CHAPTER - I

INTRODUCTION

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1.1. History of Research Work

From the time immemorial, human has been dependent on nature for survival. This dependency led the aboriginal people living in harmony with nature to evolve a unique system knowledge about plant wealth by trial and error methods (Durairaj *et al.*, 2012). Plants have been one of the major sources of medicines since the beginning of human civilization. There is a growing demand for plant based medicines, health products, pharmaceuticals, food supplements and cosmetics in the recent days (Jiny-Varghese *et al.*, 2010). Plant parts have been a typical source of medicine from a prehistoric time and have been the primary source of drugs in Indian systems of medicine and other ancient systems in the world (Dhanamani *et al.*, 2011).

India has been known to be an affluent storehouse of medicinal plants. In India, forest is the principal storehouse for variety of large number of aromatic and medicinal plants (Kavitha *et al.*, 2016). India possess rich heritage of valuable Fauna and hence has been considered as a 'treasure house' of valuable medicinal and aromatic plant species. The Ministry of Environment and Forests, Government of India have identified and documented over 9,500 plant species considering their importance in the pharmaceutical industry. Out of these, about 65 plants have large and consistent demand in world trade. Use of plants as a source of medicine has been inherited and is an important component of the health care system in India. India has 16 Agro climatic zones, 45,000 diverse plant species out of which 15,000 are medicinal plants. The Indian Systems of Medicine have

identified 1500 medicinal plants, of which 500 species are mostly used in the preparation of drugs (Maheswar, 2011).

Generally, all medicinal preparations were being derived from plants, either in the simple form of raw materials or in the refined form of crude extracts and mixtures. The latest assessments propose that several thousands of plants have been known with medicinal applications in various systems (Subbaraju *et al.*, 2005). Since medieval times, plants have been the major source of medicines for the treatment of various diseases. Currently plants remain an integral part of the health care in different countries including developed countries. According to the report of WHO in the late 90's, a very high percentage of the world's population rely on plant based therapies to cover the needs of the primary health care (Abu-dahab and Afifi, 2007).

The gradual revival of interest in the use of medicinal plants in the emerging countries have been reported safe and less or without any adverse effect particularly while comparing with synthetic drugs. In the field of traditional medicines, herbal medicines represent one of the most important fields to promote the use of herbal medicine and to determine their potential as a source of novel drugs. It is essential to study about medicinal plants which have folklore reputation in a more intensified way. The plants have been used by human beings over 100 years for medicinal purposes. The plants were used for medicinal purpose by human beings of countries like Indian sub-continent, India, Pakistan and Bangladesh (Shaikh *et al.*, 2016).

Medicinal plants have wide range of substances that can be used to treat chronic as well as infectious diseases. Medicinal plants are always recognized as rich source of antimicrobial agents and are widely used by different countries for medicinal purposes as they are powerful and potent sources of drugs. Over the years, World Health

Organization (WHO) has advocated traditional medicines as safe remedies for ailments of both microbial and non-microbial origins (Gupta and Kumar, 2017). Plants have the ability to produce a number of compounds in the form of secondary metabolites that have diverse biochemical properties. The secondary metabolites are distinguished from primary metabolites such as nucleic acids, amino acids, carbohydrate, and fat (Xin *et al.*, 2014). Production amount of the secondary metabolites varies species to species and plant to plant accordingly and the variations among different species depend on the age and variations in climates and ecological factors (Gupta and Kumar, 2017).

To be responsible for many medicinal activities plant extracts or the bioactive constituents from secondary metabolites have been reported. (Khor and Wong, 2014). The secondary metabolites are also referred to as "Natural Products" and more than 100,000 different structures of secondary metabolites are synthesized by plants, to a tune of 109 tonnes per year (Priskilla, 2011a). Secondary metabolites such as tannins, terpenoids, alkaloids, flavo-noids, glycosides and phenols which have been found to have antimicrobial properties (Aneja *et al.*, 2012). Plants have a special place in the treatment of cancer (anticancer). Nearly 35,000 plants samples from 20 countries were collected by the National Cancer Institute and has screened almost 1, 14,000 extracts for anticancer activity (Shoeb, 2006a). Over 3000 plants' species with antitumor properties were reported (Karthikeyan *et al.*, 2017).

Natural compounds are providing many active anticancer agents in current use. Presently, over 50% of drugs used in clinical trials for anticancer activity were isolated from natural sources or are related to them (Karthikeyan *et al.*, 2017). The use of plants or plants products, traditionally, as antiviral agents is relatively wider than their use in modern medicine (Abonyi *et al.*, 2009). Certain antiviral substances have isolated from

higher plants, algae and lichens (Merghoub *et al.*, 2009). Plant derived agents are being used for the treatment of cancer. By using traditional medicinal plants in an effort to discover new therapeutic agents that lack toxic side-effects associated with present chemotherapeutic agents, the numerous anticancer research studies were conducted (Kanimozhi, 2012).

1.2. Preliminary Phytochemical analysis

For thousands of years mankind is using plant source to alleviate or cure sicknesses. Plants constitute a source of different chemical compounds which are possible to use in medicine and other applications. The plant parts such as leaves, flowers, bark, seeds, fruits, stem and root contain the following bioactive compound like alkaloids, steroids, tannins, glycosides, volatile oils, fixed oils, resins, phenols and flavonoids (Joseph *et al.*, 2013).

Owing to the significance in the above context, such preliminary phytochemical screening of plants is the need of the hour in order to discover and develop novel therapeutic agents with improved efficacy. Numerous research groups have also reported such studies throughout the world (Watal *et al.*, 2014).

1.3. Phytochemical Studies

Natural medicine from plant source is well-known to be safe and effective. Plant species have been used in folkloric medicine to treat various ailments. Nowadays chemical compounds from plants continue to play a vital role in primary health care as therapeutic remedies in many developing countries. However, they could be exploited for significant pharmacological purposes (Gideon, 2015). From parts of the plant like bark, leaves, flowers. Plant-based natural constituents can be derived. The medicinal

properties of plants are unique to particular plant species or groups (Janakiraman *et al.*, 2012).

There is a growing awareness in connecting the phytochemical constituents of a medicinal plant with its pharmacological activity. Screening of active compounds from plants has led to the invention of new medicinal drugs which has efficient protection and used for the treatment of various diseases (Vidhya and Udayakumar, 2015). Nowadays natural products derived from plants are being tested for presence of novel drugs with new modes of pharmacological action. A special feature of higher plants is the capacity to produce a large number of secondary metabolites (Vidhya and Udayakumar, 2015). Phytochemicals are the natural bioactive compounds. That are naturally present in plants and the most considerable bioactive components of plants are alkaloids, tannins, flavonoids, steroids, terpenoids, carbohydrates and phenolic compounds (Santhiya *et al.*, 2016).

Within a decade, there were a numerous dramatic advances in analytical techniques including TLC, HPLC, UV, NMR and GC-MS that were powerful tools for separation, identification and structure determination of phytochemical compounds. GC-MS is a technique used for screening/identification/quantification of many vulnerable compounds in plant extracts. Gas chromatography (GC) is used to isolated drugs that might be present in the sample. The retention time (RT) is an identifying characteristic of a drug. The detector for the GC is the mass spectrometry (MS). The fragmentation pattern for a drug is unique and therefore is an identifying characteristic of a drug. The identification of a drug by its retention time and fragmentation arrangement, beside with sample exact information afforded to make GC-MS the foremost authorization method for analyzing herbal extract. In recent years GC-MS studies have been gradually applied

for the investigation of medicinal plants. This technique has proved to be a valuable method for the analysis of non-polar components and volatile essential oil, fatty acid, lipids and alkaloids (Parthipan *et al.*, 2015).

A variety of phytochemicals have been studied for their antimicrobial activity against pathogenic microbes. Numerous reports on the use of crude plant extracts and their active principles against selective microorganisms *in vitro* are also available in the literature. Phytochemical analysis of the plant extracts have revealed the presence of biologically active compounds such as flavanoids, tannins, phenols, terpenoids, sesqui terpenes, glycosides, saponins, alkaloids (Kubmarawa *et al.*, 2007).

With this information's, an attempt was made to study the different Phytochemical compounds present in leaf, stem and root of *Barleria longiflora* L.f through GC-MS analysis.

1.4. Anti-Microbial Studies

From the immemorial time, plants have been a valuable source of natural products for upholding human health, particularly in the last decade, with more intensive studies for natural therapies. Now a days, the use of phytochemicals for pharmaceutical purpose has step by step increased in many countries. According to World Health Organization (WHO) medicinal plants would be the greatest source to obtain a variety of drugs. About 80% of human being from developed countries use traditional medicine, which has compounds derived from medicinal plants (Nascimento *et al.*, 2000). In recent time, traditional medicines have been brought a huge potential in herbal medicine with enormous therapeutic potential to heal many infectious diseases without associated with the side effects unlike synthetic drugs. Bacterial infections are one of the major causes

of health problems, physical disabilities and mortalities around the world. Symptoms and complications associated with bacterial infections such as fever, chills, headache, nausea, vomiting and organ failures affect patient's life severely. Medicinal plants are a rich source of antimicrobial agents and provide a safer and cost effective way of treating the bacterial infections (Gangopadhyay *et al.*, 2012).

Since ancient times, several plant species reported to have pharmacological properties as they are known to possess various secondary metabolites like glycosides, saponins, flavonoids, steroids, tannins, alkaloids, volatile oils, fixed oils, resins which is therefore, should be utilized to combat the disease causing pathogens. One of the methods to reduce the resistance to antibiotics is by using antibiotic resistance inhibitors from plants. It is commonly well-known that plants produce a variety of compounds to be protected themselves against a variety of pathogens. The plant extracts are supposed to show the antibiotic active against drug resistant pathogens. So that investigators have recently paid attention to safer phytomedicines and biologically active compounds. They are isolated from plant species used in herbal medicines with acceptable therapeutic index for the development of new drugs (Sen and Batra, 2012).

The plant extracts and phytochemicals are having well known antimicrobial properties, it can be of great significance in therapeutic treatments. Nowadays, a number of studies have been conducted in different countries to prove such efficiency**.** Many plants are used in medicinal purpose because of their antimicrobial properties, which are due to compounds produced in the secondary metabolism of the plant. These products are recognized through their active substances, for example, the phenolic compounds which are part of the essential oils, as well as in tannin (Janssen *et al.*, 1986). The researchers from Latin America and also from other parts of the world have investigated

antimicrobial properties of plants. In Argentina, a research tested 132 known plant species used for therapeutic treatments (Anesini and Perez, 1993).

In recent years, antimicrobial properties of medicinal plants are being gradually reported from different parts of the world (Ashrafuzzaman *et al.*, 2013). Plants produce a huge variety of secondary compounds. These act as natural protection against microbial and insect attack. Some of these compounds are also toxic to animals, but others may not be toxic. Many of the secondary compounds have been used in the form of whole plants or plant extracts for food or medical applications in human (Wallace, 2004). Many plant extracts of higher plants have been studied under laboratory trails and are found to exhibit antimicrobial properties (Gupta and Kumar, 2017).

1.5. Anti-Cancerous Studies

Cancer is a major health problem in both developed and developing countries. Cancer is one of the leading causes of death worldwide and is characterized by proliferation of abnormal cells (Karthikeyan *et al.,* 2017). Cancer is a group of diseases caused by loss of cell cycle control. Cancer is associated with abnormal uncontrolled cell growth. Cancer cannot be controlled and cured, it occurs at any time irrespective of age and body parts. It is caused by a complex, poorly understood interplay of genetic and ecological factors. It continues to represent the largest cause of mortality in the world and claims over 6 million. Cancer kills yearly around 3500 per million populations around the world. Cancer is a significant worldwide health problem generally due to the lack of widespread and comprehensive early detection methods, the associated poor prognosis of patients diagnosed in later stages of the disease and its increasing incidence on a global scale. Indeed, the struggle to combat cancer is one of the greatest challenges of mankind (Mohan *et al.*, 2014).

The term cancer, malignant neoplasm (neoplasm means new growth) and malignant tumors are synonyms. Cancer is a general term applied to a series of malignant diseases which may affect many parts of the body. This disease is characterized by a rapid and uncontrolled cell proliferation leading to abnormal growth or tumor. If abnormal growth is not arrested it may progress to death of the patient (Monika and Singh, 2015). Cancer is an abnormal growth of cells that grows and spreads through uncontrolled cell division. These 'malignant' cells may invade other tissues and spread (metastasize) to more distant parts of the body. Cancer is not one disease it is a group of more than 100 distinct disorders. It is the world's second biggest killer after cardiovascular disease and it was responsible for the death of 7.6 million people in 2005. Worldwide the number of people diagnosed with cancer is estimated at around 11 million people, a figure that is set to rise to 16 million by 2020. Of all new cancer cases, it is estimated that one third could be cured if they were adequately diagnosed and treated (Chavan *et al.*, 2013). Cancer is a degenerative disease. Addition of toxins material through oncogenic nourishment like fast food, junk food, colas, habits like smoking, drinking, paan chewing, stressful lifestyle, toxic medicines and environmental pollution lowers immunity causing cancer (Nataru *et al.*, 2014). There are 10.9 million new cases, 6.7 million deaths, and 24.6 million persons alive with cancer (Meenapriya *et al.*, 2017).

The use of plant or plant products, traditionally, as antiviral agents is relatively wider than their use in modern medicine. Certain antiviral substances have so far been isolated from higher plants, algae and lichens. Nearly 35,000 plant samples were collected by the National Cancer Institute from 20 countries and around 1, 14,000 extracts were screened for anticancer activity. Over 3000 species of plants with antitumour properties have been reported. Natural products have been regarded as

important sources of potential chemotherapeutic agents and many anticancer drugs have originated from natural sources (Karthikeyan *et al.*, 2017). In entire medical history, the plant products are proven to be valuable sources of novel anti-cancer drugs (Priskilla 2011).

Due to the increased incidence of the adverse drug reactions and economic burden of the modern system of medicine, use of Phytomedicines or herbal medicine is growing exponentially. Hence in the present chapter attempts were made to develop an eco-friendly cost effective anticancer herbal medicine. Studies will also be focused towards understanding the mechanism of anticancer action of the herbal drugs selected for the study.

1.6. DNA Barcoding Studies

Medicinal plants are more economically valuable and profitable areas of complementary and alternative medicine, which generating billions of dollars in revenue. The basic key requirements of both registration and market authorization are quality aspects it needed the identification and authentication of plant material. Traditionally, plants are identified by morphological methods through macroscopic and microscopic examination by a highly trained individual or taxonomists. However, these methods have several disadvantages such as a detailed description not available in the monograph and chemical constituents of plants vary due to climatic factors (Gurudeeban Selvaraj *et al.*, 2015). Many chemical analyses are also used, e.g. thin layer chromatography (TLC), high performance liquid chromatography (HPLC), gas chromatography (GC), infrared spectroscopy (IR), or nuclear magnetic resonance spectroscopy (NMR) (Osathanunkul *et al.*, 2016).

Due to globalization, an increasing number of plants originating from different areas of the world are now offered to consumers, but there are not reliable, universal tools for their identification. DNA barcoding could be a reliable alternative to DNA fingerprinting approaches in plants identification (Galimberti *et al.*, 2013). DNA-based identification is very simple and it does not require any taxonomic expertise, and it is free from subjective errors, which is not the case in morphological identification. The main objective of barcoding is valid identification of unknown samples (Bafeel *et al.*, 2012).

The term 'DNA barcodes' was first used by Arnot (Fišer Pečnikar and Buzan, 2014). The term 'DNA Barcoding' is of recent use in the literature. The golden age of DNA barcoding began in 2003 (Priskilla 2011). DNA barcoding is a method of identifying an organism based on DNA sequence. Several recent papers have written about DNA barcoding in plants (Schori and Showalter, 2011). DNA barcoding was also used to investigate the genetic relationships among wild and cultivated plants, as well as their origin (Galimberti *et al.*, 2013).

At the present time, there are no technical limitations to the application of DNA barcoding for the traceability of plant raw materials. However, the reduced genetic diversity at cultivar level often requires the analysis of large portions of the genome, which currently have a too high cost/effectiveness ratio to be widely used. Moreover, this approach is contrary to the basic DNA barcoding methodology, which requires the analysis of short and universal DNA regions only (Galimberti *et al.*, 2013). The DNA barcoding means, one or few relatively short gene sequences taken from a standardized portion of the genome and used to identify species. The use of DNA sequences for biological identifications is not new , but the concept of a 'DNA barcode' for quick and

reliable species-level identifications across all forms of life, including animals, plants, fungi, and microorganisms, was first proposed just over a decade ago (Kress *et al.*, 2014b). There are several chloroplast genes are typically used as plant barcodes, with maturase K (matK) and ribulose 1,5-bisphosphate carboxylase/oxygenase large subunit (rbcL) consider as important barcodes (Schori and Showalter, 2011).

In plants, unlike in animals, the mitochondrial genome evolves too slowly to offer useful DNA barcode sequences. Although also possessing a relatively slow rate of evolution, several chloroplast sequences have been identified (Priskilla 2011). Several studies have now established that sequence diversity in a 650-bp fragment of the mitochondrial gene cytochrome c oxidase I (cox1; also referred to as COI) provides strong species-level resolution for varied animal groups including birds, fishes and Lepidoptera (Ramadan and Baeshen, 2012).

This CO1 does not work as a DNA barcode in plants and fungi, a concerted search was required for more effective gene regions for these major groups of organism (Kress *et al.*, 2014a). In recent year, experts paid attention to DNA markers from the chloroplast and nuclear genome, and they did a lot of work on screening and testing for potential DNA barcodes (Zhang *et al.*, 2014).

The DNA barcode loci now most commonly used for plants [a combination of plastid rbcL, matK, and trnH-psbA with nuclear internal transcribed spacer (ITS)] and fungi (nu-clear ITS) may never be as efficient and successful in identification as CO1 in animals. However, even for some groups of animals (e.g., some invertebrates, amphibians, and reptiles) CO1 works poorly and other gene regions are being used as DNA barcodes (Kress *et al.*, 2014a). Barcoding of DNA has been applied to a broad range of subjects, with taxonomic studies of "cryptic" taxa or species complexes, e.g.

skipper butterflies. In ecological studies the barcoding has also been used to survey animal diets through the analysis of plant remains in feces and in identifying smoked fish products sold under ambiguous product names (Rydberg, 2010).

DNA sequences generally seem to be as one of the main data sources for species recognition in all beings. Species description includes a combination of character types, like morphological, molecular, and ecological should be used (Dulla *et al.*, 2016). Unluckily, no other technique is there to overcome this problem, except a new technology called DNA Barcoding that uses short DNA sequences for quick, accurate, and standardized method of species level identification (Lebonah *et al.*, 2014). This technique is more and more effective to assist in resolving some of the taxonomic difficulties. DNA Barcoding is now turning out to be a widely applied tool for identification of species (Dulla *et al.*, 2016).

. DNA barcoding is a new biological tool for accurate, rapid and automated species identification using a short fragment of the genomic DNA, which has been widely used especially in authentication of Chinese medicinal plants (Techen *et al.*, 2014). Molecular identification through DNA barcoding is a powerful method for the identification of plant species, including medicinal plants and products (Osathanunkul *et al.*, 2016). The development of DNA Barcoding is cooperation between universality, resolution, efficiency, and consistency. A DNA barcode is a short and easily PCR amplifiable DNA fragment for identification of organisms to the species level. DNA Barcoding is feasible for non-experts, rapid, accurate, cost effective and also universally accessible. The barcode data can be included in studies of phylogenetic species recognition (Dulla *et al.*, 2016).

The fundamental characteristics of high taxonomic coverage, and high resolution are also required for DNA barcode. High taxonomic coverage refers to the correct amplification of the genomic region chosen as DNA barcode in the widest panel of taxa. The identification of different taxa is ensured by high resolution. As a general principle, DNA barcode regions should have a high interspecific, and low intraspecific variability (Galimberti *et al.*, 2013).

A Consortium for the Barcode of Life (CBOL) Plant Working Group analyze 7 leading candidate plastid DNA regions including matK gene, atpF–atpH spacer, rbcL gene, rpoB gene rpoC1gene, psbK–psbI spacer, and trnH–psbA spacer for a standard plant barcode. The 2-locus combination of rbcL and matK as the plant barcode has been recommended (Boonsom *et al.*, 2012).

Plant Working Group (Osathanunkul *et al.*, 2016), suggested the use of 2-locus combination of rbcL and matK as core-barcode regions, because of the straightforward recovery rate of rbcL, and the high resolution of matK. Unfortunately, matK is difficult to amplify by using a single primer pair. In opposite to that, rbcL is less problematic in terms of amplification, sequencing and alignment, and provides a useful backbone in the creation of plant DNA barcode datasets (Galimberti *et al.*, 2013).

1.7. Need of the Society

Natural Products, particularly plants, have been used for the treatment of various diseases for thousands of years (Shoeb, 2006a). At that time there was no synthetic medicines, they have been using only the herbal medicines to treat all diseases. From this we can understand that plants are rich in medicinal properties and they are very useful in human health and wellbeing (Rukshana *et al.*, 2017). Firstly in nearby 2600 BC from the

Sumerians and Akkaidians the records on the medicinal uses of plants were observed (Chanda and Nagani, 2013). Since medieval times, plants have been the major source of medicines for the treatment of various diseases. Currently plants remain a vital part of the health care in different countries including developed countries. According to the report of WHO in the late 90's, a very high ratio of the world's population depend on plant based therapies to cover the needs of the primary health care (Rosangkima and Jagetia, 2015). Recently many of the investigation were being carried out in medicinal plants. The main reason was that the synthetic drugs which was now taking up by the human have many side effects that often lead to serious complications (Rukshana *et al.*, 2017).

Medicinal plants have an important position in the drug discovery and many modern drugs have their origin in traditional medicine of different cultures. Hence, regardless of the advantages of the synthetic and combinatorial chemistry as well as molecular modeling, medicinal plants remain an important source of new drugs, new drug leads and new chemical entities (Abu-dahab and Afifi, 2007). It was reported that out of over 800 small molecule new chemical entities (NCEs) introduced between 1981 and 2002 nearly the half were natural products, semi-synthetic natural products, semi-synthetic natural products analogues or synthetic compounds based on natural products (Rosangkima and Jagetia, 2015).

1.8. *Barleria longiflora* L. f - general information

The family acanthaceae belongs to a dicotyledonous flowering plants. It is of nearly 250 genera and around 2500 species (Rahman *et al.*, 2014a). It is currently placed in order Lamiales close to the Bignoniaceae (El-Gazzar *et al.*, 2015). Mostly they are tropical herbs, shrubs, or twinings, some are epiphytes. Only a few species are distributed in temperate regions (Rahman *et al.*, 2014b). Acanthaceae family is widely used in horticulture for their various flowers or bracts with showy colours and for their variegated or bicolorous foliage. This group of plants is important to both man and animals being used as food and medicine. Acanthaceae could also be used as bio-indicators to study about the spatial distribution of plant communities (Fongod *et al.*, 2013).

Acanthaceae is a most significant plant family for native people, especially in terms of medicinal use. The different parts (leaves, stem and root) of the plant species are most commonly used for treating various ailments. Many plants in this family reported to have various pharmacological activities like anticancer, antidiabetic, antimicrobial, hepatoprotective and anti-inflammatory (Kavitha *et al.*, 2016).

The genus *Barleria* was dealt by Linnaeus in 1753. *Barleria* is a pantropical but its greatest centre of species diversity in tropical East Africa, followed by South Africa and Asia. *Barleria* is the third leading genus in this family with 300 species. 32 species are reported in India. Whereas Karthikeyan *et al*., (2009) enumerated 29 species, one subspecies and six varieties (Shendage and Yadav, 2010).

Barleria longiflora L.f. the common name is long flowered *barleria* and Kattukanakambaram in Tamil language. It is small shrub grow up to 1-2 m with white flower in dry areas. Stems are covered with glandular hairs and oppositely arranged ovate long pointed leaves with densely hairy on both sides. It is a medicinal plant widely

distributed in Tamilnadu and the plant species are distributed throughout the southern part of India are used in folklore medicine for the treatment of several illnesses such as malaria, headache, abdominal pain, dysentery, pulmonary tuberculosis, diarrhea, cold, wound, snakebite, and poisoning (Kalpana *et al.*, 2016).

1.9. Reason for choosing *Barleria longiflora* L.f.

Herbal medicine is widely practiced from ancient period throughout the world. These medicines are safe and environment friendly. According to WHO about 80% of the world's population relies on traditional medicine for their primary health care. India, being one of the world's 12 mega biodiversity countries (Sandhya *et al.*, 2006).

Acanthaceae is a large family comprising 3,175 species in 212 genera. (Sridharan and Chinnagounder1, 2012). Acanths are widely used in horticulture for their numerous flowers or bracts with showy colours and/or for their variegated or bicolorous foliage (e.g. *Graptophyllum pictum, Hypoestes phyllostachya, Pachystachys lutea, Pseuderanthemum carruthersii var. artropurpureum, Strobilanthes dyerianus, Thunbergia mysorensis* are among the most well-known tropical species). Acanthaceaes could also be used as bio-indicators to study about the spatial distribution of plant communities (Fongod *et al.*, 2013).

Acanthaceae is a huge reservoir for variety of phytochemical constituents like terpenoids, glycosides, alkaloids, saponins, β-sitosterol, palmitic acid, stigmasterol, apigenin, kaempferol, tannins, etc. Many compounds were isolated from the plants of Acanthaceae family and they possess various pharmacological activities (Kavitha *et al.*, 2016).

Acanthaceae hold antifungal, cytotoxic, anti-inflammatory, anti-pyretic, anti-oxidant, insecticidal, hepatoprotective, immunomodulatory, Anti- platelet aggregation and anti-viral potential. Phytochemical reports on family Acanthaceae are glycosides, flavonoids, benzonoids, phenolic compounds, naphthoquinone and triterpenoids (Awan *et al.*, 2014).

The genus *Barleria* L., a member of the Acanthaceae family, is a large and widespread genus of herbs and shrubs comprising approximately 300 species, growing mainly in Africa and Asia. The plants of the genus *Barleria* have been long used for boils, bee bites, and tooth-ache (Lee *et al.*, 2016).

Barleria is well known for its large attractive flowers that come in many colours (purple, pink, white and yellow) (Joshi *et al.*, 2016). *Barleria* is a flowering herb genus in this family and is commonly found in countries like India, Malaysia, Australia, America, Western tropical Africa, Indonesia, Philippines, Naharu, Hawaii *etc.* Plants of this genus has variety of medicinal activities and uses (Sridharan and Chinnagounder1, 2012).

Barleria (Acanthaceae) is one such plants of Ayurveda which enjoys high status for its versatile use in several ailments including inflammation. The genus *Barleria* has about 300 species, of which nearly 32 species are reported to occur in India and the important medicinal species are *B. buxifolia* Linn, *B. courtallica* Nees, *B. cristata* Linn, *B. longifolia* Linn, *B. prionitis* Linn, *B. lupulina* Lindl, and *B. strigosa* Willd (Karan *et al.*, 2013).

The genus *Barleria* has gained importance in recent years for the treatment of various diseases such as liver disorders, diabetes, neurological disorders,

immunodeficiency, inflammation, ulcers, HSV-2 viral diseases etc. because of its safety, efficacy and cost effectiveness (Kaur *et al.*, 2014). Flavonoids, iridoids and tannins were detected in the different parts of these *Barleria* species (Amoo *et al.*, 2011).

1.10. Aim of the Work

- To explore the preliminary phytochemical constituents of *Barleria longiflora* L.f with different solvent.
- To investigate the different phytochemical compounds which were present in the *Barleria longiflora* L.f by GC-MS method.
- To study the antimicrobial activity of the selected plant with different parts.
- To evaluate the anticancer activity of *Barleria longiflora* L.f.
- To analyze the molecular features of the plant by recording the DNA Barcode which is useful in plant identification