Geographical Indication Protection to Traditional Knowledge relating to Medicinal Plants: Case Study of Kashmir

7.1 Introduction

Indigenous or Traditional medicinal knowledge is generally defined as a subset of Traditional Knowledge (TK) ‘consisting of the medicinal and curative properties of plants in indigenous culture’, including genetic resources. TK is often ‘defined by its general characteristics: creation through a long period of time which has been passed down from generation to generation; new knowledge is integrated to the existing, as knowledge is improved; improvement and creation of knowledge is a group effort; and ownership of indigenous knowledge varies between indigenous peoples.

TK has gained special significance in the past few decades which have seen an explosion in the demand for herbal medicines in the globalized world. This rise in demand is seen as a movement which is alternate to the mainstream pharmaceutical products. This movement towards traditional and alternate source of healthcare was first noticeable in the 60’s. Possibly motivated by the general popularity of holistic healing in the United States and Europe at this time, Traditional medicine gained an international following. Notably in the United States, the United Kingdom, and Australia, acupuncture and herbal remedies became commonplace.

Such a scenario has in the past decade given rise to two major critical issues. Firstly the need for the patenting of traditional knowledge (TK) and its products and the legal and political challenges faces thereto. Secondly the international community continues to debate the benefits of traditional medicine. This chapter seeks to delve into the various issues surrounding the state of traditional medicinal plant of Kashmir in an increasingly globalized world.
7.2 Ethno-medicinal Survey of Kashmir (J&K)

7.2.1 Physiography of Kashmir Valley

Kashmir Himalayan region is nestled within the north-western folds of the recently designated Global Biodiversity Hotspot of the Himalaya. It is an integral but geologically younger part of main Himalayan range. Politically it is an important province of the Jammu and Kashmir State, accommodating much of its population and economic activity. The region sometimes referred to as ‘Switzerland of Asia’, lies between 32°-20’ to 34°-54’ Northern latitudes and 73° -55’ to 75° -35’ East longitudes, comprising an area of 15,948 Sq.km. Lofty mountains of the Pir Panjal Range in the South and Southwest and the Greater Himalayan Range in North and East enclose a deep elliptical bowel-shaped valley. About 65 per cent of its total area is covered by mountains. The valley is an asymmetrical fertile basin stretching from Southeast to North-westerly direction, measuring 187 km from Southeast to Northwest corners, while as the breadth varies considerably being 115.6 km along the latitude of Srinagar. The altitude ranges between 1,600m above sea level at Srinagar to 5,420m at the highest peak Kolahoi (Gwashibror). Based on stratigraphy and altitude, the Kashmir region comprises; the main valley floor, the side valleys and the valley facing slopes of Pir Panjal and the Greater Himalayan ranges. Valley floor is rich in alluvium, deposited by the river Jehlum and its tributaries, and has earned the name ‘Rice Bowl of Kashmir’. Side-valleys are carved out by the major tributaries of the river Jehlum. These include Daksum, Lidder and Sind valleys. Pir Panjal Range (200kms) separates the valley from Chenab valley and Jammu region. The slopes of this range are gentle towards the valley and include famous meadows like Kong-Wattan, Yusmarg, Gulmarg, Khilanmarg. Greater Himalayan range (330kms) separates it from valley of Indus and Kishenganga. The slopes of the range, besides alpine and sub alpine meadows, harbour high altitude lakes like Tarsar, Marsar, Satsar, Sheshnag, Gadsar, Vishansar, Krishansar and Gangbal.

Administratively, Kashmir valley is the summer capital of the state. It is divided into ten districts; Anantnag, Baramullah, Budgam, Bandipora, Kupwara, Pulwama, Srinagar, Shopian, Ganderbal and Bandipora.

7.2.2 Climatic Features of the Valley
Climate of the valley displays a marked seasonality akin to inner continental parts of the temperate latitudes. Until the middle of June the weather is pleasant. However, there is a conspicuous change in climate with altitude. As the altitude rises towards the meadow slopes (‘margs’) of surrounding mountains, the temperature of 24°C at Srinagar (altitude 1600m) decreases to 10°C at an elevation of 3,600m. There is also some yearly change in the climate, making some workers believe that Kashmir has not one but a combination of climates.

The temperature of valley ranges from an average daily maximum of 31°C and minimum of 15°C in July to an average daily maximum of 4°C and minimum of -4°C in January. The maximum daily humidity ranges from 80-90% throughout the year and drops to 70% at night during the winter and 40% during the summer.

The average rainfall at Srinagar is 659mm per annum and most of the precipitation occurs in the form of snow during winter and early spring. An average of 600mm of snowfall occurs in Srinagar during winter and early spring, but the snow falls on the higher slopes / altitudes are much heavier.

7.2.3 Vegetation With Reference to Medicinal and Aromatic Plants (MAPS)

The extant flora of Kashmir is Holarctic with elements belonging to two sub-kingdoms: Boreal and Tethyan, the former being represented by Circum boreal, Eurasian and Eastern Asiatic regions and the latter by the Mediterranean and IranoTurian regions. The phytogeographical analysis reveals that the angiosperm flora of Kashmir contains various floristic elements including Circum boreal, European-North Asiatic, Eastern Asiatic (Sino-Japanese), Mediterranean, Western Asiatic and Central Asiatic. Amongst major phytocoria, the Central Asiatic influence is dominant over that of Sino-Japanese and the European/ Mediterranean; the flora generally tends to lean more towards central and Northeast Asia than in the opposite direction. It is therefore arrived at the conclusion that among adjoining floristic units, the affinity of Kashmir Himalayan flora is greatest with Northern Pakistan and Western Himalaya but progressively decreases with Afghanistan, Eastern Himalaya, Tibet and Iran. However, the flora of Kashmir owes its parentage to the Tethys sea region or what is called Ancient Mediterranean Region.
The Kashmir valley is considered to have undergone tremendous change in the vegetal cover from the tropical and sub tropical to temperate types during the glacial phase of the Pleistocene. Added to the complete destruction of original vegetation by recurrent glaciations, the uplift of the Pir Panjal acted as barrier for the Southwest monsoon to penetrate the valley, including floral transformation, this phenomenon led to disappearance of the broad-leaved species and their replacement by coniferous types, such as deodar (Cedrus deodara).

Floristic wealth of valley includes a fairly good representation of medicinal plants. The medicinal flora of Kashmir, however, has not been paid due attention and Kashmir alone may have at least two times this number. Some of the most important medicinal plants of Kashmir Himalaya include Artemisia spp., Arnebia benthamii, Aconitum heterophyllum, Datura stramonium, Dioscorea deltoidea, Inula racemosa, Juniperus macropoda, Hyoscyamus niger, Picrorhiza kurroa, Podophyllum hexandrum and Sassurea spp. etc., growing in abundance in areas like Gurez and Tilail valley, Lolab valley, Pir-Panjal, Gulmarg, Sonamarg, Khilanmarg, Pahalgam and Yusmarg. Besides these a numbers of medicinal and aromatic plant species are grown in different localities and habitats of Kashmir. The important aromatic plant species (spice, condiments and flavoring) include Garlic (Allium sativa), Caraway (Carum cervi), Coriander (Coriandrum sativum), Saffron (Crocus sativus), Siya zira (Bunium persicum), Hare’s foot (Trigonella foenum-graecum), Fennel (Foeniculum vulgare), Mint (Mentha spp.). Many of these plants are used in standardized plant extracts conforming to GMP standards and are used in modern medicine as drugs. About 40 per cent of medicinal plants growing in Kashmir are used in the Indian pharmaceutical industries alone, some of them fetching high prices in the International market. The Unani system of medicine has been a common and favorite system of treatment for the ailing humanity in Kashmir. Infact, the valley is believed to have provided opportunity for sustaining the Unani system of medicine during onslaught of western system. Due to this higher demand of raw material for industrial processing, coupled with the loss of natural habitats of most medicinal plants, large-scale cultivation of promising species is being attempted at several places of the valley. The state is a treasure trove of medicinal and aromatic plants, which are mostly smuggled out of the state and find their way to big industrial houses both within and outside the country a number of medicinal plants grow in the wild in temperate and
alpine habitats out of which some have also been taken up under commercial cultivation which include *Podophyllum, Dioscorea, Valerina, Kuth, Atees Sassuralappa, Katki, Kour* etc.

### 7.3 Evolution of Traditional Knowledge of Medicinal Plants in Kashmir

The traditional health practices in Kashmir are as old as the History of Kashmir itself. Being mountainous the state witnesses heavy snowfall right from October till March. Historically people would live in the dense forests, cut off from rest of the world, for most part of the year. Illness would always be a part of a human living and the Kashmir's were no exception. Therefore the illness caused was managed within the resources in the valley. Because of a strong cultural link of Kashmir with central Asia & China the physicians of these areas had tremendous interest with the medicinal flora of the valley. Famous for its natural beauty the State had significant importance due to its geographical location. Situated on route from China to Central Asia, the State was a commercial hub for traders travelling from either side in ancient time. Commonly referred to as the famous silk route, the place was in-habited by diverse religious and cultural groups. It was this route that gave access to the invaders or for that matter, spiritual leaders, to spread Buddhism and Islam in the State. Pandavs, Mughals and Pathans too found their way to Kashmir through this route only. While the Mughal sare said to have introduced various reforms the Dogra's are believed to have developed art and crafts in the State. Along with their cultural heritage these travelers, invader's and others who settled here brought with them the systems of medicine practiced by each of them which were adopted by the locals from time to time. The recorded medical information about Kashmir dates back to 2nd century BC with Charaka. It is believed that Chakra was a Kashmiri Brahman and the court physician of King Kanishka. Unani system of medicine is believed to have been introduced to Kashmir well before the Mughals.

**(i) Pre-Mughal Period**

Both Unani System of medicine as well as Ayurveda have been introduced to Kashmir well before the Mughals due to the historical link between Central Asia & Kashmir. The prevalence of traditional medical systems in the State can be found in the books of history dating back to 2nd century. The recorded medical information about Kashmir dates back to Kushan Empire in 2nd century BC. Kanishka's kingdom
is believed to have extended from Bukhara (Uzbekistan) to Patna in the east, and from the Pamirs (now in Tajikistan) in the north to central India in the south. His capital was Purusapura (Peshawar). Historians believe that Kanishka convened the fourth great Buddhist council in Kashmir. K.K. Bhutani in his Evolution of Medicine in Kashmir Valley notes that the Court Physician of King Kanishka was a Kashmiri Brahmin. Charaka and Sushruta have mentioned about a fully evolved medical system during 320-499 BC and go on further to testify that Indian physicians excelled in pharmacopoeia, caesarean section and bone setting. It is believed that the art was confined to a few families who had achieved a mastery over it from times immemorial and maintained the same in spite of vicissitudes of time. The traits would flow from father to son and would remain confined to the families.

During the period of Sultan Shams-u-din (1210-1236 A.D) it is said that Narasimhu had made quite a name for himself. Madananga happened to be the most revered physician during the reign of Sultan Qutub-u-din (1206-1210). Blochman and Jarrett in the translated version of Ayn-e-Akbari mention that many renowned hakims and vaidyas who looked after the health of the common people flourished under the reign of Sultan Zain-ul-Abidin. According to Abul fazl, Sultan Zain-ul-Abidin had such a proficiency in medical art that he often personally prescribed and administered medicines to the patients. It has been recorded that once the Sultan was suffering from a malignant boil which baffled all Muslim hakims and Hindu vaidyas, but, fortunately, was cured by application of some ointment prescribed by Shri Bhatta. Prof. L. N. Dhar in his book ‘Kashmir-The Crown of India’ mentions name of Shri Bhatt as a famous physician in the court of Zain-ul-Abidin (during 1470 AD). The story goes that Zain-ul-Abidin got a poisonous boil which gave him much trouble. Jona Raja, the historian in his Raj Tarangini says 'As flowers are not obtainable in the month of Magha on account of the mischief by snow, even so physicians who knew about poisons could not at that time be found in the country owing to Governmental oppression. The servants of the king at last found out Shri Bhatta who knew the antidotes of poison and was well-versed in the art of healing and he completely cured the king of the poisonous boil.

The Sultan is also believed to have opened several schools, popularly known as pathsalas and vidyalayas to acquire medical learning. The Sultan also founded various schools and institutions for elementary and higher studies, known as makatib and
madaris, in Islamic sciences including medicine (tibb). A school was established near his palace at Naushahr, and Mullah Kabir was recruited as its in-charge. It is significant to mention that in spite of ravages of time, this school survived till as late as seventeenth century. The fame of his learning and sagacity was so wide-spread that students used to come from Herat and other far-flung parts of Islamic world to learn Islamic sciences at his feet. A large madrasa was also erected at Seer near Islamabad and Mullah Ghazi Khan was posted as its principal.

Lachhma Khatun, wife of a minister of the Sultan, Gul Khatun, the mother of Sultan Hasan Shah, Hayat Khatun, his queen and Shah Begum, the wife of his prime minister Malik Ahmad and nobles such as Nauroz and Tazi Bat took great interest in imparting education and in the establishment of several medical schools at their expense. Shirvana writes that Budshah patronized vaids and hakims, prominent among them being Shree Bhatt and Karpurra Bhatt. All these historians have stated Sultan Zain-ul-Abdin’s rule as a golden period for both Ayurveda and Unani systems of Medicine in Kashmir.”

“Narhari Pandit, ruled Kashmir sometime in 16th century A.D. he is said to have been a great scholar, writer, physician, administrator, poet and a warrior who had command over eighteen languages. Author of Raj Nighantu, Narhari based it on Nighantus and Kosaslike Dhanivatari Nighantu, Mandapal Nighantu, Halayudha Nighantu, Visvaprakasa Nighantu, Amar Kosa, Bhojaraja Kosa etc. Narhari Pandit's Raj Nighantu is an assimilation of almost all the drugs of classical literature, as well as some of those from the Materia Medica of Greek, Arabian and Chinese, which were in use during his period. Narhari Pandit included all the important plants and animal origin substances from Dhanwantarl (10th century AD) to Bhava Prakasa (16th century AD) alongwith other plants brought to India by Unani Hakims during medieval period.

The fact cannot be denied that Unani system followed in Kashmir may have had an effect of Herbal Supplements introduced by the Arabs which had taken firm roots in the country. Similarly some Unani scholars and physicians who fled to India during Mongol invasion of Persia and Central Asia may also have found their way to Kashmir.

(ii) Mughal Period (1526-1858 A.D)
Prior to British rule the traditional systems of medicine were the mainstay of medical and health care in the state. These systems did not suffer due to the external political interventions that were quite frequent in that period. Although Kashmiris were well acquainted with Unani system of Medicine, yet it had an influence due to the advent of Mughals. Mohammad Ali in his 'Evolution of Medicine in Kashmir' remarks that Mughal emperor Jalal al-Din Akbar 1586 A.D. opened a new chapter in the history of medicine. It is during this period that Arabic system of medicine (Tibb-e-Unani or Greco-Arab system of medicine) got introduced to Kashmir. The first Kashmiri physician of Mughal period is believed to be Khwaja Abdullah Ghazi who acquired his medical education from Hakim Danishmand Khan of Delhi. He specialized in diagnosis, wrote books on medicine and recopied several old medical manuscripts preserving them for posterity. His well-known books on medicine dealt with such books as Mujaz, Aqsaraand Qanun.Khwaja Abdullah gave his medical knowledge to Baba Majnun Narvari, a resident of Mohalla Narvar (locality) near Idgah in Srinagar.

Sofi, G.M in his book ‘Islamic Culture in Kashmir’ has compiled a list of native Hakims during Mughal period. Sofi G.M states that Baba Majnun Narvari studied medicine from Khwaja Abdullah Ghazi. Baba Majnun who died in 1060 A.H. (1650 A.D) was son of Baba Muhammad Haji and the grandson of Sheikh Masud Narvari.

Hakim Abdul Qadir Ganai resident of Mohalla Jamalatta who wrote a commentary on Tib- i-Nabavi, was also a pupil of Baba Majnun. Hakim Inayatullah Ganai son of Hakim Muhammad Sharif Ganai began his practice during the last days of Aurangzeb. He is believed to have been a great pulse expert. Hakim Muhammad Javvad is believed to be the best known Hakim during Afghan period. The story goes that he happened to meet a Pandit who had painted a tika on his forehead in the morning that had not dried up even till noon. On seeing the Pandit, Hakim Mohammad Javvad directed him to return home at once. It is said that upon reaching home, the Pandit died of heart failure. This incident is cited as a proof of the Hakim's ability to diagnose serious cases at sight. Hakim Muhammad Javvad's son, Hakim Muhammad Azim, rose to the position of Chief Physician of Maharaja Ranjit Singh at Lahore. He is believed to have possessed similar qualities as his father. It is said that once while passing by, he diagnosed the disease of a person who himself seemed quite ignorant of the same. The Hakim stopped and warned the man that he would have serious trouble if he did not immediately rub fresh cow-dung on his body and let
it dry up completely till it fell off his body. The man obeyed and when the dried cow-
dung fell off his body it was found full of lice.

Hakim Ali Naqi was a well-known physician, who died in 1783 A.D, is said to have
cured a patient suffering from double pneumonia even though the patient was given
up as hopeless by a british doctor. Hakim Nur-ud-Din Rainawari who lived at
Pampur, belonged to a family which gave birth to noted physicians like Hakim
Ghulam Rasul, Hakim Baqaula and Hakim Yusuf. Nur-ud-Din's own three sons,
Hakim Mustafa Shah, Hakim Waliullah, and Hakim Bahar Shah were all revered
hakims. Blair and Bloom mention Hakim Ali of Chiniot as the court physician of
Mughal Emperor Shahjehan. It is said that it was Hakim Ali who constructed mosque
of Vazir Khan at Lahore 1635.

(iii) Dorga Period (1842-1947 A.D.)

Although the practice of medicine continued to be a hereditary profession where son
succeeded father, the Dogra rule did ensure that the Unani system in Kashmir was
institutionalized to a great extent. Maharaja Ranbir Singh established a Translation
Bureau under the charge of a learned Hakim Muhammad Baqir, who also happened to
be the Chief Hakim to Maharaja and was assigned the title of Afsar-ul-Atibba. It was
under this bureau that Maharaja got Tib-i-unani translated from Arabic and Latin into
Persian and Dogri. Hakim Muhammad Baqir is believed to have cured a paralytic
patient by applying living wasps to the parts of body that suffered from paralysis.
Khan, M.L in ‘History of Srinagar’ states that there was also a class of men and
women who eked out their existence by applying leeches. It was a very popular
treatment for almost every disease. This practice however was put to an end for a brief
period due to the propaganda of medical missionaries that followed British rule, only
to be revived after independence.

Pandit Sat Kak, Unani Physician, held an important position of Royal Physician to
the Maharaja of J&K State. His brother Sahaz Kak Bhat, popularly known as Sahaz
Bhat, also a Unani physician, used to take recourse to reciting prayers in Sanskrit or
Arabic if only for a psychological effect on the patient. Sir Aurel Stein in a letter to
his friend Alden in 1905 wrote that Sahaz Bhat lived a fulfilling life of a scholar and
physician always sought after by fame. His calligraphic handwriting was so beautiful
that his patients would often preserve his prescriptions in velvet bags to use them as amulets.

Walter R. Lawrence in his book named ‘the Valley of Kashmir’, mentioned that in the city and larger towns, Kashmiris usually restore to their own Hakims, in the first instance, for ordinary medicinal (non surgical) diseases, and only consult Europeans for surgical complaints or when in extremis. Kashmiris began to recognize the benefits of the Western system of treatment only of late, and the growing belief in the efficacy of the European methods is due to the devotion and skill of the medical missionaries of Kashmir. Even at that time people believed in local Hakims, many of whom were men of considerable ability and experience. Lawrence mentions that there were at least 300 Hakims or doctors in Kashmir at that time and as a rule the profession was hereditary. He relates, ‘Once, when I was in great anxiety, a deputation of Kashmiris begged me to allow a well-known Hakim to treat my son. They urged that this Hakim had never failed to cure the disease’. The Hakims have a considerable knowledge of herbs, and their herb collectors are the shepherds, who spend the summer on the high mountains where the most valued plants are found. The Hakim charges wealthy patient eight annas a visit, but he makes some money by compounding medicines. Hakims of this period did not experiment surgery. They would only mark the location with a pen signifying the vein which was required to be opened and a barber would be called in to operate. If leeches are to be applied a special man is sent for. Such samples as the Hakims does not obtain from the shepherds are brought from the druggist know as Bohris. A Hakim would never attend midwifery cases for which services of special women would be utilized.

Besides the professional Hakims there are many ‘wise women’s in the villages who have considerable knowledge of the properties of herbs. The faith in the system was so widespread that nearly every peasant knew something about the medicinal properties of the herbs. Every household especially the oldest lady in the house used to preserve a kit that contained herbs for common ailments. This tradition continued till as late as early seventies in the state. It is in record the following number of locally grown herbs which were believed to have medicinal properties. Herbs like Aconitum heterophyllum (Patis), Peganum Harmala(Isband), Pichorhiza Kurroa (Chob-i-kor) Berberis lyceum (Kaodach) Dioscoreadeltoida (krits) Cuscuta sp. (Kakilipot), Cotulaanthelmintica (Bobuna), Urticadioica (Soi), Iris sp. (Sosan), Mentha sp.
(Shoeramgas), Pyrethrum sp (Pahlmund), Berberis sp. (Dandlidar), Salix sp. (Butvir), Platanusorientalis (Boin) were commonly used at the time. It was in 1937 that All Kashmir Unani Tibbi Conference (AKUTC), Kashmir and J&K Vedic Sabah, were setup for development of India System of Medicine in the state.

(iv) Post Independence (1947–till present)

It was in 1959 that Jammu and Kashmir Ayurvedic and Unani Practitioners Act was passed and subsequently Jammu and Kashmir Ayurvedic and Unani Board was established in 1968 which registered qualified and experienced Ayurveda and Unani Practitioners in the State. It is pertinent to mention here that the two medical colleges one in Kashmir Valley (Unani College and Hospital at Lal Mandi, now Children’s Hospital), and another at Jammu (Ayurveda College and Hospital) were closed down in early 1980s.

From the above discussion it is proved that there was a time when people in Kashmir would resort to traditional way of treatment for common and dreadful disease and this culture was very prevalent in the Kashmir since immemorial. There have been competent herbal healers that were known as Hakeem’s. But now this culture seems to be fading from the horizons of Kashmir. Jammu and Kashmir is very rich in medicinal plants but there is a need to explore them for the benefit of the society.

The pertinent question is that why we need to preserve traditional knowledge of medicinal plant of J&K? The answer to this is that before the dawn of English medicinal culture, Kashmiri masses would resort to herbal medicinal products or herbs for the treatment of diseases like dhihorria, jaundice, gout etc. Now the culture of this herbal healing system is fading. Secondly if an elderly citizen is having the knowledge of say 10 herbs and their usage. His son would have knowledge of 5 herbs. This way process will go on and the scale of herbal knowledge will decrease with the advancement of generations. The time will come when people would have no knowledge of these herbs. If a sophisticated machine is imported from America or any other foreign country it will cost too much to purchase. If the same is provided at low cost to the people it will make our state self-sufficient besides providing security and patent to the idea, innovation or herbal practice of an innovator. An initiative can be taken to launch a medicinal product in the market for which selection of practices will be taken from local herbal healers whereby the validity of those herbal practices will
be evaluated by reputed chemists and scientists. The herbal practice provided by an innovator/herbal healer or a farmer etc is included in the National Register of Grassroots Innovations and Traditional knowledge. With the consent of innovator or herbal healer it can be shared with the third party. With the prior permission of the innovator it may be disseminated for the benefit of the society. Property Rights of the innovator/Herbal Healer is ensured before initiating such process like improvement and design etc. However, if the herbal practice or traditional knowledge innovation provided by an innovator is well known in public domain, then the restrictions on its diffusion or application will not apply. The grassroots innovations developed by farmers, slum dwellers should be unaided, unsupervised without any aid from any external agencies.

Traditional knowledge (TK) related to the use of natural resources including medicinal plants has been recognized as one of the important assets inherited through generations by the local communities. Such knowledge is generally passed down to the next generation verbally, in the form of odes and poems. In the process of rapid modernization and advancement of medical sciences, partially documented or undocumented knowledge on ethno-medicine began to deplete drastically. Although several ethno-botanists and anthropologists have made attempts at documenting such knowledge in various parts of the world, several remote localities and indigenous communities have remained unnoticed. Traditional knowledge has now regained importance due to the discovery of new drugs and formulations from phyto-resources. As a result, there has been a spurt in herbal industries. The pharmaceutical sector has to meet the ever-growing, excessive demand and this in turn has led to wild harvest of these resources, which may lead to rapid depletion of resource base. Contrary to the growing demand of medicinal plants all over the globe, TK on ethno medicine is declining rapidly, especially in the developing countries. The Himalayan region, well known for diversity and richness in medicinal plants, also harbours a large number of ethnic communities, each with distinct culture and TK system. Rapid pace of development and socio-economic transformations have led to erosion of natural resources and TK in the western Himalayan region.

Nowadays, rural life is changing into fast life of modern cities. This change is affecting the young generation and overall increasing willingness to use allopathic medicines over ethno medicines for its faster effect. Though the respondents shared
that the process of collection of medicinal plants is time consuming and tedious, it was observed that villagers were more interested in selling these medicinal plants instead of using them for self cure. But, this trade is more or less in the informal sector and so difficult to document. Changes in agricultural practice were evident from the fact that locals preferred cash crops like soybean, rajma, potato and tomato over medicinal plants. Local needs and micro-socio-economic–environmental conditions of knowledge holders and of medicinal plants should be considered to formulate policies to conserve both traditional knowledge and the plants.

7.4 Threatened Medicinal Plants of Kashmir: Selected Case Studies

7.4.1 Study of the Threat Status of Six Medicinal Plant Species (*Arnebia benthamii, Meconopsis aculeate, Rheum webbianum, Aconitum heterophyllum, Podophyllum hexandrum and Aquilegia fragrans*).

Kashmir valley (33°20′ to 34°54′ N latitudes and 73°55′ to 75°35′ longitudes) is located in the Northwest Himalayan bio-geographic zone in India, covering an area of 15,948 Km. The valley is asymmetrical surrounded by lofted mountains of the Pir Panjal in the South and southwest and by the Great Himalayan range in the North and East, with 64% of the total area being mountainous. The climate of the area is temperate. The vegetation generally covers temperate, sub-alpine and alpine types. Alpine pastures are dominated by herbaceous medicinal plant species and dispersed patches of alpine scrubs.

Surveys were carried out during 2013-2014 throughout the Kashmir valley. The particular medicinal plant species were surveyed in 46 sites in Kashmir valley. The geographical co-ordinates of these locations were recorded with GPS. The size and range of population of selected medicinal plant species were determined by walking extensively in an area around the population. Detailed field records on habitat and altitudinal ranges were also recorded in the field. Mature individuals were counted in each area. Actual threats to the population of a selected plant species in a given area were recorded by direct observation. The Area of Occupancy (AOO) was calculated by the presence of a taxon in a uniform grid that covers the whole range of a taxon and then tallying the number of occupied grid cells with the area of individual cell. To calculate AOO, a grid size of 2×2 Km2 (cell area of 4Km2) was selected. The extent of occurrence (EOO) was calculated by α-hull. The region was recorded as one site.
when it was observed that a particular threatening event can quickly disturb all the individuals of the taxon present in this zone area. The population decline was calculated by tallying the total number of mature individuals present during the first year to the total number of mature individuals present during the second year. The data collected were assessed in light of IUCN Red List Categories and Criteria 2010 version 8.1 following Guidelines for Application of IUCN Red List Criteria at Regional Levels 2003 version 3.0. Five basic criteria (A, B, C, D and E), formulated by IUCN for assessing the taxa at regional level. Only one of the criteria (A, B, C, D, or E needs to be met. However, a taxon should be evaluated against as many criteria as available data permit.

During the current study the threat status of six medicinal plant species (*Arnebia benthamii*, *Meconopsis aculeate*, *Rheum webbianum*, *Aconitum heterophyllum*, *Podophyllum hexandrum* and *Aquilegia fragrans*) according to IUCN categories and criteria 2010 version 8.1 following regional guidelines 2003 version 3.0. Habitat degradation, overgrazing, over exploitation, deforestation and excessive tourist flow have been identified as major threats to these medicinal plant species

The medicinal plant species assessed for the research are given below:

(i) *Arnebia benthamii* (Wall. ex G.Don)

(a) **Local Distribution:** Six different populations (Aparwat, Rayil, Thajwas, Nagbaren, Munwersar and Ducksum) have been found during the present investigation. *Arnebia benthamii* occurs as small populations on moist shady open slopes or among on very steep rocks or in rock crevices at an altitude of 3100 to 4000 m.

(b) **Taxonomic Description:** *Arnebia benthamii* belongs to Boraginaceae family and is endemic to North West Himalaya. It is a rhizomatous, perennial alpine herb and attains height up to 30-95cms. The inflorescence is a spike containing more than 220 flowers. Leaves are linear, hairy and lanceolate. The flowers are tubular with a corolla tube and five fused petals and sepals. The sepals are persistent. Fruit is a single seeded.

(c) **Common Name:** Kawazaban
(d) **Ethno Medicinal Use**: The Goazaban a main component of a commercially available drug is obtained mainly from *Arnebia benthamii*, which has anti-fungal, anti-bacterial and anti-inflammatory activity. It is given against high fevers and mainly the flowers are reported to have soothing effect on patients with heart diseases.

(e) **Evaluation of Threat Status**: 

In order to assess the threat status of the species in accordance with the IUCN guidelines, Area of Occupancy (AOO), Extent of Occurrence (EOO), population size in the form of mature individuals and the different types of threats to the species were recorded. The most common threats are overgrazing, over exploitation for local use and landslides. The total AOO of *Arnebia benthamii* in Kashmir valley is 24 km$^2$, calculated by summation of all sub-populations in the Kashmir valley. The total EOO of *Arnebia benthamii* is 127.12 km$^2$, calculated by summing the areas of all triangles. As the EOO and AOO of the species is 127.12 km$^2$ and 24Km$^2$ which is less than 5,000 Km$^2$ and 5, 00 Km$^2$ respectively and there is the continuing decline in the number of mature individuals. Thus, the plant species meets the criteria for Endangered (EN) category under the criteria B1b (v) c(iv), B2b (v) c (iv) and Cc2a (i). A.K. Kaul assigned the species as Endangered in Kashmir Himalaya. IUCN (1997) also assigned the species Endangered in Jammu & Kashmir. IUCN (1998) assigned the plant species as Critically Endangered for North-western Himalaya and also in 2003, IUCN categorized endangered threat category to the species for J & K. Conservation and Management Prioritization, (1998) assigned the plant species as Critically Endangered under criteria A1acd.

(ii) **Meconopsis aculeataRoyle**

(a) **Local Distribution**: Five different Sub-populations (Gurez, Harmukh, Thajwas, Nagbaren and Munwersar) have been found in the Kashmir valley during the present investigation. This rare endemic species occurs among rocks or in rock crevices with a steeper slope and few coexisting species.
(b) **Taxonomic Description:** *Meconopsis aculeata* is an endemic perennial medicinal herb of papaveraceae family. The plant bears a single, unbranched, erect, hard, and prickly stem. Single raceme bears many flowers. Flower is showy, actinomorphic, hermaphrodite, complete and hypogynous. Flower has a thin, cylindrical, bristly and erect pedicel. Petals are four, obtuse, obovate, delicate, thin, soft and with wavy margins. Fruit is a many seeded capsule.

(c) **Common Name:** Achatsarmum

(d) **Ethno Medicinal Use:** The whole herb is used as analgesic, chronic, renal pain, tonic, narcotic and febrifuge.

(e) **Evaluation of Threat Status**

The total AOO of *Meconopsis aculeata* in Kashmir valley is 20km², calculated by summation of all sub-populations in the Kashmir valley. The total EOO of *Meconopsis aculeata* is 87.80 km², calculated by summing the areas of all triangles. As the EOO of the species is 87.80km² which is less than 100 Km² and there is the continuing decline in the number of mature individuals. Thus, the plant species meets the criteria for Critically Endangered (CR) category under the criteria B1b (v) c (iv). IUCN assigned the species as Critically Endangered for North-western Himalaya. Conservation and Management Prioritization, (1998) also assigned the plant species as Critically Endangered under criteria A1 acd; B1, 2c for J&K as well as for the globe. IUCN assigned the plant species as Critically Endangered for North-western Himalaya and Endangered for J & K

(iii) *Rheum webbianum* Royle

(a) **Local Distribution:** During the current study, *Rheum webbianum* has been documented from nine different sites (Gurez, Harmukh, Vishensar, Zailder dub, Aparwat, Munwarsar, Aharbal, Peer ki Gali and Simthan top). The species grows in alpine zone at an altitude of 3300 to 4000 m asl and is found in shady, humid places or among rocks.

(b) **Taxonomic Description:** *Rheum webbianum* is a perennial medicinal herb of polygonaceae family. The plant bears a diffusely branched inflorescence.
Leaves are radical having long petiole. Flowers are ebracteate, pedicelate, pale yellowish and filiform. Fruits are broadly oblong, winged and notched on both sides.

(c) **Common name:** Pumbchalan

(d) **Ethno Medicinal Uses:** The rhizome and roots of the plant species are source of the drug which is used as purgative. The decoction of root is used to cure lung infection and liver. The root powder is sprinkled on ulcers and wounds for rapid curing.

(e) **Assessment of Threat Status:**

The total AOO of *Rheum webbianum* in Kashmir valley is 44 km², calculated by summation of all sub-populations in the Kashmir valley. The total EOO of *Rheum webbianum* is 587.17 km², calculated by summing the areas of all triangles. As the EOO and AOO of the species is 587.289 km² and 44Km² which is less than 20,000 Km² and 2,000 Km² respectively and the number of sub-populations in the valley are 9 which also falls between 6-10 as standardized in IUCN Categories and Criteria for Vulnerable category and there is the continuing decline in the number of mature individuals. Thus, the plant species meets the criteria for Vulnerable (VU) category under the criteria B1ab (v), B2ab (v) and Cc2a (i). The results obtained during the current study are in confirmatory with CAMP who also categorized the plant species as vulnerable in J&K state.

(iv) **Aconitum heterophyllum Wall. ex Royle**

(a) **Local Distribution:** During the current study, *Aconitum heterophyllum* has been documented from six different sites (Gurez, Harmukh, Khilanmarg, Thajwas, Munwarsar, and Poshpather). The species is restricted to alpine meadowlands of Kashmir Himalayas at an altitude of 2680 to 3500 m.

(b) **Taxonomic Description:** *Aconitum heterophyllum* is a perennial medicinal herb of Ranunculaceae family. The plant bears a single, unbranched and erect stem. The plant bears tuberous root. Flowers are aggregated in racemes. Flower is hermaphrodite, bracteoles linear, petals five and glabrous.
(c) **Common Name:** Patrees

(d) **Ethno Medicinal Uses:** Ancient aconite drug in India, a valuable febrifuge, a bitter tonic, mainly given after malarial and other fevers. It is recorded to be used against dysentery, diarrhea and chronic enteritis.

(e) **Assessment of Threat Status:**

The total AOO of *Aconitum heterophyllum* in Kashmir valley is 24 km², calculated by summation of all sub-populations in the Kashmir valley. The total EOO of *Aconitum heterophyllum* is 260.38 km², calculated by summing the areas of all triangles. As the EOO and AOO of the species is 260.38 km² and 24Km² which is less than 5,000 Km² and 5, 00 Km² respectively and there is the continuing decline in the number of mature individuals. As per the data assessed against the IUCN Red List Categories and Criteria (2010), the species qualifies for the threat category of Endangered (EN) category under criteria B1b (v) c (iv) and B2b (v) c (iv). A.K. Kaul assigned the species as Vulnerable in Kashmir Himalaya. IUCN assigned the plant species as Critically Endangered for Northwestern Himalaya and also in 2003, IUCN categorized Critically Endangered threat category to the species for J & K.

(v) **Podophyllum hexandrum Royle**

(a) **Local Distribution:** During the current study, *Podophyllum hexandrum* has been documented from 13 different sites (Gurez, Hrmukh, Vishensar, Rayil, Aparwat, Nagbaren, Nandkan, Munwersar, Shikargah, Yousmarg, Aharbal, Peer ki Gali and Ducksum). The species is restricted to alpine meadow lands of Kashmir Himalayas at an altitude of 2300- 3700 m.

(b) **Taxonomic Description:** *Podophyllum hexandrum* is a valuable medicinal plant, distributed in the Himalayan zone at an altitude ranging from 2300 to 3700 m above MSL. It is an herbaceous and rhizomatous perennial plant. *Podophyllum hexandrum* (Himalayan May apple), is monocarpic perennial herb of Podophyllaceae. *Podophyllum hexandrum* grow from 12 to 18 inches far above the ground with deeply lobed leaves, fleshy stems, which arise vertically from the soil. The plant has attractive leaves that are divided into 3 lobes. The plant bear white or pale pink, 6-petaled flowers are borne at the
stout stems; these are followed by fleshy, oval and red berries. The flower has six petals and six stamens, which inspired its species name hexandrum, meaning six stamens. Fruit is a large red orreddish berry, 2.5-5 cm, with many seeds embedded in pulp. It can be propagated by seed or by dividing the rhizome.

(c) **Common Name:** Wanwagun

(d) **Ethno Medicinal Uses:** Podophyllum root contain active compounds-Podophyllin and Podophyllotoxin. It is considered a cholagogue, emetic, alterative, purgative and a bitter tonic. Recently it has been used to treat some of the cancers.

(e) **Assessment of Threat Status:**

The total AOO of *Podophyllum hexandrum* in Kashmir valley is 64 km$^2$, calculated by summation of all sub-populations in the Kashmir valley. The total EOO of *Podophyllum hexandrum* is 633.76 km$^2$, calculated by summing the areas of all triangles. As the EOO and AOO of the species is 633.76 km$^2$ and 64Km$^2$ which is less than 20,000 Km$^2$ and 2,000 Km$^2$ and there is the continuing decline in the number of mature individuals. Thus, the plant species meets the criteria for Vulnerable (VU) category under the criteriaB1b (v) and B2b (v). The results obtained during the current study are in confirmatory with the CAMP (2003) who also categorized the plant species as vulnerable in J&K state.

(vi) **Aquilegia fragrans** Benth

(a) **Local Distribution:** Five different populations (Gurez, Khilanmarg, Vishensar, Nagbaren and Munwersar) have been found during the present investigation. The plant species occurs in small and patchy populations in wet shady soil or in exposed alpine pastures among rocks or, rocky slopes in marginally hard at an altitude of 3,000-3,800 m.

(b) **Taxonomic Description:** *Aquilegia fragrans* is a perennial medicinal herb that belongs to the family Ranunculaceae. The species bear a solitary stem. Upper spike leaves commonly absent and if present much reduced. Flowers
solitary or a few per plant, dark-blue to violet sepals and petals five. Petals linear to obovate. Each petal has a curved conic-obtuse spur. Stamens many and anthers basifixed and stigma with a pinhead-shaped.

(c) **Common Name:** Zaoneel

(d) **Ethno Medicinal Use:** Root used against wounds and inflammation. Flowers used against cold and cough.

(e) **Evaluation of Threat Status:**

(f) The total AOO of Aquilegia fragrans in Kashmir valley is 20 km², calculated by summation of all sub-populations in the Kashmir valley. The total EOO of Aquilegia fragrans is 242.15 km², calculated by summing the areas of all triangles. As per the data evaluated against the IUCN Red List Categories and criteria (2010), *Aquilegia fragrans* qualifies for the threat category of Endangered (EN) under criteria B1b (v) c (iv) and B2b (v) c (iv).

7.4.1.1 **Findings of the Study**

The specific assessment of the conservation of concerned taxon is considered to be the utmost important step in order to effectively protect the taxon from extinction. Such assessment of the degree of threat of extinction of a species further clues us to assign it a standardized threatened category. If immediate site-specific actions were not taken of highly threatened taxon, they will possibly be extinct. As a result, conservation of species is considered to be the main priority in order to decline degrees of global biodiversity loss. Sufficient plant collections with good field investigation records may play a critical role in evaluating conservation status and conservation priorities. IUCN Red List Categories and Criteria have been established for this purpose. During the current study the threat status of some threatened medicinal plants of Kashmir valley have been assessed in accordance with IUCN regional guidelines 2003 version following IUCN categories and criteria 2010 version 8.1. The regional evaluation of these medicinal plant species was carried out by using criterion B, C and D proposed by IUCN.
Evaluation under A (population reduction) was not possible due to the lack of quantitative information related to population decline over years. Even though efforts were made in this study to evaluate the population size of each medicinal plant species, yet no historical data were available to quantify the trend. Criterion E (quantitative analysis) showing the possibility of extinction in the wild was not conducted for any of the medicinal plant species.

During the current study 6 species (*Arnebia benthamii, Meconopsis aculeate, Rheum webbianum, Aconitum heterophyllum, Podophyllum hexandrum and Aquilegia fragrans*) were evaluated according to IIUCN Guidelines. Throughout the investigation, it was observed that habitat degradation, uncontrolled grazing, over exploitation, deforestation and excessive tourist flow has been identified as major threats to these selected medicinal plant species in wild habitat. The habitat of most of these medicinal plant species falls within the widely grazed green alpine pastures and the grazing animals besides eating the leaves of the medicinal plant species and thus limits their population size and distribution. Overutilization of these valuable medicinal plant species for local use has adversely impacted the populations of these species. The native people eliminate the whole plant species, thus rendering them threatened. Cutting down of forests at an unprecedented rate have also extremely diminished the availability of these medicinal plant species in the wild. Deforestation as well as the agricultural activities have resulted in the habitat destruction of the medicinal plant species, thus restrict the availability of these species in the natural habitats. All these threatened factors either separately or in combination operate at different sub-population of these medicinal plant species, which results in the decline in the number of mature individuals of these species. The flora of Kashmir Himalaya has been subjected to tremendous anthropogenic pressures as a result of habit loss, deforestation, excessive grazing, tourist rush, increasing urbanization, etc. The alpine and sub-alpine meadows used as open grazing grounds. This has resulted in a good percentage of plant species to become threatened. There is an urgent need to undertake thorough studies on several aspects of our threatened medicinal plant species, and to work out measures for their conservation. Extensive field investigations in their well-known areas are required to establish their total absence, as some little-known and rare plant species from Kashmir have been recollected after a gap of up to 150 years. Research and scientific data not only determines the
importance of biodiversity conservation programmes but also helps in formulating better development intercessions. Controlling deforestation and other anthropogenic activities in sub alpine region is significant because it will ease the pressure on the resources of alpine zone. Considering both the ecological and economic significance of the transhumance and heavy reliance of the indigenous and nomadic population on these ecosystems, ways and means should be implemented to control overgrazing. The medicinal plant species which are found in very less densities and abundance need an immediate attention. These threatened plants can be rehabilitated mainly through *ex-situ* means followed by their consequent re-establishment into their appropriate habitat types and it will help in preserving a complete gene pool of these species. Moreover, awareness and capacity building of traders and nomads about each plant species, its biology, uses, method of harvest and marketing, protection strategies etc. should be initiated immediately for its conservation.

7.4.2 Studies on Ethnic Groups

Another survey was made of different ethnic groups like *Gujjars*, *Bakkerwals* and *Bhoris* were surveyed at various places in kashmir. During the survey, data regarding the traditional uses of plants was gathered by consulting people of different ethnic groups such as *Gujjars*, *Bakkerwals* and *Bhoris*. Besides, knowledgeable persons of the plains, who themselves have used these plant-based therapies for health treatments, were interviewed to prove veracity of the curative features of plants. All of them were asked for their consent to share their knowledge only for the purpose of study. *Gujjars* are the people who are generally permanent settlers at the foot hills of Himalayas and live in environment characterized by defined area with specific food habits, language, cultural homogeneity, a unified social organization and a unique way of nomadic life style. *Bakkerwals* on the other hand are goat/sheep herders generally. They are nomadic tribe and lead a lonely and tough life in the high altitude meadows of the Himalayas and Pir Panjal ranges. While interacting with the *Bakkerwals* it was found that they actually belonged to far-flung Rajouri and Poonch districts of Jammu & Kashmir and visited the study area every year in the months of April and May. They take their livestock animals high into the mountains, above the tree line to graze in the lush meadows. They travel by foot and it takes them more than thirty days to reach these meadows. They are accompanied by their dogs to guard the sheep/goats and their pack animals. During summer, they move from one meadow
to another and ultimately leave the district in the months of August and September. However, some of them have settled permanently at the foothills of the Himalayas of the district. For example, a few could be easily found near Saderkoot Bala area of the Bandipora district, living there for years. Both these ethnic groups (Gujjars and Bakkerwals) have their own knowledge of traditional herbal medicine inherited from their fore-fathers. They have to rely on the traditional system as they do not have the modern medicinal facilities available in the vicinity.

Traditionally, Bhoris are the herbal medicine practitioners of this indigenous medicine system, who use to buy important medicinal plants from needy people living both in plains as well as in tribal areas. They either visit the areas by themselves or the same people come to them for selling these plants. The people especially tribals, who sell herbal medicine in return get a little money to sustain their basic needs of livelihood. Bought medicinal plants are then prescribed and sold simply by establishing small shops not only in small villages but also in semi urban and urban areas. These practitioners commonly diagnose each health problem by an interview and by physical/visual inspection of the patient. Changes in eye and skin colour, tongue and throat regions, body temperature and status of sores are all visually inspected by the practitioner and the remedy is prescribed. Earlier prescribing herbal medicine to the patients by them was free of cost, because taking fees for any kind of treatment was highly discouraged as they believed that health care was an essential need and if a fee was charged that the poor might be deprived from treatment. In return, local people would provide them some donation in the form of cereals, pulses and vegetables. But now they not only prescribe herbal medicines but also sell it at the cost of money. However, the low cost of herbal medicine and its unlikely income is one of the reasons that youth of Bhoris are discouraged from carrying forward this ethnomedicine prescribing profession and this is the reason that only few Bhoris, practicing in this field, were found in the study area which shows that the traditional medicinal knowledge is depleting at an alarming rate. It would be appropriate to mention here that, earlier, in the study area, Bhoris were mainly the Kashmiri Pundits (followers of Hinduism) who had vast deep rooted knowledge of prescribing the patients by traditional herbal medicine. This knowledge was descended to them from their forefathers in the form of oral folklores, and is not yet documented. They enjoyed high respect and social status among the communities. But due to uprising
turmoil that started in 1989 in the valley, they left the district in order to defend themselves and migrated along with this precious knowledge to other parts of the country. This is the reason that a few abandoned shops that belonged to them were reported during the course of survey. Until they stayed in the district they shared their precious medicinal knowledge with some Kashmiri Muslims among whom a few at present are carrying forward and practicing this profession. The presence of these medicinal plant species and the associated ethno medicinal knowledge in the district indicates that the area has a high diversity of medicinal plant species and is a site of precious indigenous knowledge. Amongst the species, 19 species were collected from the wild, 5 species from cultivation and only one species from both the sources. This indicates that the residents mainly depend on the wild source or the natural environment rather than on home/vegetable gardens to obtain the medicinal plants, and the activity of cultivating medicinal plants is very poor in the study area. It also indicates that the natural forests of the state are over-exploited by the local people particularly by Gujjars, Bakkerwals and traditional practitioners (Bhoris) for their medicinal plants compositions. Further the study revealed that the Medicinal plants were used through different modes of preparation for curing various ailments, ranging from simple to highly complicated. The various forms included powder, paste, poultice, decoction, juice, infusion, lotion and raw.

Furthermore, most of the formulations were found to be prepared and administered at household level, which is in agreement with other studies. Sometimes, when necessary, people would seek the help of knowledgeable persons in their respective localities with no or meager charges. Majority of the informants, however, reported that they kept their medicinal plant knowledge secret. They further revealed that free transfer of knowledge could only take place along the family line, usually from parents to sons and that is why in present study males were found to have a rich traditional knowledge of medicinal plants than females.

Of the collected medicinal plant species, only 1 species was used for the treatment of single ailment, 2 species for the treatment of two ailments while majority of species ware used to treat more than two ailments. Since, a majority of documented plant species were used for the treatment of more than one disease; it is very difficult to assess which plant is actually effective in curing a particular disease. Thus only clinical trials on these plants can give some indications. Majority of the collected
plant species were also found to be medicinally used in other parts of Kashmir. Such widespread use of these plants by different groups of societies in Kashmir could be attributed for their efficacy against various ailments. Results also reveal that a major proportion (75%) of folk medicinal knowledge comes from people above the age of 55 years, while a small proportion (25%) of it comes from people between the ages of 37 and 50. Gender wise, men especially old ones had more traditional knowledge about medicinal plants and their uses than females. This may be attributed to two reasons. Firstly, because of the involvement of males in collection and trade related activities. Secondly, higher reaches had been under seize of security forces since decades in response to terrorist threats thus posing hindrances in the movement of women. Informants below the age of 50 years were reported less aware of the potential of medicinal plants than their older counterparts who have also gathered knowledge from the point of view of their traditional healthcare and their day to day practices. This difference in the perception of the two age classes will likely result the knowledge loss over time. Discussions and interviews with old and young people and also with Bhoris indicated that the attitude of the younger generation was not towards continuing these traditional practices because they realized that there is less opportunity in this tradition for getting immediate benefits mainly in terms of cash in the form of money. In the present investigation, it was noticed that the majority of the species (19 species) used for medicines were collected from the wild sources, 5 species from cultivation and only 1 species from both the sources. It is well known fact that the wild populations of medicinal plants are the main sources of raw materials to the pharmaceutical industries. The local inhabitants, who lived at high altitudes, were found to impose a great deal of pressure on medicinal plant populations because at higher altitudes health care facilities were almost non existent and people met their medicinal requirements with forest products. At lower altitudes people also used medicinal plants, but owing to better infrastructure, they also used nearby health centers for the treatment of various diseases. Various factors that are considered as main threats to medicinal plants were recorded by interviewing the informants. The major factors claimed were increasing population of the area, indiscriminate harvesting by unskilled gatherers, over-grazing by animals, developmental works, deforestation, agricultural expansion, lack of job opportunities, increased marketing pressure and trading of charcoal and firewood. Efforts to conserve medicinal plants in the valley were observed to be very poor. It has been
already reported in India that, most of the traditional ethno botanical knowledge is eroding at faster rate day after day due to losses of the ancient traditions and cultures as they are mostly oral.

### 7.4.2.1 Findings of the Study:

Thus, it is evident from the present investigation that, if the above mentioned factors continue to operate in the area of studies, there will be a time in near future when majority of these plants find their place in different threatened categories as described by IUCN. With a view to protect these natural resources, medicinal plants must be looked after and managed. In order to conserve these resources, local people should be actively involved in the implementation, planning, evaluation and monitoring processes of plans and projects, as they are not only the well-known persons but also beneficiaries of the area.

The result of the research conclude that following efforts need to be made to conserve the existing medicinal flora of the Bandipora district and to reap the greatest benefits from the available resources:

(i) The thinking of people must be changed about current indiscriminate harvesting practices which can be done by skill development, training and attitudinal change.

(ii) The cultivation of medicinal plants should be encouraged more and more and steps should be taken to promote their vegetative propagation through grafting, layering, cuttings and also by employing various propagules such as roots, rhizomes, bulbs, corms and buds.

(iii) Local people must be involved as leaders of activities geared towards environmental conservation awareness and this can be done by local organizations. It would be better, if local school teachers and religious leaders are involved in such awareness programmes.

(iv) More and more attention should be paid by the concerned authorities to facilitate the sustainable use of medicinal plant resources.
(v) The medicinal plants should be harvested on priority for one’s own consumption and not for commercial purposes.

(vi) For proper conservation and sustainable utilization, rules and regulations at community level should be implemented, with the help of dignitaries of the community, so that the goal of economic development could be achieved in parallel with the goal of ecosystem conservation.

(vii) Short training courses should be organized for the collectors, farmers and traders on designed module covering the areas of proper identification, collection and cultivation of medicinal plants and to improve processing and post harvest treatment of crude drugs.

(viii) Lessons learnt from success stories should also be implemented at wider scale to train local people for the cultivation of medicinal plants.

(ix) Important medicinal plants should be subjected to thorough pharmacological investigation so that new potent compounds could be discovered as there is no doubt that botanic gem is still found in the world.

(x) Small domestic industries such as beekeeping, gardening, handicrafts etc. must be encouraged through social organizations within the local communities so that the pressure on medicinal plants for their trade can be reduced to a great extent.

(xi) Reforestation activities must be encouraged to reduce pressure on fuel wood and fodder species and alternate sources like gas cylinders and energy-efficient cook stoves should be made available to local people especially those who are poor and needy which may lead to a 25-40% fuel saving.

(xii) Both in-situ and ex-situ conservation of medicinal plants in the study area should be promoted and the Traditional Healers Association should be supported, by providing funds, suitable land for cultivating medicinal plants and assistance in their activities with professional guidance which will definitely help in conservation of the fast eroding precious medicinal plants of the study area.
Further it can be concluded that an indispensable obligation for sustaining the medicinal and cultural resources of mankind is the preservation and recording of ethno medicinal uses of plants. Such an effort is widely considered as an asset for the welfare of present and future generations and extensive research on such traditional plants is of prime importance to scientifically validate their ethno medicinal claims. Keeping in view the high cost and side effects of allopathic medicine, the use of medicinal plants against different ailments plays a significant role in meeting the primary health care needs of the local people especially rural communities of the study area. Kashmir is fairly rich not only in medicinal plant species but also has deeply rooted traditional knowledge of these medicinal plants associated with the people. An immensely valuable database could be the outcome of this knowledge which in turn could provide baseline information for the commercial exploitation of bio resources. Besides, the information could prove a useful source for pharmacologists, phyto-chemists, botanists and to those interested in the development of alternative therapies provided that they work collaboratively. In addition to this, the utilization of indigenous plant-based drug resources will increase the importance of the local industry on the one hand and will minimize the expenditure incurred on the purchase of foreign drugs on the other. Hence there is a need for the inclusion of herbal medicines at primary health care level, since their long standing use as plant drugs without toxic effects would reasonably guarantee their medical efficacy and safety.

7.4.3 Field Study on Utilization of Medicinal Plants

Another field survey was taken in order to document the utilization of medicinal plants and for the same total of 15 field surveys were carried out from June, 2013 to October, 2014 in the area. Surveys were conducted from different areas and local herbalists known as Hakeems and other experienced people were taken to the field for the identification of medicinal plants used in folklore. Structured questionnaires, interviews and participatory observation were used to elicit information from the resource persons using standard methods. The result was that Ethno botanical details were collected for 38 species belonging to 18 families of Polypetalae from various parts of Kashmir, especially of higher altitudes. Out of these 38 plant species, the ethnobotanical information about Alchemilla vulgaris, Ranunculus palmatifidus, Saxifraga siberica, Sedum wallichianum and Sedum heterodontum is reported for the
first time from Kashmir Himalaya. The species are used by local and tribal people especially by Hakeems in the hilly areas. Majority of the plant species are herbaceous and multiple of home remedies are employed for the treatment of ailments. It has also been observed that most of the species are used for the general health problems and wound healings besides the treatment of diseases of skin, gastric, cough, etc. In a similar way, the most preferred plant parts for the preparation of such medicines are roots followed by leaves, flowers, whole plant, seeds and others (bark/aerial parts). The present study has reported ethno botanical uses of 38 species belonging to 18 families of flowering plants inhabiting high altitudinal areas of Kashmir Himalaya. The study revealed that the methods of use, the dosage and the duration differ from one plant species to another and also from area to area. The drugs are mostly prepared in the form of pastes, powder, latex, decoction, etc.

7.4.3.1 Findings

At present, serious threats of biopiracy and intellectual property rights, with huge economy at stake, have raised the demand for early bio-prospecting of highly important medicinal plants used in folklore. Traditional knowledge about the biodiversity reflects many generations of experience and problem-solving by the ethnic tribes. It represents an immensely valuable database that provides baseline information for the commercial exploitation of the biological resources. The information is also useful for the pharmacologists, botanists, etc. interested in the development of alternative therapies. Similarly, lesser known plant species may also prove useful in phytopharmacological research for discovery of new therapeutic substances for veterinary and other drugs. Besides, it will be worthwhile to impart knowledge to these local practioners about the variants of such medicinal plants which could be better result oriented. The documentation of traditional knowledge will also help in its conservation in relation to providing pharmacological needs for the betterment of human society.

7.4.4 Study on Economic Status of Medicinal Plant

Medicinal Plants are natural resources, formulating a backbone for AYUSH industry and treatment, which is achieving enormous popularity among the masses, more in developed countries for its curative and preventive efficacies more so for life style
disorders. The researcher studied the following selected medicinal plant for the research purpose:

(i) Kashmiri Saffron

Botanical Name: Crocus sativus Linn.

Family: Iridaceae

Local name – Kong

Distribution- Saffron is considered to be the native of south Europe and is cultivated in France, Italy, Turkey, Greece, Persia, China, Spain and Australia but Kashmir (India) is regarded the largest producer of it in the world. It is largely cultivated in Pampore (Srinagar) at the height of 1700 m. and in Kistwar at the height of 1900 m. in Jammu province.

Kong (Saffron)

Saffron is considered to be the native of south Europe and is cultivated in France, Italy, Turkey, Greece, Persia, China, Spain and Australia but Kashmir (India) is regarded the largest producer of it in the world. It is largely cultivated in Pampore (Srinagar) at the height of 1700 m. and in Kistwar at the height of 1900 m. in Jammu province. Recently it has also been cultivated in Ranikhet (U.P.) at the height of 2000 m. on trial basis. In fact there is firm belief in Kashmir and in the other states in India
too that Kesar cultivation is a boon of Kashmir and Saffron can grow only in and around Pampore.”

Kesar has been an important ingredient of the receipts of Vagbhata (500-100 BC) and Sushruta (700-600 BC) who practised medicine. During second century BC, Kalidas also referred to the occurrence of this plant in Kashmir. Afterwards the works of Carak and Susruta were translated in Persian and Arabic, a little earlier than 800 A.D., wherein this plant is mentioned by the name of Saffron, derived from the Arabic name ‘Azaferon’. In the Ayurvedic Literature the plant Kesar has 3 important synonyms i.e. Kashmiran or Kashmirajam and Valhikam, denoting its place or origin. Further its third place of origin had been mentioned by Bhavmishra as ‘Parsikan’ i.e. Iran, but he claims that the best variety of it was of Kashmiri origin. Ab-ul-Fazal (1500 A.D) in his book Ain-e-Akaberi confirms the cultivation of the saffron in the fields of Kashmir.

Saffron is a spice derived from the flower of the saffron crocus (Crocus sativus), a species of crocus in the family Iridaceous. The flower's three stigmas (the distal ends of the plant’s carpel’s, or female reproductive organs) and parts of its style (a stalk connecting the stigmas to the rest of the plant) are often dried and used in cooking as a seasoning and coloring agent. Saffron, which has for decades been the world's most expensive spice by weight, is native to Southwest Asia. Some believe that origin of saffron is located on a vast area of earth like, Greece, Turkey, Iran and central Asia. According to other historical evidences saffron was brought to India by the Persian rulers around 500 B.C various conflicting accounts exist that describe saffron first arrival in South and East Asia. The first historical accounts gleaned from Persian records. These suggest too many experts that saffron, among other spices, was first spread to India via Persian rulers. Another variant of this theory states that, after ancient Persia conquered Kashmir, Persian saffron crocus corns were transplanted to Kashmir soil. The first harvest then occurred sometime prior to 500 B.C. Ancient Chinese Buddhist accounts from the Mula-Sarasvativadin monastic order, present yet another account of saffron arrival to India. According to legend, an arhat Indian Buddhist Missionary by the name of Madhyantika was sent to Kashmir in the 5th century B.C. When he got there he reportedly sowed Kashmiri first saffron crop. On the other hand we all Indians believe upon the theory of Traditional Kashmiri Legends who state that saffron was brought to Kashmir region by two Sufi ascetics.
Khwaja Masood Wali (R.A) and Sheikh Sharif-u-din Wali (R.A) who wandered into Kashmir this stated that the plant had been cultivated in Kashmir for more than two millennia.

Kashmiri Saffron is bitter in taste and has a hay-like fragrance. It flourishes in such place where hot, dry breezes blow across arid and semi-arid lands in the summer. Nevertheless, the plant can tolerate cold winters, surviving frosts as cold as -10°C and short periods of snow cover. If it is not grown in a high-rainfall environment, the saffron crocus needs irrigation, in Kashmir, annual rainfall averages 1000-1500 mm and so Kashmiri saffron is grown without irrigation when rainfall is normal. Planting is best done in fields that slope towards the south, maximizing the crocuses’ exposure to the sun. Saffron plants need strong direct sunlight and do not thrive as shade plants. In the Kashmir, planting is done in June.

The corms are planted 7 to 15 cm beneath the surface of the soil. Harvest yield and quality are affected by the climate, planting depth, and corm spacing. Mother corms that are planted more deeply yield fewer flower buds and daughter corms, but produce higher-quality saffron.

In Kashmir, planting the corms 15 cm beneath the surface produces optimal saffron threads, while a shallower planting of 8-10 cm yields the most flowers and daughter. In Kashmir, the corms are planted 2-3 cm apart.

Medicinal Uses of Kashmiri Saffron

Medicinal uses in Ayurvedic system of medicine, the uses of saffron as medicine is available in the ancient codex of Ayurvedic classics. Apart from Caraka Samhita, Susrut Samhita, Astanga Sangraha and Astanga Hridaya, Bhavamishra (16th Century A.D.) an eminent physician of Ayurveda had given an excellent picture about saffron and described its properties elaborately. Folklore claims:

(i) Bulb of the Saffron for vathasonita / Amavata (Rheumatoid arthritis) preparation of the medicine Bulbs of Saffron are to be boiled in Cow’s milk and prepared in the form of paste. The paste is to be applied locally when the inflammation appeared in the joints of Vathasonita / Amavata (Rheumatoid arthritis) patients.
(ii) Saffron for colour complexion. 120 mg of Saffron if taken every day with one cup of milk by the pregnant women, it is said that the same will give good colour complexion to the new born baby."

Saffron was traditional used as an herbal medicine. Even now Saffron is used against diseases such as respiratory infections such as coughs and common colds, scarlet fever, smallpox, and cancer asthma disorders blood disorders, paralysis, heart diseases, stomach upsets and disorders, gout, absence of menstrual period, and eye disorders. Saffron was also an aphrodisiac, a general-use antidote against poisoning, a digestive stimulant, and a tonic for dysentery and measles. Saffron's yellowish hue was also taken as a sign by those who subscribed to the archaic ‘Doctrine of Signatures’ as a cure for jaundice

Saffron carotenoids have been shown in scientific studies to have ant carcinogenic (cancer-suppressing), anti-mutagenic (mutation-preventing), and immune-modulating properties. The active ingredient behind these effects has been identified as dim-ethyl-Croce tin. This compound counters a wide spectrum of both murine (rodent) tumors as well as human leukemia cancer cell lines. Saffron extract also delays ascites tumor growth, delays papilloma carcinogenesis, inhibited squamous cell carcinoma, and decreases the incidence of soft tissue sarcoma in treated mice.

The researchers theorize that such anticancer activity can be best attributed to dimethyl-crocin's disruption of the DNA binding ability of proteins, as shown in Thymidine-uptake studies. Specifically, the DNA-binding ability of enzymes known as type II topoisomerases within cancer cells is inhibited. Thus, the malignant cells are unable to synthesize or replicate their own DNA.

**Colouring and Perfumery**

Buddhist clergy, such as these monks in Thailand, often donned saffron-hued robes. Traditionally, these were colored using saffron-based dyes. Despite its high cost, saffron has also been used as a fabric dye, particularly in China and India. Traditionally, the noble classes were the exclusive users of saffron-dyed clothes. Saffron was thus accorded a ritualized and caste-representative significance. Saffron dye also has been responsible for the saffron, vermilion, and ochre hues of the
distinctive mantles and robes worn by Hindu and Buddhist monks. Saffron has also been used for its aromatic properties alone.

In Europe, for instance, saffron threads are processed and combined with such ingredients as alkanet, dragon's blood (for color), and wine (for color) to produce an aromatic oil known then as corium. Corium was then applied as a perfume to hair. Another preparation involved the mixing of saffron with wine to produce a viscous yellow spray that was copiously applied to the air of Roman theatres.

**Why Kashmiri saffron is costly then other saffron's in the world:**

The high cost of Kashmiri saffron is due to the difficulty of manually extracting large numbers of minute’s stigmas; the only part of the crocus with the desired properties of aroma and flavor. In addition, a large number of flowers need to be processed in order to yield marketable amounts of saffron. A pound of dry saffron (0.45 kg) requires the harvesting of some 50,000 flowers, the equivalent of a football field's area of cultivation. By another estimate, some 75,000 flowers are needed to produce one pound of dry saffron. This too depends on the average size of each saffron cultivar's stigmas. Another complication arises in the flowers' simultaneous and transient blooming. Since some 150,000 crocus flowers are needed to produce just one kg of dry saffron, about forty hours of intense labor, harvesting is often a frenetic affair. In Kashmir, the thousands of growers must work continuously in relays over the span of one or two weeks throughout both day and night. Another thing that is the object is the quality that is the main reason for its high price. Kashmiri saffron can be separated from other saffron of the world as Kashmiri saffron has

(i) “Extra-long and thick threads that expand even further on soaking / steeping while others are often smaller, thinner and broken that do not expand as much during soaking.

(ii) The second most important thing is the Color, its Deep red in color with No yellow content signifying very high coloring power while others Range from dark reddish brown to orange / yellow – indicating the use of floral wastage-low coloring power.

(iii) Kashmiri saffron is very Intense Saffron nose with high floral top notes which other saffron deficiencies. The flavor of Kashmiri saffron also discerns it from
other, only a fraction of the threads are required to create the desired flavor profiles. This is not the case in other saffron where more threads are required to create the same degree of flavor.

**Threat to Kashmiri Saffron**

The growers of famous moongra saffron (kesar) in Kashmir valley are in a predicament due to the decline in prices on account of import of cheap saffron from Iran. There are reports that the cheap Iranian saffron are being mixed with moongra saffron and are being sold as pure Kashmiri saffron at premium prices. A section of people prefer Iranian saffron to moongra saffron as it is cheaper in prices. The average price of the imported Iranian saffron is Rs16,000 per kg while the price of moongra saffron of Kashmir is around Rs 38,000 per kg. Iran is the largest exporter of Saffron but Saffron produced in Kashmir is of best quality. Due to good climatic conditions, saffron produced in Kashmir is the best one, which everyone would prefer to use. Only we have to increase its production and also stressed on branding Kashmiri saffron to counter Iranian Saffron. The farmers have to form an association to solve these issues and stop people selling fake product. It affects the image of Kashmir saffron. The farmers, however, are facing the major problem that is they have huge quantity of saffron lying unsold as nobody takes their produce. Customers prefer saffron from Iran which is cheap. There has to be proper branding of Kashmiri saffron, which should be later displayed in fairs. Government must organize fairs in different cities in India so as to make the people aware about the Kashmir brand of saffron and set up enforcement squads to check the sale of fake saffron at tourist places. In the era of economic liberalization and globalization of trade, it would not a good option to demand a hike in tariff duty to check the imports of saffron from Iran. Iranian saffron is of mediocre quality and stands no match for the moongra saffron of Kashmir. Hence, the better option would be to bring moongra saffron under geographical indications and launch a generic brand building exercise to promote exports. This is a better way to help the Kashmiri growers. It will help growers of moongra saffron. The use of geographical indications allows producers to obtain market recognition and often a premium price. With the increased internationalization of food and product markets, geographical indications have become a key source of
niche marketing. Geographical indications are also often associated with non-monetary benefits such as the protection of knowledge and community rights. Governments have been protecting trade names and trademarks used in relation to food products identified with a particular region since at least the end of the nineteenth century, using laws against false trade descriptions or passing off, which generally protect against suggestions that a product has a certain origin, quality or association when it does not. In such cases, the limitation on competitive freedoms which results from the grant of a monopoly of use over a geographical indication is justified by governments either by consumer protection benefits or by producer protection benefits the Geographical indication.

**Geographical Indications and Kashmiri Saffron**

It is known fact that, when a product associated with the name has a certain quality that derives from the geographic region and specific production process used in it should be geographical indicated. Geographical indications law restricts the use of the GIs for the purpose of identifying a particular type of product, unless the product and/or its constituent materials and/or its fabrication method originate from a particular area and/or meet certain standards. Sometimes these laws also stipulate that the product must meet certain quality tests that are administered by an association that owns the exclusive right to license or allow the use of the indication. And same is the glasses case with Kashmiri saffron.

Geographical Indications of Kashmiri saffron will confers legal protection in India. It will Prevents unauthorized use of it by others. As it provides legal protection, which in turn will boost exports and it also promotes economic prosperity of producers of saffron. Now the question before us is who will apply for it. The answer is that, any association of persons, producers, organization or authority established by or under the law can apply. The applicant must represent the interest of the producers. The application should be in writing in the prescribed form. The application should be addressed to the Registrar of Geographical Indications along with prescribed fee. The registration of a geographical indication is valid for a period of 10 year. The stress on branding Kashmiri saffron to counter Iranian Saffron is the need of the hour. Best packaging under a brand name will help growers of Kashmiri saffron and will also help to solve the problems which they are facing. The farmers have to from
association to solve these issues and stop people selling fake product as it harms the image of Kashmir saffron. There is a need to bail out the saffron growers in the current situation. The effective way will be to geographically indicate it.
(ii) Lavender

Botanical Name: *Lavandula angustifolia*

Origin: Kashmir, India

Part Used: Flowers

Process: Steam Distillation

Lavender has long been renowned as extremely versatile oil in numerous applications of aromatherapy and the fragrance industry. Lavender from Kashmir comes from the mountainsides of the Himalayas. Lavender grows profusely in an estimated 300 acres in Kashmir and Chenab valley.”

Since time immemorial, Lavender has been used for a host of therapeutic and cosmetic applications. In aromatherapy, Lavender has remarkable regenerative abilities for healing wounds and burns and is one of only a couple of essential oils that can be applied neat (undiluted) to the skin (unless prone to skin sensitivities). It has long been known for its success in treating insomnia, and like Chamomile, is especially effective in promoting a relaxed state of mind. In skin care, it is indicated for athletes foot, skin eruptions, insect bites and stings, burns, sunburn, inflammations, and wounds. Also indicated for muscular aches and pains, bronchitis, laryngitis, throat infections, flatulence, colic, nausea, cystitis, flu, depression, headache, migraines, nervous tension, shock, and PMS. Lavender has a positive effect on psychological disorders as an aid to stabilize the physical, etheric and astral bodies. In perfumery, Lavender is a middle to top note and blends well with most other essential oils, especially citrus and other florals, as well as cedarwood, chamomile, citronella, clary sage, clove, geranium, jasmine, marjoram, oakmoss, patchouli, pine, rosemary, thyme, and vetiver.
Comparison of New Kashmir Lavender Oils with Commercial Lavender Oils

True lavender oil is now becoming commercially available from Kashmir. It is possible that due to favorable climate and low labor costs, Kashmiri lavender oil may become a significant competitor with historical sources of lavender oil. With this increase in both small farm production and new commercially-available Kashmiri oil, it seems appropriate to compare several traditional sources with newer sources. There are currently 969 references to lavender oil in CAS online. The oil has been thoroughly analyzed. Tucker, Maciarello and Howell published detailed essential oil compositions for 12 lavender cultivars grown in a common garden. Lawrence has summarized the recent literature on lavender oils composition. Several cultivars of lavender were introduced to India from Bulgaria: ‘Kazanluk,’ ‘Karlovo,’ ‘Hemus,’ ‘Aroma,’ ‘Svezhest’ and ‘Vebets.’ In addition, Russian cultivars ‘Stepnaya,’ ‘Goranaya,’ ‘Prima’ and ‘Record,’ as well as French cultivars ‘Bareme’ and ‘Lambris’ were introduced. The origin of ‘B-18’ from Kashmir is not known. Various researchs and studies has been taken from time to time to compare samples of lavender oils from Kashmir against lavender oils obtained in the world market. Lavender oils were purchased from commercial vendors: Bulgaria, China, 40/42 France, Hungary, Oregon (USA) and Russia from Liberty Natural Products (LNP), Portland, Oregon; ‘Munstead’ from Young Living Farms, Mona, Utah; ‘High Alpine-France’ from Dreaming Earth Botanicals, France ex Firmenich; ‘Karlovo’ and ‘B-18’ from Himalayan Foothills Oils, Srinagar, India. The oils were analyzed on a HP5971 MSD mass spectrometer, directly coupled to a HP 5890 gas chromatograph, using a J&W DB-5, 0.26 mm x 30 m, 0.25 µ coating thickness, fused silica capillary column, using the following conditions: carrier gas He, 30.5 cm/sec (ca. 1 mL/min), 0.2 µL of 10% solution injected, split 1:15; injector 220°C, oven temperature linear programmed, 60–246°C at 3°C/min, transfer line 240°C. Identifications were made by library searches of our volatile oil library (10), using the HP Chemstation library search routines, coupled with retention time data of authentic reference compounds. Quantitation was by FID on an HP 5890 gas chromatograph, using a J&W DB-5, 0.26 mm x 30 m, 0.25 µ coating thickness, fused silica capillary column, using the following conditions: carrier gas He, 30.5 cm/s (ca. 1 mL/min), 0.2 µL of 10% solution injected, split 1:15; injector 220°C, oven temperature linear programmed, 60–246°C at 3°C/min, FID detector 240°C, H2 66 mL/min, makeup He 30 mL/min, air
300 mL/min. The FID signal (uncorrected) was analyzed using the HP Chemstation software to obtain percent of total oil for individual components. Chiral analyses were performed on a Restek Rt-DEXse 2,3-di-O-ethyl-6-O-tert-butyl dimethylsilyl β-cyclodextrin infused into 14% cyanopropylphenyl/86% dimethyl polysiloxane, 0.25 μm coating thickness, 0.25 mm x 30 m, fused silica capillary column, using the following conditions: carrier gas He, 30.5 cm/s (ca. 1 mL/min), 0.2 μL of 10% solution injected, split 1:15; injector 220ºC, oven temperature linear programmed, 70–230ºC at 2ºC/min, FID detector 240ºC, H2 66 mL/min, makeup He 30 mL/min, air 300 mL/min. Standards (R(-)-(S)-linalool, (+/-) racemic linalool, (+/-) racemic linalyl acetate) were obtained from Sigma-Aldrich (SAFC). Results and Discussion which came out was that the compositions of the lavender oils are given in T-1 along with the European Pharmacopoeia 5.0 (EP 5) standards. All of the oils were found to be high in linalool ranging from the Oregon grown (OR, LNP, 27.3%) to China (38.0%) and meet the EP 5 specifications. All of the oils were high in linalyl acetate with the lowest being China (27.2%) and the highest being ‘B-18,’ Kashmir (46.6%). In fact, the Kashmiri ‘B-18’ lavender oil actually exceeded the EP 5 specifications. Camphor gives lavender oil the undesirable medicinal/camphoraceous odor.\(^1\) The 40/42 France (a blended oil) and ‘High Alpine-France’ (possibly blended) have 0.6% and 0.7% camphor. Both of the Kashmiri oils were very low in camphor and this contributed to their excellent fragrance. All the oils are within standards for 3-octanone except the ‘High Alpine-France’, which was less than the EP 5 lower limit (0.1%). Limonene was within EP 5 (< 1.0) specifications for all oils except for the Hungarian oil that contained 1.0% limonene. All of the oils met the EP 5 standard for α-terpineol (< 2.0%), except for the ‘B-18’ oil from Kashmir, which was just at the level (2.0%). Chiral analysis focused on linalool and linalyl because these are specified in the EP 5 standards. The EP 5 standards set limits of (-)(S)-linalool (12% max) and (+)-(S)-linalyl acetate (1% max). The results of analyses on a β-cyclodextrin chiral capillary column are shown in T-2. All of the oils contained 1.1–2.9 % (+)-(S)-linalool, well below the EP 5 12.0% maximum. The oils, except Hungary, contained from trace to 0.7% (+)-(S)-linalyl acetate, which was below the EP 5 maximum of < 1.0%. The Hungarian oil contained 12.9% of (+)-(S)-linalyl acetate, far exceeding the EP 5 standard (< 1.0%). This suggests that the sample of Hungary oil obtained was a blended oil. In general, although there is some variation in the lavender oils examined, with the exception of the Hungarian sample, the range in question generally met EP 5
standards. It might be noted that ISO standards are applied differently based on the botanic germplasm of “spontaneous” vs. “clonal from various origins.” Although several of the oils failed to meet some of the ISO standards, it does not seem feasible to determine the germplasm origin for oils bought in an open, world market. The European Pharmacopoeia standard seems to be more applicable for the evaluation lavender oil because of the worldwide production today. In summary, the compositions and fragrances of the Kashmir lavender oils are comparable to the other lavender oils examined. In these studies, nearly all the oils met the EP 5 standard. Is this important? Perhaps not as important as it has been in the past. Many companies blend lavender oils from several sources to make lavender oil that meets its company specifications. Entrepreneurial companies in the United States are only selling their lavender oils in local shops, on the Internet, or for aromatherapy. As one lavender oil producer said, “We just use our nose. If it smells like lavender, we sell it.” It seems that merchandizing in the United States has, in many cases, superseded quality control.

In the west a craze to spray bedding with flavours before going to sleep has got developed among the people. Aromatherapy is gaining laurels around the world over, with Kashmir Lavender being the crown in the world of aroma. Indian Institute of Integrative Medicine Srinagar (Erstwhile Regional Research Laboratory) has developed a variety having high oil content and excellent quality profile and is now branded as Kashmir Lavender in the international market and is highly suitable for temperate conditions of Kashmir. The quality profile of lavender which is being grown at extension centre in district Pulwama is at par with the international standards and is being used in the Indian market. The oil is also sold in UK market in a limited quantity and has been approved by the user industry.

Lavender is a hardy temperate plant and grows well in well cooled temperatures and moderately warm summers and needs minimum irrigation. Areas without an impact of winter having high temperature are not suitable for its cultivation. Under Kashmir conditions minimum one or two irrigations are required during rain free period. Lavender blossoms in Kashmir in the last week of June and continues till end of July. Though there is later flowering in the month of November and is not economical for processing of lavender oil. The flowers during that period are collected, dried and sold as such. Harvesting of flowers is done by a sharp sickle on bright sunny days when
50-60% florets are open. Herbage will go on increase if proper cultural practices are followed. Flowers are immediately distilled in a still operated by a boiler for lavender oil. The herb yield declines after 12-15 years of planting and plantation needs to rejuvenated for this purpose.

Lavender can be suitable integrated with apple as an intercrop. The freshly laid apple orchards take several years to come to fruiting. During this lean period of 6-7 years there are no direct returns from the land and it will permits increased harvest per unit, better economic returns for the farming community. In Lavender, the initial investment is the plantation and processing for Lavender oil thereof which require a steam distillation unit. Actual benefits are obtained after 2nd year plantation. The institute has already local entrepreneurs in its cultivation and processing for lavender oil by providing technical knowhow and quality planting material.

Lavender oil need to be stored safely to retain its potency or the active chemical profile. It should be freed from moisture, stored in well tightly closed containers at low temperatures and away from light. Lavender oil should be packed in coloured glass bottles amber or blue or preferably in aluminium bottles. Caps of the bottles should not be off for longer periods as the oil is volatile. It has been reported that lavender oil stored under proper conditions remains pretty good even after 15 years.

There is worldwide slogan to use lavender and rose products based on organic and biodynamic methods. Organically certified lavender and rose products fetch higher price in the international market. The strategy for lavender and rose oil to get organically certified, following criteria is to be followed:

(i) The crop should be properly identified.

(ii) No chemical insecticides or pesticides are to be used.

(iii) Only farmyard manure to be used

(iv) Weed control by hand weeding.

(v) Lavender and rose oils to be analyzed for quality profiles in the field laboratory.”

Economical Aspect
As per the information obtained from the fields, State Medicinal Plants Board Srinagar and Indian Institute of Integrative Medicine, in Lavender, the initial investment is the plantation and processing for Lavender oil thereof which require a steam distillation unit.

<table>
<thead>
<tr>
<th>Total Herbage Yield</th>
<th>60-70 qtl/hac.</th>
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</thead>
<tbody>
<tr>
<td>Oil Recovery on Pilot Scale</td>
<td>1 to 1.6%</td>
</tr>
<tr>
<td>Total Oil Yield</td>
<td>60-70 kg/hac</td>
</tr>
<tr>
<td>Sale Price of Oil</td>
<td>Rs. 2500/Kg</td>
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<tr>
<td>Gross Return</td>
<td>1.50-1.75 lakhs</td>
</tr>
<tr>
<td>Cost of Production</td>
<td>0.50 – 0.60 lakh</td>
</tr>
<tr>
<td>Net Profit/hac.</td>
<td>1.0 - 1.15 lakh</td>
</tr>
</tbody>
</table>

Given proper thrust like incentives to farmers during plantation and distillation, cultivation and processing of lavender, can become potential and frontline crops for agribusiness besides a hot destination for eco-tourism by establishing lavender parks and lavender festivals. Degraded forest land and fallow lands will be ideal for cultivation of lavender. A lavender park has been already established in Pahalgam with the help of IIIM-Srinagar for salutary effects on environment. Lavender can be considered a boon to the state and to the locals considering following points in lavender cultivation in Kashmir:

(i) Lavender cultivation is better option than any other crop on rocky and gravelly lands.

(ii) The gestation period is only three years in lavender against the tree crops which have a gestation period of more than 10-15 years.

(iii) Lavender remains productive for 20 years.

(iv) No disease in Lavender crop has been reported in Kashmir.

(v) Small scale industry can be sustained for manufacturing the processing and packaging goods.

(vi) The technology is home grown of the state of J&K (IIIM, J&K).
(vii) Kashmir can safely produce at least 200 – 300 tonnes of Lavender oil valued at 90 - 135 crores annually suffice to meet the domestic needs of our country.

(iii) Rose of Tangmarg (Rosa Domascena)

It’s very few that will know that world’s best aroma is produced in Gulmarg. Rose of Tangmarg (Rosa Domascena) is the best rose of the world. This rose is resistant to all diseases and as such is the craze for aromatic industries. (Rosa damascena Mill) commonly known as Damask rose (Gulab)is the most important source of rose products like rose oil, rose concrete, absolute and rose water. They are highly expensive base materials for perfumery, flavor, cosmetic, pharmaceutical and food industries. The oil has antibacterial, antidepressant, antispasmodic properties. It is a wonderful skin tone and anti-wrinkling agent. Rose oil is used for compounding and to give characteristic rose odour with distinctive floral tonality. Rose products have good demand in India as well in other countries. The institute developed agro and processing technology for production of rose oil. Rose oil produced on the technical knowhow of this institute is at par with international standards.

Besides rose oil other value added products are obtained from rose flowers. Rose attar is used in perfumery based on sandalwood or paraffin oil. Gul-e-Roghan is prepared from dry rose petals for making hair oils. Gul-kand is prepared by mixing fresh rose petals with sugar used as laxative and in Kashmiri Khawa. Rose hips are a good source of Vitamin C. Rose concrete is produced by extracting fresh rose flowers with the organic solvent, (Perfumery grade hexane). Rose absolute is prepared from rose concrete by refluxing with 90% alcohol followed by filtration and removal of undesired fats and solvent traces. Rose water of different grades is prepared by distilling rose petals. In India 60-70% damask rose is used for preparation of rose
water used in religious ceremonies and as a coolant in soft drinks. Rose water and dry rose flowers are also used in traditional system of Indian medicine, sometimes they are also used as food adjuvants. Various rose preparations are being used as an astringent, tonic, mild laxative, antibacterial in the treatment of sore throat, enlarged tonsils, cardiac troubles, eye diseases, gall stones, cooling effect and as vehicle for other medicines.

Besides lavender and rose other aromatic plants like clarysage, rosemary, geranium, peppermint and tagetes can be also processed for essential oils. These aromatic plants have been selected on the basis of harvesting periods under temperate climatic conditions so that 6-7 essential oils and their value added products could be produced in one distillation plant. Thus this bio business is better protected from market fluctuations at national and international level.

(iv) Vanwangan (Podophyllum Emodi)

Vanwangan is found growing all over Kashmir from 6000-10000, especially in Fir forests of Gulmarg and Gurez valley. The root of the plant yields Podophyllum resin, which is very popular in modern medicine. It is a powerful purgative and its action somewhat corresponds to that of mercury, hence it is named Vegetable Calomel. It is reported on the Kashmir plants “The resin obtained from the specimen sent from Kashmir generally looks somewhat different from that of the imported drug, but physiologically it is quite as effective. The percentage of resin obtainable from Kashmir rhizome is 10 to 12 percent as compared to the foreign varieties, which contain only 3 to 4 percent. The rhizome analyzed is of excellent quality and the possibilities of manufacture of the resin on commercial scale would be considering.

(v) Kuth

Another important plant is Kuth (Saussurea Lappa). The Sanskrit name of Kuth is Kashmirja, which means “produced in Kashmir”. Even today its growth is limited to Kashmir. Kuth is used as an aromatic, stimulant, as a medicine for cough, asthma, fever, dyspepsia and skin disease. It is also used in stimulating mixtures for Cholera and prescribed as a stomachic, tonic, for ulcers and in rheumatism. It is also used as a depurative and aphrodisiac. According to Kaul, Kuth is a plant of great economic value. Stewart in his book on Punjab plants published in 1864 states that in the year
1837, 7000 maunds of Kuth were exported via Calcutta to China. However, experts suggest extraction and export of the drug on a large scale for economic upliftment of the state.

Findings

The geographical location of Kashmir provides an ideal physical environment for the growth and nourishment of many high value medicinal and aromatic plants. These crops can make a contribution to the economic development of the area in particular and the country in general. This study of the selected medicinal plants was based on surveys, interviews, and focus group meetings with participants in the market value chain including collectors/farmers, local dealers, shopkeepers and hakims, wholesalers, representatives of the domestic pharmaceutical industry, and exporters. The study reveals various species and their importance as a source of income for the nomadic tribesman and small farmer inhabitants of the mountain communities. The need of the hour is to promote, and propagate this natural wealth, with innovations for their sustainability in their natural diversities, as well as development of Agro techniques to swell their populations in unfamiliar habitat. To fill the huge appetite of the herbal industry commercialization and privatization of important components like Marketing, & processing should be a priority. Moreover, State Govt should initiate steps at administrative level for encouraging entrepreneurship in Medicinal Plants Sector, and ensuring policy framework regulating the trade, cultivation, and value addition in the sector. The sector has the potential to lead the employment/revenue generation for the State after power generation.

7.5 Human Health and Medicinal Plants

Medicinal plants have played significant role in many traditional systems of Medication from times immemorial and have been used as important therapeutic aids for alleviating ailments of humankind. India is endowed with a treasure of world’s oldest traditional systems of healthcare. The Indian System of Medicine (ISM) is of great antiquity and dates back to about 5000 years B.C. with extensive documentation and an impressive record of safety and efficacy. It includes Ayurvedic, Unani, Yoga, Siddha, Naturopathy and Homeopathic systems of medicine. All these systems of medicine are nationally and internationally recognized and have been integrated into National health care delivery system. About 90 per cent of ingredients used in ISM
are of plant origin. About 2000 species of plants are mentioned in Ayurveda. The Indian Ayurvedic medicine has a 70 per cent share of formal medicine market in the country and it caters to the need of more than 600 million people. The country has 400,000 registered traditional medicinal practitioners, compared to 332,000 doctors. The preventive and curative aspects of Eastern traditional systems of medicine particularly that of India and China are finding increased popularity and acceptance.

7.6 Global Resurgence in Herbal Medicine

The World Health Organization estimates that 75-80 per cent of people in developing countries rely on plant-based medicines for primary health care. The organization has listed over 21,000 plant names (including many synonyms) to be of medicinal use around the world. However, only about 5,000 species of higher plants have been thoroughly investigated as potential source of new drugs. Plants have contributed more than 7,000 different compounds in use today as laxatives, anticarcinogens, contraceptives, aphrodisiacs, diuretics, analgesics, anesthetics, decongestants, anti-helminthic compounds, etc. Over 25 per cent of our common medicine contains at least some compounds isolated from plants. Approximately 10 per cent of major drugs in USA have plant extracts as their active ingredients. In the USA alone from 1988 to 1998, sale of medicinal herbs and supplements went from $200 million to $5 billion. Asia is a very important market player for medicinal and aromatic plants since in most of the Asian Countries traditional health care systems are officially recognized and operate, at least, in parallel with allopathic medicine. In China, traditional medicine based on about 5,000 plants species is used to treat 40 per cent of urban patients and 90 per cent of patients in rural areas. The annual demand for plant material in the country is 70,000, excluding the domestic consumption, which has a far higher figure. The total value of furnished traditional Chinese medicine in 1996 was US $3.7 billion.

Japan has highest per capita consumption of botanical medicines in the world and the sales have grown rapidly in the recent years, because doctors increasingly incorporate traditional Chinese medicine as a complement to Western medicine. India is a major exporter of medicinal plant materials but unlike other developing countries it also exports processed plant based drugs. Seventy five per cent of the total exports from India go to countries: France, Japan, UK, Germany, USA and Switzerland.
After the advancement in allopathic system of medical sciences, use of medicinal plants in treatment of human ailments was almost pushed to back burner. However, since serious scientific research supporting their therapeutic value began around 1960, consumer response to the plant based medicines has brought global resurgence in the herbal trade. Continued onslaught of killer diseases like cancer, aids and nibbling disease like diabetes and arthritis coupled with side effects of synthetic drugs has drifted the interest of people globally from allopathy to natural system of medicine. Scientists in USA began a worldwide research and analysis of plants for treatment of cancer and other diseases. The cancer screening programme eventually analyzed 10 per cent of the total known plants species world over.

7.7 Database of Medicinal Plants in Kashmir

Kashmir valley has a treasure house of medicinal plants and many studies have been carried out to document ethno-botanical information from different areas of the region. In the present study an attempt has been made to document the ethno-medicinal usage of the various plant species in Kashmir valley. The present endeavour is a part of a survey programme aimed at to explore the traditional uses of the various plants/plant parts in Kashmir valley, India.
Table: 7-1 List of Plant Species Documented to possess Ethno-medicinal Usage in Kashmir Valley

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Scientific name</th>
<th>Family name</th>
<th>Local Name</th>
<th>Chemical constituent</th>
<th>Traditional Knowledge/Traditional use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aconitum heterophyllum Wall.</td>
<td>Ranunculaceae</td>
<td>Patis</td>
<td>Diterpenoid alkaloids</td>
<td>The plant has been found to contain a number of alkaloids with percentage as high as 0.80%. The plant is used as a febrifuge and bitter tonic. The roots are used for hysteria, throat infection, dyspepsia, vomiting, abdominal pain and diabetes.</td>
</tr>
<tr>
<td>2</td>
<td>Arisaema jacquemontiana Blume</td>
<td>Araceae</td>
<td>Hapat Makei</td>
<td>NR</td>
<td>Rhizomes mixed with edible oil form a paste, which issued for massage in order to regain muscular strength and to treat skin problems such as blisters and pimples. Rhizomes mixed with edible oil form a paste, which is used for massage in order to regain muscular strength and to treat skin problems such as blisters and pimples.</td>
</tr>
<tr>
<td>3</td>
<td>Arnebia bethamii Wall</td>
<td>Boriginaceae</td>
<td>Kah-Zaban</td>
<td>NR</td>
<td>The whole plant is used to increase lactation.</td>
</tr>
</tbody>
</table>
Lukewarm extracts obtained after boiling the whole plant in water is given to nursing mothers to increase their milk production. Also the root extract mixed with hair oil is useful for hair loss.

<table>
<thead>
<tr>
<th>4</th>
<th>Chenopodium ambrosoides Linn.</th>
<th>Chenopodiaceae</th>
<th>Ganhar</th>
<th>NR</th>
<th>Yields an essential oil, used as an anthelmintic against many forms of intestinal parasites including roundworms, hookworms and intestinal amoebae.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Cichorium intybus Linn</td>
<td>Asteraceae</td>
<td>Junglihand</td>
<td>Tannins, Polysaccharides, Sesquiterpene, Coumarin glycosides, Anthocyanins, Sesquiterpene lactones, Phytoalexin, Flavonoids</td>
<td>The root extract combined with sugary water is given in the form of 2 spoonfuls daily at bed time to cure typhoid.</td>
</tr>
<tr>
<td>6</td>
<td>Delphinium cashmirianum Royle</td>
<td>Rannunculaceae</td>
<td>Mori</td>
<td>NR</td>
<td>Flowers are used for extraction of dye used for dyeing silk. The extract of the aerial parts is diuretic, used to treat jaundice, dropsy and spleen ailments.</td>
</tr>
<tr>
<td>7</td>
<td>Euphorbia wallachii Wall</td>
<td>Euphorbiaceae</td>
<td>Guri-dud</td>
<td>Ellagic acid</td>
<td>Purgative and digestive, ecction given in gout juice is</td>
</tr>
<tr>
<td>Chapter 7</td>
<td>8</td>
<td>Ficus carica Linn.</td>
<td>Moraceae</td>
<td>Anjeer</td>
<td>Anthocyanins, Phenolic acids, Flavonoids</td>
</tr>
<tr>
<td>-----------</td>
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</tr>
<tr>
<td></td>
<td>9</td>
<td>Fritillaria roylei Hook</td>
<td>Liliaceae</td>
<td>Sheethkar</td>
<td>NR</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Hyoscyamus niger Linn</td>
<td>Asteraceae</td>
<td>Bhazar Bang</td>
<td>Tropane alkaloids</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Jurinea Cetoatocair Benth.</td>
<td>Asteraceae</td>
<td>Dhupa</td>
<td>NR</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Inula racemosa Hook</td>
<td>Asteraceae</td>
<td>Poshkar</td>
<td>Isoalantolactone, Lignans, Sesquiterpene</td>
</tr>
<tr>
<td>No.</td>
<td>Plant Name</td>
<td>Family</td>
<td>Common Name</td>
<td>Constituents</td>
<td>Uses</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------</td>
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<td>--------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>13</td>
<td>Iris hookeriana R.C. Foster</td>
<td>Iridaceae</td>
<td>Mazar Mund</td>
<td>Lactones, Alantolides, Isoalantolactone, Lignans, Sesquiterpene lactones, Alantolides</td>
<td>Tonic and stomachic. Oil of the leaves is an anthelmintic, also an expectorant and diuretic, the seeds are an aphrodisiac.</td>
</tr>
<tr>
<td>15</td>
<td>Plectrathus rugorus Wall.</td>
<td>Lamiaceae</td>
<td>Sloi</td>
<td>NR</td>
<td>Fresh leaves of the plant are crushed to yield an extract, and small quantities are dipped with tea daily for 1-2 weekstimes to cure gastroenteritis.</td>
</tr>
<tr>
<td>16</td>
<td>Rubus fuecticorus Linn.</td>
<td>Rosaceae</td>
<td>Black berry</td>
<td>NR</td>
<td>Leaf extract is mixed with hot water or milk to obtain a syrup which is bitter, and is used orally as antidote for snake bite.</td>
</tr>
<tr>
<td>17</td>
<td>Sassurea costus Lipsh</td>
<td>Asteraceae</td>
<td>Kouth</td>
<td>NR</td>
<td>Fruits are edible, roots extracts is an emetic</td>
</tr>
</tbody>
</table>

Leaves eaten as a vegetable and smoked like tobacco. Extracts obtained by crushing of roots are mixed with...
edible oil and the resulting paste is applied for two to three months regularly on weekly basis to cure arthritis.

<p>| | | | |</p>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>18</strong></td>
<td>Skimmia arborescens NP Taylor</td>
<td>Rutaceae</td>
<td>Naer</td>
</tr>
<tr>
<td><strong>19</strong></td>
<td>Urtica dioica Linn</td>
<td>Urticaceae</td>
<td>Soi</td>
</tr>
<tr>
<td><strong>20</strong></td>
<td>Viburnum grandiflorum Wall</td>
<td>Caprifoliaceae</td>
<td>Kulmanch</td>
</tr>
</tbody>
</table>
7.7.1 Methodology

During this investigation, field trips were carried out to the study area during 2012-2013. Appropriate methodology was used to obtain the ethno-medicinal knowledge about plants from the local population. Mostly local herbalists, old and experienced people were taken to the fields to identify the medicinal plants used in folklore. All the entire relevant information, in particular the method of use, about each medicinal plant species was recorded in field notebooks.

To make the survey as accurate as possible, the information was cross-checked, specimens of medicinal plants collected from each locality were provided with a collection number for future reference. The plant specimens collected were examined at the botanical division of the Indian Institute of Integrative Medicine (CSIR), Srinagar and at the Field Station Pulwama and identified from the available literature. The Medicinal plant species of the area are listed above in the alphabetical order. Each plant species is provided with its scientific name followed by the author citation, local name, family name, crude drug preparation and its use.

7.7.2 Results and Discussion

The present study shows that Kashmir is rich in useful medicinal plants with a variety of medicinal properties. A total of 20 medicinally important plants belonging to 14 different families were reported during this research. Based on the indigenous knowledge collected during the study, it can be seen that the area is a valuable source of medicinal flora with different medicinal properties. In this context it is important to appreciate that the plant/herbal remedies would be of great therapeutic value for different diseases of humans and domestic animals and offer alternative herbal treatments to a broad spectrum drugs. Most of the plants used for different medicinal purposes are regarded as very important and are used extensively. Due to this extensive usage they are over-harvested.

There is no immediate conservation programme for this valuable source of medicinal flora. The local herb-sellers pay a few rupees to local people to collect the plants for them. Most of the plants are already on the endangered list and to prevent the extinction of these medicinal plant species, efforts need to be made to protect the
endangered plant species by creating the awareness of the local people and giving them incentives to help protect these plants.

7.8 Legal Tools for Protecting Traditional Knowledge in India

This chapter explores some of the existing tools exist in India having the potential to protect traditional knowledge. Patents are sometimes cited as tools for protecting rights over traditional knowledge, but they do not suit the specific needs and characteristics of most traditional knowledge holders. Patents largely protect knowledge which emerges from modern technological enquiry. This is because the main criteria for patent protection are novelty and an ‘inventive step’. However, knowledge pertaining to medicinal plants and crops is often dynamic in nature and evolving over time and generations, and is largely held collectively. TK holders therefore may not be able to prove which inventive steps have been taken and when. Much TK is already available in the public domain which makes it ineligible for protection. Furthermore patents focus narrowly on commercial goals, without also supporting traditional practices or values.

India’s Biological Diversity Act of 2002 is a more recent law that has been enacted to provide for the conservation of biological diversity, sustainable use of its components and fair and equitable sharing of benefits arising out of the use of biological resources and traditional knowledge. This law establishes a three tier institutional structure for biodiversity governance in the country. One of the primary functions of the third tier, the Biodiversity Management Committees (BMCs), is documentation of biological diversity including habitats, landraces, folk varieties and cultivars, domesticated stocks and breeds of animals and micro-organisms, and knowledge relating to biological diversity. The other two tiers, the National Biodiversity Authority (NBA) and the State Biodiversity Boards (SBBs) are mandated to consult these BMCs when taking any decision relating to the use of biological resources and associated traditional knowledge within the territorial jurisdiction of the BMCs. The Biological Diversity Rules, 2004, specify that the main function of the BMC is to prepare a People’s Biodiversity Register (PBR) in consultation with local people. The register shall contain comprehensive information on the availability and knowledge of local biological resources, their medicinal or any other use or any other traditional knowledge associated with them. The NBA/SBBs shall specify the form of
the PBRs, the information it shall contain and the format for an electronic database. The BMC is also expected to maintain a register with details on access to biological resources and traditional knowledge granted, collection fees imposed, benefits derived and the mode of benefit-sharing.

While the Biodiversity Act has progressive provisions to protect and promote traditional knowledge, these have yet to translate into real benefits to traditional knowledge holders and local communities. At present, the efforts being made in the country are more in terms of documenting knowledge in the form of PBRs.

Another national law which has the potential to protect and promote farmers’ traditional knowledge and innovations is the Protection for Plant Varieties and Farmers’ Rights (PVFR) Act, 2001. The Act recognises the farmer not merely as a cultivator, but also as a conserver of the agricultural gene pool and a breeder who has successfully bred several varieties. The Act makes provisions for such farmers’ varieties to be registered (Section 14c, PVFR Act) either by the farmer or by an association of farmers (Section 16(d), PVP Act, 2001) or by any person authorised by the farmers to make an application on their behalf (Section 16E, PVFR Act, 2001). The Act recognises the age-old practice and rights of the farmer to save, use, sow, exchange, share or sell their farm produce including seed of a variety protected under the Act. Earlier this act was of limited use to the farmers as the registration process enshrined in it was too cumbersome for the farmers-particularly when proving the Distinctness, Uniformity and Stability (DUS) criteria required, as it took several seasons of consistent observations and documentation in the farmers’ fields.

However, over the past seven years, the Protection for Plant Varieties and Farmers’ Rights Authority has simplified the process and has identified Regional Agricultural Universities and crop-specific centres of the Indian Council of Agricultural Research to facilitate this process. As a result, the number of applications for registration has increased significantly. Since 2007, over 2,697 applications for rice have been filed on behalf of farmers, of which 25 varieties of rice have been registered by the PVFR Authority to date. Though this registration process is expected to afford substantive protection to the TK of farmers to protect it from misappropriation, the extent to which the farmers have benefited economically is yet to be ascertained. Furthermore, the Act only protects rights over seeds and not over other TK-based products.
The Convention on Biological Diversity and the recently adopted Nagoya Protocol on Access to Genetic Resources and Benefit-sharing are legal tools that have an international mandate to ensure respect and protection of the TK of local communities. The Nagoya Protocol was ratified and entered into force in October 2014. However, member countries will have to incorporate the provisions related to the Nagoya Protocol into their national legislation to operationalise the protocol. The fact that the Nagoya Protocol only covers TK which is documented/collected after its entry into force leaves, much TK unprotected.

Despite these international agreements, there have been a number of cases of biopiracy involving plants grown in India (often those with medicinal properties). Among the well-known cases are neem, turmeric, Phyllanthus amarus, etc., where patent offices in northern countries had wrongly granted patents on products or applications derived from the traditional knowledge of local communities. In some cases, the government of India took the lead and litigated against these cases and succeeded in getting the patents revoked. But it is a tedious, time-consuming and expensive process to gather evidence and prove prior art (i.e. prior existence of the product), and show that the knowledge has been in the public domain, in some cases from antiquity, and is therefore not novel. One reason for the wrongful granting of patents also relates to the fact that patent examiners do not have sufficient access to prior art information about the TK of biodiversity-rich counties. To overcome this shortcoming, the government of India has established a Traditional Knowledge Digital Library (TKDL) which involves the documentation of the traditional knowledge available in the public domain in existing literature related to Ayurveda, Siddha, Unani and Yoga in a digitised format in five international languages-English, German, French, Japanese and Spanish. This helps patent examiners at International Patent Office’s carry out searches on prior art and avoid the chances of wrongfully granting patents.

The legal tools outlined above may help to protect traditional knowledge in some cases but, given their reliance on benefit-sharing by others, it could take time to ensure benefits reach the knowledge holders, especially in tribal and traditional communities in India. Furthermore, their limited scope leaves much TK unprotected. These communities stand to benefit far more from marketing their bio-cultural
products themselves for full benefit capture, though they require appropriate legal tools and competent institutions to facilitate this and to offer sufficient protection.

7.9 Protection of Traditional Medicine: Practice and Prospect

Traditional Medicine is a subset of traditional knowledge. Its protection and sharing of benefits has been under debate at both the international and domestic level for decades. The Indian subcontinent has a rich heritage in traditional medicinal knowledge which is derived from multiple medicinal traditions, including Ayurveda, homeopathy, naturopathy, Siddha, Unani, and Yoga. Although the majority of this knowledge has been passed down through the oral tradition, considerable parts of it are described in diverse but usually inaccessible classical literature in different traditional or local languages such as Hindi, Sanskrit, Urdu, Tamil, and others. However in spite of their inaccessibility, their age-long codification warrants that they receive public domain status. In extant times, transnational pharmaceutical corporations and research institutions have sought to exploit India's medicinal heritage through the patent system. Notable examples include the turmeric, basmati, and neem patents, the applications for which were the subject of controversy at the United States Patent and Trademark Office (USPTO), the European Patent Office (EPO), and elsewhere. The experience served as a wake-up call for India to address the issue of the exploitation of its TK and the scourge of bio-piracy. India's experience is unfortunately only representative of a general trend in many developing countries with rich genetic resources and a traditional knowledge base.

India has established a defensive anti-appropriation strategy in response to the rampant bio-piracy in the form of the TKDL. This approach is an aggressive attempt to make previously inaccessible but codified Indian traditional medicinal knowledge available in digital form, so that patent examiners will have them handy as evidence of prior art (i.e., pre-existing knowledge), with a view to scuttling subsequent frivolous or biopiracy patents. The TKDL for India's systems of medicine is a massive state-sponsored interdisciplinary and interdepartmental project. It deploys the nation's wealth of human resources in medicinal knowledge systems, information technology, science, research, and bureaucracy. According to its manifesto, ‘[t]he project ... involves the documentation of the knowledge available in [the] public domain on traditional knowledge from the existing literature related to Ayurveda, Unani and
Siddha, in digitalized format in five international languages which are English, German, French, Japanese and Spanish.’ Throwing further light on the process, the Director of India’s National Institute of Science Communication and Information Resources (NISCAIR) where the project is being implemented, V.K. Gupta, avers that the TKDL database acts as a bridge between ancient traditional knowledge in the original languages (which may be in Hindi, Sanskrit, Urdu, Persian, Arabic, Tamil, etc.) and a patent examiner at a global level, since the database will provide information on modern as well as local names in a language and format understandable to patent examiners. The gap in prior art knowledge is minimized. The prior art has sufficient details on definitions, principles, and concepts to minimize the possibility of getting accepted minor insignificant modifications as novelty.”

Conceptually, therefore, the TKDL is not necessarily limited to a patent-related prior art search. Conscious effort is directed at guarding against its subversion for potential counter-productive outcomes, such as when information in the TKDL is mismanaged in a way that facilitates biopiracy. In this regard, the access and use of the TKDL database is subject to an agreement that imposes a restrictive obligation on those who legitimately possess the database and are in a position to make it accessible to third parties. Those in this privileged position include national and regional patent offices that need the TKDL databases to assist them in conducting prior art searches

One of the most significant contributions of the TKDL project within its short period of existence is its success in the proactive integration of its database ‘with the international intellectual property office activity of search and examination of the prior art search systems.’ For instance, the TKDL has improved on the problem associated with the classification system regarding the documentation of traditional knowledge.

It has done this by creating a modern classification system fashioned after the framework of the International Patent Classification (IPC). The resulting classification, which so far covers only Unani and Ayurveda medicinal systems, is ambitiously called the Traditional Knowledge Resource Classification (TKRC). The IPC was created pursuant to the World Intellectual Property Organization (WIPO) administered multilateral treaty, the Strasbourg Agreement Concerning the International Patent Classification. It provides a hierarchical system in which
technological or innovation categories are divided into a range of sections, classes, and subclasses for easy identification in prior art examination. Patent offices of more than one hundred countries, other intellectual property regional offices, as well as the International Bureau of the WIPO and the Patent Corporation Treaty (PCT) rely on the IPC for prior art searches.

The Indian initiative on the classification of traditional knowledge within the IPC has resulted in a detailed and improved IPC structure relating to traditional medicine. This includes the 2003 decision by the IPC Union to expand the classification of medicinal plants by about two hundred subgroups via the creation of a brand new group (A61K36) and, perhaps most importantly, the linkage of IPC with the TKRC through a concordance table prepared by India. Currently, the TKRC includes about 500 subgroups for medicinal plants, whereas IPC contained only one subgroup (i.e., A61K35/78).

In its operational modern system, the TKDL software incorporates the novel classification system, TKRC, and converts documented knowledge into target languages. In essence, medicinal formulations codified in ancient texts on Indian systems of medicine are transcribed or decoded into patent application formats in five so-called international languages under the meticulous supervision of scientists, technical officers, and distinguished experts in the particular systems of medicine. As opposed to transliteration, the software does knowledge based conversion where data abstracted once is converted into several languages by using state of the art technology such as Unicode, XML and metadata methodology. Software also converts traditional terminology into [Western scientific] modern terminology, for example, Kumari (local name) to Aloe barbadensis, Masurika (Sanskrit name for a disease) to small pox, etc. In general, the TKDL software is designed to translate local and previously inaccessible information buried in India's traditional medicinal knowledge heritage into their modern scientific correlation, which patent examiners can readily use for prior art searches.

The digital capture of traditional medicinal knowledge has given new momentum to traditional knowledge in many respects. Interestingly, the popular and longer standing policy responses to intellectual property's problematic relationship with traditional knowledge remain inchoate and do not seem to have translated into any concrete
results, let alone one with as much practical impact as the TKDL initiative. Specifically, the TKDL has fuelled an epistemological encounter and dialogue between traditional medicine as a local knowledge form and its more cosmopolitan Western counterpart through the direct attempt to increase traditional medicine's stake within the patent system. Even though digitization of traditional medicine through the TKDL primarily aims at establishing aspects of its standing as prior art, it must be noted that pre-existing patents, like those associated with Western medicine, are prima facie prior art. To that extent, the TKDL calibrates, or levels up, traditional medicine with its Western counterpart. This creates a semblance of psychological parity in favour of traditional medicinal knowledge vis-à-vis the extant recognition of Western scientific medicine under the patent regime. The difference is that while traditional medicine-related knowledge may be, at least in theory, freely accessible because it is part of the public domain, its Western biomedical or scientific counterpart is protected for the term of any applicable patent. Like the conventional patent system, the TKDL does not directly address the exclusive and proprietary aspects of traditional medicine. However, by creating a new classification system based on traditional medicine (i.e., the TKRC), and by informing the IPC and global patent literature, the TKDL “provides a bridge between modern science, modern medicines and traditional knowledge.

Beyond bridging, the TKDL's adoption of the concordance methodology to entrench traditional medicine in the IPC system exposes the interaction, interrelationship, and realization between Western medicine and traditional medicine in a way that blunts the sharp and uncritical loyalty to the prevalent rigid classification of the two knowledge forms. Even though the TKDL deals with codified information on traditional medicine in the public domain, as a permanent and growing feature of the global patent process, the TKDL promises to be of significant importance for the patentability of non-codified and independent traditional medicinal innovations.

7.10 Geographical Indication as an Instrument of Protection for Traditional Knowledge

Traditional knowledge, innovations and practices play an important role in practically all aspects of the lives and livelihoods of rural people in India: food and agriculture, human and animal health, clothing, shelter, architecture, art, culture,
handicrafts, natural resource management, etc. Traditional knowledge is an inextricable part of the bio-cultural heritage of indigenous peoples and local communities. It is ‘traditional’ only to the extent that its creation and use are rooted in the cultural norms and practices of a community; it does not necessarily mean ancient or static. Indeed, that which is ‘traditional’ can be seen as dynamic and evolving. Traditional knowledge is generally held collectively.

The use of traditional knowledge (TK) related to biological resources is not restricted to the lives and livelihoods of agrarian, rural and indigenous societies. In the modern day, there is an ever-growing demand for natural, herbal and organic products globally, especially in urban markets. The herbal medicine, cosmetics and personal care industries are the major users of these resources. The increased market demand for biological resources and associated TK could offer new opportunities for generating benefits and enhanced incomes for indigenous and local people. However, the current reality seems to be quite far from achieving this. There are very few experiences globally of local communities or traditional knowledge holders gaining substantially from the commercial use of their knowledge. On the contrary, cases of biopiracy and misappropriation of traditional knowledge are becoming more apparent and have been on the rise in the last two decades. This is also because more biopiracy cases have been highlighted since the Convention on Biological Diversity (CBD) was signed, and since national legislation has been introduced in member countries.

One of the primary reasons for this misappropriation is that traditional knowledge is available freely from local communities and these knowledge holders are not aware of the need to protect their intellectual property rights. The fact that this knowledge is often spread across several families and communities covering a large geographical area and sometimes even across country borders, makes protection even more challenging and misappropriation easier and more likely to occur. Misappropriation is exacerbated by the lack of effective tools for protecting the intellectual property of the holders of traditional knowledge and ensuring that they receive benefits from the commercial use of their knowledge. This is discussed further in the chapter on legal tools for protecting TK in India.

Traditional medicine is popular throughout the world. In some Asian and African countries, 80 percent of the population depends on traditional medicine, including for
primary healthcare. In many developed countries, 70 to 80 percent of the populations have used some forms of alternative or complementary medicine such as acupuncture. Many modern drugs and vaccines are based on natural resources and associated traditional knowledge. Traditional medical knowledge has social, cultural and scientific value and is important for many indigenous peoples and local communities. Growing commercial and scientific interest in traditional medicine systems has led to calls for traditional medical knowledge to be better recognized, respected, preserved and protected.

The importance of traditional medicine as a source of primary health care was first officially recognized by the World Health Organization (WHO) in the Primary Health Care Declaration of Alma Ata (1978) and has been globally addressed since 1976 by the Traditional Medicine Program of the WHO. The Member States of WHO have defined “traditional medicine” as having a long history and comprising traditional medicine as “the sum total of the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health, as well as in the prevention, diagnosis, improvement or treatment of physical and mental illnesses.”

“Traditional” means that the knowledge is created in a manner that reflects community traditions; it is often intergenerational and created and held collectively. “Traditional”, therefore, does not mean “old” but is rather related to the way in which the knowledge is created, preserved and transmitted. Traditional knowledge is generally considered the collective heritage of a particular indigenous people or local community.

Different aspects of traditional medical knowledge are under discussion in several international forums, including WHO and the World Trade Organization (WTO). The World Intellectual Property Organization (WIPO) is primarily concerned with “protection” of traditional medical knowledge in the IP sense – protection against unauthorized use by third parties. Negotiations currently underway in the WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC) seek to develop an international legal instrument that would provide effective protection of traditional cultural expressions/folklore and traditional knowledge (including traditional medical
knowledge), and address the IP aspects of access to and benefit-sharing of genetic resources. Calls for the protection of traditional medical knowledge are often based on a number of cases involving misappropriation by unauthorized third parties, who have patented compounds derived from traditional medicines without the prior consent of traditional medical knowledge holders and without fair compensation.

Examples of patents based on traditional Indian medicine have included the use of turmeric for healing wounds, the anti-fungal properties of neem, and a diabetes medicine made from extract of jamun. All three patents were subsequently revoked. In the case of captopril, a drug used to treat hypertension and heart failure, no benefits have flowed back to the indigenous Brazilian tribe that first used pit viper venom as an arrowhead poison. By contrast, the San people of the Kalahari Desert have a benefit-sharing agreement with South Africa’s Council for Scientific and Industrial Research, which is working with pharmaceutical companies to develop dietary supplements based on hoodia, a succulent plant well-known to the San for its appetite-suppressant qualities.

IP protection to medicinal plant can take two forms of protection viz., positive protection grants IP rights over the subject matter of traditional medical knowledge. This may help communities to prevent others from gaining illegitimate access to traditional medical knowledge or using it for commercial gain without equitably sharing the benefits. It may also enable active exploitation of traditional medical knowledge by the originating community itself, for example, to build up its own enterprises based on that knowledge whereas defensive protection does not grant IP rights over traditional medical knowledge but aims to stop such rights from being acquired by third parties. Defensive strategies include the use of documented traditional medical knowledge to preclude, oppose or invalidate patents on claimed inventions that are directly based on such knowledge. Defensive measures undertaken by WIPO include changes to the Patent Cooperation Treaty’s Minimum Documentation and the International Patent Classification so as to improve searches for “prior art” and prevent patents from being granted in error. In 2003, it was agreed that certain traditional knowledge documentation, such as the Indian Journal of Traditional Knowledge and the Korean Journal of Traditional Knowledge, should be included in the Patent Cooperation Treaty’s Minimum Documentation. In 2006, the
International Patent Classification was amended to include a traditional knowledge category, which covers traditional herbal medicines.

Although the Convention on Biological Diversity (1992) and Nagoya Protocol (2010) require commercial users of genetic resources and traditional knowledge to share the benefits they derive fairly and equitably, these agreements only cover resources collected after the entry into force of the CBD and the Nagoya Protocol, and do not recognise rights over traditional knowledge that is already published or ‘in the public domain’. So rather than waiting for possible ‘benefit-sharing’ by others, communities stand to gain a lot more by selling biocultural products themselves, for full ‘benefit capture’.

7.11 Concluding Summations

The IP/TK debate has reached new levels of serious review and new prospects for TK protection since the Doha meeting of November 2001 and the resulting process for the harmonization of TRIPS and CBD with respect to TK.

The growth of the herbal sector and the constant demand for new and saleable traditional medical products is new in the field of IP and traditional medical knowledge. This trend will clearly grow and should become a primary focus of IPR development. Of fundamental importance in this is the need for the herbal industry to become more proactive and responsive to this dimension. The herbal and traditional medicine industry should, of its own accord, develop industry standards that are based on ethical practice and are overseen jointly by industry-government-NGO-indigenous monitoring groups.

“To provide new models for development, information needs to be gathered on current practice. This in turns needs to be analyzed according to principles of best practice in benefit sharing and IPR. Sui generis systems alone may or may not be the way forward: they offer unique local means of protecting traditional knowledge that work for the local context. At the same time, they are at risk of being un-enforceable outside of the country or region of origin and hence creating vulnerability to the biopiracy that they are designed to prevent. For sui generis systems to work there will need to be reciprocity among countries to respect one another's local sui generis
regime—a prospect that would seem somewhat distant in the prevailing international IP political environment.

Such developments as those outlined above require backing and enforcement within the context of national and international IPR regimes. This would require WIPO, the CBD and the WTO to coordinate their policies and legal instruments in partnership with traditional knowledge holders as well as with conventional stakeholders such as governments and industry. If this can be achieved, the health benefits offered to the world through the globalization of traditional medical knowledge also stand to benefit communities and countries in terms of economic development and the growth of national pride in the preservation of culture and it’s harnessing for human well being in the context of principles of fair trade.

With the immense increase in the use of traditional medicines worldwide, protection of traditional medicinal knowledge has become an important concern. With the increase in demand for medicinal plants, exploitation of resources by the multinationals and absence of an effective system of protection, the urgent need for regulating access and benefit sharing has arisen. India is a most important resource collection centre for plants and traditional knowledge of system of medicines like Ayurveda, Siddha and Unani. As regards IP protection of traditional knowledge, it’s true that a dilemma prevails about providing patents to products and medicinal formulations, which are developed over hundreds of years.

Geographical Indication as an instrument of Intellectual Property rights can be the way to protect traditional medicinal knowledge. What we need is a sui generis law combined with certain intellectual property rights. Legislation can be enacted taking into account the various regional differences in the matter, customary laws of various communities etc. Besides, we should give more priority to collective or community rights instead of individual rights. That way it will become more profitable to the communities to commercialize their knowledge. The traditional medicinal knowledge which is not yet in the public domain can be protected as trade secrets. But the most essential thing which is needed is compatibility between the legislations and customary laws.