Wherever the art of Medicine is loved, there is also a love of Humanity.

- Hippocrates (460 BC – 370 BC)
  Greek father of medicine
1. INTRODUCTION

1.1. Medicinal plants

Since ancient times, plants have been an exemplary source of medicines. Medicinal plants contain natural chemicals and are generally known as “Chemical Goldmines”. They fall in two broad categories. Those plants which are only used by local physicians in various crude formulations to provide some relief to the local population in developing countries. Secondly, those plants which are in demand by pharmaceutical companies for their active ingredients (Baqar 2001). According to the World Health Organization (WHO), medicinal plants are those plants which are used for therapeutic purposes or which are precursors for Chemo-pharmaceutical semi-synthesis (Brussels 2001). Many plants of high medicinal value are distributed in Himalayas (Anonymous 2000). In the recent years the demand for medicinal and aromatic plants has grown rapidly, because of accelerated local, national and international interest and from the pharmaceutical industry in West. Due to continued collection and increasing market demand, many valuable herbs in the Himalayan region are facing danger of extinction.

Four thousand years ago, the medical knowledge of the Indian subcontinent was termed as Ayurveda. The Ayurvedic concept appeared and developed between 2500 and 500 BC in India. The Indian subcontinent is a vast repository of medicinal plants that are used in traditional medicinal treatments (Ballabh & Chaurasia 2007). The Indian system of medicine was regarded as a rich source of knowledge by many Westerners (Subhose et al. 2005). In India, around 20,000 medicinal plants have been recorded (Dev 1997), however traditional communities are using only 7,000-7500 plants for curing different diseases (Perumal & Ignacimuthu 2000). The medicinal plants are listed in various indigenous systems such as Siddha (600), Ayurveda (700), Amchi (600) and Unani (700) (Rabe & Staden 1977). Even today, majority of the medicines are prepared from the plants, animal products, minerals and metals, etc. Major pharmaceutical industries depend on the plant products for the preparation of Ayurvedic medicines.

Besides Ayurveda, other traditional and folklore systems of health care were developed in the different time period in Indian subcontinent. According to WHO
estimate, about 80% of the world population relies on traditional systems of medicines for primary health care, where plants form the dominant component over other natural resources (Perumal & Ignacimuthu 1998).

The use of plants for curing various human ailments figured in ancient manuscript ‘Rigveda’ (4500 – 1600 BC) with 67 medicinal plants, the Yajurveda with 81 species and the Artharvaveda (4500 – 2500 BC) with 290 species. Charak Samhita (700 BC) and the Sushruta Samhita (200 BC) described the properties and uses of 1,000 and 1,270 plants, respectively, in compounding of drugs and are still used in classical formulation in the Ayurvedic system of medicine.

Himachal Pradesh is a rich repository of medicinal wealth. In ancient times, it had been the abode of rishes and munies, who pursued their meditational and scholarly endeavours here. Rishi Vyasa, Agnivesha, Bhardwaja, Punarvasu, Atreya and Kali Dass wrote about the Himalayas, including treatises on herbs and herbal lores. A great scholar Punarvasu Atreya in Ayurveda, believed to have lived in Chandra – Bhaga river catchment in Lahaul and Spiti. Indra, the son of Kashyapa, is reported to have had soma in order to immortalize and rejuvenate himself here.

Nagarjuna, the scholar in medicinal chemistry, learned and worked in Kangra and later shifted his research activities to Trilokinath in Lahaul and Spiti. There is a reference of rare drugs like Sanjivani, Savarnyakarni, and Vishalyakarni in Valmiki Ramayana found on Kanchan hills and Kailash mountains. Several yogis like Gorakhnath, Bhairavnath, Matsyendranath and Charpatnath lived here and benefitted the people through their vast knowledge in herbal treatments (Chauhan 1999). The traditions, myths, legends and folklores of ancient Indian are still in existence in lores, temple and historical places in Himachal Pradesh only because of its geographical conditions.

1.2. Rare, endangered and threatened (RET) species of Himalayas and their cultivation

It has been observed that the frequency of some of the important medicinal and aromatic plants of Himalayas have considerably declined due to their unscientific exploitation, natural calamities, road construction, overgrazing and other activities (Dar et al. 2006). This destruction has rendered many species endangered and
threatened. Consumption of herbal medicines is widespread and increasing day by day. World Health Organization (WHO) has shown great interest in documenting the use of medicinal plants used by tribals from different parts of the World (Kamboj 2000). Many of the medicinal plants in developing countries are extracted from the wild source which has resulted in loss of genetic diversity and has led to the rapid depletion of a number of Medicinal and Aromatic plants (MAPs) from their natural habitats (Maikhuri et al. 1998; Singh 2004). This decreases their accessibility in the international market. Domestication and cultivation of MAPs is one of the viable options to meet the growing demands from the industries and to reduce the extraction pressures in natural habitats of MAPs. Several researchers studied high altitudinal medicinal plants and observed that they were highly potent and required cultivation (Sultan et al. 2006; Prakash et al. 2011b). The cultivation process will affect the economy of a country. So there is a need to conserve the medicinal plants. Several workshops and field demonstrations on conservation practices of MAP species have been conducted in Defense Institute of High Altitude Research (DIHAR), Ladakh.

1.3. Strategies for conservation of medicinal plants

Convention on Biological Diversity (CBD) stresses the need for synergy between traditional and modern scientific practices for conservation of environment and exploitation of these medicinal plants (Uniyal et al. 2006). Preservation of high altitudinal medicinal plant species of Himalayas and their traditional knowledge system are the most important aspects for the benefit of mankind, before it is lost forever. This will require a systematic approach in technology development, assessment and refinement. The problem can be overcome by building effective partnerships between farmers/growers, extension agents, private sector, NGOs/GOs, researchers and more importantly by enhancing information exchange. Furthermore, Biotechnological tools are used to select, multiply and conserve the critical genotypes of medicinal plants.

1.4. Herbal medicine market

Herbal medicine market in 1991 in the countries of the European Union was about $ 6 billion (now may be over $ 20 billion), with Germany accounting for $ 5 billion, France $ 1.6 billion and Italy $ 0.6 billion (Brower 1998). In 1996, the US herbal medicine market was about $ 4 billion and with the current growth rate may be
more than double by now. Thus a reasonable guesstimate for current herbal medicine market worldwide may be around $30 – 60 billion. The 10 best-selling herbal medicines in developed countries are those obtained from *Adhatoda vasica, Berberis aristata, Boerhaavia diffusa, Cyperus rotundus, Emblica officinalis, Glycyrrhiza glabra, Piper longum, Terminalia chebula, Tinospora cordifolia* and *Withania somnifera*. The sales of these drugs account for almost 50% of the herbal medicine market. Amongst the developed countries, Germany holds the lead and has published individual monographs on therapeutic benefits of more than 300 herbs.

### 1.5. Herbal medicine scenario in India

The Indian herbal drug market is about $ one billion and the export of herbal crude extracts is about $80 million. 80% of the exports to developed countries are of crude drugs and not finished formulations, leading to low revenue for the country. Thus, the export of herbal medicines from India is negligible despite the fact that the country has a rich traditional knowledge and heritage of herbal medicine.

India has 15,000–18,000 flowering plants, 23,000 fungi, 2500 algae, 1600 lichens, 1800 bryophytes and 30 million micro-organisms (Anonymous 1998). India also has exclusive economic zone in the ocean, harbouring a large variety of flora and fauna, many of them with therapeutic properties. About 1500 plants with medicinal uses are mentioned in ancient texts and around 800 plant species have been used in traditional medicine.

The major traditional sector pharmas in India are Himalaya, Zandu, Dabur, Hamdard, Maharishi, etc. and modern sector pharmas are Ranbaxy, Lupin, Allembic, etc. There are about 7000 firms in the small-scale sector manufacturing traditional medicines with or without standardization. However, none of the pharma has standardized herbal medicines using active compounds as markers, linked with confirmation of bioactivity of herbal drugs in experimental animal models.

### 1.6. Herbal medicine standardization

Standardization is a system that ensures a predefined amount of quantity, quality and therapeutic effect of ingredients in each dose (Zafar et al. 2005). Herbal product cannot be considered scientifically valid if the drug tested has not been authenticated and characterized in order to ensure reproducibility in the
manufacturing of the product. Moreover, many dangerous and lethal side effects have recently been reported, including direct toxic effects, allergic reactions, effects from contaminants, and interactions with herbal drugs (Vaidya & Devasagayam 2007). Therapeutic activity of an herbal formulation depends on its phytochemical constituents. The development of authentic analytical methods which can reliably profile the phytochemical composition, including quantitative analyses of marker/bioactive compounds and other major constituents, is a major challenge to scientists.

In view of the above, standardization is an important step for the establishment of a consistent biological activity, a consistent chemical profile, or simply a quality assurance program for production and manufacturing of a herbal drug (Patra & Saxena 2010). The authentication of herbal drugs and identification of adulterants from genuine medicinal herbs are essential for both pharmaceutical companies as well as public health and to ensure reproducible quality of herbal medicine (Straus 2002). According to WHO guidelines, an herbal product needs to be standardized with respect to safety before releasing it into the market.

1.7. Family Asteraceae

Asteraceae is the largest, cosmopolitan and highly evolved family of flowering plants. The number of species in the family continued to be revised with different numbers reported by various workers such as 760 genera and 10,000 species by Bentham (1873a), 950 genera with 20,000 species by Lawrence (1951), 1200 genera with 25,000 species by Carlquist (1961), 22,000 species by Turner (1977). Latest estimations are of 1600–1700 genera and 24,000–30,000 species (Funk et al. 2005). From India, Hooker (1881) reported 608 species belonging to 128 genera, Santapau & Henry (1973) 712 wild species of 139 genera. Latest estimates are of 892 species belonging to 167 genera (Hajra et al. 1995). This family is commonly regarded as the most advance plant family, because of the complex, highly evolved structure of its multi-flowered capitulum inflorescence and efficient mode of pollination. Here a large number of tiny florets are massed together for easy and collective pollination. The diagnostic features of the family Asteraceae are involucrate capitulum inflorescence, calyx modified into pappus, syngeneous stamens, unilocular ovary with a single basal ovule and one-seeded fruit (an achene). Asteraceae taxa can assume almost every life-form: herbs, succulents, lianas, epiphytes, trees, or shrubs, and they reach every environment and continent, except Antarctica (Funk et al. 2005;
Moreira-Munoz & Munoz-Schick 2007). It is the most common in the temperate regions and tropical mountains. The most species-rich genera in the aster family are Senecio (1,500 species), Vernonia (1,000 species), Cousinia (600 species) and Centaurea (600 species).

Tournefort (1700) recognized Asteraceae as a group and the family is monophyletic (Small 1919; Jansen & Palmer 1987; Hansen 1991; Michaels et al. 1993; Lundberg & Bremer 2003).

From the beginning, workers thought that the presence of both ray and disk florets represented the basic head pattern in this family. Cassini (1816) in his classic illustration placed Heliantheae at the center, Vernonieae and Eupatorieae at one end and Mutisieae and Cichorieae (Lactuceae) at the other end. According to Bentham (1873a) out of the 13 tribes, only Astereae and Senecioneae have Worldwide distribution, whereas others are not so widely represented. Vernonieae, Eupatorieae, Heliantheae, Helenieae and Mutisieae are chiefly American, and Inuleae is of the old world. Calenduleae and Arctotaceae are confined mainly to Africa and Europe but Cichorieae, Cynareae and Anthemideae to the northern hemisphere. Heliantheae was considered the most primitive tribe of the family by many workers (Bentham 1873b; Cronquist 1955, 1977; Turner 1977). Robinson & Brettell (1973), Carlquist (1976), Wagenitz (1976) and Jeffrey (1978) all divided Asteraceae into two groups approximating Asteroideae and non-Asteroideae of recent treatments.

The biggest change in Asteraceae systematics took place in the late 1980s and early 1990s and was based on the molecular work by Jansen & Palmer (1987, 1988), Jansen et al. (1991a), and Jansen & Kim (1996). They literally turned the Asteraceae phylogeny upside down, showing that part of Mutisieae was the basal branch of the family and that the tribe Heliantheae was nested far up in the tree. Furthermore, their work showed that Vernonieae and Eupatorieae, long believed to be closely related, were actually in separate parts of the phylogeny. At the same time, Bremer’s analysis (1987), based mostly on morphological data, placed Eupatorieae close to Astereae and not Heliantheae. Recently, a new higher classification system was proposed for the family (Baldwin et al. 2002; Panero & Funk 2002, 2007, 2008) that recognized new and previously described subfamilies and tribes.
In India, the chief centre of diversity of family Asteraceae is the Western Himalayas. The family is represented in a wide range of ecological conditions and habitats, but are rather rare in wet tropical regions. Tribes Vernonieae and Eupatorieae are adapted to mesic, tropical and subtropical conditions, and Astereae, Inuleae and Cichorieae to the temperate regions, because of the ecological diversification in tribes. More xeric adaptations are found in Astereae, Inuleae and Heliantheae (Heywood et al. 1977a). Some of the species which traverse through different climatic zones are *Ageratum conyzoides*, *Crepis japonica*, *Emilia sonchifolia*, *Gnaphalium luteo-album*, *Sonchus asper*, *S. brachyotus*, *S.oleraceus*, *Tridax procumbens*, *Vernonia cinerea*, etc.

Prior to DNA sequence based phylogenetic analyses, hypothesis on chromosomal base numbers in Asteraceae were hampered by a lack of understanding of which genera were basal within tribes and which tribes were basal within the family. For example, Cronquist (1981) reported that Asteraceae had a range of base numbers from x=2 to x=19+ and suggested that perhaps x=9 was ancestral. Earlier, Solbrig (1977) had also concluded x=9 as the ancestral base number of the family, based on an analysis of habit and frequency of chromosome numbers. In more recent years, following the introduction of molecular techniques for analyzing phylogenies through DNA restriction fragment length polymorphisms and base pair sequence analyses, authors have compared molecular results with chromosomical basal number data in order to reach conclusions on ancestral base numbers within groups of genera and among tribes (Baldwin et al. 2002).

**1.8. Economic importance of family Asteraceae**

Economically the family is of great importance. It has a special status in floriculture with more than 332 species, having many varieties, cultivated as ornamentals. Some of the genera, whose species are commonly cultivated as ornamentals, are *Aster, Bellis, Calendula, Centaurea, Chrysanthemum, Coreopsis, Cosmos, Dahlia, Gaillardia, Tagetes, Zinnia*, etc. Many species of the family are locally and commercially exploited for medicinal value. Besides, the family is an important source of many other valuable products such as food (lettuce), cooking oil (*Helianthus annuus, Carthamus tinctorius*), insecticides (*Pyrethrum pyrethroides*), sweetening agent (*Stevia* spp.), coffee substitute (*Cichorium intybus*), dyes, rubber, etc. (Heywood et al. 1977b). Some species grows as common troublesome weeds also.
1.9. Medicinal Importance

Besides ornamentals, family has great economic importance from medicinal point of view. Large number of species of the family are mentioned in ethanobotanical literature, besides many being exploited at the commercial level by various pharmaceutical industries for the cure of different disorders. Pullaiah (2006) has listed more than 500 species of the family as medicinal plants. Pharmaceutical value of these members is mainly due to the presence of certain phytochemicals which are their secondary metabolites. The most characteristic single group of chemicals are sesquiterpene lactones, pentacyclic triterpene alcohols, various alkaloids, acetylenes, aromatic and tannins. Medicinal preparation of some members of the family, such as Arnica montana, Chamomilla recutita, Chamaemelum nobile, Calendula officinalis, Echinacea sp., Eclipta alba, Inula helenium, Siegesbeckia orientalis, Stevia rebaudiana, Taraxacum officinale, etc. are available in India. In the Indian Asteraceae, intraspecific polyploid races are known in large number of species such as Achillea millifolium, Ageratum conyzoides, Artemisia glauca, A. maritima, A.vulgaris, Siegesbeckia orientalis, Taraxacum officinale, etc. Further, besides these cytotypes, there are many more medicinal composites with morphological variations with the same chromosomes. Well marked morphotypes are known in Achillea millifolium, Eclipta alba, Vernonia cinerea, etc. There are many medicinal composites with very wide range of distribution patterns, growing in varied ecological conditions e.g. Ageratum conyzoides, Siegesbeckia orientalis, Taraxacum officinale, etc. As the amount of active principle is known to differ with environment conditions, season, genetic makeup, developmental stage, there is a need for marking the cytovariants and phytochemical evaluation of these variants on population basis.

1.10. Cytological importance of family Asteraceae

Even cytologically, the family is quite variable as is evident from a wide range of chromosome numbers from $2n=4$ in Haplopappus gracilis and Brachycome lineariloba (Jackson 1957; Smith-White & Carter 1970) to $2n=312$ in Cotula rotundata (Lloyd 1972). The chromosomal diversification involves polyploidy, aneuploidy and phylogenetic reduction in chromosome number. Besides, the family has exploited structural changes, chromosome rearrangement, hybridization, apomixis, etc. as the evolutionary processes. Stebbins (1971a) stressed the importance
of chromosomal characters which show differences in the source of genetic variation. Since the first chromosome count in the family by Juel (1900), the chromosome data is now available for large number of species, but still about half the species are yet to be worked out cytologically.

1.11. Lahaul-Spiti

Lahaul-Spiti, the largest district in Himachal Pradesh, is a vast area of high mountains and narrow valleys bounded by Ladakh to the north, Tibet to the east, Kinnaur to the southeast and Kullu valley to the south. The district lies on the Hindustan-Tibet border. Presently studied area is a part of cold deserts in Western Himalayas. The area of Lahaul-Spiti district is 13,835 sq. kms. and population is 31,528. The district has a wide variety of attractions like snow covered mountain peaks, rugged terrains, imposing monasteries, perennial rivers, beautiful lakes, glaciers, forests and gompas. The entire district is full of natural scenic beauty providing charm to the tourists. The existing topography of the valley is unique in nature and beyond one's imagination. On the basis of geographical conditions, Lahaul-Spiti district can be divided into two main groups i.e. Lahaul valley and Spiti valleys.

Lahaul and Spiti valleys are cut off from each other by the higher Kunzum pass at 4,550 m, for more than six months in a year due to heavy snowfall.

Spiti is the sub division of Lahaul and Spiti district with its headquarters at Kaza. It is called "Little Tibet" because of almost same terrain vegetation and climate. It is linked with Kinnaur via Sutlej valley with motorable road which remains open up to Kaza for 8 to 9 months. Due to excessive snow at Rohtang Pass, the road to Lahaul valley remains closed from mid November to mid May every year.

1.12. Lahaul Valley

It is situated towards west and covers an area of 6,097 sq.kms with two rivers Chandra and Bhaga flowing throughout. Lahaul has three valleys i.e: Chandra Valley, Bhaga Valley and Chandra Bhaga Valley. The valley of river Chandra is locally called Rangoli. This region contains mainly high mountain peaks, large glaciers and vast snowfields. Lahaul is also known as “Valley of Glaciers”. Bara Shigri is the largest glacier in the Lahaul Valley. Besides these glaciers, there are four lakes,
Chandra Tal, Suraj Tal, Sissu Lake and Patseo Lake. The vegetation exists only in patches, mainly pastures, where Gaddis (the migratory people) camp during summer months. Most of the cultivation is done around the villages on the river banks. The valley of the river Bhaga is locally called Gara. The region of this valley like Chandra Valley also presents a deserted look. The valley of the combined rivers of Chandra and Bhaga is called Chandra Bhaga valley. It is popularly known as Pattan. This valley is wider, fertile and highly populated.

1.13. Spiti Valley

Spiti is pronounced as ‘Piti’ in local language which means “middle country”, lies in the middle of Ladakh and Tibet and on the eastern side of the district with Kaza as its head-quarter. The valley is a remote high area in the Himalayas situated on Tibetan plateau, with almost no rain and remains covered with snow for more than 6 months. The Spiti Valley is formed by the Spiti river which arises at the Kunzum Pass and descends into the mighty Sutlej River.

1.14. Climate

Climate of Lahaul - Spiti varies considerably. Spring begins about the middle of April and lasts up to the end of May. Next four months are regarded as summer season. There is a scanty rainfall in the area. Snowfall occurs in winter. August in the hottest month while January is the coldest month.

1.15. Agriculture

Only 25% of total geographical area is under cultivation (Bajpai 2002). Cultivation is mainly carried out in the river valleys and nearby mountain slopes up to an attitude of 4200m. People of Lahaul- Spiti cultivate barley, buckwheat, maize, sarson, cabbage, cauliflower, radish, carrot, tomato, etc. and cash crops like pea, potato, kuth and hops. The common fruit trees are apple, pear, apricot and plum, but only in Pattan valley.

1.16. People of Lahaul - Spiti

The people of Lahaul - Spiti are a mixed race. ‘Swangla’ and Gaddi, constitute the main tribes of the area. The women are very hard working. They tend fields, fetch fuel and water, and carry loads. Men are lazy and lethargic. They assist women only
during harvesting and fuel collection. People are peace loving and not involved in any crime, due to the fact that most of them follow Buddhism. The temples of worship are called ‘Gomphas’. The famous monasteries of the area are Kye, Tabo, Dhankar, Guru Ghantal and Kungri. These monasteries give religious training to ‘Lamas’.

1.17. Fauna and Flora

There are wide varieties of rare animal species in this area like Himalayan Brown Bear, Himalayan Fox, Himalayan Blue Sheep, Musk Deer, Mouse Hare, Porcupine, Lizards and Snow Leopards.

Lahaul - Spiti consists of rugged mountains, snow clad peaks, bare rocks, steep sandy slopes, dry arid weather, strong winds and low precipitation. Due to the harsh climatic conditions prevailing in the region, plants tend to become prostrate, thick, hairy, bushy, mat and cushion forming, and spiny with long roots, small, succulent or woolly leaves. The area is quite rich in plant wealth represented by a variety of plants which includes plenty of flowering plants of dry alpine and temperate zone, and a few Gymnosperms and Pteridophytes. Aswal & Mehrotra (1994) while studying the floristic diversity of cold deserts of Lahaul - Spiti reported as many as 985 species of 353 genera belonging to 79 families of Dicots, Monocots and Gymnosperms including 117 species of family Asteraceae. The area is rich in floral diversity and includes some rare, threatened and endemic species and plants of immense medicinal and economic importance like, Aconitum heterophyllum, Arnebia euchroma, Betula utilis, Bunium persicum, Cortus amatthioli, Cousinia thomsonii, Erigeron acer, E.alpinus, Ephedra gerardiana, Hyoscymus niger, Picrorhiza kurroa, Podophyllum hexandrum, Saussurea heteromalla, S. jacea, etc. The area is under considerable pressure of human intervention and natural disasters which include agriculture, heavy grazing, snow avalanches and landslides, increasing entry of tourists and transport vehicles, and over exploitation of medicinally important plants. Due to high floral diversity, Lahaul - Spiti cold deserts had already attracted the attention of a number of botanists over the years.

1.18. Need for Cyto-morphological Research

The plants of this area which are exposed to extreme cold stress conditions and high incidence of rays are expected to show a considerable amount of genetic
diversity in the form of intraspecific polyploids, aneuploids, hybrids, apomicts and taxa with B-chromosomes and various meiotic irregularities. Moreover the area has large number of medicinal plants. So there is a need for cytological exploration to pin point the new cytotypes. Few medicinally important plants have been studied cytologically from this area (Anonymous, 2004-2005; Pimenov et al. 2006). Cytological studies have been made in some plants from cold deserts of India by Gupta et al. (2009, 2010a, b), Himshikha et al. (2010), Kaur et al. (2010), Kumar et al. (2010, 2011a, b), Malik et al. (2010), Sharma et al. (2010), Singhal et al. (2010, 2011), Singhal & Kumar (2010) and Kumar & Singhal (2011), but majority of composites of this area are still not worked out. Further, there is a tremendous intraspecific chromosomal variation in the form of euploid and aneuploid chromosomal races, besides variations in the meiotic behavior in the different accessions of medicinal composites. Thus, there is an urgent need for detailed meiotic analysis from this area on population basis.

1.19. Phytochemical and Pharmacological Research

As we know that, plants are used as medicines since time immemorial. These are the richest bio-resource of drugs for modern and traditional medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs (Ncube et al. 2008). The medicinal value of plants lies in some chemical substances that produce a definite physiological action on the human body. Plants posses some of the most important secondary metabolites such as alkaloids, flavonoids, glycosides, terpenoids, tannins, saponins, carbohydrates, proteins, amino acids, volatile oils and phenolic compounds (Edeoga et al. 2005). So these phytochemical constituents play a great role in the herbal remedies. To know about these phytochemical constituents in the plants, different modern techniques of phytochemistry such as: HPLC (High Performance Liquid Chromatography), UPLC (Ultra Performance Liquid Chromatography), GCMS (Gas Chromatography Mass Spectroscopy), etc are applied, besides various bioactivities. All these are related to the chemistry of the plants and hence called phytochemistry. It is well known that the active constituents of the plants vary with the effects of the different environmental stress conditions. Besides these environmental stress conditions, cytological abnormalities, morphological variations and different ploidy levels of the plants also play great role in the variations in the content of bioactive compounds in the medicinal plants (Bimbiraite et al. 2008; Bano 2007; Downie 1988; Sharma 2012; Sharma et al. 2008).
Therefore, to check the variation in the quantity of active constituents of the medicinal plants and also to check the properties of medicinal plants different modern technique of biochemistry have been used such as:

**Phytochemical studies:**

1) HPLC (High Performance Liquid Chromatography)

**Phytopharmacological evaluation:**

1) Antimicrobial Activity
2) Hepatopotential Activity

1.20. Present study – A need

The present study covers area of North India from plains of Punjab to the higher altitude of Himalayas, particularly Lahaul - Spiti. Earlier cytological analysis has been made up to temperate vegetation, therefore, more emphasis was given on this area as this Himalayan range is very rich in biodiversity and has tremendous variation in altitude, latitude, topography, rainfall, climate, etc. The present problem has been undertaken to explore the cytogenetical and chemical characterization of some selected North Indian medicinal composites.

The objectives of the present study are as follows:

- extensive cyto-morphological surveys on some of the medicinal composites from North India, particularly from Lahaul -Spiti and its adjoining areas.
- detailed meiotic studies including microsporogenesis and pollen fertility for each species.
- information on flowering and fruiting period for each species.
- chemical characterization of some selected medicinal plants.
- evaluation of the Biochemical activities of different extracts of some selected medicinal plants on animal bodies.