CHAPTER 1
INTRODUCTION

The global pharmaceutical market is expected to exceed US$ 900 billion by the year 2009, where the herbal industry share is about US$ 62 million with good growth potential. Within the European community, botanical medicines represent an important share of pharmaceutical market. In India, the value of herbal trade is about US$ 10 billion per annum with the annual export of US$ 1.1 billion, while China’s annual herbal drug production is worth US$ 48 billion with export of US$ 3.6 billion. Presently United States is the largest market for the Indian herbal products accounting for about 50% of the total export. The figures also suggest the resurgence of herbal medicine and growing faith of people in them.

The steep rise in the herbal medicine is a reflection of the fact that the therapies developed along the principles of western medicine are often limited in efficacy, carry the risk of adverse effects, and are often too costly, especially for the developing and poor countries. However, the acceptability of the herbal medicine is usually low due to a lack of information on the scientific validation of the claim. Further, many species have not been fully characterized and there is an emerging need for the same.

Kashmir region of Himalaya is a rich source of diversified herbs and shrubs of medicinal importance. Among various species of plants of medicinal importance, the family Gentianaceae holds a distinct place, as various genera of this family are medicinally important and have been used over years in various parts of the world to treat different ailments. There are around 1000 species of this family. Among the plants often used in traditional medicine, Swertia species are quite important and have been used as crude drugs in Indian Pharmacopoeia.

There are about 250 species of Swertia, distributed worldwide, out of which near about 32 species occur in India with 15 species in north west Himalaya. About 9 species of Swertia have been reported from Jammu and Kashmir. These grow in grasslands, slopes or alpine bugyal.
A perusal of data reveals that the genus *Swertia* is heteromorphous as the species occupy habitat ranging from mesophytic, more or less xeric to temperate conditions from low to high (alpine) altitude (490—6250 mts). These species are found in western Himalayas, in Sonamarg, Batote, Banks of Chenab, Gulumg, Baderwah, Gilgit, Lidder valley, Sindh valley, Drass, Banihal, Aharbal, Zanskar and Banamarg.

*Swertia* species are used as a tonic and febrifuge. These have been used as bitter tonic, febrifuge, anthelmintic, antimalarial and antidiarrheal, (Kirtikar and Basu, 1933). In Chinese traditional medicine, 20 species of this genus are being used for the treatment of hepatic, choleric and inflammatory diseases. The herb of *S. purpurascens* is used in Pakistan as a substitute of *S. chirata*, and in Japan *S. Japonica* is an important bitter stomachic. A fair number of *Swertia* plants have been used since the remote past for the treatment of various ailments, particularly in the Indian subcontinent. Some highly effective and useful traditional applications of *Swertia* species in the indigenous system of medicine have been described by Maninder et al 1997. In Indian system of medicine, *Swertia chirata* is credited with anthelmentic and antidiarrhoeal properties and is prescribed in dyspepsia, in the debility of convalescence and generally in cases in which corroborant measures are indicated. It is official in Indian Pharmacopoeia and was formerly official in British and United States Pharmacopoeias. Unlike other bitter drugs, it does not produce constipation, instead it tends to produce a regular action and causes a free discharge of bile. It is given as powder, infusion, tincture, or as a fluid extract. However, the predominant species *Swertia chirayita*, though recorded in literature, has not been found yet from Kashmir.

The phytochemical investigation of the genus *Swertia* as carried out so far has afforded some 200 compounds with varying structural patterns. Among these xanthenoids, terpenoids, flavonoids, alkaloids, irridoid glycosides and some other compounds with varying structural patterns have been established. *Swertia* belongs to amaroidal class of drugs, which are difficult to standardize and, therefore, the physiological evaluation of drug through bitter value has been found to be useful (Hornborne & Swain, 1969). A number of species are used as substitutes for true chirata. Earlier studies on the extracts of *S. Iberica* (Hostettman et al, 1981) and *S. Japonica* (Chopra et al, 1956) revealed the presence of certain cardiac glycosides; however, mangiferin, a characterized xanthone c-glycosides present in *Swertia* was the first to be investigated.

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pharmacologically. On animal tests, it exhibited diuretic and cardiotonic properties (Hooker, 1894). Mangiferin has shown a high central nervous system stimulating effect in rat (Bhattacharya et al., 1972). Xanthones in Swertia have been reported for the antitubercular activity (Mani, 1978), and irridoids for anti-inflammatory activity (Dala et al., 1969; Chaudhary, 1995). The effectiveness of gentiopicroside has been tested in carrageenan induced foot oedema in rats with considerable success. Pharmacological effects of Swertiamarin and gentianine, the only alkaloid present in Swertia, have been investigated. It has been demonstrated that gentianine depresses the CNS and shows antiulcerogenic action and inhibits gastric secretion (Hongfa et al., 1981). Various studies on Swertia species have revealed antimalarial (Hostettman & Wagner, 1977), anti-inflammatory (Ghosal et al., 1975), hepatoprotective (Ghosal et al., 1974; Komatsu et al., 1972; Ghosal et al., 1978; Yamahara et al., 1978, Carpenter et al., 1969), antihelmentic (Iqbal et al., 2006), antioxidant (Chawdhury et al., 1978; Patro et al., 2005), anticarcinogenic (Bhattacharya et al., 1972; Saha et al., 2004), antibacterial (Komatsu and Tomimori, 1966), and hypoglycemic (Grooger, 1969; Ramesh et al., 2002; Bhat, 2005) activities.

Keeping in view the above information, the present study was undertaken to explore the medicinal potential of Swertia petiolata and Swertia tetragona, hitherto uninvestigated species in Kashmir. These species have been used traditionally and regionally for various ailments by local healers. The entire plant of Swertia petiolata is used in Tibetan medicine for its cooling potency (Tsarong Tsewang, 1994), antiinflammatory activity, as febrifuge, and as a liver tonic (Komatsu & Tomimori, 1966; Grooger, 1969). In Kashmir, the rhizome of the perennial herb is used traditionally in toothaches, in rheumatic diseases and to heal and protect wounds from infections by gujar and bakerwal community and people living in mountaineous regions, who locally call it 'momram'. Swertia tetragona is mostly substituted for Chirata, and is locally being used as anthelmintic, febrifuge and liver tonic. Therefore, these two Swertia species may also have antiinflammatory, analgesic, antimicrobial and antihepatotoxic properties. HPTLC Fingerprinting of the two species has also been undertaken for the purpose of authentication and quality control.
The objectives of the study are as follows:

1. Collection and authenticatin of *Swertia petiolata* and *Swertia tetragona* from its local habitat in Kashmir valley.
2. Preparation of hydroalcoholic and aqueous extracts of *Swertia* and their physico-chemical characterization.
3. HPTLC finger printing of the extracts.
4. Evaluation of the antiinflammatory, analgesic and antibacterial activity of the crude extracts prepared from *Swertia*.
5. Evaluating the antioxidant potential of *Swertia* species in animal models and *in vitro*.
6. The effect of *Swertias* extracts in animal model in liver necrosis.