Azadirachta indica

A. Juss.

Meliaceae

neem

LOCAL NAMES
Amharic (kinin); Arabic (nim,neem); Bengali (nimgach,nim); Burmese (bowtamaka,thinboro,tamarkha,tamar,tamaka,tamabin); Cantonese (nimba,kohomba,bevu); Chamorro (sdau); Creole (nim); English (Persian lilac,neem tree,bastard tree,Indian lilac,bead tree,margosa tree,cornucopia,Indian cedar); French (margousier,margosier,neem,nim,azadirac de l'Inde); Hindi (neem,balnimb,nim,veppam,nind,vempu); Indonesian (mind,intaran,membha,imba,mempheuh,mimba); Javanese (mimba,imba); Khmer (sdau); Lao (Sino-Tibetan) (ka dao,kadau); Malay (sadu,baypay,mambu,veppam); Nepali (neem); Sanskrit (nimba); Sinhala (kohomba); Swahili (mwarubaini,mwarubaini kamili,mkilifi); Tamil (vepa,veppu,veppam,vembu); Thai (sadao,kadao,sadao India,khwinin,saliam,cha-tang); Tigrigna (nim); Trade name (neem); Vietnamese (saafu daau,sàu-dàu,s[aaf]u d[aa]u)

Immature fruits (Schmutterer H.)

Trees in Mindinao, Philippines (Anthony Simons)

18-month-old trees grown near Leon, Nicaragua (Anthony Simons)

BOTANIC DESCRIPTION
Azadirachta indica is a small to medium-sized tree, usually evergreen, up to 15 (30 max.) m tall, with a round, large crown up to 10 (20 max.) m in diameter; branches spreading; bole branchless for up to 7.5 m, up to 90 cm in diameter, sometimes fluted at base; bark moderately thick, with small, scattered tubercles, deeply fissured and flaking in old trees, dark grey outside and reddish inside, with colourless, sticky foetid sap.

Leaves alternate, crowded near the end of branches, simply pinnate, 20-40 cm long, exstipulate, light green, with 2 pairs of glands at the base, otherwise glabrous; petiole 2-7 cm long, subglabrous; rachis channelled above; leaflets 8-19, very short petioluled, alternate proximally and more or less opposite distally, ovate to lanceolate, sometimes falcate (min. 2) 3.5-10 x 1.2-4 cm, glossy, serrate; apex acuminate; base unequal.

Inflorescence an axillary, many-flowered thyrsus, up to 30 cm long; bracts minute and caducous; flowers bisexual or male on same tree, actinomorphic, small, pentamerous, white or pale yellow, slightly sweet scented; calyx lobes imbricate, broadly ovate and thin, puberulous inside; petals free, imbricate, spathulate, spreading, ciliolate inside.

Fruit 1 (max. 2)-seeded drupe, ellipsoidal, 1-2 cm long, greenish, greenish-yellow to yellow or purple when ripe; exocarp thin, mesocarp pulpy, endocarp cartilaginous; seed ovoid or spherical; apex pointed; testa thin, composed of a shell and a kernel (sometimes 2 or 3 kernels), each about half of the seed's weight.

BIOLOGY
A. indica trees may start flowering and fruiting at the age of 4-5 years, but economic quantities of seed are produced only after 10-12 years. Pollination is by insects such as honeybees. Certain isolated trees do not set fruit, suggesting the occurrence of self-incompatibility. The flowering and fruiting seasons largely depend on location and habitat. In Thailand for instance, neem flowers and fruits throughout the year whereas in East Africa (with pronounced dry and wet season) flowering and fruiting are restricted to distinct periods. Fruits ripen in about 12 weeks from anthesis and are eaten by bats and birds, which distribute the seed. They can live for over 200 years.

ECOLOGY

A. indica is said to grow 'almost anywhere' in the lowland tropics. Under natural conditions, it does not grow gregariously. In India, it is present in mixed forest with Acacia spp. and Dalbergia sissoo; in Indonesia, it is naturalized in lowland monsoon forest. In Africa, it is found in evergreen forest and in dry deciduous forest. Adult A. indica tolerates some frost, but seedlings are more sensitive. It quickly dies in waterlogged soils. A. indica requires large amounts of light, but it tolerates fairly heavy shade during the 1st few years.

BIOPHYSICAL LIMITS

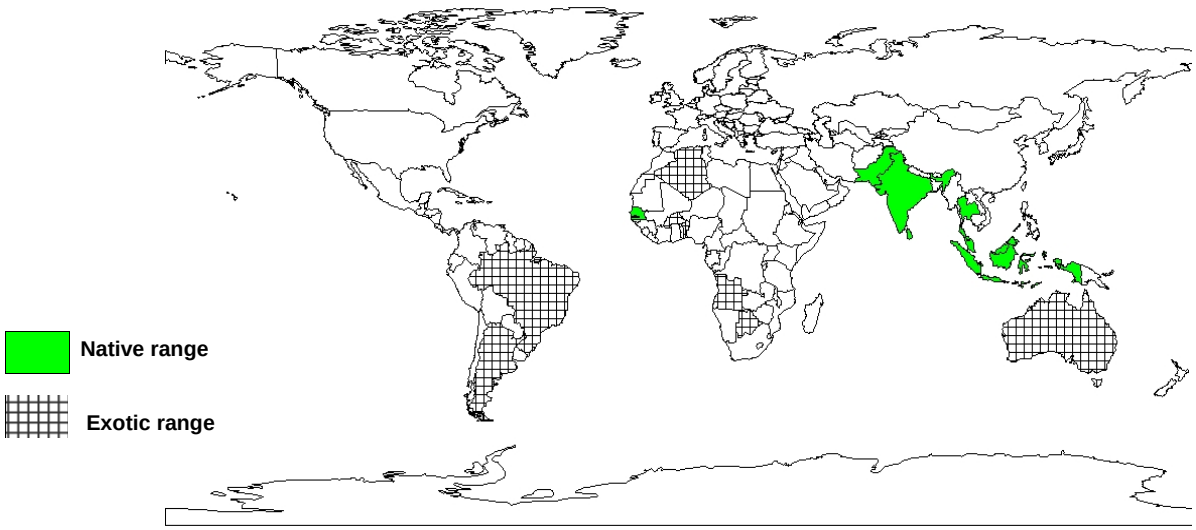
Altitude: 0-1500 m, Mean annual temperature: Up to 40 deg. C, Mean annual rainfall: 400-1200 mm

Soil type: It grows on a wide variety of neutral to alkaline soils but performs better than most species on shallow, stony, sandy soils, or in places where there is a hard calcareous or clay pan not far below the surface. It grows best on soils with a pH of 6.2-7.

DOCUMENTED SPECIES DISTRIBUTION

Native: India, Indonesia, Malaysia, Myanmar, Pakistan, Senegal, Sri Lanka, Thailand

Exotic: Algeria, Angola, Antigua and Barbuda, Argentina, Australia, Barbados, Benin, Botswana, Brazil, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Chile, China, Colombia, Congo, Cote d'Ivoire, Cuba, Democratic Republic of Congo, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Fiji, French Guiana, Gabon, Gambia, Ghana, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Jamaica, Kenya, Lesotho, Liberia, Libyan Arab Jamahiriya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mexico, Morocco, Mozambique, Namibia, Nepal, Nicaragua, Nigeria, Panama, Paraguay, Peru, Philippines, Puerto Rico, Rwanda, Sao Tome et Principe, Saudi Arabia, Seychelles, Sierra Leone, Singapore, Somalia, South Africa, St Lucia, St Vincent and the Grenadines, Sudan, Surinam, Swaziland, Tanzania, Togo, Trinidad and Tobago, Tunisia, Uganda, Uruguay, US, Venezuela, Virgin Islands (US), Zambia, Zimbabwe



The map above shows countries where the species has been planted. It does neither suggest that the species can be planted in every ecological zone within that country, nor that the species can not be planted in other countries than those depicted. Since some tree species are invasive, you need to follow biosafety procedures that apply to your planting site.

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PRODUCTS

Food: Fruits are eaten fresh or cooked, or prepared as a dessert or lemonade-type drink. The young twigs and flowers are occasionally consumed as vegetables.

Fodder: The leaves, though very bitter, are used as a dry season fodder. A. indica fruit is an important source of food for some wildlife, especially birds and bats, although they digest only the pulp, not the seed.

Fuel: Charcoal made from A. indica wood is of excellent quality and the wood has long been used as firewood. Its oil is burned in lamps throughout India.

Timber: A. indica is a species of the mahogany family, and although it has some of the characteristics of a cabinetry wood, its grain is rough and does not polish well. The wood is, nevertheless, used to make wardrobes, bookcases and closets, as well as packing cases because its insect repellent quality helps to protect the contents from insect damage. The main stem of the tree is also widely used to make posts for construction or fencing because the wood is termite resistant. The density of the wood is 720-930 kg/cubic m at 12% mc.

Gum or resin: An exudate can be tapped from the trunk by wounding the bark. This high-protein material has potential as a food additive and is widely used in Southeast Asia as ‘neem glue’.

Tannin or dyestuff: Tree bark contains 12-14% tannins. This compares favourably with conventional tannin chemicals.

Lipids: A. indica oil has long been produced in Asia on an industrial scale for soaps, cosmetics, pharmaceuticals and other non-edible products. The seed oil yield is sometimes as high as 50% of the weight of the kernel. Neem oil is valued at about USD 700/t (1990).

Poison: Azadirachtin has been identified as A. indica’s principal active compound. Extracts can be made from leaves and other tissues, but the seeds contain the highest concentrations of the compound. In India, some Neem-based pesticides include Azadi, Fortune Azadi, Godrej Achook, Margocide, Neemarin, Repelin and Nimbecidine. It acts as an insect repellant, inhibiting feeding, and disrupting insect growth, metamorphosis and reproduction. Formulations based on A. indica do not usually kill insects directly but alter their behaviour in significant ways to reduce pest damage to crops, and reduce their reproductive potential. Azadirachtin affects insect physiology by mimicking a natural hormone. It has been shown to affect egg production and hatching rates. Azadirachtin can inhibit moulting, preventing larvae from developing into pupae. Many foliage-feeding species avoid plants treated with neem compounds or cease eating after ingesting the neem. Its has proven effective as an antifeedant on about 100 insect species. Thus the extracts work especially well to protect plants from defoliation without affecting beneficial pollinating insects like honeybees.

Overall tests of neem extracts have shown results on about 300 insect species, mostly in orders Coleoptera (beetles and weevils); Dictyoptera (cockroaches and mantids); Diptera (flies); Heteroptera (true bugs); Homoptera (aphids, leaf hoppers wasps and ants); Isoptera (termites); Lepidoptera (moths and butterflies); Orthoptera (grasshoppers, katydids); Siphonaptera (fleas); and Thysanoptera (thrips). Crudely produced neem extracts can also provide excellent control on caterpillars and beetle larvae.

A traditional agricultural practice involves the production of ‘neem tea’. The seeds are dried, crushed and soaked in water overnight to produce a liquid pesticide that can be applied directly to crops. Crushed seed kernels are also used as a dry pesticide application, especially to control stem borers on young plants. These homemade remedies are often very effective in repelling pests or acting on insects as a feeding deterrent. The strength of homemade preparations can vary due to the concentration of azadirachtin and other compounds in the seed, which can in turn depends on the genetic source of the seeds. It can also be affected by the process of handling and drying the seeds, contaminants in the water, and exposure to high temperatures or sunlight. The active compounds break down quickly, so an application of neem tea generally provides protection for only about 1 week.

Neem extracts may have toxic effects on fish and other aquatic wildlife and on some beneficial insects. Therefore, care should be taken that any unused extracts are disposed of by exposing them to heat or sunlight to break down the active compounds.

Medicine: Neem has proved effective against certain fungi that infect humans. In a laboratory study, neem preparations showed toxicity to cultures of 14 common fungi. The tree has suppressed several species of pathogenic bacteria, including Salmonella typhosa and Staphylococus aureus. Various parts of A. indica have anthelmintic, antiperiodic, antiseptic, diuretic and purgative actions, and are also used to treat boils, pimples, eye diseases, hepatitis, leprosy, rheumatism, scrofula, ringworm and ulcers. Leaf teas are used to treat malaria. People use the twigs as toothbrushes, and dentists find twigs effective in preventing periodontal disease. Neem oil is a powerful spermicide and can therefore be used as an inexpensive birth control method. A neem oil-based product, Sensal, is being marketed in India as an intravaginal contraceptive. Neem oil has been used traditionally as a topical treatment for skin symptoms in both humans and livestock, but it should not be ingested orally.

SERVICES

Erosion control: Being drought resistant with a well-developed root system capable of extracting nutrient from the lower soil levels, it is a suitable tree for dune-fixation

Shade or shelter: The large crown of A. indica makes it an effective shade tree, planted widely as an avenue tree in towns and villages and along roads in many tropical countries. Because of its low branching, it is a valuable asset for use as a windbreak.

Soil improver: Farmers in India use neem cake (the residue left after extracting oil from the seeds) as an organic manure and soil amendment. It is believed to enhance the efficiency of nitrogen fertilizers by reducing the rate of nitrification and inhibiting soil pests including nematodes, fungi, and insects. A. indica leaves and small twigs are used as mulch and green manure.

Intercropping: Intercropping A. indica with pearl millet, Pennisetum glaucum, has given good results in India.

TREE MANAGEMENT
Weeding of A. indica plantations in dry areas is essential, as the tree cannot withstand competition, especially from grasses. It responds well to chemical and organic fertilizers. Trees coppice freely, and early growth from coppice is faster than growth from seedlings. A. indica withstands pollarding well, but seed production is adversely affected when trees are lopped for fodder.

GERMPLASM MANAGEMENT
Seed storage behaviour is probably intermediate. Viability is reduced from 85% to 60% after 1 month hermetic air-dry storage at room temperature and to 45% at 6 deg. C. There are about 4000-4500 seeds/kg.

PESTS AND DISEASES
A. indica has few serious pests, but several scale insects have been reported to infest it, for example Aonidiella orientalis (feeding on sap of young branches and young stems), which is the most important pest, and Pulvinaria maxima (feeding on sap and covering tender shoots and stems); the nymphs of Helopeltis antonii also feed on the sap; in India, a shoot borer damages the plant. Occasional infestations by Micotermes and Lorantus species of insects have been recorded in Nigeria, but the attacked tree almost invariably recovers. Rats and porcupines attack and occasionally kill A. indica seedlings and trees by gnawing the bark around the base.

Mistletoes that affect A. indica are Dendrophtoe falcata and Tapinanthus spp. There are no records of fungi attacking A. indica in Southeast Asia. In India and elsewhere, Psuedocercospora subsesessilis is the most common fungus attacking the leaves, causing the shothole effect. In India, the bacterium Pseudomonas azadirachtae may damage leaves.

Neem decline has been observed in Niger where the main symptom is an abnormal loss of leaves followed by dieback of branches in severe cases.

FURTHER READNG

Abbas B, El-Tayeb AE, Sulleiman YR. 1992. Calotropis procera: feed potential for arid zones. Veterinary-Record. 131(6):132.

Albrecht J. ed. 1993. Tree seed hand book of Kenya. GTZ Forestry Seed Center Muguga, Nairobi, Kenya.

Anon. 1986. The useful plants of India. Publications & Information Directorate, CSIR, New Delhi, India.

Bein E. 1996. Useful trees and shrubs in Eritrea. Regional Soil Conservation Unit (RSCU), Nairobi, Kenya.

Bekele-Tesemma A, Birnie A, Tengnas B. 1993. Useful trees and shrubs for Ethiopia. Regional Soil Conservation Unit (RSCU), Swedish International Development Authority (SIDA).

Birnie A. 1997. What tree is that? A beginner's guide to 40 trees in Kenya. Jacaranda designs Ltd.

Boa ER. 1995. A guide to the identification of diseases and pests of neem (Azadirachta indica). FAO, Bangkok.

Childs FJ et.al. 2001. Improvement of Neem and its potential benefits to poor farmers. HYDRA Publishing.

Fahmudin Agus, Subekti Rahayu. 2004. Mimba Azadirachta indica dan manfaatnya.

Faridah Hanum I, van der Maesen LJG (eds.). 1997. Plant Resources of South-East Asia No 11. Auxillary Plants. Backhuys Publishers, Leiden, the Netherlands.

Hocking D. 1993. Trees for Drylands. Oxford & IBH Publishing Co. New Delhi.

Hong TD, Linington S, Ellis RH. 1996. Seed storage behaviour: a compendium. Handbooks for Genebanks: No. 4. IPGRI.

ICRAF. 1992. A selection of useful trees and shrubs for Kenya: Notes on their identification, propagation and management for use by farming and pastoral communities. ICRAF.

Katende AB et al. 1995. Useful trees and shrubs for Uganda. Identification, Propagation and Management for Agricultural and Pastoral Communities. Regional Soil Conservation Unit (RSCU), Swedish International Development Authority (SIDA).

Kayastha BP. 1985. Silvics of the trees of Nepal. Community Forest Development Project, Kathmandu.

Lemmens RHMJ, Soerianegara I, Wong WC (eds.). 1995. Plant Resources of South-east Asia. No 5(2). Timber trees: minor commercial timbers. Backhuys Publishers, Leiden.

Mbuya LP et al. 1994. Useful trees and shrubs for Tanzania: Identification, Propagation and Management for Agricultural and Pastoral Communities. Regional Soil Conservation Unit (RSCU), Swedish International Development Authority (SIDA).

National Academy of Sciences. 1980. Firewood crops. National Academy Press. Washington D.C.

National Academy of Sciences. 1981. Fuelwood crops, shrub and tree species for energy production. National Academy Press. Washington D.C.

National Research Council. 1992. Neem. A tree for solving global problems. National Academy Press, Washington D. C.

Noad T, Birnie A. 1989. Trees of Kenya. General Printers, Nairobi.

Parkash R, Hocking D. 1986. Some favourite trees for fuel and fodder. Society for promotion of wastelands development, New Delhi, India.

Perry LM. 1980. Medicinal plants of East and South East Asia : attributed properties and uses. MIT Press. South East Asia.

Roshetko JM and Evans DO. 1997. Domestication of Agroforestry trees in Southeast Asia. Yogyakarta, Indonesia.

Singh RV. 1982. Fodder trees of India. Oxford & IBH Co. New Delhi, India.

Stoney C. 1998. Use of neem as a biological pest control agent. A publication of the Forest, Farm, and Community Tree Network (FACT Net). Winrock International, Morrilton, Arkansas, USA.

Timyan J. 1996. Bwa Yo: important trees of Haiti. South-East Consortium for International Development. Washington D.C.

Vogt K. 1995. A field guide to the identification, propagation and uses of common trees and shrubs of dryland Sudan. SOS Sahel International (UK).

Williams R.O & OBE. 1949. The useful and ornamental plants in Zanzibar and Pemba. Zanzibar Protectorate.

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