Leucaena leucocephala

(Lam.) de Wit

Fabaceae - Mimosoideae

LOCAL NAMES

Amharic (lukina); Arabic (leuceana); Creole (lisina,delen); English (leucaena,Jumpy-bean,wild tamarind,lead tree,white popinac,white lead-tree,horse tamarind); Filipino (elana,kariskis,palo-maria,ipil ipil); French (faux mimosa,leucene,Delin étranger); Gujarati (vilayati baral,lasobayal); Hawaian (false koa,koa-haole); Hindi (kadam,toira,subabul,tagari,koo babul,lamtoro,ku-babul); Indonesian (klandingan,lamtoro,petai cina,pelending); Javanese (kladingan,lamtoro); Khmer (krâthum' thé:t,khtum té:hs); Lao (Sino-Tibetan) (kathin,kan thin,kh'oonz koong,khaaw,kh'o:ng kha:w); Malay (ipil-ipil,petai jawa,petai belalang); Pidgin English (kunai,lamandro); Spanish (guaje,Salvador leucaena,Peru leucaena,giant leucaena,acacia bella rosa); Swahili (lusina,mlusina); Tamil (tagarai,nattucavundal); Thai (krathin,to-bao); Tigrigna (lucina); Vietnamese (keo d[aaj]u,keo dâu,bo chét,bo ch[es]t)

BOTANIC DESCRIPTION

Leucaena leucocephala is a small, variably shrubby and highly branched (ssp. leucocephala) to medium-sized tree with a short, clear bole to 5 m, upright angular branching and a narrow open crown (ssp. glabrata), 3-15 (max. 20) m tall, bole diameter 10-50 cm. Bark on young branches smooth, grey-brown, slash salmon pink, darker grey-brown and rougher with shallow, rusty orange-brown vertical fissures and deep red inner bark on older branches and bole. This evergreen plant is deep rooted. It often has a combination of flowers, immature and mature pods all present on the tree at the same time.

Leaves with (min. 4) 6-9 pairs pinnae; pinnular rachis 5-10.2 cm long, leaflets 9-16 (max. 21) mm long, 2-4.5 mm wide, 13-21 pairs per pinna, slightly asymmetric, linear-oblong to weakly elliptic, acute at tip, rounded to obtuse at base, glabrous except on margins. Leaves and leaflets fold up with heat, cold or lack of water.

Flower heads 12-21 mm in diameter, 100-180 flowers per head, in groups of 2-6 in leaf axils, arising on actively growing young shoots, flowers white or pale cream-white.

Pods (min. 9) 11-19 cm long, (min. 13) 15-21 mm wide, (min. 3) 5-20 (max. 45) per flower head, linear-oblong, acute or rounded at apex, flat, 8-18 seeded, mid- to orange-brown, glabrous and slightly lustrous or densely covered in white velvety hairs, papery, opening along both margins. Seeds hard, dark brown with a hard, shining testa, 6.7-9.6 mm long, 4-6.3 mm wide, aligned transversely in pod.

The specific name 'leucocephala' comes from 'leu', meaning white, and 'cephala', meaning head, referring to the flowers. There are 3 recognized subspecies: ssp. leucocephala, ssp. glabrata (Rose) S. Zárate, and ssp. ixtahuacana C. E. Hughes.

BIOLOGY

The flowers are self-fertile, and most seed results from self-pollination. Flowering and fruiting occur throughout the year as long as moisture permits; fruiting is associated with suppression of vegetative growth. Arboreal cultivars have been selected for lower flowering rate. Fruits ripen in 10-15 weeks.

Mature tree of L. leucocephala subsp. glabrata, Baja California Sur, Mexico. (Colin E. Hughes)

Flower head of L. leucocephala subsp. glabrata. Open flower head and unopened flower buds. (Colin E. Hughes)

Unripe pods of L. leucocephala subsp. glabrata typically occur in groups of 5-15 pods per flower head. High pod set has been attributed to high self fertility. (Colin E. Hughes)

ECOLOGY
L. leucocephala is essentially a tropical species requiring warm temperatures for optimum growth and with poor cold tolerance and significantly reduced growth during cool winter months in subtropical areas. For optimal growth it is therefore limited to areas 15-25 deg. north or south of the equator. L. leucocephala sheds its leaves even with light frosts, and heavy frost kills all above-ground growth, although trees often sprout the following summer. It grows well only in subhumid or humid climates with moderate dry seasons of up to 6-7 months. It thrives under irrigation regimes similar to those applied to maize (i.e. over 1200 mm/year). L. leucocephala tolerates fast fires and can regrow after being burned to the crown by slower fires.

L. leucocephala ssp. leucocephala is an aggressive colonizer of ruderal sites and secondary or disturbed vegetation in many places, both in Mexico and in many parts of Asia such as the Philippines. This has been attributed to its precocious year-round flowering and fruiting, abundant seed production, self-fertility, hard seed coat, and ability to resprout after fire or cutting. It is now naturalized and among the most prevalent invasive species in many areas such as open (often coastal) habitats, semi-natural, disturbed, degraded habitats, other ruderal sites, and occasionally, agricultural land where it has been planted as a shade tree over cacao. It is a serious problem in Tonga.

BIOPHYSICAL LIMITS
Altitude: 0-1500 (max. 2100) m, Mean annual temperature: 25-30 deg. C, Mean annual rainfall: 650-3000 mm

Soil type: Performs optimally on calcareous soils but can be found on saline soils and on alkaline soils up to pH 8; it is not tolerant of acid soils or waterlogged conditions. L. leucocephala is known to be intolerant of soils with low pH, low phosphorus, low calcium, high salinity, high aluminium saturation and waterlogging and has often failed under such conditions.

DOCUMENTED SPECIES DISTRIBUTION

Native: Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Spain, United States of America

Exotic: Antigua and Barbuda, Australia, Bahamas, Barbados, Cambodia, Cote d'Ivoire, Cuba, Democratic Republic of Congo, Dominica, Dominican Republic, Eritrea, Ethiopia, Fiji, Grenada, Haiti, India, Indonesia, Jamaica, Kenya, Laos, Malaysia, Myanmar, Nigeria, Papua New Guinea, Philippines, Puerto Rico, South Africa, Sri Lanka, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Sudan, Taiwan, Province of China, Tanzania, Thailand, Trinidad and Tobago, Uganda, Vietnam, Virgin Islands (US)

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.

PRODUCTS
Food: Pods, seeds and leaf tips have been used as food, although mimosine toxicity makes this practice risky. In Indonesia, a food called ‘tempe lamtoro’ is made of fermented leucaena seeds. Seeds can also be prepared as a coffee substitute.

Fodder: L. leucocephala is one the highest quality and most palatable fodder trees of the tropics, often being described as the ‘alfalfa of the tropics’. The leaf quality compares favourably with alfalfa or lucerne in feed value except for its higher tannin content and mimosine toxicity to non-ruminants. Livestock feed should not contain more than 20% of L. leucocephala, as the mimosine can cause hair loss and stomach problems.

Leaves have a high nutritive value (high palatability, digestibility, intake and crude-protein content), resulting in 70-100% increase in animal live weight gain compared with feeding on pure grass pasture. Herbage taken at peak quality has 55-70% digestibility and 20-25% crude protein. In addition, it is very persistent over several decades of cutting or grazing, is highly productive, recovers quickly from defoliation, combines well with companion grasses and can be grazed with minimal losses from trampling or grazing. Forage, packed in pellets and cubes, is internationally marketed as animal feed.

Apiculture: L. leucocephala is in bloom almost throughout the year, providing constant forage to honey bees.

Fuel: L. leucocephala is an excellent firewood species with a specific gravity of 0.45-0.55 and a high calorific value of 4600 cal/kg. Wood burns steadily with little smoke, few sparks and produces less than 1% ash. The tree makes excellent charcoal with a heating value of 29 mJ/kg and good recovery values (25-30%). Addition of ground L. leucocephala to fuel oil for diesel engines was found to involve no harmful agents in the ash.

Fibre: Fibre values are similar to those of other tropical hardwoods, and it produces paper with good printability but low tearing and folding strength; the wood-pulp strength is greater than that of most hardwoods, with almost 50% greater ring crush. Its pulping properties are suitable for both paper and rayon production. Also used for particleboard production.

Timber: L. leucocephala has hard heavy wood (about 800 kg/m), with a pale yellow sapwood and light reddish-brown heartwood. The wood is known to be of medium density and to dry without splitting or checking. It is strong, medium textured, close grained and easily workable for a wide variety of carpentry purposes. Sawn timber, mine props, furniture and parquet flooring are among increasingly popular uses. However, the use of L. leucocephala for sawn timber is greatly limited by its generally small dimensions (usually not greater than 30 cm diameter), its branchiness, which limits lengths of clear bole available and means wood is often knotty, and its high proportion of juvenile wood. Nevertheless, there is growing use of small-dimension sawn wood in a number of industries such as flooring, which might include L. leucocephala in the future. Poles are used to prop bananas and as a support for yams, pepper and other vines. Use of short-rotation L. leucocephala for poles is limited by their lack of durability and susceptibility to attack by termites and woodborers.

Gum or resin: Gum arises from Leucaena stems under ill-defined conditions of injury and disease or from sterile hybrids, especially L. leucocephala x L. esculenta. The gum has been analysed and found similar to gum arabic and of potential commercial value.

Tannin or dyestuff: Red, brown and black dyes are extracted from the pods, leaves and bark.

SERVICES
Erosion control: An aggressive taproot system helps break up compacted subsoil layers, improving the penetration of moisture into the soil and decreasing surface runoff.

Shade or shelter: L. leucocephala is used as a shade tree for cocoa, coffee and tea; it generally acts as a shelterbelt, providing shade and wind protection for a variety of crops, especially during early growth.

Reclamation: L. leucocephala thrives on steep slopes and in marginal areas with extended dry seasons, making it a prime candidate for restoring forest cover, watersheds and grasslands.

Nitrogen fixing: It has high nitrogen-fixing potential (100-300 kg N/ha a year), related to its abundant root nodulation.

Soil improver: L. leucocephala was one of the 1st species to be used for the production of green manure in alley-cropping systems. Leaves of L. leucocephala, even with moderate yields, contain more than enough nitrogen to sustain a maize crop. The finely divided leaves decompose quickly, providing a rapid, short-term influx of nutrients. It has even been suggested that the leaves decompose too rapidly, resulting in leaching of nutrients away from the crop-rooting zone before they are taken up by the crop. This also means that they have little value as mulch for weed control. The tree has the potential to renew soil fertility and could be particularly important in slash-and-burn cultivation, as it greatly reduces the fallow period between crops.

Ornamental: Suitable as an ornamental and roadside landscaping species.

Boundary or barrier or support: Used as a live fence, firebreak and live support for vines such as pepper, coffee and cocoa, vanilla, yam and passion fruit.

Intercropping: Leucaena is one of the most widely used species in alley cropping, where it is planted in hedges along contours at intervals of 3-10 m with crops in between.

Other services: The dried seeds are widely used for ornamentation.

TREE MANAGEMENT
L. leucocephala is a vigorous coppicer and responds well to pollarding and pruning. Coppiced stems sprout 5-15 branches, depending on the diameter of the cut surface, and 1-4 stems dominate after a year of regrowth. Wood yields from L. leucocephala over short (3-5 year) rotations compare favourably with other species, ranging from 3-4 m in height/year and 10-60 cubic m/ha a year. On less favourable sites, as in cooler tropical highland areas, on acid soils, or under high psyllid pressure, yields have often been disappointing, and under such conditions other species of Leucaena or other genera generally outperform L. leucocephala.

High plant densities are recommended for solid fodder. Fodder yields range from 40 to 80 t/ha when moisture is not limiting.

GERMPLASM MANAGEMENT
Seed storage behaviour is orthodox. Viability can be maintained for 20 years in open storage at room temperature; seeds germinate after 99 years in a herbarium; viability can be maintained for several years in hermetic storage at room temperature with 5-8% mc. There are 15 000-20 000 seeds/kg.

PESTS AND DISEASES
L. leucocephala is susceptible to the psyllid Heteropsylla cubana, which has caused serious defoliation and mortality in eastern Africa. A Caribbean parasitoid, Psyllaephagus, shows specificity and excellent appetite for H. cubana and hence offers possibilities for biological control. Some varieties are susceptible to gummosis, most likely caused by Fusarium semitectum. Ganoderma lucidum causes root rot in arid and semi-arid regions. Leaf-spot fungus also can cause defoliation under wet conditions. Wild animals avidly consume seedlings.

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