CHAPTER - 1

PLANT COLLECTION AND ITS MEDICINAL PROPERTIES

INTRODUCTION

Plants have been used for healing and health rejuvenation since time immemorial. Even now they play an important role in the health care of about 80 percentage of the world population. It is estimated that more than half of the drug under clinical use at present, owe their origin to plants. Plants are the assets of bioactive metabolites including useful drugs such as tinctures, teas, poultices, powders, and other herbal formulations (Balick and Cox, 1997; Samuelsson, 2004). Mankind has been continuously using plants in one or the other way in the treatment of various ailments. In India, the sacred Vedas dating back between 3500 BC and 800 BC give many references of medicinal plants. One of the earliest works in traditional herbal medicine “Virikshayurveda”, compiled even before the beginning of Christian era, dating between 3500 B.C and 1800 B.C, seems to be the earliest record available on medicinal plants (Ahamed et al., 2003).

The medicinal plants are the most important source of life saving drug for the majority of the world population. They continue to play a pivotal role as traditional source of medicines. These plants are used as pharmaceuticals, neutraceuticals, cosmetics and food supplements. The use of traditional medicines is pronounced in rural areas of many developing countries (Sandhu and Heinrich, 2005; Gupta et al., 2005). The indigenous traditional knowledge of medicinal plants of various ethnic communities is fast disappearing from the face of the earth due to the advent of modern technology and transformation of culture. The collection of information about natural flora, classification, management and use of plants by the people hold importance among ethno botanists. The local people and researchers face the challenging task of not only
documenting knowledge of plants, but also applying the results of their studies to biodiversity conservation and community development (Ford, 1978).

Herbal medicines have good value in treating many diseases (Patrick, 2002). India possesses a total of 427 tribal communities (Kala, 2005). Interest in traditional medicine in India has continuously been reported to explore the knowledge from various ethno botanical studies through several tribes in India. Even today many local and indigenous communities in Asian countries meet their basic needs from the products they manufacture and sell, based on their traditional knowledge. Herbal drugs obtained from plants are believed to be much safer and proved in treatment of various ailments (Mitalaya et al., 2003).

**Traditional Medicine**

Traditional medicine is the comprehensive term used to refer both codified systems of medicine such as Ayurveda and also to various forms of indigenous medicines (empirical knowledge). It is a sum total of knowledge, skill and practices based on the theories, beliefs, and experience of indigenous cultures whether it is explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvements or treatments of physical and mental illness. It is transmitted through specific culture and traditional information exchange mechanisms, for example, maintained and transmitted orally through elders or specialists and often to only a few selected people within a community (Hansen and Vanleet, 2003). It is variously termed as “complementary”, “alternative” and “non-conventional” therapies (World Health Organization, 2002).

Ayurvedha, the Indian system of traditional medicine, proved a number of medicinal plants to treat various kinds of diseases. Traditional knowledge and historic literature on medicine play an important role in the discovery of novel aids from medicinal plants (Buenz et
al., 2005). But this traditional knowledge faces serious threats of extinction due to modernization, urbanization and other developmental activities. Therefore, in the present scenario, there is an urgent and continuous need for exploration, development of cheaper and effective new drugs with better bioactive potential and less side effects. Hence, recent attention has been paid to biologically active extracts and compounds used in herbal medicines (Sharma and Kumar, 2009).

Natural resources have been exploited for human use for thousands of years, and plants have been the chief source of compounds used for medicine. Even today the largest users of traditional medicines are the Chinese, with more than 5,000 plants and plant products in their pharmacopoeia (Bensky and Gamble, 1993). There were over exploitations of this plant by the pharmaceutical industries without making any alternative methods to conserve this medicinally important plant. Hence the attempt is made to isolate the endophytes from selected medicinally important solanaceae member which acquired chemical composition of its host plant.

Solanaceae, belongs to the order Solanales, Kingdom; Plantae, is one of the medicinally important plant family and its medicinal uses described since long time. It comprises 2800-3000 species belonging to 85-90 genera of herbs, shrubs, and a few trees (Woodland, 1997). The anxiolytic properties of the Solanaceae family are also well known empirically for a long time. Freire Allemão (1862), in Medical Gazette of Rio de Janeiro explained that the word Solanum comes from the Latin word Solari, which means “to relieve”. The bioactive chemical constituents found in this family are tropane, pyrrolidine and pyrrolic alkaloids; protoalkaloids; glycoalkaloids; nicotine; cardenolides; capsaicinoids; kaurene-type tetracyclic diterpenes; steroidal glycosides; withasteroids, withanolides, and physalins (Pomilio et al., 2008). The plant is distributed throughout temperate regions of the world (Berkov et al., 2006). Most of the plants
are used as anti-inflammatory, central nervous system stimulant (Spring, 1989) for the treatment of respiratory decongestion (Zagari, 1992), dental and skin infections, toothache, and alopecia (De Foe and Senatore, 1993). It is a hallucinogenic plant that causes serious poisoning. Consumption of any part of the plant may result in a severe anticholinergic reaction that may lead to toxicity and occasionally cause diagnostic difficulties (Diker et al., 2007). It is used recreationally for its anticholinergic effects, resulting in hallucinations. The entire plant has anticholinergic compounds, but the seeds contain the highest concentration. An extract made by boiling crushed seeds retains the anticholinergic activity and has a rapid onset of action (Chang et al., 1999) and thus may be potentially useful as an alternative to atropine for the treatment of the muscarinic symptoms of organophosphate toxicity and some of the central anticholinergic effects (Theodore et al., 2004).

In this study, the following plants were randomly selected and taken for further analysis on the basis of their medicinal properties and its high alkaloids contents.

• Withania somnifera (Linn) Dunal.
• Cyphomandra betacea (Cav.) Sendtn.
• Solanum erianthum D. Don.
• Datura stramonium L.
• Nicandra physalodes (L.) Gaertn.
• Hyoscyamus niger L.
• Atropa acuminata Royle.

1.3. Collection of selected medicinal plants

Healthy, disease free plants Withania somnifera, Cyphomandra betacea, Solanum erianthum, Datura stramonium, Nicandra physalodes, Hyoscyamus niger and Atropa acuminata
were collected from different parts of India (Tamil Nadu and Srinagar) based on the availability of these plants. The species were identified and authenticated by Dr. G. Jeya Jothi, Taxonomist, Department of Plant Biology and Biotechnology, Loyola College, Chennai and the voucher specimen were deposited at the department herbarium, Loyola College, Chennai.

**Medicinal Properties of Selected Plants**

**Withania somnifera (Linn) Dunal.**

**Common Name:** Winter Cherry

*W. somnifera* (L.) Dunal (Synon. *Physalis somnifera* L., *Physalis flexuosa* L.) is an erect, grayish, stellate-tomentose undershrub (30-75 cm high) with long tuberous root. Leaves are alternate or sub opposite, broadly ovate to oblong, petiolate, sub-acute, entire, with lamina 5-10 x 2.5-7 cm. Flowers are small, greenish, axillary, solitary or in few-flowered cymes and bisexual. The calyx is gamosepalous with five 3-5 mm lobes, accrescent and inflated in a fruit. The corolla is campanulate, greenish-yellow with five 5-8 mm lobes. There are five stamens. The ovary is ovoid/globose, glabrous, and many ovuled. The style is filiform and stigma is bi-lobed. Fruit is a globose berry, orange-red when ripe and enclosed in the enlarged calyx. Seeds are many, discoid, yellow and reniform. There are about 600 seeds per gram. It has fairly long tuberous roots. The plant flowers and fruits in all the year round. Plants are propagated from seeds (Baquar, 1974). It is native of Australia, India, Pakistan, Srilanka, East Asia and Africa. These plants can be found longitudinally between equator and just beyond the tropic of cancer to 24º North and South and altitudinal ascending to 1800 m in the Himalayas. Reported temperature range for growth is 12-40 ºC with the optimum between 18-32 ºC. All parts of *Withania somnifera (L.) Dunal* are used in herbal medicine.
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*Withania somnifera* L. Dunal is an important tropical medicinal plant (Rasool and Varalakshmi, 2006; Yang et al., 2007), commonly known as Indian Ginseng for its wide range of therapeutic use in Ayurveda (Indian natural therapy) and other traditional system of medicine. The herb has been used for more than 4000 years in India. More than 91 pharmaceutical products are produced from this plant (Rai et al., 2001).

Many steroidal alkaloids including Withaferin A, Withanone, Withanolide A, Withanolide D were isolated from this plant and reported to have a wide range of properties including: anti-stress, anti-inflammatory, anti-tumor, anti-microbial, anticonvulsant, CNS depressant, hepatoprotective, immunomodulatory and insect antifeedent properties (Scartezzini and Speroni, 2000; Sangwan et al., 2004; Rasool and Varalakshmi, 2006; Sarada et al., 2007).

Many pharmacological studies have been conducted to investigate the properties of ashwagandha and to authenticate its use as a multi-purpose medicinal agent. Studies on *Withania somnifera* suggests that it reduces tumor cell proliferation and enhances the effectiveness of radiation therapy while potentially mitigating undesirable side effects (Kaur et al., 2004). *W. somnifera* (L) Dunal acts as an anti-inflammatory agent through inhibition of complement, lymphocyte proliferation, and delayed-type hypersensitivity (Rasool and Varalakshmi, 2006). It is also used in rheumatism, general debility, insomania, cough and cold, joint and nerve pain, impotency, infertility, skin infections. Due to its wide therapeutic importance it is worthwhile to obtain various qualitative and quantitative standards of drug to prevent its adulteration.

*Cyphomandra betacea* (Cav.) Sendtn; *Solanum betaceum*

*Cyphomandra betacea* (Cav.) Sendtn, is commonly called “tree tomato”, which is a small tree that may become rather woody at the base, reaching a diameter of 5-10 cm. Matured individuals are usually 2-4 m tall, with occasional tall as 7 or 8 m. The leaves are softly
pubescent on both sides and are ovate in outline with cordate bases; they may become very large, up to 30-40 cm long and 20-35 cm wide. The flowers are pendent and very fragrant, with white or pinkish, fleshy, nearly glabrous corollas with narrow spreading lobes recurved at the tips. The mature fruit is an elliptic, smooth-skinned, many-seeded berry reaching 4-10 cm long and 3-5 cm wide. The skin is usually dull red or orange, but may range from yellow to purple, sometimes with dark longitudinal stripes. The mesocarp just inside the skin varies from creamy yellow to pale orange and has a bland or bitter flavor, whereas the mucilaginous watery pulp surrounding the seeds is subacid and sweet. The major commercial variety seen in the U.S. has deep red or purple fruits with a purplish or blackish layer around the seeds. In South America, however, most tree tomato fruits are orange or reddish outside with orange or yellowish mesocarp. This type, known as the yellow strain, reputedly has a milder flavor than the red type and is used in New Zealand for canning (Fletcher, 1979).

Tree tomatoes are eaten by scooping out the entire inner part of the fruit, discarding the exocarp and outer layer of the mesocarp. The latter has a disagreeable bitter taste and must be removed; this is facilitated by immersing the fruits in boiling water for several minutes (Hume and Winters, 1949). The seeds may be eaten or strained out. The taste is much like that of the garden tomato, *Lycopersicon esculentum*, Mill. But the fruits are more acid and less juicy and have a noticeable aftertaste. Because of their resemblance to tomatoes, they may be used in similar ways: eaten raw, cut up in salads, or cooked or stewed with meat. In Bolivia, tree tomatoes are mixed with hot chili peppers to form a piquant sauce (Cardenas, 1969). The fruits are reputedly boiled as a soup in New Guinea (Vink 16343, A, L). They are usually sweetened, however, and may be made into preservatives in jams, pies and other desserts. In South America, tree tomatoes are often blended with milk and sugar to make a refreshing drink much like a
North American milkshake. The fruits of *C. betacea* are relatively nutritious because of their high vitamin content, very rich in β-carotene, making them good sources of pro-vitamin A, and they also contain large amounts of ascorbic acid or vitamin C (Dewes and Callaghan, 1970). Their high pectin content makes them especially suitable for jam and jelly making. Levels of nitrogen and free amino acids are higher than those of most fruits except avocados and bananas; the values for potassium and phosphorus are also high among fruits, which are normally poor sources of these elements (Dewes and Callaghan, 1970).

**Solanum erianthum** D. Don

**Common Name:** Malaisundai

*Solanum erianthum* D. Don is an unarmed shrub or small tree up to 4-10m tall with a dense of soft stellate hairs, stem up to 20 cm in diameter leaves simple, ovate-elliptical, margin in entire or slightly wavy, base rounded to cuneate, apex acute to acuminate. Adding to the taxonomic confusion is the fact that *S. erianthum* has been extensively referred to as *S. verbascifolium* L. which actually proved to be identical with a South American species (Blomqvist and Nguyen Tien Ban, 1999). *S. erianthum* have been used as a traditional medicinal plant for treatment of inflammatory diseases, burns and wounds (The Wealth of India, 1972; Krishnamarg, 2000). The leaves of *S. erianthum* have been reported for anti-malarial and anticholinergic activity (Makinde, 1998; Huang, 2009). Leaves contain steroidal alkaloids solasodin, tomatidine, solaverbascine and phytosterols. Leaves and stems contain glyco alkaloid, salasodine, disogenin, solafiloridine and vesperitilin. Fruits and leaves contain glycol alkaloid. Plant contains steroidal saponin and genins, alkaloids, solaverbascine, solasodine, tomatidenol (Yoganarsimhan, 1996). Paliyar tribes use the crushed fruits and apply topically on their legs, while entering into forest to protect from leech-bite.
Datura stramonium L.

Common Name: Jimson weed

*Datura stramonium* L. is a wild-growing herb, known as Jimson weed. It also has several other names: thorn apple, angel’s trumpet and loco weed. The incidence of *D. stramonium* poisoning is sporadic with a cluster of poisoning cases occurring mostly among adolescents. Some medicinal uses of this plant are anti-inflammatory property of all part of the plants (Spring, 1989), stimulation of the central nervous system (CNS) (Guharov and Barajas, 1991; Manandhar, 1995), respiratory decongestion (Zagari, 1992), treatment of dental and skin infections (John, 1984; Darias et al., 1986; De Foe and Senatore, 1993) and also in the treatment of toothache (Abebe, 1986) and alopecia (John, 1984). It is used recreationally for its anticholinergic effects, resulting in hallucinations. The entire plant has anti-cholinergic compounds, but the seeds contain the highest concentration. An extract made by boiling the crushed seeds retains the anticholinergic activity and has a rapid onset of action (Chang et al., 1999). Thus it may be potentially useful as an alternative to atropine for the treatment of the muscarinic symptoms of organophosphate toxicity and some of central anticholinergic effects (Theodore et al., 2004). The anticholinergic compounds of *D. stramonium* are likely to produce delirium and stupor but rarely cause deep coma. Seed extract has an analgesic effect in both acute and chronic pain (Khalili and Atyabi, 2004). It is also used frequently in anti-asthmatic treatment and known for its hallucinogenic and euphoric effects (Muller, 1998; Weitz, 2003; Ertekin et al., 2005). The anticholinergic alkaloids contribute to the antiasthmatic properties (Friedman, 2004). Plant occurs indigenously in Southern Africa and distributed to other areas of the world. It was used by Red Indians for many years as euphoric agent. Since 1800 it is used as a therapeutic agent in Great Britain (Dessanges, 2001).
Nicandra physalodes (L.) Gaertn.

Common Name: Apple of Peru

Nicandra physalodes is commonly known as ran popati. It is an erect herb, with light blue or light purple flowers (Yoganarasimhan, 2000). Stem is erect, angular, 40-150 cm tall, glabrescent or pubescent. Petiole 1.5-6 cm; leaf blade ovate or elliptic, 4-20×2-13 cm, papery, sparsely pubescent on both surfaces, base cuneate, margin lobed or coarsely sinuate-dentate, apex acute or short acuminate. Pedicel 1.5-4 cm. Calyx 0.8-3 cm deeply parted; lobes broadly ovate, apex acute, 2.5-4 cm in diam. Corolla pale blue, blue-purple or bluish with white center, 2.5-4 cm wide. Berry brown or yellow, 1-2 cm in diam. Seeds pale brown, 1-1.2 mm in diam. Fl. summer, fr. autumn (Zhang, 1994). Decoction of leaves is used for killing head lice (The Wealth of India, 1972). The plants are reported to possess diuretic, anthelmintic, and insecticidal properties. Aqueous extract of the stem, fruits and root show antibacterial activity against bacteria and fungi (Mahadevan et al., 2004). Besides free calystegines, calystegine B1 occurs as the 3-O-b-D-glucoside in Nicandra physalodes fruits (Griffiths et al., 1996).

Hyoscyamus niger L.

Common Name: Henbane

Hyoscyamus niger L. is commonly known as Henbane or Hogs bean in English, Parasigaya in Sanskrit and Khursani ajwayan in Hindi (Kirtikar and Basu, 1975). It is a grayish green shrub consists of leaves and stem with flowering tops giving strong unpleasant smell and bitter taste. Two forms of this species, biennial and annual are known and used medicinally. Stems erect, leafy, branched (biennial form) or few-branched (annual form), densely covered with long glandular hairs. Leaves alternate, gray-green, covered with short glandular hairs, short-stalked (lower) to sessile (upper), oblong to lanceolate, 5-20 cm long, coarsely toothed to acutely
pinnate-lobed, with conspicuous pale veins covered with long glandular hairs. Lower leaves short-stalked, upper sessile. Seeds are dark grey in colour reniform in shape and about 1.5 mm long having a minutely reticulated testa (Uniyal, 1989). The alkaloid contents of *H. niger* are well documented, thereby Egyptian henbane is found to possess greater percentage of alkaloids (0.7-1.5%) than European henbane. The racemic form of 1-hyoscyamine, atropine and scopolamine are often found in leaves (Robbers et al., 1996) while the root part is reported to contain apoatropine (atropamine) and cuscohygrine (Haga, 1954). Henbane seed contains about 0.06-0.1% of alkaloids like hyoscyamine with a little hyoscine and atropine (Uniyal, 1989). It is distributed throughout Europe. In India, it is generally found in Jammu & Kashmir (Garhwal Himalayas, 8000 -11000 feet height), Himachal Pradesh and Kumaon of Uttar Pradesh (Duke, 1985). *H. niger*, though recorded as a poisonous plant, is traditionally used in Indian medicine as well as Chinese medicine for its use in stomach cramps, heavy coughs, neuralgia and manic psychosis. The plants is also said to possess anti-spasmodic, sedative and analgesic properties (Duke, 1985). In Tibetan medicine, the seeds of *H. niger* are used as anthelmintic, antitumor and febrifuge. They are also found to be useful in the treatment of stomach/intestinal pain due to worm infestation, toothache, infection of pulmonary regions and tumor (Tsewang, 1994). It is extensively used as a pain killer when affecting the urinary tract, especially when suffering from kidney-stone. Externally the seed oil is used for neuralgic, dental and rheumatic pains (Bown, 1995; Chevallier, 1996).

**Atropa acuminata Royle.**

**Common Name:** Indian belladonna

*A. acuminata* is a perennial plant that grows tall and straight plant of about 3 to 5’ high. The leaves are stalked, elliptic-lanceolate acuminate, 3 to 6’ long and 2 to 4’ broad. The aerial
shoots die every autumn and new ones arise in the following season and form a large tap root with many rootlets. They are woody, pale brown in colour, 6’ or more in length and 3/8 to 3/4’ in diameter. They have short transverse scars due to the folding of outer bark. It flowers from June to August. The bell shaped flowers are solitary, short stalked, about an inch long and are generally yellow in colour. The flowers are hermaphrodite (have both male and female organs) and are pollinated by insects. The fruit is a purple black berry of the size of a cherry (The Wealth of India, 1999) and the seeds ripen from August to October. The plant is a wild one in Aapharwat area of Gulmarg, Ferozpur and Thajwass glaciers of Sonamarg in the valley of Kashmir. It is abundantly used as a traditional medicine for treating arthritis and related inflammatory disorders by Gujars and nomads inhabiting the higher reaches of the valley of Jammu and Kashmir. In literature, it has been also found to be present in abundance in Muzaffarabad, Kanawar (PAK, 8,500), and many other places in Baluchistan.

Indian belladonna is the most studied species of *Atropa*. It was exploited during World War-I and large quantities of roots were exported from Himalayas and other outlying parts of the Himalayas. Indian belladonna is now used in India also for the manufacture of tinctures, plasters etc. The roots may serve as a source of atropine. *A. belladonna* is a perennial herb widely distributed throughout Central and Southern Europe. It is cultivated for medicinal purposes in England, Central Europe and on an increasingly large scale in the USA. The plant contains several alkaloids, chiefly l-hyoscyamine, C_{17}H_{23}O_{3}N and small amounts of atropine.

It is native to Central and Southern Europe and cultivated worldwide. The genus *Atropa* comprises four species of medicinal plants, distributed in the Mediterranean region, Southern Europe and Asia. Of these, *Atropa belladona* has long been a reputed drug in Europe and is now cultivated in some places on the Himalayas is found wild in India is *A. acuminata* Royle.
It contains tropane alkaloids, which possess anticholinergic and spasmolytic properties (Tyler et al., 1988). They are commonly used as an anaesthetic and spasmolytic and in eye surgery. These are a series of secondary metabolites that have been mainly described in the Solanaceae family and initially in the genus *Atropa* that act as feeding deterrents and antimicrobial defenses for the plants (Waterman, 1993).

More medicinal value and pharmaceutical uses are found in these selected medicinal plants, but some plants are found rare and endangered. Hence this research work was aimed to conserve the medicinal plants through exploitation of endophytes by isolation Solanaceae members.