# Leucaena diversifolia

Benth.

Fabaceae - Mimosoideae

LOCAL NAMES
English (wild tamarind,red leucaena,leucaena,diversifolia); Filipino (ipil-ipil); French (leucaena petit feuille); Indonesian (lamtoro); Spanish (guaje)

BOTANIC DESCRIPTION
Leucaena diversifolia is a tree or erect shrub, 3-20 m tall, with a single-stemmed bole 20-50 cm in diameter, slender and clear up to 10 m in height, ascending branches with horizontal twigs. Bark on young branches smooth, rougher on bole, grey-brown with shallow rusty orange-brown vertical fissures; slash green then cream.

Leaves with (min. 14) 16-24 (max. 28) pairs pinnae; pinnular rachis (min. 3.5) 5-7 (max. 8) cm long, densely covered with white hairs; leaflets (min. 2.9) 4-5.5 (max. 7) mm long, (min. 0.6) 0.8-1 (max. 1.2) mm wide, (min. 43) 48-58 (max. 62) pairs per pinna, linear-oblong, acute at apex, strongly asymmetric at base, glabrous except for hairy margins.

Flower heads 11-15 mm in diameter, the buds loosely packed; 45-90 flowers per head, in groups of 1-5 (max. 7) in leaf axils, on actively growing indeterminate shoots, the leaves developing with flowers; stamen filaments, anthers and style white, pale pink, sometimes bright shocking pink, and occasionally bright scarlet; anthers sparsely hairy at the tip.

Pods 1-6 (max. 7) per flower head, (min. 7) 10-13 (max. 15.5) cm long, (min. 11) 13-16 (max. 17) mm wide, narrowly linear-oblong, flat 6-20-seeded, pod walls thin, papery dark brown or reddish-brown, sometimes lustrous, glabrous or covered in dense velvety hairs, opening along both sides. Seeds 4.3-5.5 mm wide, 2.7-3.4 mm long; the smallest of any species of Leucaena.

The specific name ‘diversifolia’ means ‘with leaves of different shapes on the same individual’; from the Latin ‘diversus’ (divergent) and ‘folium’ (leaf).

BIOLOGY
As a self-incompatible tetraploid, L. diversifolia is also one of the most important parent species in artificial hybridization. In its natural range, it flowers from (February) May to June (December), and fruits from (June) August to February (April).

Mature tree of L. diversifolia near the southern limit of its natural range, near Yajalon, Chiapas in southern Mexico, showing typical tree form and open crown. (Colin E. Hughes)

Flowering shoot of L. diversifolia showing lax flower head buds on actively growing shoots. (Colin E. Hughes)

Ripe pods of L. diversifolia from Oaxaca, south central Mexico. Pods of L. diversifolia are variably glabrous, or (as here) densely pubescent. (Colin E. Hughes)

ECOLOGY

The natural distribution of L. diversifolia corresponds to a narrow zone of moist or very moist submontane evergreen forest, subject to frequent mist and cloud cover. L. diversifolia also grows sometimes abundantly in secondary vegetation. As a mid-elevation species, it is tolerant of cool climates but not frost. In Hawaii, on cool mid-elevation sites, it outyields L. leucocephala, but it did not survive moderate frost in Florida. It thus grows well in cool, stable, frost-free climates that closely resemble conditions in the natural populations in Veracruz, Mexico. Rainfall and cloud cover are high in the natural range with 1500-3500 mm rainfall, a short dry season of 0-3 (max. 4) months and frequent mist.

L. diversifolia is a tropical highland species found in cool and seasonally wet locations. It does not withstand drought well and tolerates only partial shade. It is often grown in deforested degraded areas dominated by Imperata cylindrica and Themeda triandra.

L. diversifolia is selfing; it flowers and fruits over an extended season and sets prodigious quantities of seed from an early age. In other words, it has all the traits to make it an aggressive colonizer of ruderal sites and secondary or disturbed vegetation in many places.

BIOPHYSICAL LIMITS

Altitude: 30-1500 (max. 1740) m, Mean annual temperature: 18-30 deg. C, Mean annual rainfall: 600-3500 mm

Soil type: Prefers slightly acid, fertile soils but is tolerant of leached soils.

## DOCUMENTED SPECIES DISTRIBUTION

Native: Guatemala, Honduras, Mexico, Nicaragua

Exotic: Angola, Antigua and Barbuda, Bahamas, Barbados, Benin, Botswana, Brunei, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Colombia, Comoros, Congo, Cote d'Ivoire, Cuba, Democratic Republic of Congo, Djibouti, Dominica, Dominican Republic, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Grenada, Guadeloupe, Guinea, Guinea-Bissau, Haiti, India, Indonesia, Jamaica, Kenya, Laos, Lesotho, Liberia, Madagascar, Malawi, Malaysia, Mali, Martinique, Mauritania, Montserrat, Mozambique, Myanmar, Namibia, Netherlands Antilles, Niger, Nigeria, Panama, Papua New Guinea, Philippines, Puerto Rico, Rwanda, Sao Tome et Principe, Seychelles, Sierra Leone, Somalia, South Africa, Sri Lanka, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Sudan, Swaziland, Tanzania, Thailand, Togo, Trinidad and Tobago, Uganda, US, Vietnam, 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.

PRODUCTS
Fodder: L. diversifolia has lower palatability and digestibility and higher condensed tannin levels than L. leucocephala, indicating lower fodder quality. However, digestibility and tannin levels are intermediate compared with other Leucaena species. The mimosine content is low (1.5-2.5%). Rations for ruminants should not contain more than 50% L. diversifolia, and the proportion for non-ruminants should not exceed 10%.

Fuel: One of the primary uses of the species is firewood and charcoal; its energy value is 900-19 300 kJ/kg.

Fibre: The pulp is desirable for paper production.

Timber: Sufficiently large logs are used in construction and as poles. The wood of L. diversifolia has a density of 400-500 kg/cubic m.

Gum/resin: L. diversifolia produces a water-soluble gum containing the sugar rhamnose.

SERVICES
Soil erosion: Soil erosion can be controlled effectively by planting L. diversifolia.

Shade/shelter: Its light crown makes L. diversifolia an ideal species for shade over perennial crops such as coffee, and this has been one of the main uses in Jamaica, Papua New Guinea and, where cultivated within its natural range, in Mexico and Guatemala.

Reclamation: In reforestation schemes, it is planted for soil amelioration and stabilization.

Nitrogen fixing: The tree nodulates and fixes atmospheric nitrogen with Rhizobium strains that also nodulate with L. leucocephala. On soils very low in nitrogen, a moderate application of nitrogen fertilizer may increase nodulation and nitrogen fixation. A fertilizer application of 50-100 kg N/ha was found to increase the number of nodules per tree from 11.5 to 25-30, while nodule dry weight increased by 63-70%.

Soil improver: The annual leaf dry matter production can reach 10-16 t/ha. When incorporated as green manure, this adds 72-119 kg nitrogen, 2.5-3 kg phosphorus, 29-60 kg potassium, 47-94 kg calcium and 7.5-18.5 kg magnesium to the soil per ha. This is equivalent to about 10 t/ha cattle manure per year.

Intercropping: In agroforestry and mixed pastures, L. diversifolia is grown as an alternative for L. leucocephala, where the latter performs poorly because of high altitude or psyllid attack.

Other services: L. diversifolia is a promising parent in artificial hybridization and its hybrid with L. leucocephala, designated KX3 by the University of Hawaii, has proved to be fast growing with impressive tree.

TREE MANAGEMENT
The aggressive nature and profuse growth of L. diversifolia occasionally make it a weed; seedlings can be controlled effectively by spraying them with diesel oil at the 3-5 leaf stage. Established trees can be controlled by impregnating freshly cut stumps of a basal diameter of 1-20 cm with diesel oil. The treatment should be repeated on coppiced stumps. Delaying application until 1 day after cutting reduces its efficacy.

GERMPLASM MANAGEMENT
Seed storage behaviour is orthodox; viability can be maintained for several years in hermetic storage at room temperature with 5-8% mc. There are 60 000-80 000 seeds/kg.

PESTS AND DISEASES
A common disease is leaf spot caused by Camptomeris leucaena. Spots on upper leaves are often insignificant, but the fungus sporulates profusely, producing crowded, black pustules on lower leaves. Fusarium semitectum causes gummosis and canker on stems, branches and penduncles, and dark brown spots on young twigs, leaves, penduncles, pods and seeds, eventually causing the tree to die. A moth, Spatularia mimosae, may cause economically significant damage to the seeds. Diploid forms of L. diversifolia have high psyllid resistance; tetraploid forms are only moderately resistant. Both forms show high resistance to seed beetles, Araecerus levipennis and A. fasciculatus; in Hawaii, damage to unprotected seed is often only 1/4 f that to seed of susceptible Leucaena species. There are some indications that L. diversifolia is tolerant of some root-attacking nematodes.

## FURTHER READNG

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## SUGGESTED CITATION

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