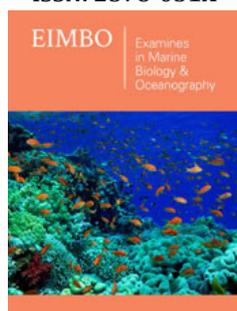


On-farm cultivation of Economically Important Medicinal and aromatic plants for rural livelihoods improvement in Chitral, Northern Pakistan

Aziz Ali*

Research Fellow, Tajikistan

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***Corresponding author:** Aziz Ali,
Research Fellow, Tajikistan

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Abstract

This article is developed after consulting and analyzing the findings of primary research on local herbal medicines, indigenous knowledge on herbs and traditional uses of these medicinal plants for several human ailments in district Chitral, northern Pakistan and reviewing intensive ancillary data and literatures on the subject from different libraries and using various search engines in the internet. The purpose of developing this article is to provide first-hand information on economically important medicinal and aromatic plants available in Chitral district regarding their local names, English names, scientific names, habitat and physical characteristics, local uses and part of the plant used in medicine, time and method of collection, traditional and medicinal uses, cultivation and propagation details, conservation issues, mitigation measures and economic value of the species, especially for the young researchers, planners, community mobilizers/social organizers and extension workers to facilitate their work for conservation, sustainable management of natural resources and poverty reduction and livelihoods improvement activities. Moreover, the study into the system of the traditional knowledge of plant use in the region will help to revive and record the diminishing traditional knowledge of plants and recurring it to local communities. In this way the orally transmitted knowledge can be conserved as part of living cultural and ecological systems helping to maintain a sense of pride in local cultural knowledge and practice, and reinforcing links between communities and the environment, so essential for conservation. Colour photographs of plants, their parts used in medicines have been incorporated between the text in order to assist the field workers, medicinal plant collectors and dealers to identify the correct plant species and to collect the appropriate part of the plant from the field which contains the active ingredients and has market value. I have tried my best to present best quality photos in the document and for this purpose I have borrowed some photos from friends and some from internet as well with due acknowledgement. In the text you may find some repetitions specially in describing methods of cultivation & propagation, conservation issues, mitigation measures etc. of the species. The mentioned captions could have been described collectively but by doing so, conscious efforts have been made to present detailed information on each species without confusing the readers, as preference of species varies with times, with individuals and markets.

Introduction

Pakistan is a developing country and about 70% of its population in rural areas where modern medical facilities are very limited. The rural population mostly depends upon Ayurvedic and Unani system of medicine for the treatment of their various ailments. Both these indigenous systems mainly depend on crude drugs of vegetable origins for the preparation of medicines used for the treatment. Medicinal and aromatic plants are important renewable natural resource and Khyber Pakhtunkhwa Province in general and Chitral district are abundantly endowed with rich wealth of medicinal and aromatic plants. Chitral, a district of the Khyber Pakhtunkhwa Province of Pakistan, lies in the remote and isolated region of Hindu Kush (one of the four grand mountain chains in Asia) on the border with Afghanistan. All human settlements, wildlife and vegetation in Chitral depend directly or indirectly on the river systems that are fed mostly by the glaciers on high mountains. This mountainous region has limited arable land and poor physical infrastructure of irrigation channels and roads. The marginal size of cultivable land is further diminishing as a result of fragmentation

when it is sub-divided among the children. The rural people depend largely on subsistence agriculture for their sustenance, producing small amounts of cereal crops using traditional agricultural practices and/or raising limited number of live-stock. Cultivation of cash crops like potatoes has begun recently in certain parts of the district and some farmers are earning a sizeable income from the production of fruits and vegetables. To supplement insufficient farm output, people are also involved in a diverse range of non-farming activities. Medicinal plants are an important natural resource in the mountainous terrain of Chitral district that play a vital role in the maintenance of human health, especially in poor communities where even relatively low-priced western medicines remain exorbitantly expensive. Despite the long tradition of usage of medicinal plants, their proven efficacy and lack of affordable alternatives, the availability of many of these plants is in jeopardy. Various factors are responsible for diminishing the valuable plant resources but nearly all have anthropogenic factors.

Over the years the medicinal plant resource is being exploited in this region, but no attention was given by the government or NGOs to promote this potential resource of economic importance, however, their growing demand in national and international markets has encouraged farmers to cultivate medicinal plants on their farms to supplement their income. Recently there is a growing realization to improve indigenous production and processing of drug plants. In developed countries, many people are turning to herbal remedies and the promotion and development of processing of plant-based products have been given a fresh impetus owing to the following ground realities:

- A. Improved education and health consciousness among people particularly in developed countries and increasing demands for naturals and organic products.
- B. Free market economy bringing in more openness and expanding market and demand for new resources, materials and products.
- C. A growing responsibility of minimizing socio-economic inequalities in favour of rural people resulting in creation of additional job and income opportunities for the poor people.
- D. Poor economic conditions in developing countries restricting import, thereby placing increased reliance on medicines using local plant resources.
- E. Increasing awareness regarding biodiversity conservation and sustainable use of plant resources [1].

Cultivation and propagation of medicinal plants

Some medicinal and aromatic herbs can be cultivated on farm or marginal lands as a supplement to household income provided the ecological and climatic conditions are conducive for the species. Ecological conditions play significant role in the production of medicinal plants. In cultivation of medicinal plants more emphasis is given on the level of active ingredients the plant contains rather the bulky yield of the plants, which is only possible if the plants grown in their natural habitat. Habitat of medicinal plants and

aromatic herbs play an important role in the development of their active ingredients such as alkaloids, volatile oil, essential oil, tannin, saponin and gums. A plant of higher elevation and temperate climate may not produce the desired level of active ingredients in lowlands and thus despite of its adoptability at lower elevation, it may not be useful for the extraction of alkaloids or other ingredients due to low level of specific chemical constituents [2]. For the purpose of cultivation and propagation there are two categories of plants in this country i.e. plants required long period of growth (3-8 years) along with higher altitudes and plants which can be cultivated with short rotation period in foothills and in plains e.g. *Plantago ovata* (ispaghol), *Carum copticum* (ajwain), *Nigella sativa* (kalonji), *Foeniculum vulgare* (sonf) and *Mentha arvensis* (podina) etc can be easily grown and commercially cultivated in plains with short rotation (SH Zaidi). However, all the important medicinal plant species selected in this paper occurring in Chitral district may not be commercially cultivated. But cultivation of these species is imperative for their conservation and sustainable management in their natural habitat and to regulate their yield on sustained basis to supply crude drugs to the local inhabitants and the markets as a source of income generation at local level.

In cultivation of medicinal plants, there are both advantages and disadvantages. The disadvantages of the collection from wild sources are that the availability of the plant is not ensured, the quality of the plant is not homogenous, the contaminations remain not known, and above all there is a possibility of depletion and consequently complete elimination of the medicinal plants from the wild or natural habitats. According to certain international regulations, such as Washington Convention of 1973, the trade and use of some of the medicinal plants collected from the wild sources are restricted. The advantages include the quality and quantity of plant materials is ensured, and it may be more economical because large area needs not be covered for collection of plants. Moreover, regulated cultivation also helps in ascertaining the optimum condition for harvesting the specific plant for maximum active ingredient at a given time. According to a paper by S. F. Hussain of PCSIR the menthol in *Mentha piperata* is maximum at the beginning of flowering, and therefore, it is best time for harvesting. The roots and tubers of some of the medicinal plants used by industries for the extraction of the active ingredients needs to be cultivated on rotational basis. For example, *Dioscorea species* (Kanis) attains maximum diosgenin content between 5-6 years. Therefore, according to the annual requirements of diosgenin, six areas may be selected in appropriate ecological zones where the plantation is carried out every year on one of these plots so that by the sixth year when the plantation is started in the sixth plot the tubers are ready to be collected from the first plot. Thus, a cycle for collection of *Dioscorea* will be formed. This would ensure a sustain supply of *Dioscorea* to the market or industry. Another important aspect in this business is the assessment and overall estimation of the produce in the region. We know that we have rich wealth of medicinal and aromatic herbs in our area, but we have no scientific information regarding its quantum with growing needs. The human pressure on medicinal plants has been escalating year after year.

The bulk of collections are made from the forests where they are categorized as “minor forest produce” and exploited through contractors and in some areas being taken for granted. Natural forest area is diminishing, and village lands have considerably shrunk. Consequently, many economically important medicinal and aromatic plant species in their natural habitat are at the verge of extinction. These issues strongly demand for conservation and sustainable management of medicinal and aromatic herbs through involvement of the local communities, creating general awareness and enhancing their capacities in on-farm cultivation, sustainable harvesting, pre and post-harvest management and marketing. In this paper on medicinal plants conscious efforts have been made to answer “How” for some of the select economically important medicinal plants of the Chitral district. However, this manual should not be taken as panacea for all related issues rather it should be taken as very initial step and humble efforts towards exploring and systematizing the immense knowledge on medicinal plants and aromatic herbs in Chitral district of Northern Pakistan. Description and related information on usage, cultivation/propagation, conservation issues, mitigation measure and economic value of some of important medicinal and aromatic plants of district Chitral are given here under:

Black Cumin/Black Zeera

- A. Scientific Name:** *Bunium persicum*
- B. Synonyms:** *Carum bulbocastanum*; *Carum carvi*; *Cuminum nigrum*
- C. Local Name:** Hojoj
- D. Family:** Umbelliferae (Apiaceae)
- E. Habitat:** Mountain slopes in central Asia and dry scrubby slopes in the Himalayas.
- F. Physical Characteristics:** Black zeera is a perennial plant growing to 0.6 m. The flowers are hermaphrodite (have both male and female organs in a single flower) and are pollinated by insects. The plant prefers light (sandy); medium (loamy) soils but also grows in heavy (clay). The plant thrives well in well-drained soils. The plant prefers acid, neutral and basic (alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It requires moist soil.
- G. Part Used:** Fruit (seed), leaves and root (bulb)
- H. Time of Collection:** June -July
- I. Method of Collection:** Zeera is collected from the field when the fruit (often called seeds) ripens in late June or in July. Locally there are two methods of Zeera collection (a) picking of ripened umbels by hand or uprooting of whole plants (b) harvesting by using sickle. In case of sporadic cover of plants in the field usually the first method is used, which is unscientific and harmful for the regeneration of plants. The later method of harvesting is used for dense zeera crop, usually set aside a piece of land by the farmers for this purpose. Locally this piece of land is called hojojili (Cumin field). Care should be taken in harvesting by sickle that the bulbs

may not be damaged as it often happened if the soil (field) is loose and wet and the sickle is blunt.

J. Local Uses

Black Zeera is collected from the field, dried and stored. The seeds are boiled in water with a little bit of salt and the decoction is given to sooth abdominal pain, dyspepsia and indigestion. Black Zeera is commonly used as flavouring agent and condiment in many local food and dishes.

Figure 1



Figure 1: Black zeera (hojoj) in bloom.

K. Medicinal Uses

Zeera is generally used as condiment, flavouring agent and as spice but it has significance in homeopathic medicines. Ripe black cumin fruits (seeds) are reported to contain an essential oil (upto 7%) rich in monoterpene aldehydes; the main components are cumin aldehyde, p-mentha-1,3-dien-7-al and p-mentha-1,4-dien-7-al (up to one third each); terpene hydrocarbons are the main components of fruits collected in the wild or harvested unripe.

L. Cultivation Process

We have very little information on this species and do not know the exact method of its cultivation. However, local experience reveals that cultivation through seed (fruit) without any treatment is quite difficult and takes long time (3-4 years) for fructification. Nevertheless, the plant likes well-drained light to medium soil with sun or light shade.

M. Propagation

Black Zeera can be propagated by seed or through bulbs. The seeds can be sown in lines or through broadcasting by mixing with sand to ensure equal distribution of seeds in the field. In case of bulb, the best method is sowing the bulbs in lines (6x6 inches plant to plant and 12x12 inches row to row). In both cases the sowing should be done in early spring or late autumn.

Figure 2



Figure 2: Fruits (seed) of black zeera.

N. Conservation issues

In Chitral district black zeera, over the years, has been continuously diminishing from its natural habitat because of several reasons including increasing human as well as livestock population, intensive agricultural practices, prolonged drought and over-exploitation by this species for commercial reasons. This species has great economic potential to contribute to rural livelihoods in the mountain community and needs conscious efforts not only for its conservation in its natural habitat but also for on-farm cultivation through encouraging local interested entrepreneurs.

O. Mitigation measures

The fast diminution of this species can be checked by creating awareness among the community regarding the importance of this species through training and workshops at the local level. Special training is also needed for local plant collectors in proper harvesting of this species in the wild as well as in the farms or marginal lands. By encouraging on-farm cultivation of this species, the pressure on the natural habitat of Zeera can be substantially reduced.

P. Economic value

Black zeera fetches good prices in local as well as in national markets. Locally kg of black zeera costs Rs. 800 and at national markets the prices range from 1200-1500/kg.

Caper/Kavir

A. Scientific Name: *Capparis spinosa*

B. Synonyms: *Capparis aegyptia*

C. Local Name: Kavir

D. Family: Capparidaceae

E. Habitat: Probably originated from dry regions in west or central Asia. Kavir grows on rocky slopes up to 3000 meters in the

Himalayas.

F. Physical Characteristics: Caper plants are small shrubs and may reach about one meter upright. However, wild caper plants are more often seen hanging, draped and sprawling as they scramble over soil and rocks. Kavir thrives well in hot dry exposed sites receiving intensive sunlight. Plants are productive in areas having 350mm annual precipitation falling mostly in winter and spring months and easily survive under temperatures higher than 35-40°C. However, caper is a cold tender plant and has a temperature hardiness range like the olive tree i.e. -8°C. Plants grow well in nutrient-poor, sharply-drained gravel soils. Mature plants develop large, extensive root systems that penetrate deeply into the earth. The caper's vegetative canopy covers soil surfaces against torrential rains, which helps to conserve soil in the fragile mountains and uphold water reserves. Leaf stipules may be formed into spines. Flowers are born on first-year branches and are hermaphrodite.

G. Part Used: the unexpanded or half-expanded floral buds and fruits

Figure 3



Figure 3: Kavir/Caper plant.

H. Time of Collection: May-June

I. Method of Collection: The unopened or half-opened floral buds of Kavir are collected by hand in the morning preferably on dry days. Harvesting is carried out intermittently from the wild throughout the growing season, as there is no tradition of on-farm cultivation of this species.

J. Local Uses:

The unexpanded or half-expanded floral buds of Kavir are collected and put in an earthen vessel with water and kept in the rooftop under the open sky for at least seven days. The floral buds are then separated from the water, dried and stored. A very popular vegetable is prepared from these floral buds locally called

Kavirogh, which is used as food. This Kavirogh is also given to the typhoid and malaria sufferers. The water from the earthen vessel is also considered to be very effective against typhoid, malaria and abdominal pain.

The dried fruit locally called Chuntique is collected and mashed up, with few drops of water, and with pestle and mortar into a thick paste. From this paste small balls are made, dried and stored. These balls later on are used for face pack (Puru) to cleanse and clear the face from pimples and as well as a sun block. "Parpi", a legendary drug, is allegedly collected from the root tip of Caper (Kavir) and is, according to local Hakims and Tabibs, the remedy of every kind of ailments and diseases. Kavir is a xerophytic and deep-rooted species and it is very difficult to dig out the root tip from the soil and is very rarely accessible.

K. Medicinal Uses

Capers are said to reduce flatulence and to be anti-rheumatic in effect. In Ayurvedic medicine capers are recorded as hepatic stimulants and protectors, improving liver function. Capers have reported uses for arteriosclerosis, as diuretics, kidney disinfectants, vermifuges and tonics. Capers contain considerable amounts of the anti-oxidant bioflavonoid rutin. The root-bark is analgesic, anthelmintic, antihemorrhoidal, aperient, deobstruent, depurative, diuretic, emmenagogue, expectorant, tonic and vasoconstrictive. It is used internally in the treatment of gastrointestinal infections, diarrhoea, gout and rheumatism. Externally, it is used to treat skin conditions, capillary weakness and easy bruising. The bark is harvested in the autumn and dried for later use. The stem bark is bitter and diuretic. If taken before meals it will increase the appetite. The unopened flower buds are laxative. They are used internally in the treatment of coughs, and externally to treat eye infections. They are harvested before the flowers open and can be pickled for later use. When prepared correctly they are said to ease stomach pain. A decoction of the plant is used to treat vaginal thrush. The leaves are bruised and applied as a poultice in the treatment of gout. The flower buds are pickled and used as a flavouring in sauces, salads etc. The young fruits and tender branch tips can also be pickled and used as a condiment. The flower buds are harvested in the early morning and wilted before pickling them in white vinegar.

L. Cultivation Process

Contrary to other countries cultivation of Caper has not been reported elsewhere in Pakistan. The plant is available in wild and the plant collectors are collecting the buds. For cultivation this species requires a well-drained dry position in full sun. It tolerates a pH in the range 6.3 to 8.3. This species is not hardy in the colder areas of the country it tolerates temperatures down to between -5 to -10°C. Being a perennial species, this plant produces annual stems from a woody base. In Egypt, Iran, Italy, Cyprus, Greece and Spain etc capers are often cultivated for their aromatic flower buds, which are used as a condiment, they are also frequently gathered from the wild. Generally, the most common cultivated form tends to be spineless i.e. *Capparis spinosa-inermis*. This variety can be grown

in anything from a light to a heavy soil mixture. For optimal results it is preferable to plant in a well-drained soil. As far as hardiness goes, this variety can be a little temperamental.

M. Propagation

Capers are propagated by seeds and the seeds best sown as soon as they ripe. The seed can be raised in a gravel medium in small trays and the seedlings should be pricked out from the frame/tray into individual pots of well-drained soil when they are large enough to handle. Grow on the young plants for at least their first winter in a greenhouse and plant out in late spring or early summer. Figure 4



Figure 4: Dried capers.

Caper seeds are miniscule and are slow to nurture into transplantable seedlings. Fresh caper seeds germinate readily but only in low percentages. Dried seeds become dormant and are notably difficult to germinate and therefore require extra measures to grow. Dried seeds should be initially immersed in warm water at 40°C and then let soak for 1 day. Seeds should be wrapped in a moist cloth, placed in a sealed glass jar and kept in the refrigerator for 2-3 months. After refrigeration, soak the seeds again in warm water overnight. Plant the seeds about 1 cm deep in a loose well-drained soil media. Transplanting is carried out during the wet winter and spring periods, and first-year plants are mulched with stones. In Italy, plants are spaced 2 to 2.5 meters apart (depending on the roughness of the topography; about 2,000 plants per hectare). A full yield is expected in 3 to 4 years. Plants are pruned back in winter to remove dead wood. Pruning is crucial to high production. Heavy branch pruning is necessary, as flower buds arise on one-year-old branches. Three-year-old plants will yield 1 to 3 kilograms of caper flower buds per plant. Caper plantings will last 20 to 30 years.

N. Conservation issues

Traditionally this species has been remained an important component of Khow (Chitrali) cuisine as well as remedy for variety of human ailments in Chitral. Up till in the recent past there was no any conservation issue regarding this species and the plant

used to grow abundantly in the foothills and slopes of Chitral. During the last decade there is drastic decline in the population of this species in its natural habitat has been observed. It is mainly because of prolong drought conditions and increase in human as well as livestock population in the region. Moreover, the people also become more aware regarding the importance of this species as medicine as well as food and source of income for the poor people, thus the over exploitation got impetus over a couple of years and because of this the population of this species is rapidly declining in the region.

O. Mitigation measures

In-situ conservation by creating awareness regarding the importance of this species among the community and capacity building of the key members of the community in conservation and sustainable management of economically important plant species in the region.

P. Economic Value

Dioscorides mentioned capers as being a marketable product of the ancient Greeks. Locally dried capers are being sold Rs.1000/200kg (dried) and nationally it is up to Rs.1500/kg.

Hing/Stinking Gum

A. **Scientific Name:** *Ferula narthex*

B. **Synonyms:** *Ferula asafoetida*, *Narthex asafoetida*, Hing asafoetida

C. **Local Name:** Rao, hing

D. **Family:** Apiaceae

E. **Habitat:** Mountain slopes in West Asia from Afghanistan to Pakistan-northern Pakistan and Baluchistan.

F. **Physical Characteristics:** In Chitral *Rao* grows in the up hills and dry slopes above 2000 meters. It is a perennial plant and grows up to 2 - 2.5 meters in size. It flowers from June to July depending on elevation. Flowers are hermaphrodite (have both male and female organs) Pollination is carried out by insects. The whole plant is very strong smelling. This species prefers sandy and loamy well-drained soils. It cannot grow in the shade, but it can survive in dry or moist soil.

G. **Part Used:** Gum, stem, leaves and roots

H. **Time of Collection:** June -July

I. **Method of Collection:** Traditionally *Rao* is collected from the wild by hand or sometimes using sickles to cut the branches or whole plant. Sometimes the whole plant is uprooted when there is need of roots or based on the rarity of plants in the wild. For extraction of the gum from the plant instead of giving incision into the plant usually the whole plant is cut at ground level without considering the seed setting and its natural regeneration in the wild. This is because of lack of knowledge and awareness on the part of plant collectors and is one of the major factors of alarmingly depletion of this species from the wild.

J. Local Uses

Leaves and young shoots are edible and used as potherb and the gum obtained from the roots and stem by making incisions (hing) is used as a condiment and as medicine. Locally this species is used for coughs, asthma, toothache, gastric problems and constipation.

Figure 5



Figure 5: *Ferula narthex* (Rao) Phasti Chitral.

If incision is made vertically down the stems of mature *Rao*, a milky liquid exudes, left for a day, the liquid thickens (locally called hing) and is collected. This hing is used against kudakan (child's disease) and is also effective against cough, asthma (damkuthahi) and in some areas it is used for toothache. The bitter tasting stem is also eaten raw for constipation and gastric problems. The dried roots of *Rao* are ground and mixed with boiling barley (about 200 grams to 2 kg of barley) and are given to cows as a foodstuff to prepare them for mating.

K. Medicinal Uses

Medicinally the gum resin obtained from the root is anthelmintic, antispasmodic, expectorant and nervine. It is used in the treatment of asthma, whooping cough, flatulent colic, and in pneumonia and bronchitis in children. The leaves are carminative and diaphoretic. The plant has recently been investigated as a potential contraceptive. The root is a source of the gum asafoetida, it is used as a condiment and as a medicine. It is obtained by incision of the roots.

L. Cultivation Process

Although there is no tradition of cultivation of drug plants like *Rao* in Malakand Division but because of recent progress towards realization of the economic importance of these plants and their scarcity in their natural habit, it becomes imperative to take initiatives for the conservation and sustainable management of the economically important medicinal plants in this region through training and information sharing with community. For cultivation *Rao* requires a deep fertile soil in a well-exposed sunny position. The species is not too hardy but can tolerate -5 to -10°C. The whole

plant is very strong smelling. Plants have a long taproot and are intolerant of root disturbance. They should be planted into their final positions as soon as the plants are in the position to handle. Fresh seeds generate optimum results.

Figure 6



Figure 6: Root of Ferula/hing.

M. Propagation

This species can be propagated by means of seed; the best method is to sow the seeds as soon as they ripen. The young seedlings should be transplanted into permanent positions as soon as they are large enough to be handled because the plants dislike root disturbance. Artificial cultivation of this plant in farmlands would be beneficial for the rural poor and contribute towards conservation of wild population of this species.

N. Conservation issues

Owing to the usefulness of this species for different local remedies, many local people and nomadic gujurs are actively involved in collection and marketing of this drug plant. The collectors being ignorant uproot and over exploit this important medicinal plant in unscientific and unsustainable ways. Consequently, the plant is disappearing from the wild and becoming rare in its natural habitat.

O. Mitigation measures

A general awareness regarding the importance of the drug plants and their sustainable harvest and management is needed for the community. The on- farm cultivation and linkages of farmers with relevant markets can play effective role in this regard. This species can be propagated by means of seed; the best method is to sow the seeds as soon as they ripen. Artificial cultivation of this plant in farmlands would be beneficial for the rural poor and contribute towards conservation of wild population of this species.

P. Economic Value

Rao (hing) has a good market and locally hing is available for Rs. 10,000-12000kg. In the national market is Rs and in the international market the price of hing is Rs 15,000kg.

Himalayan Peony/Mamekh

A. Scientific Name: *Paeonia emodi*

B. Synonyms: Peony/Mamekhi

C. Local Name: Mamekhi

D. Family: Paeoniaceae

E. Habitat: Forest and scrub, often gregarious, 1800 - 2500 metres

F. Physical Characteristics: Mamekhi is herbaceous or shrubby, perennial, erect, high up to one meter with a cluster of fleshy tuberous roots. In Chitral it is found on the fringes of coniferous forest and dry slopes at altitudes 2000-3000 meters. It flowers from May to June and the fruits ripen from June to July. Stem somewhat woody, leaves alternate and divided into distinct leaflets. Flowers are white, showy, 7-10cm in diameter, usually solitary sometimes in groups of two or three. Seeds are shiny, black and smooth. Himalayan peony grows well in cool climate of the hilly areas. Well thrive in deep, rich and moist loamy soils. This species prefers moist and humid environment.

G. Part Used: Tuberous Roots

H. Time of Collection: October -November

I. Method of Collection: Medicinal Plant collectors and nomads who roam around in the pastures with their livestock collect roots of Mamekhi locally in the month of October-November. The roots are uprooted manually by pulling the plants or sometimes dig out using pickaxe. The roots are then washed to remove the soil particles attached to the roots then the roots are dried usually under open sun and sometimes under shade. Then the dehydrated roots are stored or sent to market in envelopes or sachet of various sizes depending on the quantity collected by the individuals. Without knowing some collectors uproot young plants of this species which yet not developed the active ingredients in their roots, which is useless and should be avoided. The recommended time for collection in October or November when the plants shed seeds and the plant is 4-5 years old.

Figure 7



Figure 7: Himalayan peony in Madaklasht pasture.

J. Local Uses

Tuberous roots of mamekhi are collected from the high pastures, cleaned and chopped into pieces. These are then boiled in water and the decoction is used for lumbago, colic, and uterine diseases. It is also sometimes given to children as blood purifier. The dried roots are ground to a powder, mixed with flour, water and two eggs to make a thin paste. From this paste thin bread locally called Resheki is prepared which is given to women to aid pregnancy.

K. Medicinal Uses

In ancient reports it has been mentioned that this drug plant was used by Avicenna and Baitar as brain and nerve tonic, remedy for epilepsy and as a tranquilizer, however, not much scientific data are available to supplement these ancient reports. The fleshy tubers are a useful medicine for the treatment of hysteria, convulsions, colic, uterine diseases and obstructions of the bile duct. They are given to children as a blood purifier. The seeds are cathartic and emetic. An infusion of the dried flowers is useful in the treatment of diarrhoea. A tea made from the dried crushed petals of peony flowers has been used as a cough remedy, and as a treatment for haemorrhoids and varicose veins.

L. Cultivation Process

Himalayan peony needs a deep rich soil, preferably neutral or slightly alkaline, Thrive quite well in sun or light shade. It is best grown amongst shrubs, doing better when given some shade. Plants are tolerant of a wide range of soil conditions but will not survive if the soil becomes waterlogged or is too dry. This species is lime tolerant. Plants grown on sandy soils tend to produce more leaves and fewer flowers, whilst those growing on clay take longer to become established but produce better blooms. Mamekhi plants are hardy to about -20°C. Mamekhi is very greedy plant inhibiting the growth of nearby plants, especially legumes. Strongly resents root disturbance, taking some time to recover after being divided. Plants take 4-5 years to flower from seed. They generally breed true from seed.

M. Propagation



Figure 8: Roots of Mamekhi

The plant can be propagated by vegetative means as well as by seeds. In case of vegetative propagation, the fleshy tuberous roots are cut into small pieces and sown at 20-30cm in October and November. It grows well in the cool climate of hilly areas,

thrives in a deep rich moist loamy soil. It prefers a moist and humid environment. In case of seed the best method of propagation of peony is to sow the seeds as soon as it is ripe. When sown fresh, the seed produces a root about 6 weeks after sowing with shoots formed in the spring. Stored seed is much slower; it should be sown as soon as possible but may take 12-18 months or more to germinate.

Figure 8

The roots are very sensitive to disturbance; so many growers allow the seedlings to remain in their pots for 2 growing seasons before potting them up. This allows a better root system to develop that is more resilient to disturbance. If following this practice, make sure you sow the seed thinly. The seedlings should be pricked out into individual pots or in permanent positions as soon as they are large enough to handle. Division with great care in spring or autumn. Each portion must have a leaf bud. If the lifted root is stood in shade for several hours, it becomes less brittle and easier to divide. Divisions that have several buds will usually flower in the second year, but those that only have one or two buds will take several years before they have grown sufficiently to flower.

N. Conservation issues

This species has been under severe pressure due to indiscriminate harvesting of natural forest, over exploitation, over grazing and loss of habitat; the population of this plant is diminishing with the increasing human as well as livestock population. The traditional method of collection by uprooting the plants manually or using pickaxe and removing complete root system before seed shedding have jeopardised the very survival of this species in its natural habitat in this region. This species has been declared as vulnerable by IUCN- the world conservation union, because of rapid depletion of population of this species from its natural environment.

O. Mitigation measures

In order to conserve this valuable plant species in its natural habitat the most important thing is to create awareness among the communities regarding the importance of this species, its conservation, major threats and the ways of sustainably managing such resources in the area. Collection of young plants of one to 2 years should be avoided and it should be ensured that the mature plants should only be collected after shedding of seeds in October-November. After extracting the roots, the remaining plant materials should not be removed from that place, as the seed and some part of roots are very important sources of regeneration of the species in the area. Artificial propagation of this species would not only meet the increasing market demand for this plant but would be an income generating activity in remote villages of the district. Moreover, the increasing pressure on the wild population of this species would also be reduced up to a certain extent.

P. Economic Value

Mamekhi roots are available in the local market at the rate of Rs. 600-800 per kg. In the national and international market, the price of a kg mamekhi is approximately Rs. 1000-1500 respectively.

Chilghoza Pine

A. Scientific Name: *Pinus gerardiana*

B. Synonyms: *Pinus gerardii*

C. Local Name: Chilghoza

D. Family: Pinaceae

E. Habitat: Mountain slopes in the North-western Himalayas are the natural habitat of this species. Thrives well in dry inner valleys, usually on limestone, 2000 to 3000 metres. Gregarious on dry steep rocky slopes on granite or clay slate in areas beyond the reach of the south-western monsoons.

F. Physical Characteristics: Chilghoza pine tree is an evergreen medium sized tree 10-15m tall. Crown usually deep, wide and open with long erect branches. Bark very flaky, peeling to reveal light greyish-green patches. Leaves in fascicles of 3 and 6-10cm long. Flowers are monoecious and pollinated by wind. Female cones 12-20cm long, about 10cm wide when open. Seeds (nuts) more than 2cm long with rudimentary wing. The seeds are not shed but are retained by the wing adhered to the base of the scale. Annual growth rate is about 30cm and thrive well in full sunny situation.

G. Part Used: Seed (Nuts)

H. Time of Collection: Mid-August-September

I. Method of Collection: In Chitral and other Chilghoza growing areas in NWFP Chilghoza nuts are collected in a traditional way by beating the tree with long sticks, which not only damages the tree by injuring the branches and making them susceptible to various pathogens but the young cones of first year are also shattered. This ill practice of harvesting of pine nuts is continuous threat for the very survival of this rare Himalayan tree species.

Figure 9



Figure 9: Chilghoza tree in Chitralgol National Park.

J. Local Uses

Chilghoza pine is found in small patches in southern Chitral and associated with deodar (*Cedrus deodara*), blue pine (*Pinus wallichiana*) and oak (*Quercus ilex*). Seeds-raw or cooked are rich

in oil, they have a pleasant flavour with a hint of resin and is used locally as a staple food like pistachio nuts. The nuts of this species are valued for its taste and vigour and has good market. Locally it is used for various ailments like weakness, indigestion and as tonic. Moreover, it is useful in weakness of limbs, paralysis, deafness, pain in the joints and chronic bronchitis. The oil extracted from the kernels is locally valued highly for its stimulating and healing power. The wood of this species has been used locally as torch wood and still used as igniter to wet wood among the people who are living in the periphery and fringes of these forests.

K. Medicinal Uses

The pine nut (seed) is anodyne and stimulant. The oil extracted from the seeds is used as a dressing on wounds and ulcers. The oil is also used for the treatment of headache and related diseases. The turpentine obtained from the resin of all pine trees is antiseptic, diuretic, rubefacient and vermifuge. It is a valuable remedy used internally in the treatment of kidney and bladder complaints and is used both internally and as a rub and steam bath in the treatment of rheumatic infections. It is also very beneficial to the respiratory system and so is useful in treating diseases of the mucous membranes and respiratory complaints such as coughs, colds, influenza and tuberculosis. Externally it is a very beneficial treatment for a variety of skin complaints, wounds, sores, burns, boils etc and is used in the form of liniment plasters, poultices, herbal steam baths and inhalers.

L. Cultivation Process

Chilghoza pine thrives in a light well-drained sandy or gravelly loam soils. The plant dislikes poorly drained soils. The established plants of Chilghoza can tolerate drought up to a certain extent. Chilghoza is a slow growing tree and this species is cultivated for its edible seed (nuts) in Asia. Plants are strongly out breeding; self-fertilized seed usually grows poorly and often hybridise freely with other members of this genus. Leaf secretions of this species inhibit the germination of seeds, thereby reducing the amount of plants that can grow beneath the tree and surrounding area. This plant species can be successfully grown in areas where the soil quality is of a poor standard i.e. lacking in enough nutrients. This plant species does tolerate heavy clay soils as well. Chilghoza can be grown in any soil from a light to a heavy soil mixture. For optimal results it is preferable to plant in a well-drained soil. The plant prefers a position within full sun.

M. Propagation

The species can be easily propagated by seeds. The seeds are sown in polythene tubes in a nursery. It is best to sow the seed soon after the seeds ripen in individual pots or polythene tubes in a wooden frame preferably in early winter. The soil, sand, farmyard manure and if possible, humus should be mixed in equal proportion to fill the pots or tubes. In case of old or stored seeds a short stratification of 6weeks at 4°C can improve the germination percentage. Plant seedlings out into their permanent positions as soon as possible (size 30-50cm) and protect them for their first winter or two. Plants have a very sparse root system and the sooner

they are planted into their permanent positions the better they will grow. We plant them out when they are about 10-20cm tall. Another method of propagation is through cutting. In this method cuttings are taken from young trees i.e. less than 10years old trees. Disbudding the shoots few weeks before taking the cuttings may help for better success rate. Root initiating hormones like Indole Acetic Acid (IAA) etc will further support towards this end, but cuttings are normally very slow to grow, thus not recommended.

N. Conservation issues

Over the years the community people particularly the people who are living in the fringes of these forests have been exploiting the Chilgoza trees as fuelwood and for lighting purposes. This species has been the only source of lighting (torch wood) before the introduction of kerosene to this region till late 1960. In some places in southern Chitral the people still use this precious species as fuel and igniter to wet wood. The indiscriminate and ruthless cutting of this valuable tree for fuelwood has resulted in the degradation of the Chilgoza forests in Chitral. Owing to the increasing demand for and scarcity of timber this species is also used in some areas for timber purposes, which worsens its precarious status. The nuts of this tree are being over harvested, and, in some cases, the local people remove 100% cones from trees. As a result, there is virtually no natural regeneration of this species, which is vital for sustainability of any species. The nuts are sold in the market as dry fruit and fetch a good price. The business of pine nuts was very limited in the past and very few people were involved in nut collection. This business got impetus over a couple of years because of the involvement of middlemen from down country specially businessmen from Banu and Waziristan and the high demand from Middle East Countries.

Figure 10



Figure 10: Opened cones of Chilgoza.

According to certain quarters the current pine nuts trade somewhere in the region is of 60-70 million rupees a volume, which continues to grow each year. The businessmen from Banu and Waziristan were the pioneers of the trade in Chitral and continue to dominate the market with virtually no locals involved even at the smallest scale. Owing to the mentioned causes this unique tree species has become locally endangered in this region and requires immediate conservation measures. This species has also been listed

as lower risk, near threatened ("LR/nt") by the World Conservation Monitoring Centre-Tree Database.

O. Mitigation measures

The throbbing issue of over exploitation of Chilgoza can be averted by creating community awareness and imparting training to the concerned people who are involved in collection of Chilgoza regarding improved method of harvesting and sustainable management of Chilgoza forests. Majority of the people belong to poor segment of the society, which is dependent on natural forest for their livelihoods. Creating awareness and providing necessary training regarding conservation and sustainable management of natural resources in the area, will facilitate the community and enhance their capacities in scientific and sustainable harvesting of pine nuts without exerting any strain on the crop and enhance their gains from pine nuts by eradicating the role of middlemen and linking the community direct with the market to enhance profit margin on the sale of pine nuts. Innovation for Poverty Reduction Project (IPRP) - an SDC funded project and IUCN Chitral have initiated a joint small-scale pilot project on conservation and sustainable management of this species in Shishikoh valley southern Chitral. In this connection necessary baseline studies have been carried out by both the partner organizations. Necessary tool/kits and basic trainings in Chilgoza harvesting have also been imparted to the target community. Market study has been carried out by IPRP and target groups have been formed in the valleys and linkages have been developed for collective marketing of pine nuts, thus enhancing profit margin of the community by 77% within short span of time.

There are some other potential sites in southern Chitral to extend and replicate this project and there is high demand both from the communities and district government for the replication of this project. In this connection initial discussions held with IPRP and both the partners in principle agreed to replicate the project in other valleys based on the success stories and experiences from Shishikoh valley.

Figure 11



Figure 11: Chilgoza nuts above and kernels below.

P. Economic Value

Locally Chilgoza nuts with shell are sold for Rs. 2000/kg; in national market the prices are between Rs. 3000 and in international market the price for a kg nut is more than Rs.5000.

Anjabar/Knotweed

A. Scientific Name: *Bistorta mplexicaule*

B. Synonyms: *Polygonum bistorta*

C. Local Name: Anjabar

D. Family: Polygonaceae

E. Habitat: Damp meadows and along watercourses, especially on acid soils.

Shaded grassy places in valleys, mixed forests on mountain slopes from 1000-3300meters elevations.

F. Physical Characteristics

Anjabar is a perennial herb often grows wild in damp and moist soils. Stem is erect 45-10cm tall. Foliage basal leaves 3-9" long and 1-5" wide, dark green often with prominent white mid vein. Petiole 5-10cm. Flowers tightly clustered spike 2-4" long on a leafless stalk (peduncle) above foliage, pink to red in colour.

G. Part Used: Roots and rhizomes

H. Time of Collection: September -October

I. Method of Collection

Traditionally the roots are uprooted from the moist soils and fringes of the forests and in some places small pickaxe is used to dig out the rhizomes of this species by the local people and plant collectors. The best method of collection is to collect the plant when its stem gets rigid and the plant reaches its maturity, sheds seeds and the root stores maximum active ingredients.

J. Local Uses

Locally the roots and rhizomes of Anjabar are collected, dried and ground into powder. The powdered rhizomes of this herb are used to treat chronic diarrhoea, excessive bleeding from any part of the body, and externally on fresh wounds to stop bleeding.

Figure 12



Figure 12: Anjabar- *Polygonum bistorta*

K. Medicinal Uses

Although no specific mention has been made for this species, there have been reports that some members of this genus can cause photosensitivity in susceptible people. Many species also contain oxalic acid (the distinctive lemony flavour of sorrel) - whilst not toxic this substance can bind up other minerals making them unavailable to the body and leading to mineral deficiency. Having said that, several common foods such as sorrel and rhubarb contain oxalic acid and the leaves of most members of this genus are nutritious and beneficial to eat in moderate quantities. Cooking the leaves will reduce their content of oxalic acid. People with a tendency to rheumatism, arthritis, gout, kidney stones or hyperacidity should take especial caution if including this plant in their diet since it can aggravate their condition.

L. Cultivation Process

Like other medicinal plants no cultivation of this species in Malakand division has been reported. It grows wild in moist places i.e. along the irrigation channels, in the paddy fields and in forest fringes where moisture is available. Succeeds in an ordinary garden soil but prefers a moisture retentive not too fertile soil in sun or part shade. The plant repays generous treatment. A very cold-hardy plant, tolerating temperatures down to at least -25°C. Anjabar plants are somewhat spreading, forming quite extensive colonies especially in low-lying pastures and wasteland where there is enough moisture.

M. Propagation

Anjabar is easily propagated by seed. Seeds are sown in early spring in a well-prepared bed or frame. Germination is usually free and easy. Can also be propagated through division of rhizomes in spring or autumn.

N. Conservation issues

Like other economically important medicinal herbs Anjabar is also being ruthlessly exploited by many plant collectors in this region. Ever increasing human as well as livestock population put continuous pressure on all wild resources. Land fragmentation and high degree of urbanization have negative impact on these resources, as the marginal lands are rapidly coming under built up environment at the expense of natural resources. Majority of plant collectors being ignorant collect the young plants which have no medicinal value.

O. Mitigation measures

Mitigation measures include: Plant should not be collected before seed setting and shedding; young plant should not be uprooted; only the mature and thick rooted plants have medicinal as well as market value; where there population of this species is sparse it is very important not to remove all the plants from the site rather one fourth plants should be preserved in the natural habitat of the species. Creating awareness among the local communities regarding the importance of this drug plant for the communities and their coming generations; capacity building of select community members in sustainable harvest of medicinal and aromatic plants,

promotion of local entrepreneurs and develop linkages with national and international markets to generate income from the medicinal plant resources at local level. Proper research and study to assess the available quantum of the species in the region and population trend of the species are crucial towards better planning for sustainable management of the medicinal and aromatic plants resource.

P. Economic Value

At the local market the roots and rhizomes of Anjabar are sold at the rate of Rs 800 In national and international markets the prices are Rs 1000 and Rs 3000 respectively.

Barberry / Chowenj

A. **Scientific Name:** *Berberis vulgaris*

B. **Synonyms:** *Berberis parkeriana*

C. **Local Name:** Chowenj

D. **Family:** Berberidaceae

E. **Habitat:** Hedges, roadsides, along the field boundaries and irrigation channels, clearings etc, often preferring a sunny position.

F. Physical Characteristics

Barberry is a medium sized thorny shrub. This species is deciduous in nature i.e. it loses its leaves each year. The flowers are hermaphrodite i.e. having both male and female organs in a single flower. The flowers are yellow in colour and in a cluster form and pollinated by insects. This species is generally considered hardy and frost tolerant.

G. **Part Used:** Leaves, fruit, roots & stem bark

H. **Time of Collection:** September to November

I. **Method of Collection:** Traditionally fruits are collected by hands when they ripen in August to September, leaves are collected fresh and roots are dugout using pickaxe throughout the summer. The best method of collection is in autumn when the seed ripens and the roots store maximum quantity of active ingredients. the dug roots should wash and cleaned then dried in shade and chopped into small pieces of 1.5 to 2.5inches and stored in dry places. The bark of the stem has also medicinal as well as market value and this should also be removed by removing the small twigs from the main stems and by slightly hammering the stem the bark can be easily removed and then the bark should be treated in the same fashion for storage and marketing as in case of roots.

J. Local Uses

Young leaves re-collected, crushed and a paste is obtained which is mixed with soup (Kali) and is given to the patient of chronic fever. Juice is extracted from the ripen fruits by crushing them and after filtering through a muslin cloth the juice is stored in bottles. This juice is used as blood purifier and sometimes also added to Kali and used against fever. The root is considered to be most effective part

of this plant. Roots are dug out, cleaned and chopped into small pieces and boiled in water for 2-4 hours. Then the decoction is stored in bottles and is given to the patient of backache and boils. When the decoction is further boiled for 6-8 hours you may get a thicken paste locally called "gholja". From this gholja small tablets are made and are given to the patients of urinary tract infection (UTI) twice a day for the three consecutive days. Eggs and butter should be included in the diet.

Figure 13



Figure 13: *Berberis vulgaris*.

K. Medicinal Uses

Barberries have long been used as herbal remedy for the treatment of a variety of complaints. All parts of the plant can be used, the plant is mainly used nowadays as a tonic to the gallbladder to improve the flow of bile and ameliorate conditions such as gallbladder pain, gallstones and jaundice. The bark and root bark are antiseptic, astringent, cholagogue, hepatic, purgative, refrigerant, stomachic and tonic. The bark is harvested in the summer and can be dried for storing. It is especially useful in cases of jaundice, general debility and biliousness, but should be used with caution. The flowers and the stem bark are antirheumatic. The roots are astringent and antiseptic. They have been pulverized in a little water and used to treat mouth ulcers. A tea of the roots and stems has been used to treat stomach ulcers. The root bark has also been used as a purgative and treatment for diarrhoea and is diaphoretic. A tincture of the root bark has been used in the treatment of rheumatism, sciatica etc. The root bark is a rich source of the alkaloid berberine (about 6%). Berberine, universally present in rhizomes of *Berberis* species, has marked antibacterial effects. Since it is not appreciably absorbed by the body, it is used orally in the treatment of various enteric infections, especially bacillary dysentery. It should not be used with *Glycyrrhiza* species (i.e. Liquorice or Moyu or Muruk) because this nullifies the effects of the berberine. Berberine has also shown antitumour activity and is also effective in the treatment of hypersensitive eyes, inflamed

lids and conjunctivitis. A tea made from the fruits is antipruritic, antiseptic, appetizer, astringent, diuretic, expectorant and laxative. It is also used as a febrifuge. The fruit, or freshly pressed juice, is used in the treatment of liver and gall bladder problems, kidney stones, menstrual pains etc. The leaves are astringent and antiscorbutic. A tea made from the leaves is used in the treatment of coughs. The plant (probably the inner bark) is used by homeopaths as a valuable remedy for kidney and liver insufficiency.

L. Cultivation Process

This plant prefers a warm moist loamy soil, but it is by no means fastidious, succeeding in thin, dry and shallow soils. It grows well in heavy clay soils, succeeds in full sun or light shade but requires a moist soil when grown in the shade of trees. Hardy to about -35°C. It can be pruned back quite severely, it re-sprouts well from the base.

M. Propagation

The plant can be propagated vegetatively by cuttings and by suckers. Can also be grown by seeds.

Figure 14



Figure 14: Barberry roots.

In case of propagation through seeds, optimum result can be achieved when sown as soon as the seeds ripe in a bed or frame. When the seedlings are large enough to handle, prick them out into individual pots or if growth is enough growing them on in their permanent position. Germination averages out at about 90%. Cuttings can be obtained from the mature wood of the current season's growth preferably in early spring before the leaves sprout and it is easy to propagate this species. Suckers can also be obtained from the mature plants and can be planted in late autumn and or early spring.

N. Conservation issues

The major conservation issues for this species are lack of information regarding the medicinal as well as economic value of the plant by the community. The community people consider this species as obnoxious weed and removing it ruthlessly from their farmlands and field boundaries without knowing the values of the important plant species. In some areas the community people

collect this species for fuel purposes. In some areas of Malakand Division the plant collectors dig out the roots commercially, which is the big threat for the very survival of this species. Thus, population of this plant species is declining rapidly in this region.

O. Mitigation measures

General awareness should be created among the masses regarding the medicinal and economic values of these plants and the importance of their conservation and protection for the coming generation. Moreover, capacity building of the select local community members in handling and managing medicinal plants would contribute towards conservation and management of this species. Furthermore, entrepreneurs should be developed around commercially important drug plants and linkages should also be established between the local entrepreneurs and local and national markets in order to generate income at local level from medicinal plants.

P. Economic Value

Dry fruits of barberry, roots and barks are available in the local market. Fruits are Rs. 500-800/kg and Roots and barks are about Rs. 1000-1200/kg.

Sea-buck-thorn/Mirghinz

A. Scientific Name: *Hippophae rhamnoides var. turkistanica*

B. Synonyms: *Hippophae rhamnoides*

C. Local Name: Mirghinz

D. Family: Elaeagnaceae

E. Habitat: Cold temperate regions of the world i.e. in the Hindukush Himalayan region, adjoining areas of China, parts of Europe and former USSR as well as in the Scandinavian region.

F. Physical Characteristics

Mirghinz is a deciduous and spiny shrub or sometimes developed into a small tree of 1-4 meters, however it grows more up to 10 meters where there is enough water available. The leaves are small usually 3-8cm long and 0.4-1cm wide, linear, lanceolate and covered on the backside with silvery stellate scales that reflects sunshine and reduce moisture loss. Mirghinz plants are either male or female. The male produces pollen and having flowers without petals. Each male flower contains four stamens. The female flowers produce fruit and seeds and have flowers without petals also. Female flowers depend on wind for pollination.

G. Part Used: Fruits

H. Time of Collection: September- November

I. Method of Collection: No mechanised method for collection of the berries from Mirghinz has been introduced in this region. The people use traditional methods i.e. either picking seeds by hand (very laborious job) or by cutting the main branches with axe instead of selective cutting of fruit bearing twigs, which is injurious to plants.

Figure 15



Figure 15: Mirghinz Begusht Chitral.

J. Local Uses

Mirghinz berries are collected, dried and ground into a paste which is applied around irritated eyes. It is considered most effective when used in early morning and before going to bed. The juice is extracted from ripen berries and given to the people with abdominal pain and as an anthelmintic. The paste is also applied to split heels, a condition often resulting from wearing chapels (sandals). In some places the ripen berries are also eaten by children.

K. Medicinal Uses

The pharmacological Committee of Ministry of public health of the former USSR approved sea buckthorn oil for clinical use in hospital in 1966. Several drugs have been developed from sea buckthorn which are available in different form e.g. liquid, powder, plasters paste, pills, suppositories etc for different ailments and diseases. These drugs are being used for oral mucositis, rectum mucositis, vaginal mucositis, cervical erosion, radiation damage, burns, scalds, duodenal ulcers, gastric ulcers, chilblains, skin ulcers caused by malnutrition and other skin damages. The most important pharmacological functions of sea buckthorn oil are anti-inflammatory, bactericidal, pain killer, and promoting regeneration of tissues. Organic Chemistry Institute, Kerghazia Academia of Sciences has developed "Kiplekos" and "Dawughir" the new drugs from sea buckthorn that enhance the endurance capacities of human beings (Lu Rongsen, 1992).

L. Cultivation Process

Sea buckthorn prefers loamy soils, it thrives well in riverbeds. In case of arid area to establish sea buckthorn plantation, a good water supply must be ensured. On riverbeds sea buckthorn can tolerate inundation, because flood water contains oxygen. Moreover, places where the ground water level is less than 0.5 m are not suitable for raising sea buckthorn plantation. Sea buckthorn cultivation is recommended in early spring but not in autumn because of the constraining features of the roots. Survival rate of

autumn plantation has been very low. The roots of sea buckthorn are very sensitive to wind and sunshine and drying of roots should be avoided. It is good to place roots in muddy water before planting sea buckthorn plants. Sea buckthorn is a typical dioecious plant. The number and disposition of pollinisers directly influence the yield of the plantation. It is recommended that between every two lines of female plants there should be a mixed line of male and female plants or the pollinisers account for 6-7% of the total plants. Generally, the distance within which the female plant can be pollinated is about 100m.

M. Propagation

Sea buckthorn can be propagated by several ways. Artificial propagation can be established with cultivated seedlings, cuttings, grafted seedlings and other propagating materials. But the most important propagation methods are to cultivate seedlings from seeds and to use cuttings from hard as well as soft woods. Raising seedlings from seed is a simple method of propagation and has some advantages i.e. it produces greater number of seedlings, involve lower cost than other methods of propagation and seedlings thus produced survived better grow faster compare to cuttings. For better result before sowing the seeds should be treated with hot water (60-70 degree centigrade) then slowly cooled and dried.

Figure 16



Figure 16: Mirghinz Sholkoch Chitral.

N. Conservation issues

This valuable plant species is ruthlessly cut mainly for fuel purpose and making hedges/fencing around agricultural fields. In some places of Chitral this species is being replaced from its natural habitat by black locust and other fast-growing trees to meet the local needs of fuelwood and fodder. Like other forest tree species, no environmental/ ecological valuation or economic valuation of this species has been done by any relevant government agency or NGO/private sector in Malakand division. The people being ignorant about the medicinal importance and economic value of the species are over exploiting this species. Non availability of market information about the sea buckthorn products and

lack of processing unit in the region have put the very survival of this species in jeopardy and the species is depleting at alarming rate from its natural habitats. In Skardu area AKRSP and PCSIR Laboratories Peshawar have initiated project on sea buckthorn recently on experimental basis. Initial findings have reported to be encouraging. In Baluchistan under Arid Zone Project preliminary work is being going on to develop sea buckthorn on large and commercial scale.

O. Mitigation measures

General awareness among the rural communities regarding the importance of this species is crucial for its conservation and propagation. The economic, medicinal as well as ecological significance of this species need to be highlighted and disseminated among the general public through development of brochures, organizing campaigns, conferences at valley levels and workshops. Capacity building of select community members in handling with sea buckthorn, development of marketable products and linkages with local and national markets would bring positive results in conservation and sustainable management of this neglected tree species of high economic value. Establishment of small sea buckthorn processing unit in the town not only create employment opportunities for the locals but would play a catalytic role in conservation and promotion of this species in Chitral.

P. Economic Value

Economic value of this species has yet to be explored in this region. However, some report from AKRSP Skardu reveals that berries of sea buckthorn is locally sold for Rs. 500-800/kg by division of rhizomes in spring. Larger

Almond/Badam

A. **Scientific Name:** *Prunus amygdalus*

B. **Synonyms:** *Prunus communis*

C. **Local Name:** Badam, kandu,

D. **Family:** Rosaceae

E. **Habitat:** It is believed that almond originated in this part of the world Russian botanists are of the opinion that its place of origin is situated somewhere in the neighbourhood of the Pamir in the Hindukush Range. Almond trees grow wild in mostly dry and hot regions.

F. Physical Characteristics

The almond tree grows wild in Chitral at an elevation ranging from 1,600 to 2,500 metres above mean sea level. Almonds grow on relatively small trees that frequently are planted in orchards. A member of the rose family of plants, almond trees flower in early spring producing pale pink flowers that look like wild roses. Leaves appear after the trees flower. Green fruits develop in early or mid-summer, depending on the region and the type of almond. Almond fruits resemble small apricots, but the soft part cannot be eaten. The fruit dries to a thin, tough skin that eventually breaks open to reveal the nuts, which are encased in shells.

G. **Part Used:** Nuts

H. **Time of Collection:** June -July

I. **Method of Collection:** In Chitral almonds are collected in a traditional way by beating the trees with a long stick and then the nuts are collected from the ground floor. This is rough and wrong method of harvesting the nuts in which the trees get damaged because of indiscriminate beating of the branches. Many young branches get scratched and many trees because of injury become susceptible to various pathogens. By taking slight precautionary measures in harvesting the level of injury to the precious trees can be reduced. Figure 17.



Figure 17.

J. Local Uses

The almond is used as dry fruit often served with dried mulberry or apricots in winters. They are also widely used in bakery, candies, and cooking. Oil is used to moisturize dry skin, soothe chapped lips, and relieve itching due to dryness as almond oil is not greasy, it is absorbed quickly. In Chitral we have two varieties of Almonds one is cultivated (sweet almond) and the other is wild (bitter almond).

K. **Sweet Almond (*Prunus amygdalus dulcis*):** Sweet almond is cultivated for its valued nuts and oil over the long years in Chitral, but its cultivation has got impetus in recent years because of community awareness and recently shifting in farming system from subsistence to commercialisation. In farming much emphasis is being given to cash crops e.g. potatoes and bean and horticulture including nuts.

L. **Bitter Almond (*Prunus amygdalus amara*):** Bitter almond or wild almond grows in the mountain slopes of Chitral. As reflects by its name the kernels of bitter almond are not edible, but the oil has been used in various local applications and remedies. Oil from the bitter almond is extracted by separating the kernels from their shells and then by crushing and pressing to produce fixed oil. Fixed oil means it does not evaporate and does not have a smell. This fixed oil is obtained by crushing and pressing bitter almonds with slight heat.

M. Local uses

Kernel of the wild almond is bitter and not edible, but the oil extracted from the kernel is tasteless and has medicinal value. Locally, it is commonly used for cooling, massaging and as a hair

oil. Leaves and gum of this tree are also used in various traditional remedies. Bitter almond itself is not edible but its oil is sweet and edible. It is used in various local recipes and used as hair oil, which is considered very effective against dandruff.

N. Medicinal Uses

In addition to its oral uses in herbal medicine, sweet almond oil is used in the pharmaceutical industry as a carrier for injectable drugs that deteriorate in a water-based carrier. Almond oil is also used as massage oil or as an ingredient in cosmetics and soaps. While almonds may be eaten alone, they are also widely used in bakery, candies, and cooking. Almonds may be blanched (the dark skins removed), ground, mixed with water to form a substitute for milk, usually called almond milk. Almond oil is used externally to moisturize dry skin, soothe chapped lips, and relieve itching due to cold and dryness. Almond oil is not greasy and absorbed quickly. Because of its mild properties it generally does not irritate skin and it does not appear to cause sensitisation that may lead to allergic reactions. Sometimes, sweet almond oil is taken by mouth as mild laxative. The human ingestion of 7.5ml of Bitter almond oil has resulted in death, so this oil should be handled with much care. Children under the age of 12 should not take sweet almond oil by mouth due to the slight possibility that they could breathe particles of the oil into their lungs. Women who are pregnant or breast-feeding should avoid taking sweet almond oil by mouth because not enough is known about how it might affect a developing fetus or an infant.

O. Cultivation Process

Almond thrives in a light well-drained sandy or gravelly loam soils. The plant dislikes poorly drained soils. The established plants of Almond can tolerate drought up to a certain extent. Almond is a slow growing tree and this species is cultivated for its edible nuts. This plant species can be successfully grown in areas where the soil quality is of a poor standard i.e. lacking in enough nutrients. This plant species does tolerate heavy clay soils as well. For optimal results it is preferable to plant in a well-drained soil. The plant prefers a position within full sun.

P. Propagation

The species can be easily propagated by sowing seeds (nuts). The seeds are sown in raised as well as flat beds and in polythene tubes in nursery. While preparing beds in nursery or filling polythene tubes/pots the soil, sand, farmyard manure should be

mixed in equal proportion. The best season for sowing is November before snowfall. The plants germinate in March or April depending on temperature. It takes 2-3 years to get plantable size from nursery. Plants have a very sparse and sensitive root system and the sooner they are planted into their permanent positions the better they will grow. The other way of its propagation is through budding/grafting in appropriate stock, preferably on apricot stock. It performs well and come to fruition within short span of one year after budding/grafting. The undesirable apricot trees can easily be replaced by better quality almond by top-working (pollarding the apricot trees and budding/grafting the young branches of apricot with almond in the following year)

Q. Conservation issues

The natural habitat of this species is continuously shrinking because of agricultural expansion, intensification and slope cultivation. The mountain communities, being unaware of the importance of this species, are cutting and uprooting it for fuelwood purposes, thus threatening its very survival. It is an endangered tree species and has been included in the list of the protected forest trees under the Government Forest Act 1927.

R. Mitigation measures

The threat to the wild almond can be averted through artificial propagation and plantation of this species in marginal land and other available spaces. Moreover, wild almonds in an area indicate the potential of developing edible and improved varieties of this species, which has a high market price. Wild almonds can be easily propagated in nurseries by seeds. In case of Chitral plantable size can be achieved after three years in double cropping areas and after four years in the single cropping zones.

S. Economic Value

Almond has great demand in local as well as national markets. In the local market a kg of almond is costs Rs. 1200 to 1500 and in national and international markets it is Rs. 3000-3500 respectively.

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