



(REVIEW ARTICLE)



The potential role of traditionally used plants as immunomodulators

Ramesh Kumari Dasgupta ^{1,*}, Subhendu Dey ¹, Subham Roy ¹, Amit Samanta ¹ and Jashabir Chakraborty ²

¹ Department of Pharmaceutical Chemistry, Mata Gujri College of Pharmacy, Mata Gujri university, Purabpali Road, Kishanganj, -855107, Bihar, India.

² Department of Pharmacology, Mata Gujri university, Purabpali Road, Kishanganj, -855107, Bihar, India.

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Abstract

One of the biological systems in the body with the most complexity is the immune system. A vast number of viruses, bacteria, and fungi attack the immune system during an infection. The body's immune system uses special receptor to recognize pathogens and immediately react by activating immune cells, cytokines, and chemokines, as well as by releasing inflammatory mediators. A wide variety of traditional botanicals are employed as immunomodulators by leveraging the benefits of Ayurveda, the oldest me by taking the advantage of the positive effects of Ayurveda, the oldest medical system, a wide range of traditional plants are used as immunomodulators and a large number of plants metabolites as are thought to modify to show the immunomodulatory activity. By keeping in mind, the enormous potential of medicinal plants and the pharmaceuticals made from them. We are introducing this review in an effort to spread awareness of Indian traditional plants as immunomodulators throughout the world.

Keywords: Immunomodulators; Pathogens; Potential; Metabolites

1. Introduction

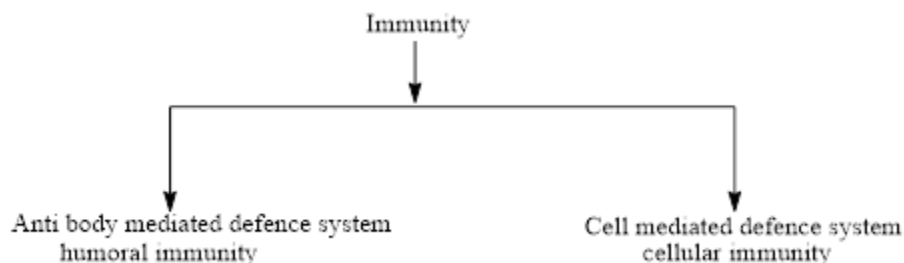
The World Health Organization (WHO) estimates that around three-quarters of the world's population relies on herbal treatments (mostly) for their healthcare. In actuality, plants and herbs are among mankind's oldest allies. It is clear from the history of humanity that medicinal plants have been utilized as part of the treatment plan to treat a wide range of illnesses. ^[1] The use of these medicinal herbs as immune system modulators is currently gaining a lot of attention. Numerous studies in the field have revealed that a variety of substances, including alkaloids, flavonoids, terpenoids, polysaccharides, lactones, and glycoside derivatives, are to blame for changes in the immunomodulatory capabilities. ^[2]

There is a lot of interest in the current research being done to create natural compounds made from plants that are both effective and safer to use as immunomodulators. The development of herbal medicine as a multi-component agent is anticipated to influence the intricate immune system in a way that prevents infection rather than treating and curing disease. The current review concentrates on an overview of several medicinal plants and their immunomodulatory activities while keeping all of these factors in mind.

2. Immunity

Immunity can be explained as the body's capacity to recognize and fight off a sizable number of contagious and potentially dangerous bacteria, allowing it to prevent or fight off infections and prevent organ and tissue damage. The body's inherent defensive mechanism against a wide range of illnesses and disorders is another definition of immunity. A vast range of illnesses and harmful substances can be stopped by the complicated immune system's ability to produce an infinite number of cells and molecules. ^[3]

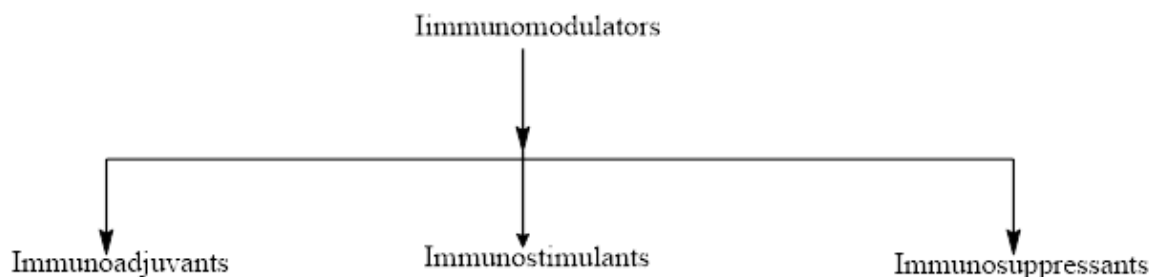
* Corresponding author: Ramesh Kumari Dasgupta



One of the biological research areas that is expanding quickly is immunology, which holds enormous potential for treating a wide range of illnesses and disorders. The first line of defense for an immune system is a short-term mechanism. The second line of defense is a highly developed adaptive immune response that is characterized by complexity, diversity, and Memory. [4]

3. Immunomodulators

Immunomodulators is define as a biological or synthetic molecule that has the ability to stimulate, inhibit, or modify any of the components of the immune system, such as the innate and adaptive immune systems. [3] A healthy immune system Increased the expectancy of life. Immunomodulator intake along with antigen, the process is meant to boost the immunity. Clinically, immunomodulators can be classified into the following three categories:



3.1. Immunoadjuvants

Immunoadjuvants can be thought of as particular immune stimulants because they are used to increase the effectiveness of vaccines. The possibility exists that immunoadjuvants will be the real immune response modulators. [5]

3.2. Immunostimulants

Immunostimulants are intended to improve the body's ability to fight infection, they are by nature non-specific. They have the ability to affect both innate and adaptive immune responses. Immunostimulants are expected to work as immunopotentiators in healthy individuals by boosting the immune system's fundamental immunological response, or prophylactic and promotional medicines. [6]

3.3. Immunosuppressants

A physically and functionally diverse class of medications known as immunosuppressants is frequently used with other medications to treat autoimmune diseases and various types of organ transplant rejection. [7]

4. Plants with immunomodulatory properties

4.1. Ginseng

Ginseng (the root of *Panax ginseng* Meyer, Family *Araliaceae*), one of the most well-known oriental medicinal herbs, has been widely used for various disorders. [8] *Ginseng* (contains various pharmacological components including a series of tetracyclic triterpenoid saponins (ginsenosides), polyacetylenes, polyphenolic compounds, and acidic polysaccharides. [9] *Ginseng* has been extensively reported to maintain homeostasis of the immune system and to enhance resistance to illness or microbial attacks through the regulation of immune system.

4.2. Licorice

Licorice (Glycyrrhiza uralensis, Family *Leguminosae*), a promising immunomodulatory and anticancer herb and a common ingredient in major prescriptions in Chinese medicine. Its pharmacological important due to presence of triterpenes, saponins, flavonoids and phenolic compounds. ^[10,11] The immunomodulatory effect via activation of T lymphocytes by licorice polysaccharides in CT-26 BALB/c tumor model mice was analyzed by flow cytometry.



Figure 1 A Ginseng; B Licorice

4.3. Ginger

One of the most widely used spices in the world, *ginger (Zingiber officinale* Roscoe family *Zingiberaceae*) has been used as a spice and a medicinal herb since ancient times. There are more than 200 identified compounds in ginger, and its bioactive constituents include tannins, anthocyanins, terpenes and phenolic compounds. The main phenolic substances included in *ginger* are gingerols, shogaols, and paradols. The primary phenolic chemicals present in fresh ginger are called gingerols, which primarily consist of 6-gingerol as well as 4-, 5-, 8-, 10-, and 12-gingerols. *Gingerols* possess a wide array of bioactivities, such as antioxidant and anticancer, Anti inflammation, antiemetic, antinociceptive, antimicrobial, anti-hyperglycemic, anti-arteriosclerotic, rubefacient, digestive, and laxative effects. Among these, the immunomodulatory properties of these compounds, which attract attention due to their effects on the immune system.

[12]

4.4. Ashwagandha

Ashwagandha (Withania somnifera family *Solanaceae*) has been extensively studied as an immunomodulatory agent, *Ashwagandha (Withania somnifera)*, which is described in the Rasayana family of medicines in the Indian system of medicine known as Ayurveda. The withanolide glycosides, which make up the majority of the components in *Withania somnifera*, stimulate the growth of mouse splenocytes and mobilise macrophages to perform their immunomodulatory function. ^[13]

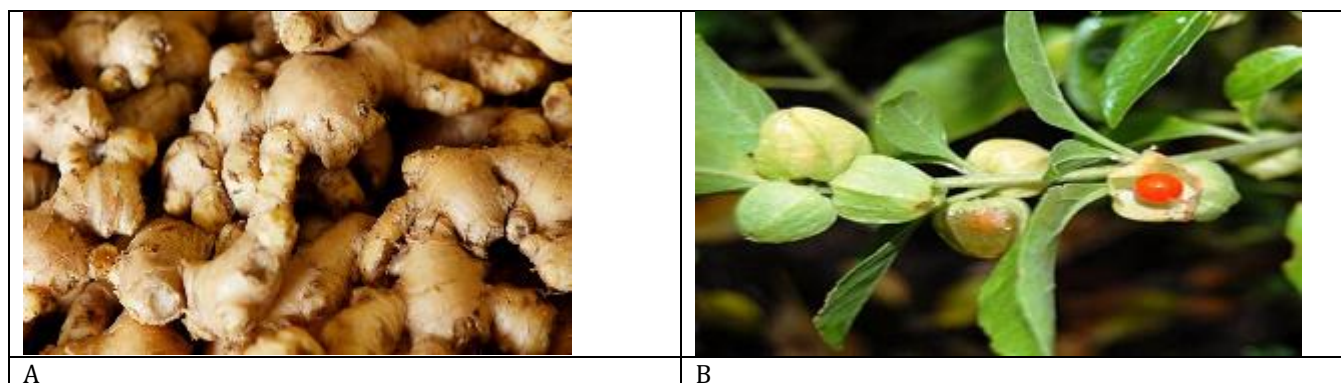


Figure 2 A Ginger : B. Ashwagandha

4.5. Astragalus

Astragalus membranaceus (family *Leguminosae*), is a traditional Chinese medicinal herb, has immunoregulatory properties in many diseases. The main constituents of *Astragalus membranous* include polysaccharides, saponins, flavonoids, amino acids, and trace elements.

It can stimulate macrophage migration and release of immune response mediators. *Astragalus membranaceus* may be a useful medication for boosting the host's ability to fight against infections. [14]

4.6. TULSI

Tulsi (Ocimum sanctum, family Lamiaceae) is considered a holy plant in Ayurveda and is, available everywhere in India. The plant is also known as holy basil. The leaves contain mainly ursolic acid, apigenin and an oil that contains monoterpene 1,8-cineole, and eugenol. The leaves show an immunomodulatory effect by an increase in IFN- γ , IL-4, T-helper cells, NK cells, and enhance phagocytic activity and the phagocytic index. The oil also boosts immunity by mediated GABAergic pathways and by the cell-mediated and humoral immunity. An immunomodulatory activity of an aqueous leaf extract of *Ocimum sanctum* was evaluated by in-vitro and in-vivo methods using delayed type hypersensitivity, humoral antibody titer, total leucocyte count and differential leucocyte count models. [15]

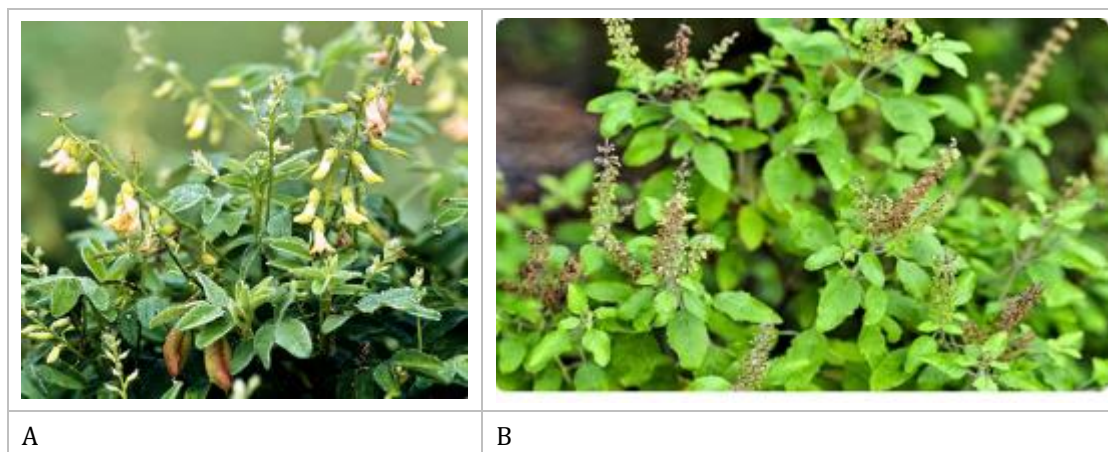


Figure 3 A. *Astragalus* ;B. *Tulsi*

4.7. Mulberry

One of the most frequently used medicinal and herbaceous traditional Chinese medicines is *mulberry leaves (Morus alba)* family *Moraceae*. Numerous bioactive substances, such as polysaccharides, rutin, and anthocyanins, which have anti-diabetic, anti-tumor, anti-inflammatory, anti-oxidative, and immunostimulatory properties, are abundant in these leaves. The *mulberry* leaf polysaccharide (MLP) showed effect on immune responses and serum ND antibody titers in NDV-vaccinated chickens. It was also reported that MLP enhanced the respiratory mucosal barrier immune response in chickens. [16]

4.8. Kalmegh

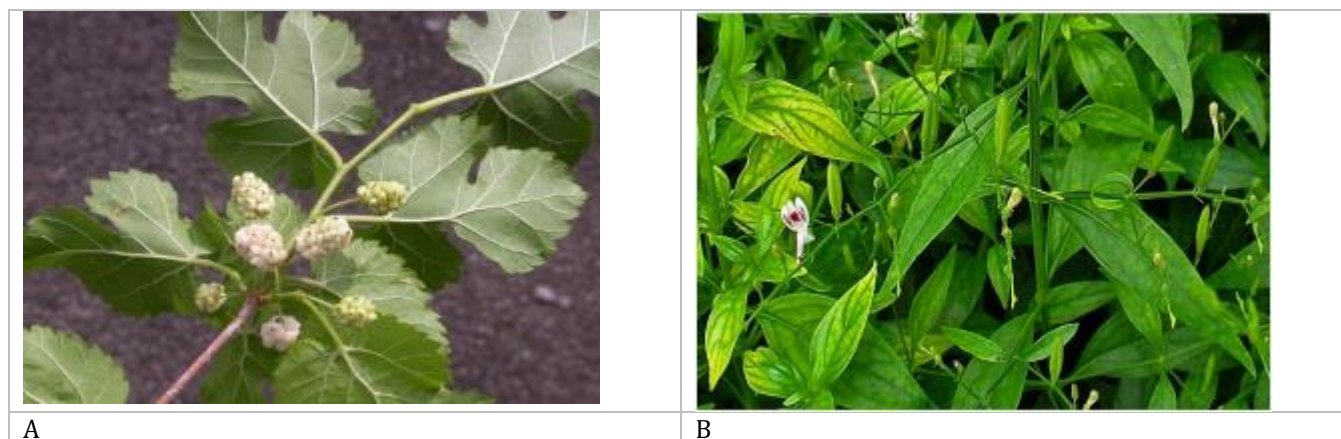


Figure 4 A. *Mulberry*; B. *Kalmegh*

Andrographis paniculata is an herbaceous plant belonging to family *Acanthaceae* found throughout tropical and subtropical Asia. Its major constituents are diterpenoids, flavonoids, and polyphenols have been reported in the published literature for anti-bacterial, anti-malarial, filaricidal, anti-diarrhoeal, anti-ulcerogenic, anti-hyperglycemic,

hepatoprotective, anti-inflammatory, immunostimulatory, and anti-allergic properties. The effects on the seasonal cold and flu virus and other viruses are suggestive that *A. paniculata* may be a modifiable factor in impacting immune function. [17]

4.9. Cinnamon

Cinnamon (Cinnamomum zeylanicum, family Lauraceae) has been used as a spice and as traditional herbal medicine for centuries. The available in vitro and animal in vivo evidence suggests that cinnamon has anti-inflammatory, antimicrobial, antioxidant, antitumor, cardiovascular, cholesterol-lowering, and immunomodulatory effects. These activities are due to presence of volatile oils in the bark, leaf, and root bark of *Cinnamomum zeylanicum*. These oils have monoterpene hydrocarbons in different proportions. Three of the main components of the essential oil obtained from the bark of *C. zeylanicum* are trans-cinnamaldehyde, eugenol, and linalool. The dried stem bark of *Cinnamon* contains four characteristic components—cinnamaldehyde, cinnamic acid, cinnamyl alcohol, and coumarin. [18]

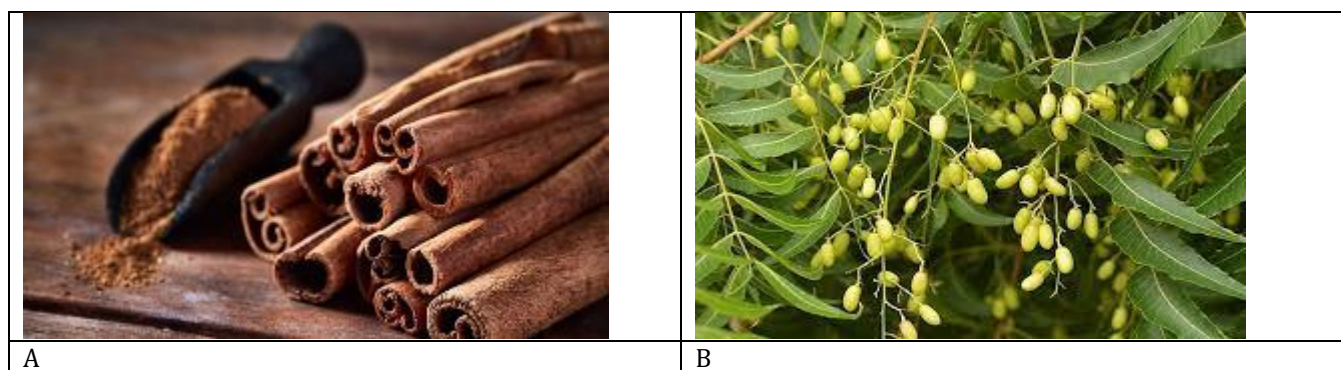


Figure 5 A. Cinnamon: B. Neem

4.10. Neem

Neem (Azadirachta indica, family Meliaceae). *Neem* has been recommended by ayurveda for a wide range of diseases. *Neem* contains many chemically diverse and structurally complex phytochemicals such as limonoids, flavonoids, phenols, catechins, gallic acid, polyphenols, nimbins. These phytochemicals possess vast array of therapeutic activities that include anti-viral, anti-malarial, anti-bacterial, anti-cancer properties. It has antibacterial, anthelmintic, antiviral, anticancer and more importantly Immunomodulatory agent. The aqueous and ethanolic seed extract reported the highest enhancement in all immunological parameters. [19]

5. Conclusion

Immunity is the ability of the body to defend itself against disease-causing organisms and immunomodulator increase this ability. As medicinal plants have large of active chemicals and these also have a number of pharmacological qualities, such as the ability to modulate immune system components. In this review article, we summaries some important plants which can increase the immunity to fight against pathogens.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to disclosed.

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