

A Study on Medicinal Plants and uses as Anti-Microbial Agent

Karishma Mishra^{1*}, Dr. Mohd. Ahamad²

¹ Research Scholar, Shri Krishna University, Chhatarpur M.P.

² Assistant Professor, Shri Krishna University, Chhatarpur M.P.

Abstract - Medicinal plants have played an important role in the evolution of traditional Indian medicine in India. There are an estimated 70,000 plant species that have been utilised for medical purposes at some point or another. Conventional medications may be isolated or synthesised using herbs as a starting point. The Chinese pharmacopoeia contains about 5,700 traditional remedies, the majority of which are derived from plants, while over 2000 Ayurvedic practitioners felt that plant species had therapeutic worth. Although complete plants are seldom employed, around 500 herbs are still used in traditional medicine.

Keywords - Medicinal plants, Tuberculosis, Meditational uses

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INTRODUCTION

Medical plants, which have been used to cure sickness for millennia, hold considerable promise for meeting these demands. Pure or uncooked, they have been frequently utilised. Medicinal plants and significant traditional knowledge of herbal medicine usage in treating different ailments are only found in India, making it a unique country in the world. As a result, it makes a great deal of sense to combine old-world knowledge with cutting-edge research methods. The diversity and abundance of medicinal plants is absolutely astounding. According to Charak Samhita (ca. 1000 BCE), one of the first Indian medical treatises, there were over 340 plant-derived medications in use. Medical professionals continue to rely on wild plants for the majority of their supply. Plant medications were not widely used as field crops in the nation until the second half of the 19th century, despite a long history of knowledge of their use in medicine. The Vedas are the ancient Indian epic literature that were composed about 1500 BC. Herbal knowledge from that historical period is well-documented in these books. The Charak Samhita, composed by the physician Charaka, followed the Vedas approximately 700 BC. In India, he is revered as the father of medicine. Around 350 therapeutic plants are described in this medical book. Asthma and leprosy have long been treated using gotu kola (*Centella asiatica*), a Middle Eastern plant that has lately been shown to be beneficial in the treatment of asthma. The way sickness is seen in Ayurvedic medicine varies from that of Western medicine. According to Ayurvedic physicians, while antibiotics may be useful in some circumstances (such as

surgery), they target the body's physiology from the inside out and are thus seen to be a source of illness. In Ayurvedic medicine, the goal is to bring the body back into equilibrium.

MEDICINAL PLANTS

Many people are optimistic that herbal treatments, which have been used to cure illness for thousands of years, would be able to fill these voids. Many different types of unprocessed materials have been put to good use. Traditional herbal medicine in India is one of the world's most vast and unique resources for treating a broad variety of ailments. Therefore, it is quite reasonable to put to the test the historical knowledge that has been supported by evidence by using modern scientific techniques.

It is astounding how many plants there are that have the potential to be utilised as medicines. More than 70,000 plant species, from small lichens to huge oak trees, are employed in medicine, according to early estimates. Herbs are the original source for many pharmaceuticals; the active compounds are then isolated or synthesised.

DRUGS IN AYURVEDA

The basic materials for Ayurvedic remedies come from a wide range of plant and mineral sources. The alkaloids in plants are typically what causes their effects. Almost without exception, they seem to be chemical byproducts (even modern drugs

are based on these, but the proportion of synthetic derivatives is higher). Critical factors include the kind of soil, the amount of sunlight received, the timing of harvests, the methods used to produce the drugs, and the plants that thrive under those conditions. It's conceivable that a plant species' medicinal effectiveness changes depending on the environment in which it thrives. Plant-based medicines have the potential to affect physiological processes. The chemical components of the plant utilised to guide the selecting process. Because of the work done by scientists in the 18th century to extract and isolate plant chemicals, we typically think of plants and their effects in terms of the active substances they contain. This reference book is similar in that it describes the major therapeutic components of the medicinal plants it addresses and how these components act. An All-In-One Reference Guide on Medicinal Plants (Prajapati, 2010) The extraction and purification of plant compounds is crucial since they constitute the basis for some of the most effective medications used by humans. Morphine, the strongest painkiller, and tubocurarine, the greatest muscle relaxant, are both derived from the poppy plant (*Chondrodendrontomentosum*, *Papaver somniferum*). Cocaine, an anaesthetic produced from the coca plant, is only one example of its kind (*Coca erythroxylen*). Quinine's antimalarial effects, digoxin's (*Digitalis*) heart-medication effects, and ephedrine's (adrenaline's) cough-suppressant advantages aren't immediately obvious, and it's hard to imagine a situation in which you'd require them (a common ingredient in recipes and do-it-yourself cold treatments). These and many more conventional pharmaceuticals are generated from isolated plant constituents. Common sense and tried-and-true practises tend to provide the best results. Several of the one hundred plant species examined indicated anti-mycobacterial action (Gautam R. et al., 2007).

MEDICINAL PLANTS AS A SOURCE OF IMPORTANT DRUG

The sole source of several tried-and-true medications is the plant kingdom. Natural medicines include those made from plants, animals, bacteria, and minerals. In 1991, Germany accounted for \$ 3 billion of the EU's herbal medicine market (which may have grown to over \$20 billion by now), followed by France and Italy, each with \$ 1.6 billion. About \$80 million, or 1% of the total value, of India's herbal medicine market comes from overseas sales of crude extracts. As a result, experts put the current global market for herbal medicines at \$30–\$60 billion. To far, China has contributed information on more than 800 distinct species of medicinal plants, making it one of the world's main sources of herbal medicine. Western markets place particularly high value on Indian exports of *Allium sativum*, *Aloe barbadensis*, and *Panax* herbal therapies. With around 45,000 plant species, including 15,000–18,000 flowering plant species, 23,000 fungus species, 2500 algae species, and 1600 lichen species, India is one of the most fragile biodiversity centres in the world. The World

Health Assembly ultimately decided that people's access to herbal medicine was vital to their health after much debate (WHA 42.43, 1989). This is according to research (Kamboj, 2000). A vast majority of today's pharmaceuticals are derived from secondary metabolites, most notably nitrogenous alkaloids (Rout et al., 2009).

TUBERCULOSIS

People have been using herbs as medicine since before our ancestors evolved. Several currently used DMGs were discovered in as-yet-untapped natural reservoirs, demonstrating that nature has served as a supply of therapeutic compounds for thousands of years. The rising prevalence of diseases caused by antibiotic-resistant organisms has rekindled interest in the discovery of new anti-mycobacterial drugs in recent years. Droplets expelled from the mouth, nose, and lungs of an infected individual during a cough or sneeze are the primary mode of transmission of active TB from one person to another (Swaminathan et. al., 2010). As drug-resistant forms of *Mycobacterium tuberculosis* continue to emerge, this disease remains a major problem in poor countries. Worrying new data on the global spread of tuberculosis (TB) has been revealed by the World Health Organization (WHO). More than five thousand people every day lose their lives to TB, and almost one-third of the global population is now thought to be unclean. Numerous symptomatic patients are also latent carriers, therefore this group might serve as a source of the illness in the future. The number of fatalities attributable to TB has increased as a result of the AIDS pandemic. Multidrug-resistance has emerged as a contributing cause to rising tuberculosis (TB) infection and mortality rates (MDR). Although many compounds have been evaluated for their effectiveness as anti-TB drugs, only a select few have demonstrated enough therapeutic promise to go into the clinical pipeline. Even though just a handful of chemicals have been launched as novel anti-TB drugs in the last 40 years, drug resistance is still a key worry with newly found anti-mycobacterial therapies, underscoring the need for further study in this field. The extraction of innovative, safe, and highly efficient nanoparticles from plants is an area that needs immediate study.

MYCOBACTERIUM: A PATHOGEN OF TB

The genus *Mycobacterium* is part of the *Mycobacteriaceae* family of *Actinobacteria*. During development, mycobacteria—named after the Greek word for "fungus"—appear as a mouldy growth on the surface of liquids (Fig. 1). Obligated pathogenic bacteria called *Mycobacterium tuberculosis* are the leading cause of TB globally (Figs. 2 and 3). This bacterium may cause tuberculosis, which can then be transferred via the air (Mohammad Asif et al., 2012).

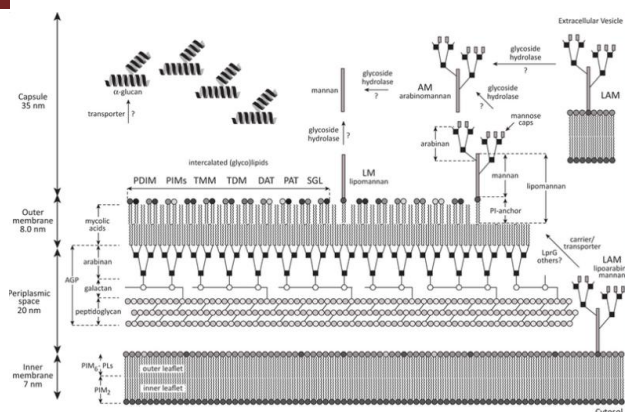


Figure 1: Structure of Mycobacterium cell membrane

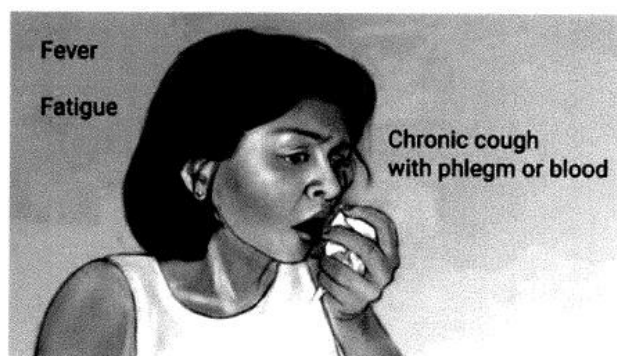


Figure 2: Transmission of aerosolized droplets of *M. tuberculosis*

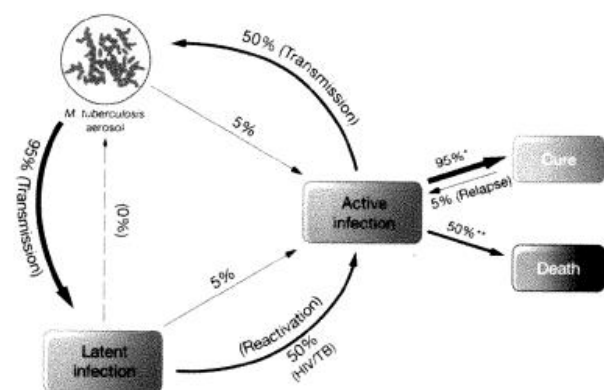


Figure 3: Transmission of Tuberculosis

Tuberculosis is characterised by a series of symptoms including a persistent cough that lasts for three weeks or more, chest discomfort, blood in the cough, extreme exhaustion, rapid weight loss, anorexia, loss of appetite, pale skin, and fever.

Mycobacterium avium composite infection, characterised by nontuberculous NTM, is a mycobacterial disease. The bacterial infection known as paratuberculosis is caused by the *Mycobacterium avium* subspecies and is most often seen in dairy cattle. However, it may also infect birds, pigs, and humans, causing a respiratory illness (particularly those with weakened immune systems). John's

disease and other paratuberculosis disorders are a global issue because they are caused by the bacterium *Mycobacterium avium*. This virus may cause respiratory illnesses in birds, pigs, and humans, particularly individuals with weakened immune systems. Subsp. paratuberculosis bacteria have several functions in the development and progression of both Crohn's disease and diabetes in humans. Milk may contain *Mycobacterium avium* subspecies, a potentially dangerous bacteria. paratuberculosis by eating contaminated dairy cattle feed or being exposed to sick cows. A fever or chills, nausea, vomiting, diarrhoea, loss of appetite, excessive exhaustion, enlarged glands, and difficulty sleeping are all possible symptoms.

Another kind of acid-resistant and rapidly replicating bacteria is *Mycobacterium phlei*. It has been shown that *M. phlei* is present in drinking water and poses no threat to human health or animal health. Gram-positive bacteria like the one known as *M. phlei*. *Mycobacteria* are capable of thriving in a broad range of habitats, including soil, plant surfaces, and even water. Viruses and parasites are no match for *M. phlei*'s potency. Coughing, fatigue, and lack of appetite are some of the symptoms (Cheepsattayakorn et al. 2013).

Acid-fast bacteria include *Mycobacterium smegmatis*. Because it is representative of other mycobacterial species, this bacterium has been the subject of significant study all around the globe. The evidence points to *M. smegmatis* being a human pathogen (Cheepsattayakorn et al. 2013).

MECHANISM OF MULTIDRUG-RESISTANCE (MDR)

Multi-drug-resistant tuberculosis refers to tuberculosis that has developed resistance to at least two drugs, such as the powerful first-line therapies isoniazid (INH) and rifampicin (RMP) (MDR-TB). If the antibiotic course is stopped and medication levels in the body are inadequate to kill 100% of germs, then the formation of multidrug-resistant strains may occur during treatment of entirely sensitive TB. Recent studies have shown a multitude of molecular pathways involved in MDR. In order to increase the effectiveness and compliance of tuberculosis treatment, the World Health Organization developed the direct experience treatment short course (DOTS) policy.

INVENTION OF NEW DRUG FOR THE MANAGEMENT OF TUBERCULOSIS

As a result of their efficacy against bacteria, antibiotics are often employed in TB treatment. Mycobacterial cell walls are notoriously tough to penetrate and make many antibiotics useless, which hinders the development of viable TB therapies. Treatment with the two most common

antibiotics, isoniazid and rifampicin, may be made more successful by extending it over a longer period of time. Nanoparticles are made by combining an extract of a plant with a metal oxide (AgNO₃, CuSO₄).

NEED FOR NOVEL AND SAFE TB DRUG DEVELOPMENT

There is a lack of comprehensive biomarkers or alternative endpoints, which makes it difficult to predict early success or failure of treatment, which is a key obstacle to the development of innovative TB drugs. Research on TB treatments' early bactericidal activity (EBA) has been critical throughout the years. EBA studies seek to lower the bacterial load in patients' sputum by at least half during the first two to five days of therapy (Cheepsattayakorn et al. 2013). We want to create the first plant-based medicine on the market by synthesising plant-based nanoparticles containing a metal medication (AgNO₃, CuSO₄) for the treatment of a critical medical disease.

FUTURE PROSPECTUS IN TB RESEARCH

There has been no new chemical discovery in TB treatment in the previous 40 years. There are no new plant-based drugs on the market today, however. Nanoparticle medicines generated from plants have seen increased research and development in the treatment of tuberculosis during the last several years. There is an immediate need to find and develop new anti-TB medications to combat drug resistance and improve the success rate of treatments for latent TB, which is considered to be caused by pulmonary tubercles.

DRUG-RESISTANT TUBERCULOSIS

Mycobacterium's resistance to first- and second-line treatments has increased the public health risk posed by TB. The outcome is a global pandemic of drug-resistant forms of *Mycobacterium TB*, most notably in India. Among newly diagnosed cases, the rate of MDR-TB is estimated to be 3.3%, whereas the rate among previously treated patients is estimated to be 20%. Cases of tuberculosis resistant to several medications were reported by 105 countries by the end of 2015. (XDR-TB). 9.7 percent of those diagnosed with MDR-TB are also suspected of having XDR-TB. The prevalence and death rates of TB across the globe are documented in this study.

SECONDARY METABOLITES

Most of the molecules that plants produce, called secondary metabolites, have nothing to do with the plant's growth or development. The precise biological function of these compounds in plants is still a mystery. Amino acids, organic acids, and other primary metabolites play crucial roles in plant metabolism and are often the building blocks for secondary metabolites. Plants and other organisms rely heavily on secondary metabolites for defence,

while people utilise them for medical, flavouring, and recreational reasons. According to their size, secondary metabolites may be classified as either tiny, huge, or non-small (Agostini-Costa et al., 2012).

MEDICINAL PLANT USED AS ANTI-MICROBIAL AGENT

Preservatives made from the oils of plants and spices have been used for centuries. Ethanol and water-soluble substances like as polysaccharides like starch, polypeptides like fabain, and different lectins stand out among the numerous plant components demonstrated to have antibacterial effect. Treatment with less polar solvents may allow for the extraction of tannins and terpenoids present in the aqueous phase. Random sampling, chemical screening, biological screening, and ethanomedical application are only few of the methods that may be used to identify new drugs from medicinal plants. After considering the results of research (Mendonca-Filho, 2006).

DEVELOPMENT OF ANTI-CANCER AGENTS FROM MEDICINAL PLANTS

In both the global and Indian contexts, cancer is the biggest killer. Despite improvements in prognostic and diagnostic procedures since the 1960s, mortality rates remain high, and medical requirements are mostly unmet. Cancer treatments options span from drug administration to radiation and surgical removal. There are a number of obstacles chemotherapy must overcome despite its importance in cancer treatment. Multidrug resistance, substantial damage to normal cells, inadequate drug reaching target cells, angiogenesis, and metastasis are all examples. That's why making medicines that don't cause any negative reactions is such a priority in the pharmaceutical industry. A unique approach to avoiding this fatal illness is the use of substances, either synthetic or natural, to limit tumour formation in people. Herbal remedies are helpful since they are not only effective but also risk-free. Many plants have bioactive chemicals that have been employed in the research and development of cancer treatments. Both the sample source and the screening methods used are critical in ensuring accurate results (Agarwal et al., 2012). Recent developments in isolation and structural elucidation technologies, as well as increased understanding of molecular science, have made the identification of certain herbs with anti-cancer effects more likely. Over 85,000 chemicals have been examined for cytotoxicity using a variety of cell line-based assays, and in vitro screening utilising human cell lines is an innovative and effective way for assessing these results (Agarwal et al., 2012). In vivo studies, which are conducted on actual animals, verify the usefulness of compounds discovered in in vitro tests. Many different bioassays and staining methods exist for identifying apoptosis, necrosis, and DNA damage in cultured

cells. There has been an unprecedented rate of identification of novel therapeutic leads thanks to the use of several molecular targets.

Cancer medications work by preventing proteins from carrying out their regular functions inside cells. Proteins of this kind include DNA topoisomerase I and II, cyclin-dependent kinases (CDKs), growth and transcription factors, and many more. Compounds that produce de-polymerization of tubulin include camptothecin derivatives like topotecan and irinotecan, and vinca alkaloids including vinblastine, vincristin, colchicines, and maytansine. Their cytotoxicity originates from the fact that they block the action of topoisomerase I, an enzyme crucial to the process of DNA replication and repair (Crag and Newman, 2005). The creation of cyclin-dependent kinase inhibitors was motivated, in part, by quercetin and other naturally occurring chemicals. Cell cycle arrest in the G0/G1 phase is when its anti-tumor actions become apparent (Bhanot et al., 2011).

CANCER DEVELOPMENT

Genes and the environment are two major contributors to cancer's complicated aetiology. Exposure to both chemicals and solar radiation has been linked to the development of cancer. It seems to reason that epithelia would be where the vast majority of malignancies first show themselves. About 10 million individuals get the disease annually, with 6 million succumbing to it. The most notable contributors to rising cancer rates are the widespread use of tobacco products and some aspects of the typical Western diet (high fat, low fibre content). As of 2012, there are around a hundred distinct forms of cancer, each of which is called by the primary cell type that it affects. When cancerous cells are killed, they undergo a phase of anaplastic proliferation in which they cease their normal functions and begin to divide uncontrollably, hence contributing to the growth of the tumour (except in the case of leukaemia where normal blood function is altered and abnormal division of blood cells takes place, sometimes the shape of blood cell becomes like sickle known as sickle cell anemia). Hormones released by growing tumours may disrupt normal bodily processes, such as those involved in digestion, the nervous system, and circulation. If a tumour develops slowly and steadily, most doctors will assume it is harmless. Cancer cells may invade healthy organs and tissues all across the body via the lymphatic system and the circulatory system, causing widespread damage. Because of their capacity for proliferation, angiogenesis, and metastasis, cancer cells may continue to expand unchecked. Metastasis is the process by which cancer cells invade and destroy healthy tissue at distant sites in the body after initially originating in one organ (Sonnenschein and Soto, 2013).

Human papillomavirus (HPV, connected to cervical cancer), hepatitis B and C viruses (HBV and HCV,

respectively, associated to liver cancer), and Epstein-Barr virus (EBV, linked to lymphoma), to name a few, have all been linked to various forms of cancer (childhood cancers). In their research on the intricacy of cancer, American researchers Hanahan and Weinberg (2000, 2011) identified six shared characteristics that are essential to the malignant transformation of normal cells. Tumor cells are able to generate their own growth signals (autocrine growth), ignore signals that would normally stop their growth (insensitivity to anti-growth signals), avoid their own programmed death (apoptosis), induce angiogenesis (the formation of new blood vessels to bring nutrients to tumours) (unlimited reproductive potential), proliferate indefinitely (sustained angiogenesis), invade neighbouring tissues, and metastasize (spread).

CONCLUSION

In a private context, it is impossible to fathom the antimalarial properties of quinine, the heart drug digoxin (Digitalis), or the cough suppressant ephedrine, which is a frequent element in recipes and DIY cold cures. These and many other conventional medications are derived from isolated plant parts. These conventional drugs are the most effective ones. A test on 100 distinct plant species revealed that they had anti-mycobacterial properties.

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Corresponding Author

Karishma Mishra*

Research Scholar, Shri Krishna University, Chhatarpur M.P.