1.0. Introduction

Phytopharmaceuticals are an inexhaustible reservoir of chemotherapeutics to treat many ailments such as cold, fever, diarrhea, psychic problems, birth control and dental hygiene throughout the world (Mitscher et al., 1987; Deans and Svoboda 1990). According to Deans and Svoboda (1990) 2,50,000 higher plant species are believed to exist on earth. India, owing to its vast green forests, rivers and hills, with its richness of biodiversity can be considered as the paradise of medicinal plants.

Medicinal plants are very important source of life saving drugs for the ever increasing world population. According to World Health Organization upto 80 per cent of the world’s population is dependent mainly on traditional medicinal plants. Plants are also the source of many modern medicines. Approximately one quarter of prescribed drugs are based on plant ingredients. Starting from the most popular analgesic aspirin derived from Salix species to most valuable anti cancer drugs viz., Vinblastine, Vincristine and Paclitaxel are derived solely from plant sources (Tripathi and Tripathi, 2003).

The developing countries greatly depend on plants, where a major role in health care is played by traditional medicine (Zakaria, 1991). The use of synthetic drugs leads to undesirable hazards and side effects. There is
a world trend towards going back to natural resources (mainly traditional medicine) which are both economically and culturally acceptable with less side effects.

For the treatment of various diseases, dating back to the Vedic ages (1500 - 800 BC), the Indian indigenous system of medicine Ayurveda is based on the use of extracts of plants. Among the angiosperms investigated only 15 percent have been estimated chemically (Farnsworth and Soegarto, 1991), the source of biologically active constituents from a large number of plants, still remains untapped.

The importance of screening plant species as well as the knowledge of the use of plants in medicine for bioactive compounds, has been recently encouraged by several investigators from different regions including India (Naqvi et al., 1991; Abraham et al., 1986), Pakistan (Rizvi et al., 1987), Nepal (Taylor et al., 1995), Saudi Arabia (Khatibi et al., 1989), Somalia (Bloor, 1995), Rwanda (Vlietinck et al., 1995) and Cuba (Martínez et al., 1996).

Infectious diseases are the second leading cause of death worldwide. Accordingly, there is an increasing need to identify new antibacterial agents with a particular emphasis on multi-drug resistant bacteria and newly emerging pathogens. Evolution of bacteria towards resistance to antimicrobial drugs, is an unavoidable aspect of the general evolution of
bacteria and is a major public health concern as it is extremely difficult to overcome (Courvalin, 2005). New hopes to delay the emergence and subsequent dissemination of resistant microorganisms or resistant genes come from the discovery of natural products that may act as efficient leads in the development of novel antimicrobial agents (Newman, 2006).

In India, medicinal plants are widely used by all sections of people either directly as folk remedies or in different indigenous systems of medicine or indirectly in the pharmaceutical preparations of modern medicines. According to National Health Experts, 2000 different plants are used for medicinal preparations for both internal and external use in India alone. Among them only 200 are of animal origin, and 300 of mineral origin, while 1500 drugs are extracted from various plants (Srinivasan et al., 2001). There is a continuous and urgent need to discover new antimicrobial compounds with diverse chemical structures and novel mechanism of action owing to an alarming increase in the incidence of new and re-emerging infectious diseases. Another big concern is the development of resistance to the antibiotics in current clinical use (Rosario Rojas, 2003).

The search for new effective antimicrobial agents is necessary due to the appearance of microbial resistance and occurrence of fatal opportunistic infections associated with AIDS, antineoplastic chemotherapy and transplants. Ethnobotanical data have proven to be
useful in the search for new antimicrobial agents and many of these compounds have been isolated from medicinal plants (Penna et al., 2001). Resistance towards presently available antibiotics has necessitated the search for new antimicrobial agents (Josphat et al., 2007).

Medicinal plants and herbs have been preferred sources of active molecules which become lead compounds for the manufacture of various pharmaceutical products (Hammer et al., 1999).

Conventional antibacterial therapy is facing a crisis owing to rapidly increasing development of resistance to existing agents. Such resistance has an impact on all areas of chemotherapy. The first pathogen (Staphylococcus aureus) that has become resistant to all known antibiotics has posed a great threat (Ojala T et al., 2000).

The use of natural products with therapeutic properties is as ancient as human civilizations and, for a long time, plants were the main source of drugs. One approach that has been used for the discovery of antimicrobial agents from plants is based on the evaluation of traditional medicinal plant extracts (Davis, 1997; Duran and Duman, 2002).

Interest has considerably increased for finding naturally occurring antioxidant and antimicrobial compounds suitable for use in food and/or medicine due to undesirable side effects such as toxicity and carcinogenicity of synthetic additives (Losso et al., 2007; Scalbert et al.,
2005). In this regard, a growing rate of research was conducted on many plant species in order to find new natural bioactive compounds in them.

Because of the side effects and the resistance that pathogenic microorganisms build against antibiotics, in the recent past much attention has been paid to extracts and biologically active compounds isolated from plant species used in herbal medicine (Essawi and Srour, 2000).

Currently, natural plant compounds are the focus of some biotechnological companies which are looking for the new antimicrobial agents (Schachter, 2003).

It is estimated that the cost of treating hospital acquired drug resistant infections in the United States alone is US $ 4.5 billion annually (McGowan, 1991). There is a generalized sense of alarm regarding drug resistance (Cohen, 1992; Neu, 1992; Murray, 1994; Gould, 1994; Hryniewicz, 1992; casellas et al., 1994). The conditions that existed before 1940, in the pre antibiotic era may recur; this suggests that we are on the threshold of an uncertain future. There is an increased prevalence of drug resistant pathogens for example vancomysin resistant betalactamase producing Enterococcus species, methicillin resistant Staphylococcus aureus (MRSA), multidrug resistant Acinatobacter baumanii etc., that has been observed in hospital acquired pathogens (Kaatz et al., 1990).
Recently there are reports of New Delhi metallo-beta-lactamase-1 (NDM-1) an enzyme which makes bacteria resistant to a broad range of beta-lactam antibiotics. NDM-1 was first detected from a Swedish patient of Indian origin in 2008. It was isolated from *Klebsiella pneumoniae*. It was later detected in India, United Kingdom, Pakistan, Brazil, Canada, Japan and United States. By horizontal gene transfer, this gene for NDM-1 spreads from one strain of bacteria to another (Kumaraswamy et al., 2010).

The causes of antimicrobial resistance may be due to the sale of antibiotics without prescription, the use of broad spectrum antimicrobial agents, instead of agents with a narrower spectrum and the excessive consumption of antibiotics (Nijsten et al., 1993; Bates et al., 1993). Since many of the drugs currently in use are harmful and have adverse side effects, the search for new antimicrobial substances with minimal side effects is warranted.

Pharmacological activity of medicinal plants is conferred by the secondary metabolites which are small molecules in contrast to the primary metabolites such as the proteins, carbohydrates and lipids. In plants secondary metabolites accumulate in smaller quantities in specialized cells. When compared with primary metabolites, secondary metabolites are generally detected in lower concentrations and these are termed as the low volume high value products or specialty chemicals.
Secondary metabolites are formed by three general pathways

1) The Shikimic acid pathway that leads to the formation of coumarins, lignins, phenols, tannins and various aromatics.

2) The acetate melonate pathway that forms the precursors to glycerides, phospholipids, fatty acids, waxes, glycolipids etc.,

3) The acetate mevalonate pathway that results in terpenoids (Farnswarth, 1985).

In plants most of the secondary metabolites have a complex structure which determines their biological activity.

The secondary metabolites possess various biological activities, ranging from antibiotic, antimicrobial, hormonal and insecticidal properties, to highly important pharmaceutical and pharmacological activities viz., antidiabetic, anticancer and anti HIV. By acting as chemical defense against insects, microorganisms and predators, and as attractants of pollinators these compounds help plants to survive in their environment (Farnswarth, 1985).

*Salacia oblonga* belonging to family *Celastraceae* is a woody medicinal climber native to India and Sri Lanka, commonly known as Ponkoranti (in Malayalam) and chundan (in Tamil) due to its golden colored root bark. *Salacia oblonga* has been used in the treatment of
diabetes for thousands of years (Grover et al., 2002). Two thiosugars isolated from *S. oblonga* extract, salacinol and kotalanol (Fig. 1.1), have inhibitory effects, *in vitro*, against isomaltase, maltase, and sucrase. The inhibitory effect against sucrase is more potent than the prescription alpha-glucosidase inhibitors voglibiose and acarbose that are used in the treatment of diabetes (Matsuda H et al., 2005).

![Fig. 1.1. Structure of Salacinol and Kotalanol.](image)

Through the reduction of the enzymatic breakdown of di-, tri-, and oligosaccharides by these enzymes, carbohydrate absorption is decreased, attenuating the postprandial glycemic response. The undigested di-, tri-, and oligosaccharides pass through the small intestine into the colon where they are digested by the colonic microflora producing gaseous byproducts in Heacock et al., 2005 (Walever et al., 1998).
1.1. Objectives

Keeping in view the importance of natural drugs in the treatment of various perennial diseases, the study has been taken up with the following objectives:

- Evaluation of the antimicrobial activity of *S.oblonga* using polar & non-polar solvents i.e., methanol, ethanol, water, ethyl acetate, chloroform, petroleum ether and hexane etc.,
- Determination of the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) values for all solvents.
- Phytochemical analysis of the active principles responsible for the activity.
- Isolation of the active components responsible for the activity.