

Azadirachta indica – The Indian lilac

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ABSTRACT

Neem (*Azadirachta indica*) has become important in the global context today because it offers solution to the major concerns faced by humankind. *A. indica* is a fast-growing widely distributed evergreen tree that is most commonly found commonly in India, Africa, and America. *A. indica* is perhaps the most useful traditional medicinal plant in India. Each part of the neem tree has some medicinal property and is thus commercially exploitable. It is now considered as a valuable source of unique natural products for the development of medicines against various diseases and also for the development of industrial products. It has its own properties which make it unique such as pesticidal, antiallergenic, antidermatic, antifeedant, antifungal, anti-inflammatory, antipyorrhic, antiscabic, cardiac, diuretic, insecticidal, larvicidal, nematocidal, spermicidal, and other biological activities. Hence, it is also referred to as “one solution to thousand problems.”

KEY WORDS: Neem, Properties, Uses

INTRODUCTION

Azadirachta indica (Neem), a herb extensively used in Ayurveda, Unani, and Homoeopathic systems of medicine to treat many health-related problems and ailments, and also known to exert anticancer, antioxidant, wound healing, and antimicrobial properties, is also known to be one of these plants from which almost every part is used. In early times, people used the tender twigs of neem as a dentifrice due to its renowned antibacterial properties. It is claimed that neem provides an answer to many incurable diseases.^[1] Conventionally, neem products have been used against a wide variety of diseases which include heat rash, boils, wounds, jaundice, leprosy, skin disorders, stomach ulcers, and chicken pox. Modern research also confirms neem’s curative powers in case of many diseases and provides indications that neem might in future be used much more widely. Thus, it is regarded as the “one tree pharmacy” that provides its extensive benefits to skin and hair. Neem is indigenous to Indian subcontinent.^[2]

Taxonomic position:

Kingdom: Plantae

Order: Rutales

Family: Meliaceae

Genus: *Azadirachta*

Species: *Indica*^[3]

DISTRIBUTION

It is native to East India and Burma; it grows in much of Southeast Asia and West Africa, and more recently, Caribbean and South and Central America. In India, it occurs naturally in Siwalik Hills, dry forests of Andhra Pradesh, Tamil Nadu, and Karnataka to an altitude of approximately 700 m. It is cultivated and frequently naturalized throughout the drier regions of tropical and subtropical India, Pakistan, Sri Lanka, Thailand, and Indonesia. It is also grown and often naturalized in Peninsular Malaysia, Singapore, Philippines, Australia, Saudi Arabia, Tropical Africa, the Caribbean, and Central and South America.^[4]

DESCRIPTION

This tree is 40–50 feet with a straight trunk and long spreading branches forming a broad crown; it has rough dark brown bark with wide longitudinal fissures separated by flat ridges. The leaves are compound,

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imparipinnate, each comprising 5–15 leaflets. The compound leaves are themselves alternating with one another. It bears many-flowered panicles, mostly in the leaf axils. The sepal are ovate and about 1 cm long with sweet-scented white oblanceolate petals. It produces yellow drupes that are ellipsoid and glabrous, 12–20 mm long. Fruits are green, turning yellow on ripening, aromatic with garlic-like odor. Fresh leaves and flowers come in March–April. Fruits mature between April and August depending on the locality.^[5]

Products and their Uses

From the process of crushing neem seed for oil, kernel dust and neem cake are obtained and are used to prepare various pesticides and medicines for day-to-day use. The cake is ground into a powder and it is used as an insecticide. The powder can also be placed in water for 12 h, which produces an aromatic solution that is sprayed in the houses to repel various biting and bloodsucking insects. A variety of commercial products including pesticides, human and animal medicines, and health-care materials are produced from the neem seed.^[6]

Medicinal Uses

Mostly all parts of the tree have been used medicinally for centuries. It has been used in Ayurvedic medicine for >4000 years due to its exciting medicinal properties. The ancient Sanskrit medical writings refer to the benefits of neem's fruits, seeds, oil, leaves, roots, and bark. Each has been used in the Indian Ayurvedic and Unani medicine, and is now being used in pharmaceutical and cosmetics industries.^[7] The bark of the tree is used to treat diarrhea, ticks, and lice. The neem cake obtained is antiwormicidal and the neem oil is used to treat wounds, worms, constipation, indigestion, lung, and throat disorders. They are also effective against bleeding, foot rot, fever, udder infection, etc. The gum and oils obtained from neem tree have effects for glossitis, jaundice, intestinal wounds, blood dysentery, and swelling of liver.^[8]

Anti-ulcerative

Ulcers are due to imbalance between factors such as acid and pepsin and defensive factors such as mucin secretion, cell proliferation, and prostaglandins. The role of hydrochloric acid in the pathogenesis of gastric ulcer is well known. It also causes release of histamine furthering acid output and thus further damaging the mucosa. The presence of acid causes a decrease of gastric pH and leads to the activation of pepsinogen to pepsin, which increases the size of the lesion by its proteolytic action. The reduction of acid secretion is necessary for gastric and duodenal ulcers.^[9]

Antimalarial

The antimalarial activities of suspension of the barks and leaves of *A. indica* were used. The tablet

suspensions exhibited high prophylactic, moderate suppressive, and a very minimal curative schizonticidal effect. The neem oil formulation was found effective in controlling mosquito larvae in different breeding sites under natural field conditions. Neem oil formulations are relative less toxic, eco-friendly, and insects are unable to develop resistance and may be used as an alternative to other pesticides for control of vector-borne diseases.^[10]

Antiinsecticidal

The complexity of the molecular structure of azadirachtin precluded its synthesis for pesticide use. Extracts of neem seeds containing azadirachtin together with several structurally related molecules have formed the basis of neem usage in insect control. Insects from different orders differ in their responses to azadirachtin. Neem insecticides are effective mainly as insect growth regulators and sterilants, against a broad spectrum of pest insects. Crude neem extracts have been used at a local, small-farm level for sometimes in countries where neem grows indigenously or where plantations have been established.^[11]

Anti-inflammatory Properties

Nimbidin is a major active principle of the seed oil of *A. indica* possessing significant anti-inflammatory activity. A study revealed that it inhibited some functions of the macrophages and neutrophils which are relevant to inflammatory response in both *in vivo* and *in vitro* testing. Oral administration of 5–25 mg/kg nimbidin to rats for 3 consecutive days inhibited the migration of macrophages to their peritoneal cavities in response to inflammatory stimuli and also inhibited phagocytosis and stimulated respiratory burst in those cells.^[12]

Anticarcinogenic Effect

The active ingredients obtained from the plant have been demonstrated unequivocally to induce apoptosis in several types of tumor cells and to organize and gear up the immune system to take on the cancer cells through cross-priming. Regular use of neem and its preparations have been found to prevent the onset of cancer through multiple mechanisms including production of substantial levels of antioxidants and carcinogen-detoxifying enzymes. That neem extracts possess potent ability to remove cancerous phenotype, have long been known to people in Asia, particularly in India.^[13]

Antibacterial Property

The petroleum ether, methanol, and aqueous extracts of the leaves of *A. indica* (Meliaceae) were screened for their antimicrobial activity using the cup plate agar diffusion method. They were tested against six bacteria; two Gram-positive bacteria (*Bacillus*

subtilis and *Staphylococcus aureus*) and four Gram-negative bacteria (*Escherichia coli*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, and *Salmonella typhi*). The susceptibility of the microorganisms to the extracts of these plants was compared with each other and with selected antibiotics. The methanol extract of *A. indica* exhibited pronounced activity against *B. subtilis*.^[14]

Uses of Neem in Dentistry

The primary acid tolerant bacteria associated with dental plaque include *Streptococcus mutans*, *Streptococcus oralis*, *Streptococcus sobrinus*, *Lactobacillus acidophilus*, *Streptococcus salivarius*, *Streptococcus mitis*, *Streptococcus sanguis*, *Streptococcus intermedius*, and *Streptococcus anginosus*. Such bacteria can lead to tooth enamel breakdown and potential discoloration of the tooth surface, and these esthetic changes can persist for many years and may result in dental caries. The changes in the homeostasis of the oral cavity with an overgrowth of *S. mutans* are recognized as the primary cause of the disease. Neem provides resistance against such bacteria such as *S. mutans*, *S. mitis*, *S. sanguis*, and *L. acidophilus*.^[15,16]

CONCLUSION

Since neem is a natural renewal resource producing extensive useful biomass, its propagation and economic exploitation will be beneficial, particularly to the third world. During the past five decades, apart from the chemistry of the neem compounds, considerable progress has been achieved regarding the biological activity and medicinal applications of neem. It is now considered as a valuable source of unique natural products for the development of medicines against various diseases and also for the development of industrial products. In recent years, some useful commercial products have been developed from *A. indica*, and there is considerable scope for future product development.

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