

212 THE PRESENT RESOURCES OF MEDICINAL PLANTS AND THEIR FUTURE  
DEVELOPMENT IN PAKISTAN

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Pakistan, with a total area of about 364,737 sq. miles, comprises two distinct geographical units namely West Pakistan with an area of 310,236 sq. miles and East Pakistan with an area of 54,501 sq. miles. The flora and fauna of the two wings are quite distinct. While the Northern and North-Western areas of mountainous zone in West Pakistan have a temperate climate, the Indus basin plains are marked with great aridity and temperature fluctuations. In East Pakistan, the climate is tropical.

The vast medicinal plant resources of the two wings of Pakistan may be classified in two categories, namely, (1) from naturally growing resources and (2) from cultivation. The number of plants mentioned in British<sup>1</sup> or American<sup>2</sup> pharmacopoeias and which are indigenous to the country is more than 40. A list of such plants is given in the appendix. West Pakistan as a whole is richer, as compared to East Pakistan in the number of plants included in Western pharmacopoeias. But a number of medicinal plants, whose value has long been established in Ayurvedic or Unani system of medicine occur in East Pakistan and that area is regarded to be potentially quite rich a source for the same.

Some of the areas like Kaghan Valley, Kurram Valley, Gilgit Agency, Quetta, Murree Hills and the Gullies and Azad Kashmir in West Pakistan and Chittagong and its Hill tracts and Sylhet in East Pakistan are very rich sources of medicinal plants. Most of the medicinal plants, even in pre-partition days, were used to be collected from those areas and with respect to certain medicinal plants the extraction was so heavy that the plants have become rare in those areas.

#### Medicinal Plant Resources of West Pakistan

In order to assess the distribution of medicinal plants and to carry out the quantitative survey of these plants, a scheme under the name of 'Botanical Survey of Medicinal Plants' was approved by the Government of Pakistan under the Ministry of Food and Agriculture and started operating in 1951. In spite of the many handicaps this department is conducting survey of the availability and sources of indigenous medicinal plants and herbs. Besides the work of survey, this department is also maintaining an experimental farm to study the

cultivation and characteristics of a number of medicinal plants grown under semi-temperate conditions.<sup>3</sup> A chemistry section, attached to this department is carrying out the determination of active principles of medicinal plants grown in the farm and as well as those collected from different localities within the country.

Though the progress of work is rather slow, it has been possible for this Department to survey the plant potentialities of the following regions: Gilgit Agency, Kurram Valley, Kaghan valley, Murree Hills and Gullies, Desert areas of Sind and part of Baluchistan. But by no means it can be said that survey work is complete and rather it can be said that only a beginning has been made. Besides the vastness of the areas concerned, the inherent difficulty of lack of uniform distribution of medicinal plants makes it difficult to have any accurate estimation of the resources. However, as a result of the surveys, we now have a better picture of the present state of medicinal plants in West Pakistan.

At present, amongst the medicinal plants, *Artemisia* and *Ephedra* are the outstanding species which are commercially exploited. But because of synthetic substitutes, the prospect of their continued application in medicine is getting poorer and poorer. In order to compete with the market better management for the collection and processing of the herbs is needed. *Ricinus communis*, the seeds of which are used commercially, is available in good quantities and cultivation can be extended much more to feed the local industry as well as for export purposes. In the desert areas of Sind, and other drier regions, where it is difficult to grow any food crop, *Ricinus communis* can be grown on commercial basis.

While the number of medicinal plants grown and commercially exploited is limited only to a few, a number of plants mentioned in the Western pharmacopoeias also exist in the country, but they do not occur in large quantities so as to be profitable for export purposes. However there are bright possibilities of their cultivation on commercial scale depending upon their demand in the world market. Some of the plants which could be included in the list of commercially cultivable resources are given below :

*Atropa acuminata*.—The extraction of this

plant has been so heavy in the past, that it has become rare now. It is still found sporadically in Hills, Gullies, Kaghan Valley and Kurram Valley but is not found in exploitable quantities. It is easy to increase its cultivation in the areas where it used to grow wild in the past. It is now being grown in our experimental farm for the purpose of study of its germination behaviour, growth characteristic etc.

*Colchicum luteum*.—This plant is a good substitute for *C. autumnale* which is official in British Pharmacopoeia. It is found to grow scatteredly in Murree Hills and in Hazara district. Because of small size of the corms, it is not economical to collect it from wild resources. In the areas where it is found growing naturally, the cultivation of the same can be taken up in compact blocks with very little care. Around Abbottabad, on the Hills and slopes, where nothing else is being grown for any food crop, the land can be used profitably for its cultivation.

*Digitalis purpurea*.—Though this plant is usually cultivated, it has been observed at Naddi in the Kaghan Valley to grow profusely as an escape from an abandoned old nursery of the same. In the climate of Abbottabad this plant is being grown very successfully.

*Glycyrrhiza glabra*.—The root of *Glycyrrhiza glabra* is in great demand in foreign countries. This plant is found to grow scatteredly in parts of Baluchistan, Gilgit Agency and in Kurram valley. This may be taken up for cultivation in the areas where it is found to be growing naturally.

*Hyoscyamus niger*.—There are several other species of *Hyoscyamus* which need study as regards their chemical constituents. This plant is found only in small patches in parts of Baluchistan, Gilgit Agency etc. In view of the increasing demand for pharmaceutical industry this should be cultivated. In our experimental farm, *H. niger* is being grown but it is not very successful. Often due to pathogenic attack, the crops are destroyed. In the North Regional Laboratories of the C.S.I.R. Peshawar, this has been reported to grow successfully with promising contents of active principles.

*Datura stramonium*.—This plant is also found to grow in waste land in small patches in Baluchistan, Hazara and Several other places in West Pakistan and also in East Pakistan. Suitable waste lands can be used for a wide-scale cultivation of the plant in both West and East Pakistan.

Besides the plants mentioned in the pharmaco-

poeias, there are hundreds of plants which occur in both the wings of Pakistan and information about the distribution of such plants is being collected.

### Cultivation of Medicinal Plants

It will be apparent from the foregoing statement that in order to improve upon the resources of medicinal plants it is imperative that cultivation or organised plantation of medicinal plants is needed to be taken up for meeting the needs of pharmaceutical industries and for the purpose of export also. Already our country is in shortage of foodgrains and all efforts are being made to boost up the production of food crops. Side by side, it is also necessary that minor cash crops are raised in places where normal food crops are difficult to grow. Intensive research is needed for experimentation along this line. The results obtained from trials of two crops raised in our experimental farm are mentioned in the following :

*Opium poppy*.—Opium poppy has been put under cultivation only during post-partition days in West Pakistan for the extraction of crude opium. However the total production of crude opium is not sufficient to meet the demand for narcotic purposes. As far as we are aware, there has been no attempt for the production of morphine from the crude opium. It has been reported that the morphine percentage of the opium produced in Pakistan is very low and unsuitable for the purpose of commercial production of morphine. In the samples of opium collected from our farm-grown plants, morphine has been found to the order of 15%. It has been experimentally found and established that percentage of morphine in the crude opium samples is highest on the first day's collection and after that it gradually decreases. Usually the villagers mix the whole lot of crude opium and hence is the

TABLE 1.—ANALYSIS OF THE OPIUM SAMPLE FOR THE CROP YEAR 1958-59.

Lancing operations	Yield in g.	Morphine %	Remarks
1st lancing collection	105.5	15.0	
2nd " "	213.0	14.6	Max. morphine
3rd " "	218.8	12.0	%
4th " "	417.1	10.4	Max. opium
5th " "	303.0	8.3	yield.
6th " "	247.5	7.8	Mean results
7th " "	180.8	6.7	9.67
8th " "	80.2	6.2	
9th " "	53.2	6.1	
Total	1819.1		

probable cause of the low content of morphine in crude opium. If the crude opium is collected separately in two lots, the first being the collection of first 3 or 4 lancings and the second lot of subsequent lancings, it is possible that pharmaceutical industries would welcome the samples of first lot for the preparation of morphine.

In West Pakistan, there is bright prospect of its cultivation on a still larger scale to meet the pharmaceutical and other needs of the country. The seeds of opium poppy are also used in food industries as well as in pharmaceutical industries.

*Pyrethrum*.—The flower heads of pyrethrum plants are in great demand for the preparation of insecticides. Previously this plant was tried at Murree but without much success. It has been found to be growing very successfully in Abbottabad climate. The yield of flower heads has been found to be of the order of 500 lbs. per acre and the pyrethrin contents are in the range of 0.70 to 1.35%. Though this does not correspond to best commercial variety grown in countries like Kenya, it is acceptable as a medium quality for commercial use. The plants live up to 5 years or more and the production of flower heads is at its maximum during the second and third years of their growth. Our results indicate that cultivation on a wide scale will be successful in a semi-temperate climate.

*Ammi visnaga*.—This is an exotic plant, only recently introduced in Pakistan and is now of much interest as the source of *Khellin*. This plant has almost been naturalised at Abbottabad and is spreading in the neighbouring fields as an escape.

The above results show the need of research on the cultivation of medicinal plants which requires specialisation in this field as only the yield of the crop is not the main criterion but the presence of active principles for which the plant is being cultivated is of paramount importance.

#### Essential Oil-bearing Plants

Essential oil-bearing plants form a very rich section of medicinal plants. Essential oils are not being used exclusively by pharmaceutical industries, but they are used in the manufacture of soaps, cosmetics, soda water industries, confectionaries, disinfectants, detergents and are being burnt as incense. The seeds of *Cuminum cymium*, *Foeniculum vulgare*, *carum copticum*, *Pimpinella anisum* etc., are too well known to us for high content of their essential oils. In Pakistan, the yield of many of these seeds or fruits is insufficient for consumption as spices. Cultivation of many of these plants can be extended to meet the local demand for use as

TABLE 2.—PERCENTAGE OF ESSENTIAL OILS PRESENT IN SOME PLANTS OF PAKISTAN AS COMPARED TO THAT OF FOREIGN.

Name of plant and locality	Percentage of yield of essential oil from	
	Local	Foreign
1. <i>Cinnamomum comphora</i> leaves (shade dried) local	2.8 (E. Oil)	1.00
2. <i>Saussurea lappa</i> roots from Gilgit	1.7 (Camphor)	2.01
3. <i>Artemisia maritima</i> green top from Kaghan	1.00 to 1.20	1.22
4. <i>Sikimia laureola</i> green leaves from Gullies	0.90	—
5. <i>Thymus serpyllum</i> leaves from Kaghan.	0.60	0.49 (India)
6. <i>Valeriana wallichii</i> (i) roots from farm	0.50	0.15 to 0.60
7. <i>Senecio jacuemontianus</i> roots from Gullies	1.03	1.2 (India)
8. <i>Senecio jacuemontianus</i> roots from Azad Kashmir	0.71	—
9. <i>Angelica glauca</i> roots from Azad Kashmir	0.13	—
10. <i>Chemopodium ambrosioides</i> green tops local	0.14	0.35 to 3.1
11. <i>Carum copticum</i> fruits from Farm sample.	1.25 to 1.40	upto 1.15 (India)
12. <i>Foeniculum vulgare</i> fruits from Farm sample	3.87	—
13. <i>Acorus calamus</i> roots from Dadar.	2.47	—
14. <i>Zanthoxylum alatum</i> seeds, local	3.0 to 4.0	1.5 to 3.50
15. <i>Origanum vulgare</i> green leaves from Kaghan.	2.00	3.70
16. <i>Elsholtzia patrinii</i> green leaves from Kaghan.	0.3	—
	1.40	upto 2.00

spices and as well as for pharmaceutical and other preparations. Some of these plants like *Cuminum cyminum* are found to grow in nature, by proper management and supervision, the area of its growth can be increased. At present our knowledge about the possible resources of essential oil from plants growing in nature is very limited, but if proper survey is conducted, it is very likely to tap new rich sources of essential oils from our indigenous flora which may find its use in pharmaceutical or some allied industries. From time to time we conducted surveys of medicinal plants, often plants which indicated the presence of essential oil were also collected for analysis. Though the work on the analysis of essential oil was not taken up systematically, the following table shows the oil content of the samples collected from forests as well as from plants grown in the experimental farm.

Some plants like *Juniperus*, *Thymus serpyllum*, *Acorus calamus* are found in commercially exploitable quantities in Baluchistan and Northern areas, but chemical analysis of the active constitu-

ents has to be done in order to see the suitability of these plants for pharmaceutical preparations.

#### Medicinal Plant Resources of East Pakistan

Occurrence and general distribution of crude drugs in East Pakistan is fairly well known but very little information is available about the quantity in which these drugs are available. Some years back a scheme to survey the drug plants of East Pakistan was taken up under the aegis of Pakistan Council of Scientific and Industrial Research at the Biochemistry Department of Dacca University. About two years back with the initiation of Botanical Survey of Medicinal plants, a scheme for the establishment of a research sub-station of medicinal plants has started functioning at Forest Research Laboratory, Chittagong. Intensive survey of that region for indigenous medicinal plants have been taken up and for experimental cultivation of medicinal plants, an experimental farm of about 25 acres is being utilised near Chittagong. *Rauwolfia serpentina* is one of the major crops that have been taken up for large-scale cultivation. *Andrographis paniculata*, *Ricinus communis* and many other indigenous medicinal plants are being grown there to find out their growth characteristics and yield.

The following is the list of some important medicinal plants which can easily be cultivated on a large scale.

1. <i>Abroma augusta</i> ..	19. <i>Hibiscus abelmoschus</i>
2. <i>Acacia catechu</i> ..	20. <i>Hydnocarpus kurzii</i>
3. <i>Acorus calamus</i> ..	21. <i>Lawsonia alba</i>
4. <i>Aloe vera</i> ..	22. <i>Mentha arvensis</i>
5. <i>Alstonia scholaris</i> ..	23. <i>Mentha viridis</i>
6. <i>Andrographis paniculata</i>	24. <i>Nardostachys jatamansi</i>
7. <i>Asparagus racemosus</i> ..	25. <i>Piper nigrum</i>
8. <i>Bacopa monieri</i> ..	26. <i>Piper longum</i>
9. <i>Butea frondosa</i> ..	27. <i>Rauwolfia serpentina</i>
10. <i>Caesalpinia bonducella</i>	28. <i>R. canescens</i> and other spp.
11. <i>Carum copticum</i> ..	29. <i>Ricinus communis</i>
12. <i>Cassia fistula</i> ..	30. <i>Saraca indica</i>
13. <i>Cuminum cymimim</i> ..	31. <i>Scilla indica</i>
14. <i>Curcuma longa</i> ..	32. <i>Strychnos nuxvomica</i>
15. <i>Datura sp.</i> ..	33. <i>Terminalia arjuna</i>
16. <i>Dioscorea spp.</i> with toxic tuber. ..	34. <i>Terminalia bellerica</i>
17. <i>Derris ferruginea</i> ..	35. <i>Terminalia chebula</i>
18. <i>Hemidesmus indicus</i> ..	36. <i>Zingiber officinalis</i>

#### Future Development

With the rise in the cost of living it is becoming less economical to collect crude drugs from nature even when some of these plants are found in sufficient quantities. Already the more valuable ones are now rare or are being exterminated. As there is acute shortage of cultivable land, the areas of forests should be developed for the production of crude drugs by starting large scale plantations. A programme of research for the development of medicinal plants is suggested in the following and in fact on these lines the work has been started by the

Botanical Survey of Medicinal Plants Branch at the Pakistan Forest Institute, Abbottabad :

This Branch will have a ten-point programme of research in the Botanical Survey of Medicinal Plants Branch :

(i) Quantitative survey of all the provinces of Pakistan for plants of economic importance, including medicinal plants.

(ii) Chemical analysis and isolation and quantitative estimation of the active principles of such plants.

(iii) Effect of the time and method of harvesting and method of cleaning and drying on the contents of the active principles of such plants. This will show the way to develop standard techniques for harvesting these products.

(iv) Identification and isolation of physiological strains and correlating them with botanical characters for use in field identification.

(v) Developing field tests for presence of active principle .

(vi) Developing techniques for the cultivation and propagation of the useful and rich strains so as to reduce the cost of harvesting by restricting the field of distribution.

(vii) Developing useful and rich strains by breeding and selection.

(viii) Developing portable plants for the extraction of active principles or their concentrates in the field.

(ix) Proposing and drafting legislation for the proper protection of plants of medicinal importance.

(x) Advising the trade and Government departments.

**Acknowledgement.**—Thanks are due to Dr. M. B. Rahman, Forest Chemist, under whose guidance the chemical analyses were done.

#### References

1. *British Pharmacopoeia*, (1953).
2. *The Pharmacopoeia of the United States of America*, (1955).
3. A.H. Khan, *Studies on Growth and Cultivation Characteristics of Medicinal and Other Economic Plants under Semi-temperate*

- Conditions—Pakistan J. Forestry, 7 No. 4 (1957).
4. M. B. Zaman, and S.M. Imam, *Proceedings of the Fourth Congress of the Pan Indian Ocean Science Association*, (1960).
  5. R. G. Wright—Ephedrine: its sources and uses—Pakistan J. Forestry, 10 No. 2 149-152 (1960).
  6. R.N. Chopra et al., *Indigenous Drugs of India*, (U.N. Dhar & Sons, Calcutta, 1958).
  7. *Report on the Pakistan Forest College and Research Institute*, (1950-55).

### Appendix

#### QUANTITATIVE SURVEY OF AREAS YIELDING MEDICINAL PLANTS AND THE QUANTITIES OF DRUGS THAT CAN BE COLLECTED ANNUALLY.

Locality	Quantity in maunds
Gilgit Agency :	
1. <i>Juniperus maenopoda</i>	berries 5,000
2. <i>Juniperus recurva</i> ..	berries limited quantities
3. <i>Glycyrrhiza glabra</i>	roots 40
4. <i>Podophyllum emodi</i> ..	Rhizome 60
5. <i>Valeriana wallichii</i> ..	roots 150
6. <i>Colchicum luteum</i>	corm 30
7. <i>Aconitum heterophyllum</i>	roots 50
8. <i>Aconitum napellus</i> ..	roots 50
9. <i>Hyoscyamus niger</i> ..	leaves & seeds small quantity

10. *Ferula* spp. .. resin ,, "
11. *Saussurea lappa* .. roots 500
12. *Carum bulbocastanum* .. fruits 30-50
13. *Cuminum cyminum* .. fruits 100
14. *Ephedra* spp. .. Twigs 2,000
15. *Picrorhiza Kurroa* .. roots 100

#### Tharparker in Sind :

1. *Acacia Senegal* .. gum large quantities
2. *Cassia angustifolia* .. leaves 100
3. *Comiphora mukul* .. gum resin large quantities
4. *Citrus colocynthis* .. fruits ,, "

#### Baluchistan. :

1. *Ephedra* sp. .. twigs 15,000
2. *Juniperus macropoda* .. berries 5,000
3. *Hyoscyamus niger* .. leaves & seeds. 100
4. *Ferula* sp. .. roots 300
5. *Acorus calamus* .. roots large quantities
6. *Thymus serpyllum* .. leaves ,, "
7. *Glycyrrhiza glabra* .. roots limited quantities

#### Kurram Agencies :

1. *Artemisia maritima* .. green tops large quantities
2. *Valeriana wallichii* .. roots limited ,,
3. *Podophyllum emodi* .. roots ,, "

#### Kaghan Valley :

1. *Podophyllum emodi* .. roots very limited quantity
2. *Valeriana wallichii* .. roots large quantities
3. *Paeonia emodi* .. roots ,, "
4. *Rheum emodi* .. roots 100
5. *Lavatera kashmiriana* .. roots 500
6. *Swertia petiolata* .. roots 100