, Sukkur, Sind.
83. Ahmed Khan & Co., Karyana Bazaar, Sukkur, Sind.
84. Haji Abdul Sattar & Haji Usman, Shahi Bazaar, Sukkur, Sind.
85. Jan Muhammad & Abdul Ghafoor, Karyana Bazaar, Sukkur, Sind.
86. Haji Zakria Ahmed Pansari, Karyana Bazaar, Sukkur, Sind.
87. Muhammad Ibrahim Karyana Merchant, Karyana Bazaar, Sukkur, Sind.
88. G.H. Umer, Karyana Merchant, Karyana Bazar, Sukkur, Sind.
89. Narani Pansar, Karyana Bazar, Sukkur, Sind.
90. Ashraf Anis & Co., Karyana Bazaar, Sukkur, Sind.
91. Muhammad Hanif and Brothers, Karyana Bazaar, Sukkur, Sind.

## HYDERABAD, SIND

92. Chamber of Commerce, Chandni Cinema, Hyderabad, Sind.
93. Nabi Bakhsh & Co., Market Road, Hyderabad, Sind.
94. Haji Umer Din, Haji Allah Rakkha, Market Road, Hyderabad, Sind.
95. Sikandar Ali Karyana Merchant, Market Road, Hyderabad, Sind.
96. Ramzan Ali & Muhammad Alim Brothers, Market Road, Hyderabad, Sind.
97. Ramzan Ali & Brothers, Market Road, Hyderabad, Sind.
98. Abdul Ali & Brothers, Market Road, Hyderabad, Sind.
99. S. Mehar Ali Karyana Merchant, Market Road, Hyderabad, Sind.
100. Din Muhammad Karyana Merchant, Market Road, Hyderabad, Sind.
101. Jamal Bahi & Ibrahim and Sons, Market Road, Hyderabad, Sind.

## **KARACHI, SIND**

102. Baqai & Co., Judia Bazaar, Karachi, Sind.
103. Hussaini Corporation, Judia Bazaar, Karachi, Sind.
104. M. Jamil & Sons, Muhammadi Street, Karachi, Sind.
105. Hakim & Co., Judia Bazaar, Karachi, Sind.
106. Nayab-ud-Din, Judia Bazaar, Karachi, Sind.
107. Haji Pir Purkhash Corporation, Judia Bazaar, Karachi, Sind.
108. Yousaf Karim, Judia Bazaar, Karachi, Sind.
109. Awan Traders, Ali Akbar Street, Judia Bazaar, Karachi, Sind.
110. Karim Co., Darya Lal Street, Judia Bazaar, Karachi, Sind.
111. Ali Muhammad Bilal, Judia Bazaar, Karachi, Sind.
112. Musarrat Traders Corporation, Judia Bazaar, Karachi, Sind.
113. Abu Bakar & Sons, Judia Bazaar, Karachi, Sind.
114. Muhammadi General Store, Judia Bazaar, Karachi, Sind.
115. Insaf Karyana Store, Judia Bazaar, Karachi, Sind.
116. Hussaini Store, Judia Bazaar, Karachi, Sind.
117. Haji Usman Bilal, Judia Bazaar, Karachi, Sind.
118. Musleh-ud-Din & Sons, Judia Bazaar, Karachi, Sind.
119. Yousaf Ali, Qamar-ud-Din, Judia Bazaar, Karachi, Sind.
120. Capri Traders, Judia Bazaar, Karachi, Sind.
121. Muhammad Jumma & Sons, Judia Bazaar, Karachi, Sind.
122. Producer Co., Judia Bazaar, Karachi, Sind.

## **QUETTA, BALUCHISTAN**

123. Farooq Traders, Importers Exporters & Dry Fruit Commission Agents, Shahra-e-Iqbal, Quetta, Baluchistan.
124. Chaudhri Muhammad Ali & Co., Importer Exporter Commission Agents, Shahra-e-Iqbal, Quetta, Baluchistan.
125. Wattan Trading Co., Dry Fruit Commission Agents, Shahra-e-Iqbal, Quetta, Baluchistan.

### Code of Conduct on Medicinal Plant Research

#### PREAMBLE

The participants of an IDRC - sponsored meeting on Medicinal Plants Research in Calicut, India, 6-8 February, 1995, have noted that:

*Whereas plants have been the source of food and medicine throughout history and;*

*Whereas traditional systems of medicine have employed medicinal plants for primary health care purposes, and;*

*Whereas approximately 80 percent of the world's population is dependent upon traditional and folk systems of medicine for primary health care, and;*

*Whereas an increasing number of medicinal plants are being approved by governments in developed and developing countries for use in primary health care delivery systems, and;*

*Whereas there is a great need to increase awareness of the value of medicinal plant biodiversity and associated knowledge and;*

*Whereas the supply of medicinal plants in the South Asian region, combined with absence of standards for crude drugs results in the prevalence of adulteration and substitution, and;*

*Whereas there are at least 55,000 licensed pharmacies and companies utilizing medicinal plants, and ;*

*Whereas Many traditional herbal medicines are relatively low in cost.*

*And agreed as follows:*

#### ARTICLE 1 Origin of medicinal plant materials

Plant material will be properly documented with respect to identity and location of source.

#### ARTICLE 2 Collecting material and quality specifications for fresh, dried and processed plant materials.

In view of the existing over-exploitation of many medicinal plant species, standards will be agreed upon for the collection of each species. Standards will relate to the part of the plant collected, stage of development and timing of collecting. As far as possible these standards will accord with authoritative publications.

All aspects of processing will accord with agreed procedures and be related as far as possible to authoritative texts. These aspects will include storage of plants, time of processing, methods used (solvents, heat etc.), including equipment, standards of clearness to reduce microbial contamination and storage of extracts. Limits of other plant parts, in addition to the target plant part will be set, as will the limits for foreign mineral matter. Where such standards or procedures are not widely documented they will be developed through research.



### ARTICLE 3 Characterization of therapeutic value and information on use and constituents

All research on herbal medicines must document the accepted value of the plant-derived material in human health benefits.

Dosages, i.e. form (powder, decoction etc.), amount, and timing of dosage will be documented with specific details of processing and preparation. Forms of preparation relate to one or more of powdered plant materials, extracts, purified extracts or partially purified active substances isolated from plants. Routes of administration are also to be documented.

Active constituents, as far as they are known, should be stated and their structural formulae given. However, in many cases, the plant preparation as a whole is therapeutically effective even though active principles are not known. Such 'crude' preparations are recognized as useful and documented in texts because activity may depend on a large number of components.

In single plant remedies contents of known therapeutically active constituents should be determined and acceptable dosage range specified for the health systems in which the remedy is used. When the medicine is a herbal mixture, the most characterizing compounds should be described.

### ARTICLE 4 Documentation of therapeutic uses

Documentation of therapies for specific diseases and maladies should include status of use of medicinal plants in therapy (in the past, current or changes proposed) and also adjunct therapies, such as diets, life style modifications, baths, psychological or ritual treatments.

Disorders treated may include folk terms and maladies which are culturally defined.

Data on therapy should be supplemented by criteria for diagnosing the disease or malady and also by relating the therapy to the stage of the disease.

### ARTICLE 5 Toxicity of herbal medicines

It is recognized that toxicological investigations are required to supplement human experience in defining possible toxicity of herbal preparations. Where this is not documented in authoritative texts, the WHO research guidelines are appropriate.

### ARTICLE 6 Clinical trials

Clinical trials are used to validate efficacy, to develop new medicines, to revise dosage formulations and to test activity of extracted purified or crude compounds. In this respect, the WHO research guidelines are appropriate.

### ARTICLE 7 Pharmacological studies of herbal medicines

Non-clinical studies may be required to determine whether the clinical use of a herbal medicine is valid, to characterize its range of pharmacological actions or to study pharmacologically active products/compounds. In this respect, the WHO research guidelines are appropriate.

## ARTICLE 8 Availability of plant material

Relevant government agencies will be informed of any networking involving bilateral agreements where research and materials are to be conducted and made available across national boundaries. Access to materials will be on mutually agreed terms in accordance with Article 15 of the Convention on Biological Diversity.

In the event that international concerns express interest in bio-active agents identified during network research, equitable partnerships will be developed to accord with any relevant national law and the Convention on Biological Diversity so that positive inputs in economic terms can be made to conservation and the establishment of local production of herbal medicines.

## ARTICLE 9 Indigenous knowledge

The network recognizes that traditional use of a herbal medicine is usually a part of culture. Folklore and traditional knowledge should therefore be an integral part of research planning, and such knowledge should be respected, acknowledged and interpreted during the development of research proposals. Communities which provide such knowledge should be involved with research objectives, research planning, and be informed of the results generated.

## ARTICLE 10 Sustainability of plant resources

Where collecting plant material results in destruction of the plants, guidelines need to be developed to assure regeneration.

Where plant resources are rare in nature, and over-exploited in specific areas, or otherwise undergoing genetic erosion or population fragmentation from any cause, the network will pursue research to bring suitable genotypes into cultivation to provide reliable and sustainable sources of material.

This Article accords with Article 10 of the Convention of Biological Diversity and Chapters 15 and 32 of Agenda 21.

## ARTICLE 11 Other ethical considerations

A number of other ethical considerations impinge on research. The network recognizes the following principles:

- (i) Research planning has to differentiate between herbal medicines which have a well-documented background resulting from long usage and those where traditional usage is unclear and not well-documented.

In this respect, questions of safety and efficacy arise. Plants which are both effective and non-toxic in a particular treatment can be promoted for wider use for that treatment, but, promotion of those which are toxic is unethical as currently used.

- (ii) The promotion of plants which are sanctioned as non-toxic but lack sanctioning as effective may occur where significant numbers of people exist who can have access to such plants but lack alternative treatments, documented and known to be effective

## **Priorities for Medicinal Plants Research and Development in Pakistan**

- (iii) Plant remedies not sanctioned to be non-toxic will not be promoted. However, research can be pursued on them with a view to identifying safe limits. This principle can be applied to diverse sources of the same species which vary in their active principle contents, and where use in therapy can be queried on safety grounds.
- (iv) Provided that no plants are known or suspected to be toxic, the promotion of multiple plant preparations-where one or more is not sanctioned as non-toxic- is ethical only in situations where reasonable and known-to-be-safe alternatives do not exist, and where research is underway to determine the safety of the non-sanctioned plant.
- (v) Where research involves human beings it will be conducted in accordance with principles of respect for persons, justice, benefit, and lack of maleficence.
- (vi) Promotion of any herbal remedy through the network will accord with required regulatory mechanisms in the country and will only be deemed permissible if concepts of equity and sustainable development are taken into account.

### TEXTS USED IN FORMULATING THE AGREEMENT

WHO International Symposium on Medicinal Plants held at the Morris Arboretum, PA, USA 19-21, April, 1993.

Proceedings of an International Workshop, IDRC, Ottawa, Canada, 2-4 March, 1994.

WHO Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines, 1993.

Communication to IDRC-SARO from Ethics Committee of IDRC, Ottawa, Canada, November 1994.

## **Pokhara Declaration**

From 15-17 May 1996, a workshop was held in Pokhara, Nepal, hosted by the Institute of Forestry, Tribhuvan University, Pokhara. The workshop was conducted under the auspices of the International Centre for Integrated Mountain Development (ICIMOD); the International Development Research Centre (IDRC); the IDRC Medicinal Plants Network (IMPN); the International Network for Bamboo and Rattan (INBAR) and the International Plant Genetic Resources Institute (IPGRI). It was attended by delegates from the six countries of the Himalayan Region and beyond, including Pakistan, India, Nepal, Bangladesh, China and Thailand, whose fields of expertise included areas such as economics and management of forest and agricultural resources; Indigenous peoples and cultural traditions and mountain development. Ways and means of developing specific non-timber forest resources in a more sustainable manner than hitherto carried out were discussed, and the conclusions reached were formulated into what has become known as the Pokhara Declaration.

The delegates agreed on the following declaration :

### **WE RECOGNISE THAT THE FOLLOWING FACTORS ARE OF CRITICAL CONCERN:**

1. Over 120 million people in the Himalayan region rely on plant products, mostly extracted from the wild, and over 450 million people have interlinkages with this economy downstream.
2. Non-timber forest resources, including bamboo, rattan, and medicinal plants, play a vital role in this region. They are invaluable to the livelihoods and cultural traditions of its richly diverse human communities.
3. The region which is ecologically complex, diverse, and fragile, is heavily degraded and rapidly becoming impoverished in terms of biological diversity.
4. Many existing production systems are equally fragile and threatened, resulting in grave threats to the livelihoods of millions of disadvantaged people.
5. Degradation is directly related to factors including increasing populations; indiscriminate extraction harvesting; overgrazing; soil erosion; open cast mining; shifting cultivation and other changing patterns of land use.

### **WE ALSO TAKE NOTE OF A NUMBER OF ISSUES CONCERNING KNOWLEDGE:**

1. There is a wide gap in knowledge regarding collection and utilization of bamboo, rattan, and medicinal plants in the region, and research capabilities and interests vary widely between the different countries of the region.
2. Where information does exist, it is inadequate, uncritical, and often not easily accessible to researchers, farming communities, governments, and development agencies, resulting in many inadequate or restrictive policies and regulations.

### **Priorities for Medicinal Plants Research and Development in Pakistan**

3. There is a lack of information about the demand and supply situation; market intelligence, and the actual operation of local, national, regional and international trade of these commodities.
4. There is a lack of attention to the development of appropriate technologies and extension which will enhance, on the one hand, the sustainable production systems of the poor and, on the other, conserve the resource base, protect essential watersheds, and reduce soil erosion.

#### **THE WORKSHOP PARTICIPANTS AGREED UPON THE FOLLOWING RESOLUTIONS :**

1. There is an urgent need to conduct integrated, innovative, and collaborative research to obtain the information required to solve the constraints and problems noted above.
2. There is an urgent need to seek peoples' participation at the grassroots community level, thereby making them full partners in the research.
3. Such research should be strategically focused to improve conservation, cultivation, production, sustainable management, and utilization of a limited number of priority species initially.
4. There is an urgent need for interdisciplinary cooperation, networking, and information dissemination in the region.
5. The results of such research should have measurable and sustainable beneficial impacts on economically disadvantaged people and lead to sustainable development initiatives at all levels.

## Priority Species for which Cultivation Methods are known

*Acorus calamus*  
*Atropa acuminata*  
*Berberis species*  
*Cannabis sativa*  
*Carum copticum*  
*Carthamus tinctorius*  
*Catharanthus roseus*  
*Chrysanthemum cinerariifolium*  
*Cichorium intybus*  
*Colchicum luteum*  
*Crocus sativus*  
*Cuminum cyminum*  
*Datura species*  
*Dioscorea deltoidea*  
*Glycyrrhiza glabra*  
*Hyoscyamus niger*  
*Juniperus communis*  
*Lavatera kashmiriana*  
*Matricaria chamomilla*  
*Mentha species*  
*Ocimum Species*  
*Papaver somniferum*  
*Plantago ovata*  
*Podophyllum emodi*  
*Punica granatum*  
*Rheum emodi*  
*Ricinus cummunis*  
*Rosa damascena*  
*Saussurea lappa*  
*Skimmia laureola*  
*Solanum khasianum*  
*Valeriana wallichii*  
*Withania Sommifera*

Through support for research, Canada's **International Development Research Centre (IDRC)** assists scientists in developing countries to identify long-term, workable solutions to pressing development problems. Support is given directly to scientists working in universities, private enterprise, government, and nonprofit organizations.

Priority is given to research aimed at achieving equitable and sustainable development worldwide. Projects are designed to maximize the use of local materials and to strengthen human and institutional capacity.

Led by the dedication and innovative approach of Third World scientists — often in collaboration with Canadian partners — IDRC-supported research is using science and technology to respond to a wide range of complex issues in the developing world.

IDRC is directed by an international Board of Governors and is funded by the Government of Canada. At the United Nations Conference on Environment and Development (UNCED), IDRC's mandate was broadened to emphasize sustainable development issues. IDRC's international network and expertise will be used to help the world move toward implementation of UNCED's Agenda 21 program of action.

**Le Centre de recherches pour le développement international (CRDI)** soutient des travaux et des activités de recherche dans les pays en développement de manière à assurer un développement durable et équitable à l'échelle mondiale.

Les recherches sont menées par des scientifiques affiliés à des institutions, à des entreprises, à des gouvernements ou à des organismes de développement. Des partenaires canadiens y contribuent régulièrement.

Les projets soutenus financièrement ou techniquement par le CRDI privilégient le recours aux ressources locales et s'appuient sur le génie, l'intelligence et le sens de l'innovation des chercheurs des pays en développement.

Le CRDI contribue au renforcement des connaissances et des capacités de recherche des pays en développement pour lutter contre la pauvreté et pour améliorer les conditions de vie et l'environnement des populations affectées.

Le CRDI est dirigé par un Conseil des gouverneurs international. Ses fonds proviennent du gouvernement du Canada. La Conférence des Nations unies sur l'environnement et le développement (CNUED) a choisi le CRDI pour participer à la mise en oeuvre du développement durable à l'échelle planétaire. Le CRDI verra à concrétiser le programme Action 21 élaboré lors du Sommet de la Terre.

Con el fin de asegurar un desarrollo sostenible y equitativo a escala mundial, el **Centro Internacional de Investigaciones para el Desarrollo (CIID)** financia trabajos y actividades de investigación en los países en desarrollo. Las investigaciones están a cargo de científicos que trabajan en instituciones, empresas, gobiernos u organismos dedicados al desarrollo. Estos científicos reciben regularmente la colaboración de sus colegas canadienses.

Los proyectos apoyados financieramente o técnicamente por el CIID favorecen el uso de recursos locales y se apoyan en el talento, la inteligencia y el sentido de innovación de los investigadores de los países en desarrollo.

El CIID contribuye al fortalecimiento de los conocimientos y a la capacidad investigativa de los países en desarrollo para luchar contra la pobreza y mejorar las condiciones de vida y el medio ambiente de las poblaciones afectadas.

Un Consejo de Gobernadores Internacional tiene a su cargo la dirección del CIID, cuyos fondos provienen del Gobierno de Canadá. La Conferencia de Naciones Unidas sobre el Medio Ambiente y el Desarrollo (CNUED) ha seleccionado al CIID para participar en la realización del desarrollo sostenible a escala mundial. El CIID se encargará de hacer realidad el programa Agenda 21, elaborado durante la Cumbre de la Tierra.

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This report, which is one of a series of country studies being conducted in South Asia, with funding and support from the IDRC Medicinal and Aromatic Plants Program in Asia (MAPPA), previously known as the IDRC Medicinal Plants Network (IMPN), provides a comprehensive review of the medicinal plant sector in Pakistan. It describes the prevailing situation with regard to this sector, including the cultural background and issues related to the resource base. A number of important themes are focused upon – the economic background; the traditional health care system practised in Pakistan and information and coordination – with constraints, opportunities and priorities being outlined for each of these topics. Finally, the report proposes a number of multidisciplinary interventions, which would address crucial gaps, and which would go a long way towards achieving the sustainable development of the medicinal plant sector in Pakistan.