1. INTRODUCTION

Medicinal plants form the backbone of traditional system of medicine in India. Pharmacological studies have acknowledged the value of medicinal plants as potential source of bioactive compounds. Plants are known to be the source of many chemical compounds. Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources, many of them based on their use in traditional medicine. Various medicinal plants have been used in daily life to treat diseases all over the world. They have been used as a source of medicine. World is endowed with a rich wealth of medicinal plants. Man cannot survive on this earth for a long period without the plant kingdom because the plant products and their active constituents play an important role. Herbs have always been the principal form of medicine in India and presently they are becoming popular throughout the world, as people strive to stay health in the face of chronic stress and pollution, and to treat illness with medicines that work in count with the body’s own defense (Boominathan and Ramamurthy, 2009).

India has a rich heritage of traditional knowledge and is home to several important time-honored systems of health care like Ayurveda, Siddha and Unani. It has been estimated that the proportion of medicinal plants in India is higher than any country of the world with respect to the existing flora of that respective country. Medicinal plants continue to be an important therapeutic aid for alleviating the ailments of humankind. The search for eternal health and longevity for remedies to relive pain and discomfort drove early man to explore his immediate natural surroundings to the use of many plants, animal products and minerals etc for the development of a variety of therapeutic agents. Today, there is a renewed interest in traditional medicine and an increasing demand for more drugs from plants sources. This revival of interest in plant derived drugs is mainly due to the current widespread belief that “green medicine” is safe and more dependable than the costly synthetic drugs, many of which have adverse side effects (Shiva, 1996 and Kala et al., 2006).
Siddha System of Medicine also known as Siddha Vaidya in India is the oldest among the Indian Medical Systems namely Ayurveda, Siddha & Unani & it is also the oldest medical system in the world. Since number of people, preferring natural health remedies and herbal health remedies are increasing day by day and Indian medical systems like Ayurveda are gaining popularity all over the world, I think it’s the best time to give you some information about Siddha Medicine which is far more advanced than Ayurveda in usage of herbs, metals, minerals as well as animals in preparing highly effective medicines and not to mention, Siddha system of Medicine is the oldest Medical system in existence. Siddha System of Medicine is an integrated part of Indian System, which is very potent and unique system when compared with other traditional systems in existence.

Siddha medicine is contributing much to the health care of human beings and Siddha Vaidya could be considered as the crown of all the traditional arts of the ancient world owing to its richness and simplicity. Siddha system propounded by the Siddhars is a vast and unique system which defines health as a perfect state of physical, psychological, social and spiritual well being of an individual. The system not only deals with medicine, but with spirituality, righteous way of living, rejuvenation and its main aim Kaivalya or Attainment of Perfection. Siddhars learned that the only way of stopping the cycle of rebirths was to make the body as strong as a stone, unaffected by diseases, old age or even death. Thus the Kayakalpa system was formed.

World is endowed with a rich wealth of medicinal plants. Herbs have always been the principal form of medicine in India and presently they are becoming popular throughout the world, as people strive to stay health in the face of chronic stress and pollution, and to treat illness with medicines that work in count with the body’s own defense (Perumalsamy et al., 1998). There is a widespread belief that green medicines are healthier and more harmless or safer than synthetic ones. Medicinal plants have been used to cure a number of diseases. Though the recovery is slow, the therapeutic
use of medicinal plant is becoming popular because of its inability to cause side effects and antibiotic resistant microorganisms (Rawat, 2003).

Medicinal plants continue to be an important therapeutic aid for alleviating the ailments of humankind. The search for eternal health and longevity for remedies to relive pain and discomfort drove early man to explore his immediate natural surroundings to the use of many plants, animal products and minerals etc for the development of a variety of therapeutic agents. Today, there is a renewed interest in traditional medicine and an increasing demand for more drugs from plants sources. This revival of interest in plant derived drugs is mainly due to the current widespread belief that “green medicine” is safe and more dependable than the costly synthetic drugs, many of which have adverse side effects.

A major part of the total population in developing countries still used traditional folk medicine obtained from plant resources (Panthi and Chaudhary, 2006). There are many approaches to the search for new biologically active principles in medicinal plants (Parekh and Sumitra, 2006). India is the largest producer of medicinal herbs and is appropriately called the botanical garden of world (Shariff, 2006).

Plants are known to be the source of many chemical compounds. Medicinal plants were used by people of ancient cultures without the knowledge of their active ingredients. The common practice of taking crude extract orally is laden with hazards as the extracts may contain some toxic constituents. There is an ever increasing need to limit toxic clinical drugs (Lown, 1993). In modern times, the active ingredients and curative actions of medicinal plants were first investigated through the use of European Scientific methods (Herborn, 1998). The most important ingredients present in plant communities turn out to be alkaloids, terpenoids, steriods, phenols, glycosides and tannins (Abayomi, 1993).
The information obtained from extracts of medicinal plants makes pharmacological studies possible. The mode of action of plants producing therapeutic effects can also be better investigated if the active ingredients are characterized. In the recent years, research on medicinal plants has attracted a lot of attentions globally. Large body of evidence has accumulated to demonstrate the promising potential of Medicinal Plants used in various traditional, complementary and alternate systems of treatment of human diseases. Plants are rich in a wide variety of secondary metabolites such as tannins terpenoids, alkaloids, flavonoids, etc, which have been found in vitro to have antimicrobial properties (Cowan, 1999).

Over the past 20 years, there has been a lot of interest in the investigation of natural materials as sources of new antibacterial agents. Different extracts from traditional medicinal plants have been tested. Some natural products have been approved as new antibacterial drugs, but there is an urgent need to identify the novel substances that are active towards pathogens with high resistance.

Clinical microbiologists have two reasons to be interested in the topic of antimicrobial plant extracts. First it is very likely that these phytochemicals will find their way into the arsenal of antimicrobial drugs prescribed by the physicians; several are already being tested in humans. Scientists realize that the effective life span of any antibiotic is limited, so new sources especially plant sources are also being investigated. Second the public is becoming increasingly aware of the problems with the over prescription and misuse of traditional antibiotics. In addition many people are interested in having more autonomy over their medical care. A multitude of plants compounds (often of unreliable purity) is readily available over the counter from herbal suppliers and national food stores and the self medication with these substances is a common practice to certain extent. Infectious diseases are the leading cause of death worldwide. The clinical efficiency of many existing antibiotics is being threatened by the emergence of multidrug resistant pathogens. Higher plants as sources of medicinal compounds have continued to play a dominant role in the
maintenance of human health care since ancient times. Over 50% of all modern clinical drugs are of natural product origin and natural products play a vital role in modern drug development in the pharmaceutical industry (Cowan, 1999).

Antibiotic resistance has become a global concern. The clinical efficacy of many existing antibiotics is being threatened by the emergence of multi-drug resistant pathogens. Many infectious diseases have been known to be treated with herbal remedies throughout the history of mankind. Natural products, either as pure compounds or as standardized plant extracts, provide unlimited opportunities for new drug leads because of the unmatched availability of chemical diversity. There is a continuous and urgent need to discover new antimicrobial compounds with diverse chemical structures and novel mechanisms of action for new and re-emerging infectious diseases (Parekh and Chanda, 2007). Therefore, researchers are increasingly turning their attention to folk medicine, looking for new leads to develop better drugs against microbial infections. The increasing failure of chemotherapeutics and antibiotic resistance exhibited by pathogenic microbial infectious agents has led to the screening of several medicinal plants for their potential antimicrobial activity (Colombo and Bosisio, 1996).

Infectious diseases are the leading cause of death worldwide. The clinical efficiency of many existing antibiotics is being threatened by the emergence of multidrug resistant pathogens (Bandow et al., 2003). Bacterial pathogens have evolved numerous defense mechanisms against antimicrobial agents and resistance to old and newly produced drug is on the rise. The increasing failure of chemotherapeutics and antibiotic resistance exhibited by pathogenic microbial infectious agents has led to the screening of several medicinal plants for their potential antimicrobial activity (Colombo and Bosisio, 1996; Scazzocchio et al., 2001). There are several reports in the literature regarding the antimicrobial activity of crude extracts prepared from plants (El-seedi et al., 2002; Rojas et al., 2003; Duraipandiyan et al., 2006; Parekh and Chanda, 2007a).
Plants produce a diverse range of bioactive molecules making them a rich source of different types of medicines (Stuffness and Douros, 1982). Higher plants as sources of medicinal compounds have continued to play a dominant role in the maintenance of human health care since ancient times. Over 50% of all modern clinical drugs are of natural product origin and natural products play a vital role in modern drug development in the pharmaceutical industry (Baker et al., 1995).

Plants with possible antimicrobial activity should be tested against an appropriate microbial model to confirm the activity and to ascertain the parameters associated with it. The effects of plant extract on bacteria have been studied by a very large number of researches in different parts of the world (Ates and Erdogrus, 2003). Much work has been done on ethnomedicinal plants in India (Negi et al., 1993). Interest in a large number of traditional natural products has increased (Taylor et al., 1996). It has been suggested that aqueous and Ethanolic extract from plants used in allopathic medicine are potential sources of antiviral, Anti-tumoral and antimicrobial agents. The selection of crude plant extracts for screening programmes has the potential of being more successful in initial steps than the screening of pure compounds isolated from natural products. The above results of their plant extract studies show that such extracts can be used by communities for curative purpose (Cordell, 1981; Micheal, 1990; Daiziel, 1955; Pamploma-Roger, 1999).

Alcoholic extracts of the roots and fruits showed hypoglycemic and antidiabetic activity (Kamalakkannan et al., 2003; Karunanayake et al., 1984; Sabu and Kuttan, 2004). With respect to clinical applications, it should be noted that the roots are astringent, bitter and febrifuge. They are useful in diarrhoea, dysentery, dyspepsia, stomachalgia (Shoba and Thomas, 2001), cardiopalmsus, seminal weakness, vomiting, intermittent fever and swellings. The leaves of *A. marmelos* are useful as laxative, febrifuge and expectorant, also in ophthalmia, deafness, inflammations, cataract, diabetes, asthmatic and antifungal complaints (Rana et al., 1997). Also, the effect of these extracts was examined in the regulation of hyperthyroidism (Kar et al.,
and for the analgesic activity in mice. The stem extract inhibit in vitro proliferation of human tumor cell lines (Lampronti et al., 2003).

1.1 Antimicrobial activity

Antimicrobial activity of ethanol and aqueous extract of *Aegle marmelos* leaves were tested against selected Gram positive and Gram negative bacteria and fungi. Potent drugs play a key role in the world economy, since two third of the population depends on the medicines. 25-50 % of the prescribed medicines are obtained from natural sources. Now the attention of the researchers has been turned toward the animals, since most animals are found to be having a wide variety of bioactive substances.

Further, over 60% of potentially useful compounds (antidermatophytes, anti-inflammatory, anti HIV, anti- Cancer etc) discovered so far from living organism, have been obtained from animals and nearly 45% of these were discovered in *Aegle marmelos*. Thus, they are supreme biochemists. Increase of antimicrobial resistance is a global growing-problem. Isolation of microbial agents less susceptible to regular antibiotics and recovery of increasing resistant isolates during antibacterial therapy are rising throughout the world, which highlights the need for new principles. In treating burns, dermatophytes and infectious diseases, use of plants is common in traditional medicine of India. Plants and plant products have been used extensively throughout history to treat medical problems. Numerous studies have been carried out to extract various natural products for screening antimicrobial activity but attention has not been focused intensively on studying the combinations of these products for their antimicrobial activity.

Scientists from divergent fields are investigating plants with an eye to their antimicrobial usefulness. A sense of urgency accompanies the search as the pace of species extinction continues. Laboratories of the world have found literally thousands of phytochemicals that have inhibitory effects on all types of microorganisms *in vitro*.
More of these compounds should be subjected to animal and human studies to determine their effectiveness in whole-organism systems, including in particular toxicity studies as well as an examination of their effects on beneficial normal microbiota. It would be advantageous to standardize methods of extraction and in vitro testing so that the search could be more systematic and interpretation of results would be facilitated. Also, alternative mechanisms of infection prevention and treatment should be included in initial activity screenings. Disruption of adhesion is one example of an anti-infection activity not commonly screened currently. Attention to these issues could usher in a badly needed new era of chemotherapeutic treatment of infection by using plant-derived principles.

Over the last few years, researchers have aimed at identifying and validating plant-derived substances for the treatment of various diseases (Cragg et al., 1997; De Smet, 1997; Shu, 1998). Interestingly, it is estimated that more than 25% of modern medicines are directly or indirectly derived from plants (Cragg et al., 1997; De Smet, 1997; Shu, 1998). In this context, it is worth mentioning that Indian medicinal plants are considered a vast source of several pharmacologically active principles and compounds and that are commonly used in home remedies against multiple ailments (Biswas et al., 2002; Chattopadhyay et al., 2004). Neem and turmeric are quite popular among these important medicinal plants and several pharmacologically active compounds have already been isolated and extracted from these plants (Bandyopadhyay et al., 2002; Chattopadhyay et al., 2004; Swarnakar et al., 2005). Bael (Aegle marmelos L. Corr.) is another Indian plant, which has enormous traditional uses against various diseases and many bioactive compounds have been isolated from this plant also (Badam et al., 2002; Gupta and Tandon, 2004).

Bael is a medium-sized, armed, deciduous tree from the family Rutaceae. This tree was originated in India and is presently growing in most of the countries of Southeast Asia. In India, it grows wild, especially in dry forest, outer Himalayas, Shivaliks, South Indian plateau with altitudes ranging from 250-1200 m and also
cultivated throughout Indian sub continent for its fruits. It prefers dry and sunny or warm parts of the hill slopes with well-drained loamy soil (Hajra et al., 1997). Leaves, fruits, stem and roots of this tree at all stages of maturity are used as ethno medicines against various human ailments (Badam et al., 2002). Extensive chemical investigations on various parts of the tree have been carried out and more than 100 compounds have been isolated. Many of these compounds including skimmianine, aegelin, lupeol, cineole, citral, citronellal, cuminaldehyde (4-isopropyl benzaldehyde), eugenol, marmesinin, marmelosin, luvangetin, aurapten, psoralen, marmelide, fagarine, marmin and tanin have been proved to be biologically active against various major, minor diseases including cancer, malaria and gastroduodenal disorders (Takase et al., 1994; Jagetia et al., 2005; Costa-Lotufo et al., 2005; Lambertini et al., 2004; Khalid et al., 1986; Misra et al., 1991; Capasso et al., 2000; Goel et al., 1997). Various crude extracts of this plant have shown activities including antiulcer, antidiabetic, antihyperlipidaemic, antioxidant, antimicrobial, radioprotective, anti-inflammatory, analgesic, antispermatogenic and antipyretic effects on various animal models (Rastogi and Mehrotra, 1991; Rastogi and Mehrotra, 1993).

Bacteria are the most versatile unicellular pathogens, which are normally transmitted through soil, water, air and food and cause diseases in human beings and animals. Such types of diseases could be treated with various natural products including bael. Various extracts of bael leaves, roots and fruits have been reported to be active against many bacterial strains. Leaf extracts have shown activity against Escherichia coli (George et al., 1947).

Antimicrobial properties of various plants parts like root stem leaves, seeds, flowers, fruits have been well documented for some of the medicinal plants for the past two decades (Levan et al., 1979). Medicinal and aromatic plants and essences rich in antibacterial compounds could be an alternate way to combat against bacterial diseases (Abramowize, 1990; Samy et al., 1998; Meera et al., 1999). Since 1940’s, many bacteria have been now becoming resistant to them. According to Levan et al.,
natural plant products may offer a new source of antibacterial agents. In recent years antimicrobial properties of Indian medicinal plants have been increasingly reported (Aswal et al., 1996; Ahmad et al., 1998). The traditional treatment approach is of much significance, especially in India due to the endemic presence of infective gastro intestinal diseases which are the major causes of infant and adult mortality (Miranda et al., 1993).

1.2 Antiulcer activity

For over a century, peptic ulcer disease has been one of the leading causes of gastrointestinal surgery, with high morbidity and mortality rates. The prevalence of gastrointestinal ulcers differs around the world: duodenal ulcers are dominant in the Western populations and gastric ulcers are more frequent in Asia, especially in Japan. As the prevalence of this disease increases over time, one would expect peptic ulcers to continue to have a significant global impact in the basic health systems and in patients' life quality. In recent years, gastric ulcer has also been associated with infection of gastrointestinal mucosal tissue by *Helicobacter pylori*. About 70% of patients with peptic ulcer disease are infected by *Helicobacter pylori* and eradication of this microorganism seems to be curative for this disease.

In recent years, a large advance in chemical and pharmacological studies has contributed to the knowledge about new therapeutically active compounds obtained from the natural products. These compounds can be used directly as leads for the development of new medicines or as pharmacological tools to discover new active compounds, so they can be life-saving or determine the quality of life in long-lasting diseases. The natural active compounds classes or secondary metabolites as alkaloids, flavonoids, terpenoids, tannins and others have attracted researchers to investigate their chemical, toxicological and pharmacological features. The alkaloids represent a group of natural products that has had a major impact throughout history on the economic, medical, political and social affairs of humans. They are a diverse group of
low molecular weight nitrogen-containing compounds derived mostly from amino
acids.

These secondary metabolites are found in about 20% of plant species and they
are classified as true alkaloids, which have nitrogen atoms in heterocyclic rings,
protoalkaloids, which do not have the nitrogen atom(s) in heterocyclic rings and
pseudoalkaloids, which are not derived from amino acids but may have nitrogen atoms
in heterocyclic rings. Several alkaloids are being used in therapeutics as
pharmacological tools. A wide range of biological activities of alkaloids have been
reported. However, the alkaloids and other natural compounds have complex activities
and it is necessary to analyze pharmacological activities in the general tissues, linking
the structure with the activity presented. It is common to find pharmacological results
where a single experimental model generalizes a biological answer, but these can’t be
accepted because all the pathologies in question are also complex and it is necessary to
investigate specific experimental models.

Gastroduodenal ulcer is a common disorder of the gastrointestinal tract
(Bandyopadhyay et al., 2002). It is now considered that gastroduodenal ulcer is a
disease of multifactorial origin but its detailed etiology is still not clear. Development
of oxidative stress (Bandyopadhyay et al., 2002; Chattopadhyay et al., 2006 and
Biswas et al., 2003), lowering of gastroprotection, decrement of mucosal blood flow,
delayed restitution and regeneration etc. play dominant role in the pathogenesis of
ulcer (Biswas et al., 2003; Wallace and Granger, 1996). Ulcer develops when there is
imbalance between the defensive and aggressive factors on the mucosa resulting from
either potentiation of aggressive factors and/or lowering of mucosal production
(Biswas et al., 2003; Wallace and Granger, 1996). Stress, non-steroidal anti-
inflammatory drugs (NSAIDs) and Helicobacter pylori are the most common causes of
ulceration (Bandyopadhyay et al., 2002). Cigarette smoking and alcohol ingestion are
other inducers of this disease (Maity et al., 2003). Current medicinal therapy with
proton pump inhibitors and selective H$_2$ receptor blockers can efficiently cure ulcers.
But none of these are devoid of side effects and execute their action within a limit. Moreover, the recurrence of ulcer after stopping the medication is very high. About 70% of ulcers could recur after stopping medication. These drawbacks of the currently available antiulcer medicines necessitate the development of newer generation phytogenic drugs.

Many Indian medicinal plants like turmeric and neem have already shown antiulcer activity and various activity and various active compounds have been isolated from these plants (Bandyopadhyay et al., 2004; Borrelli and Izzo, 2000). Bael is another Indian indigenous plant which also has prominent gastroprotective effect. Pretreatment of rats with unripe bael fruit extract produced a significant inhibition of absolute ethanol induced gastric mucosal damage (Dhuley, 2004). This activity may be due to the compound luvangetin present in the fruit. Gastric ulcer is basically mediated by the development of oxidative stress and the compounds preventing ulcer formation may act through inhibition of oxidative stress in the gastroduodenal mucosa. The phenolic compounds are potent antioxidants and have powerful antiulcer activities (Bandyopadhyay et al., 2002). These compounds contain an OH group linked with the aromatic ring and thus may possess potent antioxidant and antiulcer activities.

The natural active compounds classes or secondary metabolites as alkaloids, flavonoids, terpenoids, tannins and others have attracted researchers to investigate their chemical, toxicological and pharmacological features. The alkaloids represent a group of natural products that has had a major impact throughout history on the economic, medical, political and social affairs of humans. They are a diverse group of low molecular weight nitrogen-containing compounds derived mostly from amino acids. These secondary metabolites are found in about 20% of plant species and they are classified as true alkaloids, which have nitrogen atoms in heterocyclic rings, protoalkaloids, which do not have the nitrogen atom(s) in heterocyclic rings and pseudoalkaloids, which are not derived from amino acids but may have nitrogen atoms in heterocyclic rings (Henriques et al., 2004).
Several alkaloids are being used in therapeutics as pharmacological tools. A wide range of biological activities of alkaloids have been reported: emetic, anticholinergic, antitumor, diuretic, sympathomimetic, antiviral, antihypertensive, hypnoanalgesic, antidepressant, miorelaxant, antitussigen, antimicrobial and anti-inflammatory (Henriques et al., 2004). However, the alkaloids and other natural compounds have complex activities and it is necessary to analyze pharmacological activities in the general tissues, linking the structure with the activity presented. It is common to find pharmacological results where a single experimental model generalizes a biological answer, but these can’t be accepted because all the pathologies in question are also complex and it is necessary to investigate specific experimental models.

The genesis of gastroduodenal ulcer requires acid, peptic activity and a breakdown of mucosal defense mechanism (Robert, 1981). Recent studies have implicated the production of free radicals and lipid peroxidation in the development of ulcers (Gutteridge, 1995). Efforts were made to find a suitable agent for the treatment of peptic ulcer in natural products of plants and animal origin. In Indian traditional system of medicine, Shankha bhasma derived from conch-shell (Gastropoda, Class: Mollusca), is used in the treatment of ulcers, dysentery, dyspepsia, indigestion and jaundice. The constituent of Shankha bhasma is mainly silicate of magnesia (Nadkarni, 1982). Previous studies revealed that some compounds including cinnamic acid and coumarins derivates and alkaloids have been isolated from Aegle marmelos (Basu and Sen, 1974; Govindachari and Premila, 1983; Sharma et al., 1981). The aegeline (Basu and Sen, 1974) was isolated from the leaves, whereas skimmianine (Govindachari and Premila, 1983) was obtained from the roots of the plant.

1.3 Antipyretic activity

The antipyretic activity relates to applications for registration of non-steroidal anti-inflammatory products intended primarily for symptomatic long-term treatment of such disorders as rheumatoid arthritis and osteoarthritis and other disorders of joints,
muscles and tendons. Flurbiprofen or 2-(2-fluoro-4-biphenyly) propionic acid is a new member of the phenylalkanoic series. Like its predecessors, it has been shown to possess significant analgesic, anti-inflammatory and antipyretic properties. Although the analgesic and antipyretic property of this drug has been investigated in animals, Adams using yeast-fevered rats found that the lowest effective dose to inhibit pyrexial action was 0.12mg/kg for flurbiprofen and 25mg/kg for aspirin 200 times potency weight for weight.

Where specific antipyretic activity is claimed or implied, this must have been investigated directly in controlled studies which include short-term double-blind comparison against placebo and comparisons with other compounds. The clinical parameters in all studies must be such that they give a clear picture of the extent to which the disorder, the symptoms and physical function are influenced. Existing sets of criteria for the diagnosis and grading of rheumatoid arthritis may be regarded as a basis.

1.5 Antioxidant activity

Till date as such no set definition of antioxidants exists. Scientists are still striving hard to find out the role of particular dietary supplements in body that have potent health benefits. Since, different antioxidant compounds found in diet considerably vary from one another; it is a difficult task to identify the role of a single compound. In simple words, "Antioxidants are a type of complex compounds found in our diet that act as a protective shield for our body against certain disastrous enemies (diseases) such as arterial and cardiac diseases, arthritis, cataracts and also premature ageing along with several chronic diseases". The above definition gives an idea about what actually an antioxidant is, as still a lot of work has to be carried on getting exact information about antioxidants, their exact amount in one's diet and their function.
Therefore, it was thought worth while to evaluate antioxidant activity of *Aegle marmelos* to confirm its folk medicinal claim. Many naturally occurring products have been reported to contain large amount of antioxidant compounds other than vitamin C, E and carotenoid. These antioxidants play a vital role in delaying, intercepting or preventing oxidative reactions catalyzed by free radical. Antioxidant activity of medicinal plants might be due to the presence of phenolic compounds such as flavonoids, Phenolic acids and phenolic diterpine. Synthetic antioxidants like butylated hydroxy anisole (BHA) butylated hydroxy toluene (BHT), tertiary butylated hydroxyl quinine and gallic acid esters have been suspected to be carcinogenic.

Hence, strong limitations have been placed on their use and there is a trend to replace them with naturally occurring antioxidants. The recent researches on free radicals promise a revolutionary improvement in health and life-style of humans. Against this background information and appreciating the knowledge of medicinal plants an effect has been made in this study to evaluate the antimicrobial and antiulcer activity of *Aegle marmelos* medicinal plants and also characterizing them by screening preliminarily by phytochemical analysis. The study also pertains to inculcate the subject about the utilization of natural flora as therapeutic agents.

1.5 **Antispermatogenic activity of insect**

Man cannot survive on earth for long life without plant kingdom because, plant products and their active constituents play an important role in many fields including pharmacological field. In addition to pharmacological use, plants also possess toxicological, pesticidal, insecticidal and larvicidal effects. Chemical pesticides not only kill the pests but also a large variety of living things including humans. DDT has a half life (The amount of time required for half of the chemical to decompose) of 10-15 years. It has been reported in Delhi, that the high accumulation of pesticides and DDT in the body of mothers causes premature deliveries with a low birth weight of Infants and even death of many children (Ravi Krishnan, 2009).
In recent years the increasing information on hazardous effect of synthetic insecticides on plant, animal and human health has alarmed Scientists to seek some alternative ways which are eco friendly (Ambika, 2012). To minimize the environmental pollution caused by toxic chemicals such as synthetic insecticides and pesticides, great emphasis is placed on the phytochemicals, being used as pesticides. Natural plant extracts play an increasingly prominent role as alternatives to synthetic pesticides due to the increasing concern on health hazards, environmental pollution and negative effects on non target organisms (Sharma et al., 2006).

Botanical insecticides are naturally occurring chemicals extracted from plants (Senthilnathan, 2006). They are highly effective, and ecologically acceptable (Mathews, 1994) which are safer than synthetic insecticides, easily degradable, have broad spectrum in action, non persistent and easily processed (Howse, 1995). They also offer desirable alternatives to synthetic chemicals in the agro-eco system where protection of the environment and preservation of beneficial organisms are important (Weathers bee and Tang, 2002). The revolution in preparing pesticides from plants has reduced the environmental problems. Studies on bioactivity of plant derivatives for pest control continue to increase, but few of the plant derivatives have potential insecticidal properties (Mohan et al., 2011). There are more than 2400 plant species belonging to 189 plant families which have been known to produce valuable chemical factor and metabolites (Emara et al., 2002 and Tulukadar, 2006). Insecticides from medicinal plants are also an alternative for hazardous pest management because they pose low threat to the environment or to human health compared to synthetic insecticides (Moreira et al., 2007). Plants are members of traditional pharmacopeia in many Asian African cultures and have also been used for pest control (Ivbijaro et al., 1990).

Hence environmental and health problems associated with the use of synthetic insecticides lead to look for natural plant protection agents such as botanical insecticides. In the continuous search for new and safe pest control methods, plants
are considered as one of the richest sources. Active substances extracted from plants may not only act as toxicants (Schoonhoven, 1978; Mariappan and Saxena, 1987) but also as repellents, synergists (Su and Harvot, 1981), Insect growth regulators (Bowers et al., 1972) and phagodeterrents (Meisner et al., 1982). Generally botanicals are potentially useful substitutes for synthetic chemical insecticides (Bingaman and Christians, 1995) and useful in many pest management programmes (Shekari et al., 2008).

Nowadays using chemical insecticides is the only available methods for pest control. Controlling by this method has become increasingly difficult, because of reduced effectiveness of pesticides caused by emergence of pesticididal resistance in arthropod pests. Therefore an effort is warranted to find alternatives. Since no single method of insect control is likely to provide a solution in all situations, the present trend is to adopt an integral approach for insect control, combining two or more methods with a view to obtain maximum effort and to avoid the excessive use of synthetic chemical insecticides (Park, 2009). Much progress has taken place in recent years to control the insect pests by some new techniques such as Male Sterilie techniques, (Rathinasamy, 1999) with the help of natural plant extracts and from their derivatives. Some of the plant extract and their derivatives are known to affect the reproduction, reproductive behaviour and reproductive organs of insects and also affects spermatogenesis, fertility and sterility on male insects. So, the plant extracts can be used as alternative botanical insecticides with reference to the histological changes on the reproductive system of insects.

1.6 Aegle marmelos

*Aegle marmelos* Correa (family Rutaceae) appears to be relevant and this plant is available in India, Bangladesh, Myanmar, Burma and Sri Lanka. The leaves, roots, bark, seeds and fruits are edible and have medicinal values. Its distribution is mainly within the sub-Himalayan forests, in dry hilly places ascending to 4,000 feet. It is called “Shivadume”, the tree of Shiva. In Hindu mythology leaves and wood of Aegle
marmelos are used to worship Lord Shiva. The medicinal properties of this plant have been described in the Ayurveda. In fact, as per Charaka (1500 B.C) no drug has been longer or better known or appreciated by the inhabitants of India than the Bael. Hindus also believe that goddess Lakshmi resides in Bael leaves. It is therefore widely cultivated and commonly found in the vicinity of temples (Chemexcil, 1992).

*Aegle marmelos* belongs to the family Rutaceae, commonly called as Bael (English), Vilvam (Tamil) and is found throughout India. Bael is a medium sized deciduous tree bearing strong axillary thorns and leaves with 3 or 5 leaflets. Bael leaves are extremely useful for treating diabetes, jaundice, cholera and asthma. Bael leaves are made into a poultice and used in the treatments of ophthalmic. Bael leaf poultice is applied to inflammations–with black pepper for edema, constipation, and jaundice.

The Bael tree is considered as a sacred tree by the Hindus. They offer its leaves to Lord Shiva during worship. The essence of its fruits and leaves possess an evaporating oil which is very good for human system. The leaves absorb foul gases from the atmosphere and keep it clean and salubrious while the raw bael fruit produces heat and has purgative effect. The ripe fruit has cooling effect and is constipative. Raw bael fruit is consumed for treatment of ailments such as arthritis and gout. Ripe fruit is taken during summer to keep the body and mind cool. Bael also helps to sharpen intellect and concentration of mind.

All parts of this tree, viz. root, leaf, trunk, fruit and seed are useful in several ailments. The root is an important ingredient of the 'Dasmula' (ten roots) recipe (Chopra, 1982). The decoction of the root and root bark is useful in intermittent fever, hypo-chondriasis, melancholia, and palpitation of the heart (Nadkarni, 1954). The leaves and bark have been used in medicated enema. The leaves are also used in diabetes mellitus. The greatest medicinal value, however, has been attributed to its fruit (Chopra, 1982) and the unripe fruit is said to be an excellent remedy for diarrhoea and is especially useful in chronic diarrhoeas (Satyavati et al., 1976). The
effectiveness of *A. marmelos* fruit in diarrhoea and dysentery has resulted in its entry into the British Pharmacopoeia (Chopra, 1982). Moreover, Chopra (1982) has appropriately stated that "No drug has been longer and better known nor more appreciated by the inhabitants of India than the Bael fruit." Charaka has described this plant as a Rasayana (Pandeya, 1983).

**MORPHOLOGY**

Syn : *Crataeva marmelos* Linn.
Genus : *Aegle*
Species : *marmelos*
Family : Rutaceae

**Vernacular names (Nadkarni, 1978)**

English : Bengal quince, Beal fruit, Golden apple, Holy fruit, Indian quince, Stone apple.
Tamil : Aluvigam, Iyalbudi, Kuvalam, Mavilangai, Vilwam, Villuvam.
Telungu : Bilvamu, Maluramu, Maredu, Sailushamu, Sandiliyamu, Sriphalamu.
Hindi : Bel, Bili, Sirphal, and Bela,
Bengal : Bael, Bel,
Gujarat : Billi,
Kannada : Bela, Bilva
Malayalam : koovalam, vilwam.
Orissa : Belo
Kannada : Bela, Bilva
Botanic Description

*Aegle marmelos* is a slow-growing, medium sized tree, up to 12-15 m tall with short trunk, thick, soft, flaking bark, and spreading, sometimes spiny branches, the lower ones drooping. Young suckers bear many stiff, straight spines. A clear, gummy sap, resembling gum arabic, exudes from wounded branches and hangs down in long strands, becoming gradually solid. It is sweet at first taste and then irritating to the throat.

The deciduous, alternate leaves, borne singly or in 2's or 3's, are composed of 3 to 5 oval, pointed, shallowly toothed leaflets, 4-10 cm long, 2-5 cm wide, the terminal one with a long petiole. New foliage is glossy and pinkish-maroon. Mature leaves emit a disagreeable odour when bruised.

Fragrant flowers, in clusters of 4 to 7 along with the young branchlets, have 4 recurved, fleshy petals, green outside, yellowish inside, and 50 or more greenish-yellow stamens.

The fruit, round, pyriform, oval, or oblong, 5-20 cm in diameter, may have a thin, hard, woody shell or a more or less soft rind, gray-green until the fruit is fully ripe, when it turns yellowish. It is dotted with aromatic, minute oil glands. Inside, there is a hard central core and 8 to 20 faintly defined triangular segments, with thin, dark-orange walls, filled with aromatic, pale orange, pasty, sweet, resinous, more or less astringent and pulp.

Embedded in the pulp are 10 to 15 seeds, flattened-oblong, about 1 cm long, bearing woolly hairs and each enclosed in a sac of adhesive, transparent mucilage that solidifies on drying.
Ecology

The tree grows wild in dry forests on hills and plains of central and southern India and Burma, Pakistan and Bangladesh, also in mixed deciduous and dry dipterocarp forests. *A. marmelos* is a subtropical species. In the Punjab, it grows up to an altitude of 1,200 m where the temperature rises to 48.89º C in the shade in summer and descends to -6.67º C in the winter, and where prolonged droughts occur. It will not fruit where there is no long, dry season, as in southern Malaysia.

Biophysical Limits

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
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</thead>
<tbody>
<tr>
<td>Altitude</td>
<td>0-1200 m</td>
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<tr>
<td>Mean annual temp.</td>
<td>-6-48 deg C.</td>
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<tr>
<td>Mean annual rainfall</td>
<td>570-2000 mm</td>
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</tbody>
</table>

Soil type

*A. marmelos* is said to do the best on rich, well-drained soil, but it has grown well and fruited on the oolitic limestone of southern Florida. It also grows well in swampy, alkaline or stony soils having pH range from 5 to 8. In India it has the reputation of thriving where other fruit trees cannot survive.

Therapeutic Value

1. **The medicinal value** of Bael fruit is enhanced due to presence of Tanin, the evaporating substance in its rind. The rind contains 20% and the pulp has only 9% of Tanin. This substance helps to cure diabetes.

2. **Treatment of Asthma** - Grind 5 g of Bael leaves. Add 1 spoon of honey. Take orally in morning and evening for relief.

3. **Cure of Anaemia** - Extract the pulp of Bael. Dry it and grind it to powder form. Add one spoonful of this powder to boiled cow milk. Also add some sugar candy. Take this dose twice a day in morning and evening for a long period.

4. **Fractures** - Extract the pulp of raw bael. Dry it and grind it to powder form. Mix 10 g of powder, 50 g of pure ghee, ½ spoonful of turmeric powder with a glass of luke warm water, stir well. Take it orally twice a day.
5. **Healing of Wound** - Take rind, root, leaves, fruit pulp of equal quantity. Grind them to extract juice. Add 10 g of honey. Drink it.

6. **Swollen Joints** - Few bael pulp mixed with hot mustard oil to be applied on the affected area twice a day during morning and evening for relief.

7. **High Blood Pressure** - Bael leaves to be taken every morning. The juice of bael leaves added with honey can also be taken every morning.

8. **Jaundice** - Extract juice of 100 Nos. of soft bael leaves. Mixed it with the powder of 10 Nos. of black pepper. Take the mixture every morning and evening. Added to this take at least five glasses of sugarcane juice daily after meals.

9. **Diarrhoea** - Dry raw bael fruit pulp. Take out seeds. The dried pulp if consumed quickly stops loose motion.

10. **Troubles During Pregnancy** - One spoon of raw fruit pulp if taken twice a day stops frequent vomiting nausea during pregnancy. Little sugar candy may be added to the pulp for taste.

11. **Typhoid** - Our body becomes weak due to high fever. Grind 200 Nos. bael leaves. Boil in one cup of water till it becomes thick. Take this paste with a little honey twice or thrice a day.

12. **Healthy Mind and Brain** - Ripe bael fruit taken with fresh cream (butter) and sugar candy powder sharpens concentration and intelligence.
1.7 OBJECTIVES OF THE STUDY

Ulcer is a term used to refer to a group of ulcerative disorders of the upper gastrointestinal tract involving principally the most proximal portion of the duodenum and stomach, which have in common the participation of acid-pepsin in their pathogenesis. In modern medicine no satisfactory effective therapy is still available to prevent recurrence of ulcer. Gelusil, Digene are some of the most popular drugs used against ulcer disease.

Plants are able to synthesize a broad range of different chemical compounds called secondary metabolites and these are easily degradable. Many of them provide new sources of natural compounds. Majority of world population in developing countries relay on herbal medicines. Currently 80% of the world population depends on plants derived medicine for the first line to primary health care because it has no side effects. In the present study the effect of aqueous and ethanolic extract of *Aegle marmelos* linn, leaves are selected in this study.

Herbal medicines are in great demand in the developed as well as in developing countries for primary health care because of their wide biological and medicinal activities, higher safety margins and lesser costs. Many plants were used for experimentally induced gastric-ulcer in rats. However searches for the ideal antiulcer natural drug have been still continuing. On account of this, the present study has been aimed to investigate the antiulcer effects of *Aegle marmelos*. The goal of our present study has been extended to evaluate the effect of *Aegle marmelos* on various biochemical parameters.

- To carry out physico-chemical analysis in the leaves of *Aegle marmelos* (*L.*) Corr.
- To screening the various phytochemicals present in the leaves of *Aegle marmelos* both qualitatively and quantitatively.
➢ To bring out the therapeutic value of *Aegle marmelos* by analyzing the useful phytochemicals constituents present in the *Aegle marmelos* leaves by using Gas chromatography-Mass Spectromotry (GC-MS) technique.

➢ To bring out the active components of *Aegle marmelos* by analyzing the useful phytochemicals present in the *Aegle marmelos* leaves using HPLC and HPTLC.

➢ In the present investigation, antioxidant activity of alcoholic and aqueous extracts of *Aegle marmelos* leaves are assessed.

➢ To find out the antimicrobial activity of the crude extracts of *Aegle marmelos* against human pathogenic microorganisms.

➢ To find out the anti-pyritic activity of the crude extracts of *Aegle marmelos*.

➢ To study the effects of leaf extracts on antiulcer activity of the crude extracts of *Aegle marmelos* against albino rats.

➢ To estimate the biochemical constituents (total proteins and total carbohydrates such as hexose amine, sialic acid, fucose, glycoprotein) in the dissolved gastric juice of animals.

➢ To study the effects of leaf extracts on gastric juice solution containing Hydrogen ion concentrations, pepsin activity and estimation of mineral content sodium and potassium ion concentration.

➢ To study the control of insects by an eco-friendly and sustainable methods. These methods control the insects with reference to the histological changes on the male reproductive systems. Thus bringing sterility with respect to the following aspects:-

(i) Histopathological effect of *Aegle marmelos* leaf extract on the testis and testicular follicles of the insect mole cricket, *Gryllotalpa africana*.

(ii) The anti spermatogenic and sterility effect of *Aegle marmelos* leaf extract on the insect mole cricket, *Gryllotalpa africana*.

(iii) The biochemical analysis of the tissues of *Gryllotalpa africana* after plant extracts treatment.