

Guidelines for
**CULTIVATION, COLLECTION
CONSERVATION AND PROPAGATION
OF MEDICINAL HERBS**



Dr. Muhammad Aslam

JUNE, 2006



PROJECT ON
INTRODUCTION OF MEDICINAL HERBS AND SPICES CROP
MINISTRY OF FOOD, AGRICULTURE AND LIVESTOCK, ISLAMABAD.

**Guidelines for
Cultivation, Collection, Conservation
and Propagation of Medicinal Herbs**



By

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JUNE, 2006

**Project On
Introduction of Medicinal Herbs and Spices as Crop
Ministry of Food, Agriculture and Livestock,
Islamabad**



الَّذِي جَعَلَ لَكُمُ الْأَرْضَ فِرَاجًا وَالسَّمَاءَ بِنَاءً
وَأَنْزَلَ مِنَ السَّمَاءِ مَاءً فَأَخْرَجَ بِهِ مِنَ الثَّمَرَاتِ رِزْقًا لَكُمْ
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میوے پیدا کئے۔ پس کسی کو اللہ کا ہم سر نہ بناؤ۔ اور تم جانتے تو ہو۔



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FOREWORD

Agricultural Research and Development programmes in Pakistan have been focused mainly on major crops and very little on minor crops especially medicinal herbs. The eco-system in which medicinal herbs are growing has intrinsic association with environmental values in conserving soil, water and providing a habitat for other species. In addition, these have considerable value in both economic and social terms particularly in rural areas. There is a need to promote cultivation of medicinal herbs as crop in various agro-ecological regions of Pakistan for one or other of the following reasons:

- Diversification of Agriculture system to enlarge export commodity list.
- Stimulate and feed local market and industry to develop new value-added products.
- Medicinal herbs are re-emerging as a health aid due to the escalating costs of prescription drugs in the maintenance of personal health.
- These are providing livelihood to a significant number of peoples in the rural as well as urban communities.
- Due to over exploitation of the medicinal herbs from the natural resources, some of the species are threatened of being extinct from the ecosystems.
- Reduction of imports of medicinal herbs and meeting export demands as in the international market the opportunities are emerging day by day for the trade of medicinal herbs and offer to fetch foreign exchange for the country.

At present, research is being carried out in isolation at various institutes in the country and due to lack of proper information and coordination, a very little potential has been exploited. The purpose of this book captioned as “Guidelines on cultivation, collection, conservation and propagation of medicinal herbs” is to provide information to focus research and technology transfer for their commercial production keeping in view the World Health Organization (WHO) guidelines on Good Agricultural and Field Collection Practices (GACP). These will ensure and contribute to the quality assurance of medicinal herb materials used as a source for herbal medicine, which aims to improve the quality, safety and efficacy of finished product. The raw material of medicinal herbs produced following these guidelines will also help better marketing at national and international level. The book will help all the stakeholders in the chain from production to trade of medicinal herbs. The development of research based technology following these guidelines and its demonstration to the farming community will also help to increase the farm income and livelihood of the farmers. It could help in gradual increase in the use of native raw material in various processing industries and will broaden the scope of their cultivation.

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Agriculture Development Commissioner

Islamabad
June, 2006

Acknowledgements

I am grateful to Dr. Zahoor Ahmad, Plant Genetic Resources Programme NARC, Muhammad Muslim Pakistan Forest Institute Peshawar; Prof. Dr. Usmanghani Khan Hamdard University, Karachi and Dr. Sarfraz Ahmad Arid Zone Research Centre, Quetta for their help in providing useful information on the subject. I am thankful to Dr. Asrar Ahmad, Qarshi Industries (Pvt) for reading the manuscript and valuable comments.

I also appreciate the assistance of my son M. Umair Aslam, daughter Amna Kausar and wife for helping and facilitating me in many ways in accomplishing this document.

My thanks are also for Mr. Ali Haider for typing work on the document.

Dr. Mohammad Aslam

CHAPTER – 1

Introduction

There are about 4950 plant species exist in Pakistan and out of which only 300 species (6.1%) are identified as medicinal herb species (FAO 2002). Whereas Shinwari, 1996 reported that there are about 6000 plant species exist in Pakistan and out of which only 1010 species (16.8 %) are identified as having medicinal value. The term “medicinal herbs” includes all spices, aromatic plants and other plants with known medicinal value.

Almost 90 % of country’s medicinal herbs requirement is imported. It is important to mention that over 50 % of the population in Pakistan, being cured using traditional medicines by almost 50,000 traditional herbal practitioners (Usmanghani et.al. 2000). There are about 86 registered manufacturers of herbal medicine which consume most of the material. The major manufacturers produce 300-400 products plants raw materials. In this traditional medicine system most of the medicinal herbs consumed are collected from wild and very few are cultivated by very small number of farmers. Pakistan also imports very large quantities of herbs for this purpose, however very small quantities are also exported. The trade in herbal material is monopolized by wholesale drug dealers, with the small shopkeepers, pansar stores, hakims relying on wholesalers for their supply and almost 250 plant species of medicinal herbs are being traded (Zahoor).

Pakistan has a wide range of agro-climatic zones where all kinds of crops, fruits, vegetable and medicinal herbs are growing. The agricultural sector maintains the livelihood of the large rural community and ensures that sufficient food is available for domestic needs. In this sector majority of people are surviving just around the ‘poverty line’. The majority of farmers are small-scale farmers producing for their own subsistence. They have few resources, which are vulnerable to many risks of natural hazards and socio-economic dilemmas. Agricultural research and development programmes in Pakistan have been focused mainly on major crops and very little on other plants that are an integral part of rural ecosystem especially medicinal herbs. The ecosystem in which they are growing has intrinsic association with environmental values in conserving soil, water and providing a habitat for other species. In addition, these have considerable value in both economic and social terms.

Genetic diversity of medicinal herbs is continuously under the threat of extinction due to environment-unfriendly harvesting techniques and intermittent cultivation. Further more medicinal herbs sector needs focus, as it is facing problems of a variety of nature. Maintaining the supply of medicinal herbs is a problem mainly because most medicinal herbs are harvested from the wild, or “wild crafted.” As the medicinal herbs trade has become market oriented, the growing number of wild crafters is outstripping natural populations. Mostly the collectors of medicinal herbs are rural households, small and marginal farmers. Collection is done by persons who have no training in the job and are without any supervision. This collection is seldom done on scientific/systematic way with the result that many of the drug plants have come into disrepute on account of the

haphazard collection, non-grading and improper care in drying and storage. Some times adulteration with unauthentic plants is practiced with a motive of larger gains and financial benefits. In recent years, there has been a consistent growth in the demand for plant-based drugs and products from a variety of species. This has given rise to large scale collection and habitat degradation. It has resulted in the scarcity of a number of valuable medicinal herb species, and their wide range of chemical diversity will diminish at the present scale of extraction from natural habitats. Although the demand for medicinal herbs is increasing but the appropriate knowledge of agronomic practices, nutritional needs, and plant protection measures, post harvest handling, processing and the assured marketing is major constraints in the development of medicinal herbs on sustainable basis. A balance view is needed of the value of medicinal herbs for their environmental function and the value of products derived from them.

Some of the medicinal herbs are also grown as minor crops particularly by small farmers to diversify their cropping system and to earn some additional income for their livelihood. Certain medicinal herbs like *Plantago ovata*, *Crocus sativus*, *Lallamentia roylean*, *Rosa damasscena* and *Curcuma domestica* are grown in particular ecologies. However, the farmers involved in the cultivation of medicinal herbs are not fully aware of the principles and technical guidance for the production techniques. The major constraints in cultivation of medicinal herbs are lack of appropriate production technology, non-availability of registered planting materials (seed and varieties) and assured marketing system.

There is immense need to provide guidelines on Good Agricultural and Field Collection Practices (GACP) that ensures and contribute to the quality assurance of medicinal herb materials used as a source for herbal medicine, which aims to improve the quality, safety and efficacy of finished product. Sustainability of medicinal herbs will depend on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. Therefore, management of these natural resources is of great importance. The sustainable management of medicinal herbs resources through community's participatory approach will be the most efficient way to conserve diversity, traditional knowledge and will support conservation of environment in general. There is need to focuses on the community in terms of resources (human, land, animal power, seed, manure/fertilizers, bio-pesticides, implements, finance), perfect marketing and extension of technical skills and information through the local community. This document is designed to provide basis for sustainable cultivation, preservation, propagation and collection of medicinal herbs following good agriculture and field collection practices (GACP) formulated on the basis of World Health Organization (WHO) guidelines. It will help growers and collectors in the development of appropriate conservation, cultivation and harvesting strategies.

CHAPTER - 2

Cultivation of Medicinal Herbs

Sustainable cultivation of medicinal herbs will mainly focus on environmental health, economic profitability and market requirement/demand. As a matter of principle it is important to mention that cultivation of a medicinal herb is only meaningful if the chemical and pharmaceutical properties of that plant are acceptable as per requirements specified in the national pharmacopoeia and also of the end users and market. Preferably medicinal herbs have to be grown as crop following principles of organic agriculture. Medicinal herb's as crop has to be kept free from the use of pesticides, herbicides and other chemical interventions until and unless it is inevitable. The Good Agricultural Practices (GAP) and technical orientation for the cultivation of medicinal herbs as crop are given as follows;

1. Identification of Cultivated Medicinal Herb

The identification of a particular Medicinal herb under cultivation is also very important. The medicinal herbs are most easily identified when they are nearly mature in growth and are flowering. Once the identification of the mature plants is learned, the identification of the seedling plants is easier. The description of various medicinal herbs for their identification is given in monographs published by National Institute of Health, Islamabad and Hamdard Foundation Karachi. Terms describing the parts of medicinal herbs are fairly well standardized and universally used. Learning these terms and their meaning greatly assists communication between medicinal herbs growers, technicians and scientists. The commonly used medicinal herbs in Pakistan carrying details of botanical name, common name, occurrence, plant identification, parts used, medicinal value and propagation methods are given chapter – 6, learning of which will help in the identification of various medicinal herbs.

Plant parts helping in identification

Root System

Roots anchor the plant and absorb water and plant nutrients from the soil. Plants have different root systems. Many dicots have a taproot system, consisting of one large, vertical root (the taproot) that produces many smaller lateral roots. Mostly arid environment plants have taproots adapted to 'tap' water far deep. Monocots, including grasses, generally have fibrous root system consisting of a mat of threadlike roots that spread out below the soil. The roots that extend from the base of the shoot, roots rising above ground from stems are said to be adventitious roots. The amount of root branching and growth results from the interaction of many factors – soil depth, moisture, soil fertility, temperature, length of growing period, species, and variety. Roots concentrate in

areas well supplied with plant nutrients and available moisture. Learning the root system will help to identify plant species and variety.

Shoot System

It consists of vegetative shoots, which bear leaves, and floral shoots, which end in flowers. A vegetative shoot consists of a stem and the attached leaves. Visually all the plant species differ in shoot system, close observation of the following will help in plant identification.

Stems

Stem is an alternating system of nodes, the points at which leaves are attached and internodes the segments between nodes. In the angle formed by leaves and the stem is an axillary bud, which forms a shoot. At the tip of young there is a terminal bud with developing leaves and series of nodes and internodes. Modified stems with diverse structures and functions have evolved in many medicinal herbs. These modified stems, include stolons, rhizomes, tubers and bulbs are often mistaken as roots. These features appear are distinct owing to each plants species and even variety, learning of which will be helpful in identification of a Medicinal herb.

Leaves

Leaves vary in form but generally consist of a blade and a stalk, the petiole, which joins leaf to a node of the stem. Leaves of grasses and many monocots lack petioles; instead, the base of the leaf forms a sheath that envelops the stem. The leaves of monocots have parallel veins that run the length of the leaf blade. The dicots leave generally have network of veins. Leaves are divided into two types i.e. simple and compound leaves. A simple leaf has a single undivided blade and the blade of a compound leaf is divided into several leaflets. As leaf morphology varies among Medicinal herb species hence, learning of these will help identify various medicinal herbs.

Flowers

Medicinal herbs have numerous floral variations and learning about this aspect will help in plant identification. Flowers have four basic floral organs-sepals, petals, stamens and carpels. Complete flowers have all the four organs, and incomplete flowers are lacking one or more of the four floral parts. A flower having both stamens and carpels is termed a perfect flower, even if it is incomplete because it lacks sepals or petals. The incomplete flowers are missing either stamens or carpels. If staminate and carpellate flowers are located on the same individual plant, then that plant species is said to be monoecious, wheat is an example. A species which has staminate flowers and carpellate flowers on separate plants are called dioecious and date palm is one example. The inflorescence is the group of flowers or head.

Seed

The seed has three main parts – the seed coat or pericarp, the cotyledons (one in monocots and two in dicots) and the embryo. The shape and size of seed in various medicinal herbs varies enormously. Various progressions of seeds are relating to play an important role in adaptation in the dispersal and germination of seeds.

It is important to mention that all the above parts help in identification. No doubt these parts perform same functions in all plants but also show some differences in structure and appearance among various Medicinal herb species and varieties.

The growth stages

Knowledge of plant growth stages is not only helpful in proper identification but are also useful because certain cultural practices are more effective in increasing medicinal herbs yields if they are applied at the right growth stage of plant. The life cycle of a plant can be divided into several growth stages such as seed, germination, seedling, rapid increase in vegetation and reproduction. The vegetative and reproductive stages can be broken into additional stages according to the amount of vegetation and plant development. These various growth stages can be visually recognized. Growth stages in order of their occurrence in various medicinal herbs are:

1. **Emergence** – The germinating seeds appearance above the soil surface.
2. **Seedling** – young plants are establishing root systems and leaves.
3. **Branching** – plants are developing branches.
4. **Heading** – flower heads are emerging from the plants.
5. **Flowering** – florets are open; pollen is being shed; ovaries are being fertilized.
6. **Filling** – fertilized ovaries are enlarging, small and soft seed are formed.
7. **Maturity** – At maturity plant changes color from green to brownish. Some plants shatter its leaves. The seed become hard.

Identification of medicinal herbs requires careful observation of plant characteristics which are in corroboration with specification given in the national documents such as “Pakistan Encyclopedia Planta Medica” published by Hamdard Pakistan or “Monographs of Unani Medicine” published by National Institute of Health, Islamabad Pakistan. The variety selected for cultivation must be identified and recommended by some authentic source. The growers also need to identify the variety they are cultivating. These characteristics are too numerous to list here, but some of the more important characteristics for the guidelines of the growers are;

- Leaf shape and size.
- Leave arrangement.
- Plant height.
- Type of flower arrangement.
- Size, shape and colour of flower.
- Season and length of plant life.
- Root system.

2. Selection of Medicinal herbs

The farmers should prefer to grow/cultivate only those medicinal herbs which are recommended by the agriculture or forest department. The variety of that plant is known and recommended by authentic source. The farmers could also cultivate medicinal herbs under contract growing with some pharmaceutical company or trader involved in the business. The growers should know the medicinal uses of the plant or parts of the plant which they are planning to cultivate. Farmers should select those plants for cultivation which are suitable to their ecology and fit in the cropping patterns they are already practicing.

3. Botanical Identity

Before cultivation of a Medicinal herb the farmers must know the name and variety of that plant. It is essential to correctly remember the local name and botanical name of a Medicinal herb under cultivation. Medicinal herbs have English, and a scientific/botanical name. Each Medicinal herb also has more than one local name even within an agro-ecological zone. Hence, for the growers knowing and using the English name or scientific name is very helpful while marketing a Medicinal herb as crop. It is also important that growers should know and record the names of the cultivar of the Medicinal herb they are cultivating and also the source of the seed, plants, or propagation materials they have got for cultivation.

4. Specimens

If the growers feel some difficulty or doubts in the identification of plant materials he is cultivating, he should contact agriculture or forest department of his area with the specimen of that plant. The grower should keep record the information provided by the experts.

5. Site Selection

The pharmaceutical properties of a Medicinal herb for which it is grown is largely dependent on the environment (Aerial & Edaphic). It is therefore advisable that a Medicinal herb should only be cultivated in the well suitable agro-ecological zone. The medicinal herbs should not be grown on a contaminated soil even if it grows very well due to suitable climate. In a given cropping system where huge quantities of insecticides, pesticides and herbicides were used on previous crop, Medicinal herb crop should not be cultivated. The soil under cultivation should be free from all types of contaminations.

6. Seed and Propagation Materials

The propagation materials are those materials which are used to cultivate medicinal herbs. A Medicinal herb depending on its characteristic may be propagated through seeds, bulbs, cuttings and rhizomes. However, term seed is used for these materials. It is very important that prior to cultivation of a Medicinal herb its variety should be well known and information regarding its seed or propagation materials is specified. Before cultivation of a Medicinal herb as crop a growers should have the knowledge of the following;

Selection of Variety

- Obtain information about variety from authentic source such as researchers, seed supplier or other farmer experience.
- Should know the yielding ability and medicinal usage of the variety under cultivation.
- Farmers should know the good agro-management practices of that variety such as planting time, fertilization, weed control etc.
- Variety should be selected that fit very well to the prevailing cropping systems of that area according to the planting time or conditions required for its growth in a given crop rotation.

Resistance to diseases and insects

- The variety should be resistance to a broad spectrum insect, pest and disease.

Adaptation

- The varieties should be well adapted to that area and climate because the varieties performance is affected due to certain conditions as temperature, moisture, winter hardiness, time of rainfall etc.

Time to maturity

- Maturity of the variety must occur at a time favorable to grain ripening and drying.

Resistance to shattering

- The variety should have firm thresh ability. Threshing of such types can easily be done manually or by machines.
- Could remain in the field after maturity without excessive shattering loss or plant lodging.

Market demands

- The variety selected for cultivation should have demand in the market and must meet requirements of buyer in the market.

Selection of Seed

- Seed used should be pure of one variety only.
- Free of other crop seeds.
- Free of foreign matter.
- Weed seed-especially noxious or new weeds.
- No more than 2 percent inert matter, broken seeds or trash.
- Seed should be disease free and should be treated for seed borne diseases before being planted.
- The seed used should have germination ability of 80-85 percent or above.
- The plump and bright seed should be used and shriveled, deformed and damage seed should be discarded.

Seed source

- The seed of a variety should be obtained from a research station, registered nursery or grower or Government Farms.

7. Cultivation

Managing land properly for the cultivation of medicinal herbs is very important for the growers/farmers to have a quality produce. Knowledge of the climate, soil characteristics, soil moisture, soil erosion, and salinity and plant growth requirements is needed. Available machinery and power affect decisions that how the land is managed. In a given crop production system, where a Medicinal herb will be cultivated as crop, the existing cropping patterns, livestock raising and other sources available must also be considered. Livestock will provide a basis for use of organic compost. It is recommended that medicinal herbs as crop may preferably be cultivated following procedures of organic agriculture which mainly aiming to build soil fertility and avoiding the use of synthetic agricultural inputs (including fertilizers, pesticides, herbicides).

Tillage practices and seeding is one of the most critical of all operations to obtaining good crop. Time spent by a farmer in selecting good seed and carefully planting the seed, is time well spent. A good stand of vigorous, well branches plants is essential for obtaining a good yield. The farmer must know the conditions needed for good germination and stand establishment and how to obtain them in a seedbed. Local conditions have much influence on the best time and method of planting. The objective of seeding is to obtain an optimum number of uniformly spaced, vigorous plants. Such plants are better able to produce required quality standards and high yields by efficiently using all growth factors and conditions. It is recommended that organic matter in the soil

should be maintained at desirable level and for that farm yard manure should be added in the soil before planting. Unless it is inevitable, no insecticides or pesticides should be used. The preference should be on organic cultivation of medicinal herbs. For the better understanding to cultivate medicinal herbs on sustainable basis following are some good agriculture practices for the considerations of growers. Information on cultivation of some medicinal herbs is given in table-1.

Soil conditions

There are many environmental factors that affect the growth of plants and their final yield. We have no control over many of the very important factors such as climate – temperature, rainfall, wind and sunlight. Similarly, we have little or no influence on many important soil characteristics. Some of these characteristics are soil texture (size of soil particles), minerals in the soil and the rate they decompose, and soil depth. In our soils organic matter content has been reduced through years of tillage, has reduced the rate of water infiltration into many tilled soils, created a less favorable soil structure and increased erosion. However, in few areas soil fertility has increased through the wise use of manure, growing legumes and commercial fertilizers. Therefore the knowledge of the soil components, physical characteristics, chemical characteristics and water holding capacity enables better soil management decisions such as when and how much to till, frequency to irrigate and evaluating soil problems etc.

The soil is composed of four quite distinct phases or parts – solid, liquid, gaseous and living. Each part can vary considerably in composition and in proportion to each other. These variations cause differences in soil properties such as structure, consistency, fertility, aeration, moisture holding relationships and ease of tillage. Learning about the soil will help growers to better manage their soil for the cultivation of medicinal herbs as crop.

Solid phase

Solid phase of the soil system can be observed visually and is tilled readily. The solid phase occupies from 40 to 60 percent of the volume of the soil; the remaining volume is pore space between the mineral particles and is occupied by air, water and living organisms. The tilled soils of Pakistan consist of approximately 98–99.5 percent mineral matter by weight and 0.5-2.0 percent organic matter. The mineral matter less than 2 mm in diameter is divided into three major size classes – sand, silt and clay.

Liquid phase

The liquid phase, water, of the soil is of prime significance because plants obtain the water they need from the soil. It is essential for the chemical, physical and biological processes taking place in the soil as well as in plant nutrition.

Gaseous phase

The gaseous phase of the soil occupies the soil pores not occupied by water. Thus, the amount of air occupying pore space is inversely proportional to the amount of pore space

occupied by water. When all the pore space is occupied by water, the soil is described as being saturated or water logged. Most plants are adversely affected by lack of oxygen in the soil when a water logged condition exists.

Living phase

Soil micro-organisms are found in large numbers in the normal soil. Most of them are fungi, actinomycetes and bacteria. These are associated with decomposition of organic matter. During the decomposition process the soil is enriched with organic matter. Small animals of the soil as earthworms, ants, moles, and gophers are considered to be beneficial to the soil. Their activities aid soil aeration, soil aggregation and organic matter decomposition.

Organic Matter

Soil organic matter is a small but important part of the solid phase of the soil. Its importance can hardly be over emphasized because of all the favorable contributions organic matter imparts to the soil. Organic matter is a source of all elements essential to plant growth and aids in maintaining a favorable soil structure and provides energy for soil organisms. Organic matter on a weight basis is able to hold and supply much more water to plants than mineral soil. Much of the value of organic matter in reducing soil erosion is derived from the more favorable and stronger soil structure imparted by the organic matter.

Soil reaction

Soil reaction is a measure of acidity or alkalinity of the soil solution and is expressed in terms of pH. Acid soils are found where water (rainfall and irrigation) has been high enough to leach exchangeable bases from the soil. Important bases leached from the soil are calcium, magnesium, potassium and sodium. Alkaline soils are found where the water has not been sufficient to leach the bases from the soil profile. Soils present in parts of Pakistan have moderate to excess calcium in the soil. The ideal soil pH for most of herbs is 6.3 to 7.0 (slightly acidic to neutral), although they can tolerate a slightly wider range.

Soil profile

A vertical section of the soil through all its horizons is called a soil profile. Usually a soil has some obvious changes in color, texture and structure from the surface soil through the subsoil.

Soil water

Water is an essential part of the biological system. Plants depend on the soil as a source of water. Knowledge of how water enters and held in the soil and is removed from the soil assists in making good use of water. The physical appearance and feel of the soil is a very practical method of estimating soil moisture content.

Land Preparation for cultivation of medicinal herbs

Managing land properly for the production of medicinal herbs depends on the climate, soil characteristics, soil moisture, soil erosion and salinity and plant growth requirements. Machinery and power (tractor, or oxen) affect decisions on how the land is managed. Livestock raising the feed production for livestock must also be considered as one of the important parts of organic production system. Which crops are grown, cropping systems and the time that cultural practices should be adjusted to make the best use of prevailing climatic conditions? In Pakistan, the typical moisture pattern 70% of annual rainfall is received in summer (monsoon) and winter receives 30% of annual rainfall. Of course, a large part of Pakistan's agricultural land is under irrigated conditions. Much of Pakistan would be arid zones, too dry for agriculture without irrigation.

Land preparation is performed using proper tillage implement (cultivator, disc plough, rotavator). Soil is tilled to prepare a desirable seedbed, to kill weeds and improve the physical condition of the soil. In dry land agriculture moisture storage and soil conservation are considered part of preparing a desirable seedbed.

The soil should be well worked but firm so there is good contact between soil and seed. Seeds in moist loose soil may germinate then die due to rapid drying of loose soil and surface of soil should be free of hard crust which seedling cannot penetrate.

Time of planting

Planting time is a critical factor to raise a healthy and good quality crop of medicinal herbs. Too early plant emergence produces erects, poor branches plants and may have more insect and disease problems. Too late plant emergence also produces poor branches and poorly rooted plants. Planting times of some selected medicinal herbs are given in table-1 and 2.

Actual planting/sowing of crop

Seeding is one of the most critical of all operations to obtaining good yields. A good stand of vigorous, well branches plants is essential for obtaining a good yield. The farmer must know the conditions needed for good germination, stand establishment and how to obtain them in a seedbed. Local conditions have much influence on the best time and method of planting. The objective of seeding is to obtain an optimum number of uniformly spaced, vigorous plants. Such plants are better able to produce high yields by efficiently using all growth factors and resisting unfavorable conditions.

Before actual planting destroy all weeds before seeding using cultivator. Weeds which germinate before or with the crop are very damaging to the stand and growth by competing for moisture, light and nutrients. Like other crops farmers are traditionally growing, medicinal herbs may be planted using different methods i.e. in rows, on raised

beds or by broadcast method. Drill sowing in rows is preferred. Planting of medicinal herbs can also be cultivated on raised bed. Sowing methods of selected medicinal herbs are given in table-1.

Seed Rate

The seed rate will vary with different species of medicinal herbs under cultivation. Medicinal herbs with small seeds will require less seed rate than the bold seeds. Late plantings require more seed than earlier plantings. Broadcasting seed requires more seed than drilling. Seed rates for selected medicinal herbs are given in table-1. The seed should also be treated with some recommended fungicide before sowing.

Depth of seeding

On fine prepared seedbed place seeds on proper depth. Seed placed deeper will be slow to emerge and the number of plants reduced. For evenness in emergence, place seed at uniform depth. Medicinal herbs may be placed in rows or broadcast. Drill planting in rows should be is preferred. Seed may be broadcast when soil is too wet for drilling. Seeding depth will vary with the type and variety selected for cultivation.

Botanical Name	Common Name	Sowing Time	Seed Rate Kg/ha	Sowing Method	Harvest Time
<i>Matricharria chammomilla</i>	Gul-e-Baboona	Oct-Nov	1	Rows 40cm apart	April
<i>Carum copticum carvi</i>	Zirah Siyah	Oct-Nov	8.5	On ridges or rows	May
<i>Hyoscyamus niger</i>	Ajwain Khurasani	Oct	7	Ridges or rows 45 cm apart	April
<i>Plantago ovata</i>	Ispaghul	Sept-Oct	6.5	Ridges or rows 45 cm apart	Mar-Apr
<i>Mentha arvensis</i> <i>Mentha piperita</i>	Mint, Podina	Oct & Feb	10,000 stem	Ridges or rows 30 cm apart	April & Nov
<i>Lallementia royleana</i>	Tukham-e-Balangoo	Nov	7-8	Ridges or rows 45 cm apart	Mar-Apr
<i>Ocimum basilicum</i>	Basil, Tulsi	Feb-Apr	4-5	Ridges or rows 60 cm apart	Sept-Nov
<i>Brassica juncea</i> <i>Brassica juncea</i>	Rai, Black Mustard	Nov	5-7	Ridges or rows 40 cm apart	April
<i>Foeniculum vulgare</i>	Fennel, Saunf	Oct-Nov	10-12	Ridges or rows 45 cm apart	Apr-May
<i>Anethum graveolens</i>	Dill, Soya	Oct-Nov	8-10	Ridges or rows 45 cm apart	Apr-May
<i>Lactuca serriola</i>	Lettuce, Salad	Oct-Nov	7-10	Ridges or rows	March

				30 cm apart	
<i>Nigella sativa</i>	Cumin, Kalonji	Oct-Nov	12.5-15	Ridges or rows 25 cm apart	Apr-May
<i>Lepidium sativum</i>	Halun, Cress	Oct-Nov	6-8	Ridges or rows 35 cm apart	April
<i>Pimpinella anisum</i>	Aniseed, SonfRumi	Nov	12-15	Ridges or rows 30 cm apart	May
<i>Linum usitissimum</i>	Alsi, Flax Linseed	Nov	10-15	Ridges or rows 30 cm apart	Apr-May
<i>Cuminum cyminum</i>	Cumin, Zirah Safaid	Nov- Dec	8-10	Ridges or rows 25 cm apart	Mar-Apr
<i>Silybum marinum</i>	Milk thistle	Nov	5-6	Ridges or rows 50 cm apart	May-Apr
<i>Cichorium intybus</i>	Chicory, Kasni	Nov	8-10	Ridges or rows 40 cm apart	May
<i>Vinca rosea</i>	Sada Bahar	Feb	1-1.5	Ridges or rows 50 cm apart	Nov
<i>Cymbopogon jwarancusa</i>	Izkhir Lemongrass	Feb-Mar	20,000 roots	Ridges or rows 50 cm apart	June-Dec
<i>Lawsonia inermis</i>	Henna	March	8-12	Ridges or rows 45 cm apart	Nov-Mar
<i>Ricinus communis</i>	Castor	Mar-Jun	12-16	Ridges or rows 1 m apart	Nov-Dec
<i>Hibiscus sabdariffa</i>	Red Sorrel Karkader Sabdariffa	July	5 kg	Ridges or rows 40cm apart Plant to plant 20cm	May
<i>Crocus sativus</i>	Zafran, Saffron	August	85,000 bulbs	Ridges or rows 30 cm apart Plant to plant 15cm	Oct-Nov
<i>Curcuma longa</i> L.	Haldi, Turmeric	Mar-Apr	100 kg rhizomes	Ridges or rows 40-45 cm apart	Oct-Nov
<i>Cardiospermum halicacabum</i> L.	Hubul-kulkul	March	7.5-9	Ridges or rows 50 cm apart	October
<i>Vernonia anthelmintica</i> L.	Kali Ziri, Fleabane	Aug- Sept	7-8	Ridges or rows 30 cm apart	Nov-Dec
<i>Portulaca oleracea</i> L.	Kulfa, Purslane	Mar-Jun	4-5	Ridges or rows 30 cm apart	October
<i>Psoralea corylifolia</i> L.	Babchi, Psoralia	Mar-Apr	12.5	Ridges or rows 45 cm apart	July-Nov

8. Ecological environment and social impact

Cultivation of medicinal herbs is widely viewed not only as a means for meeting current and future demands for large-volume production of plant-based drugs and herbal remedies, but also as a means for relieving harvest pressure on wild populations. From agronomic point of view, there are sufficient opportunities to cultivate medicinal herbs in various agro-ecological zones of Pakistan. Agro-economics of various medicinal herbs and spices depict that these could be successfully grown as minor crop. Cultivation of medicinal herbs will not only help farmers to achieve economic benefits but also it is a good mean for conservation of the medicinal herbs in a given ecology. The farmers may also consider the following options for better utilizing the natural resources in a given agro-ecological zone.

- On agricultural lands that are dependent on rainfall, some times, lands remain uncultivated due to non-availability of water. If rains are not in sufficient amount and proper time, farmer could not plant major crop or the crop fails to establish. In such situation the soils are exposed to erosion. However, on such land some medicinal herbs (*Carthamus oxycantha*, *Cannabis sativa* etc.) are growing naturally as weeds in that habitat without any special care or maintenance. Tillage is practiced to eradicate these plants and these tillage operations tend to compact the subsoil, resulting in increased bulk density and decreased water intake rates and also add to cost in the form of fuel and machinery. Those plants have some medicinal value. Therefore farmers could keep these weeds as a wild crop and agro-management of these plants as a crop has special significance to farmers and environment.
- The growers could achieve additional economic benefits by inter cropping various medicinal herbs such as turmeric (*Curcuma domestica*), Kalongi (*Nigella sativa*) and Lin seed (*Linum Usitatissimum*) etc.
- The deciduous nature medicinal herbs such as Arandi (*Ricinus communis*), Chiraita Shireen (*Swertia chirata*) etc. depending on suitability of their growth habits may be planted on marginal lands, on slopes of hillsides, banks of canals and watercourses.
- In almost all the cropping systems in various agro-ecological zones of Pakistan, weeds are quoted as a big factor in causing yield loss (15-30%) in major crops causing economic disadvantage to farmers. To eradicate these weeds, herbicides use had been promoted which cost very high and are not environment friendly. However, many of these weeds *Fumaria indica*, *Anagalis arvensis*, *Chenopodium album* etc. have medicinal value. The farmers can earn an additional income by collecting and selling different parts of weeds. It will help reducing chemical pollution due to herbicides and also will provide self-employment opportunity to resource poor people in rural community.

9. Climate

Climate is probably the dominating factor in cultivation of medicinal herbs. Decision to select a suitable Medicinal herb as crop to adjust it in prevailing cropping systems and the cultural practices to be performed depend on climatic conditions. There are two distinct cropping seasons in Pakistan i.e. winter (rabi) and summer (Kharif). The typical moisture pattern in Pakistan is that almost 60-70 percent of annual rainfall is received in summer (monsoon) and rather dry winters. Of course, a large part of Pakistan's agricultural land is under irrigated conditions. The medicinal herbs suitable for cultivation as crop in rabi will be grown in rabi only and kharif season medicinal herbs in kharif only. The some of the medicinal herbs according to their sowing time is given in table-2.

Table-2 Medicinal herbs and Their Sowing Time			
S.No	Name of Species	Common Name	Sowing Time
Medicinal herbs of Winter (Rabi) Season			
1.	<i>Carum copticum</i>	Ajwain Desi	Mid October
2.	<i>Lallementia royleana</i>	Tukham-e-Balongo	October
3.	<i>Nigella sativa</i>	Kolangi	October
4.	<i>Coriandum sativum</i>	Dhania	October-November
5.	<i>Plantago ovata</i>	Ispbagol	October
6.	<i>Hyoscymus niger</i>	Ajwain Kharasani	October
7.	<i>Cumin cyminum</i>	Safaid Zeera	October
8.	<i>Matricharria chammomilla</i>	Gul-e-Baboona	October
9.	<i>Trigonella foenumgarceum</i>	Methra	November
10.	<i>Anethum sowa</i>	Soya, Dill	November
11.	<i>Foeniculum vulgare</i>	Sonf	November
12.	<i>Linum ustilaginum</i>	Alsi	November
13.	<i>Brassica juncea</i>	Rye	October-November
14.	<i>Cichorium intybus</i>	Kasni	November
15.	<i>Silybum marianum</i>	Milk Thistle	November
Medicinal herbs of Summer (Kharif) Season			
1.	<i>Mentha spp.</i>	Podina	March
2.	<i>Ocimum basilicum</i>	Niazbo	March-April
3.	<i>Ocinum sanctum</i>	Tulsi	March-April
4.	<i>Curcuma longa</i>	Haldi	March-April
5.	<i>Ricinus communis</i>	Castor	March-July
6.	<i>Portulaca oleracea</i>	Kulfa	March-June

7.	<i>Cyamopsis tetragonoloba</i>	Guar	May-June
8.	<i>Fagopyrom esculentum</i>	Buck wheat	July-August
9.	<i>Crocus sativa</i>	Zaffron	August
10.	<i>Vernonia anthelmintica</i>	Kali Zeeri	August-September
Perennial Medicinal herbs			
1.	<i>Rosa damascana</i>	Gul-e-Surakh	February
2.	<i>Lawsonia alva</i>	Hina (Mendhi)	March
3.	<i>Cymbopogan citrates</i>	Lemon grass	March
4.	<i>Phyllanthus emblica</i>	Amla	March-April
5.	<i>Psoralea corylifolia</i>	Balchi	March-April
6.	<i>Vinca rosea</i>	Sada Bahar	March-April

10. Soil fertility management

Medicinal herbs like other plants, needs a balanced and adequate supply of nutrients for their normal growth and development. The soils of Pakistan are well supplied with all the elements needed for good medicinal herbs production except nitrogen and phosphorus. The medicinal herbs growers need to know how much of what fertilizer to apply when if the fertilizer is to be used efficiently, effectively and economically. The testing of the soils from a authentic soil laboratory is always useful in this regard.

Fertilizers are applied in amounts sufficient to produce maximum profitable returns. Most of the information needed to determine if fertilizers can be used profitably is obtained from fertilizer research experiments and demonstration plots. Proper application of fertilizers containing these elements produces desirable results.

Adequate soil fertility ensures the most efficient use of available water. Farmyard manure along with nitrogen and phosphorus not only increase the fertility of the soil but also improve the structure of the soil. It should be realized that many growth conditions influence the final yield and quality of a Medicinal herb crop besides soil fertility. Thus, no one amount of fertilizer is the right amount for all conditions. Plant requirements and the chemical characteristics of nitrogen and phosphorus influence, when the best time to apply these nutrients is. An adequate supply of phosphorus is more critical to the medical plant when it is young than when it is nearing maturity. Phosphorus stimulates root growth and early plant vigor; thus, phosphorus fertilizer should be applied so it is available to the young seedling. Phosphorus hastens maturity and is vital to flowering and seed formation.

Nitrogen promotes chlorophyll development, rapid growth, branching and large leaves. Excess nitrogen causes excessive plant growth and height which may result in lodging and quality deterioration. Phosphorus fertilizer should be placed in the root zone and preferably where the roots of the germinating plants will come in contact immediately

with the fertilizer. Nitrogen fertilizer can be applied to the seedbed prior to planting at planting time.

Well rotten farm yard manure (FYM) has been recognized as a valuable fertilizer for medicinal herbs as crop. The organic matter added to the soil by manure results in many beneficial effects. FYM should be applied four to five week before planting which will supply nutrients as well as help to retain moisture. The applying of human excreta should not be used at all in or as FYM and fertilizer.

11. Irrigation and drainage

Irrigation should be applied according to the need of the crop. Over irrigation may cause fungal diseases and post harvest losses. The water remain standing in the field also result in damage to plants hence excessive water should be drained out. It is therefore important that irrigation should be properly applied and field drainage should be controlled. Both practices should be carried out according to the needs of the crop during its various stages of growth. Water used for irrigation purpose should comply with quality standards. The quality of water should be tested from authentic government or private laboratory. Care should be exercised so that the plants under cultivation are neither over, nor it should go under water stress during entire growth period. Preferably canal water should be applied. Brackish tube well water and contaminated water should not be used for irrigation purposes. Water coming from sewerage or effluent/ waste water from factories or any other source should not be used for irrigation purposes to medicinal herbs.

12. Plant maintenance and protection

It is recommended that the growers should pay regular visits to their fields grown under medicinal herbs. A record should be maintained regarding crop observations. Grower should identify pest, diseases, weed and nutrition problem. Growers should also determine whether the pest or problem is of economic or health importance, a significant nuisance or otherwise detrimental. For the effective control of field/crop problem growers should consider alternatives and always prefer integrated pest management (IPM) approach. Alternatives might include the following:

- Always prefer to use a resistant variety against pest and diseases.
- Always prefer to use mechanical (cultural) means of control.
- Preference should be given to use biological or integrated pest management approach.
- Do nothing and hope the pest does not occur or goes away.
- Apply chemical only when economic damage requires control.
- Apply a chemical as a preventative control before the pest is present in important numbers.

Several of the above methods may be applied. If agricultural chemicals (pesticide, insecticide and herbicide) are chosen as a means to meet your objective, only select chemicals which are effective in accomplishing your objective. Also determine which of the chemicals are available in your community. Consider each of the following;

Selection of the chemical

- i. Always use those chemical with known hazard of application (toxicity).
- ii. Ensure that the means of application a chemical are available.
- iii. The residual activity of chemical should be known. Certain agro-chemicals are effective over a long period of time. This is known as their residual life. Long residual life may or may not be desirable. The residual effects of a chemical may endanger people, animals, wildlife, etc. long after the pest has been eliminated. Certain herbicides may prevent the growing of desirable plants long after the unwanted plants (weeds) were killed. Read all labels for information on the residual life of the chemical. The chemicals with harmful residues should not be used.
- iv. Phytotoxicity or possible damage to other crops or plants should be known.
- v. The effects of the chemical on non-targets such as wildlife, predators, domestic animals and humans should be known.
- vi. Other possible effects on the environment; unwanted contamination of air, soil, water or vegetation should be known.
- vii. The cost to be incurred of that chemical including cost of application and possible economic benefits vs. cost should be known.
- viii. The farmer should know his ability to apply the chemical properly.

Select method of application and rate

- a. Direction on the label should be followed.
- b. Compare timeliness and costs of various methods of application.

Select the formulation and concentration to use

- a. Follow label directions.

Calculate quantity needed

- a. Amount/quantity to be used should be calculated based on rate of active ingredient per acre.
- b. Be sure to consider that most chemicals are sold at various concentrations.

Purchase of chemicals.

- a) Purchase a chemical which have proper ingredients.
- b) The chemical might be available in desired concentration and formulation.

- c) Chemical should be taken from fresh stock and it should have been stored under the proper conditions and the containers which have not been opened or altered.

Safety, applying, storage and disposition of pesticides

All pesticides and many other agricultural chemicals are poisons. They should be handled, applied and stored at all times with proper care. They may harm people, farm animals, birds, wildlife, etc., in the area where they are being applied or misused. There are so many ways that chemicals can be misused and it is nearly impossible to list them all. Therefore, one should be aware of and apply all safety precautions at all times when handling or near pesticides.

Safety

1. Read the label before handling, mixing or applying any chemical. Follow label directions.
2. All chemicals should be considered as poisonous and/or dangerous and handled with care. Avoid unnecessary contact with the skin, eyes or by breathing. Insecticides especially, vary in how poisonous they are. The more poisonous materials should be handled and applied only by persons properly trained to use them.

Health protection

1. If you feel sick or your vision is blurred or you are nauseated or other symptoms occur, stop work and see a doctor. Be able to tell him what material or materials you have been use.
2. Always wear gloves when handling a agro-chemical.
3. Wash and change clothing after using a chemical. If a chemical is spilled on clothing, remove and wash immediately.
4. Hands and face should be washed before eating and smoking.
5. Do not smoke while applying a chemical.
6. Always use protective clothing and masks as required by label directions.

Application of chemicals

1. All chemicals should be applied according to label directions. Do not increase the concentration or dosage, nor change the time of application, except when local recommendations are supported by recent research findings.
2. Protect other persons and non-targets such as food, animals, wildlife, predator insects, etc., from accidental exposure to pesticides.

3. Where required, post signs on treated property. Do not enter a treated area until the period of danger stated on the labeled directions has passed.
4. Before applying agricultural chemicals, check all equipment to see that the equipment is working properly.
5. Dispose of all the containers properly after use and never use them to hold other chemicals or foods etc.

Storage of chemicals

1. Store all chemicals in original containers and in a locked closet out of reach of children, irresponsible people, pets and livestock.
2. Never transfer chemicals in to other containers.
3. Keep all chemicals away from foods, foodstuffs, forage, grains, oils and fertilizers.
4. Avoid exposing all chemicals to extremes of temperatures and to high humidity.
5. Make certain that partly used containers are tightly closed and clearly labeled.
6. If spraying is to be stopped for some reason, any unused diluted materials should be removed from the sprayer and drained on waste land, placed in a hole in the soil, or stored temporarily in a suitable non-corrosible container, clearly labeled with the name of the chemical, the extent to which it has been diluted and the date of preparation.

Disposal of pesticides and pesticide containers

Any chemical solution that remains after a spraying should be drained into waste land or in a hole in the soil where it will not be harmful. Carefully select an area for this purpose. Never allow chemicals to get into streams, irrigation or drainage canals or lakes.

Importance and methods of weed control

A weed is a plant growing where it is not wanted; it is a plant out of place. A tomato plant in a wheat field and a wheat plant in a tomato field could be considered weed. Weeds cause more loss and expenses in agriculture than all other pests. Weeds occur in all crops every year while insects and diseases may not occur every year.

Weed control methods

Weeds should be killed when they are small as young weeds are easier to kill. The weeds should be killed before they use much moisture from the soil. It helps to reduce weeds intensity in future as seeds are not produced. Weed control methods are classified as preventative, biological, cultural and chemical. Cultural and chemical controls are the two most important in Medicinal herb production.

Cultural Practices

Many cultural practices help minimize and control weeds. Some of the important ones are:

- Use pure seed, free of weeds.
- Prepare a good seedbed free of weeds. A good seedbed aids rapid germination and establishment of the Medicinal herb.
- Vigorous seedlings are able to compete better with weed seedlings.

Hand weeding can be very effective in controlling annual and biennial weeds but is of very little value in eliminating perennials. Pulling weeds in the Medicinal herb field is hard work and time consuming. Unfortunately, much of the hand weeding is done at such a late stage of growth that the Medicinal herb crop has already suffered severely from weed competition.

Livestock grazing of weeds growing on the stubble fields and fallow provides a source of livestock feed, is not costly, and is partially effective in controlling weed growth. Spine weeds and weeds too bitter for the livestock are not controlled; thus the value of livestock grazing weeds is much less than desired.

Chemical Control (Herbicides)

The use of chemicals to control weeds is increasing rapidly. Herbicides (chemicals which kill plants) are used to supplement mechanical and other methods of weed control. Applying herbicides is less of a health hazard of the applicator than is the application of most insecticides. Never-the-less herbicides need to be applied more carefully than insecticides.

Herbicides, properly applied, are very effective in controlling weeds. To get the most effective weed control possible:

1. Select the chemical which will do the job.
2. Apply the chemical when it will be most destructive to weeds but will not cause ill effects on the Medicinal herb crop.
3. Apply at the right rate of application—no more, no less.
4. Uniform distribution is essential.

13. Harvesting

Medicinal herbs should be harvested during the optimal season or time period to ensure the production of medicinal plant materials and finished herbal products of the best possible quality. The time of harvest depends on the plant part to be used. Detailed information concerning the appropriate timing of harvest is often available in national pharmacopoeias, published standards, official monographs, major reference books and the scientific literature. However, it is well known that the concentration of biologically

active constituents varies with the stage of plant growth and development. The best time for harvest should be determined according to the quality and quantity of biologically active constituents rather than the total vegetative yield of the targeted Medicinal herb parts.

Harvesting should take place when the plants are of best possible quality, according to their different utilizations. Medicinal herbs should be harvested under the best possible conditions, avoiding dew, rain or exceptionally high humidity. It has been observed by experts that oil and active principles are more concentrated in the morning before strong sunlight affected them, so harvesting should be done early in the day but after any dew has disappeared. If harvesting occurs under wet conditions, the harvested material should be transported immediately to an indoor drying facility to expedite drying so as to prevent any possible deleterious effects due to increased moisture levels, which promote microbial fermentation and mould. During harvesting, care should be taken to ensure that no foreign matter, weeds or toxic plants are mixed with the harvested Medicinal herb materials.

All the harvesting devices should be kept clean and adjusted to reduce damage and contamination from soil and other materials. They should be stored in an uncontaminated, dry place free from insects, rodents, birds and other pests, and inaccessible to livestock and domestic animals.

Contact with soil should be avoided to the extent possible so as to minimize microbial contamination of harvested Medicinal herb materials, where necessary, large drop cloths, preferably made of clean muslin, may be used as an interface between the harvested plants and the soil. If the underground parts (such as the roots) are used, any adhering soil should be removed from the Medicinal herb materials as soon as they are harvested. The harvested raw Medicinal herb materials should be transported promptly in clean dry conditions. They may be placed in clean baskets, dry sacks, trailers, hoppers or other well-aerated containers and carried to a central point for transport to the processing facility.

Any mechanical damage or compacting of the raw Medicinal herb material should be avoided. Making a heap of harvest materials should be avoided and the sacks should not overfill because these practices will result in composting or otherwise diminish quality of the produce. Decomposed Medicinal herb materials should be discarded during harvest, post-harvest inspections and processing, in order to avoid microbial contamination and loss of product quality. Medicinal herb materials that are to be used in the fresh state should be harvested and delivered as quickly as possible to a processing facility in order to prevent microbial fermentation and thermal degradation. The materials may be stored under proper clean conditions. The use of preservatives should be avoided. If used, they should conform to national or regional regulations for grower and end-user.

Harvested raw Medicinal herb materials should be protected from insects, rodents, birds and other pests, and from livestock and domestic animals. Any pest control measures taken should be documented.

Equipment should be kept in clean and technically perfect working condition. Those machine parts, including their housing, that have direct contact with the harvested crop should be regularly cleaned and kept free of oil and other contaminants (including plant left-over). Cutting devices of harvesters must be adjusted so that their collection of soil particles is reduced to a minimum. In the course of harvesting, care should be taken to ensure that no toxic weeds are mixed with the harvested crop. Damaged and perished plant parts must be promptly sorted out. The harvested crop should not come into direct contact with the soil. It must be promptly collected and submitted to transport under dry and clean conditions (by use of sacks, baskets, trailers, containers, etc.). All containers used in the harvest must be cleaned and kept free of the remnants of previous crops; containers not in use must also be preserved in a dry condition, free of pests and inaccessible to mice/rodents as well as livestock and other domestic animals.

All containers used at harvested should be kept clean and free from contamination by previously harvested medicinal herbs and other foreign matters. If plastic containers are used, particularly attention should be paid to any possible retention of moisture could lead to the growth of mould. When containers are not in use, they should be kept in dry conditions, in an area that is protected from insects, rodents, birds and other pests, and to livestock and domestic animals. Delivery of freshly harvested plant material to the processing facility must occur as quickly as possible in order to prevent its heating up.

14. Personnel Health, Hygiene and Sanitation

Growers and producers should have adequate knowledge of the Medicinal herb concerned. This should include botanical identification, cultivation characteristics and habitat requirements (soil type, soil pH, fertility, plant spacing and light requirements), as well as the means of harvest and storage.

All personnel (including field workers) involved in the cultivation, harvest and post-harvest processing stages of Medicinal herb production should maintain appropriate personal hygiene and should have received training regarding their hygiene responsibilities.

Only properly trained personnel, wearing appropriate protective clothing (such as overalls, gloves, helmet, goggles, face mask), should apply agrochemicals.

Growers and producers should receive instruction on all issues relevant to the protection of the environment, conservation of Medicinal herb species, and proper agriculture stewardship.

CHAPTER - 3

Collection of Medicinal Herbs

Most of the raw material for traditional medicines system is generally those plants which are growing wild in the forests and range land areas. The collecting places for these plants may range from sub-alpine, temperate and sub-tropical hilly areas to deserts in the plains. From the wild most of the drug plants are collected by petty contractors or the local people. Many rural households and professional collectors of medicinal and aromatic plants are small and marginal farmers. Collection is done by persons who have no training in the job and are without any supervision. It is done by locals who inherit the know-how from their forefathers about the use and market of herbs. In majority of the cases wild-collection exceeds the sustainable quantity available from the natural resources thus threatening plant species. This situation has compelled almost all developing countries to enact laws governing the production and distribution of Medicinal herb material to safeguard the survival of species in nature for future generations. This collection is seldom systematic and controlled; as a result many of the drug plants have come into disrepute on account of the haphazard collection, non-grading and improper care in drying and storage. Some times adulteration with spurious plants is practiced with a motive of larger gains and financial benefits.

1. Permission to collect

Most of the Medicinal herbs are available in Forest protected areas. Few species can be collected in grazed areas. Medicinal herb collectors are mostly collect important local medicinal herbs from protected area. Time and effort can be saved by narrowing areas of search to those habitats where Medicinal herb species occurs in abundance. Local community residents of a selected area/region can often provide information about growing areas. Care should be taken to respect property rights of landowners, and permission should be obtained before entering private land for collection of Medicinal herb materials. Laws regarding plant collecting should be checked for a given habitat/localities. Forest department of that area should be approached and proper permission from the agency should be solicited. Medicinal herb species and varieties which are declared as endangered should not be collected at all.

2. Management plan for collection

The collection of the medicinal herbs should not be haphazard and unplanned. Before collection all the information about a Medicinal herb should be collected from authentic source. The amount to be collected should be sorted out and proper plants parts and stage should be very well known. Information about the geographical distribution of a Medicinal herb to be collected should be gathered. Collection of medicinal herbs is a tedious and laborious job due to scattered nature of these plants in various ecologies. The

collectors should make frequent visits to the areas for the purpose of getting information about the habitat and to plan properly for collection of the target medicinal herbs. The collection of medicinal herbs is based on tactical management which has many segments from site selection to marketing. Hence, the collectors should gather all possible information he should not ignore any segment while planning to collect plant materials. It may happen that after gathering considerable quantities of some plant the collector finds that the market is fully supplied at the time and either there is no sale for it or it can be sold only at a price that will not compensate him for his labor. Such a situation may usually be avoided by first submitting representative samples of the material to be collected, together with a statement of the approximate quantity that can be furnished, to a number of reliable dealers. Such procedure is especially recommended in the case of plants that are liable to deteriorate in a relatively short time, making it inadvisable to hold them until market conditions improve. Therefore it is essential that collectors should be able to plan every aspect properly. Following are few of the important considerations for collectors as a part of the collection management plan;

Information on the target species

When collecting medicinal herbs, it is seldom necessary to pick the entire plant since the active principles are usually concentrated in specific plant parts. There is an optimal time for collection of herbs depending upon the time of ripening of the specific parts of the plants. As a rule, the collection of roots, corms, rhizomes and bulbs should be carried out at the onset of winter or late autumn; leaves and barks in summer; flowers at blossom time and seeds at the time of ripening. Some herbs are better fresh, while others dried. These conditions will determine the wisest or most practical way of collecting quality herbs. It is therefore necessary that the collectors should have the knowledge/information about the target species. It includes the botanical and local name, botanical description, identification and medicinal value of target plant species. The distribution patterns of target plants in various ecological regions and their genetic diversity should be known prior to the collection. The information on the folk/traditional knowledge about the medicinal properties and uses of that plant by the local community must be gathered through reliable sources. This type of information could be acquired from National Herbarium at National Agricultural Research Center (NARC) Islamabad, National History Museum Islamabad and from various universities located in all provinces. Authentic books and monograph published by National Institute of Health, Islamabad and Hamdard Foundation are also very helpful in this regard.

Population density of medicinal herbs

Ecological consciousness is important when picking wild herbs. Never intend to collect an entire population of a Medicinal herb from one area to ensure the future survival of the species. Try to collect plants from here and there allowing/leaving some population propagating for future. Never pull out the entire plant even its roots are required as medicinal value; adopt the proper method of root collection so that the plant's

reproduction process is not hindered. There are laws enforced for protecting endemic wild species and other plants to save them from extinction. Collectors are urged to leave enough plants growing in each locality to conserve the plant population for future years.

Quality of medicinal herbs to be collected

It is necessary to know which part of the plant and at which stage of its growth medicinal constituents are high according to the required quality. If the collection is made prematurely or is delayed the active constituents of medicinal herbs decrease affecting the potency and quality of the drug. Medicinal qualities/potency of a particular Medicinal herb or its parts also varies with the season to season and from place to place. Therefore it is an important factor to be kept in mind while gathering/collecting medicinal herbs during proper season and from proper habitat. Therefore is important to follow good collection practices to have high quality materials. Drying and storing facilities, which are very important for producing quality herbs should be considered valid if the high quality plant material is collected properly. The quality collected drug plants will fetch good economic returns.

Environmental Information

It is best to collect wild herbs from high spots, dry soil and where the air is fresh and clean. Avoid picking herbs in stagnant water or downhill from human occupation (where groundwater contamination is possible). Picking of herbs by road is not desirable, as the plants are contaminated and poor in ingredient. It is therefore necessary to have the information on the environment in which the target medicinal herbs are growing. The knowledge of the topography, geology, soil and climatic conditions of that area will help to plan accessibility of collectors to reach that area of collection. The local maps of the area will prove very helpful to provide information in this regard.

3. Selection of medicinal herbs for collection

Pakistan is rich in Medicinal herb resources due to its varied climatic and suitable environment. In recent years, it has been observed that there has been a increase in the demand for plant-based drugs and several plant products from a variety of species. This has given rise to large scale collection and habitat degradation due to unplanned collection practices. As a result a number of valuable Medicinal herb species is diminishing with the present scale of selective extraction from natural habitats. Therefore plant species which are under the threat of extinction should not be selected. Medicinal herbs with known medicinal value should be selected for collection. The collectors of medicinal herbs should be acquainted with the market demands of a certain Medicinal herb before collection. The prospective collector should be able to determine which plants found in a locality offer the best opportunity for profit. Before selection of a plant to be collected it is very much essential that its botanical variety should be with known

and it should be confirmed from some authentic source such as monographs published by National Institute of Health, Islamabad and Hamdard Foundation Karachi. If there is some difficulty in selection of a specific Medicinal herb and variety the collector should prepare botanical specimen and should be submitted to the National Herbarium at National Agricultural Research Center (NARC) Islamabad, National History Museum Islamabad. The collector should keep the record safely about all information provided by the agencies.

4. Collection procedure of medicinal herbs and spices

The medicinal value of botanical drugs depends to a large extent on the time of their collection. Roots from annual plants should generally be dug just before the flowering period; those of biennial and perennial plants should be gathered late in the fall or early in the spring, because during the growing season they are deficient in their active constituents and are of poorer quality generally. Barks also should preferably be collected during the dormant season when the sap is not flowing. Leaves and herbs are of most value when collected during the flowering period or just before they have finished growing. Flowers should always be gathered when they first open. The medicinal qualities of herbs are affected by the weather, the time, the place, and the method of picking. The detailed procedure for collection of medicinal herbs is given as follows;

Suitable weather for collection

It is best to collect medicinal herbs in dry weather. Active ingredients/principles are usually diminished by rain (and affected by soaking the plant in water). Wet herbs are likely to spoil more quickly. In dry periods, herbs contain more oily and resinous particles which encourage better storage.

Suitable time of the day good for collection

The best time of the day to collect herbs is in the early morning, after the dew has evaporated, or in the evening, before the dew begins to form. When the sun is high and hot, the leaves tend to droop, releasing some of their medicinal qualities into the atmosphere.

Suitable Season of collection

It is important to collect at the time of the year when the drug contents of the plants at their peak. Roots are collected either very early in the spring before growth has begun, or late in the fall. Herbs (the part of the plant above ground) are usually collected during the blooming-fruiting period. Leaves are usually collected before blooming begins and can either be removed from the plant in the field, or the plants can be harvested and the leaves

can be removed later at the collection area. Seeds and fruits are best harvested when ripe. Bark should be collected when it slips most easily, during the dormant season or in early spring. Collection season of some medicinal herbs are given in table 3.

Table-3 Collection time of some important medicinal herbs		
Botanical Name	Common Name	Collection season
<i>Commiphora wightii</i>	Gugal, dhup	August-October
<i>Gentiana kurroo</i>	Karu	August-October
<i>Atropa accnita</i>	Patish	September-October
<i>Dactylorhiza hatagiera</i>	Salib Panja	September-October
<i>Carum carvi</i> L.	Kalazira	June-July
<i>Artemisia absinthium</i> L.	Artemisia	August-September
<i>Viola odorata</i>	Banafsha	April-May
<i>Perovskia abrotanoides</i>	Persoshan, sunshob	August-November
<i>Valeriana jatamansi</i> Jones	Mushak-bala	September-October
<i>Ephedra gerardiana</i>	Ephedra	July-November

Proper tools for collection

A wide range of tools from a pocket knife to shovels of one type or another, hedge clipper, pruning shear, trowel and pick can be used by collector, depending on what plant parts are to be harvested. For example, a shovel or a knife would be needed to harvest roots-plus a pair of shears to cut the tops. Bark collectors should need a sharp knife, the size depending on the thickness of the material to be harvested.

As the collector gains experiences, he will be able to determine exactly what tools are required for each kind of material. However, he will always want to carry the minimum number needed. All tools should, of course, be kept oiled and sharp; and they should be cleaned after each use.

Plant parts and proper stage of collection

The size and shape of plant materials collected can be important to the herbalist but often in a way that is opposite to what one might think. The condition in which the herb grew will be reflected in the strength of the herb. Often an old, but small, root is valued more highly than a large root. A tough struggle during life of a herb is thought to produce a stronger herb and have a good appearance. The concentration of particular chemicals can vary dramatically between patches of particular plants. Experience will increase your ability to detect herbal value. In the field, taste, texture and appearance are the collector's analytical categories. Therefore it is essential that a Medicinal herb or its parts should be properly collected to ensure the best possible quality. Few of the important points for the consideration of collectors are given as follows;

Collection of Leaves

Collection of young leaves and basal leaves are generally considered the best. Leaves can be collected throughout the season but are best selected before flowering and after fruiting. The active principles tend to migrate from the leaves into the flowers and fruit and then back into the leaves after the fruit have matured. Some prefer to pick leaves from sterile stems (stems that do not have any flowers or fruit on them). e.g. *Adhatoda vasica*, *Mentha spp.*, *Datura stramonium*, *Hyoscyamus niger*, *Cymbopogon citratus*, *Lawsonia alba* and *Swertia chirata*.

Collection of Buds

The collection of buds should be preferred when they are fully formed but before they start to open e.g. *Rosa indica* and *Bauhinia variegata*.

Flowers

The flowers should be collected at the commencement of the flowering period. Flowers rapidly deteriorate after this time e.g. *Matricaria chamomilla* (Gul-i-baboona), *Iavatera kashmiriana*, *Viola serpens* (Banafsha), and *Nymphaea lotus* (Nelofer). The optimum time for picking flowers is their flowering period.

Fruits and seeds

The fruits and seeds of a Medicinal herb should be collected/picked just before or at the time of ripening. They should be picked before they are ready to fall off. e.g. *Nigella sativa*, *Lallemantia royleana*, *Carum copticum*, *Pimpinella anisum*, *Plantago ovata*, *Terminalia chebula*, *Emblica officinalis*, *Withania coagulans*. The collected material will ripen off the plant and will not be over-ripen.

Bark

The sap flow is most active in the spring, just before the buds open, and in the fall, just after or even as the leaves are falling. The bark is most saturated with the medicinal qualities at these times. Therefore the bark should be collected at this stage or time. When collecting bark, remember that if a strip is taken 360 degrees circumferentially from the trunk, the entire tree will die. Therefore it should be removed in little patches and it should be taken from the smaller side branches. It should be collected when it slips most easily, during the dormant season or in early spring.

Collection of Roots

Annual- Roots of annuals are seldom collected. It should be collected shortly before the initiation of flowering period because the active ingredients will tend to gravitate toward the sexual parts as they develop. The plant will soon deteriorate after the seeds are produced, and then the roots die example of such plant is *Chicorium intybus* (kasni), *Hibiscus sabdariffa*, *Viola serpens* (bansha).

Biennials- These roots are best harvested in the autumn of the first year or in the spring of the second. The roots are storage organs and accumulate plant constituents during the summer months. In the second year, most of the root's content has migrated into the above-ground parts. The root now becomes woody, hollow and more or less worthless as herbal medicine examples are *Atropa acuminata*, *Colchicum luteum*, (surangjan thalkh), *Hyoscyamus niger* (ajwan khurasani).

Perennial- The roots of a permanent perennial are to be harvested, it is best to excavate the soil from one side of the plant and then cut off a few pieces of root with sharp knife or spade and refill the pit. The roots and rhizomes are picked simultaneously and are best selected in the fall after the sap has returned to the root, or in the spring before it has risen. Root bark should be removed soon after picking (if not needed or if it is the active part). The bark is easier to remove at this time and allows the root to dry more quickly. Most wild perennials are better medicines after two years of growth. They get richer in quality as they mature. This isn't always the case, however. e.g. *Glycyrrhiza glabra* (Mulathi), *Asparagus*, *Paeonia emodi* (Mamekh), *Saussurea costus* (kuth), *Valeriana jatamansi* (Mushak bala), *Berberis lyceum* (Darhald).

Collection of Tubers

Tubers should be collected just after the flowering season. They should not be damaged during collection since their medicinal qualities may be greatly reduced if the tuber surfaces are gashed e.g. *Discorea deltoidea*, *Polygonatum multiflorum* (Shakakul misri).

Collection of Bulbs

Gather after the leaves of the plant begin to wither, such as *Colchicum luteum*, (Suranjan-i-sherin) and *Gloriosa superba*.

5. Cleaning and preparation of collected materials

Cleaning harvested plant materials is called garbling. It includes removal of stones, soil, and unwanted plants and plant parts. Roots and underground parts may have to be washed if soil clings to them. The proper preparation of the collected material is of the utmost importance. Plant material containing dirt or other foreign matter, or it is moldy or

has an undesirable color or odor, it may be rejected or will get very low price. Fibrous roots, or rootstocks with numerous small roots or rootless, require careful washing to remove such matter. The larger stems of herbs and leaves should be discarded, as they possess little or no value, and leaves that are partly dried from age or that are discolored or injured by disease or insects should be excluded if the best price is to be obtained.

6. Drying of collected materials

The material must be carefully dried for its proper marketing. The plant material may easily spoil in both appearance and value if improper methods of drying are not used. The purpose of drying medicinal herbs is to keep their quality while removing the water contents. Medicinal herbs carry about 70-75 percent water. Fleshy roots dry very slowly and frequently become moldy unless they are sliced across or lengthwise to permit more rapid evaporation of the moisture. Leaves readily lose their green color while drying and sometimes become brown or even black. They should, therefore, be spread out in a well-ventilated room to dry as rapidly as possible. Exposure to direct bright sunlight is undesirable because it frequently causes bleaching of the leaves. Fruits, particularly those that are juicy, are especially difficult to handle on account of their tendency to become sour or moldy. They should preferably be spread out in thin layers on wire or cloth screens that will permit a thorough circulation of air and on which they can be frequently stirred. Seeds must be thoroughly cured; even ripe seeds that appear to be dry will frequently heat and spoil if stored without having been spread out and allowed to dry for at least several days. Hence, proper drying of drug material is essential for trade nationally and internationally. Drying is done to reduce the moisture content up to 5-10 percent to minimize spoilage. A considerable quantity of herbs is dried in the shade. If they are dried in light, natural or otherwise, they will lose both quality and color as the volatile oils evaporate in the heat. Properly dried herb will usually retain its original color. Plants that become moldy, must smell, much lighter or browner from too much heat will lose some of their medicinal qualities in the drying process. Medicinal herbs are dry when they are fragile enough to break and crackle when pressed. Fully dried leaves will part from the stems and they will fall to pieces, not fall into dust. Medicinal herbs may be dried in three ways:

- Outdoors
- Indoors
- Artificially

Outdoor drying

The plant material should be spread thinly either on mat or tarpal. The drying screen should be mounted to ensure good air circulation. Drying must be done in a well ventilated, shady or dark place keep in mind that medicinal herbs should not dried in sun. One should turn the herbs a few times, checking to see if they are properly drying. The herbs will probably take four or five days to dry properly; those with thicker leaves may take a week or even two.

Indoor drying

Indoor drying must be done in a dust-free, well ventilated room. The herb can be dried on a mat or a very well clean (free from dust and contamination) hard floor. Some prefer to dry leafy foliage in bunches. The bunch should be tied together and hung with the flower-heads down or more properly, the roots up. Keep the herbs out of direct sunlight (even light shining through a window).

Artificial drying

Artificial drying is increasingly being employed since it produces a superior product retaining much of the original flavor and avoiding a hay-like taste. The drying yard should be properly cleaned. The drying temperature has a vital influence on the quality. In artificial drying, it should be done on the temperature of 24-26⁰ C or 75-80⁰ F (but not exceeding 33⁰ C or 90⁰ F) for one to three days, turning once or twice daily. The high temperature for drying should be avoided as the essential oils and the flavor are lost at high temperatures. Commercial oven dryers have fans that aid ventilation. Mistakes in controlling temperature may destroy the active ingredient of drug plants.

7. Storage of collected materials

When the herbs are dried properly they should be stored as quickly as possible so that they could not re-absorb any moisture from the atmosphere. Place the herbs in air-tight containers in a cool, dark place. Different types of storage can influence the quality of the herb. Dried herbs store best in the whole form and most buyers choose this form of storage. A further important consideration in storage is to limit contamination. Most authorities recommend storage in air-tight containers in a dry dark place at a temperature not exceeding 18⁰ C. Heat robs herbs of their flavor whilst dampness causes ground herbs to cake and deteriorate. Most authorities recommend that herbs for the retail market should be available in small quantities preferably in jars or packets. The purity of raw drugs and the processing technology have a significant role in determining the quality of the finished product.

8. Packaging and Labeling of collected materials

Clean burlap sacks, boxes, and paper sacks are all usable for packing dried plant material. Boxes should be dry and lined with clean paper. Collectors should avoid using plastic bags because any excess moisture present when the bags are shut may result in molding. It is essential to label the herbs properly. Each container should have proper identification label with herb name, variety, date and place/site of collection. Plant material should be stored under sanitary conditions that minimize rodent and insect contamination. Clean, dry ventilated storage areas are best for preserving quality. The best way to store the dried material is to pack it in clean bags or boxes. If, however, the material is likely to be

injured by exposure to air or light, or if it is subject to the attack of insects, it should be placed in tightly closed cans or other receptacles and marketed at the earliest opportunity

9. Personnel Health, Hygiene and Sanitation

The all members of collecting team should have adequate knowledge of the Medicinal herb concerned. This should include botanical identification, cultivar characteristics and habitat of that Medicinal herb, as well as the means of collection, drying and storage.

All personnel involved in the collection and post-harvest processing stages of Medicinal herb materials should maintain appropriate personal hygiene and should have received training regarding their hygiene responsibilities. Personnel with any type of disease should not participate in collection activities at any stage. Smoking and eating should not be permitted in processing and storage areas. Collectors should wash their hand properly before starting any activity and should not wear any jewellery, watches or other such item while engaged in activities

Only properly trained personnel, wearing appropriate protective clothing (such as overalls, gloves, helmet, goggles, face mask), should be involved in the activities from collection of medicinal herbs to drying and storage.

Collectors should receive instruction on all issue relevant to the protection of the environment, conservation of Medicinal herb species, and proper collection stewardship.

CHAPTER - 4

Conservation of Medicinal Herbs

The Pakistan has a diverse climatic and ecological zones and topographical regions with a spectrum of flora including plants with medicinal value. The uncontrolled exploitation of medicinal herbs result in deprive of natural Medicinal herb heritage as well as environment degradation. The major cause of this dilemma is that almost all the medicinal herbs are collected from the wild and the local collectors are not aware of the proper procedure of collecting. Moreover, the local communities are ignorant in conservation initiatives. There is immense need to that the Medicinal herb species should be conserved as evolving populations in nature. Attempts are needed to give emphasis on the conservation and propagation of Medicinal herb species both that are susceptible to endangerment or vulnerability and species which are not currently endangered may become so unless are not conserved on sustainable basis.

Pakistan is signatory of the Convention on Biological Diversity (CBD), FAO undertaking 2002, Convention on International Trade in Endangered Species (CITES) and various others. Hence, Pakistan needs to put efforts regarding conservation of its biological diversity including medicinal herbs. Therefore Ministry of Environment has drafted the "Biodiversity Action Plan (BAP). This action plan has proposed actions for *in-situ* and *ex-situ* conservation of its biodiversity including medicinal herbs. Genetic diversity of traditional medicinal herbs (including aromatic and spices) is continuously under the threat of extinction due to environment-unfriendly harvesting techniques. A balance view is needed of the value of medicinal herbs for their environmental function and the value of products derived from them. Further more, this sector needs focus as it is facing problems of a variety of nature. Maintaining the supply of medicinal herbs is a problem mainly because most medicinal herbs are harvested from the wild, or "wild crafted." For many plants, this practice has been relatively kind for centuries, as those who use the plants have collected only what they need. As the trade has become market-oriented and international, the growing number of wild crafters is outstripping natural populations. Hence, there is need to establish this trade on sustainable basis. The vulnerability of medicinal herbs to over-exploitation and threat of extinction, need to be dealt pragmatically. Policies of Pakistan on Conservation of Biodiversity of medical and aromatic plants are concentrated both on *in-situ* and *ex-situ* conservation however, the country has still to go a long way to frame laws and policies to conserve all its genetic material, bilateral and multilateral exchange of material, farmers and community rights etc. Efforts on research and development programmes are needed to focus on medicinal herbs because these are an integral part of rural ecosystem.

There is a need to promote cultivation, preservation, propagation and collection of medicinal herbs on sustainable basis by adopting good agriculture and field collection practices that encourages and contribute to the quality assurance of Medicinal herb materials as a source for herbal medicine. It should also aim to improve the quality, safety and efficacy of finished products. The sustainable management these natural

resources through community's participatory approach will be the most efficient way to conserve diversity, traditional knowledge and genetic variation of medicinal herbs and will support conservation of environment in general.

The conservation and sustainable use of medicinal herbs seeks to secure conservation of plant species, and their habitats. In this section information are provided on conservation and propagation procedures for medicinal herbs which will ultimately help to sustain the natural environment in which they are growing.

Conservation of Medicinal herbs

Medicinal herbs and spices have great value in Pakistan. The eco-system in which they are growing has intrinsic association with environmental values in conserving soil, water and providing a habitat for other species. In addition, have considerable value in both economic and social terms to the local community. A balance view is needed of the value of medicinal herbs spices for their environmental function and the value of products derived from them. Genetic diversity of traditional medicinal herbs is continuously under the threat of extinction as a result of

- Growth-exploitation.
- Environment-unfriendly harvesting techniques.
- Loss of growth habitats.
- Un-monitored trade of medicinal herbs.

Priorities in the sustainable management of medicinal herbs include the conservation of this biological diversity at the level of eco-system, species and genetic sources. It is only possible through the involvement of all stakeholders and interested parties to take it of utmost importance to reach a balanced decision and ensure an action plan for genetic conservation that may be generally accepted and thus sustainable in the long terms.

The management of an appropriate combination of resource areas, in various locations and under diverse environmental conditions will be the most efficient way to conserve diversity and genetic variation of medicinal herbs and spices. The concerns and issues relating the conservation of these plants could be addressed through a variety of activities involving pinnacle government and non-governmental organizations of the sector. The general principals and procedure being recommended and adopted include:

In-situ Conservation

This is the best method for protecting the genetic resources, however it is not easy to maintain due to population pressure and resource constraint. In Pakistan for *in-situ* conservation, 14 National Parks have been established with the objectives for the preservation of biodiversity including medicinal herbs. Due to lack of required resources, the management of these has not produced desired results as a consequence the over-

exploitation of biodiversity including medicinal herbs is still continued. However, effective efforts could be made to educate the community of the particular areas about the importance of the conservation of these natural resources.

Ex-situ Conservation

Several approaches could be suggested for ex-situ conservation of medicinal herbs however, these will complement the in-situ conservation efforts. For example, species which are under threat in the natural habitat, or which are commercially important can be cultivated. Few of the key aspects of ex-situ conservation of medicinal herbs include;

- Germplasm collection of medicinal herbs.
- Storage of germplasm in Gene banks.
- Promote aspects of policy and research concerning the cultivation of medicinal herbs and their genetic improvement.
- Field trials and demonstration of medicinal herbs involving participatory approach.
- Conservation in botanical gardens.

Germplasm Collection and Gene Bank Preservation

Germplasm collection and storage in the gene bank is one of the effective methods of ex-situ conservation of medicinal herbs. It needs well established facilities of storage with controlled temperature and air tight rooms, greenhouses etc. and proper documentation of accessions. In Pakistan medicinal herbs germplasm collection and preservation in gene bank is being carried out by Pakistan Agricultural Research Council through its well established Plant Genetic Resources Institute located at National Agricultural Research Centre Islamabad.

Promotion Cultivation of Medicinal herbs

The good agricultural and collection practices (GACP) in diverse environmental conditions will be the most efficient way to conserve diversity and genetic variation of medicinal herbs. GACP are imperative to develop as their adoption will ensure availability of quality Medicinal herb materials for end users in local and international markets. Cultivation and propagation of medicinal herbs vary according to their growth form and season of growing. In Pakistan, cultivation of medicinal herbs is very intermittent. Definitely the medicinal herbs are not alternative to major crops. However, based on their importance in health care, precious natural resources and economic value in trade, efforts are needed to promote them for cultivation as minor crops. This will help to reduce heavy burden on import bill and save foreign exchange. From agronomic point of view, there are sufficient opportunities to cultivate medicinal herbs in various agro-ecological zones of Pakistan. However, it is important to mention that agronomic

suitability is only meaningful if the chemical and pharmaceutical properties are acceptable as per requirements of the end users and market.

To promote cultivation of medicinal herbs as crop few of the important agro-management points are as follows for the consideration of researchers and policy makers.

- Provide information regarding medicinal herbs and spices to the farmers and collectors in the form pamphlets in local language and using media such as radio, news-paper and television. The information of this sort should include package of technology as well as marketing demand and price of various medicinal herbs and spices.
- Agriculture Extension Departments through consultation with the specialists should provide productions guides and appropriate technology to the farmers of their areas.
- The reputed pharmaceutical, dealers, exporters and manufactures of finished products may help promotion of medicinal herbs and spices through contract growing of these plants and crops.
- Seed companies of the country can also play a pivotal role in this regard.
- Private and public organisations involved in this sector may join their hands to hold farmer's/collectors conferences and promote community participation through concept of "Herb Associations".
- Some of the companies buying herbs and contract growing also can provide some useful production information and some seed companies who sell large volumes of herb seed may provide technical assistance.

Botanical Gardens

The establishment of botanical gardens is also an efficient way of *ex-situ* conservation. The public and private organizations should be involved in the establishment of herbal gardens. An herbal or botanical gardens may vary in their size from small to larger depending on the resources available for establishment and maintenance. The garden should be well designed on a proper location. The ideal position of an herbal garden is a south- and or west- facing part of the garden that slopes slightly towards the sun. As herbs are wild plants tamed to fit a garden, hence try to grow them in conditions comparable with their original environment. Generally the herbs are adaptable and they do quite well outside their native habitat, provided conditions what they prefer.

CHAPTER – 5

Propagation of Medicinal Herbs

Propagation of medicinal herbs is the multiplication and production of plants using any plant parts to produce a new plant or a population of plants. These parts include seeds, cuttings, layers, buds, scions, and various kinds of specialized structures such as bulbs, corms and tubers. During its life cycle all medicinal herbs undergo through a periods of vegetative growth during which it forms stems, leaves, and roots, and reproductive development period when it forms flowers, fruits, and seeds. Plants undergo life cycle changes beginning with the propagation of a specific part (seed, cutting, bulbs etc.) and ending with the death of the individual plant. The growth and development patterns taking place are visible and the variations that are expressed in this process are characteristic of the individual plant. For example, annual plant complete the entire cycle from germination to dissemination of seeds and death in one growing season. Biennial plants have a two-year cycle. During the first season, the plants complete vegetative period and during the second season, the plants produce flowers and seeds and die.

The change from the vegetative to the reproductive stage is responsive to environmental factors, such as temperature and length of day. Perennial plants live for more than two years and repeat the vegetative-reproductive change annually (or biennially) and new shoots are produced by buds. This cycle is also responsive to environmental factors. Herbaceous perennials produce shoots which grow during one season and die at the end of the growing season. The plant survives during adverse periods by specialized underground stem structures with roots that remain perennial (bulbs, rhizomes, crowns). Woody perennials develop permanent woody stems that continue to increase annually from apical and lateral buds with characteristic growth and dormancy cycles. An individual plant that develops from a seed is referred to as a seedling whether it is an annual, biennial, herbaceous, or woody perennial. Propagation methods of various medicinal herbs commonly used in Pakistan are given in table-4.

Medicinal herbs Propagation Methods

The medicinal herbs are propagated through various means. The propagation of medicinal herbs through seeds is well known to collectors and farmers. The other methods include vegetative propagation through, cuttings, tubers, suckers and bulbs. The details various methods are given as follows;

Seeds as propagation material

Most medicinal herbs are reproduced by seed. Propagation by seeds at a large scale is an efficient and economic method of Medicinal herb multiplication. Propagation through seed is carried out using three basic systems:

- Sowing of seeds in the well prepared fields using appropriate method (broadcasting or using drill).
- Sowing of seeds in the nurseries and then transplanting to a field.
- Sowing of seeds greenhouse, cold frame, or similar structure, and then transplanting to the field.

For commercial production of medicinal herbs as crop, the most common and feasible practice is to sowing of seeds direct in the field. This requires the following key points for consideration:

1. Preparation of proper seed bed.
2. High quality seed.
3. The correct planting time.
4. Seed treatment prior to planting (pre-treatment of seeds).
5. The proper method of sowing, using broadcast or mechanical seeders.
6. The proper sowing depth.
7. The proper sowing rate.
8. The proper post-sowing care.

Field seeding of medicinal herbs in forest areas is accomplished either through natural seed dissemination or planting. Costs and labour involved in case of direct seeding are lower than those for transplanting seedlings, provided soil and site conditions favour the operation. The major difficulty is the very heavy losses of seeds and young plants that result from predation by insects, birds, and animals and from drying, hot weather, and disease. A proper seed bed is essential and the soil should be properly fertilized and competing weeds/vegetation should be removed. The soil may be prepared by disking or furrowing. Seeds may be broadcast by hand or by special planters or drilled with special seeders. Seeds should be treated with proper fungicides and if possible with some bird and rodent repellent.

Propagation through Nursery Sowing

In propagating and growing young nursery plants, facilities and procedures are best arranged to optimize the response of plants to some fundamental microclimatic and edaphic factors influencing their growth and development such as light, water, temperature and nutrients. In addition, young nursery plants require protection from pathogens and other pests, as well as control of salinity levels in the growing media.

Field nurseries should be raised where seeds are planted closely together in beds and will be used for growing transplants of medicinal herbs in the forests particularly the deciduous type plants. The conditions for optimum seed germination and seedling emergence are same to those required in propagation through seed (as described above). However, field transplant nurseries produce seedlings at a close spacing using smaller areas and more careful management. It is more appropriate to produce woody plant

seedlings first in nurseries and then transplant than direct sowing them to the target location. Seedlings may be transplanted to target location either bare root or in appropriate containers. Bare-root transplanting invariably results in some root damage and transplant shock, both of which check growth. Handling prior to transplanting should involve hardening-off, which involves a controlled growth cessation. This causes accumulation of food, making the plant better able to withstand adverse environmental conditions.

Handling of nursery seedlings

Black polythene bags measuring 15cm to 18cm wide and 19.5-20cm high should be filled with nursery compost or topsoil enriched with well-decomposed manure at a ratio of 3:1. The bags should be arranged in rows of 5 wide, leaving lanes of about 45-60cm to allow for watering, weeding and chemical spraying. For direct seed sowing or the direct sticking of cuttings, the beds should be raised and the soil should be sifted to remove large stones and other debris. Firm down the soil and rake the surface before sowing. Ensure that seeds are soon in neat rows. This will help to distinguish between the emerging weeds and the plants it wants when hand weeding. Irrigate with a gentle spray of droplets after sowing.

Irrigation in the nursery

It is important that plants are irrigated regularly and uniformly. Periods of dryness weaken the plant and make it susceptible to disease. Regular watering encourages strong root growth and vigorous shoot growth. The seedbed should be watered twice every other day until seedlings emerge. Leafy cuttings require high humidity, as they are unable to draw water up through the soil until their roots have begun to grow. Potted plants require even moisture throughout the compost and inadequate watering will leave the base of the pot dry. The consequence of poor watering is that the roots will remain at the surface and not reach down to moisture stored lower down in the soil.

Pest and diseases control

Hygiene on the nursery is important. Sweep away any leaf debris that is on the ground, as this will harbor pests. When the nursery is temporarily empty, introduce fowls to the nursery for a few hours. They will eat any small grubs and insect eggs that may infest the plants later on. Do not leave plants in standing water where the roots will become waterlogged. This will encourage rotting and weaken the plants making them more susceptible to fungal attack.

Ventilation

Regularly prop opens the lid of the propagation unit with a piece of wood to avoid a build-up of heat. This is particularly important in the daytime when, without a breeze, the sun's heat will be captured in the unit and will damage the cuttings.

Vegetative Propagation

A vegetative part such as bud, graft, cutting etc. when it is separated from the plant and propagated for raising new seedlings and plants, the method is called vegetative propagation. Vegetative reproduction is the most important propagation method used for the commercial production of many, if not most medicinal herbs.

Adventitious root formation is a pre-requisite to successful cutting propagation. In forestry, cutting propagation is one of the common and successful methods. Vegetative propagation of forest planting stock through adventitious rooting is one of the most exciting emerging technologies in forestry.

Propagation by stem and leaf-bud cuttings (single-eye cuttings) requires only that a new adventitious root system be formed, because a potential shoot system (a bud) is already present. Root cuttings and leaf cuttings must initiate both a new shoot system as well as new adventitious roots. For species that can be propagated easily by cuttings, this method has numerous advantages. Many new plants can be started in a limited space from a few stock plants. It is inexpensive (compared to other asexual methods), rapid, and simple, and does not require the special techniques necessary in grafting, budding, or micro propagation. Cutting propagation avoids the graftage problems of incompatibility with rootstocks and poor graft union formation. Greater uniformity is obtained by absence of the variation which sometimes appears as a result of the variable seedling rootstocks of grafted plants. The parent plant is usually reproduced exactly, with no genetic change.

Propagation through Cuttings

Cuttings are the most important means of propagating ornamental shrubs-deciduous species as well as the broad-and narrow-leaved types of evergreens. Cuttings are also used widely in commercial greenhouse propagation of many flowering plants in floriculture such as roses, chrysanthemums, geraniums etc. This method is also commonly used in propagating some foliage crops, certain fruit crops, and some vegetables (chicory, sweet potato) and forestry species. However, cutting propagation, like any other asexual technique, may potentially increase disease and insect susceptibility, since the plants may lack the genetic diversity of seedling-produced plants.

Types of cuttings

Cuttings are made from the vegetative portions of the plant, such as stems, modified stems (rhizomes, tubers, corms, and bulbs), leaves, or roots.

Stem cuttings

In propagation by stem cuttings, segments of shoots containing lateral or terminal buds are obtained with the expectation that under the proper conditions adventitious roots will develop and thus produce independent plants. Stem cuttings can be divided into four

groups, according to the nature of the wood used: hardwood, semi-hardwood, softwood, and herbaceous.

Hardwood cuttings

Hardwood cuttings are those made of matured, dormant firm wood after leaves have abscised. The use of hardwood cuttings is one of the least expensive and easiest methods of vegetative propagation. Hardwood cuttings are easy to prepare, are not readily perishable, may be carried safely over long distances and it does not require special equipment during rooting. Hardwood cuttings vary in length from 10 to 76 cm. Long cuttings are appropriate when they are to be used as rootstocks for fruit trees, permit the insertion of the cultivar bud into the original cutting following rooting, rather than into a smaller new shoot arising from the original cutting. At least two nodes are included in the cutting; the basal cut is usually just below a node and the top cut 1.3 to 2.5 cm above a node. Cuttings of narrow leaved evergreen plants must be rooted under moisture conditions that will prevent excessive drying as they usually are slow to root, sometimes taking several months to a year. These cuttings ordinarily are best taken between late fall and late winter. Proper care of the cuttings after the material is taken from the stock plants is important.

Semi-hardwood cuttings

The Semi-hardwood cuttings are made from woody, broad-leaved evergreen species and leafy summer and early fall cuttings of deciduous plants with partially matured wood. Cuttings of broad-leaved evergreen species are generally taken during the summer (or late spring through early fall in warmer climates) from new shoots just after a flush of growth has taken place and the wood is partially matured. Many shrubs, such as camellia, azaleas, and holly, are commonly propagated by semi-hardwood cuttings. Semi-hardwood cuttings are made 7.5 to 15 cm long with leaves retained at the upper end. If the leaves are very large, they should be trimmed to reduce the leaf surface area, which lowers transpiration water loss and allows closer spacing in the cutting bed. It is necessary that leafy cuttings be rooted under conditions that will keep water loss from the leaves at a minimum.

Softwood cuttings

Cuttings prepared from the soft, succulent, new spring growth of deciduous or evergreen species is known as softwood cuttings. Softwoods are produced during growth flushes and may occur just once per year.

Herbaceous cuttings

Herbaceous cuttings are made from succulent, non woody plants like geraniums, chrysanthemums, carnations, and many foliage crops. They are 8 to 13 cm long with leaves retained at the upper end, or without leaves. Most florists' crops are propagated by easily rooted herbaceous cuttings.

Leaf cuttings

In leaf cuttings, the leaf blade, or leaf blade and petiole, is utilized in starting new plants. Adventitious buds, shoots, and roots form at the base of the leaf and develop into the new plant; the original leaf does not become a part of the new plant. Only a limited number of plant species can be propagated by leaf cuttings. The long tapering leaves are cut into sections 8 to 10 cm long. These leaf pieces are inserted three-fourths of their length into the rooting medium, and after a period of time a new plant forms at the base of the leaf piece.

Leaf-bud cutting

A leaf-bud cutting (single-eye or single-node cutting) consists of a leaf blade, petiole, and a short piece of the stem with the attached axillary bud. They differ from leaf cuttings in that only adventitious roots need form. The axillary bud at the nodal area of the stem provides the new shoot. Leaf-bud cuttings are particularly useful when propagating material is scarce, because they will produce at least twice as many new plants from the same amount of stock material as can be started by stem cuttings. Each node can be used as a cutting.

Root cuttings

The root cuttings as a propagation material gives better results when root cuttings/root pieces are taken from young stock plants in late winter or early spring when the stock plants in late winter or early spring when the roots are well supplied with stored food but well before new growth is started. Taking the cuttings during the time when the parent plant is rapidly making new shoot growth should be avoided.

Propagation through Tubers

Tubers are also means effective means of propagation. The tubers for propagation should be collected only when the plants are not actively growing but it should be in dormant phase. Small tuber, which includes a bud, should be removed from the parent plant without destroying the whole plant. These tubers are then planted on a raised bed or well prepared fields.

Propagation through Suckers

Suckers are the shoots that are produced from the roots. These are also used to propagate many plants. These suckers are separate from the main plant keeping a piece of root attached. These are then planted by preparing a fine seed bed and irrigate the field as soon as planting is completed. Avoid the suckers drying out

Propagation through Offsets

These are the little clumps of new shoots that form clumps or sets of buds at the base of some species e.g. banana and plantain. Separate these from the main plant and divide them into individual plants or small clumps. Do not allow these to dry out or be left in the sun. Plant these clumps into the nursery beds or into their final planting place and irrigate them properly.

Undercutting seedbeds

Drawing the blade of a machete at ground level, under a raised bed of cultivating plants, is known as ‘undercutting’. This is a useful technique when growing cultivating plants in the nursery to help them to develop a very fibrous root system. This results in good plant establishment when they are transplanted to their final planting site. Undercutting promotes vigorous fibrous roots and prevents the roots from penetrating too far down into the nursery bed. Undercutting can only be done on a raised bed that is twice the width of a machete.

Managing the Propagation Environment

Propagation Structures

Facilities required for propagating plants by seed, cuttings, and grafting, and other methods include two basic units. One is a structure with temperature control and ample light, such as a greenhouse, modified Quonset house, or hotbed-where seed can be germinated, or cuttings rooted, or tissue culture micro plants rooted and acclimatized. The second unit is a structure into which the young, tender plants (liners) can be moved for hardening, preparatory to transplanting out-of-doors. Cold frames, low polyethylene tunnels or sun tunnels covered by Saran, and lath houses are useful for this purpose. Any of these structures may, at certain times of the year and for certain species, serve as a propagation and acclimation structure.

Sanitation in Propagation

Proper sanitation during propagation and growing has become widely recognized as an essential part of nursery operations. During propagation, losses of young seedlings, rooted cuttings, tissue-cultured rooted plants, and grafted nursery plants to various pathogens and insect pests can be devastating, especially under the warm, humid conditions found in propagation houses. Ideally, sanitation strategies should be considered even in the construction phase of propagation structures.

The pathogens and other pests are best managed by dealing with them under situations where they can enter and become a problem during propagation procedures such as:

- The propagation facilities-propagating rooms, containers, pots, flats, knives, shears, working surfaces, hoses, greenhouse benches, and the like.
- The propagation media-rooting and growing mixes for cuttings, seedlings, tissue culture plantlets.
- The stock plant material-seeds, cutting material, scion, and stock material for grafting, tissue culture, etc.

All pathogens and other pests should be controlled in each of these areas, this will help the young plants growing healthy and free from pest and diseases.

The space where the actual propagation (making cuttings, planting seeds, grafting) takes place should be a light, very clean, cool room, completely separated from areas where the soil mixing, pot and flat storage, growing, and other operations take place. Traffic and visitors in this room should be kept to a minimum. At the end of each working day all plant debris and soil should be cleaned out, the floors hosed down, and working surfaces washed with disinfectant solutions of sodium hypochlorite solution (Clorox).

Flats and pots coming into this room should have been washed thoroughly and, if used previously, should be heat-treated or disinfected with proper/recommended chemicals. No dirty flats or pots should be allowed in the propagation area.

CHAPTER - 6

Medicinal Herbs/Plants of Pakistan

Medicinal herbs commonly used in Pakistan are developed to provide information to growers and collectors for sustainable cultivation, preservation, propagation and collection of medicinal herbs. It will help growers and collectors for identification of medicinal herbs. It also provides information on family and names (botanical and common) of medicinal herbs, their occurrence, parts used, medicinal value and propagation. It will help in developing strategy for conservation, cultivation and harvesting of these plants following good agriculture and collection practices and to provide quality produce or materials according to the needs of the end users. Medicinal herbs are classified in various ways depending upon their scientific name, local name, uses and active gradients present in plant organs, particularly roots, leaves, flowers, seeds or other parts of the plant. National Institute of Health, Islamabad and Hamdard Foundation have published comprehensive monographs on traditional medicine in Pakistan. These monographs are providing details on various aspects of medicinal herbs. These are comprised of all details from names (Botanical, Tibbi, Common and English), plant identifications and information on the plant materia-medica of traditional systems of medicine as well as to pharmacognosy and pharmacology of the various medicinal herbs.

Botanical Name: *ABRUS PRECATORIUS L.*

Common Names: Gunchi and Chanoti

Family: Fabaceae

Occurrence: Sindh and Punjab

Plant Identification: It is a woody climber, the branches are slender and glabrous, leaves pinnate, leaflets 10-20 pairs; flower pink or white about 1.0 cm long, pods 2.4-4.0 cm long and 1-2 cm in width, oblong, turgid; seed small, shining red with black spot at the hilum.

Parts Used: Fresh and dry leaves, roots and seed.

Medicinal Value: Externally resolvent, deterrent, corrosive, desiccative and internally stimulant.

Propagation: Naturally propagated through seeds

Botanical Name: *ABUTILON INDICUM (L.) Sweet*

Common Names: Khanghi, Karandi, Madmi and Petari

Family: Malvaceae

Occurrence: Weedy places of hot areas of Sindh and Punjab.

Plant Identification: It is an erect and woody perennial herb or under-shrub up to 90 cm tall; leaves cordate, long, stalked slightly lobed, entire or unequally toothed. Flowers are solitary, yellow, 2.5 cm across and open in the evening; carpels 15-20, separating from the central axis, forming a flat-topped fruit; seed without hair.

Parts Used: Seed and leaves

Medicinal Value: Demulcent, diuretic, useful in piles, gonorrhoea and gleet.

Propagation: It propagates from seed under natural conditions.

Botanical Name: *ACACIA NILOTICA* (L.) Del.

Common Names: Babul and Kikar

Family: Fabaceae

Occurrence: Sindh, Punjab, NWFP and Balochistan

Plant Identification: It is medium size much branch tree; leaves compound, pinnate, branches with spines, pinnate 3-10 pairs, leaf-lets 10-20 pairs, flower yellow in globose heads, petals twice as long as sepals, pods 7-15 cm long, stipitate, moniliform, compressed, densely grey tomentose, sub-indehiscent; Seeds 8-12.

Parts Used: Leaves, Bark, Gum

Medicinal Value: Astringent and styptic, systemically as well as locally

Propagation: It propagates through seeds

Botanical Name: *ACHILLEA MILLEFOLIUM* L.

Common Names: Gandana, Akarkara, Biranj saif

Family: Asteraceae

Occurrence: Northern Punjab, Himalayan Region and NWFP

Plant Identification: It is erect, pubescent strongly scented perennial herb about 60 cm tall; leaves alternate, oblong-lanceolate 5-15 cm, narrowly divided, stem leaves sessile; flowers heads radiate, small, crowded in branched corymb, flower white or pale pink, corolla or the central flowers 5-lobed; fruit an achene, oblong, flattened and shining.

Parts Used: Whole plant

Medicinal Value: Anti-inflammatory, carminative

Propagation: Propagation through runners and seeds

Botanical Name: *ACHYRANTHUS ASPERA* L.

Common Names: Amaranthus, Charchuta, Obat kandri

Family: Amaranthaceae

Occurrence: Balochistan (Lasbela District)

Plant Identification: A small erect herb, leaves opposite and obovate, flowers on spike, numerous, greenish white, bracteoles spinous.

Parts used: Whole plant

Medicinal Value: Useful against insect bites, resolves suppurating tumours in the arm pits and bloody piles, anti-malarial.

Propagation: Trough seeds and flowering occur from September – April

Botanical Name: *ACORUS CALAMUS L.*

Common Names: Kull and Bach

Family: Araceae

Occurrence: Shallow and slow flowing water waste in Balochistan and Sindh

Plant Identification: It is an aquatic herb with characteristic thick, pleasantly aromatic rhizome with leaves up to 1 meter long; roots thick, creeping; the flower head is a spadix, 10-20 cm long, with minute yellow green flowers opening from the base upward, sepals 6 free; petals none; stamens 6 at the base of the sepal; berries yellow, green, angular, 1-3 seeded; seeds oblong.

Parts Used: Rhizome

Medicinal Value: Aromatic stimulant, antiphlegmatic.

Propagation: Through rhizomes and seeds

Botanical Name: *ADHATODA VASICA Nees*

Common Names: Arusi, Rusa, Vasa and Vasaka

Family: Acanthaceae

Occurrence: Sindh and Punjab up to 1200 m

Plant Identification: It is cultivated or self sown, evergreen 3-6 meters tall shrub; leaves large lanceolate 10-20 cm by 4-8 cm; flowers white, in short dense axillary pedunculate spikes 2.5-10 cm long; peduncles 2.5-10 cm long; bracts 1-2 cm by 4-12 mm, obovate, sub-acute, green, pubescent; petals about 2.5 cm long; capsule 2.5 cm long; seed 4, glabrous.

Parts Used: Leaves and Root

Medicinal Value: Expectorant and antispasmodic.

Propagation: Propagation is through seeds.

Botanical Name: *AEGLE MARMELOS (L.) Correa*

Common Names: Bael fruit, Bengal quince, Bel phal , Belgiri, Babbarto

Family: Rutaceae

Occurrence: Commonly cultivated, Sub-Himalayan tract, Balochistan

Plant Identification: A small, medium sized thorny deciduous tree, leaves alternate, commonly 3 foliate, flowers greenish white, sweet scented, fruit globose like a ball, gray or yellowish hard, seeds numerous embedded in yellow pulp.

Parts Used: Fruits

Medicinal Value: Mucilaginous, antidysenteric, alterative, antidiabetic.

Propagation: Cultivated by seeds and flowering in April – May.

Botanical Name: *AGAVE VERA-CRUZ Mill.*

Common Names: Kuwar-buti

Family: Agavaceae

Occurrence: Wild in Islamabad, NWFP and Punjab (wild and cultivated).

Plant Identification: It is a large, perennial herb, with leaves 1.25-2.0 meters long and 10 cm wide, arranged in a rosette with marginal prickles, pointing uniformly, downwards and a strong terminal prickle, never channeled throughout; inflorescence a huge panicle

of cymes forming a pyramidal thyrus; perianth-tube short; stamen exceeding the perianth; style filiform; seed flattened and black in colour.

Parts Used: Whole plant

Medicinal Value: Plant is purgative.

Propagation: Propagation is through seeds

Botanical Name: *ALBIZIA LABBECK (L.) Benth*

Common Names: Siris tree, East Indian Walnut, Siris, Sultan-ul-Ashjar

Family: Fabaceae

Occurrence: Avenue tree in Sindh and Punjab

Plant Identification: It is a large, deciduous much branch ornamental tree of avenue; leaves are compound, flowers whitish fragrant, in pedunculate heads, 5-10 cm long, solitary, calyx, 3 mm long, corolla 8 mm long, funnel shaped, lobes ovate, acute; stamen 2.5-4.0 cm long, stamen tube shorter than the corolla tubes; pods 15-20 by 2.5-5.0 cm thin, flat, strap shaped, rounded at both ends; seeds 6-10.

Parts Used: Bark, Seed, Flower and Pods

Medicinal Value: Leaves are used to treat the night blindness; Bark and seeds are restorative, astringent, diarrhea, dysentery and gonorrhoea. Flowers are used as an emollient on boils and swellings. A poultice of the seed applied to reduce the swelling of cervical glands.

Propagation: It is propagated through seeds and seedlings are transplanted.

Botanical Name: *ALHAGI MAURORUM Medic.*

Common Names: Jawansa, Ghaz, Kandra, Shinz, Taranjabin

Family: Fabaceae

Occurrence: Sindh and Balochistan, Salt range, Peshawar, Chitral, Gilgit and Mirpur.

Plant Identification: It is a small, annual or biennial shrub, up to 60 cm tall; covered with numerous hard and long spine; leaves simple, drooping, oblong, leathery, smooth and apex rounded; flowers 1-6, borne on a spine or on a short stalk, small; corolla reddish, much longer than the calyx; pods 2.5 cm long, curved or straight, greenish grey and very hard.

Parts Used: Whole plant

Medicinal Value: Laxative, diuretic and expectorant. Oil from leaves used in rheumatism. Flowers are used to cure pile.

Propagation: It propagate naturally as weed through seeds

Botanical Name: *ALLIUM ASCALONICUM auctt. Ind.*

Common Names: Gandna, Khukhai

Family: Alliaceae

Occurrence: Balochistan (Zhub District)

Plant Identification: A small annual herb, forms cluster of small bulbs, coated, strongly scented, leave hollow, flowers star shaped.

Parts Used: Bulb

Medicinal Value: Aphrodisiac, antibiotic, lowers fever; reduce blood cholesterol levels, useful in earache.

Propagation: Through Bulb. Flowering in April – July

Botanical Name: *ALLIUM CEPA Linn.*

Common Names: Piyaz, Basr, Basal, Onion

Family: Liliaceae

Occurrence: Widly cultivated in Pakistan

Plant Identification: The plant is bulbous, perennial herb, bearing linear, hollow fleshy, cylindrical leaves, Leaves in two rows, shorter than the scape, umbelglobular, many flowered, pedicles longer than flowers.

Parts Used: Bulb, Seeds

Medicinal Value: Aphrodisiac, antibiotic, lowers fever, reduce blood cholesterol levels, useful in earache.

Propagation: Seeds grown in nursery and then transplanted. Flowering in April – July

Botanical Name: *ALLIUM SATIVUM Linn.*

Common Names: Garlic, Lehsan, Thom

Family: Liliaceae

Occurrence: Widly cultivated in Pakistan

Plant Identification: It is a perennial herb having bulbs with several smaller bulbs called cloves. Leaves are flat and bear white flowers and bulbs. The cloves are surrounded by a thin white or pinkish sheath.

Parts Used: Bulb

Medicinal Value: Blood purifier, alterative, tonic for gastrointestinal tract, Discourages growth of bacteria and viruses. An effective hypotensive maintains blood pressure and is also antidiabetic.

Propagation: Seeds grown in nursery and then transplanted. Flowering in April – July

Botanical Name: *ALOE BARBADENSIS Mills.*

Common Names: Aloes, Aloe Vera, Ghikuar

Family: Liliaceae

Occurrence: Sindh, Punjab and some areas of Balochistan

Plant Identification: It is an erect herb up to 90 cm tall; leaves fleshy, convex below, tapering to a blunt point, smooth, pale green, irregularly white blotched, horny prickles on the margins; flowers yellow or orange coloured, cylindrical, about 3 cm long pedicillate, lower ones drooping; perianth dull reddish, cylindrical, segments 6, almost equaling the oblong tube-like part; stamen 6; ovary superior.

Parts Used: Whole plant

Medicinal Value: Esteemed laxative (Cathartic), anticonstipatory.

Propagation: Vegetatively propagated through suckers.

Botanical Name: *ALTHAEA OFFICINALIS (L.)*
Common Names: Marsh Mallow, Khatmi, Gul khairo
Family: Malvaceae
Occurrence: Cultivated in Punjab and Kashmir
Plant Identification: It is a perennial herb with grey green velvety leaves. Flowers are single or clustered, pale blue to rose pink, many varieties. Seeds solitary in each carpel, ascending. Roots are long and narrow.
Parts Used: Flowers, Seeds, Roots
Medicinal Value: Suppurative, Repercussive, Emollient and Expectorant
Propagation: It is sown through seeds or seedlings are transplanted in spring.

Botanical Name: *ANEMONE OBTUSILOBA D. Don.*
Common Names: Al-kanet, Rattan jog, Ratanjot
Family: Ranunculaceae
Occurrence: Hills of Punjab, NWFP
Plant Identification: It is a small, perennial herb with rootstock clothed with old leaf-sheaths; leaf lobes, sessile, floral leaves un-united; flowers white.
Parts Used: Whole plant
Medicinal Value: Root is mixed with milk and given internally for contusion and used externally as a blistering agent. Seeds produce vomiting and purging.
Propagation: Through seeds.

Botanical Name: *ANETHUM GRAVEOLENS L.*
Common Names: Dill, Soya, Shabbat, Soye, Soa
Family: Apiaceae
Occurrence: Cultivated all over the country for local use as well as for herbal markets.
Plant Identification: It is an erect, annual, branched aromatic herb, 1-1.5m tall; leaves 2-3 pinnate, plants resemble with fennel, flowers yellow in compound umbels, calyx teeth none or minute; petals ovate with a broad tip uneven; style small; fruit 4 mm by 2 mm, narrowly winged, oil glands large, solitary in each furrow; seeds much flattened.
Parts Used: Seed, Fruits
Medicinal Value: Carminative, resolvent, diuretic, emmenagogue
Propagation: Crop is sown in November like fennel using a seed rate of 8-10 kg/hectare.

Botanical Name: *ARTEMISIA ABSINTHIUM L.*
Common Names: Absinthium, common wormwood, Afsantin, Khatraq, Saryala.
Family: Asteraceae
Occurrence: Northern Areas and Kashmir
Plant Identification: It is an aromatic, bitter, hairy, perennial herb, 30-90 cm tall; leaves 2.5-5.0 cm long, ovate, unequally cut into segment, hairy on both side; flower heads numerous, yellow in colour, stalked, in drooping raceme; fruit are achene and very small.
Parts Used: Whole plant
Medicinal Value: Antiperiodic, anti-inflammatory, tonic for major organs.
Propagation: Through seeds

Botanical Name: *ASPARAGUS ADSCENDENS* Roxb.
Common Names: Asparagus, Sufaid musli, Shiqaqul Misri, Gazar-Dashti
Family: Liliaceae

Occurrence: Hilly areas of NWFP and Punjab up to 1500 meters.

Plant Identification: A shrub with woody, striate, minutely scabrid stem; flowers numerous in racemes; 2.5-5.0 cm long, racemes simple or branched often bearing cladodes towards the top; pedicels 3-5 mm long, filiform, jointed above or below the middle; perianth scarcely 2.5 mm in diam; stamens shorter than the perianth; anthers medium sized; berry 3-5 mm in diam.

Parts Used: Root and leaves.

Medicinal Value: Aphrodisiac, tubers are used in spermatorrhoea, gleet and chronic leucorrhoea; also in diarrhoea, dysentery and general debility.

Propagation: Through seeds and cuttings

Botanical Name: *ASTRAGALUS HAMOSUS* L.
Common Names: Asab-ul-malik, Akhil-ul-malik
Family: Fabaceae

Occurrence: Balochistan, Sindh, Punjab

Plant Identification: It is annual herb; stem 30-60 cm long; leaves petioled 7-15 cm long, leaflets oblong, pale green; 6-20 flowers in a head; calyx 4-5 mm, teeth as long as the tube; corolla pale yellow, half as long as the calyx; 1.2-2.5 cm long, cylindrical, glabrous, much recurved, 16-18 seeds per flower.

Parts Used: Whole plant

Medicinal Value: Plant is emollient, demulcent; useful in irritation of mucous membrane and in nervous affections, lactagogue and laxative, used in catarrhal affection.

Propagation: Through seeds

Botanical Name: *ATROPA ACUMINATA* Royle.
Common Names: Belladonna, Luffah, Mako Siyah, Sunchi, Akohi
Family: Solanaceae

Occurrence: Himalayan region and Balochistan

Plant Identification: It is an erect herb, 90-150 cm tall; leaves petioled, elliptic-lanceolate; flowers solitary, bell-shaped, short stalk and usually yellow coloured; fruit purple or nearly black of the size of a cherry.

Parts Used: Leaves and Root

Medicinal Value: Externally antispasmodic, anodyne, useful for relieving palpitation and internally antispasmodic, anti-inflammatory.

Propagation: Through seeds

Botanical Name: *AZADIRACHTA INDICA* (L.) Jauss.
Common Names: Neem, Margosa Tree
Family: Meliaceae

Occurrence: Indian sub-continent and grown everywhere in plains

Plant Identification: It is a large, evergreen, much branched tree up to 15 meters tall; leaves pinnate 20-38 cm long, crowded towards the end of the branches; leaflets 9-15, sub-opposite, obliquely lanceolate, acuminate, flowers white, 4 mm long, in branched, axillary panicles; calyx 5-fid; petals 5, anthers 10; ovary glabrous, 3-celled; drupe 1.3-2.0 cm ovoid-oblong, 1-celled, 1-seeded; fruit yellow when ripe.

Parts Used: Leaves, Root bark, Flowers, Seeds

Medicinal Value: Antidiabetic, alterative, blood purifier, anti-inflammatory, antifungal, antimalarial, expectorant, anthelmintic, antidotal, antilithic, diuretic, emmenagogic, insecticidal; antiseptic.

Propagation: The seedlings are raised from the seeds and when these are about 30-50 cm tall, are transplanted.

Botanical Name: *BARLERIA PRIONOTIS L.*

Common Names: Katsareya

Family: Acanthaceae

Occurrence: Sindh and Balochistan

Plant Identification: It is a spiny shrub, 60-150 cm tall; leaves are large, elliptic, acuminate, 6-13 cm by 2.5-6.0 cm in size, spine-tipped, pubescent, shortly petioled or sessile. Flowers are yellow, large showy, sessile, often solitary axillary, bracts leafy, about 1.5 cm long, 5 mm wide, oblong-lanceolate, spine-tipped; bracteoles about 12 mm long, narrowly linear-subulate; corolla 3-4.5 cm long; capsules 2-2.5 cm long, ovoid with a long tapering solid beak and 2 seeded.

Parts Used: Leaves, Root, Bark

Medicinal Value: Plant is diuretic, tonic, febrifuge and anticatarrhal. Bark juice is expectorant, diaphoretic. Dried bark is recommended in whooping cough. Root paste is applied on boils and swellings.

Propagation: Through seeds

Botanical Name: *BAUHINIA VARIEGATE L.*

Common Names: Kachnar, Wild Ebony

Family: Caesalpiniaceae

Occurrence: Cultivated in Islamabad, Punjab and Sub-Himalayan areas

Plant Identification: It is a medium sized, deciduous tree, obtuse, young shoots clothed with brown pubescence; leaves stalked, 10-15 cm long, many nerved, slightly leathery and deeply divided; flowers in short racemes at the end of the branch, or in the axil of leaf, fragrant, petals white or purple; pods 15-18 cm long, about 2.5 broad, flat slightly curved and seed 10-15.

Parts Used: Flowers, Bark and Roots

Medicinal Value: It is alterative, tonic, blood purifier, anthelmintic and astringent.

Propagation: Through seeds nursery is raised and transplanted.

Botanical Name: *BERBERIS ASIATICA* Roxb.
Common Names: Berberry, Darhald, Rasaut, Amber Baris and Zarishk
Family: Berberidaceae

Occurrence: Hills of NWFP and Punjab

Plant Identification: It is an erect, stout shrub, about 8 ft. high; previous year's branches yellowish brown or grayish yellow, angular; spines small; leaves elliptic to ovate oblong, margins usually with distant spinous teeth, 2.5-7.5 cm long, leathery when mature; flowers in racemes with 10-25 branches, sessile, bright red at first, finally bluish purple; berries purple or black with distinct styles.

Parts Used: Roots, Leaves, Stem

Medicinal Value: Alterative, antibilious, febrifuge, antiperiodic, antidiarrhoeal, anti-infective, appetitive.

Propagation: Seeds for raising nursery, the seedlings are transplanted.

Botanical Name: *BERBERIS LYCIUM* Royle

Common Names: Kashmal and Zarch, Darhald

Family: Berberidaceae

Occurrence: NWFP, Punjab and Balochistan hills

Plant Identification: It is a small, semi deciduous spiny shrub 2-3m tall; leaves 2.5-7.5 by 8.1mm, sessile, lanceolate, or narrowly obovate-oblong, entire or with a few large spinous teeth, dull green above, racemes shortly stalked, drooping; flowers at the base, pedicles slender, 1-3 cm long, berries globose, avoid, 8 mm long and blue covered with bloom.

Parts Used: Whole plant

Medicinal Value: The watery extract from root and stem is used in ophthalmia and jaundice. Fruit is cooling and laxative, and used for the relief of intestinal colic and pharyngitis.

Propagation: Seeds for raising nursery, the seedlings are transplanted.

Botanical Name: *BERGENIA HIMALAICA* Bioss

Common Names: Bergenia, Pakhan Bed, Baanpatrak, Kamarghvel.

Family: Saxifragaceae

Occurrence: Murree, Azad Kashmir, Northern Area, NWFP

Plant Identification: It is a small herb with fleshy leaves; leaves ovate, turning red at the base in autumn, hairy on both sides; flowers 3cm in diam., white, pink or purple; fruits nearly round; seeds very small and oblong with rounded ends.

Parts Used: Leaves, Roots.

Medicinal Value: Antidotal, ecboic, strong diuretic, emmenagogue, antimenorrhagic.

Propagation: Through seeds

Botanical Name: *BUNIUM PERSICUM* (Bioss.)

Common Names: Kalazira

Family: Apiaceae

Occurrence: Gilgit, Baltistan, Chitral, Swat, Hazara, Balochistan

Plant Identification: It is a perennial herb 15-60 cm tall, branched; leaves 2-3 pinnatisect, lower leaves petiolate, upper sessile, ray 8-20, 1-6 cm long unequal, pedicles 3-4 times longer than flowers; petals white 3 mm long, dark brown, ridged prominent.

Parts Used: Seed

Medicinal Value: Seeds are carminative, lactogogue stomachic. Commonly used as condiment. Seeds contain essential oil.

Propagation: Seeds and suckers

Botanical Name: *BUTEA MONOSPERMA* (Lam.)

Common Names: Butea tree, Bengal Kino, Dhak, Pals, Tesu, Palas Papri

Family: Fabaceae

Occurrence: Sub-Himalayan tract from Hazara Eastward, Powtohar area

Plant Identification: It is a small tree with crooked, stem, large and irregular branches; leaves pinnately trifoliate leaflets broadly obovate from a cuneate base; flowers 3-5 cm long, bright red, tinged with orange appearing when the tree is leafless, calyx 1-3 cm long, broadly campanulate, grey silky inside; teeth short, deltoid; corolla clothed outside with silvery silky hairs, standard ovate, acute, 2-3 cm broad, stamens diadelphous; ovule 5-6, thin flat.

Parts Used: Leaves, Flowers, Seeds, Bark.

Medicinal Value: Leaves and flowers are astringent, diuretic, tonic, emenagogue and aphrodisiac.

Propagation: Through seeds

Botanical Name: *BUXUS WALLICHIANA* Baill.

Common Names: Papri

Family: Euphorbiaceae

Occurrence: Balochistan and salt range of Punjab.

Plant Identification: It is a small tree; leaves 1-3 by 8-13 mm, lanceolate or narrowly elliptic-oblong, bright glossy green above racemes very short, about 8m long, terminal flowers female, sepals 2-3 mm long, thin, obtuse, stamens exerted, anthers oblong, style equal to ovary,

Parts Used: Leaves, Bark and Wood

Medicinal Value: Leaves are purgative, diaphoretic and useful in rheumatism and syphilis; wood is diaphoretic and bark is febrifuge.

Propagation: Through seeds

Botanical Name: *CAESALPINIA BONDOC (L.) Roxb*
Common Names: Bonduc nut, Karanjwa, Mechka, Khurbat
Family: Caesalpiaceae

Occurrence: Sindh

Plant Identification: It is a large scrambling thorny shrub; leaves 30-40 cm long, main leaf axis armed with stout, sharp spines, leaflets about 10 pairs, elliptic-oblong, tip pointed, 2.5-5 cm long having a pair of short spines, Flowers in racemes, each with a bract; calyx rusty, corolla yellow; pods clothed with wiry prickles, ovate or oblong, inflated, 5-6.5 cm long; seeds 1-3, hard, grey shining.

Parts Used: Leaves, Bark, Roots

Medicinal Value: Antispasmodic, antipyretic, antifatulent and effective against colic due to flatulence.

Propagation: Through seeds

Botanical Name: *CALAMINTHA VULGARIS (L.)*
Common Names: Asabi-ul-Fatiyat
Family: Lamiaceae

Occurrence: Swat, Murree, Hazara and Temperate Himalayas

Plant Identification: It is a medium size herb, stem slender, un-branched; flowers purple or pink in large crowded compact clusters, each surrounded by many long hairy bracts equal in length to calyx, about 1 cm, 2 lipped, curved hairy; corolla hairy, tube straight, 2 lipped, upper lip erect, lower spreading, stamen 4 in unequal pairs under the upper lip.

Parts Used: Whole plant

Medicinal Value: It is astringent, carminative and heart tonic.

Propagation: Through seeds

Botanical Name: *CALOTROPIS PROCERA (Wild.) R. Br.*
Common Names: Swallow-wort, Milk weed, Aak, Madara, Karag, Kotiro
Family: Asclepiadaceae

Occurrence: Throughout Pakistan

Plant Identification: It is a medium sized, shrub much branched from the base covered with soft, white tomentum; leaves large 5.0 – 12.5 cms, broadly ovate-oblong, elliptic or obovate, sessile; flowers 2cm across, whitish violet, corona scales about 6mm long, equaling or exceeding the staminal column, apex bifid and without auricles, follicles 7.5-10 cm long, and 5-7 cm broad, many seeded.

Parts Used: Flowers, Stem, Roots

Medicinal Value: Externally; anti-inflammatory and counter-irritant and internally alterative, antispasmodic and resolvent.

Propagation: Through seeds

Botanical Name: *CANNABIS SATIVA L.*
Common Names: Indian Hemp, Bhang, Hashish, Ganja, Bhangia, Qinnab
Family: Cannabinaceae
Occurrence: Islamabad, Gilgit and NWFP up to 250m
Plant Identification: It is an annual monoecious herb of summer, 1 meter tall; leaves palmate partite, opposite, upper leaves 1-5 lobed, lower ones 5-11 lobed, linear lanceolate, middle lobe longest; flowers are greenish yellow, calyx of male flowers with five segments, female flowers sessile, in the axils of leafy bracts.
Parts Used: Leaves, Flowers, Seeds
Medicinal Value: Plant is narcotic, sedative, hypnotic, avoricious, aphrodisiac, and stimulant.
Propagation: It reproduces naturally through seeds

Botanical Name: *CAPPARIS DECIDUA (Forsk.)*
Common Names: Caper Plant, Kabra, Kaledok, Kaler.
Family: Capparidaceae
Occurrence: Throughout Pakistan
Plant Identification: It is a large glabrous straggling shrub, mainly leafless or very small leaves, twigs smooth, green; leaves on young shoots only less than 1.3 cm long; flowers 2 cm in diam; and red or yellow in colour, in corymbs on short lateral braches; sepals pubescent, petals oblong, fruit red or pink in colour and 1.2 – 1.8 cm diam.
Parts Used: Whole plant
Medicinal Value: Resolvent for cephalic region, anti-inflammatory for spleen, emmenagogue. Bark is laxative, diaphoretic, anthelmintic, and acrid.
Propagation: Through seeds

Botanical Name: *CARDIOSPERMUM HALICACABUM L.*
Common Names: Hubul-Qubul and Kanphuti
Family: Sapindaceae
Occurrence: Sindh and Pothwar area
Plant Identification: It is a small, perennial climber, having glabrous, thin branches and tendrils; leaves biternate with usually 3 leaflets which are very acute at the apex. Flowers bisexual and unisexual, 6 mm in diam., ternate, white, and small irregular; lowest pair of flower stalks converted into spiral tendrils. Capsules are sub-globose and balloon like, 2-3 cm in diameter.
Parts Used: Whole plant
Medicinal Value: The juice of the plant is used as an emmenagogue in amenorrhoea; and as demulcent in gonorrhoea and pulmonary diseases. The plant is also anthelmintic. The leaves are stimulant and diuretic. The root is mucilaginous; it is diaphoretic, emetic, laxative, stomachic, rubefacient and emmenagogue. The seeds are a tonic in fever; and a diaphoretic in rheumatism.
Propagation: Through seeds

Botanical Name: *CARTHAMUS OXYCANTHA* M. Bieb.

Common Names: Poli

Family: Asteraceae

Occurrence: Grows as a weed throughout Pakistan.

Plant Identification: It is an erect and annual herb; leaves oblong or oblong-lanceolate and very spiny; flowers orange yellow, outer bracts of head longer than the flowers; corollas all tubular, deeply 5-toothed, slender; anther bases forked; tails short fringed; achene ovoid with top broad and 4-angled smooth.

Parts Used: Flowers and Seeds

Medicinal Value: The flowers are tonic, stimulant, sedative, emmenagogue, laxative and diaphoretic.

Propagation: Through seeds

Botanical Name: *CASSIA ABSUS* L.

Common Names: Chaksu, Chashkhacham, Choriya Chanor

Family: Caesalpiniaceae

Occurrence: Sandy and desert areas in NWPF and Punjab

Plant Identification: It is perennial under shrub or shrub, growing up to 60-80 cm tall; leaves and stem are hairy, branches growing upward, leaves are compound leaflets ovate, 2.5-5.0 cm long, the pod is 3-6 cm long, containing 5-6 seeds which are shining and flat.

Parts Used: Seeds

Medicinal Value: Effective against ophthalmic disorders.

Propagation: Through seeds, which are sown in Spring. The plant to plant distance of 50 cm is appropriate for better yields.

Botanical Name: *CASSIA ANGUSTIFOLIA* Vahl

Common Names: Sanna Makki, Senna

Family: Caesalpiniaceae

Occurrence: Sindh, Punjab, Balochistan

Plant Identification: It is a bushy, large, perennial herb and 30-90 cm tall; leaves having 5-8 pairs of leaflets, oblong-lanceolate acute, basal appendages tool shaped, spreading or reflexed; flowers in racemes, yellow; pods broadly oblong slightly curved; valves papery, smooth, without hairs, appendages or crests.

Parts Used: Leaves, Pods

Medicinal Value: Cathartic, Leaves are purgative, effective in constipation, biliousness, gout and rheumatism.

Propagation: Through seeds, sown in February-March.

Botanical Name: *CASSIA FISTULA* L.

Common Names: Amaltas, Khayar Shanber, Chamkani

Family: Caesalpiniaceae

Occurrence: Throughout Pakistan

Plant Identification: It is cultivated as an avenue tree and is small or medium sized growing up to 4 meters tall, ever-green; leaves 22-45 cm long; linear-oblong; leaflets 4-8 pairs, opposite, ovate oblong; flowers 5 cm in diam., bright yellow, in lax drooping axillary racemes 30-60 cm long; calyx 8-10 mm long, divided almost to the base; petals 1.8-2.5 cm long, obovate, shortly claw; stamens all antheriferous; pods 30-60 cm long, 2.5 cm in diam., cylindrical, smooth, pendulous; seeds 40-100 immersed, in dark coloured sweetish pulp.

Parts Used: Leaves, Flowers, Pods, Roots

Medicinal Value: Laxative/purgative (for malhumours), emmenagogue.

Propagation: Through seeds nursery is raised and when seedlings are about 30 cm tall, these are transplanted.

Botanical Name: *CATHARANTHUS ROSEUS L.*

Common Names: Madagascar Periwinkle, Sada-bahar

Family: Apocyanaceae

Occurrence: Cultivated as an ornamental plant

Plant Identification: It is a small, evergreen, 40-80 cm tall; leaves opposite, 3.8 to 5.0 cm long, obovate, glossy green above; flowers rosy, white or pink, 2.5-3.8 cm in diam., in axillary pairs; corolla salver-shaped, tube 2 cm long, slender, swollen at the top at the insertion of the stamen; stamen, almost sessile; ovary with two glands situated between and exceeding the carpels; follicles single 2.5 cm long 2-3 mm thick; seed 1 mm long back, tubercled.

Parts Used: Whole plant

Medicinal Value: Herb is used as anti-diabetic and anti-oxidant; juice of leaf is applied on wasp sting; infusion of leaf is given in menorrhagia. Leaves contain alkaloid, vincain, resin and essential oil.

Propagation: Nursery is raised from seeds and seedlings are transplanted in field.

Botanical Name: *CELOSIA ARGENTEA L.*

Common Names: Sufaid murg, Sarori, Saroali

Family: Amaranthaceae

Occurrence: Common weed in cultivated fields, open places and riverbanks.

Plant Identification: It is an erect, annual weed, 39-90 cm tall; leaves 2.5-15.0 cm long, narrow linear; flowers white or pinkish, 8-14 cm in diam., glistening in long-stalked, simple or branched, cylindric, oblong or ovoid spikes, 2.5-20.0 by 2.0-2.5 cm, looking like the spike of a grass; sepals 5, lanceolate, short pointed, longer than the bracts; petals none; stamen 5, united; fruit dry, ovoid, enclosed in the sepals, short pointed; seeds few.

Parts Used: Seed

Medicinal Value: Seeds are aphrodisiac, used in diseases of eye and blood and mouth sore and diarrhea.

Propagation: Through seeds.

Botanical Name: *CENTELLA ASIATICA (L)*
Common Names: Indian Pennywort, Brahmi buti, Brahmi
Family: Apiaceae

Occurrence: Punjab, NWFP

Plant Identification: It is a common, trailing herb, rooting at the nodes; leaves many at each node, kidney-shaped, about 5 cm long, shallow, toothed, palmately nerved; stalks 7.5-15.0 cm long, channeled; flowers in clusters of umbels, each cluster bearing 4 or 4 small flowers, reddish; fruit minute.

Parts Used: Above ground parts

Medicinal Value: Tonic for brain, exhilarant for vital organs, alterative, psychotropic.

Propagation: It reproduces itself from seeds.

Botanical Name: *CERATONIA SILIQUA L.*

Common Names: Kharnub

Family: Fabaceae

Occurrence: Grown as an ornamental plant at few localities.

Plant Identification: It is a small, evergreen 4-5 m tall; leaves paripinnate; leaflets 3-5 pair, 4-5 cm long, elliptic or broadly obovate; flowers unisexual and minute in spike-like racemes, 5-30 cm long axillary from the old wood; calyx small, saucer shaped, lobes very short; petals absent; stamens 5, filament long; dish conspicuous, intra-staminal; ovary shortly stipitate, arising from the center of the disk; stigma large, sub-sessile; pod 7.5-20.0 by 1.3-2.5 cm, compressed, thick and turgid; seeds pale-brown, shining embedded in pulp.

Parts Used: Seeds, Pods

Medicinal Value: Seed husk is astringent and purgative. Seed yields fatty oil. Seeds are also used as a substitute of coffee. The pods are astringent and are used in cough.

Propagation: Nursery raised from seeds and when the seedlings are 20-40 cm tall; these are transplanted in the field.

Botanical Name: *CHENOPODIUM ALBUM L.*

Common Names: White Goose Foot, Bathu, Qataf, Bathwa, Torsaag

Family: Chenopodiaceae

Occurrence: As a weed throughout Pakistan.

Plant Identification: It is an erect, annual herb 20-60 cm tall; leaves varying from rhombic-ovate to lanceolate or the upper-most even linear, acute, variable in size; flowers in a compact cluster to lax panicle spike; calyx 2.0-2.7 mm broad and 1-2 mm long, keeled at the back; seed rounded, compressed, smooth, black and shining.

Parts Used: Above ground parts, Seeds

Medicinal Value: Laxative, useful in liver disorders.

Propagation: Through seeds

Botanical Name: *CICHORIUM INTYBUS L.*
Common Names: Endive, Chicory, Kasni, Gulsuchal, Tukham-e-kasni
Family: Asteraceae

Occurrence: Wild in open places and cultivated in Punjab and NWFP.

Plant Identification: It is an erect, medium sized annual herb; stem angled, grooved; leaves 7.5-15.0 cm long, pinnately divided, upper leaves entire; flowers blue, in solitary terminal or axillary clustered heads 2.5-4.0 cm diam; stalk thickened in the middle, bracts of heads green, glandular hairy; corollas all with 5 toothed ligules; style arm long; achene small pale, angled with the crown of pappus scales.

Parts Used: Leaves, Flowers and Roots

Medicinal Value: Reduces extra heat of various organs, deobstruent, tonic and febrifuge.

Propagation: It is sown as a winter crop in November and harvested in June. Some times it is also inter-cropped with other fodder crops.

Botanical Name: *COMMIPHORA WIGHTII*
Common Names: Salai tree, Gum Gugal, Muql, Gugar,
Family: Burseraceae

Occurrence: Calcareous soil and rocky places of Sindh and Balochistan

Plant Identification: It is a medium size thorny plant, 1-2 m tall, trunk knotty; outer bark greenish yellow; each branch ends in a sharp spine; leaves alternate, simple or 3-foliolate; margin smooth shining; flowers unisexual or bisexual, few, solitary or in clusters, calyx tubular, glandular; petals 4; drupe fleshy, roundish.

Parts Used: Gum and Resin

Medicinal Value: Resolvent of inflammations, good for bleeding piles.

Propagation: Through suckers.

Botanical Name: *CORDIA DICHOTOMA Forst.*
Common Names: Sebestan plum, Lasora, Sabistan
Family: Boraginaceae

Occurrence: Lower Balochistan, Sindh, Punjab and NWFP.

Plant Identification: It is 3-10 meters tall tree with leaves elliptic to ovate or obovate, usually 8-12 by 4-8 cm; flowers in dichotomous bractless inflorescence, male and hermaphrodite produced on separate trees, anthers 2.0-2.8 mm long; hermaphrodite flowers with calyx 5-6 mm long; corolla 8-10 mm long, campanulate 4-6 mm in diam; drupe globose 10-15 mm in diam; yellow or somewhat orange or reddish.

Parts Used: Fruit

Medicinal Value: Expectorant for dry cough.

Propagation: Through seeds, seedlings are raised in nursery and transplanted.

Botanical Name: *CORIANDRUM SATIVUM L.*
Common Names: Coriander, Dhania, Dhaneo, Kishneez
Family: Apiaceae

Occurrence: Cultivated throughout Pakistan

Plant Identification: It is a smooth erect, annual herb; leaves pinnately divided, leaflets of the lower leaves broadly ovate, lobed, toothed, of the upper leaves linear; flowers white or purplish, in umbels; corolla notched, ovate with a broad tip; calyx teeth, small, short pointed; fruit spherical, ridges not prominent; oil glands solitary under the secondary ridges; seeds convex on one side, concave on the other.

Parts Used: Leaves, Fruits

Medicinal Value: Fresh; carminative and antifatulent. Dry (seeds); cardiac refrigerant, antifatulent.

Propagation: It is sown in October-November. A seed rate of 10-15 kg/hectare is used.

Botanical Name: *COTONEASTER NUMMULARIA* Fisch.

Common Names: Siah-chob

Family: Rosaceae

Occurrence: Hilly areas of Punjab, NWFP and Balochistan

Plant Identification: It is a prostrate, deciduous shrub; twigs hairy when young, becoming glabrous and purplish brown with age; leaves up to 2.0 cm long, orbicular beneath, rounded at both ends; petiole, 2-3 mm long; cymes very short; 2-5 flowered, stamens 13-15; styles 2, fruit black.

Parts Used: Whole plant

Medicinal Value: The fruits are used as expectorant, aperient and stomachic.

Propagation: Through seeds

Botanical Name: *Crocus sativus* L.

Common Name: Saffron

Family: Iridaceae

Occurrence: Cultivated in Balochistan and Azad Kashmir.

Plant Identification: Saffron is a corm with glasslike leaves. It has a mauve flower with three protruding vermilion stigma.

Parts Used: Flowers

Medicinal Value: The stigmas and style tops flavor and color liqueurs and many dishes especially rice. Saffron is considered as an aphrodisiac, but high doses may be narcotic. It is used to reduce fever, cramps, enlarged livers, and to calm nerves. It is also applied externally for bruises, rheumatism, and neuralgia.

Propagation: Through corm. One inch size corms are planted in September.

Botanical Name: *CRATAEGUS SONGARICA* C. Koch

Common Names: Ban-sangli

Family: Rosaceae

Occurrence: Hilly areas of Punjab, NWFP and Balochistan

Plant Identification: It is a deciduous, shrub or small tree; leaves 2.5-6.2 cm long, broader than long, thin deeply fid and toothed; flowers 1.2 cm in diam., white in many flowered terminal corymbose cymes; fruit globose, ovoid, 1 cm long, scarlet.

Parts Used: Fruit

Medicinal Value: The liquid extract of fruit is cardiac tonic and used as remedy for organic functional diseases of heart such as dyspnea, hypertrophy, vulvular insufficiency and heart oppression.

Propagation: Through seeds

Botanical Name: *CUMINUM CYMINUM L.*

Common Names: Cumin, Zira Sufaid

Family: Umbelliferae

Occurrence: Cultivated in Balochistan

Plant Identification: It is a glabrous; annual herb, 1-3 ft. high; root long, slender, perpendicular; stem arising almost from the base; branches forked. Basal leaves slender, short stalked, feathery, divided into very slender lobes which run parallel to the main axis, soon falling off; upper leaves similar, having short, sheathing, winged stalks. Flowers in large, long stalked branched umbels; secondary umbels 1-6, short, few flowers; flowers very small. Capsules are cylindrical.

Parts Used: Seed

Medicinal Value: The seed is a rich source of thymol; it is a stomachic, diuretic, carminative, stimulant, astringent and emmenagogue.

Propagation: It is cultivated in some areas of Balochistan. It is sown through seed in the month of October. The seed rate used is 5-20 kg/hectare and crop mature in April.

Botanical Name: *CUPRESSUS SEMPERVIRENS L.*

Common Names: Saru, Sarus Safaid

Family: Cupressaceae

Occurrence: Cultivated in the plains of Punjab and NWFP

Plant Identification: It is a tall tree with a pyramidal crown; bark of the stem grayish brown, branches ascending up-ward, branchlets deep-green, very slender; leaves with closely adpressed tips, 1 mm long, ovate, back with a longitudinal furrow, male cone terminal on branchlets, about 3-4 mm long; microsporophylls about 10 pairs, opposite decussate; young ovulate cone globose; mature cones 2.5-4.0 cm in diam; scales 8-14; seeds over 60 per cone; brown, compressed.

Parts Used: Wood and fruit

Medicinal Value: The fruit and wood are anthelmintic and astringent.

Propagation: Through seeds

Botanical Name: *CURCUMA DOMESTICA L.*

Common Names: Haldi

Family: Zingiberaceae

Occurrence: Cultivated mainly in central Punjab

Plant Identification: It is a perennial plant with large ovoid root stock; tubers sessile, thick, cylindrical, bright yellow inside; leafy tufts 1.2-1.5 cm; leaves long-petioled; blade 30-45X10-20 cm, oblong, arrow at the base; flowers pale yellow; bracts of flowers pale green.

Parts Used: Rhizome

Medicinal Value: The rhizome is carminative, stimulant, aromatic, antipyretic and alterative. It is considered as blood purifier and is also applied externally to sprains and wounds.

Propagation: It is propagated through tubers/rhizomes which are planted in February-March in well drained and light soils. Its cultivation on ridges helps in harvesting the rhizome.

Botanical Name: *CUSCUTA REFLEXA* Roxb.

Common Names: Dodder, Amarbel, Zarbuti, Akash-bel, Aftimun, Ishq Paicham

Family: Convolvulaceae

Occurrence: Found everywhere as a parasite on plants

Plant Identification: It is a leafless yellow plant parasite found commonly on tree and shrubs; stem long, fleshy, stout forming dense yellow masses on the host; flowers solitary or in clusters; flowers stalk short and curved; bracts small fleshy; corolla white, lobes triangular; fruit small, globose, seeds 2-4, large.

Parts Used: Whole plant

Medicinal Value: To get rid of atrabilious matter from the body and as anthelmintic.

Propagation: Through cuttings

Botanical Name: *CYAMOPSIS TETRAGONOLOBA* L.

Common Names: Guar

Family: Fabaceae

Occurrence: Cultivated in the dessert areas of Punjab and Sindh.

Plant Identification: Guar is a leguminous herb resembling soybean plant. It is medium-sized, 50-100 cm tall, annual herb covered with hairs; leaves up to 25 cm ovate and coarsely toothed; flowers bracts bristle like, projecting beyond the bud; calyx 4-5 mm, tube oblique, teeth 5, unequal, lowest long, bristle-like; petals 5, just protruding from the calyx; stamen 10, united, style short; pods 4.0-7.5 cm long, straight, thick, fleshy, ribbed; seeds about 6-12 per pod.

Parts Used: Seeds

Medicinal Value: The seeds are laxative, used in biliousness and night-blindness. The guar gum is used as a thickener in cosmetics, hand lotion and creams. It is also used to thicken and stabilize salad dressing, bakery products and in ice cream.

Propagation: It is sown as a summer crops in dry areas. The seed rate of 10-15 kg/hectare is used. It is drought tolerant plant and needs little irrigation.

Botanical Name: *CYMBOPOGON CITRATES* (DC.) Stapf.

Common Names: Lemon grass, Izkhar

Family: Poaceae

Occurrence: Cultivated in Kitchen gardens

Plant Identification: It is tufted perennial grass, growing up to 60-80 cm tall, many branches arising from the base; the leaves are very long, 25-35 cm long, 1 cm broad, linear, oblong, the inflorescence on long panicle, loose spike; flower very small in size.

Parts Used: Leaves, Panicle

Medicinal Value: It is given to control diabetes. It has high contents of vitamin 'A' and helpful for women with heavy bleeding. The essential oil extracted from this herb is used in perfumery, cosmetics and as flavouring substances.

Propagation: It is propagated vegetatively through culms. The culms are planted about 4 cm deep in the soil and approximately 10-15 cm should be about the soil. The best planting time is after winter. It can be grown even on marginal lands.

Botanical Name: *DALBERGIA SISSOO* Roxb.

Common Names: Rose Wood, Shisham, Tali, Sissoo

Family: Papilionaceae

Occurrence: Balochistan, Sindh, NWF and Punjab

Plant Identification: It is deciduous tree, growing up to 10-50 m; leaves imparipinnate; swollen at the base; stipules about 5 mm long lanceolate; leaflets 3-5, alternate, 4-5 cm long, ovate, abruptly acuminate; flowers 5-8 mm long, pale yellowish white, sessile; calyx 5 mm long, tubular campanulate, teeth short, ciliate, the two upper connate; standard ovate; wing oblong; keel obtuse, its petals joined at the tip; stamens 9; pods 5-7.5 cm long, 6-12 mm broad, thin, strap shaped; seeds 6 mm long, kidney shaped, 1-3.

Parts Used: Whole plant

Medicinal Value: Leaves are bitter and stimulant; decoction is used in gonorrhoea. Root is astringent. Wood is alterative, used in leprosy, boils, and eruptions and to stop vomiting.

Propagation: The nurseries are raised from seeds and transplanted; it can also be propagated vegetatively through cuttings.

Botanical Name: *DATURA INNOXIA* Mill.

Common Names: Dhatoora

Family: Solanaceae

Occurrence: In waste areas throughout Punjab, NWFP and Sindh

Plant Identification: This exogenous species is very similar to the indigenous species, *Datura metel* L.; it is distinguished from the latter by the presence of dense pubescence on the stem and leaves, 10-toothed corolla and long weak spines on the capsules.

Parts Used: Whole plant

Medicinal Value: The fruits are sedative and intoxicating. The juice of flowers is useful for earache. The leaves are applied to boils, sores and fish bites. The seeds and leaves are used as antispasmodic, anodyne and narcotic.

Propagation: Through seeds.

Botanical Name: *DATURA METEL L.*

Common Names: Sufaid Dhatoora

Family: Solanaceae

Occurrence: Throughout Pakistan

Plant Identification: It is a course spreading, annual or biennial herb or under-shrub, up to 3 meters tall, covered with fine, minute hair, branches in pairs. Leaves triangular ovate 10-20 cm long, unequal sided at the base, pointed at the apex, flowers tubular, large, white, shortly stalked, calyx tubular 5 cm or more long; corolla funnel shaped, usually white. Fruit drooping, roundish, sharp prickles, seated on the persistent, enlarged basal part of the calyx; opening through irregular cracks on its walls; fruit stalk short, thick, curved to one side; seed numerous, light brown, flat.

Parts Used: Leaves, Seeds and Root

Medicinal Value: All parts of the weed are strongly intoxicant, narcotic, aphrodisiac, toxic, antispasmodic and anodynous.

Propagation: It reproduces itself through seeds.

Botanical Name: *DIGITALIS PURPUREA L.*

Common Names: Foxglove, Diljit, Dijtalis

Family: Scrophulariaceae

Occurrence: Cultivated in NWFP and Kashmir

Plant Identification: It is an erect biennial herb up to 1.5 m tall; leaves alternate, ovate-oblong, up to 30 cm long, basal leaf forming a rosette, numerous flowers at the top of the stem, purple in colour; calyx deeply lobed, stamen four, ovary superior; capsule egg shape.

Parts Used: Leaves

Medicinal Value: Leaves are tonic and are used to stimulate cardiovascular system; it slows the heart rate and reduces cardiac oedema with diuresis and increases the coagulability of blood.

Propagation: Through seeds.

Botanical Name: *DIOSCOREA DELTOIDEA Wall.*

Common Names: Knis, Kildri, Kniss, Kirta Kunj

Family: Dioscoreaceae

Occurrence: In hilly areas of NWFP, Kashmir and Northern Areas

Plant Identification: It is a perennial herb with inedible tuber; stem twining to left; leaves alternate, 5-17.5 cm long, often as broad as long, ovate, acuminate, base cordate, lobes rounded; lobes usually rounded, 9-nerved; petiole as long as the blade, slender; male spike solitary; female spike long, few flowered; capsule 1.7-2.5 X 2.8 cm; seeds winged.

Parts Used: Tuber

Medicinal Value: The tubers are used in the treatment of bilious colic and as a diuretic and expectorant. They are also used to kill the lice and also a fish poison.

Propagation: Through tubers/rhizome which are planted in spring.

Botanical Name: *DIOSPYROS LOTUS L.*

Common Names: Amlok

Family: Ebenaceae

Occurrence: Hazara and Swat areas

Plant Identification: It is a medium size, deciduous tree up to 3 m tall; leaves alternate, ovate or elliptic-oblong, acuminate, base rounded or somewhat narrowed, glabrous except for few scattered hairs beneath when young; male flowers about 5 mm long 3 mm across, the calyx sub-sessile in clusters of 2-3; calyx 2 mm long, cleft half way down; corolla tubular, lobed nearly half-way down; lobes obtuse; stamen 16 in two series; female flowers 1.0 cm long 1.5 cm across, the calyx, nearly sessile, solitary; calyx and corolla as in male but larger; fruit 2 cm long, avoid, dark-purple.

Parts Used: Seeds and Fruits

Medicinal Value: Seed are sedative. Fruit is antifebrile and is used to promote secretion.

Propagation: Through seeds, soaking of seeds before sowing help to enhance germination.

Botanical Name: *DODONAEA VISCOSA (L.) Jacq.*

Common Names: Aliar

Family: Sapindaceae

Occurrence: Sub-Himalayan tract, Punjab and Balochistan.

Plant Identification: It is an evergreen shrub, up to 2 m tall, branches erect, angular; leaves alternative 4-7.5 cm by 5-25 mm, simple, entire, sub-acute or apiculate; flowers greenish-yellow, 5 mm in diam., dioecious, in terminal panicles, oblong; petals absent; disk obsolete in male, small in female flowers; stamen usually 8; fruit a membranous, septical capsule 2-4 valved, each valve broadly winged on the back, 1.3 cm long, 2 cm across the wings; seeds 2 mm long, dark brown or black, dull.

Parts Used: Leaves

Medicinal Value: Leaves are sudorific, febrifuge; used in gout, rheumatism, wounds, swellings and burns.

Propagation: Through cuttings.

Botanical Name: *DREGA VOLUBILIS (L. f) Benth.*

Common Names: Sneeze wort, Nak-chikni

Family: Asclepiadaceae

Occurrence: Kashmir, NWPF, Punjab and Jhelum Valley.

Plant Identification: It is a glabrous shrub; leaves opposite 6.0 - 15.0 cm by 4.0-11.5 cm, broadly ovate; flowers green or yellowish-green 1.2 cm in diam., in drooping, umbellate cymes, arising singly at the nodes from the side of leaf-axil; calyx divided to the base, lobes 2-3 mm long, ovate; corolla 6 mm long, cup shaped, divided more than half way down, lobes broad-ovate obtuse, overlapping to the right in the bud; follicles usually solitary, 7.5-10.0 cm by 1.8 cm, slightly tapering to a blunt point, longitudinally ribbed or winged; seeds 1.2 cm long, broadly ovate, compressed; coma 3.8 cm long.

Parts Used: Whole plant

Medicinal Value: Plant is used in eye diseases and cold; to cause sneezing and in snake bite. Leaves applied externally on abscesses and boils. Young shoots are expectorant and emetic.

Propagation: It reproduces through seeds.

Botanical Name: *ECHINOPS ECHINATUS Roxb.*

Common Names: Camel's Thistle, Barham Dandi, Labh, Unt-katara,

Family: Asteraceae

Occurrence: Sindh and Punjab

Plant Identification: It is an erect, much branched, annual herb, 30-60 cm tall; branches ascending from the base; leaves 7-12 cm long, oblong, sessile, pinnately divided, spinous; spines often 4 cm; flower heads forming a white ball 2.5-4 cm in diam with many stout spines, each head contains one flower; outer bracts 6-8, lanceolate, smooth, inner 8 mm long, united, tips bristly, hardening round the silky achene; pappus of short bristles; corolla tubular, slender, deeply cut into 5-segments; style arm thick.

Parts Used: Leaves, Fruits, Root

Medicinal Value: Blood purifier, alterative, nervine tonic.

Propagation: Through seeds

Botanical Name: *ELAEAGNUS ANGUSTIFOLIA L.*

Common Names: Sinjit, Sanzalai

Family: Elaeagnaceae

Occurrence: Balochistan

Plant Identification: It is a small tree, branches silvery with scales, often spinous, dark brown when older; leaves 2.5-7.5 cm long, oblong, ovate, blunt, silvery beneath, stalk 6 mm; flower 4-6 mm long, yellow, silvery, bell-shaped above, stalked, fragrant, solitary or in clusters of 3; calyx of 4 triangular teeth, soon falling off, stamen 4, on the mouth of the calyx, alternating with the lobes; fruit 1.8 cm long, oblong, red, dry or fleshy, stone thick.

Parts Used: Seeds, Flowers

Medicinal Value: Oil used in catarrhal and bronchial affections. Juice of flower is used for malignant fever.

Propagation: Through seeds

Botanical Name: *ELAEODENDRON GLAUCUM Pers.*

Common Names: Bakra

Family: Celastraceae

Occurrence: Sub-Himalayan tract

Plant Identification: It is a small, deciduous tree up to 3 m tall; leaves opposite or sub-opposite, rarely alternate, 5-15 cm long, very variable, ovate, elliptic or oblong, glabrous, acute or acuminate; petiole 1.3-2.5 cm long, stipules small; flowers 8 mm in diam; calyx divided to the base, lobes unequal, orbicular with membranous margin; petals oblong, obtuse; stamen 4-5, inserted, half as long as the petals; disk thick; fruit a yellowish green drupe, 8-15 mm long, ovoid, apiculate, nearly dry, usually 1-seeded.

Parts Used: Leaves, Root, Root bark

Medicinal Value: Powdered leaves are used as fumigatory to cure women from the hysterical fits and to relieve from headache.

Propagation: Through seeds

Botanical Name: *EMBILICA OFFICINALIS* Roxb.

Common Names: Amla

Family: Myrsinaceae

Occurrence: Cultivated in garden in NWPF and Punjab.

Plant Identification: It is a small or medium-sized, deciduous tree; leaves 1.1.2 cm long and 2.5 mm broad, linear oblong, entire, obtuse, glabrous, sub-sessile, stipulate; flowers minute, greenish unisexual; fruit 1.7 cm in diam., sub-globose, yellow, succulent.

Parts Used: Fruit

Medicinal Value: Fruit is very rich sources of vitamin-C; the fresh fruit is refrigerant, tonic, antiscorbutic, diuretic and laxative; it is used in fevers, hiccup, vomiting, indigestion, habitual constipation and other disorders of the digestive system. The dry fruit is an excellent astringent, refrigerant, stomachic, anti-scorbutic and blood purifier.

Propagation: For improved varieties, the bud wood is grafted on the root stock while for wild types these are propagated from seeds.

Botanical Name: *EPHEDRA PROCERA* Fisch and Mey.

Common Names: Naru oman

Family: Ephedreaceae

Occurrence: Balochistan

Plant Identification: It is an erect, branched shrub, up to 2 m tall; branches smooth, striate; leaves none; staminate strobilli solitary, sub-globose; anthers 6-8; ovulate strobile erect; flower 1; bracts 2-3 pairs, the inner connate below the middle; tubilus short, straight; fruit red, ovoid-subglobose, 1-seeded.

Parts Used: Stem, root and berries

Medicinal Value: The decoction of stems and roots is used as a remedy for rheumatism and syphilis. The juice of berries is useful in affection of the respiratory passages. The liquid extract is useful for controlling asthma.

Propagation: Through seeds and cuttings.

Botanical Name: *EQUISETUM ARVENSE* L.

Common Names: Nari

Family: Equisetaceae

Occurrence: Hindukush Himalayan Range

Plant Identification: It is a small, creeping plant; rhizome, slender, freely forking; fertile stem usually precocious, succulent, whitish pinkish, 5.0-30.0 cm high, elongating and becoming rather slender, mostly without green branches from the nodes; sheaths 0.5-2.5 cm long with 8-12 distinct teeth; cone 0.5-3.5 cm long, sterile stems erect to prostrate, 1-4 mm thick and 1 meter high, the main stem 10-14-furrowed; branches 3-4 angled, solid, spreading or ascending, not recurving, mostly simple.

Parts Used: Whole plant

Medicinal Value: It is mostly used as diuretic. It is also considered as haemostatic and haemopoietic; used in dropsy, gravel in kidney. Plant is used to stop acidity of the stomach and in dyspepsia.

Propagation: Through seeds and runners.

Botanical Name: *ERYTHRINA SUBEROSA* Roxb.

Common Names: Dhauk, Pangra

Family: Fabaceae

Occurrence: Hills of Islamabad and surrounding areas

Plant Identification: It is a tall (12-17 meter) tree, with prickles on branches; leaves trifoliate, sometimes armed with a few scattered prickles; leaflets 10-15 cm long; stipules linear-lanceolate, caduceous; racemes 1-4 near the ends of the branches, peduncled, 5-10 cm long; calyx 5-8 mm long; corolla scarlet; standard 4-5 by 1.2-1.5 cm; keel less half as long as the standard, connate, much exceeding the minute falcate pointed wings; pods stalked, 12.5-15.0 cm long, subterete torulose; seeds 2-5, pale brown, dull.

Parts Used: Leaves, Bark

Medicinal Value: Leaves are anthelmintic, cathartic, galactagogue, discutient. The bark is laxative, diuretic, emmenagogue, and expectorant, anthelmintic anti-bilious and febrifuge.

Propagation: Through seeds.

Botanical Name: *EUPHORBIA ANTIQUORUM* L.

Common Names: Thor, Tridhar

Family: Euphorbiaceae

Occurrence: Sindh, Balochistan

Plant Identification: It is a variable, fleshy, small tree or shrub; branches jointed, stout, 3 or 5 angled, thorny, with rolling ridges; leaves small, falling off early; flowers minute, in yellow clusters.

Parts Used: Stem, Latex

Medicinal Value: The latex is a drastic purgative, powerful emetic and deobstruent; it is given in visceral obstructions, dropsy and pains.

Propagation: It propagates vegetatively as well as through seeds.

Botanical Name: *EUPHORBIA HELIOSCOPIA* L.

Common Names: Gandi-buti, Chatriwal

Family: Euphorbiaceae

Occurrence: Punjab and Balochistan plains

Plant Identification: It is an erect, small annual herb, much branched; leaves 1.3-5.0 cm long, stem leaves ovate, with a broad tip or oblong, narrowed into a stalk, leaves round the flowers 2-4, small; flowers in umbles; rays 5; calyx about 3 mm in diam., smooth, 4-lobed, glands yellow, rounded, entire; style united; capsule 3 mm in diam., smooth; seeds minutely netveined, ovoid, 2 mm.

Parts Used: Whole plant

Medicinal Value: Latex is applied to eruptions. The herb is cathartic. Root is anthelmintic. Oil from seed is said to be purgative.

Propagation: Vegetatively as well as through seeds.

Botanical Name: *EUPHORBIA INDICA* Lamk.

Common Names: Duddhia, Hazardana,

Family: Euphorbiaceae

Occurrence: Throughout Pakistan

Plant Identification: It is an erect or sub-erect 10-45 cm tall, sparsely hairy herb with milky juice; leaves obliquely broad or narrow, oblong, stipules minute; flowers minute in terminal or axillary clusters, often with two floral leaves at the base; involucre bracts minute cup shaped; stamen several, surrounding a 3-angled ovary; style 3, very short; capsule 3-lobed, velvety, 2.5 mm diam, sub-globose; seed one in each cell, smooth.

Parts Used: Whole plant

Medicinal Value: The infusion of dried leaves is used in diarrhoea, dysentery, menorrhoea and leucorrhoea.

Propagation: It propagates vegetatively as well as through seeds.

Botanical Name: *FAGOPYRUM ESCULENTUM* Moench

Common Names: Baru, Buckwheat

Family: Polygonaceae

Occurrence: Cultivated in Hindukush Himalayan Region

Plant Identification: There are two species of *Fagopyrum* called *F. esculentum* (Sweet buckwheat), and *F. tataricum* (Bitter buckwheat) grown in Northern Areas of Pakistan. It is an annual herbaceous, with few branches, approximately 30-40 cm tall; the leaves are 1.5 cm long and 0.5 cm wide; the flowers are white in colour; the plants of *esculentum* species are slightly taller than *F. tataricum*.

Parts Used: Seeds

Medicinal Value: The seeds help to reduce the cholesterol level in human body, so important food to control blood pressure.

Propagation: The seeds are sown in July-August like other crops at high altitudes and crop mature in approximately in 60 days.

Botanical Name: *FARSETIA HAMILTONII* Royle

Common Names: Farid-buti, Farid-muli

Family: Brassicaceae

Occurrence: Sindh, Balochistan

Plant Identification: It is a small, branched woody, erect and twiggy shrub; leaves linear, very narrow; flowers small in long spicate racemes; sepal 4, hairy, blunt, margin thin, papery; petals-4, pink, ovate with a broad tip, a little longer than sepals, long-stalked; stamen 6; pods linear 1.3-2.5 cm by 1-2 mm; seeds 1-seriate.

Parts Used: Whole plant

Medicinal Value: It is used in rheumatism and as cooling medicine.

Propagation: Through seeds.

Botanical Name: *FERULA FOETIDA* Linn.

Common Names: Gum Ferula, Hing, Hiltit, Ushi

Family: Apiaceae

Occurrence: Balochistan and Northern Area

Plant Identification: It is a perennial monoecious herb with a conical erect rhizome; stem furrowed, smooth, green, succulent, attaining a height of about 2 meters tall; leaves compound; inflorescence compound umbel of yellow flowers; fruit a cremocarp.

Parts Used: Gum-resin

Medicinal Value: Carminative, nervine stimulant, expectorant.

Propagation: Through rhizome

Botanical Name: *FICUS BENGALENSIS* L.

Common Names: Banyan tree, Bargad, Bohr, Bar

Family: Moraceae

Occurrence: Cultivated, Wild throughout Pakistan

Plant Identification: It is a large ever-green tree with numerous aerial roots from the horizontal branches forming support to the main plant; leaves 10-20 cm, broad, ovate or elliptic, entire, obtuse, rounded petiole 1.3-5.0 cm; stipules 2.0-2.5 cm; male flowers many at the mouth of the receptacle; stamen 1; figs axillary, in pairs 1.3-2.0 cm across, sessile with rounded bracts at the base; globose, red when ripe.

Parts Used: Leaves, Bark, Aerial roots

Medicinal Value: Desiccative and tonic (for sexual organs).

Propagation: Through cuttings and seeds

Botanical Name: *FICUS CARICA* L.

Common Names: Fig, Teen, Anjir, Anjeer zard

Family: Moraceae

Occurrence: Cultivated in NWPF and Punjab

Plant Identification: It is a small tree with many branches up to 3 m tall; leaves 3.5-12.5 cm, membranous, orbicular, ovate, acute or apiculate, toothed or serrated, entire or obtusely 3-5 lobed, base 3-nerved; petiole 2.5-5.0 cm; stipule in pairs ovate acute deciduous; receptacle 1.2-2.5 cm; male flower on pedicles; sepals 4-5, lanceolate; gall flowers sessile or pedicled; perianth deeply 5-cleft; ovary ovoid; female flowers perianth of gall flower; achene trigonous, granular; style sub-terminal, long hairy; stigma bifid.

Parts Used: Fruit

Medicinal Value: Concoctive, Deobstruent, Diaphoretic.

Propagation: Through cuttings and seeds.

Botanical Name: *FICUS RACEMOSA L.*

Common Names: Gular, Kombal

Family: Moraceae

Occurrence: Plains and foot hills of Punjab

Plant Identification: It is a large much branch tree with smooth and reddish brown bark; leaves 10-17.5 cm long, ovate, margin even smooth above, velvety beneath, base round, tapering to the point, stalk 2.5-5.0 cm long; stipules 1.3-2.5 cm, ovate, narrow, velvety, soon falling off; fruit 3 cm in diam., reddish, top depressed, pyriform, stalked, in clusters on short leafless scaly branchlets on the trunk and large branches, basal bracts 3 or 4, ovate, small over lapping.

Parts Used: Bark, Root, Leaves, Fruit

Medicinal Value: The leaves being astringent are prescribed in dysentery, menorrhagia and haemoptysis; it is a useful mouth-wash for spongy gums. The bark is astringent and stomachic.

Propagation: Through cuttings

Botanical Name: *FICUS RELIGIOSA L.*

Common Names: Pipal

Family: Moraceae

Occurrence: Wild in foot hills and planted in plain areas

Plant Identification: It is a large tree, smooth; leaves leathery, shining above, base rounded, point long, cordate; stalk 7.5-10.0 cm long, slender; fruit sessile in pairs, smooth, depressed, spheroidal, dark purple when ripe, 1.3 cm in diam., basal bracts 3, broad, spreading, leathery.

Parts Used: Seed, Fruit and Bark

Medicinal Value: Bark is astringent a paste of the bark is applied to inflammatory swellings as an absorbent; its juice relieves toothache and strengthens the gums; it is a useful dressing for cracked and inflamed soles of the feet.

Propagation: Through cuttings and seeds

Botanical Name: *FOENICULUM VULGARE Mill.*

Common Names: Sweet Fennel, Saunf, Badyan, Rizeh, Raz

Family: Apiaceae

Occurrence: Cultivated throughout Pakistan

Plant Identification: It is an erect, about 1 meter tall, annual herb; stem hollow; leaves 2-4 times pinnate, segments linear, strongly scented when rubbed; flowers yellow in compound umbel, umbel of 15 or more rays; calyx teeth none; petals notched; fruit oblong, not flattened; ridges prominent; furrows with oil glands; seeds flattened, inner face slightly hollow.

Parts Used: Fruit and Root

Medicinal Value: Tonic for digestive tract and for eyesight.

Propagation: It is a winter crop and sown in November. The seed rate of 12-15 kg per hectare is used to get optimum yield. Crop is sown in rows 40 cm apart.

Botanical Name: *FUMARIA INDICA* (Hausk.) Pugsley
Common Names: Fumitory, Pitpapra, Papra, Shatra and Baqlatul-Malik
Family: Fumariaceae
Occurrence: Commonly found as weed in plain areas and foot hills.
Plant Identification: It is a small, scandent, branched, annual herb; stem up to 45 cm long; leaves much divided, racemes lax; flowers white or pinkish, 5-6 mm long; fruit globose, 2-3 mm in diam., rugose when dry, rounded at the top with 2 pits, 1-seeded nutlets with crestless seeds.
Parts Used: Above ground parts
Medicinal Value: Alterative for fevers and as blood purifier.
Propagation: Through seeds

Botanical Name: *GENTIANA KURROO* Royle.
Common Names: Indian Gentian, Juntiana, Nilkanth, Kutki and Kamalphul
Family: Gentianaceae
Occurrence: Balochistan, Azad Kashmir, Himalaya 1500-3300 m
Plant Identification: A stout perennial un-branch herb; leaves opposite, exstipulate, radical 7.5 cm by 8 mm long, oblong or linear; stem leaves 2.5 cm, linear united at the base into a tube; flowers upto 5 cm in diam., solitary or racemed; capsule 1.8 X 1.2 cm; seeds twice as long as broad.
Parts Used: Root, Rhizomes and whole plant
Medicinal Value: The root is tonic, stomachic and febrifuge. It is used for urinary infections. It also acts as antiperiodic, antibilious, astringent and aperient.
Propagation: Through seeds

Botanical Name: *GERANIUM ROBERTIANUM* L.
Common Names: Bhandra
Family: Geraniaceae
Occurrence: At high altitude in moist forests.
Plant Identification: It is an erect, softly hairy, medium size, annual herb; stem succulent, 30-60 cm tall; leaves broad, triangular, 2.5-7.5 cm broad; flowers red pink streaked with white in two flowered clusters on long stalked, 1.3 cm in diam. sepals 5, long pointed, petals 5 narrow, stamen 5, capsule 2 cm long.
Parts Used: Whole plant
Medicinal Value: Herb is haemostatic and astringent; applied to tumors, used in fever, consumption and as a gargle.
Propagation: It is vegetatively propagated.

Botanical Name: *GIRARDINIA PALMATE* (Frossk)
Common Names: Bich-buti, Keri, Bhabar
Family: Urticaceae
Occurrence: Hilly areas of Punjab and NWFP

Plant Identification: It is a large, erect annual herb; leaves 10-30 cm long and broad, ovate, upper leaves 3-5 lobed, heart shaped at the base, sharply toothed; stipule large united, leaf-like, divided at the tip; flowers small, green, sessile, closely crowded, male and female on the same or separate plants, when the male and female are together, the male are in nearly cylindrical clusters on the lower part of the spike, and the female in clustered heads in the upper part; when separate, male in long slender often branched spikes; male flowers, sepals-4, petals none, stamen 4; female flowers, calyx tubular with a small 3-toothed mouth, splitting in fruit, style long.

Parts Used: Leaves

Medicinal Value: Leaves are used against headache, swollen joints and decoction is effective in fever.

Propagation: Through seeds

Botanical Name: *GLYCYRRHIZA GLABRA L.*

Common Names: Glycyrrhiza, Liquorice, Maluthi, Khoga Waley, Aslussus

Family: Fabaceae

Occurrence: Wild and cultivated in Balochistan, Chitral and Northern Areas.

Plant Identification: It is a branched perennial herb, 90-150 cm tall; leaves alternate, compound; leaflets 7-9 pairs; flowers in loose raceme, violet coloured, pod compressed, small glandular and many seeded.

Parts Used: Root

Medicinal Value: Expectorant, demulcent, laxative.

Propagation: Through cuttings.

Botanical Name: *GREWIA ASIATICA L.*

Common Names: Phalsa, Falsa, Pharwa, Palsah

Family: Tiliaceae

Occurrence: Cultivated in Punjab, Sindh and NWFP

Plant Identification: It is a large shrub; leaves large 7.5-20.0 cm long, broadly ovate, acute or shortly acuminate, bluntly serrate, base cordate; flowers small and yellow in colour emerging in axillary clusters; sepals 8 mm long; petals more than half the length of sepals; fruit 8-12 mm, globose, deep purple when ripe.

Parts Used: Leaves, Fruit and Bark

Medicinal Value: Effective against bilious fevers and palpitation.

Propagation: Through cuttings.

Botanical Name: *HEDERA NEPALENSIS Koch.*

Common Names: Banda, Banbatkari, Lublub

Family: Araliaceae

Occurrence: Common in Muree hills and surrounding areas

Plant Identification: It is an evergreen climbing shrub climbing by means of adventitious roots over trees and rocks; leaves simple, 7.5-10 cm long, linear-lanceolate to cordate-ovate, entire or variously lobed, palmate or subpinnatifid, petiolate; panicle not

elongated; flowers yellow green, small in stellately hairy umbels; fruit 6 mm diameter smooth, round, yellow turning black.

Parts Used: Leaves and Fruits

Medicinal Value: The berries are purgative and are used in febrile disorders. The dry leaves are stimulant, cathartic and diaphoretic.

Propagation: Through seeds.

Botanical Name: *HELIANTHUS TUBEROSUS L.*

Common Names: Jerusalem artichoke

Family: Asteraceae

Occurrence: Islamabad and hilly areas of NWPF and Northern Areas

Plant Identification: It is an annual herb, growing up to 1-1.5 m tall and the plants resemble with sunflower; the leaves and stem are hairy, stem is hollow and branched, the leaves are cordate, ovate in shape, and pointed at the apex; leaves are about 7 cm long and 5 cm broad; flower head resembled much with sunflower but relatively smaller in size; the florets are yellow in colour; the plant produces abundant underground tubers which have thin skin and much branched and resemble in shape to ginger.

Parts Used: Tubers

Medicinal Value: The tubers are safe and nutritive food for diabetes.

Propagation: The tubers are sown on ridges in the month of March and plant to plant and row to row distance of 20 cm and 50 cm respectively. The plant can be grown even on marginal land. The tuber formation starts in October and is completed in December.

Botanical Name: *HELICTERIS ISORA L.*

Common Names: Screw tree, Screw bean, Maror phalli, Gasht Bargasht, Pechak

Family: Sterculiaceae

Occurrence: Dry forests and in surroundings of Islamabad

Plant Identification: It is a large deciduous shrub with hairy young parts; leaves alternate in two opposite rows on the branchlets, 7.5-15.0 cm long, round-ovate, short-pointed; stipules 6 mm, subulate or linear; flowers 2.5-5.0 cm long, solitary or 2-4 together in a cluster on short stalks, axillary; calyx tubular, almost 2-lipped, crown wooly; petals 5, scarlet, 2.5 cm long, turned black, staminal tube 5-toothed at the apex; style 5; fruit 5 cm long; seeds numerous.

Parts Used: Root, Bark and Fruit

Medicinal Value: Antiphlegmatic in intestinal complaints, antidiysenteric.

Propagation: Through seeds

Botanical Name: *HELIOTROPIUM EUROPAEUM L.*

Common Names: Hathi-sunda, Bahanger Sunda

Family: Boraginaceae

Occurrence: Sindh and Balochistan

Plant Identification: It is an annual herb 45 cm tall; stem woody at the base; leaves petiolate, petiole upto 4 cm long; lamina elliptic-ovate, slightly attenuate towards the base,

apex obtuse to roundish, rarely acute, 1-6 cm long, 1.0-3.5 cm broad; inflorescence usually terminal, some-times axillary; calyx persistent, divided to the base, lobes lanceolate, covered with white spreading trichomes; corolla 3.0-3.5 mm long; fruit globose, lobed, 1.5-2.2 mm; nutlets 4, free, dorsally convex, ovate.

Parts Used: Whole plant

Medicinal Value: Plant is emetic its leaves applied as a cleaning and healing agent to boils and ulcers.

Propagation: Through seeds

Botanical Name: *HIBISCUS CANNABINUS L.*

Common Names: Sun, Sanukra,

Family: Malvaceae

Occurrence: Cultivated in Punjab, Sindh and NWFP

Plant Identification: It is a prickly annual or perennial herb up to 1.5 m tall; stem glabrous; lower leaves entire, cordate, upper deeply palmately lobed; petiole prickly, lower much longer than the blade; stipule linear, pointed; peduncles axillary, very short; sepals bristly, lanceolate, connate below the middle, with a gland at the back of each; corolla large spreading, yellow with a crimson centre; capsule globose, pointed, bristly; seeds very glabrous.

Parts Used: Leaves, Flowers, Seed

Medicinal Value: Leaves are purgative. Juice of leaves with sugar and black pepper is use in biliousness with acidity. Seeds are aphrodisiac, fattening and are externally applied to pains and bruises.

Propagation: It is planted as a summer crop through seeds.

Botanical Name: *HIBISCUS MUTABILIS L.*

Common Names: Gul-i-Ajaib

Family: Malvaceae

Occurrence: Cultivated in Punjab

Plant Identification: It is a deciduous shrub; leaves 11 cm across or more, cordate, 5-7 lobed or angled, irregularly crenate-dentate more or less softly pubescent; peduncles axillary, 7.5-15.0 cm long, jointed near the flower; bracteoles 7-10, linear-lanceolate, shorter than the calyx; calyx velvety-pubescent; corolla 7.5-10.0 cm across, often double.

Parts Used: Whole plant

Medicinal Value: The leaves are applied to swellings. Plant is emollient. Flowers are used for pectoral and pulmonary complaints, and as a stimulant.

Propagation: Through seeds

Botanical Name: *HIBISCUS ROSA-SINENSIS L.*

Common Names: Shoe Flower, China Rose, Gurhal, Jasun, Badshah-Pasand

Family: Malvaceae

Occurrence: Cultivate in gardens

Plant Identification: It is a large evergreen shrub; leaves 7.5-10.0 cm long, ovate or lanceolate, acuminate, coarsely toothed, glabrous or nearly so; peduncles solitary, axillary, 8.5 cm long, jointed above the middle; bracteoles 5-7, lanceolate, half as long as or nearly equaling the calyx flowers normally red but also crimson; calyx divided nearly half way down; corolla 10 cm across; staminal-tube much exerted, 5-toothed at the apex.

Parts Used: Whole plant

Medicinal Value: Exhilarant, astringent, cardiac tonic, febrifuge, reduces blood heat, checks urogenital discharges.

Propagation: Through cuttings.

Botanical Name: *HIPPOPHAE RHAMNOIDES L.*

Common Names: Barru, Malekh

Family: Elaeagneaceae

Occurrence: Northern areas of Pakistan at high altitudes

Plant Identification: It is a shrub or small tree which may grow up to 3-4 m tall, much branched, thorny, silvery grey twigs; leaves are alternative, narrow, spread very thinly covered in hairs above and scaly silvery grey on the underside; the flowers appears before the leaves in April-May; the male and female flowers are borne on separate bushes; the flowers are inconspicuous and of simple structure; the male flowers are in globe – shape axillary clusters, the female flowers in short dense hyacinth like bunches; the fruits are juicy, densely clustered and mostly orange in colour.

Parts Used: Berries

Medicinal Value: The berries contain high contents of vitamin ‘C’ and small quantities of vitamins A, B, E and P.

Propagation: Through seeds. A nursery is raised in spring and when seedlings are 30 cm tall can be transplanted.

Botanical Name: *HYOSCAMUS NIGER L.*

Common Names: Henbane, Sure, Telingchi, Ajwain-I-khurasani, Dantura

Family: Solanaceae

Occurrence: Cultivated in Balochistan, Azad Kashmir and NWFP.

Plant Identification: A pubescent, more or less hairy, erect, herb; radical leaves 15-20 cm long, entire or coarsely sinuate-toothed or lobed, spreading, oblong-ovate, stem leaves smaller, sessile, ovate, lobed; flowers 2.5-3 cm in diam., dark yellowish green, veined with purple, sessile, one sided spike; capsule 1.2 cm in diam.

Parts Used: Leaves, Seed, Flowers

Medicinal Value: Sedative and hypnotic, antiphlegmatic for productive cough.

Propagation: Through seeds at high altitudes.

Botanical Name: *HYPERICUM PERFORATUM L.*

Common Names: Balsana

Family: Hypericaceae

Occurrence: Sindh, Punjab and NWFP

Plant Identification: It is an erect, perennial herb upto 80 cm tall; stem 2-angled; leaves 2 cm long, oblong, blunt, dotted, sessile; flowers yellow in colour, 2.5 cm in diam., in terminal or axillary short-stalked clusters; sepals 5, 4 mm long, united at the base; petals 5, persistent with black glandular edges; stamen many, in 3 bundles; anthers black dotted; style 3 as long as the stamens, ovary 3-celled; capsule 1.2 cm long, ovoid; seeds many and small in size.

Parts Used: Whole plant

Medicinal Value: The herb is antidepressant, astringent, resolutive, anthelmintic, emmenagogue, diuretic, and poisonous to horses. Herb is used in disturbed sleep.

Propagation: Propagation through seeds

Botanical Name: *HYSSOPUS OFFICINALIS L.*

Common Names: Hyssop, Zufah, Zoofa khushk

Family: Lamiaceae

Occurrence: Balochistan, Azad Kashmir and Western Himalaya

Plant Identification: It is a herbaceous, aromatic, glabrous perennial, about 60 cm tall; leaves sessile, linear to oblong, usually narrow at both ends, up to 5 cm long; flowers bluish purple; calyx persistent.

Parts Used: Whole plant

Medicinal Value: Pectoral (in cough and bronchial asthma), anthelmintic, tonic, stimulant, diuretic, deobstruent, cathartic, stomachic, expectorant and diaphoretic carminative.

Propagation: Through seeds and cuttings.

Botanical Name: *IMPATIENS BALSAMINA L.*

Common Names: Gul-mehndi, Dopati

Family: Balsaminaceae

Occurrence: Under forests and along roads in Murree and Kashmir

Plant Identification: It is a small, annual herb; stem hollow; leaves 4-6 cm, narrowly lanceolate, stalked, deeply toothed; flowers 1.2 cm long without the spur, usually clustered stalks; sepals 3, 2 upper small, flat, usually green, the lower forming the lip, more or less tubular, petals 3, upper broad somewhat concave, 2 lower smaller, forming wings, deeply 2-lobed; stamen 5, clasping the ovary; capsule 8-12 mm in oblong, narrowed at both rounded ends, densely felted or woolly, burst open when ripe by valves which curl up and jerk away many seeds.

Parts Used: Whole plant

Medicinal Value: The plant is used for pains in the joints, internally act as emetic, cathartic and diuretic. Flowers are cooling, tonic, useful when applied to burns and scald.

Propagation: Through seeds.

Botanical Name: *INDIGOFERA ARTICULATA* Gouan (L.)

Common Names: Neel Sarmay

Family: Fabaceae

Occurrence: Balochistan and Sindh

Plant Identification: It is a large shrub with woody branches; leaves 2.5-5.0 cm long; leaflets opposite, large obovate; petiole 1.2 cm long; stipules minute, setaceous; racemes subsessile 12-20 flowered, shorter than the leaves, 1.2-2.5 cm long whilst in flower; calyx 1 mm, campanulate, argentous, teeth deltoid, cuspidate, as long as the tube; corolla 4 mm, reflexed 3-4 seeded, torulose, at first argentous, finally glabrescent. Beside *Indigofera articulata*, three other species called *I. linifolia*, *I. oblongifolia* and *I. trifoliata* are also found in Pakistan and have almost the same uses as *I. articulata*.

Parts Used: Root, Seed, Leaves

Medicinal Value: The plant is deobstruent and alterative.

Propagation: Its propagation is through seeds.

Botanical Name: *IPOMOEA HISPIDA* (Vahl).

Common Names: Bhanwar

Family: Convolvulaceae

Occurrence: Common in plains and lower hills

Plant Identification: It is a hairy twining herb; leaves 6.5 by 2.5 cm, oblong, cordate, short point stalk 2.5 cm; flowers 1.6 cm, pink, sessile in heads; bracts 1.2 cm 6 mm, round hairy, 2-celled.

Parts Used: Whole plant

Medicinal Value: The plant boiled in oil is used to cure rheumatism, headache, epilepsy, leprosy and ulcer.

Propagation: Through seeds.

Botanical Name: *IPOMOEA AQUATICA* Forsk.

Common Names: Nari

Family: Convolvulaceae

Occurrence: Found in water ponds and near crop field in Sindh and Punjab

Plant Identification: It is an aquatic trailing annual herb; stem hollow; leaves 7.5-15.0 cm, stalk 2.5-15.0 cm, generally long, oblong-cordate, entire or angular, almost lobed; flower pale purple 5 cm in diam.; bracts small; sepals 5, 8 mm long, almost equal, smooth; corolla 5-plaited, smooth; stamen 5; capsule 8 mm, ovoid; 4-2 seeded; seeds minute, silky.

Parts Used: Whole plant

Medicinal Value: The herb is emetic, purgative; used as antidote to opium and arsenical poisoning and given in nervous and general debility.

Propagation: Through cuttings/branches

Botanical Name: *JASMINUM GRANDIFLORUM L.*

Common Names: Jasmine, Chambeli

Family: Oleaceae

Occurrence: Wild and cultivated throughout Pakistan

Plant Identification: It is a twining shrub; branches ribbed; leaves opposite; leaflets 7-11; flowers fragrant, in lax axillary or terminal panical; sepals long, linear; corolla white, often tinged with purple on the outside, lobes spread.

Parts Used: Flowers, Root and Leaves

Medicinal Value: The leaves are astringent; they are chewed to relieve toothache and to heal ulcers in the mouth; their juice is applied to remove soft corns between toes; the bland oil which has been boiled with the leaf juice is used in otorrhoea; a paste of the leaves is applied to wounds.

Propagation: It is vegetatively propagated through cuttings

Botanical Name: *JASMINUM SAMBAC (L.) Ait.*

Common Names: Mogra, Motia

Family: Oleaceae

Occurrence: Cultivated throughout Pakistan

Plant Identification: It is an erect shrub; at times scandent; young branches pubescent; leaves opposite, simple, variable in shape, membranous, 3.5-7.5 cm long with prominent lateral nerves. Inflorescence terminal, bearing solitary or 3-flowered cymes; flowers white, fragrant; calyx pubescent, lobes 5-9, tapering to a fine point; corolla lobes as many as calyx lobes, often numerous, spreading; tubes narrow, elongate. Fruit black when ripe, surrounded by persistent calyx.

Parts Used: Whole plant

Medicinal Value: The whole plant is anthelmintic, deobstruent, diuretic and emmenagogue. A poultice of the dry leaves is applied to indolent ulcers and other skin diseases. The flowers are a powerful lactifuge; the crushed flowers are applied to the breasts to check secretion of milk if an abscess is being developed.

Propagation: It is vegetatively propagated through cuttings.

Botanical Name: *JATROPHA CURCAS L.*

Common Names: Jamalgota, Baghbhrandha

Family: Euphorbiaceae

Occurrence: Cultivated as an ornamental plant in gardens in Sindh and Punjab

Plant Identification: It is a medium size shrub, native to tropical America and cultivated in gardens in Punjab and Sindh. The leaves and stem looks like castor and leaves are shining; white milk like liquid is excreted from the branches when cut. It bears many berries at the top of each branch.

Parts Used: Whole plant

Medicinal Value: The seeds are purgative; fresh latex is styptic; it is applied to bleeding wounds; it is locally used over piles, scabies, eczema, ringworm, itch, herpes and decayed teeth. A decoction of the leaves is a febrifuge and a mouth-wash for strengthening the

gums; the crushed leaves are rubefacient and discolicent. The oil extracted from the seeds is a purgative and alterative

Propagation: The seeds sown in the field or nursery, the seedlings can be transplanted.

Botanical Name: *JUNIPERUS EXCELSA* M.B.

Common Names: Apurs, Luir, Shur

Family: Cupressaceae

Occurrence: Forest tree in Balochistan, Chitral

Plant Identification: It is a medium size tree, bark vertically fissured; leaf of two kinds, young seedlings and some of the lower branches subulate, pungent, leaves needle like, sharply spiny; flowers monoecious, the male at the tips of the branchlets, the female terminating short side branchlets; fruit 8 mm in diam. Globose, blue-black, very resinous, the tips of the scales forming transverse ridges; seeds 2-5.

Parts Used: Berries, Oil from seed

Medicinal Value: The fruit and oil are diuretic, carminative, stimulant; and is used in dropsy, gonorrhoea, gleet, leucorrhoea and some cutaneous diseases. The berries are given in scanty urine, cough and pectoral infections and are also recommended in tuberculosis and diabetes.

Propagation: Through seeds.

Botanical Name: *KOCHIA INDICA* Wight

Common Names: Bui, Kochia

Family: Chenopodiaceae

Occurrence: Waste place in Potohar and cultivated as ornamental plant

Plant Identification: It is a small erect annual, hairy herb; branches from the base; branchlets long, widely separating; leaves small, oblong with rounded ends, short pointed, sessile; flowers minute, male and female sometimes separate, bractless; sepals curved, in fruit closing over, leathery with 5 free of united horizontal, ovate, blunt, thick wings, forming a broad triangular calyx; stamen 5, anthers large protruding; style slender; stigmas 2-3, thread like; seed orbicular.

Parts Used: Whole plant

Medicinal Value: The plant is cardiac stimulant.

Propagation: The nursery is raised from the seeds and seedlings are transplanted.

Botanical Name: *LACTUCA SERRIOLA* L.

Common Names: Lettuce, Salad, Kahu

Family: Asteraceae

Occurrence: NWFP, Balochistan, Punjab

Plant Identification: It is an medium size, erect annual or biennial herb; prickly at the base; leaves 12.5-17.5 cm, pinnately divided; stem leaves lobed at the base, half stem clasping; flowers yellow in erect, cylindrical, few flowered, branches racemed head 1.2 cm long. Stalks bracteate, white; achenes 6 mm, many-ribbed, ribs rough, brown, beak very slender.

Parts Used: Leaves and Seeds

Medicinal Value: The herb is cooling, sedative, diaphoretic, diuretic, antiseptic, hypnotic, expectorant and useful in the treatment of coughs in phthisis, bronchitis, asthma and pertussis.

Propagation: Through seeds.

Botanical Name: *LALLEMANTIA ROYLEANA Benth.*

Common Names: Balangoo, Tukham-e-Balangoo, Parchank

Family: Lamiaceae

Occurrence: Cultivated in desert areas of Punjab and Sindh

Plant Identification: It is a small, erect annual herb up to 40 cm long, with slightly angled stem; leaves ovate or oblong, blunt, coarsely round toothed; flowers 1.6 cm, pale lilac, shortly stalked, in many circular clusters at intervals along narrow long spikes; bracts small, soon falling off, oblong, or lanceolate, teeth with long bristle points; calyx 8 mm, erect stiff, 2 lipped, upper lip with 3 obtuse lobes of which the lateral are under the mid-lobe; corolla tube pairs, ascending under the upper lip of the corolla.

Parts Used: Seeds

Medicinal Value: Seed are cooling, sedative and used in flatulence and constipation.

Propagation: It is sown in the month of November in dry areas. The seed can be sown in rows or through broadcast. It is drought tolerant plant species and needs little water. Mostly farmers are not adding any fertilizer but experiments have sown that application of DAP fertilizer at the time of sowing helps in better stand establishment and higher yield. The crop is harvested in April.

Botanical Name: *LANTANA CAMARA L.*

Common Names: Panch phul, Ganary, Ganary Kumara

Family: Verbenaceae

Occurrence: Naturalized in Punjab and Sindh

Plant Identification: It is a straggling and aromatic shrub, 1.3-2.8 meters tall; leaves opposite ovate, sub-acute, base truncate or narrowed; petiole 8-12 mm long; flowers 6 mm in diam., orange in colour; peduncles 33 cm long, hispid, thickened upwards; bracts 6-8 mm long, lanceolate; calyx 2 cm long; corolla tube 8-13 mm long; fruit 5 mm in diam., black and shining. Due to its prolific growth and wide adaptability, it has developed into a serious pest.

Parts Used: Whole plant

Medicinal Value: The plant is considered as diaphoretic, carminative and antiseptic. It is also considered as tonic and is used in ataxy of abdominal viscera.

Propagation: Through seeds.

Botanical Name: *LAWSONIA INERMIS L.*

Common Names: Mehndi, Hena

Family: Lythraceae

Occurrence: Cultivated mainly in central Punjab and Sindh

Plant Identification: It is a glabrous shrub, twigs quadrangular, often ending in thorns; leaves opposite, elliptic, rhomboid; flowers white, creamy or rosy, 8 mm in diam., in large terminal pyramidal panicles; calyx broadly campanulate, lobe 4; petals 4; stamen 8; ovary 2-4 celled; ovules many; capsule 5-8 mm in diam.

Parts Used: Bark, leaves, flower, Oil and Essence

Medicinal Value: Refrigerant, alterative, detergent, sedative and astringent.

Propagation: It can be propagated through seeds and cuttings

Botanical Name: *LEPIDIUM SATIVUM L.*

Common Names: Pepper wort, Halim, Hurf, Haloon, Habul Reshad

Family: Cruciferae

Occurrence: Cultivated in Sindh, Punjab and Balochistan

Plant Identification: It is an annual, glabrous, 15-45 cm tall herb; leaves arising from the underground part of the stem divided twice pinnately; flowers in long racemes, small, white; pods notched at the tip, margins winged, 2-seeded.

Parts Used: Seeds and Leaves

Medicinal Value: The seeds are tonic, alterative, aphrodisiac, stimulant and aperient; use in dysentery, diarrhoea, skin diseases, bleeding piles and rheumatic pains; Leaves are stimulant and diuretic; they are particularly useful in scorbutic diseases.

Propagation: It is propagated through seeds.

Botanical Name: *LINUM USITATISSIMUM L.*

Common Names: Linseed, Flax, Alsi, Tukhm-Zaghira, Tisi, Tukhma Katan

Family: Linaceae

Occurrence: Cultivated in Punjab, Sindh and NWFP

Plant Identification: It is a medium size erect annual herb, up to 60 cm tall; stem cylindrical; leaves alternate, narrow, nearly 3-nerved, linear lanceolate, sessile. Flowers in loose clusters, blue; sepals 5, narrow pointed, slightly hairy, persistent; petals 5. capsules roundish, pointed at the apex, 10-celled, each cell containing 1 seed; seeds oval, smooth, shining, usually brown coloured.

Parts Used: Seed, Bark, Leaves, Flowers

Medicinal Value: The seeds are diuretic and emollient; they are administered in gonorrhoea, inflammatory, gastro-intestinal disorders, irritation of the genito-urinary organs, nephritis, cystitis, colds, coughs, sore chest and throat and pulmonary complaints. Flower is a cardiac and nerve tonic; bark and leaves are used in gonorrhoea.

Propagation: It is sown in November. The row distance of 30 cm is appropriate for higher yield. It requires low input. The crop matures in April - May.

Botanical Name: *LOLIUM TEMULENTUM L.*

Common Names: Machani, Darneel

Family: Poaceae

Occurrence: Throughout Pakistan

Plant Identification: It is a medium size annual herb, 30-40 cm tall; culms simple, erect or ascending; leaf blade linear, lanceolate, acute, margin scarbrid; ligules very short, membranous; spike 15-30 cm long, rachis stout; spikelets usually about 1 cm long and half as broad, oblong, many flowered sessile in alternating, distichous notches of the stout rachis.

Parts Used: Whole plant

Medicinal Value: Plant is sedative poultice and cure freckles and cattle poisoning.

Propagation: Through seeds

Botanical Name: *MALLOTUS PHILIPPINENSIS (Lam.)*

Common Names: Kamala, Kamatah, Kanbila, Kambero

Family: Euphobiaceae

Occurrence: Swat eastwards ascending 1300 meters and cultivated in gardens.

Plant Identification: It is a small evergreen tree; leaves alternate, very variable, usually ovate, ovate-oblong, elliptic or sometimes lanceolate, minutely pubescent beneath, and closely dotted with minute red glands, distinctly reticulate; flowers yellow in colour 3 mm in diam, dioecious; petals absent; male flowers in terminal clustered erect spike-like racemes 10-25 cm long; a few solitary racemes; bracts minute; calyx 2 mm long, cleft to the base; female flowers spicate, spikes solitary or several 2.5-10 cm long; calyx 3 mm long, persistent below the fruit; ovary 3-celled; fruit a capsule, 8-12 mm in diam.

Parts Used: Seeds, Leaves and Roots

Medicinal Value: Anthelmintic, vermifuge, vulnerary.

Propagation: Through seeds.

Botanical Name: *MALUS PUMILA Mill.*

Common Names: Sub

Family: Rosaceae

Occurrence: Cultivated in Northern areas, Punjab, Sindh and NWFP.

Plant Identification: It is a small deciduous tree; leaves 5-7.5 cm long, usually ovate; petiole 1.2-5.0 cm in umbels or fascicles, on short lateral leafy shoot; tomentose; calyx tube campanulate tomentose; petals with a distinct claw; style 5, shortly united below; fruit globose, depressed at each end and tipped with the persistent calyx lobes.

Parts Used: Fruit, Bark, Root

Medicinal Value: Fruit is nutritive and useful in obviate constipation. Root is hypnotic, refrigerant and anthelmintic.

Propagation: Through seeds and cuttings.

Botanical Name: *MALVA SYLVESTRIS L.*

Common Names: Common Mallow, Gul-e-khaira, Khatmi, Khubazi

Family: Malvaceae

Occurrence: Cultivated in gardens and field throughout Pakistan

Plant Identification: It is an erect, glabrous, annual herb, 30-90 cm tall; leaves cordate, lobed, petiolate; flowers pink streaked with purple, 3.7 cm in diam., petals notched longer than the calyx; claw of the petals bearded, peduncle longer than the flowers.

Parts Used: Seeds, Leaves and Flowers

Medicinal Value: The plant is mucilaginous, demulcent, emollient, cooling and febrifuge and is used in the affection of the mucous membrane of the pulmonary tracts of the urinary bladder.

Propagation: Through seeds and the seeds are sown in March-April. The seedlings can also be transplanted from nursery.

Botanical Name: *MARRUBIUM VULGARE L.*

Common Names: Pahari gandana, Faraceem

Family: Lamiaceae

Occurrence: NWFP and Kurram Agency

Plant Identification: It is a large erect herb; leaves 1.2-4 cm in diam., ovate or circular, toothed; flowers white, 1.3 cm in diam., in axillary clusters; corolla short, 2-lipped, upper lip erect, divided, lower spreading, mid-lobe largest; stamen 4, blunt, smooth.

Parts Used: Seeds, Leaves and Flowers

Medicinal Value: The plant is bitter, tonic, carminative, expectorant, diuretic, pectoral and is useful in cough, cold and pulmonary infections.

Propagation: Through seed.

Botanical Name: *MATRICARIA CHAMMOMILLA L.*

Common Names: Chamomila, Babuna, Gul-e-Baboona, Babuno

Family: Asteraceae

Occurrence: Balochistan, NWFP and Islamabad

Plant Identification: It is an aromatic, erect much branched, 30-70cm tall annual herb; leaves divided 2 or 3 times, thread-like; flower heads terminal, about 2.5 cm in diam., on slender branched stalks, bearing an outer whorl of 10-20 white flowers and a yellow centre; bracts of the flower heads with white margins; flower bearing receptacle elongated during fruiting. Achenes small, grey, with 3-5 faint, white, slender ribs.

Parts Used: Flowers, Oil

Medicinal Value: Anti-inflammatory and nerve stimulant.

Propagation: The seeds are very small in size so should not be sown deep in soil. It is sown in September-October. The seed rate of 0.8 kg/hectare is enough. The row to row distance of 50 cm should be maintained. The sowing in rows helps in harvesting the flowers. The flowers after harvesting should be dried under shade.

Botanical Name: *MELILOTUS INDICUS (L.)*

Common Names: Ban methi, Sinjee

Family: Fabaceae

Occurrence: It is a common weed in winter crops throughout Pakistan

Plant Identification: It is a small slender annual herb, 30-50 cm tall; leaves pinnately 3-foliolate; leaflets 6-12 obovate, lateral leaflets nearly sessile, terminal one stalked; stipule linear, long-pointed; flowers pale yellow, minute axillary racemes; calyx 1 mm, teeth 5; petals 5, 2 mm long, soon falling off; glabrous 2-3 mm long usually 1-seeded.

Parts Used: Whole plant

Medicinal Value: Seeds are useful in bowel complaints and infantile diarrhoea. Leaves are discutient and emollient. These are externally applied as poultice on swellings.

Propagation: Through seeds.

Botanical Name: *MENTHA ARVENSIS L. and also MENTHA PIPERITA L.*

Common Names: Mint, Pepper mint, Podina, Fudanj

Family: Lamiaceae

Occurrence: Throughout Pakistan

Plant Identification: It is a slender, hairy, perennial herb; 15-30 cm tall; leaves roundedly ovate, acute, or sub-obtuse, toothed, hairy, stalked; flowers 4 mm in diam., blue lilac, hairy inside; stamens exerted; nutlets 1 X 0.5 mm, ellipsoid, slightly keeled, finely marked, pale yellow. The whole plant is sweet scented.

Parts Used: Leaves

Medicinal Value: It is antispasmodic, carminative, stomachic, refrigerant, stimulant, diuretic and emmenagogue. Mint herb is an aromatic and is used in chutneys.

Propagation: Through stolons which are planted in October-November or February-March. Approximately 50,000 to 80,000 stolons are enough for one hectare. The row-to-row distance of 30 cm is appropriate.

Botanical Name: *METHAN LONGIFOLIA (L.)*

Common Names: Parchunk, Podina

Family: Lamiaceae

Occurrence: Wild in hilly areas

Plant Identification: It is an erect, strongly scented perennial herb; leaves lanceolate, ovate or oblong, sharply-toothed, nearly sessile, short-pointed, grey velvety above, white felted below; flowers small, lilac, in large clusters, crowded on axillary and terminal cylindrical tapering spikes; lower bracts leaf-like, upper smaller, lanceolate; calyx sharply 5-toothed, bell-shaped, hairy; corolla 4-lobed, lobes erect, nearly equal; stamen 4, equal, protruding.

Parts Used: Whole plant

Medicinal Value: The infusion of leaf is taken as a cooling medicine. Dried leaves and flower tops are carminative, stimulant, and are also taken in form of tea.

Propagation: Through stolons planted in October-November or February-March. Approximately 50,000 to 80,000 stolons are enough for one hectare. The row to row distance of 30 cm is appropriate.

Botanical Name: *MENTHA SPICATA L.*

Common Names: Jangli podina

Family: Lamiaceae

Occurrence: Balochistan and NWFP

Plant Identification: It is a perennial, glabrous or nearly so; stem erect with ascending branches 30-70 cm, leaves sessile or sub-sessile, lanceolate or ovate lanceolate, sharply serrate, whorls of flower in narrow interrupted spikes, 5-10 cm long, the central spike exceeding the lateral ones; calyx, teeth hirsute or glabrate; corolla about 3 mm long, whitish, seed rare.

Parts Used: Whole plant

Medicinal Value: stimulant, antiseptic and carminative.

Propagation: Through stolons.

Botanical Name: *MIMOSA PUDICA L.*

Common Names: Lajwanti Choti (small), Chuimui

Family: Mimosaceae

Occurrence: Cultivated in garden.

Plant Identification: It is a diffuse prickly under-shrub; leaves sensitive, digitately branched; leaf stalks 2.5-5.2 cm long, prickly; pinnate 1-2 pairs, 2.5-7.5 cm long; leaflets 24-40, very small, sessile, leathery, bristly beneath. Flowers small, bisexual and unisexual, in small, stalked heads all down the branches, 1-2 from each axil, pink in colour; flower stalks prickly. Pods about 2.5 cm long, flat, very bristly along the sutures, having 3-5 one seeded joints that separate when ripe from each other and from the persistent sutures.

Parts Used: Leaves, Stem, Root

Medicinal Value: The leaves and roots are useful in stones and other diseases of the kidneys, piles and allied urinary diseases; in large doses the root is poisonous and emetic. The leaf juice is a useful dressing for fistular sores and abscesses.

Propagation: Through seeds.

Botanical Name: *MIRABILIS JALAPA L.*

Common Names: Gul-e-abbas

Family: Nyctaginaceae

Occurrence: Cultivated or escape

Plant Identification: It is large, perennial herb, forming a thick round bush; about 90 cm tall; leaves ovate, narrow pointed, 12.5 cm long; flowers showy of various colour, mottled or striped, each flower with cup like bract resembling a calyx, calyx bright coloured with a long tube and spreading limb; corolla absent; fruit black, covered with tubercles.

Parts Used: Leaves, Root

Medicinal Value: The leaf juice is a useful cleaning and healing agent for wounds. The root is a purgative.

Propagation: Through seeds.

Botanical Name: *MOLLUGO NUDICAULIS* Lamk.

Common Names: Gandibuti

Family: Aizoacea

Occurrence: Sindh, Punjab and NWFP

Plant Identification: It is a small, prostrate annual herb; leaves oblong, blade prolonged, tapering to the base; flowers green, in clusters on branching stalks; sepals 5, oblong or oval, with thin margins; petals none; stamen 3 or 5; stigma 3 very small; capsule 2 mm, round many seeded; seeds minute, black.

Parts Used: Whole plant

Medicinal Value: The plant is used athrepy and whooping cough. Leaves are applied as poultice on wounds and boils to remove pus.

Propagation: Through seeds which germinate during summer season.

Botanical Name: *MOMORDICA BALSAMINA* L.

Common Names: Jangli Karela

Family: Cucurbitaceae

Occurrence: Climbing on trees in Sindh and Southern Punjab.

Plant Identification: It is a slender, climbing annual or biennial herb; tendril simple; leaves usually 5-lobed or angled, 3-8 cm in diam., orbicular, palmately lobed, cordate at the base, obtuse at the apex; flowers yellow, 12 mm long; fruit 2.5-7.5 cm long, ovoid, smooth or muricate, narrowed at both ends, orange when ripe.

Parts Used: Fruit

Medicinal Value: Fruit is effective in healing wounds, expelling round worms, diabetes, stomachic, anthelmintic, and laxative. It is also used in leprosy, piles, jaundice, rheumatism, gout, blood and liver diseases.

Propagation: Through seeds sown in March-April.

Botanical Name: *MORINGA OLEIFERA* Lam.

Common Names: Horse Radish, Drum stick tree, Sahajna, Sajina, Soanjna

Family: Moringaceae

Occurrence: Cultivated in Punjab, NWFP

Plant Identification: It is also called drumstick. It is a large deciduous tree; leaves 30-75 cm long, usually 3-pinnate, pinnae and pinnules opposite, deciduous; leaflets 1-2 cm long, the lateral elliptic, the terminal obovate, entire, membranous; flowers 2.5 cm in diam., white strongly honey scented; capsule 22.5-50.0 x 1.5-2.0 cm, pendulous, 9-ribbed.

Parts Used: Roots, Fruits, Flowers and Bark

Medicinal Value: The bark is abortifacient. The flowers are stimulant and aphrodisiac. The fruit is used in diseases of liver and spleen, articular pains, tetanus and paralysis. The oil from the seeds is used as external application in rheumatism. The root is used as stimulant in paralytic affection and intermittent fever, used in epilepsy and chronic rheumatism, carminative, stomachic, abortifacient, as cardiac and circulatory tonic. The seeds are used in venereal affections.

Propagation: Through seed

Botanical Name: *MORUS ALBA L.*

Common Names: Mulberry, Shatut, Tut

Family: Moraceae

Occurrence: Cultivated in Balochistan, Punjab, NWFP and Northern Areas

Plant Identification: It is a large deciduous tree; leaves very variable in size and shape usually 5-7.5 cm long, ovate obtuse, acute or shortly acuminate, serrate; flowers greenish, sexes often on different branches occasionally of different trees; male spike 1.2-3.8 cm long, flowers with small pedicel; sepals 3 mm long, hoary; female spike ovoid, pedunculate, the peduncle as long as the spike; sepals 4, glabrous of shortly ciliate; fruit 5-6 cm long, sweet ovoid, white or reddish black when ripe.

Parts Used: Fruits, Leaves and Bark

Medicinal Value: Effective against upper respiratory tract disorders particularly as repercussive.

Propagation: Mainly through cuttings which are raised in nurseries.

Botanical Name: *MORUS INDICA L.*

Common Names: Tut Shahhindi

Family: Moraceae

Occurrence: Cultivated in Punjab, NWFP and Northern Areas

Plant Identification: It is a medium sized, much branch, deciduous tree; leaves 6-15 cm with 1.2-2.5 cm long stalk, ovate (often lobed) sharply toothed, long pointed, rough; flowering and fruiting spike short, avoid, dark purple; sepals 4; stamen 4.

Parts Used: Fruit, Bark, Leaves, Root

Medicinal Value: The bark is anthelmintic and purgative; leaves are used as decoction to gargle in the inflammation of vocal cord. The root is anthelmintic and astringent. Fruit is laxative, cooling, and aromatic, allays thirst and reduces fever.

Propagation: Mainly through cuttings which are raised in nurseries.

Botanical Name: *MORUS NIGRA L.*

Common Names: Shahtut, Tut Syah

Family: Moraceae

Occurrence: Cultivated in Balochsitan, NWFP and Northern areas

Plant Identification: It is a tall tree, up to 10 meters in height; leaves dark more or less pubescent; twigs dark coloured; leaves 5-10 cm long, thick, dull green, cordate-ovate, with a deep and nearly symmetrical basal sinus, abruptly short-pointed, rough above, more or less pubescent beneath, margin with coarse angled or pointed teeth; fruit purple to black 2.5-3.0 cm long.

Parts Used: Fruit and Bark

Medicinal Value: The bark is purgative and vermifuge. Fruit is laxative, nutritive, and refrigerant. Herbal manufacturers use the fruits in cough syrups.

Propagation: Mainly through cuttings which are raised in nurseries.

Botanical Name: *MUCUNA PRURIENS (L.) DC*
Common Names: Velvet bean, Cow hage, Kaonch, Kamachah, Jaloni Buti
Family: Papilionaceae
Occurrence: Azad Kashmir and Northern areas
Plant Identification: A slender hairy climber. Leaves 3-foliolate; leaflets ovate, white pubescent beneath. Flowers large, 2.5-3.5 cm long, purple, in drooping racemes. Pods 2.5-7.5 cm long, curved like an "S", ridged longitudinally clothed with stinging hairs.
Parts Used: Roots, seeds and pods
Medicinal Value: Avoricious, aphrodisiac, nervine tonic, hairs and pods as vernifuge.
Propagation: Through seeds which germinate in summer.

Botanical Name: *MYRTUS COMMUNIS L.*
Common Names: Myrtle Berry, Aas, Moriyar, Mort, Mara, Vilayiti Mehndi, Sutra
Family: Myrtaceae
Occurrence: Balochistan and NWFP
Plant Identification: It is an evergreen shrub; leaves opposite, about 2.5 cm long, ovate-lanceolate, pellucide-punctate; flowers 1.2 cm in diam., white, solitary, axillary; calyx limb 4-5 cleft; petals 4-5, free; stamens numerous; ovary 2-3 celled; berries black.
Parts Used: Leaves
Medicinal Value: Antidiarrhoeal, Styptic. The essential oil of the leaves is antiseptic and is locally applied in rheumatism.
Propagation: Through seeds.

Botanical Name: *NEOLITSEAE CHINENSIS (Lam.) Chun.*
Common Names: Litsea Bark, Maidah Lakri, Maidah-Sak, Garbijaur
Family: Lauraceae
Occurrence: Sub-Himalayan tracts and adjacent plains.
Plant Identification: It is a medium size evergreen tree with leaves variable, alternate, elliptic, ovate, acute or acuminate, base usually narrowed; flowers yellow, small, in heads of about 8-12 flowers arranged in contracted pedunculate corymbs each surrounded by an involucre of 4 rounded, concave, tomentose bract; perianth lobes very irregular, generally absent; stamen up to 20 or more; fruit globose, 8 mm in diam., black when ripe, supported by thickened pedicel and base of perianth.
Parts Used: Bark, leaves, berries
Medicinal Value: Astringent, stimulant and aphrodisiac.
Propagation: Through seeds.

Botanical Name: *NERIUM INDICUM Mill.*
Common Names: Oleander, Kaner, Ghanira, Zhar Zehra, Dafli
Family: Apocynaceae
Occurrence: Cultivated and self sown through out Pakistan
Plant Identification: It is an evergreen shrub with milky juice; leaves linear-lanceolate, narrowed at both ends, thick, 10-15 cm by 8-22 mm; flowers 3.5 cm

across, red, pink or white, fragrant, in terminal panicle; calyx 6 mm long, divided nearly to the base; corolla tube 1.8 long, lower half cylindrical hairy within, throat funnel shaped, stamens at the top of corolla tube; ovary of 2 distinct carpel; follicles connate; seeds 5 mm long, oblong, villous.

Parts Used: Whole plant

Medicinal Value: Resolvent, deterrent, cardiac and aphrodisiac tonic, local systemic resolvent and sedative.

Propagation: Through cuttings which are planted initially in polythene bags with soil or in a well prepared soil under shade. After root initiation, the seedlings are transplanted.

Botanical Name: *NIGELLA SATIVA L.*

Common Names: Black Cumin, Black Seeds, Siyah Dana, Kalongi, Shoneez

Family: Ranunculaceae

Occurrence: Cultivated in Punjab

Plant Identification: It is a pretty herb, about 50-60 cm in height; leave 2-3 pinnatisect, divided into linear segments, 3-5 cm long; the plant has finely divided foliage and pale bluish or white flower; leaves are opposite in pairs on either side of the stem. Its lower leaves are small and petiolate, upper leaves are long (6-10 cm). Flowers grow terminally on branches and are approximately 2-5 cm across, sepal's acute, clawed, nectarial petals 8, geniculate, with a gland in the knee. Carpals 5-7, inflated, watery, united to the top, beak as long as the ovary, seeds 3 angled and 2-3 mm in length.

Parts Used: Seeds and Oil from seed

Medicinal Value: Stimulant, diuretic and emmenagogue, stomach and liver tonic.

Propagation: It is sown in November, with the seed rate of 12 –15 kg/hectare, row to row distance of 25-30 cm. The crop matures in May.

Botanical Name: *NYMPHAEA ALBA L.*

Common Names: Nilofar

Family: Nymphaeaceae

Occurrence: Lakes of Punjab and Azad Kashmir

Plant Identification: It is submerged perennial herb with creeping rootstock; leaves 12.5-15.0 cm in diam., base heart shaped, nearly circular, floating; stalks long, hollow, in deep water ribbon like; stipules at the base of the stalk; flowers 7.5-10.0 cm in diam., sepals 4; petals many; stamen many; anthers without appendages, linear; stigma 6, forming a rosette of 6 rays in the centre; berry round, 3.8 cm long.

Parts Used: Root, Flower and Fruit

Medicinal Value: The flowers are anti-aphrodisiac. Infusion of flower and fruits is given as diaphoretic and in diarrhoea. Root and stalks are astringent, slightly narcotic and are used in dysentery.

Propagation: It is multiplied vegetatively.

Botanical Name: *OCIMUM AMERICANUM L.*
Common Names: Basin, Jangli Tulsi, Niazbo, Kali tulsi
Family: Lamiaceae

Occurrence: Cultivated in sporadic patches all over the country.

Plant Identification: It is an erect, herbaceous shrub, 30-50 cm tall; much branched; leaves 2.5-3.5 cm long, narrowly ovate, toothed or entire; spike 7-20 cm long, whorl of flowers close; bracts ovate, awned, ciliate; corolla white, 2-lipped; stamen 4, the upper pair abruptly bent near the base with a crest tuft of hairs or tooth at the bends.

Parts Used: Leaves, Seed, Root

Medicinal Value: Expectorant, febrifuge, demulcent.

Propagation: The nursery is raised in March-April and then seedlings are transplanted in the field at 50 cm row spacing.

Botanical Name: *OCIMUM BASILICUM L.*
Common Names: Faranj Mushk, Ram Tulsi, Tukham-e-Rehan
Family: Lamiaceae

Occurrence: Commonly cultivated in gardens.

Plant Identification: It is a herbaceous, erect, strongly aromatic plant, smooth or nearly so; leaves large, variable, ovate or lanceolate, usually without hairs, up to 2.5 cm long, 3.7 cm broad; flower heads in branched or unbranched racemes; flower small whorled, white or pale purple; calyx 2-lipped, persistent, enlarged and hardened in fruit; corolla conspicuous, 2-lipped; fruit of 4 large, pitted nutlets, mucilaginous when wetted.

Parts Used: Whole plant

Medicinal Value: The flowers are carminative, diuretic, stimulant, stomachic and demulcent. Mucilagenous seeds are given in infusion in gonorrhoea, dysentery and chronic diarrhoea, internal pile, cough, kidney disorders and fever. The leaf juice is remedy for ring worm.

Propagation: The nursery is raised in March-April and seedlings are transplanted in the field at 50 cm row spacing.

Botanical Name: *OCIMUM SANCTUM L.*
Common Names: Tulsi,
Family: Lamiaceae

Occurrence: Cultivated in gardens and medicinal purposes in fields

Plant Identification: It is an erect, softly hairy medium size perennial herb, often woody below; leaves oblong, elliptic oblong, entire, serrate, narrow at both ends, 2.5-6.0 cm long, floral leaves sessile; Inflorescence of elongated racemes, flowers very small, closely whorled, white pink or purple, small fruiting calyx broadly campanulate, membranous, 2 lower teeth with very long bristle points, longer than the upper which is broadly oblong; corolla extending beyond calyx; fruit forming 4 small brown nutlets.

Parts Used: Whole plant

Medicinal Value: Leaves are expectorant, stomachic, stimulant, antiperiodic, anticatarrhal, diaphoretic, and aromatic. Seed is demulcent, given in urinary disorder.

Propagation: The nursery is raised in March-April and then seedlings are transplanted in the field at 50 cm row spacing.

Botanical Name: *OENOTHERA BIENNIS* L.

Common Names: Evening primrose

Family: Onagraceae

Occurrence: In cooler places of Pakistan esp. Northern areas.

Plant Identification: It is biennial herbaceous plant, much branched from the base and approximately 60-70 cm tall; the stem is woody at the base, the leaves are long, lanceolate and about 2.5 cm long and 0.5 cm wide; flowers are yellow and open in the evening; many seeds are produced in each capsule.

Parts Used: Oil from the seeds

Medicinal Value: The oil from the seeds contain an essential fatty acid the administration of this oil as a food supplement prevents from all these diseases and disorders.

Propagation: The nursery is sown in October-November and when seedlings are 3-4 leaved; these are transplanted in the field at a plant to plant and row to row distance of 50 cm. The addition of farm yard manure in the field helps to have better yield. A temperature of 20-30 °C at flowering improves the oil and gamma linolenic acid contents in the seeds. The high temperature reduces the oil and gamma linolenic acid in seeds. The crop matures in July-August.

Botanical Name: *OLEA FERRUGINEA* Royle

Common Names: Zatoon Madaras, Kau, Khot, Khat

Family: Oleaceae

Occurrence: Hilly areas of NWFP, Balochistan and Punjab

Plant Identification: It is a medium size evergreen tree, upto 4-6 m tall; leaves oblong-lanceolate, entire, cuspidate; flower 8 mm in diam., whitish, bisexual, in axillary trichotomous panicles about half as long as the leaves; bracts minute, linear; calyx 1 mm long, cup-shaped, sub-truncate; corolla ovate, sub-acute, 2 mm long, lobes spreading; anthers oval; drupe 5-8 mm long, ovoid, supported by the persistent calyx; fruits black when ripe.

Parts Used: Leaves, Bark, Gum

Medicinal Value: Leaves and bark are bitter astringent; used as antiperiodic in fever, debility and, gonorrhoea. Oil from the fruit is rubifacient.

Propagation: Through seeds

Botanical Name: *ONOSMA HISPIDUM* Wall.

Common Names: Alkanet Root, Ratanjot, Shakjar, Yarlilang, Laljari

Family: Boraginaceae

Occurrence: Balochistan, NWFP and Tribal areas

Plant Identification: It is a medium sized unbranched, 20-50 cm tall, hairy biennial herb; leaves oblong; flowers yellow, 1.8 cm in diam., often forked racemes, 2.5-15 cm; bracts 1.2-2.5 cm leaf like; calyx 5-lobed, lobes 8 mm, narrowly oblong; corolla 6 mm in diam. at the top, smooth, without tubular lobes; stamen 5, attached near the middle of the corolla tube, linear; style longer than the stamen; nutlets 4, stony, shining, white, smooth.

Parts Used: Leaves, Flower, Root

Medicinal Value: Desiccative for ulcers and purulent hard sores as well as for eruptions.
Propagation: Through seeds which are planted in November.

Botanical Name: *ONOSMA BRACTEATUM* Wall

Common Names: Borage, Gaozaban, Lisan al-Thawr

Family: Boraginaceae

Occurrence: At high altitude in Kashmir up to 4000 M.

Plant Identification: It is a medium sized perennial herb up to 50 cm tall; many branches arising from a persistent cluster of basal leaves; leaves lanceolate, entire, acute narrowed towards the base into a winged petiole; inflorescence of terminal glomerate clusters very dense; calyx divided to the base, lobes linear-lanceolate, 15-18 mm long; petals blue or purple, equaling the calyx, 13-17 mm; nutlets gray, angulate, 4-5 mm long.

Parts Used: Whole plant

Medicinal Value: The herb is refrigerant, demulcent and tonic. It is used in rheumatism, syphilis, leprosy and heart diseases.

Propagation: Through seeds which are planted in November.

Botanical Name: *OPUNTIA DILLENII* Haw.

Common Names: Nagphani

Family: Cactaceae

Occurrence: In dry areas of Punjab and Sindh

Plant Identification: It is a stout, prickly, branched from the base, 1.8 meter tall shrub, main stem absence, branches jointed, joint flat, succulent; leaves pale green, 3 mm long, conical from the base; broadly obovate, not very thick; areoles large, bearing 4-6 prickles; flowers arising from the tufts of spines, yellow or redish, 7.5 cm in diam; calyx lobes numerous on the hollow receptacle; petals numerous; fruit pear-shaped, fleshy, purple, with spine bearing tubercles near the apex; berry pyriform, truncate, depressed at the apex, deep reddish-purple when ripe.

Parts Used: Pulp of leaf, juice, fruits

Medicinal Value: The leaf pulp is applied to eyes in ophthalmia. Milky juice is purgative. Fruit is refrigerant, demulcent, expectorant and used in gonorrhoea.

Propagation: Through cutting.

Botanical Name: *ORCHIS LATIFOLIA* L.

Common Names: Salep Orchid, Salab Misri, Saleb, Khasiyatus Saleb

Family: Orchidaceae

Occurrence: NWFP and Azad Kashmir from 2400 to 3600 m

Plant Identification: It is a medium size, glabrous, perennial herb, 30-90 cm tall with tuberous flattened roots; leaf 5-15 cm oblong, lanceolate, blunt, base sheathing; flowers 1.6 cm long, dull purple, crowded; lip spotted; bracts green, narrowly lanceolate, lower much larger than flowers; sepals and petals equal.

Parts Used: Tubers and Roots

Medicinal Value: Tubers are expectorant, astringent.

Propagation: Through cutting and tubers.

Botanical Name: *ORIGANUM VULGARE L.*
Common Names: Wild Marjoram, Jangli Sathara, Saatar, Mirzanjosh
Family: Lamiaceae
Occurrence: In NWFP upto 2400 m
Plant Identification: It is an erect, hairy, up to 50 cm tall, scented herb; leaves broadly ovate, stalked, sometimes toothed; flowers very small, pink, in clusters or heads at the end of branches; floral leaves like bracts, lanceolate, longer than calyx, overlapping, often purple, calyx bell-shaped; corolla barely 2-lipped, upper lip erect, nearly flat, notch lower spreading, 3-lobed; stamen 4, in unequal pairs, just protruding; style divided; nutlets 4, smooth.
Parts Used: Whole plant, Oil from herb
Medicinal Value: Carminative, antifatulent, resolvent, deobstruent.
Propagation: It reproduces itself through seeds

Botanical Name: *ORIGANUM MAJORANA L.*
Common Names: Common Marjoram, Mirsanijosh, Bantulsi, Dona Marwa
Family: Lamiaceae
Occurrence: Cultivated in Northern areas and Swat
Plant Identification: It is a medium sized aromatic perennial herb, 30-60 cm tall, leaves petiolate elliptic, 6-25 mm long, entire, broadly obtuse, tomentose; spikelets oblong, 3-5 in a cluster; bracts not prominently coloured; calyx oblique; corolla white to pink or pale lilac, 4 mm long, limb short, upper lip erect, unequally 2-lobed
Parts Used: Whole plant
Medicinal Value: Demulcent, stimulant, resolvent, antispasmodic, carminative, expectorant and tonic to liver.
Propagation: Through seeds.

Botanical Name: *OXALIS CORNICULATA L.*
Common Names: Khati buti, Amrul,
Family: Oxalidaceae
Occurrence: In shady place throughout Pakistan
Plant Identification: It is a hairy annual or perennial; herb, stems trailing, branched; leaves alternate, up to 2.5 in diam; leaflets 3, pale green, cordate; flowers yellow; stalks axillary, bearing 2 flowers; capsules downy, cylindrical about 2.5 cm long, many seeded.
Parts Used: Whole plant
Medicinal Value: The leaves are cooling, refrigerant, appetizing, stomachic and antiscorbutic.
Propagation: Through seeds.

Botanical Name: *PAEONIA EMODI Wall.*
Common Names: Paeoni Root, Ood Saleb, Favania, Mamekh
Family: Ranunculaceae
Occurrence: Azad Kashmir and hilly areas of NWFP and Punjab

Plant Identification: It is a stout, glabrous, perennial shrub, 30-90 cm tall; leaves large, once or twice ternatisect, ultimate segments of leaves oblong or lanceolate; flowers large white, long-peduncled; follicles 1 or rarely 2, ovoid.

Parts Used: Flower, Seed, Tuber

Medicinal Value: Nervine tonic, antiepileptic.

Propagation: Through seeds

Botanical Name: *PANICUM ANTIDOTALE Retz.*

Common Names: Gunara, Ghamur

Family: Poaceae

Occurrence: Sindh, Balochistan, and NWFP

Plant Identification: A perennial grass 70-150 cm tall with creeping rootstock; culms solid, smooth, nodes thickened; leaf-blade very long, 15-60 cm, linear, finely acuminate, ligules short, ciliate; panicle 15-30 cm long, pyramidal; spikelets crowded, 2-3 mm long, ovate-acute, glabrous.

Parts Used: Whole plant

Medicinal Value: The smoke of burning plant is used as a disinfectant in small pox and a fumigant to wounds.

Propagation: Through seeds during summer season.

Botanical Name: *PANICUM MILIACEUM L.*

Common Names: China, Cheeni

Family: Poaceae

Occurrence: Sindh, Balochistan, NWFP, and Northern Areas

Plant Identification: It is an annual 1-2m tall grass, culm leafy, nodes bearded; finely acuminate, flat; margin scabrid; sheath deeply groove; panicle 30 cm long, nodding or curved; spikelets ovoid acute, 4-5 mm; seeds orbicular, white.

Parts Used: Whole plant

Medicinal Value: The plant is recommended as a cure for gonorrhoea.

Propagation: Through seeds sown in June-July and harvested in October-November.

Botanical Name: *PAPAVER SOMNIFERUM L.*

Common Names: Opium, White Poppy, Afim, Post, Khaskhash

Family: Papaveraceae

Occurrence: Cultivated and wild in NWFP and Tribal areas

Plant Identification: A medium size, 50-70 cm tall, unbranched annual herb with white latex, leaves oblong, stem clasping, lobed and toothed; flowers large showy whitish purple or scarlet; sepals smooth; stigmatic rays 5-12; capsule about 3cm in diam., round stalked; seeds white or black, many.

Parts Used: Capsules

Medicinal Value: Anaesthetic, anodyne, narcotic, sedative. It contains about 25 alkaloids and has immense medicinal properties.

Propagation: Through seeds and sowing time is November.

Botanical Name: *PASPALUM SCORBICULATUM L.*

Common Names: Korda, Kodo

Family: Poaceae

Occurrence: Cultivated in plain areas of Punjab and Sindh

Plant Identification: It is an erect annual grass upto 150 cm tall, with tufted culms; leaf-blade 15-45 cm; sheaths compressed; racemes 2-6, sessile, spreading up to 15 cm long; spikelets 2-3 mm long, lower glume absent, upper glume as long as the spikelets; upper lemma thickly coriaceous, brownish; palea orbicular, turmid.

Parts Used: Whole plant

Medicinal Value: The plant is used in scorpion sting and has narcotic properties.

Propagation: Through seeds during summer season.

Botanical Name: *PEDALIUM MUREX L.*

Common Names: Bada-gokhru, Farid buti, Khasak-i-kalan

Family: Pedaliaceae

Occurrence: Sindh and Balochistan

Plant Identification: It has a small thick stem, succulent, 15-30 cm tall, annual herb, having minute glands and musky odour; leaves broadly ovate, oblong, glaucous green, margin waxy; stalk long; flower small, axillary, solitary, yellow; stalk short, with 2 black glands at the base; fruit hard, ovoid, with 4 sharp, conical, basal spines.

Parts Used: Whole plant

Medicinal Value: Diuretic, demulcent, used in disorder of urinary system, acute gonorrhoea, spermatorrhoea, impotence and dropsy.

Propagation: Through seeds during summer season.

Botanical Name: *PEGANUM HARMALA L.*

Common Names: Syrian Rue, Harmal, Ispand, Kisankur, Spanda

Family: Zygophyllaceae

Occurrence: Widespread as a weed throughout Pakistan

Plant Identification: It is a much branched, densely foliate herb upto 30-60 cm tall; root perennial; stem and branches annual; leaves much divided, lobes or segments linear, short-pointed; stipules bristle like; flowers 1.2-1.8 cm in diam., white, solitary, sessile or stalked in the axils of branches, sepals 4-5, linear, short-pointed, persistent, usually longer than the petals; petals 4-5, linear, oblong, nearly equal; stamen 12-15 broad below, some without anthers; capsule 5-8 mm in diam., depressed above, lobed, splitting into 3 valves; seeds many, angled.

Parts Used: Leaves, Seeds, Roots

Medicinal Value: Effective against cold malhumoural affections.

Propagation: Through seeds which germinate during summer season.

Botanical Name: *PERILLA FRUTESCENS* (L.) Britt.

Common Names: Bhanjira

Family: Lamiaceae

Occurrence: Hilly areas of Punjab and NWFP (350-1800 m)

Plant Identification: It is an erect, medium sized, aromatic annual herb of shady area of food hill zone; leaves ovate or rounded, blunt; flowers white small, in pairs on long one-sided erect axillary and terminal simple or branching racemes; bracts lanceolate; calyx bell-shaped, 5-toothed, becoming much larger; corolla 5-lobed; stamen 4, hardly protruding; style 2-fid; nutlets nearly round.

Parts Used: Whole plant

Medicinal Value: It is antiseptic, sedative and antidot. Leaves, stem and seed are diaphoretic, resolvent and cephalic.

Propagation: Through seeds in nature.

Botanical Name: *PERISTROPHE BICALYCVLATA* (Retz.) Nees

Common Names: Atrilal, Pitpapra

Family: Acanthaceae

Occurrence: It is found wild in Punjab and Sindh

Plant Identification: It is a small, erect, hairy, spreading 30-100 cm tall annual herb; leaves ovate, broad, entire, more hairy on lower surface; petiole 6-12 mm long; bracts 2, opposite, unequal, longer than the calyx; bracteoles 4, smaller; corolla pink, about 12 mm long, pubescent outside; capsule about 8 mm long, 2 mm broad, ellipsoid, narrowed into a cylindrical stalk, pointed pubescent; seeds 4, flattened, covered with minute papillae.

Parts Used: Whole plant

Medicinal Value: The herb macerated into an infusion of rice is considered as antidote to snake-bite.

Propagation: Through seeds during summer season

Botanical Name: *PERVOSKIA ABROTANIODES* Karel.

Common Names: Shanshoai

Family: Lamiaceae

Occurrence: Balochistan and Northern areas at high altitude, 2200-4200 m.

Plant Identification: It is much branched shrub, 60-120 cm tall, woody at the base clothed with white or grey scurf, leaves 2.5-5.0 cm, linear-oblong, calyx clothed with long cottony wool like thing; corolla 2-lipped, tube exerted; stamen 2, lower fertile; style lobes acute; nutlets pyriform, smooth, dry.

Parts Used: Flowers

Medicinal Value: Flowers are applied on the body for cooling in fever.

Propagation: Through seeds.

Botanical Name: *PHOENIX DACTYLIFERA L.*
Common Names: Date Palm, Khajoor, Chuhara, Katal, Khurma
Family: Palmae

Occurrence: Cultivated and wild in Sindh, Punjab, NWFP

Plant Identification: It is a tall reaching up to 30 meters, leaves palmy, glabrous, green, 2.5-5.0 meters long; leaflets distichous, 16-45 cm long and nearly 2 cm broad, sharply pointed, male flowers white, in short compact panicles 15-25 cm long; female flowers distant, on similar panicles, roundish; fruiting spadix 60-90 cm long; fruit 1.5-3 cm long, sweet, edible, reddish or yellowish-brown.

Parts Used: Juice, Gum, Fruit

Medicinal Value: Nutritive, restorative, tonic, aphrodisiac.

Propagation: It is propagated through suckers which are arising from the plants and it is very slow process. Now technology has been developed for its propagation through tissue culture.

Botanical Name: *PHYLLANTHUS EMBLICA L.*
Common Names: Indian gooseberry, Emblic myroblan, Amla, Ambla, Anura
Family: Euphorbiaceae

Occurrence: Cultivated and wild in Sindh, Punjab, and NWFP.

Plant Identification: It is a medium-size deciduous tree; leaves linear-oblong, entire, and 1.0-1.4 cm long, stipules ovate, minute; flowers without petals, yellow or greenish in axillary fascicles on the leafy twig; sepals 6; male flowers without disk or of 6 minute glands; anthers 3; female flowers have capular disk; ovary 3-celled; style connate at the base; fruit 1.5 cm., globose to sub-globose, yellow, succulent, containing a 6-ridged stone, the budded clones have fruit of large size.

Parts Used: Fruit, Flower, Roots, Leaves, Bark and Seed

Medicinal Value: Carminative, diuretic and antiseptic. Dried fruit is used in haemorrhage, diarrhoea, dysentery, jaundice, dyspepsia and anaemia. Seeds are used in asthma, bronchitis and biliousness. The young leaves are used in intermittent fever. Flowers are refrigerant, cooling and aperient. Root and root bark is astringent.

Propagation: Through seeds, budding and grafting.

Botanical Name: *PICRORHIZA KURROOA Royle ex Benth.*
Common Names: Picrorhiza, Kutki, Kaur
Family: Scrophulariaceae

Occurrence: At high altitude in Himalaya and Hindukush Regions

Plant Identification: It is a small perennial herb; rootstock thick covered with withered leaf-bases; leaves radical 5-10 cm long, spoon shaped, toothed, base narrowed into a winged sheath stalk; flowers 6-8 mm long, blue in colour; calyx lobes 5, lanceolate; corolla tube curved, broad, upper lip nearly hooded, notched, lower lip 3-lobed, shorter, middle lobes shortest; stamen 4, capsule 1.2 cm long, ovoid; seeds curved netted.

Parts Used: Root

Medicinal Value: Antibilious, hepatoprotective, bitter antispasmodic.

Propagation: Through seeds and root stock.

Botanical Name: *PIMPINELLA ANISUM* L.

Common Names: Anise, Anisun, Sonf Rumi, Mahori

Family: Apiaceae

Occurrence: Balochistan and hilly areas of NWFP

Plant Identification: It is an annual herb, up to 45 cm tall; radical leaves lobed, somewhat celery-like, stem leaves more finely cut, upper most with almost filiform segments; flowers yellowish-white, in compound umbels; greenish grey, oblong, furrowed.

Parts Used: Seeds, Leaves, Root, Fruit

Medicinal Value: Carminative and flavouring agent.

Propagation: It is cultivated through seeds which are sown in cooler areas in October-November.

Botanical Name: *PISTACIA INTEGERRIMA* Stew. ex Brandis

Common Names: Pistacia galls, Kakkar, Kakkara singi, Somak

Family: Anacardiaceae

Occurrence: Common in hilly areas in NWFP and Northern Areas.

Plant Identification: A medium sized deciduous tree with rough, grey bark; leaves alternative, pari or impairpinnate, 15-22 cm long; leaflets 4-6 pairs, sub-opposite, 7.5-15X2.4-4 mm, lanceolate, entire, coriaceous, glabrous; flowers small apetalous, diocious; drupe 6 mm in diam., oblique, glabrous, rugose, broader than long.

Parts Used: Galls, Fruits

Medicinal Value: Effective against cough, asthma and whooping cough.

Propagation: Through seeds

Botanical Name: *PLANTAGO OVATA* Forsk.

Common Names: Spogel (seeds), Plantain, Ispaghool, Barhang, Sangpara

Family: Plantaginaceae

Occurrence: Southern Punjab and Sindh

Plant Identification: It is a sparsely or thickly villous, stemless, subcaulescent; leaves 7.5-20 cm long, filiform linear or narrowly lanceolate, finely acuminate, 3-nerved; scapes numerous; spikes 1.2-5.0 cm long, ovoid or cylindric; flowers 6 mm long; corolla lobes rounded, concave, obtuse or apiculate; capsule 2-celled. Cells 1-seeded.

Parts Used: Seeds, Husk

Medicinal Value: Glutinous, laxative. The seeds are demulcent, cooling, diuretic and used in inflammatory conditions of mucous membrane of gastro-intestinal and genito-urinary tracts. Also used in chronic dysentery, diarrhoea and constipation.

Propagation: Ten kg seeds per hectare are sown in October - mid November and irrigated immediately for germination. Crop matures in March.

Botanical Name: *PODOPHYLLUM EMODI* Wall

Common Names: Bankakri

Family: Podophyllaceae

Occurrence: Found under trees at high altitude of 2500-3500 m in NWFP, Northern Areas, Balochistan and Kashmir.

Plant Identification: It is an erect, glabrous, perennial herb, 15-30 cm tall; leaves 2, long petioled, 15-25 cm in diam., orbicular, 3-5 lobed to the middle or base; lobes cuneate, acutely serrate; flowers 2.5-3.7 cm in diam., white, solitary; berry 2.5-5 cm long, ellipsoid, red.

Parts Used: Rhizome, Root

Medicinal Value: Rhizome and roots are hepatic-stimulant, cholagogue and purgative. The resin is cholagogue, alterative and bitter tonic and drastic purgative.

Propagation: Through rhizomes, which are buried in soil 4-6 inches.

Botanical Name: *Polygonum aviculare* L.

Common Names: Knotgrass, Kesru, Bannali, Banduke

Family: Polygonaceae

Occurrence: Balochistan, NWFP and Punjab at altitude of 1200-4200 m.

Plant Identification: It is a prostrate, smooth, annual herb; stem and branches prostrate, 30-60 cm long, leafy, finally grooved; leaves 1.2-2.5 cm, narrowly lanceolate, almost sessile; stipules long, tubular, strong straight; flowers small green with white or red tips, in axillary clusters; nut minutely wrinkled, ovate, flattened.

Parts Used: Whole plant

Medicinal Value: The plant is styptic and astringent. Seeds are emetic and purgative. Dried root is applied externally as anodyne.

Propagation: It is propagated through seeds

Botanical Name: *PONAGAMIA PINNATA* (L.) Merrill

Common Names: Karanja, Karanji

Family: Fabaceae

Occurrence: Cultivated in Punjab, Sindh and foothills of Himalaya

Plant Identification: It is a medium sized, evergreen tree; leaves imparipinnate; rachis 4-15 cm long; stipules small, obtuse, oblong; leaflets 5-9, opposite, 5-10 cm long, ovate, oblong, usually short abruptly acuminate; flowers 1.2 cm long, white tinged, in pedunculate axillary; bracts ovate, acute, 2 mm long; calyx 3 mm long, campanulate, purplish, standard sub-orbicular, emarginated, obscurely clawed, wings obliquely oblong; stamen monadelphous; pods 3.5-5.0 cm by 2-2.5 cm, obliquely oblong indehiscent; seeds usually one.

Parts Used: Seeds, Leaves, Bark, Root

Medicinal Value: Seeds are used externally in skin diseases and as fish poison. Bark is recommended internally in bleeding piles. Leaves applied on ulcers as a poultice. Juice of root is used for closing fistulous sores and for cleaning foul ulcers; given internally with equal amount of coconut milk and lime in gonorrhoea. Root is used as fish poison. Oil from seed is useful in cutaneous affections herpes and scabies; used in rheumatism.

Propagation: Through seed

Botanical Name: *PORTULACA OLERACEA* L.

Common Names: Purslane, Rajlah, Kulfa, Kharfah

Family: Portulacaceae

Occurrence: Throughout Pakistan

Plant Identification: It is a small, prostrate, smooth, fleshy annual; nodes of the stem without scales or hairs; leaves alternate, sessile, flat, wedge shaped to linear, upto 3.7 long; flowers in terminal clusters, sessile, yellow; capsules opening transversely; seeds numerous.

Parts Used: Whole plant

Medicinal Value: The plant is alterative, sedative and demulcent for liver. Seed is demulcent, astringent, diuretic and vermifuge.

Propagation: Through seeds as a winter crop.

Botanical Name: *PROSOPIS CINERARIA* (L.) Druce

Common Names: Jhund, Jhan, Kandi

Family: Fabaceae

Occurrence: Common in Sindh, Balochistan and Punjab

Plant Identification: It is a large shrub armed with short straight prickles which, on older branches are broad; pinnate 1-2 pairs, 2.5-7.5 cm long; leaflets 16-24 sessile, oblong, oblique, base rounded; flowers creamy white, nearly sessile in slender pedunculate; spikes 5-10 cm long, axillary or arranged in terminal panicles; calyx 1 mm long, cup shaped, 5-toothed; petals 3 mm long, tip recurved; pods 12.5-25 cm by 5-8 mm, pendulous, cylindrical, turgid; seeds 10-15, oblong, compressed.

Parts Used: Bark, Flower, Fruit,

Medicinal Value: Pods are astringents. Bark is used in rheumatism and scorpion-sting.

Propagation: Through seeds

Botanical Name: *PRUNUS AMYGDALUS* Batsch

Common Names: Almond, Badam Shirin, Loz, Badaam

Family: Rosaceae

Occurrence: Cultivated in Balochistan and Northern Areas.

Plant Identification: It is a small tree with many branches; leaves oblong lanceolate, serrate; petiole glandular, as long as the leaf; stipules fimbriate; flowers white, tixed with pink, mostly paired; fruits with a dry pericarp, stone with shallow wrinkles and minute pores.

Parts Used: Seeds, Leaves, Oil

Medicinal Value: The seeds are demulcent, stimulant and nervine tonic. The oil is slightly laxative. Burnt shell of almond is used as a tooth-powder.

Propagation: The rootstock is budded using the bud wood from desired clones.

Botanical Name: *PUNICA GRANATUM L.*

Common Names: Anar, Anar Dana

Family: Punicaceae

Occurrence: Balochistan, Azad Kashmir, Northern Areas, NWPF and Punjab

Plant Identification: It is a small deciduous tree or shrub, upto 3-4 m tall; leaves opposite, 2.5-6.2 cm long, oblong-lanceolate, oblong-elliptic or oblong-oblongeolate, glabrous, entire, short petioled; flowers 3.7-5 cm long and as much across, scarlet; fruits 3.7-7.5 cm or more in diam., globose.

Parts Used: Seeds

Medicinal Value: The fresh juice is cooling, refrigerant. The pulp is cardiac and stomachic. The rind of the fruit with aromatics like cloves etc. is useful in diarrhoea and dysentery. The root, bark and stem bark is astringent, anthelmintic and specific in tape-worm. The seeds are stomachic.

Propagation: It is vegetatively propagated through cuttings.

Botanical Name: *RAUWOLFIA SERPENTINA Benth*

Common Names: Chota chand

Family: Apocynaceae

Occurrence: Cultivated in Punjab and NWFP

Plant Identification: It is a small, herbaceous shrub, upto 45 cm tall; leaves in whorls of three, thin, lanceolate or obovate, oblique, lower end tapering into a short stalk, green when dry, pale beneath. Inflorescence long stalked, many flowered cyme, 2.5-5.0 in diam., stalk 5-10 cm long, stout; flowers white or pinkish, nearly 2.5 cm long, stalk very small, bright red, corolla tube long, slender, dilated a little above the middle. Drupes obliquely ovoid, purplish black, 3.5 cm long.

Parts Used: Leaves and Roots

Medicinal Value: It is a febrifuge and emmenagogue; it has a marked sedative and hypnotic action; it is a valuable remedy for insomnia, hypochondriasis, insanity, irritable condition of the central nervous system and high blood pressure. Root is used in fever during puerperium and intestinal disorders such as diarrhoea and dysentery.

Propagation: Propagation is through seeds.

Botanical Name: *RHEUM EMODI Wall.*

Common Names: Rhubarb, Rheum, Rweand-chini, Bekh Rebas, Tursak

Family: Polygonaceae

Occurrence: Azad Kashmir, alpine and sub-alpine Himalayas.

Plant Identification: It is a stout leafy herb 1.5-2.0 m tall, stem stout, streaked green or brown; radical leaves often very long, 30 cm in diam., orbicular or broadly ovate, obtuse, 5-7 nerved; petiole 30-45 cm long, very stout, flowers in panicles, papilose puberulous, dark purple, sepals 5; stamen 6-9; ovary 2-4 angled; panicle 60-90 cm long with erect strict branches; fruit 1.2 cm long, ovoid-oblong, purple,

Parts Used: Rhizome, Root

Medicinal Value: The roots are astringent, tonic and purgative. The tuber is pungent, bitter, alexiteric, emmenagogue, and diuretic; reported to be useful in biliousness,

lumbago, sore-eye, piles, chronic bronchitis, fever, asthma, coryza, pains and bruises. The main constituents of rhizomes are anthraquinone derivative.

Propagation: Propagation is through rhizomes

Botanical Name: *RICINUS COMMUNIS L.*

Common Names: Castor, Castor Oil Plant, Arand, Murpad, Arandai

Family: Euphorbiaceae

Occurrence: Cultivated and wild throughout Pakistan

Plant Identification: It is an evergreen soft-wooded shrub or occasionally a small tree; leaves alternate, 22-40 cm long and broad, palmate, teeth irregular, 7 or more lobe; petioles stout, about as long as the blade; stipules 2.5 cm long, connate, leaf-opposed, caduceous; flowers large in terminal subpanicked racemes, monoecious, apetalous; capsule 1.5-2.5 cm in diam., globose oblong, smooth or echinate.

Parts Used: Seed, Oil from seed, Leaf

Medicinal Value: The leaves are applied to the forehead to get relief from headache and as poultice for boils. The oil from seeds is given as purgative. The seed are purgative, counterirritant in scorpion-sting. It is also used as fish poison. It is also considered useful in jaundice. The roots are considered to be efficacious in lumbago, rheumatic swellings, sciatica and pleurodynia. The root bark is a powerful purgative.

Propagation: Through seed as a summer crop and wild plants are perennial.

Botanical Name: *ROSA DAMASCENA Mill.*

Common Names: Rose, Damask Rose, Gulab, Gul Surkh, Ward, Jarphul

Family: Rosaceae

Occurrence: Cultivated in central Punjab

Plant Identification: It is an erect shrub armed with curved unequal prickles mixed with prickly and glandular bristles; leaflets 3-7, usually 5 on flowering shoot, simply serrate; flowers large 5-10 together; calyx reflexed after flower not persistent, outer segments pinnatifid; fruit ovoid, red.

Parts Used: Petals, Aqua and Buds

Medicinal Value: Refrigerant, mild laxative, mild astringent.

Propagation: It is vegetatively propagated through cuttings.

Botanical Name: *ROSA INDICA L.*

Common Names: Sada Gulab

Family: Rosaceae

Occurrence: Cultivated throughout Pakistan

Plant Identification: It is a glabrous, evergreen shrub; stipules very narrow, adnate almost to the top; prickles uniform, bristles absent; flowers large in many colours, on long pedicles, rarely single; sepals reflexed; style distinct.

Parts Used: Flower Petals, Aqua, Buds

Medicinal Value: Fruits are applied to foul ulcers and also used on wounds, sprains and injuries.

Propagation: It is vegetatively propagated through cuttings.

Botanical Name: *RUBUS ULMIFOLIUS* Schott.

Common Names: Alish, Akhi

Family: Rosaceae

Occurrence: Balochistan, hilly areas of Punjab, NWPF and Northern areas

Plant Identification: It is a sub-erect shrub, twigs angular; prickles stout, recurved, extending to petioles and inflorescence; leaves 5-15 cm long, stipules 5 mm long; leaflets, either pinnately or pedately arranged, oblique, ovate, elliptic or obovate, the terminal orbicular or obovate; flowers pink, 8-18 mm in diam., calyx velvety, petals obovate, exceeding the sepals; fruit 8 mm in diam., black, succulent.

Parts Used: Whole plant

Medicinal Value: The plant is cordial astringent; used for looseness of bowels, infusion of leaves taken to stop diarrhoea and for bleeding. Decoction of root is useful in dysentery, relaxed bowels, whooping cough.

Propagation: It is propagated through seeds and cuttings

Botanical Name: *SALIX CAPREA* L.

Common Names: Musk Willow, Willow, Bed mushk, Gurba Bed

Family: Salicaceae

Occurrence: Cultivated in Balochistan and NWFP

Plant Identification: It is a small tree with sweet-scented flower; leaves 5-10 cm long, rugose above, grey-tomentose beneath, crenate or nearly entire; stipules conspicuous; male catkin 2.5-3.5 cm long, sessile, stout, silky, bracts elliptic, acute, dark brown, with long silky hairs; stamen 2, filament free; disk gland solitary; female catkin a little shorter than male, longer in fruit, capsule downy, stipitate.

Parts Used: Flowers, Leaves, Bark

Medicinal Value: Analgesic, cardiac tonic, febrifuge, diuretic.

Propagation: Through seeds

Botanical Name: *SALVADORA OLEOIDES* Decne.

Common Names: Jhal, Pilu, Pil

Family: Salvadoraceae

Occurrence: Throughout Pakistan

Plant Identification: It is a large shrub or small tree; leaves coriaceous; petiole 5-12 mm long, lamina elliptic-lanceolate; inflorescence axillary panicles, or branched, spikes, 2.5-4.0 cm long; flowers greenish white, 2-3 mm in diam., calyx with round lobes and wavy margin, divided half way to the base; corolla 2-3 mm long, obovate or oblong, lobes sub-acute and recurved; stamen 4; fruit a drupe, 5 mm in diam., globose, yellow when ripe.

Parts Used: Seed, Oil from seed, Bark, Root

Medicinal Value: Leaves are purgative and are used to cure cough. Fruit is aphrodisiac. Root bark is vesicant. Oil from seed is applied on painful rheumatism and after childbirth.

Propagation: Propagation through seeds under natural conditions

Botanical Name: *SALVADORA PERSICA* L.

Common Names: Pilu, Darakht-I-miswak

Family: Salvadoraceae

Occurrence: Karachi, Sindh, Lasbella, Balochistan; Sibi

Plant Identification: It is an evergreen small tree; trunk short; branches straggling; bark thin, grey; wood soft. Leaves opposite, entire variable, fleshy, greyish green. Flowers in branched spikes or racemes, small, greenish; corolla and calyx hardly separable. Drupes very small, round, surrounded by the persistent calyx and corolla, 1-seeded.

Parts Used: Leaves, bark, fruit, seed oil

Medicinal Value: The leaves are bitter, aromatic, deobstruent, carminative, diuretic and anthelmintic. The fresh bark is a vesicant and stimulant. The berries are digestive, lithontriptic, fattening, deobstruent, carminative and diuretic.

Propagation: Through seeds.

Botanical Name: *SARACA INDICA* L.

Common Names: Ashoka tree, Ashok

Family: Fabaceae

Occurrence: Cultivated in gardens throughout Pakistan

Plant Identification: It is a small evergreen tree; leaves 15-25 cm long paripinnate; leaflets 10-20 cm long, 4-6 pairs, oblong-lanceolate, glabrous; flowers changing from yellow to orange and finally scarlet, in dense corymbs, 7.5-10.0 cm in diam., bracts and bracteoles coloured; calyx petaloid, tube 1.2-1.6 cm long, cylindrical, oblong; petals absent; stamen 7-8, much exerted; pods 15-25 cm long and 5 cm wide, hard, flat, dehiscent.

Parts Used: Leaves, Bark, Seeds, Flowers

Medicinal Value: In uterine affections as astringent and sedative.

Propagation: Through seeds

Botanical Name: *SAUSSUREA LAPPA* Clark

Common Names: Arabian Costus, Costus, Kuth, Qust Shireen

Family: Asteraceae

Occurrence: At high altitudes in NWFP, Northern Areas and Azad Kashmir

Plant Identification: It is a very large, erect, velvety herb; leaves rough above and smooth beneath, irregularly toothed, radical; leaf-stalk 30-60 cm long, lobed and winged; stem leaves 15-30 cm long, petiolate, base forked half stem-clasping; flowers about 1.8 cm long, dark purple in round sessile cluster, 3-5-3.7 cm in diam. heads.

Parts Used: Root

Medicinal Value: It is stomachic, tonic, aphrodisiac, antiseptic, aromatic, stimulant, depurative, astringent, sedative and carminative.

Propagation: Through seeds. Roots are collected in September – October.

Botanical Name: *SESAMUM INDICUM* Linn.
Common Names: Sesame, Gingeli seeds, Till, Tir, Kunjad.
Family: Pedaliaceae

Occurrence: Cultivated in Punjab, Balochistan and Sindh

Plant Identification: It is an erect, velvety, annual herb, 30-60 cm tall; leaves 7.5-12.5 cm long; oblong or ovate, toothed, upper alternate lower, opposite often lobed; flowers 3 cm long, white or purplish, sometimes marked with yellow; capsule 2.5 cm long and 6 mm, broad, erect, rough, 4-angled oblong pointed.

Parts Used: Leaves, Seed and Oil from seed.

Medicinal Value: The oil from seed is used in preparation of liminents, plasters, ointments and oil dressings of ulcers, suppurating wounds and urinary complaints. Seeds are emollient tonic, diuretic, lactagogue, useful in piles. The leaves are used as demulcent in infantile cholera, diarrhoea, dysentery, and other bowel disorders, catarrh and bladder troubles, acute cystitis and strangury.

Propagation: It is sown in July and harvested in October. Sown in rows at a distance of 30 cm. It can also intercrop with summer legumes.

Botanical Name: *SESBANIA SESBAN* (L.) Merr.
Common Names: Jayanti, Jaint
Family: Fabaceae

Occurrence: Cultivated in Punjab, NWPF and Sindh

Plant Identification: It is a large soft-wooded, annual shrub 2-5 m tall; stem 3-15 cm in diam.; leaves 7.5-15.0 cm long; leaflets 21-41 pairs opposite, smooth, linear-oblong, pale green, very shortly petioled; flowers 1.2-1.8 cm long, pale yellow, tinged with purple, in lax, few flowered axillary racemes; raceme 7.5-15.0 cm long, calyx 5 mm, smooth, teeth short, triangular; wings oblong; keel straight obtuse; stamen 10, diadelphous; pods 15-24 cm long, seeds 20-30.

Parts Used: Seed, Bark and Juice of leaves.

Medicinal Value: Leaf juice in anthelmintic. Seed is emmenagogue, astringent and stimulant; used in diarrhoea, menstrual disorder and enlarged spleen.

Propagation: It is sown during summer.

Botanical Name: *SIDA CORDIFOLIA* L.
Common Names: Golden clock, Country mallow, Beej band, Bala, Kharend, Simak
Family: Malvaceae

Occurrence: Wild distributed in Sindh and Punjab

Plant Identification: It is an annual or perennial, much branched, softly hairy, erect; leaves very hairy on both the surfaces, cordate or ovate oblong, 2.5-5.0 long, upto 3.5 cm broad, apex broad; margins having round teeth; petioles as long as the leaves. Flower solitary or few together, yellow; stalks short; fruit up to 0.8 cm in diam., carpels 7-10, awned, furrowed at the back, strongly wrinkled, covered with stiff, recurved hairs.

Parts Used: Seeds, Root, Leaves, Stem.

Medicinal Value: Seeds are viscous and aphrodisiac. Roots are nervine and alterative tonic and anti-inflammatory. Leaves are demulcent and antihemorrhagic. Oil is nervine tonic, anti-inflammatory.

Propagation: Through seeds

Botanical Name: *SILYBUM MARIANUM (L.) Gaertn.*

Common Names: Milk thistle

Family: Asteraceae

Occurrence: Commonly found as weed in Punjab, Sindh and NWFP

Plant Identification: It is an erect, annual or biennial, shining smooth herb 0.5–1.0 m tall; stem grooved not winged; leaves large with strong spines, lobed; flowers rose purple in large solitary, terminal nodding heads 2.5-5.0 cm in diam; bracts of heads leathery with a spine 1.2-1.8 cm long, outer with a short point; floor of head fleshy; anther bases forked; style nearly entire; achene 6 mm, transversely wrinkled, black or grey, flattened.

Parts Used: Leaves and Seed

Medicinal Value: Leaves are aperient and sudorific. Seeds are demulcent.

Propagation: Through seeds during winter season.

Botanical Name: *SOLANUM NIGRUM L.*

Common Names: Black night shade, Mako, Karmachu, Gach mach, Pat-pirun.

Family: Solanaceae

Occurrence: It is distributed in Punjab, Sindh and NWFP.

Plant Identification: It is an erect, leafy, annual, without prickles. Leaves stalked, thin, smooth, ovate; margins wavy or bluntly lobed with a few broad teeth. Flowers in axillary or lateral, drooping, umbellate, long stalked cymes, small, white. Berries round, about 0.8 cm in diam., green at first, red or yellow when ripe, shining.

Parts Used: Whole plant

Medicinal Value: Alterative, diuretic, repercussive, sedative, anodyne.

Propagation: Through seed.

Botanical Name: *SONCHUS ARVENSIS L.*

Common Names: Soan, Bhangra

Family: Asteraceae

Occurrence: NWFP and Punjab up to 3000 m.

Plant Identification: It is a perennial cosmopolitan weed with milky juice; root stock creeping, stem hollow; leaves 15-25 cm long, lanceolate, with lobes pointing back wards; heads and stalks glandular hairy; flowers yellow and appear in autumn.

Parts Used: Whole plant

Medicinal Value: The herb is diuretic, sedative, cooling hypnotic, diaphoretic, antiseptic and expectorant.

Propagation: Through seeds

Botanical Name: *SYZYGium CUMINI (L.) Skeels*

Common Names: Jambul, Jamun, Jammun

Family: Myrtaceae

Occurrence: Cultivated in Punjab, Sindh and NWFP

Plant Identification: It is a large, evergreen tree, growing up to 15 m tall, with light-grey and nearly smooth bark; leaves opposite, 7.5-15.0 X 3.7-6.2 cm, lanceolate, elliptic-oblong or broadly ovate-elliptic, coriaceous, petiolate; flowers 6-8 mm in diam., dirty white, fragrant; fruit up to 2.5 cm long, obovoid, oblong or sub-globose; fruit pink then black, one seeded.

Parts Used: Fruit, Leaves, Bark, Seed

Medicinal Value: Stomach and liver tonic, antidiarrhoeal, antidiabetic.

Propagation: The plant can be raised from seeds and selected clones vegetatively.

Botanical Name: *TAMARINDUS INDICA L.*

Common Names: Tamarind, Imli, Tamar-hindi, Gadamri

Family: Caesalpiniaceae

Occurrence: Cultivated and wild in coastal areas of Sindh and Balochistan

Plant Identification: It is a large evergreen, much branched, tree up to 20 m tall; leaves 7.5-15.0 cm paripinnate; leaflets, 20-30 pairs, opposite, oblong; flowers pale yellow streaked with red in long lax racemes; calyx teeth 4, lanceolate, the two lowest connate; petals 3; stamen 3, monadelphous; pods 7.5-20.0 cm long and 2.5 cm wide, constricted between the seeds, leathery, flattened, edible, indehiscent; seeds 1.2 cm in diameter embedded in a brown or black pulp, shining.

Parts Used: Fruit, Leaves, Flowers and Bark

Medicinal Value: Febrifuge and turgative of phlegm, antibilious, digestive.

Propagation: Through seed

Botanical Name: *TAMARIX DIOICA Roxb.*

Common Names: Tamarix, Tamarisk, Jhao, Kotiro, Kirri, Kirvi, Tarfa, Gaz

Family: Tamaricaceae

Occurrence: Distributed in river beds in Punjab and Sindh

Plant Identification: It is a dioecious, large shrub or small tree, up to 1.8-2.2 meter tall, branches long, drooping; leaves minute, scale-like, sheathing, apex acuminate; flowers purple-pink in short compact stalked spikes; bracts nearly as long as the flowers, triangular, long-pointed, reddish-brown; stamen 10; style 3; capsule oblong, tapering, twice as long as the withered sepals and petals.

Parts Used: Gall and Bark

Medicinal Value: Ash acts as carminative, diuretic, resolvent of hepatic and splenic inflammations and enlargements.

Propagation: Through seeds

Botanical Name: *TARAXACUM OFFICINALE* Weber

Common Names: Dudal, Kanphul, Gulsag, Rasuk

Family: Asteraceae

Occurrence: Abundantly distributed as weed in Punjab, Balochistan and NWFP.

Plant Identification: It is a small, perennial herb with an over wintering, long, spindle like root. All parts of the plants contain a milky sap that oozes out when the plant is cut. The leaves arranged in a dense rosette, are extremely variable in shape and deeply pinnately divided. Leaves are narrowly oblong, divided and sessile; flowers yellow, in solitary heads, on a leaflets hollow stalk, which is 5-20 cm long. The fruits, which form a fluffy ball when ripe, are spindle shaped achenes.

Parts Used: Leaves, Roots

Medicinal Value: Prevents the formation of gall stone and kidney stone. It also relieves rheumatic pains, including painful arthroses caused by the excessive uric acid.

Propagation: Through seeds and it also from rhizome

Botanical Name: *TAXUS WALLICHIANA* Zucc.

Common Names: Birmi

Family: Taxaceae

Occurrence: At high altitudes in NWFP, Northern Areas and Azad Kashmir

Plant Identification: It is an evergreen, medium size tree, up to 7 m tall; stem fluted, branches wide spreading; leaves 2.5-3.8 m long, linear, flattened; flowers diocious, male flowers catkin which are subglobose and solitary in the leaf-axils; stamen 10, pollen sacs 5-9, globose; female flower solitary, axillary, in fruit the disk enlarges becomes succulent and bright-red, 8 mm long and surrounds the olive-green seed of which only the tip is exposed; embryo with 6-7 cotyledons.

Parts Used: Leaves and Flowers

Medicinal Value: The taxol extracted from the plant is used to treat breast cancer. Leaves are used in bronchitis, hiccough and asthma. Leaves and fruits are sedative, antiseptic and emmenagogue.

Propagation: Through seeds

Botanical Name: *TERMINALIA BELERICA* Roxb.

Common Names: Beleric myrobalan, Bahira, Balilah

Family: Combritaceae

Occurrence: Cultivated as an avenue tree below 1000 m. in Punjab and NWFP

Plant Identification: It is a large deciduous tree; bark ash grey with longitudinal furrows; leaves 7.5-20.0 cm long and 5-15 cm broad, broadly elliptic, sub-acute, base narrow often unequal; petioles 2.5-7.5 cm long; flower 1.2 cm in diam., pale yellow or white with unpleasant smell, in axillary slender interrupted spikes; calyx tube 5-7 mm across, teeth 5, lobes triangular, stamen 10; fruit 2.5 cm long, fleshy, velvety; seed thick.

Parts Used: Kernel, Fruit

Medicinal Value: Fruit is bitter, astringent, tonic, laxative and antipyretic. The half-ripe fruit is used as purgative. Kernel is narcotic.

Propagation: Through seeds

Botanical Name: *TERMINALIA CHEBULA* Rets.
Common Names: Chebulic Myrobalan, Hareer, Halila zard, Halila Siyah, Harr
Family: Combrataceae
Occurrence: Cultivated in NWFP and Punjab
Plant Identification: A deciduous tree with dark brown bark, young parts covered with rusty brown hairs; leaves nearly opposite, 7.5-15.0 cm long, ovate, short pointed; base usually rounded, petiole 1.2-2.5 cm, long, often with 2 or more glands on the upper side near the top; flower 1.2 cm in diam., pale yellowish-white, bisexual in axillary and terminal; calyx tube 3 mm across, lobes short, teeth 5; petal absent; stamen 10; fruit 2.5 – 5.0 cm long, fleshy, smooth, 5-ribbed when dry, nut rough.
Parts Used: Fruit, Bark
Medicinal Value: Fruit is laxative, alterative, astringent, stomachic, and tonic.
Propagation: Through seeds.

Botanical Name: *TERMINALIA TOMENTOSA* W. and A.
Common Names: Asana, Saradru
Family: Combrataceae
Occurrence: NWFP and Punjab
Plant Identification: It is large tree; twigs villous; leaves leathery, villous on the under surface, linear oblong obtuse, with two large glands on the midrib; nerves many, parallel; flowers in large, villous panicles; calyx villous with yellowish brown hairs; fruit large, glabrous, with 5 equal wings.
Parts Used: Bark
Medicinal Value: The bark is astringent, cardiac tonic, diuretic and styptic; it is useful in ulcers, haemorrhages, fractures, bronchitis, leucorrhoea, gonorrhoea, diarrhoea, dysentery, heart diseases.
Propagation: Through seeds

Botanical Name: *THEVETIA PERUVIANA* (Pers.) Schum.
Common Names: Pila-kaner
Family: Apocynaceae
Occurrence: Cultivated in Punjab, NWFP and Sindh
Plant Identification: It is an evergreen, glabrous shrub or under tree, 5-7 meters tall, with milky juice; leaves spirally arranged, 7.5-10.0 cm long and 6 to 11 mm wide, crowded, linear, narrowed at both ends, petiole minute; flowers yellow in colour, 5 cm in diam., terminal cymes; bracts variable, calyx 6 mm., divided to the base, segments 5, narrow acute; corolla more than 5 cm long, tubular at the base; stamen 5; fruit broadly obovate 3.2 cm long and 3.8 cm broad, mesocarp bony; seeds 4 or less.
Parts Used: Bark, Kernel, Juice from stem
Medicinal Value: The bark is febrifuge, bitter and cathartic. Milky juice and seeds are highly poisonous. Kernel is acro-narcotic poison.
Propagation: Through seed

Botanical Name: *THYMUS SERPYLLUM L.*
Common Names: Thyme, Kandro, Ban Ajwain, Hasha, Satarfarsi
Family: Lamiaceae

Occurrence: Balochistan, Azad Kashmir and Northern areas.

Plant Identification: It is a small, slender, much branched, perennial herb with procumbent branches; leaves opposite, simple, exstipulate, 3-6 mm long, nearly sessile, gland dotted, oblong, ovate, entire, obtuse; flowers small purple, in small clusters, crowded in short terminal spikes; stamens 4; nutlets 4.

Parts Used: Seeds and Leaves

Medicinal Value: Mild laxative, digestive, carminative, antiphlegmatic, anthelmintic, tonic for viscera.

Propagation: Through seed

Botanical Name: *TINOSPORA CORDIFOLIA (DC.) Miers*

Common Names: Tinospora, Gilu, Sat Gilo, Giluncha

Family: Menispermaceae

Occurrence: Cultivated in NWFP, Punjab and Sindh

Plant Identification: It is a large twining; stem succulent; bark light grey, papery at first and later corky; leaves cordate, long stalked; flowers on nodes on the old wood, in racemes, dioecious, very small, yellow; drupes sessile, red, very small.

Parts Used: Root, Stem, Juice of plant

Medicinal Value: Alterative, general tonic, blood purifier.

Propagation: Through seed

Botanical Name: *TRACHYSpermum AMMI (L.) CARUM COPTICUM*

Common Names: Omum, Bishop's weed, Ajwain, Jann, Sperkai, Nankhawah

Family: Apiaceae

Occurrence: Cultivated in Sindh, Punjab and Balochistan

Plant Identification: It is an erect, medium size annual herb, root spindle shaped, ultimate segments of leaves linear, often 1.2-2.5 cm long; flowers white; bracts many, linear, sometimes divided; bracteoles 3-5, small, linear, rays velvety; fruit 2 mm, ovoid, rough with hard tubercles; carpels dorsally flattened, ridges distinct, oil gland solitary, small.

Parts Used: Fruit, Root, Seed

Medicinal Value: Root is carminative and diuretic, Fruit is stimulant, carminative tonic, antiseptic, stomachic; used in colic, flatulence, indigestion, diarrhoea, tonic dyspepsia and cholera.

Propagation: It is sown in November using seed rate of 10 kg per hectare with row-to-row distance of 40 cm. The crop is harvested in May.

Botanical Name: *TRAPA BISPINOSA Roxb:*

Common Names: Water chestnut, Singhara, Pani-phal, Kesru, Gaonri.

Family: Onagraceae

Occurrence: Wild and cultivated in stagnant water in Punjab and Sindh.

Plant Identification: It is a floating perennial herb, stem long; submerged portion at intervals; leaves broad, floating, crowded into rosettes on the upper part of the stem, dark green, shining above, wooly beneath, tips slightly round-toothed; petiole 10-15 cm long, stipules linear, thin; flower small, white axillary, solitary, stalked; calyx tube short, 4-fid; petals, 4 small; stamen 4; fruit 2.5 to 3.8 cm long and broad, horny ovoid with a broad top, ripening under water 4-angled, seed one.

Parts Used: Nuts

Medicinal Value: Nuts are cooling and useful in bilious affections and in diarrhoea.

Propagation: Through cutting and seeds

Botanical Name: *TRIANTHEMA PENTANDRA L.*

Common Names: Spreading hogweed, Biskhapra, Santh, Itsit, Wahu

Family: Aiezoaceae

Occurrence: Wild in Sindh, Punjab and Balochistan

Plant Identification: It is a prostrate perennial herb; leaves 2.5 to 5.0 cm long, oblong, elliptic; flower in sessile clusters; calyx lobes ovate, stamen 5; style 2; capsule beak consisting of two lanceolar portions, separating into 2 one-seeded parts.

Parts Used: Whole plant

Medicinal Value: Diuretic, diaphoretic, antipyretic, emmenagogue, antidropsical. Root is irritant and cathartic.

Propagation: Through seeds

Botanical Name: *TRIBULUS TERRESTRIS L.*

Common Names: Caltrop, Bakhra, Chota Gokhro

Family: Zygophyllaceae

Occurrence: Common weed in sandy places throughout Pakistan.

Plant Identification: It is a prostrate, hairy annual or perennial herb with procumbent or ascending branches; leaves opposite, leaflets 4-7 pairs, sub-acute; stipules ovate, acute; flowers yellow; fruit hairy, cocci with 2 long and 2 short spines.

Parts Used: Whole plant

Medicinal Value: Diuretic, urinary antiseptic.

Propagation: Through seed under natural conditions.

Botanical Name: *TRICHODESMA INDICUM (L.)*

Common Names: Chota Kulfa, Sindhi gaozaban

Family: Boraginaceae

Occurrence: Throughout Pakistan up to 1400 m.

Plant Identification: It is a small erect, annual herb; leaves 2.5 to 10.0 cm long, sessile, lanceolate, stem, clasping; flowers pale blue turning to pink, then white, 1.8 to 2.5 cm in diam., solitary, on drooping, axillary stalks; calyx 8 mm, conical, lobes 5, prolonged below into 5 recurved tails; corolla tube 8 mm, lobes 8 mm, conical, lobes 5, prolonged below into 5 recurved tails; corolla tube 8 mm, lobes, ovate, abruptly tapering into a fine point, a yellow glandular spot at the base of each; stamen 5, woolly; fruit oblong with rounded ends, 4- ridged, separating into 4 rough nutlets.

Parts Used: Whole plant

Medicinal Value: Plant is diuretic, emollient and depurative. Root is applied as paste on swelling and joints and used in dysentery of children. Leaves and root are effective against snake bite.

Propagation: Through seeds.

Botanical Name: *TRIFOLIUM PRATENSE L.*

Common Names: Trepatra

Family: Fabaceae

Occurrence: In hilly areas of NWPF and Northern areas at 1300-3000 m.

Plant Identification: It is a prostrate, hairy, perennial herb; leaves trifoliate; leaflets ovate or oblong, tip blunt or notched, stipules united to the leaf stalks; flowers purple, small, many in long stalked ovoid or round heads, 1.8 to 3.8 cm in diameter, with 1 or 2 leaves at the base; calyx bell shaped, teeth 5, nearly equal or 3 lower longest, narrow, longer than the tube; petals narrow, persistent; keel blunt; stamen 10, upper free, other united; pods very small in the withered corolla; seed one.

Parts Used: Flowers

Medicinal Value: Dried flowers are expectorant and antiseptic.

Propagation: Through seeds

Botanical Name: *TRIGONELLA FOENUM-GRÆCUM L.*

Common Names: Fenugreek, Malkhuzay, Methi

Family: Papilionaceae

Occurrence: Cultivated in many parts of Pakistan.

Plant Identification: It is an erect, strongly scented, robust, 30-60cm tall annual herb; leaves compound; leaf-lets 3; 6 to 12 mm long, lanceolate, tip blunt, broad, stipule minute, lanceolate, soon falling off; flowers yellow, 6 mm in diam., nearly sessile; calyx 4 to 5 mm, teeth 5; petals 5, longer than the calyx, standard narrow, wings short; keel pods firmly united; stamen 10, united into a tube; pods linear-oblong, 2.5-3.5 cm long, thin, pointed, seeds 4 to 8.

Parts Used: Seed and Leaves

Medicinal Value: Effective against affections due to cold malhumours.

Propagation: It is planted in October-November and harvested in April. For fresh vegetable, the crop is cut 6 cm above ground level, and it sprouts again.

Botanical Name: *URGINEA INDICA Kunth*

Common Names: Squill, Asqeel, Jangli Piaz, Ansal, Kundri

Family: Liliaceae

Occurrence: Hilly areas of NWPF

Plant Identification: It is an unbranched herb with bitter bulb, more than 1.2 cm tall; leaves radical, 15-45X1.2-2.5 cm, linear, nearly in 2 rows; flowers about 8 mm long, white with green lines, bell-shaped in terminal racemes; capsule 1.2-1.8 cm long oblong, 3-valved; seeds many, flat black.

Parts Used: Bulbs

Medicinal Value: Effective against hard swellings, warts and corns, as resolvent in jaundice and to improve eyesight.

Propagation: Through bulbs.

Botanical Name: *URTICA DIOICA L.*

Common Names: Bichu buti

Family: Utricaceae

Occurrence: In hilly areas of Punjab and NWFP at altitudes of 1300-3000 m

Plant Identification: It is a robust medium size, perennial herb, with creeping rhizome. All parts of the plants are covered with hair. Leaves are stalked and heart shaped at the base and coarsely serrate. The green flowers are arranged in long clusters of male or female flowers. Carpels held by sepals are flattened.

Parts Used: Roots, Leaves, Juice from plant

Medicinal Value: It is diuretic, anti-rheumatic and blood purifying.

Propagation: Through seeds and rhizome.

Botanical Name: *VALERIANA JATAMANSI Jones*

Common Names: Mushk-Bala

Family: Valerianaceae

Occurrence: NWFP, Northern areas and Azad Kashmir.

Plant Identification: It is a small, pubescent, perennial herb, 15-45 cm tall; branching stem succulent, radical leaves 2.5-7.5 cm in diameter, several, sharply pointed, toothed, cordate, ovate, entire or pinnate, long petioled; flowers white or pink in clusters, bracts small, oblong or linear; corolla tube 5-lobed, funnel shaped; stamen 3; fruit hairy, nearly globose.

Parts Used: Root

Medicinal Value: Roots are aromatic and used as stimulant, carminative and antispasmodic.

Propagation: Through roots

Botanical Name: *VERBASCUM THAPSUS L.*

Common Names: Jangli tambaku

Family: Scrophulariaceae

Occurrence: NWFP and Northern Areas at 300-4000 m.

Plant Identification: It is a large, 90-180 cm tall herb, with star-shaped hairs; stem, stout, with prolonged leaf bases; leaves sessile, ovate, oblong lanceolate; flower yellow, 1.8 to 2.5 cm in diameter, nearly sessile, crowded in terminal spikes; bracts longer than flower; calyx 5-lobed, lobes overlapping; corolla concave, wooly outside, tubes short, lobes 5, nearly equal, broad, blunt; stamen 5, 3 short 2 long; capsule ovoid, felted; seeds many.

Parts Used: Leaves, flowers, roots, seeds.

Medicinal Value: Seeds are aphrodisiac and narcotic. Leaves, flower and root are astringent, pectoral and demulcent, root is febrifuge.

Propagation: Through seeds

Botanical Name: *VERBENA OFFICINALIS L.*

Common Names: Faris-tarium, Karaita,

Family: Verbinaceae

Occurrence: Punjab, NWFP and Tribal areas

Plant Identification: It is a spreading, medium sized, perennial herb, nearly smooth, stem; leaves 5-10 cm long, lobed, ovate, toothed, base narrow, lower leaves stalked, upper sessile; flowers blue of lilac, 6 mm in diam., tubular, hairy, teeth 5; corolla hairy, tube nearly cylindrical, longer than calyx, lobe 5; stamen 4, in unequal pairs, enclosed in the corolla; fruit of 4 nutlets enclosed in the calyx.

Parts Used: Whole plant

Medicinal Value: Fresh leaves are tonic rubifacient, febrifuge; used in rheumatism and joint diseases. Root is said to cure scrofula and an antidote to snake bite.

Propagation: Through seeds

Botanical Name: *VERNONIA ANTHELMINTICA Wild.*

Common Names: Blue fleabane, Kali zeeri, Somrajban giri, Zira dashti, Bakchi.

Family: Asteraceae

Occurrence: Wild in Punjab and NWFP and now cultivated in Hazara

Plant Identification: It is an erect, medium size, up to 40 cm tall, annual herb, with many branches; leaves 7.5-12.5 cm long, ovate-lanceolate, coarse toothed, pointed; heads 1.3-2.0 cm in diam, clustered, stalks long, bracts of heads with broad purplish tips, hairy, inner shorter than outer; corollas unequal; achene 5 m, ribbed.

Parts Used: Seeds

Medicinal Value: Seeds and roots are tonic, stomachic, diuretic and anthelmintic. It is also used as a mouthwash.

Propagation: Through seeds which are sown in July and harvested in November.

Botanical Name: *VIOLA ODORATA L.*

Common Names: Violet herb, Viola, Banafsha, Farfir, Banafsho.

Family: Violaceae

Occurrence: Punjab, NWFP and Azad Kashmir at 1500-2000 m.

Plant Identification: It is a stemless herb, with stout rootstock and slender runners; leaves 1.2-2.5 cm in diameter, with round tip, tufted, broadly ovate-heart shaped, and round toothed; stipule, entire or toothed; sepals rounded at the tip; spur nearly straight; stigma curved down; capsule round, few seeded.

Parts Used: Whole plat

Medicinal Value: Mild laxative and pectoral.

Propagation: Trough runners which are transplanted in the field.

Botanical Name: *VITEX TRIPOLIA* L.
Common Names: Five leaved chaste tree, Nirgundi, Sambhalo.
Family: Verbanaceae

Occurrence: NWPF and Sulaiman mountains areas at 700-900 m.

Plant Identification: It is a large shrub, with compound leaves; leafstalk 5 cm long; leaflets 3, sessile 2.5-7.5 cm long, smooth, short grey wooly beneath; flowers lavender blue in branching terminal raceme 2.5-10.0 cm long, often leafy at the base; calyx 2-3 mm, 5-toothed; corolla 8-12 mm; stament-4 protruding; drupe 5 mm, black.

Parts Used: Leaves, Flower and Fruit

Medicinal Value: Flowers are given in severe thirst, fever and vomiting. Fruit is prescribed in amenorrhagia. Externally, leaves are applied on rheumatic joints.

Propagation: Through seeds and cuttings.

Botanical Name: *WITHANIA SOMNIFERA* Dunal
Common Names: Winter cherry, Asgand, Asgand Shirin, Askan, Bogni Booti.
Family: Solanaceae

Occurrence: Throughout Pakistan ascending to 1650 m.

Plant Identification: It is an erect, branching plant, 30-150 cm tall, wholly covered with white stellate hairs; leaves ovate, up to 10 cm long; flowers bisexual, greenish or lurid yellow, in clusters of about 25 forming umbellate cymes. Berries partially enclosed in the enlarged calyx, red, globose; the part outside the calyx pubescent; seeds yellow, scurfy.

Parts Used: Whole plant

Medicinal Value: Antirheumatic, alterative and diuretic.

Propagation: Through seeds

Botanical Name: *ZINGIBER OFFICINALIS* Rose
Common Names: Ginger, Adrak, Sundh, Sonth, Zinjibeel.
Family: Zingiberaceae

Occurrence: Cultivated under shade in Sindh and Punjab

Plant Identification: It is a large biennial herb; rootstock horizontal, aromatic, pale green, bears many sessile; stem elongated tubers, tuberous, long leaf, 30 cm by 5.0-7.5 cm which are linear, oblong, lanceolate, sessile, lower part surrounding the stem; flowers spike terminating the leafy system, up to 7.5 cm long; bracts pointed; corolla segments greenish yellow, lip small, purplish black, mid-lobe not notched; stamen dark purple, very rarely has flowers.

Parts Used: Rhizome

Medicinal Value: Rhizome of the plant is carminative, condiment, stomachic, expectorant, stimulant and rubefacient.

Propagation: Through rhizome as summer crop

Botanical Name: *ZIZYPHUS JUJUBA* Mill.
Common Names: Jujube, Unnab
Family: Rhamnaceae

Occurrence: Cultivated and wild throughout Pakistan.

Plant Identification: It is a much branched shrub or small tree, glabrous; many sharp spines on the branches; leaves 1.8-6.0 cm long, rounded at the both ends, ovate-lanceolate, glabrous; petiole 2-7 mm long; flowers greenish, clustered, axillary; petals 5, clawed; tips truncate; stamen 5; style 2-3; fruit round or oblong, succulent, red, shining.

Parts Used: Fruit, Bark

Medicinal Value: Blood purifier, emollient and pectoral.

Propagation: Through seeds and to get true to type plants, bud wood is grafted on rootstocks.

Glossary of Botanical Terms Used

Achene: A small, dry fruit that contains one loose seed and that does not split open spontaneously, e.g. sunflower seed.

Acuminate: Tapering gradually to a point at the apex.

Alternate: Arranged singly at different points along a stem or axis.

Annual: A plant which grows from a seed, flowers, sets seed and dies in one year.

Apex: The tip.

Argentous: referring to silver color leaves.

Axil: The more-or-less V-shaped angle made by the junction between a leaf and a stem or twig.

Axillary: Growing from an axil.

Berry: A stoneless, pulpy fruit containing one or more embedded seeds, e.g. grape.

Bilabiate: Two-lipped.

Blade: The broad, thin part of a leaf or petal.

Blotched: Any fungal disease of plants marked by discolored areas on leaves and stems.

Bracteoles: an organ resembling a leaf or scale that arises from a branch of a flower cluster where the flowers develop.

Bracts: The leaf-like structures of a grouping or arrangement of flowers (inflorescence). A green leaf-like structure which has a flower in its axil, and which may remain on the plant with the fruit. Bracts vary enormously in size, shape and function.

Bud: A protuberance on a stem, from which a flower, leaf or shoot develops.

Bulb: Any underground plant storage organ, for example, a corm, tuber, or rhizome, from which a new plant grows every year.

Bulbous: Growing from a plant bulb.

Calyx: The sepals collectively; the external floral envelope, usually consisting of layered, fleshy leaves and membranes.

Campanulate: "Bell-shaped," as the flowers of the lily, *Agapanthus campanulatus*.

Capsule: Dry or fleshy fruit which splits open to release the seeds.

Carpel: The wall of a simple pistil, or part of a wall of a compound pistil.

Claw: The narrow, curved base of a petal or sepal in some flowers.

Cone: A rounded, more or less elongated cluster of fruits or flowers covered with scales or bracts.

Corm: A bulblike but solid, fleshy underground stem base.

Corolla: The petals of a flower, which may be separate or joined in varying degrees.

Corymb: A generally flat-topped flower cluster with pedicels varying in length, the outer flowers opening first.

Cordate: Heart-shaped or "Valentine"-shaped.

Corona: Crown like structure on some corollas.

Coriaceous: Referring to leather (coriaceous).

Crenate: Having rounded teeth along the margin.

Culm: The hollow stem of grasses and bamboos.

Cuspidate: Referring to a cusp or point (cuspidata).

Cyme: A branching, relatively flat-topped flower cluster whose central or terminal flower opens first, forcing development of further flowers from lateral buds.

Deciduous: Falling off each season (as leaves); bearing deciduous parts (as trees).

Dentate: Sharply toothed, with the teeth pointing straight out from the margin.

Dichotomous: Forking or branching regularly by pairs.

Dioecious: Having male and female flowers on separate plants. For fruit and seed production to take place, there needs to be a male and female plant present.

Drupe: A fleshy fruit containing a single seed in a hard "stone", e.g. peach.

Emarginated: Cut out or hollowed; notched, especially at the ends.

Evergreen: retain leaves throughout the year and their growth slows down in winter.

Filiform: Threadlike.

Fringed: Referring to cold regions (frigida).

Fruits: The seed bearing part of a plant. Different kinds of fruits include;

Nutlet: A hard dry fruit containing a single seed.

Pod: A long dry fruit, usually containing several large seeds, which splits open along one or both seams to release the seeds.

Funnelform: Descriptive of a flower whose corolla tube widens gradually and uniformly from the base.

Glabrous: Not hairy.

Glandular: Having glands, which secrete sticky substances.

Globose: Approximately spherical.

Grain: Achene-like fruit, but with the seed not loose.

Herb: A plant that has no woody tissue and it dies down at the end of a growing season.

Herbaceous: Non-woody, herb-like.

Hermaphrodite:

Hilum: The scar on a seed coat marking the place where it was attached to the ovary during development.

Hyacinth: A plant of the lily family, cultivated widely for its spikes of highly fragrant pink, white, or blue flowers.

Indigenous: Native; naturally occurring.

Inflorescence: The way flowers are arranged in a cluster; generally, a flower cluster.

Keel blunt: A ridge-shaped part of an organism.

Lanceolate: Widening to a maximum near the base and tapering to a point at the apex.

Lateral: Occurring on or growing from the side (compare terminal).

Leaf: A vegetative organ which, when complete, consists of a flat blade, a petiole or stalk, and (usually two) small leafy appendages at the base of the petiole.

Leaflet: A division or part of a compound leaf.

Linear: Long and narrow, with nearly parallel sides.

Lobe: A part of division, especially when rounded, of an organ.

Mesocarp: A plant that flowers only once in its life and then dies.

Midrib: the central vein or rib of a leaf, extending from the base to the apex.

Monoecious: Having separate male and female flowers but on the same plant.

Monadelphous: used to describe stamens that have all the filaments united to form a single bundle in the shape of a tube.

Node: A point on a stem at which leaves are produced.

Nut: A hard-walled, one-seeded fruit that does not split spontaneously, e.g. Hazelnut.

Oblong: Longer than wide and rounded at the ends, with nearly parallel sides for much of the length.

Obovate: Oval, but broader toward the apex; refers to leaf shape.

Obtuse: Rounded or blunt.

Oval: Broadly elliptical.

Ovate: Oval, but broader toward the base; egg-shaped.

Ovoid: Ovate.

Palmate: With 3 or more leaflets, nerves, or lobes radiating from a central point.

Partite: Referring to parts or a part (partitus).

Paripinnate: Referring to a feather (pinnata).

Panicle: A branching flower grouping, with branches that are usually racemes.

Pedicel: The stalk of one flower in a cluster.

Peduncle: The stalk of a flower cluster or of a solitary flower.

Pedunculate: the stalk of a single flower or the main stalk of a flower cluster.

Perennial: A plant which lives from year to year, starting into growth again each spring.

Perfect: A flower that has a full complement of male and female parts as well as petals and sepals.

Persistent: Remaining on the plant; not falling off readily.

Perianth: the calyx and corolla collectively.

Petal: One unit of the corolla.

Petiole: The stalk of a leaf.

Perianth-tube: The calyx and corolla collectively form a tube.

Pinnate: Compound with the leaflets arranged on each side of the rachis.

Pinna: Plural pinnae; a leaflet or primary division of a pinnately compound leaf.

Pistil: The female reproduction organ of a flower.

Pod: Generally, a dry fruit that splits open.

Procumbent: Growing along the ground without rooting, and having ascending tips.

Prostrate: Growing flat along the ground.

Pubescent: Covered with down or soft, short hairs.

Pyriform: Referring to a pear, or actually any fruit.

Pyramidal thyrsus: Shaped like a pyramid.

Raceme: An unbranched, elongated flower grouping, with individual flowers on distinct stalks.

Rachis: The central axis of a spike, raceme or compound leaf.

Radiate: A flower head that has petals radiating from a center.

Receptacle: The end of the stem or stalk on which the flower parts are borne.

Rhizome: A perennial creeping underground portion of a stem which may look like a root; producing shoots on top and roots beneath; different from a root in that it has buds, nodes, and scaly leaves; rootstock.

Rhomboid: The shape of angular, i.e., with the outline of an equilateral parallelogram with oblique angles. In a rhomboid only opposite sides are equal.

Robust: Strong, with great physical strength.

Rootstock: Rhizome.

Rosette (basal): Leaves radiating directly from the crown of the root.

Runner: A thin stem or shoot growing along the ground and producing roots at the nodes.

Saprophytic: A plant (usually lacking chlorophyll) that lives on dead organic matter.

Scale: A small, usually dry leaf that is closely pressed against another organ.

Scape: A leafless flower stalk that grows from the ground.

Sepal: The individual divisions of the calyx (outer floral envelope).

Serrate: Saw-toothed, with the teeth pointing toward the apex.

Sessile: Lacking a stalk, such as a leaf or flower with no obvious stalk.

Sheath: An expanded or tubular structure that partially encloses a stem or other organ.

Shoot: A new young growth; a stem or branch and its leaves.

Shrub: A woody plant that produces no trunk but branches from the base.

Sinuate-toothed: used to describe a leaf with a wavy intended margin.

Sinus: space or hole; a cleft or recess.

Solitary: Not growing as part of a cluster or group.

Spadix: A thick, fleshy flower spike (usually enveloped by a spathe), as in members of the arum family (Skunk Cabbage, Jack-in-the-Pulpit, Dragon Arum, etc.).

Spheroidal: Some thing shaped like a sphere.

Spike (flower): An unbranched, elongated flower grouping in which the individual flowers are sessile (attached without stalks).

Spikelet: A small spike, particularly one of the few-flowered spikes making up the inflorescence of a grass.

Spore: A one-celled reproductive body produced by relatively primitive plants.

Spur: A slender, hollow projection from a petal or sepal.

Stamen: The pollen-bearing anthers with attached filaments (sometimes without filaments); the male organ of a flower.

Stipule: Resembling small or minute leaves at the base of leaves of certain plants.

Striate: marked with fine longitudinal lines or ridges.

Strobile: A cone or conelike structure.

Style: The slender, elongated part of a pistil.

Sub-indehiscent: Resistant to not opening up to release seeds when ripe.

Succulent: Juicy; fleshy.

Taproot: A single main root that grows vertically into the ground.

Tendrils: A modified leaf or branch structure, often coiled like a spring, used for clinging in plants that climb.

Ternate: Occurring in threes or divided into three parts.

Tomentose: With dense matted hairs.

Trifoliate: Having three leaves.

Trifoliolate: Having three leaflets.

Tuber: A swollen root or underground stem, which forms a food store for the plant.

Tubercles: A small projection, knob or swelling.

Twigs: A young shoot of the past season.

Umbel: A flower grouping with individual flower stalks or floral groupings radiating from a central axis; often flat-topped and umbrella-like.

Villous: Covered with long soft hairs.

Glossary of Medical Terms Used

Abscesses: A localized collection of pus caused by suppuration buried in tissues, organs, or confined spaces.

Acrid: Irritating or deeply bitter.

Adaptogenic: Helping the human organism adapt to stressful conditions.

Aerophagy: An excess of air in the alimentary canal that is relieved through burping or flatulence.

Ague: An intermittent fever, sometimes with chills, as in malaria.

Alkaloid: A large, varied group of complex nitrogen-containing compounds, usually alkaline, that react with acids to form soluble salts, many of which have physiological effects on humans. Includes nicotine, cocaine and caffeine, etc.

Alterative: A medicinal substance that gradually restores health and the nutritional state of the body.

Amenorrhea: Absence or suppression of menstruation.

Anaesthetic: Numbs the nerves and causes loss of sensation.

Analgesic: A medicine which relieves or reduces pain.

Anaphrodisiac: Reduces sexual desire.

Anodyne: A pain-relieving medicine, milder than analgesic.

Anthelmintic: An agent that kills, destroys and expels worms from the intestines. Same as vermifuge.

Appetitive: Help in desire to eat.

Antiflatulent: Help to reduce the presence of excessive amounts of air or gases in the stomach or intestine, leading to distention of the organs.

Anticатарhal: Reduce inflammation of a mucous membrane, with a free discharge especially such inflammation of the air passages of the head and throat.

Antidiabetic: An agent that prevents diabetes.

Anticonstipatory: Help in problem of infrequent or difficult evacuation of the faeces.

Antiphlegmatic: Reduces sluggishness

Antidysenteric: Helps any of various disorders marked by inflammation of the intestines, especially of the colon, and attended by pain in the abdomen, tenesmus, and frequent stools containing blood and mucus. Causes include chemical irritants, bacteria, protozoa, or parasitic worms.

Anti-aphrodisiac: Suppressing sexual desire.

Antibacterial: Destroys or stops the growth of bacteria.

Antibilious: An herb that combats biliousness. The term biliousness refers to a group of symptoms consisting of nausea, abdominal discomfort, headache, constipation, and gas that is caused by an excessive secretion of bile.

Antibiotic: An agent that inhibits the growth or multiplication of, or kills, a living organism; usually used in reference to bacteria or other microorganisms.

Antidepressant: Reduces or prevents depression.

Antidote: Counteracts a poison.

Antifebrile: Pertaining to or characterized by fever.

Antifungal: An agent that inhibits the growth or multiplication of fungi, or kills them outright.

Anti-inflammatory: Reducing or neutralizing inflammation.

Anti-lithic: Aids in preventing the formation of stones or calculus in the kidneys and bladder.

Antiparasitical: Destructive to parasites.

Anti-periodic: Prevents the periodic recurrence of attacks of a disease; as in malaria.

Antipyretic: Reduces fever. Same as febrifuge or refrigerant.

Anti-rheumatic: An agent that relieves or cures rheumatism.

Antisclerotic: Removes deposits from circulatory vessels.

Antiscorbutic: An agent effective in preventing scurvy.

Antiseptic: Preventing sepsis, decay, putrefaction; also, an agent that inhibits the growth of, and kills, germs, bacteria & microbes.

Antispasmodic: Relieves or prevents spasms, cramps, and convulsions.

Aperient: A gentle purgative of the bowels.

Aperitif: Appetite stimulant.

Aphrodisiac: Increasing or exciting sexual desire.

Aromatic: Agents which emit a fragrant smell and produce a pungent taste. Used to make other medicines more palatable.

Astringent: An agent that causes tissue to contract.

Atrabilious: Ill natured.

Ataxy: Lack of muscle control.

Blistering agent: It causes the collection of serum between the layers of skin.

Bronchial: Pertaining to one or more bronchi.

Cardiac: Stimulates or affects the heart.

Cardiotonic: Tones the heart muscle.

Carminative: An agent that relieves and removes gas from the digestive system.

Catarrh: An inflammation of the mucous membranes with a free discharge. This has special reference to the air passages of the head and throat, e.g. hayfever, rhinitis, influenza, bronchitis, pharyngitis, asthma.

Cathartic: A powerful purgative or laxative, causing severe evacuation, with or without pain.

Concoctive: To make some thing new by mixing various substances.

Cystitis: Inflammation of the urinary bladder.

Decoction: A preparation made by boiling a plant part in water.

Demulcent: An agent that soothes and softens irritated tissue, particularly mucous membranes.

Demulcent febrifuge: Reduces heat while building bodily fluids.

Deobstruent: Removes obstructions by opening natural passages or pores of the body.

Desiccative: Dehydrating agent.

Detergent: An agent that cleanses boils, sores, wounds etc.

Detersive: Detergent. Cleanses wounds and sores, and promotes the formation of scar tissue.

Diaphoretic: An agent that induces sweating or perspiration.

Digestive: An agent that promotes digestion.

Discussant: An agent that dissolves or causes something, such as a tumor, to disappear.

Disinfectant: Kills infections and disease producing microorganisms.

Diuretic: An agent that increases the secretion and elimination of urine.

Drastic: A violent purgative.

Dropsy: Generalized edema (swelling).

Dyspepsia: Indigestion.

Dyspnea: Sense of difficulty in breathing, often associated with lung or heart disease.

Ecbolic: Induces the premature abortion of a foetus.

Eczema: Acute inflammation of the skin.

Emetic: An agent that induces vomiting.

Emmenagogue: A substance that promotes or assists the flow of menstrual fluid.

Emollient: An agent that softens the skin, and soothes inflamed and irritated tissues.

Epilepsy: Disturbances of brain function that may be manifested as periodic impairment or loss of consciousness, psychic or sensory disturbances.

Eruptions: The act of breaking out, appearing, or becoming visible, as eruption of the teeth or lesions of the skin due to disease.

Esculent: Edible or fit for eating.

Exhilarant: Stimulating gladness or refreshness.

Expectorant: An agent that induces the discharge of mucous secretions from the lungs and bronchial tubes.

Febrifuge: That which reduces or prevents fever. Same as antipyretic or refrigerant.

Febrile: pertaining to or characterized by fever.

Freckles: Precipitation of pigments in the skin.

Fumigatory: Causing sterilization by disinfectant vapours.

Gargle: A liquid medicine for washing out the throat.

Gastrointestinal: Pertaining to gut to anus including all associated structures.

Germicide: Kills germs.

Gonorrhoea: Sexually transmitted disease.

Gleet: A urethral discharge, either of mucus or pus; commonly seen in the chronic form of gonorrheal urethritis.

Gout: A group of metabolic disorders where serum uric acid levels are increased.

Haemopoietic: Process of formation of blood cells (haemopoiesis).

Hiccup: Repeated spasmodic inspiration with sudden closure of glottis (hic sound).

Hypnotic: Induces sleep.

Hypotensive: Causing or marking a lowering of blood pressure.

Hysterical: Relating to hysteria.

Hypertrophy: Increase in tissue size.

Indolent: A term applied to a painless sore which is slow healing.

Infusion: A preparation made by soaking a plant part in hot water (or cold water, for a cold infusion); in essence, a "tea".

Insecticide: Kills insects.

Jaundice: Malfunction of liver.

Laxative: A mild purgative. Herb that promotes evacuation of the bowel.

Leukorrhoea: A whitish, viscid discharge from the vagina.

Lactagogue: An agent that causes an increased flow of milk.

Lactifuge: An agent that decreases secretion of milk.

Malignant: Cancerous.

Mucilaginous: Pertaining to or resembling or containing mucilage. Herbs that have a soothing effect on inflamed mucous membranes.

Narcotic: An addicting substance that reduces pain and produces sleep.

Nephritis: Inflammation of the kidney.

Nervine: An agent that affects, strengthens, or calms & soothes the nerves.

Nutrient or Nutritive: Nourishing, increases weight and density.

Obviate: To anticipate and prevent.

Oedema: Swelling due to presence of excess fluid.

Ophthalmic: Healing for disorders and diseases of the eye.

Ophthalmicum: A remedy for diseases of the eye.

Otorrhoea: A discharge of fluid from the ear esp. pus.

Palpitation: An abnormal awareness of the heart beat.

Pectoral: Relieves disorders of the chest and lungs, as an expectorant.

Pertussis: An acute, highly contagious infection of the respiratory tract.

Phthisis: Tuberculosis.

Poultice: A moist, usually warm or hot mass of plant material applied to the skin, or with cloth between the skin and plant material, to effect a medicinal action.

Psychotropic: Exerting an effect upon the mind

Purgative: An agent that causes cleansing or watery evacuation of the bowels, usually with griping (painful cramps).

Purging: Causing evacuation of the bowels.

Pyelitis: Inflammation of the pelvis of the kidney and its calices.

Repercussive: An action exerted in return.

Refrigerant: Relieves fever and thirst. Lowers body temperature.

Rheumatism: Inflammation of joints.

Resolvent: Promotes the resolving and removing of swellings and abnormal growths, such as a tumour.

Restorative: Restores consciousness and/or normal physiological activity.

Rubefacient: An agent that causes reddening or irritation when applied to the skin.

Scorbutic: Concerning or affected with scurvy.

Sedative: Calms the nerves, anxiety, allays excitement, induces relaxation, promotes drowsiness and is conducive to sleep.

Spermatorrhea: Abnormally frequent involuntary loss of semen without orgasm.

Stimulant: An agent that causes increased activity of another agent, cell, tissue, organ, or organism.

Stomachic: Substances which give strength and tone to the stomach.

Styptic: Checking bleeding by contracting blood vessels.

Sudorific: Herbs that promote or increase perspiration.

Suppurative: The formation of pus, the act of converted into and discharging pus.

Syphilis: A sexually transmitted disease.

Thymol: An antiseptic often used for mouth washes.

Tonic: An ambiguous term referring to a substance thought to have an overall positive medicinal effect, typically strengthening and revitalising the body or specific organs.

Vermifuge: Having worm-killing properties; an agent that kills intestinal worms.

Viscera: Internal organs of the body cavity especially abdomen.

Vulnerary: An agent or herb used for healing wounds, sores, fresh cuts etc.

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