Review of Literature
3.0. REVIEW OF LITERATURE

3.1 Need to find antibiotics of herbal origin

Almost since the beginning of the antibiotic era, bacterial resistant has been seen as the major obstacle to successful treatment. Hardly any group of antibiotics has been introduced to which some bacteria has not developed resistance. Resistance was often minimized as a problem simply because the problem was not recognized. At the end of the 1960s the Surgeons’ General of the U.S. stated that “we could close the book of infectious diseases.” At the time he uttered these words the emergence of resistance did not seem to affect therapeutic options and although S. aureus had become resistant to benzyl penicillin and showing resistance to methicillin. It remained sensitive to gentamycin and infections could therefore still be treated.

At the start three bacterial species were capable of causing life threatening illness. They are Enterococcus faecalis, Mycobacterium tuberculosis and Pseudomonas aeruginosa. These bacteria are already known to be resistant to every one of the over 100 antibiotics available except for vancomycin. Vancomycin is the antibiotic of last resort for treatment of resistant infection and within last few years scientist has found strains of Streptococcus pneumonia and Staphylococcus aureus to be resistant to this antibiotic.
In human medicine alone, the US Centre for Disease Control and Prevention estimates that approximately one third of the 150 million prescriptions for antibiotics written each year were unneeded. Although antibiotic discovery has been exponential since the 1940s no new clinically useful drugs were discovered after 1961. Almost all the drugs that have been launched since the 1960s are modification of the antibiotics we already have. The introduction of organ transplantation in late 1960s promoted the massive increase in the antibiotic use, which was accompanied by an increase of methicillin resistance in *Staphylococci* and vancomycin resistance in *Enterococci*.

Recent report have also shown a marked increases of antibiotic resistance of UTI due to non-rational and excessive uses of antibiotics as therapeutic agents or as growth promoter in livestock. Another aspect of resistance lays in the use of antibiotic resistant genes- a selection marker in genetically modified organisms (GMOS). The main safety factor concern is the release of the resistant genes to sensitive organism when these GMOS are introduced into the environment.
3.2 Present and future demands of herbal medicine

Use of indigenous drugs from plant origin forms a major part of complementary and alternative medicine / traditional medicine. The world market for herbal medicine, including herbal products and raw material has been estimated to have an annual growth rate between 5 and 15%. Total global herbal drug market is expected to grow by the year 2050. Indian traditional medical system has a great wealth of knowledge and wisdom in the treatment of many illnesses. Ayurvedic medicine contributes approximately 35000 million rupees annually to the international market. In India herbal medicinal plants based industry is growing at the rate of 7-15% annually. The value of medicinal plants related trade in India is estimated at Rs.50000 million per annum. Such a tremendous increase in the global market for medicinal plants provides very great potential for trade and commerce in the pharmaceuticals, phytochemicals, nutraceuticals, cosmetics and other related industries in India (Singh et al., 2003). Scientifically validated and technologically standardized herbal medicines may be divided using a safe path of reverse pharmacology approach based as traditional knowledge database. This may play a crucial role in drug discovery, development and therapeutics in addition to dealing with a typical Western bias against Ayurveda (Patwardhan et al., 2003). Herbal drug technology includes all the steps that are involved in converting plant materials into
medicines, where standardization and quality control with proper integration of modern scientific techniques and traditional knowledge would remain important. Herbal medicinal product may vary in composition and properties, unlike conventional Pharmaceutical product, which are usually prepared from synthetic, chemically pure material by means of reproducible manufacturing techniques. The procedures adopted for identification and quality assurance of the starting material in herbal medicine is therefore, an essential pre requisite to ensure reproducible quality which contributes to its safety and efficacy. Terrestrial plants which have long been identified to contain antimicrobial sensitivity are listed in Table 1.

Table 1. Works concerned with the screening of medicinal plants for various infectious diseases

<table>
<thead>
<tr>
<th>Year</th>
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<th>Aspect(s) studied</th>
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<tbody>
<tr>
<td>1993</td>
<td>Mazuru</td>
<td>Antimicrobial activity of Dalbergia melanoxylon extracts</td>
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<td>Alade and Irobi</td>
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<td>Aramando et al.</td>
<td>Anti gonorrheal activity of plants in Guatemala for the treatment of Sexually transmitted disease</td>
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<td>Silva et al.</td>
<td>Antimicrobial activity of Guinea-Bissau traditional remedies</td>
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<td>1996</td>
<td>Martinez et al.</td>
<td>Screening of some Cuban medicinal plants for antimicrobial activity</td>
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<td>1996</td>
<td>Angeles Verastegui et al.</td>
<td>Antimicrobial activity of extracts of three major plants from the Chihuahuan desert</td>
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<td>1998</td>
<td>Ali Shatayesh et al.</td>
<td>Antimicrobial activity of 20 plants used in folkloric medicine in the Palestinian area</td>
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<td>1998</td>
<td>Urzua et al.</td>
<td>Antimicrobial study of the resinous exudate and diterpenoids isolated from <em>Eupatorium salvia</em></td>
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<td>1999</td>
<td>Asima and Brantner</td>
<td>Antibacterial steroid alkaloids from the stem bark of <em>Holarrhena pubescens</em></td>
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<td>Djipa et al.</td>
<td>Antimicrobial activity of bark extracts of <em>Syzygium jambos</em> (L.) Alston (Myrtaceae)</td>
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<td>Ojala et al.</td>
<td>Antimicrobial activity of some coumarin containing herbal plants growing in Finland</td>
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<td>Perumal Samy and Ignacimuthu</td>
<td>Antibacterial activity of some folklore medicinal plants used by tribals in Western Ghats of India</td>
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<td>2001</td>
<td>Lopez et al.</td>
<td>Antiviral and antimicrobial activities of Colombian medicinal plants</td>
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<td>Pundarikashshudu et al.</td>
<td>Antibacterial activity of <em>Galega officinalis</em> L. (Goat’s Rue)</td>
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<td>2001</td>
<td>Awadh Ali et al.</td>
<td>Screening of Yemeni medicinal plants for antibacterial and cytotoxic activities</td>
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<td>Isolation and identification of antibacterial compounds from <em>Vernonia colorata</em> leaves</td>
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<td>Neto et al.</td>
<td>Antibacterial activity of some Peruvian medicinal plants from the Callejon de Huayas</td>
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<td>Cos et al.</td>
<td>Further evaluation of Rwandan medicinal plant extracts for their antimicrobial and antiviral activities</td>
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<td>2003</td>
<td>Karaman et al.</td>
<td>Antimicrobial activity of aqueous and methanol extracts of <em>Juniperus oxycedrus</em> L.</td>
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<td>2005</td>
<td>Ravikumar et al.</td>
<td>Antibacterial activity of traditional therapeutic coastal medicinal plants against some human pathogens</td>
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</table>
Clinical microbiologists have two reasons to have interest 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 physicians. Several antimicrobial drugs are already being tested in humans. It is reported that on the average, two or three antibiotics derived from microorganisms are launched each year (Clark, 1996). After a downturn in that pace in recent decades, the pace is again quickening as scientists realize that the effective life span of any antibiotic is limited. Worldwide spending on finding new anti-infective agents (including vaccines) is expected to increase 60% from its present level.

In this direction new sources antimicrobial agents especially plant origin are also being investigated. Second, the public is becoming increasingly aware of problems of over prescription and misuse of commercial antibiotics. In addition, many people are interested to have more autonomy over their medical care. A multitude of plant compounds of herbal origin (often of unreliable purity) is readily available over the counter from suppliers and natural food stores for self medication. The use of plant extracts, as well as other alternative forms of medical treatments, is enjoying great popularity in the late 1990s. Earlier in this decade, approximately one-third of people surveyed in the United States used at least one “unconventional” therapy during the previous year (Eisenberg et al., 1993).
It was reported that in 1996, sales of botanical medicines increased 37% over
1995 (Clink, 1997). It is speculated that the American public may be reacting
to over prescription of sometimes toxic drugs, just as their predecessors of
the 19th century (see below) reacted to the overuse of some drugs for
bleeding, purging, and calomel (Yankauer, 1997).

3.3. Plants harnessed for medicine

It is estimated that there are 250,000 to 500,000 species of plants on
Earth (Vorris, 1996). A relatively small percentage (1 to 10%) of these is used
as foods by both humans and other animal species. It is possible that more
number of plants could be used for medicinal and other purposes (Moerman,
1996). Hippocrates (in the late fifth century B.C.) mentioned nearly 300 to
400 medicinal plants (Schultes, 1978). In the first century A.D., Dioscorides
wrote De.Materia Medica, a medicinal plant catalog which became the
prototype for modern pharmacopoeias. The bible offers descriptions of
approximately 30 healing plants. Indeed, frankincense and myrrh probably
enjoyed their status of great worth due to their medicinal properties reported
to have antiseptic properties, they were even employed as mouthwashes.
The fall of ancient civilizations forestalled Western advances in the
understanding of medicinal plants, with much of the documentation of plant
pharmaceuticals being destroyed or lost (Stockwell, 1988). During the Dark
Ages, the Arab world continued to excavate their own older works and to build upon them. Of course, Asian cultures also busy compiling their own pharmacopoeia. In the West, the Renaissance years saw a revival of ancient medicine, which as built largely on plant medicinal.

North America’s history on use medicinal plants follows two stands by indigenous cultures (Native American) dating from prehistory and an “alterative” movement among Americans of European origin, beginning in the 19th century (Weiner, 1980). Native American use of medicinal plant has been reviewed extensively in a series of articles by Moerman (1996). He reported that 1,625 species of plants have been used by various Native American gross as food while 2,564 species have been used for drugs (Clink, 1997). According to this estimate, approximately 18,000 species of plants were neither used for food nor drugs. Speculations as to how and why a selected number of plant species came into use for either food or drugs is fascinating but outside the scope, of this review.

3.4 Use of medicinal plants in early days

Among Europeans living in the New World, the use of botanicals was a reaction against invasive or toxic mainstream medicinal practices of the day. No less a luminary than Oliver Wendell Holmes noted that medical treatments in the 1800s could be dangerous and ineffective. Examples
include the use of mercury baths in London "barber shops" to treat syphilis and dangerous hallucinogens as tuberculosis "Cure". In 1861 Holmes wrote, "If the whole materia medica as now used could be sunk to the bottom of the sea, it would be all the better for mankind and all the worse for the fishes". In 1887, alternative practitioners compiled their own catalogs, notably the Homeopathic Pharmacopoeia of the United States.

Mainstream medicine is increasingly receptive to the use of antimicrobial and other drugs derived from plants, as traditional antibiotics (products of microorganisms or their synthesized derivatives) became ineffective and as new, particularly viral diseases remain intractable to this type of drug. Another driving force for the renewed interest in plant antimicrobials in the past 27 years has been the rapid rate of (plant) species extinction (Lewis and Lewis, 1995). There is a feeling among natural products chemists and microbiologists alike that the multitude of potentially useful photochemical structures, which could be synthesized chemically, is at risk of being lost irretrievably (Borris, 1996). There is a scientific discipline known as ethnobotany (or) ethnopharmacology, whose goal is to utilize the impressive array of knowledge assembled by indigenous peoples about the plant and animals products they have used to maintain health (Gorges and Pandelai, 1949; Rojas et al., 1992; Sylva et al., 1996; Vandenberge et al., 1986). Lastly, the ascendancy of the human immune deficiency virus (HIV) has
spurred intensive investigation into the plant derivatives which may be effective, especially for use in underdeveloped nations with little access to expensive Western medicines.

3.5 Current status of herbal antimicrobials

The current state of plant antimicrobials in the United States, ranging from extracts commonly in use, largely by the lay community, to substances being prospected and tested by researchers and clinicians. Also, compounds potentially effective in treating HIV infections, which are being sought far and wide for probable use in North America, are also addressed. An attempt is also made to summarize the current state of knowledge of relatively undefined herbal products. This review does not address the worldwide use of plants as medicinal, but, rather, it focuses on plants and their extracts currently in use in North America. Only phytochemicals reported to have anti-infective properties are examined. The many plants used as immune system boosters are outside the purview of this review, within these boundaries, reports cited in the peer-reviewed literature are given heaviest emphasis. Detailed descriptions of individual plant-derived medications can be found in the first edition of the Physician’s Desk Reference for Herbal Medicines published by Medical Economics Company in 1998.
3.6 Coastal Vegetation

Coastal Vegetation is categorized into 3 major divisions - mangroves, salt marshes and sand dunes based on occurrence and adaptations. The mangrove forests constitute mostly trees for shrubs, predominantly occurring in muddy soil substrates of inter-tidal areas, lagoons, estuaries and backwaters in tropical and sub-tropical countries.

The salt marshes are plant communities of grasses, herbs or shrubs, which grow in wet soil substrates that are alternately inundated and drained by tidal action. The sand-dune vegetation occupies dry sandy area of coast (Vaidya, 2001). All the vegetation thrives under extreme coastal environment by the virtue of synthesizing stress-induced metabolites belonging to chemical groups such as, steroids, triterpenoids, saponins, flavonoids, alkaloids and tannins. These coastal plant derived chemicals are mostly identified for its antiviral property. Based on traditional knowledge and scientific works 18 coastal plant species have been identified as possible potential sources of antiviral drugs, but all exploration or antimicrobial drugs from coastal vegetation are still in its infancy (Tables 2 and 3).
<table>
<thead>
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<th>Year</th>
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</tr>
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<td>Loder and Russell</td>
<td><em>Bruguiera sexangula</em>&lt;br&gt;<em>Bruguiera exaristata</em>&lt;br&gt;<em>Bruguiera paviflora</em></td>
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<td>1972</td>
<td>Molyneux</td>
<td><em>Derris trifoliata</em></td>
<td>Toxicity of fish</td>
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<td>1974</td>
<td>Ganguly and Sircar</td>
<td><em>Rhizophora mucronata</em>&lt;br&gt;<em>Sonneratia apetala</em></td>
<td>Plant growth hormone</td>
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<td>1977</td>
<td>Chou et al.</td>
<td><em>Xylocarpus granatum</em>&lt;br&gt;<em>Xylocarpus moluccensis</em></td>
<td>Insect antifeedant</td>
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<td>Jongsuvat</td>
<td><em>Acanthus ilicifolius</em></td>
<td>Anticancer</td>
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<td>1981</td>
<td>Rollet</td>
<td><em>Languncularia racemosa</em>&lt;br&gt;<em>Rhizophora lamarckii</em>&lt;br&gt;<em>Derris uliginosa</em></td>
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<td>1982</td>
<td>Balasooriya et al.</td>
<td><em>Thespesia populnea</em>&lt;br&gt;<em>Aegiceras corniculatum</em></td>
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<td>1982</td>
<td>Singh and Dhawan</td>
<td><em>Bacopa monniera</em></td>
<td>Rat poison</td>
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<td>1983</td>
<td>Mc Millan</td>
<td><em>Halophila ovalis</em></td>
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<td>1985</td>
<td>Ghos et al.</td>
<td><em>Suaeda maritima</em></td>
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<td>1987</td>
<td>Chaudhari and Mahapatra</td>
<td><em>Pluchea indica</em></td>
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<td>Thangam and Kathiresan</td>
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