Azadirachta indica A. Juss.

Synonyms: *Melia azadirachta* Linn., *Melia indica* (A. Juss) Brandis

Family: Meliaceae

Vernacular names: English: neem, margosa; India: limbdo (Gujarati); nimb, nim (Hindi); bevu, bevina mana, olle (Kannada); veppu, vepe (Malyalam); nimbay, limbo (Marathi); vembu, veppam (Tamil); vepa, yepa (Telgu); Burma: tamar, tamarkha, thinbaw, kalar tamar; Thailand: sadao thai, sadao ban (central), dao (south), siliam (north); Sri Lanka: kohomba (Sinhala), vempu (Tamil); Indonesia: imba, mimbo (Java), intaran (Bali), meupleuh (Madura); Malaysia: mambu; Pakistan: nimmi; Iran: nib; Singapore: nimbagaha.

Origin and geographical distribution: *Azadirachta indica* (neem) is indigenous to the dry forests of South and Southeast Asia and is widely distributed in India, Nepal, Pakistan, Bangladesh, Sri Lanka, Myanmar, Thailand, Malaysia, Indonesia and Iran. Original natural distribution is obscured by widespread cultivation but neem is believed to be native to at least Burma and NE India. The tree's adaptation to hot and dry climates has made it one of the most commonly planted species in arid and semi-arid areas, both within its natural range and also in Africa, Central and Southern America, the Caribbean and Philippines. *Azadirachta indica* var. *siamensis* Veleton is native to Thailand.

The tree, inflorescence, fruits and seeds of neem

Description: A medium to large tree, 15–20 m in height with a clear bole of up to 7 m, bark tubercled, grayish to dark grey. Compound leaves imparipinnate, shinning, deeply serrate; leaflets sub-opposite, very oblique at base. Flowers cream or yellowish white in auxiliary panicles, elongate. Fruits one-seeded drupes 1–2 cm long with woody endocarp, greenish yellow when ripe. Seeds ellipsoid, cotyledons thick, fleshy and oily.

Uses: The wood is strong and valued for furniture, carts, boards, panels, etc. Small twigs are used as toothbrushes. Fruits are rich in azadirachtin and other pesticide compounds. Leaves are good fodder and also have medicinal and insect repellent properties. The pulp of the ripe fruits is used as tonic, purgative, emollient and anthelmintic. Seed kernel used as an insecticide effective against a large number of insects. The seed kernel also yields margossa oil, which is mainly used in the making of soap and toothpaste. Bark is used for various medicinal purposes, primarily anti-protozoal, anti-allergic, anti-dermetitic and anti-fungal. Anti-spermicidal properties have been identified.

Reproductive biology: Neem plants normally flower in April. Flowers hermaphrodite or male. There are some genotypes, which flower in September and fruit in December, following inevitable self-pollination. Each panicle has 12–15 small branches and total of at least 100 flowers. The flowers are frequented by bees, flies, ants, butterflies and thrips. Each flower possesses five sepals, five petals and 10 stamens. The anthers are placed on the inner side of the staminal tube towards apex close to stigma. Anthers dehisce vertically towards inside and release pollen grains. The time of anthesis is 4 pm to 6 pm. After pollination, the petals curve back and the staminal tube turns brown. Ovary 3-carpellary with 2 ovules in each carpel; usually only one ovule develops into seed. No. of chromosomes is n=14.

Ecology: In India, neem grows in tropical dry areas up to 1200 m asl. It can thrive on a wide range of soils and climatic conditions. A soil pH value of 6.2–7.0 is suitable, but pH as low as 5.9 and as high as 10 may also be tolerated under certain circumstances. The absolute maximum shade temperature varies between 40–50 °C and minimum temperature 0–15 °C. Best growth is found in areas with 750–1000 mm rainfall, but neem can survive with rainfall as low as 150 mm.

Propagation: Mature trees seed profusely; seeds are dispersed mainly by birds. Plenty of seedlings emerge during rains. The tree establishes naturally under the protection of thorny bushes, hedges or boulders. Artificial regeneration of neem can be done by direct sowing, cuttings and planting out of entire seedlings or stumps. Seeds are produced from the age of about 5 years. Ripe fruits are collected as soon as they drop. There are about 2000–3000 fruits and 3300–6300 seeds per kg. Germination capacity of fresh seeds is 70–90%, but seeds do not store well; viability is virtually zero in 7 weeks.

Conservation status and tree improvement: Despite widespread use of neem, global programmes for the evaluation and improvement of neem genetic resources were not initiated until the establishment of the International Neem Network (INN) in 1994 (www.fao.org/forestry/site/neem/en), largely because of practical problems in seed storage and transport. The genetic material in the existing plantations has most likely been chosen in an empirical, restricted manner and its genetic base is likely to be very narrow, particularly in countries outside the natural distribution range. National institutions from 23 countries in Asia, Africa, Latin America and Europe have taken part in the Network's activities on exploring and evaluating the genetic diversity of neem, coordinated by FAO with the technical support of Danida Forest Seed Centre. The objectives are to improve the genetic quality and adaptability of neem to improve its utilization throughout the world, contributing to development and meeting the needs of rural people.

Research on genetic conservation: The Forest Research Institute, Dehradun undertook a survey of different populations of neem to understand the variability associated with place of origin. Seeds were collected from 20 sources in 8 states, and large variation was observed in seed weight and leaf length. A national neem provenance trial consisting of 39 provenances and an international neem trial including 18 provenances from Asian and African countries have been established at the Arid Forest Research Institute, Jodhpur. Candidate Plus Trees have been selected in different agro-climatic zones to screen for high-yielders of oil and azadirachtin. Genetic diversity has been estimated in 37 neem accessions from 10 states of India and 4 exotic lines from Thailand by AFLP markers. In 1990, a programme to develop a supply of improved neem seed was started in Tamil Nadu and 149 plus trees were selected. Seeds from 32 phenotypically superior trees from seven Indian locations shown large variation of azadirachtin content (0.29–8.83 g/kg). Demonstration plantations have also been established at Ratchaburi Forest Research Station, Thailand. The Thai Royal Forest Department has established research projects on neem improvement including plus tree selection, progeny testing and establishment of gene conservation. Research on seed processing and storage is being conducted at the Forest Research Institute, Yezin, Myanmar. Neem is one of the priority multipurpose tree species in Indonesia but the development in neem improvement is limited.

Agencies active in genetic conservation of the species: *India:* Arid Forest Research Institute, Jodhpur; Institute of Forest Genetics and Tree Breeding, Coimbatore; National Botanical Research Institute; Tamilnadu Agriculture University; Neem Foundation, Mumbai; BAIF Development Research Foundation; Vittal Mallya Scientific Research Foundation. *Thailand:* Royal Forest Department; Kasetsart University. *Nepal:* Institute of Forestry, Tribhuvan University; Forest Research and Survey Centre. *Other:* University of Peradeniya (Sri Lanka); Bangladesh Agricultural Research Council; Bangladesh Forest Research Institute; Forest Research and Development Centre, Bogor (Indonesia); Ministry of Forestry, Forestry Department (Myanmar); Pakistan Forest Institute, Peshawar; Forest Science Institute of Vietnam; Ecosystem Research and Development Bureau (Philippines); Department of Forestry (Lao PDR); Forest Research Institute Malaysia.

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This note was prepared by V.P. Tewari and D.K. Mishra from Arid Forest Research Institute, Jodhpur, India.

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