Neem (*Azadirachta indica A. Juss*.), a Tree of the 21st Century

By

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The Neem tree (*Azadirachta indica A. Juss*.) has been known as the wonder tree for centuries in the Indian subcontinent. It has become important in the global context today because it offers answers to the major concerns facing mankind.

The history of the Neem tree is inextricably linked to the history of the Indian way of life. Although the antiquity of Neem is shrouded in the mists of time, this evergreen robust looking tree has long been cherished as a symbol of health in the country of its origin. It has, for a very long time, been a friend and protector of the Indian villager. Brihat Samhita, an ancient Hindu treatise, contains a chapter of verses on plant medicines. It contains recommendations for specific trees to be planted in the vicinity of one's house. Neem was highly recommended.

The Tree

Neem is a medium sized to large tree characterised by its short straight trunk, furrowed dark brown to grey bark, and dense rounded crowns of pinnate leaves. Native to India, Neem is widely planted and naturalised in semiarid areas throughout Asia and Africa. Neem is an evergreen of the tropics and sub-tropics. It belongs to the family Meliaccae and is a cousin of the Chinaberry. With an extensive and deep root system, the hardy Neem can grow luxuriantly even in marginal and leached soils, and thrives up to an elevation of 1500m. The Neem flowers profusely between February and May. The honey-scented white flowers, found in clusters, are a good source of nectar for bees. Neem fruits are green drupes which turn golden yellow on ripening in the months of June, July and August, in India. The kernels have about 45% oil. The termite resistant Neem timber is used as a building material, and in making furniture and farm implements. The bark yields tannin and gum. The amber hued gum is used as a dye in textiles and in traditional medicines.

Medical Properties

The medical properties of Neem have been known to Indians since time immemorial. The earliest 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 systems of medicines, and is now being used in the manufacture of modern day medicinals, cosmetics, toiletries and pharmaceuticals.

Neem fruits, seeds, oil, leaves, bark and roots have such uses as general antiseptics, antimicrobials, treatment of urinary disorders, diarrhoea, fever and bronchitis, skin diseases, septic sores, infected burns, hypertension and inflammatory diseases. This is mainly due to the chemical constituents which enable Neem to protect itself from a multitude of pests by a substantial number of pesticidal ingredients. Its main chemical composition is a blend of 3 to 4 related compounds along with over 20 lesser ones, which are equally as active. The general class of these compounds is triterpenes and within this category, the most effective are the limonoids, which are abundant in Neem oil. At least nine limonoids are effective in inhibiting insect growth, especially some of the most deadly varieties found in human health and

agriculture worldwide. Of these limonoids, azadirachitin has been found to be the main ingredient for fighting insects and pests, being up to 90% effective in most instances. It repels and disrupts the life cycle, however does not kill immediately, but is nonetheless one of the most effective growth and feeding deterrents ever examined. Meliantriol is another feeding inhibitor which prevents locusts chewing, and has therefore been in traditional use in India for crop protection. Nimbin and nimbidin, also found in Neem, have anti-viral properties and these have been effective in inhibiting fungal growth on humans and animals. Gedunin, a lesser limonoid, is effective in treating malaria through teas and infusion of the leaves.

Fungicides

Neem has proved effective against certain fungi that infect the human body. Such fungi are an increasing problem and have been difficult to control by synthetic fungicides. For example, in one laboratory study, conducted by Khan and Wassilew – 1987, Neem preparations showed toxicity to cultures of 14 common fungi, including members of the following genera:

- Trichophyton – an 'athlete's foot' fungus that infects hair, skin and nails;
- Epidermophyton – a 'ringworm' that invades both skin and nails of the feet;
- Microsporum – a 'ringworm' that invades hair, skin and (rarely) nails;
- Trichosporon – a fungus of the intestinal tract;
- Geotrichum – a yeast like fungus that causes infections of the bronchi, lungs and mucous membranes;
- Candida – a yeast-like fungus that is part of the normal flora but can get out of control, leading to lesions in mouth (thrush), vagina, skin, hands and lungs.

Components of the Neem tree and their uses

Bark

The bark is cool, bitter, astringent, acrid and refrigerant. It is useful in tiredness, cough, fever, and loss of appetite, worm infestations. It heals wounds and is also used in vomiting, skin diseases and excessive thirst. Twigs have been used as a 'toothbrush' and for dental care, since antiquity. Neem toothpaste has been on sale in the US and Germany for some time, and is now available here.

Leaves

According to Ayurveda, Neem leaves help in the treatment of Vatik disorders (neuromuscular pains). Neem leaves are also reported to remove toxins, purify blood and prevent damage caused by free radicals in the body by neutralising them. A paste made with leaves is used in India for the cure of chicken pox, smallpox and warts. A poultice is effective for boils, ulcers and eczema.

Fruits

Neem fruits are bitter, purgative, antihemorrhodial and anthelmintic (vermifuge) in nature.

Flowers

The flowers are used in vitiated conditions of pitta (balancing of the body heat) and kapha (cough formation). They are astringent, anthelmintic and non-toxic.

Seeds

Neem seeds are also described as anthelmintic, antileprotic (cures or prevents leprosy) and antipoisonous. Seeds along with leaves and dry Neem cake are an active ingredient in mosquito coils.

Oil

Neem oil, derived from crushing the seeds, is antidermatonic, a powerful vermifuge and is bitter in taste. It has a wide spectrum of action and is highly medicinal in nature. As an oil used in aromatherapy, it has been effective in the treatment of head lice in children, especially where tea tree has failed to clear up the condition. This was particularly noticeable on an outbreak of head lice, two years ago, at a school local to my practice, where I treated several children. Those with blonde to reddish hair had their head lice condition cleared up much quicker with Neem oil applied at a 3% dilution to a shampoo base, than with tea tree.

Specific uses of Neem

Skin Conditions

Neem has an almost magical effect on chronic skin conditions that fail to respond to conventional treatments. Acne, psoriasis, eczema, and ringworm are conditions that are effectively treated by a Neem preparation.

Hair and Nails

Scalp conditions like dandruff, scaling and even hair loss improve with Neem products. Yellow or brittle nails, caused by the presence of yeast or fungi, are normalised by the use of Neem.

Teeth and Gums

Neem mouth rinse is very effective in the treatment of infections, tooth decay, bleeding and sore gums. A mouthwash, using Neem oil, has been used for the treatment of mouth ulcers.

Fungi, Parasites and Viruses

Stringent laboratory condition tests have proved the efficacy of Neem in destroying fungi, parasites and viruses without killing off beneficial intestinal flora. It is very effective in the treatment of Athletes' Foot, thrush, candida infestations and herpes.

Diabetes

Neem has been found to reduce insulin requirements by up to 50% for diabetics, without altering blood glucose levels.

Heart and Blood

A recent study showed that a Neem treatment lowered high cholesterol levels. It has also been tested, with good results, for other heart conditions.

Insects

Neem is a very effective insect repellent, without being toxic to pets and humans.

AIDS and Cancer

Tests are currently being carried out, with encouraging results. During the course of the freedom movement in India, led by Mahatma Gandhi, there was an upsurge of the 'Swadeshi' or nationalistic sentiment. This led to a move to encourage 'Swadeshi' science. Neem research in India was part of this movement. Pioneering work on the possible commercial use of Neem oil and cake was done by the Indian Institute of Science in Bangalore during the 1920s.

Mahatma Gandhi kept the tradition of Neem alive, and is known to have been a firm believer in the goodness of Neem. Dr Ekaid informed Gandhi that laboratory experiments revealed that Neem leaves contain more nutritious elements than any other similar vegetation that has been subjected to chemical analysis earlier. A Neem leaf chutney was a part of Gandhi's everyday diet. A nutraceutical tea, now being manufactured, would surely have been Gandhi's favourite beverage.

Physico-composition of Fresh Neem Leaves: Neem Tea and its Uses

Tender leaves, along with black pepper, are effective in intestinal helminthiasis (parasitic infections). An aqueous extract of tender leaves has been found to possess antiviral properties against vaccinia (viral disease in cattle), variola (smallpox), fowl pox and New Castle diseases. Fresh mature leaves, along with the seeds of *Psoralea corglifolia* and *Cicer arietinum* are effective in leucoderma. Studies on plasma clotting time using Russell's viper venom have proved that the leaf extract contains a clotting inhibitor, justifying its use in the treatment of poisonous bites. Animal-based experiments have shown that total extract of Neem leaves is a potent hepatoprotective agent. Water extract of Neem leaves shows significant antiulcer activity and reduction in severity of gastric damage, and prevents most cell degranulation and mucus depletion. The phosphate buffer, ether and alcoholic extracts of the leaves inhibit the activity of the micro-organism *Micrococcus pyrogenes var. aureus*. The essential oil possesses anti-bacterial activity. It inhibits the growth of *Mycobacterium tuberculosis, Salmonella paratyphi, Salmonelbtyphi, Vibrio cholera Pacini* and *Klebsiella pneumonia* (Schroter) *Trevisan* (organisms which cause typhoid, cholera and pneumonia. Chewing fresh Neem leaves acts as a sedative and relaxant.

The Future with Neem

Poverty

Today's exploding growth in human population is seriously depleting the world's natural reserves and economic resources. Unless the run-away human population growth rate is slowed down, there would be little hope for raising everyone out of poverty in the developing world. Besides educational constraints, the non-availability of inexpensive methods of contraception, which do not cause trauma or aesthetic, cultural, and religious sensitivities of people, limit the success of birth regulation programmes. However,

recent findings indicate that some Neem derivatives may serve as affordable and widely available contraceptives. A recent controlled study in the Indian army proved the efficacy of Neem as a contraceptive.

According to a recent report by the Washington based International Food Policy Research Institute, by 2020, the world will be an even more unfair place than it is at present, with food surpluses in the industrialised world and with chronic instability and food shortages in the south, particularly in African countries.

The US Academy of Sciences currently attaches very high importance to the Neem tree. The United Nations declared Neem as the "Tree of the 21st Century".

Bioactivity

Search for environmentally safe pesticides received an impetus in early 1960s following the publication of Silent Spring by Rachel Carson in 1962. It was around this period that Indian scientists reported the feeding deterrent property of Neem seed kernel suspension against desert locust. Subsequently, several bioactive ingredients were isolated from various parts of the tree, more notable being the isolation of meliantriol and azadirachtin. These findings aroused worldwide interest in the bioactivity of the Neem tree.

The Neem seems to be a virtual designer tree – tailor-made for combating the serious problems confronting mankind today. The information being generated on it in the modern format of science continues to confirm all the ancient claims. Its mammalian safety and environmental friendliness reports are highly encouraging. Its bioactivity spectrum against the harmful organisms is ever increasing.

Neem is now widely used in America in fields ranging from pharmaceutical, health and beauty, pet care, pesticides and insecticides, and agriculture, while health and beauty and pharmaceutical products are available in Austria and Germany.

Neem products are also available in the UK and a nutraceutical tea is the newest product to come on the market. A key advantage to using Neem, as opposed to some medical treatments and other herbs, is its compliance with the first tenet of the Hippocratic Oath taken by all physicians: "First, cause no harm." Over thousands of years, Neem has been used by hundreds of millions of people and no hazards have been documented for normal dosages. Only at very high levels may Neem be toxic, something each of us understands can be true of anything taken internally.

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