Calliandra calothyrsus

Scientific name
Calliandra calothyrsus Meisn.

Synonyms
Anneslia calothyrsa (Meisn.) Kleinhonnte
Anneslia calothyrsus (Meisn.) Donn. Sm.
Feuilleea calothyrsus (Meisn.) Kuntze.
Calliandra confusa Sprague & Riley
Calliandra houstoniana var. calothyrsus (Meisn.) Barneby
Anneslia confusa (Sprague & Riley) Britton & Rose
Calliandra similis Sprague & Riley
Anneslia similis Sprague and Riley
Anneslia acapulcensis Britton and Rose.
Calliandra acapulcensis (Britton and Rose) Standl.

Family/tribe
Family: Fabaceae (alt. Leguminosae) subfamily: Mimosoideae tribe: Ingeae. Also placed in: Mimosaceae.

Common names
calliandra, red calliandra (English); kalliandra, kalliandra merah (Indonesia); barba de gato, barbillo, barba de chivo, barbe jolote, barbe sol, cabello de angel, carboncillo, clavellino, pelo de angel (Spanish).

Morphological description
Small, perennial, thornless leguminous tree growing 2-12 m high. Trunk diameter up to 30 cm with white-reddish brown bark. Leaves are bipinnate and alternate; the rachis is 10-19 cm long, without glands; pinnae are (3-) 6-20 jugate, rachilla are 2-11 cm long; there are 19-60 pairs of leaflets; leaflets are linear, oblong and acute, 5-8 mm x 1 mm. Inflorescences are particulate with flowers in umbelliform clusters, 10-30 cm long. Flower sepals and petals are green, calyx 2 mm long, corolla 5-6 mm long. The numerous red staminal filaments are 4-6 cm long. Fruits are broadly linear, flattened, 8-11 cm x 1.0 cm with thickened and raised margins, finely pubescent or glabrous, brown dehiscent, 8-(-12) seeded. Seeds are ellipsoid, flattened, 5-7 mm long and mottled dark brown.

Distribution
Native to:
Humid/sub-humid regions of Central America and Mexico. Found from the western Pacific coast of Mexico, south throughout Belize, Guatemala, Honduras, El Salvador, Nicaragua and Costa Rica, to the north coast of central Panama covering the latitudes from 9-19ºN. Introduced into Indonesia in 1936 and from there to other parts of the tropics, notably east Africa, the area where it is now most widely used for fodder.

Uses/applications
A multipurpose species grown primarily for forage as a supplement to low quality roughages for ruminant livestock. Also used for the provision of green manure, shade for coffee and tea, land rehabilitation, erosion control. Used as a pollen source for honey production and a host for the lac insect (Laccifer lacca) for shellac production. It is also important in parts of Africa (e.g. Uganda, Rwanda) in providing stakes for climbing beans.
An excellent fuelwood for cooking and small fires; calliandra wood dries very quickly (overnight for small stems) and burns well with a smokeless fire.

Ecology
Soil requirements
Grows well on a wide range of soil types ranging from deep volcanic loams to more acidic metamorphic sandy clays. Naturally well suited to the light-textured slightly acidic soils of volcanic origin. Well adapted to acid infertile soils but will respond to fertiliser application on such soils.
It does not tolerate waterlogged conditions, and does not grow well on poorly drained calcareous soils.

Moisture
In its native range, grows in annual rainfall regimes of 700-3,000 mm with 1-7 dry months. Poor tolerance of inundation. Not very drought tolerant, but can withstand dry periods, particularly in riverine environments, or where a perched watertable is present. Evergreen in humid climates but semi-deciduous in areas with a long dry season.
In exotic locations, grows best at 250-1,300 m altitude with annual rainfall of 2,000-4,000 mm and a 3-6 month dry season.

Temperature
Adapted to altitudes from 0-1,850 m asl. Mean monthly maximum temperatures of 24-28°C, and mean minimum temperatures of 18-24°C. *C. calothyrsus* is frost susceptible but possesses considerable cool tolerance for a tropical species, growing naturally to 1,800 m asl in Guatemala and exotically to 2,000 m asl in Indonesia and Kenya.

**Light**

Intolerant of heavy shade. In Uganda and Tanzania it is being adopted in home garden systems where it is planted under banana with moderate shade.

**Reproductive development**

Flowering can occur throughout the year given sufficient soil moisture, but is concentrated between October and January (late wet season). Flowering will cease over the dry season where greater than 4 months dry occurs. Flowers are andromonoecious, bearing both hermaphrodite (bisexual) and staminate (male) flowers. Predominantly outcrossing with a weak, possibly late-acting, self-incompatibility system. The level of selfing is influenced by provenance, age, floral phenology, population size and pollinator behaviour. Pollination is achieved by hawkmoths, bats of the genus *Glossophaga* and other less specialised fruit bats.

**Defoliation**

Depends on use. First cut 8-12 months after sowing. For maximum leaf production, cut to a height of 0.5-1.0 m every 2-3 months. Not as deep rooting or drought tolerant as *L. leucocephala*. To prevent leaf loss in the dry season, cut at the end of the wet season. Normally cut for feeding as direct grazing by cattle, sheep and goats will normally result in high rates of plant mortality. Slashing calliandra to less than 30 cm above ground level and allowing ruminants to graze the regrowth can reduce plant mortality. This limits the stripping of bark and cambium from the stem. Calliandra is generally recommended for cut-and-carry feeding rather than for use in direct grazing systems.

**Fire**

Unknown. Probably tolerant once established.

**Agronomy**

Guidelines for the establishment and management of sown pastures.

**Establishment**

Seed requires scarification. Good results are achieved by soaking seed in cold water for 48 hours. Hot water treatment can be used but there is a risk of killing seed through excessive exposure to high temperature. Mechanical scarification is also used. Use scarified seed planted at 1-3cm depth or seedlings raised in nurseries when the plants are 20-50cm tall. Seedlings can be planted 0.5-1.0 m apart in hedgerows spaced 3-4 m apart, or in fodder banks spaced 0.5-1.0 m apart in a grid pattern. Attention to early weed control will shorten the establishment period. Promiscuous in its *Bradyrhizobium* requirements, but benefits from inoculation in new areas. Early growth is slow. Once the species is mycorrhizal, growth is vigorous and the tree reaches a height of 3.5 m in six months. Does not establish well from cuttings.

**Fertiliser**

Use of fertiliser on infertile soils will improve early growth, but it is less responsive to fertiliser than other tree species.

**Compatibility (with other species)**

Normally cut for feeding rather than direct grazed. High mortality can occur when direct grazed by ruminants. Coppicing stems to 30 cm above ground level, and allowing livestock to graze the regrowth can avoid this. (See section on defoliation).

**Companion species**

Grasses: Has been grown as a hedgerow in signal grass (*Brachiaria decumbens*), buffalo couch (*Stenotaphrum secundatum*) and *Imperata cylindrica* pastures. Generally grown as line plantings along fencelines and paddock boundaries, or integrated into garden systems where it is grown with a wide range of crop species. Used as a shade tree over coffee and tea. Suitable host for sandalwood (*Santalum album*).

**Pests and diseases**

Significant pests and diseases are starting to appear on calliandra in east Africa, particularly Uganda, including heavy infestation by a scale insect (*Pulvinarisca jacksoni*), severe and sudden dieback (of uncertain cause) on unpruned trees at about two years old. In Indonesia, a scale insect occasionally infests branches and stems, termites and borers attack the stem, and a looper eats the leaves. Fungal diseases (e.g. *Corticium salmonicola* and *Xylaria* spp.) may infect and kill stems made susceptible through harvest wounds.

**Ability to spread**

Will not spread when utilised in agricultural systems.

**Weed potential**

Can be an aggressive coloniser of disturbed habitats, depending on seed set, which varies with the availability of suitable pollinators.
Has colonised disturbed habitats in Uganda and Hawaii.

**Feeding value**

**Nutritive value**

*In vitro* digestibility of dried leaf from 19 provenances ranged from 24-47%. Wide variation in condensed tannin (CT) concentrations has also been reported (1.5-19.4%). Several studies have reported negative nitrogen balances resulting from high levels of supplementation with calliandra leaf. Despite this, reasonable animal production is achieved where calliandra has been adopted as a supplement to poor quality basal diets or as a partial replacement of concentrate feeds. Good source of the vitamin carotene.

**Palatability/acceptability**

Freshly harvested leaves of calliandra are generally highly palatable to ruminants where animals have prior experience with the forage, although some problems with palatability have been reported from Mexico and Central America. Provenances vary in palatability to some extent. Palatability is significantly reduced when wilted or dried leaves are fed at high levels of supplementation. At normal supplementation rates (20-40%), wilting or drying of leaves will have no effect on intake.

**Toxicity**

No known toxicities to ruminants.

**Production potential**

**Dry matter**

Produces DM yields of 3-14 t/ha/year, depending on climate and soil fertility. The Nicaraguan provenance of 'San Ramon' is superior for leaf production, but should not be promoted for fodder, as its nutritive value is significantly lower than that of other provenances, including 'Patulul' (Guatemala) and the Kenyan land race ('Embu'). Indonesian landraces from Bandung and Maduin performed well as multipurpose accessions, producing high levels of both leaf and wood.

**Animal production**

Generally used to improve the utilisation of low quality grasses or as a replacement for concentrate feeds. In Zambia, goats fed a basal diet of poor quality hay lost weight at 20 g/day. Weight gains of 24 g/day were achieved when supplemented with 140 g/day DM of calliandra leaf. In Indonesia, sheep liveweight gains increased from 26 up to 52 g/day when supplementation levels of fresh calliandra leaf increased from 0-35% of total ration. Cattle direct grazing calliandra over a 12-month period in Indonesia gained 0.33 kg/head/day compared with 0.16 kg/head/day from those grazing an *Imperata cylindrica* control. Despite the promising early results, calliandra proved unable to withstand direct grazing and experienced 100% plant mortality over a 2-year period. Experimentally in Kenya, 3 kg of fresh calliandra leaf plus 2 kg of concentrate feed provided a similar response in milk yield and butterfat to 3 kg of concentrate feed. The response may arise from the provision of tannin-protected protein that can be efficiently absorbed post-ruminally. In Kenya, the recommendation to farmers is that 500 plants, managed in a hedgerow, will provide enough leaf to supplement the diet of one dairy cow. A dairy goat needs 100-150 plants.

Not suitable as a feed for monogastric animals due to its high levels of astringent CTs. Small amounts may be fed to chickens as leaf meal: the carotene content gives a dark yellow yolk which can increase the market value of the eggs.

**Genetics/breeding**

Agronomic evaluations have identified superior provenances/landraces. Artificial hybridisation has been carried out between 3 species of *Calliandra*. Hybrids between *C. calothyrsus* and *C. houstoniana* may have potential for cultivar development, but such hybrids have not yet been adopted by farmers.

**Seed production**

High levels of seed production in Central America. Provenances/accessions should be separated by at least 2 km distance to prevent cross-pollination. For maximum seed production, trees should be widely spaced with an area of 9-16 m²/tree. Coppice trees to 1 m prior to the wet season to stimulate flower production. Well-fertilised soil will increase the production of hermaphrodite flowers. Seed crops are commonly poor in the first year of production. A lack of suitable pollinators has limited seed production in some exotic locations.

Pod ripening is basipetal over several months (90-120 days) and seed dispersal is through explosive apical dehiscence of the pods. Seed ripens sequentially along the inflorescence, starting from the base. Single harvest strategies will therefore result in seed losses from early dehiscing of pods, or varying quantities of unripe seed. Tarpaulins can be laid under seed trees to collect seed as it falls.

**Herbicide effects**

Unknown. Likely to be similar to *Leucaena leucocephala*.

**Strengths**

- Multipurpose tree.
- Fast-drying, high quality fuelwood for small fires/cooking.
- Well-adapted to moderately acid soils and highland tropical environments.
- Highly productive in humid-tropical and highland-tropical locations.
Limitations

- Low in vivo digestibility forage quality due to moderately high concentrations of condensed tannins.
- Cannot be directly grazed by ruminant livestock.

Other comments

Selected references


Internet links

http://www.green.ox.ac.uk/cnrd/tfp40/contents.pdf
http://www.hort.purdue.edu/newcrop/duke_energy/Calliandra_calothyrsus.html
http://www.green.ox.ac.uk/cnrd/african_man.pdf

Cultivars

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Country/date released</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>No cultivars of C. calothyrsus have been formally released.</td>
<td></td>
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Promising accessions

<table>
<thead>
<tr>
<th>Promising accessions</th>
<th>Country</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Patulul’ provenance</td>
<td>Guatemala, collected by ORI, UK</td>
<td>Produced high levels of both leaf and wood in multi-location trials, and also shown to have superior nutritive value.</td>
</tr>
<tr>
<td>‘Bandung’ and ‘Maduin’ landraces</td>
<td>Indonesia, collected by ORI, UK</td>
<td>Produced high levels of both leaf and wood in multi-location trials. Widely distributed to exotic locations.</td>
</tr>
<tr>
<td>‘Embu’ landrace</td>
<td>KARI/ICRAF, Kenya</td>
<td>Closely related to Indonesian landraces.</td>
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</table>

Inflorescence.
Flowers, immature pods, and seeds.
Pollenation by bats of the genus Glossophaga.
Ripening pods (left), and empty pods after dehiscence (right).
Productive in humid tropical locations.

Row plantings with *Brachiaria decumbens* cv. Basilisk.

A multi-purpose small tree.

Hedgerows being used with alley cropping of maize (*Zea mays*).

Heavily grazed plants.

Air-dry; fodder of mixed species, including *Calliandra* being fed to cattle.