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MEDICINAL IMPORTANCE OF GENUS *INULA*- A REVIEW

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ABSTRACT

Genus *Inula* is important medicinally as it has anticancerous, antibacterial, hepatoprotective, cytotoxic and anti-inflammatory properties. The species growing in East Asia are widely used by the local people for varied medicinal properties which have prompted many workers to study the phytochemistry of these species which has ultimately resulted in the extraction of a number of novel bioactive molecules. This emphasizes on the need of extensive study for revealing the medicinal importance of the other species of *Inula*.

Keywords: Alkaloids, Bioactive molecules, Himalaya, Medicinal plant, Sesquiterpenes.

INTRODUCTION

The genus *Inula* belongs to tribe Inuleae, family Asteraceae (Qaiser and Abid, 2003) with about 100 species (Ali et al., 1992). Diverse biological activities have been attributed to this genus, like, anticancer, antibacterial, hepatoprotective, cytotoxic, and anti-inflammatory (Zhao et al., 2006).). As per the available literature the species of reputed medicinal value are distributed in East Asia from Korea to western Pakistan and these include: *I. royleana* DC. (Kaul, 1997), *I. helenium* L., *I. racemosa* Hooker fil., *I. viscosa* (L.) Aiton, *I. britannica* L. (Blaschek et al., 1998), *I. japonica* Thunb.(Jiangsu, 1977), *I. rhizocephala* var. *rhizocephaloids* (Clarke) Kitam., *I. obtusifolia* A. Kern. (Chaurasia et al., 2010), *I. grantioids* (Kirtikar and Basu, 1933), *I. helianthus-aquatica* C.Y.Wu (Zeng et al., 2009). These plants are used in ethno-medicine of the region in which they are growing. These have also been chemically evaluated for their medicinal properties and active principles which reveals the chemical potential of the genus and suggested for further studies in the species which have not been chemically evaluated. The

medicinal plants which have been chemically evaluated are as follows:

Inula royleana DC., a medicinal perennial herb, is native to Western Himalaya (Stojakowska and Malarz, 2004). In Kashmir Himalaya it is known as Gugi Phool, is less common and found at an altitude of 2800-3400 m (Khuroo et al., 2007). It is reported that roots of this plant contain sesquiterpene lactones of eudesmane type (Bohlmann et al, 1978; Qurishi et al., 1980), abietane diterpenes (Edwards et al., 1962; Bhat et al., 1975) and diterpene alkaloids (Khaleque et al., 1959; Hegnauer 1964). These compounds possess a variety of biological activities e.g., insecticidal (Jennings et al., 1986), insect repellent (Ulubelen et al., 2001), antimicrobial (Yang et al., 2001), anti-inflammatory (Dirsch et al., 2000) and antiproliferative against different cancer cell lines (Lawrence et al., 2001; Konishi et al., 2002). Some abietanes have vasodepressor effect as well (Kolak et al., 2001; Ulubelen et al., 2002). Roots of this plant are known to have neuromuscular blocking properties (Manchanda et al., 2000) and are used to cure headache (Kala, 2006). In Kashmir Himalaya, shoots of *I.*

royleana are used for curing dermatitis (Kaul, 1997) and its dried flowers are used for curing throat sores, wounds and inflammation of hooves after boiling in water for half an hour and adding few drops of edible oil (Khuroo et al., 2007). In Pakistan, whole plant is used for intestinal problems (Khan and Khatoon, 2008). Alkaloid of the roots of this plant also helps in lowering hypertension (Haq and Alam, 2010). Roots are stored for protecting garments, its extract is used for curing dermatitis and allergy and root in the form of paste is also applied with leaf on swelling sprains and as an antiseptic in Kangra district of Himachal Pradesh (Prakash and Aggrawal, 2009).

Inula helenium L., is a widespread medicinal plant native to Middle Asia, that has been officially listed in some European pharmacopoeias (Blaschek et al., 1998). An essential oil have been reported from the roots of this plant containing eudesmane-type sesquiterpene lactones with alantolactone and isoalantolactone, thymol derivatives (Bohlmann et al., 1978), triterpenes, sterols and polysaccharide inulin (Blaschek et al., 1998) forming its main constituents. The sesquiterpene lactones of *I. helenium* show cytotoxic and antiproliferative activities against human cancer cell lines. Moreover, the compounds also inhibit plant growth (Blaschek et al., 1998; Lawrence et al., 2001; Dirsch et al., 2001; Konishi et al., 2002).

Inula racemosa Hook. f., is a critically endangered Himalayan herb (Anonymous, 1998). It is distributed from temperate to alpine altitudes of Kashmir and Himachal Pradesh where it is known as “Pushkarmoola” and is used as a medicinal plant (Shabir et al., 2010). Its roots are expectorant, seeds are aphrodisiac, roots are used to cure skin diseases and as adulterant for *Sassurea costus* roots (Sarin et al., 1996). Roots of this plant have shown the presence of alantolactones and isoalantolactones (Kalsi et al., 1989; Wang et al., 2000) by chemical profiling. It is due to the presence of these alkaloids that this

plant has antifungal properties (Satyawati et al., 1987). This plant is also used by native Americans for treating tuberculosis (Moerman, 1986). Alantolactone present in the roots of *I. racemosa* is useful for reducing fat by enhancing insulin sensitivity (Tripathi and Chaturvedi, 1995) and for treating pulmonary and cardiovascular disorders (Miller, 1998; Lokhande et al., 2006). Its leathery leaves act as sinks for particulate pollutants chiefly carbon particles (Agarwal, 1986).

Inula britannica is a wild plant found in Eastern Asia, including China, Korea, and Japan. The flowers of this plant are used for treating digestive disorders, bronchitis, and inflammation (Bai et al., 2005). Its extracts are reported to have anti-inflammatory, antibacterial, antihepatitic, antidiabetic, and antitumor activities (Jiangsu, 1977; Song et al., 2000; Kobayashi et al., 2002; Song et al., 2002). Various sesquiterpene lactones have been isolated from *I. britannica* (Zhou et al., 1993; Park and Kim, 1998). Several isolated (Rafi et al., 2005) and derivatized (Liu et al., 2004) sesquiterpene lactones show cytotoxic activity. In addition, kaurane glycosides, as well as some flavonoids and steroids, are reported from *I. britannica* (Shao et al., 1996).

Inula japonica Thunb., a well known traditional herbal medicinal plant, is widely distributed in Japan, China and Korea (Jiangsu, 1977). The dried leaves and roots of this plant have been used as Chinese folk medicine to treat knife wounds, furunculosis and cough; flowers have peptic, detumescence, anti-inflammatory and vermifuge properties (Lin et al., 1989). Diversified effects such as antidiabetic, hypolipidemia (Han et al., 2004), antitumor, antifungal, antibacterial, hepatoprotective and antihepatitic (Song et al., 2002; Cha et al., 2006 and Wang et al., 2007) have been exhibited to this plant by modern pharmacological study.

Inula viscosa (L.) Aiton (syn. *Dittrichia viscosa* Greuter), commonly known as “sticky fleabane”

is a perennial weed found in most of the Mediterranean basin (Al-Eisawi, 1998; Baytop, 1999; Al-Dissi *et al.*, 2001). *I. viscosa* has been used for years in traditional medicine for its anti-inflammatory (Barbetti *et al.*, 1985), antipyretic, antiseptic, and antiphlogistic activities (Lauro and Rolih, 1990; Lev and Amar, 2000) and for treating diabetes (Yaniv *et al.*, 1987). It has been found that aqueous extracts of *I. viscosa* possess antifungal activity under *in vitro* conditions (Qasem *et al.*, 1995; Maoz *et al.*, 1999) with some of its organic solvent extracts showing antibacterial activity (Debat, 1991). Evidence for the antifungal activity in plant extracts was provided by Cohen *et al* (2002). This herb has also been used in Spanish traditional medicine for treating gastro-duodenal disorders (Lastra *et al.*, 1993). *I. viscosa* has antiulcerogenic effects (Alkofahi and Atta, 1999), causes abortion (Farnsworth *et al.*, 1975; Karim *et al.*, 1990; Al-Dissi *et al.*, 2001), prevents implantation of zygote in mammals (Al-Dissi *et al.*, 2001), prevents growth of pathogenic fungi (Maoz and Neeman, 2000) and has a strong antioxidant activity (Schinella *et al.*, 2002). There is also evidence for nematocidal/antihelminth properties of *I. viscosa* (Oka *et al.*, 2001). *I. viscosa* contains some pharmacologically active compounds (Ulubelen *et al.*, 1987 and Wollenweber *et al.*, 1991) including sesquiterpenes, sesquiterpene acids (Marongiu *et al.*, 2003), azulenes, lactones, flavonoids, and essential oils (Lauro and Rolih, 1990).

Inula rhizocephala var. *rhizocephaloids* (Clarke) Kitam., an endemic plant species to Nubra and adjacent ranges of Ladakh (Joshi *et al.*, 2006) is a small prostrate herb with yellow flower heads densely clustered at centre and is commonly known as Riamko. It is rare and is found along moist places of North Pullu at an altitude of 4724m. The dried roots of this plant are used for treating colds, cough and chest complaints (Chaurasia *et al.*, 1996).

Inula obtusifolia A. Kern. is distributed in North-West Himalaya. It is a branched perennial herb with yellow heads, commonly known as Rupmak in Leh valley and found at an altitude of 3353m and is quite useful for domestic animals suffering from diphtheria (Chaurasia *et al*, 1996). It is also used for tuberculosis, chest problems, cough and as an antiseptic (Khan and Khatoon, 2008).

Inula grantioides, another important medicinal species of *Inula*, has a wide distribution in Sind province. In Pakistan this plant is known as "Naro" and "Kolmur". This plant has a local use in Lasbela for treating patients suffering from asthma (Burdi *et al.*, 1990). It contains an oil that has antibiotic activity (Ahmed and Chughtai, 1961; Kirtikar and Basu, 1933).

Inula helianthus-aquatica C. Y. Wu is a medicinal plant used to treat some cancers in traditional medicine of Yunnan, China. A sesquiterpene lactone namely Bigelovin has been isolated from this herb which acts as an inhibitor to eight cancer cell lines, prominent example being human monoblastic leukemia U937 cells (Zeng *et al.*, 2009).

DISCUSSION

Although there are about 100 species of genus *Inula* distributed mostly in East Asia but most of the species are growing in the alpine and sub-alpine areas of the Western Himalaya. Because of the presence of these species in inaccessible areas, only a few species have been subjected to chemical characterisation as evident from perusal of the review of literature during the present study. The species studied clearly indicate that this genus is a potential source for isolation of a variety of chemically defined compounds like sesquiterpene lactones, sesquiterpene acids, triterpenes, sterols, alantolactones, isoalantolactones, flavonoids etc. It is due to the presence of these compounds that the plants of genus *Inula* act against different diseases like hepatitis, allergy, tumour, ulcers, tuberculosis, cough, colds, diabetes etc. In addition to this,

some species of *Inula* have been exclusively used in ethno-medicine like *Inula grantioides*, *Inula rhizocephala* var. *rhizocephaloids* and *Inula obtusifolia*.

CONCLUSION

The synthesis of medicinally important phytochemicals by the plants of genus *Inula* has been established beyond doubt. The plant species are being used both in allopathic as well as in traditional systems of medicine for the treatment of a number of ailments. Since, only a few species are being exploited for this purpose, the rest of the species also need to be given due attention as they may prove of immense importance in the production of secondary metabolites and maybe some novel compounds as well.

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