Calopogonium caeruleum

Scientific name

Calopogonium caeruleum (Benth.) C. Wright

Synonyms

Basionym: *Stenolobium caeruleum* Benth.

Family/tribe

Family: *Fabaceae* (alt. *Leguminosae*) subfamily: *Faboideae* tribe: *Phaseoleae* subtribe: *Glycininae.*

Morphological description

A twining, perennial legume, with stems up to several metres long, becoming woody with age, rooting at nodes when in contact with moist soil; may be hairy or nearly hairless. Leaves trifoliolate with a long petiole (to 16 cm); leaflets elliptical, ovate or rhomboid ovate, 6–9 cm × 4–6 cm. Lateral leaflets are oblique and pubescent above, velvety pubescent below. The inflorescence is an elongated raceme, up to 50 cm long with many flowers consisting of a bell-shaped, 5-lobed calyx and blue or violet corolla, about 1 cm long. The rachis is furrowed and covered with short hairs. Pod linear-oblong, 4–8 cm × 0.8 cm, straight or curved, beaked, impressed between the seeds, pubescent. Seeds are shiny-brown in colour, 4–5 mm across, orbiculate in shape; 4–8 seeds/pod. 20,000–50,000 seeds/kg.

Similar species

***C. caeruleum*:** Stems, petioles, calyces and pods densely reddish-brown tomentose, the trichomes not individually visible, inflorescences usually >20 cm long; pods 4–8 cm long, 8 mm wide.

***C. mucunoides*:** Stems, petioles, calyces and pods sparsely long-hispid, the trichomes to c. 2 mm long; inflorescences <15 cm long; pods 2–4 cm long, 3.5–5mm wide.

Common names

Asia: thua sealulium (Thailand)

English: caeruleum (= *sky blue*) calopo; jicama (USA)

Latin America: ahorca perro, bejuco culebra, bejuco de lavar, caraotillo, choreque, falso pica-pica, frijol boniato, frijolillo, haba de burro, jícama cimarrona, jíquima, klein kau, mata potrero, namie napirang (Spanish); catinga do macaco, feijão-bravo, feijão-de-macaco, feijãozinho-da-mata (Brazil)

Distribution

Native:

Northern America: Mexico (Chiapas, Colima, Guerrero, Jalisco, Mexico, Michoacán, Nayarit, Oaxaca, Puebla, Querétaro, San Luis Potosí, Tabasco, Veracruz,


Inflorescence and seed pods


Twining, perennial legume trellised for seed production


Lateral leaflets oblique, terminal leaflet symmetrical.

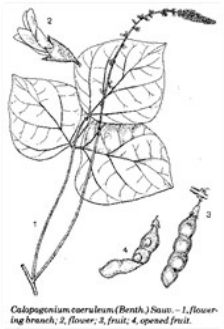

Inflorescence an elongated raceme to 50 cm long with many flowers

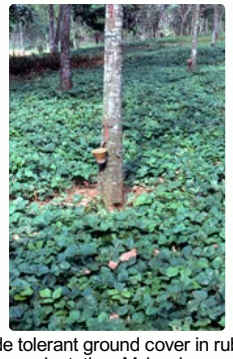

Rachis covered with short hairs


Immature 4-8 seeded, beaked pods


Ripening pods

Seeds


Line illustration


Shade tolerant ground cover in rubber plantation, Malaysia

Yucatán)

Caribbean: Cuba, Hispaniola, Puerto Rico, St. Vincent and Grenadines (St. Vincent), Trinidad and Tobago

Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama

South America: Argentina (Misiones), Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Suriname, Peru, Venezuela

Cultivated/naturalized:

Throughout the humid tropics

Uses/applications

Forage

C. caeruleum has little or no appication as a forage due to its low palatability.

Environment

Green manure crop providing large amounts of dry matter through leaf fall. Cover crop, especially in tropical tree plantations (in SE Asia, often in a mix with other legume species). It forms a dense cover even under trees protecting the soil from erosion, improving soil fertility, and smothering weeds, thereby reducing the need for herbicides.

Ecology

Soil requirements

Adapted to a wide range of soil textures and soils with pH as low as 4.0. Grows best on well-drained soils. Despite its tolerance of low pH, responds to P fertilizer and lime on acid infertile soils.

Moisture

Adapted to the humid tropics with annual rainfall of 1,000–3,000 mm, but will persist in environments with as low as 700 mm rainfall. More drought tolerant than *C. mucunoides* and *Neustanthus phaseoloides*.

Temperature

Prefers tropical environments with 25 ºC maximum and 18 ºC minimum day temperatures, with outer limits of 32 ºC maximum and 10 ºC minimum. Will outperform *C. mucunoides* and *Centrosema molle* in cool conditions.

Light

Productivity is relatively constant at 60–100% light transmission. Will grow productively in mature coconut plantations (60–70% PAR), and is tolerant of heavy shade.

Reproductive development

In the humid tropics, flowers indeterminately through the first wet season, producing seed into the dry season. Capable of producing moderate amounts of seed in the establishment year.

Defoliation

Rarely grazed by cattle and may dominate pastures unless controlled.

Fire

No information available.

Agronomy

Guidelines for establishment and management of sown forages.

Establishment

Usually established from seed, sowing into a cultivated seedbed at the beginning of the wet season. Establishment can be slow and may be improved by addition of P Fertilizer and lime, and by controlling weeds. Current recommendations for cover crop under oil palm in southeast Asia are to seed *C. caeruleum* and *Neustanthus phaseoloides* at 1–1.5 and 5–7.5 kg seed/ha, respectively. Can be established by stem cuttings but low success rates (5% of cuttings) are common. Using older stem material and treating stems with root-promoting hormones can improve success rates. Slower to establish than *C. mucunoides* and *N. phaseoloides* and may take 20 months to achieve a complete cover. As a green manure crop, can be established by broadcasting into upland rice following the final weeding. Mid-season plantings may reduce rice yields.

Fertilizer

Despite its acid soil tolerance, best growth of *C. caeruleum* on an acid, infertile soil in Indonesia was achieved with application of 10.8 t lime/ha and 315 kg triple superphosphate/ha. The critical levels of Al saturation and available P (Olsen) of the soil for *C. caeruleum* were 6.8% and 7 ppm P, respectively. Growth declined at higher Al saturation percentage and lower P concentration.

Compatibility (with other species)

Companion grasses are grazed in preference to *C. caeruleum*, resulting in the dominance of this unpalatable legume.
In species mixtures, *C. caeruleum* eventually dominates, especially under heavy shade, along with *Grona heterocarpa* ssp. *ovalifolium*.

Companion species

Legumes: Planted as a cover crop in southeast Asian plantation agriculture, often in a mixture with one or more of the species *C. mucunoides*, *Centrosema molle*, *Neustanthus phaseoloides* and *Grona heterocarpa* subsp. *ovalifolia*.

Pests and diseases

The fungal pathogens *Cercospora* leafspot, anthracnose and *Rhizoctonia* foliar blight have been identified on *C. caeruleum* in Colombia.

Ability to spread

Will spread from stolons under favourable conditions, rooting at the nodes.

Weed potential

Can become a weed and has invaded seasonally wet tropical environments.

Feeding value

Nutritive value

Top growth has moderate to high nutritive value and contains 13–23% CP. In Nigeria, 6-month regrowth had *in sacco* DMD of 48–55%, CP 13–16%, Ca 2.0–2.25%, P 0.2–0.3%; dry-season values were somewhat lower. In Colombia, leaf material of 6 months old plants contained 18% CP, 1.15% Ca, 0.20% P, 49% IVDMD and no condensed tannins.

Palatability/acceptability

Very low palatability to ruminant livestock. Over an 8-month period of grazing by sheep in a rubber plantation in Malaysia, *Paspalum conjugatum* and other forages rapidly decreased in contribution to DM as they were grazed in preference to *C. caeruleum* which increased its contribution from 5 to 40%. Palatability improves to a limited extent during the dry season, although intake generally remains extremely low. There may be potential to select for improved palatability from within the available germplasm collection. Ensiling may improve palatability.

Toxicity

Appears not to contain compounds toxic to livestock.

Feedipedia link

https://www.feedipedia.org/node/587

Production potential

Dry matter

One of the most productive herbaceous legumes, generally producing yields of 3–7 t DM/ha/year. Produced DM yields of 1–1.5 t/ha/year under mature oil palm (10% light transmission), out-yielding a wide range of common herbaceous legumes. As a green manure crop/mulch, leaf fall from uncut *C. caeruleum* can be as high as 7 t DM/ha/year. In Nigeria, it had the second highest green manure effect on maize yield among 12 legumes tested, providing an N equivalent of about 90 kg/ha.

Animal production

Sheep grazing pastures dominated by *C. caeruleum* under 7-year-old mature rubber at Selangor, Malaysia, gained 99 g liveweight/head/day at a stocking rate of 2 sheep/ha (72 kg/ha/year). The forage availability was <0.6 t/ha. Under immature rubber, early high levels of forage production (2.2 t/ha) supported liveweight gain of 84 g /head/day at a stocking rate of 14 sheep/ha (429 kg/ha per year). Grazing decreased the proportion of palatable species and increased the proportion of *C. caeruleum* from 5 to 40%.

Cattle grazing open guinea grass (*Megathyrsus maximus*)-*C. caeruleum* pastures gained 500 g/head/day over the first 2 years of grazing, but liveweight gains declined to 200 g/head/day as the legume became dominant over the subsequent year.

Genetics/breeding

No breeding programmes are currently being conducted. In field and pot experiments in Colombia, most *C. caeruleum* accessions showed poor adaptation to acid infertile soils and drought, and had problems with diseases, pests and acceptance by cattle. A few accessions, however, showed promise, indicating agronomic and forage quality variation within the species.

Seed production

Produces seed in the first year of growth. In southern Thailand, seed production was increased by basal fertilizer application of monocalcium phosphate, gypsum, potassium sulphate, magnesium, zinc, copper, cobalt and molybdenum at the rates of 205, 40, 330, 60, 14, 4, 0.6 and 1.2 kg/ha, respectively. Seed yield increase was attributed to improved plant survival and increased number of pods per plant.

Herbicide effects

A range of herbicides applied at a spray volume of 400 L/ha was evaluated for control of weeds during the establishment of *C. caeruleum* sown 3–4 cm deep as a cover crop. Oxyfluorfen at 0.3 kg/ha applied in the rows immediately after sowing *C. caeruleum* caused some initial injury but the effect was short-lived. No damage occurred with the herbicides diphenamid at 3 kg/ha, neburon at 2 kg/ha, napropamide at 2 kg/ha, alachlor at 0.5–1 kg/ha and metolachlor at 2 kg/ha. In a separate experiment, imazethapyr at 15–400 g ai/ha provided excellent control of weeds and facilitated rapid establishment of *Neustanthus phaseoloides* and *C. caeruleum* in oil palm plantations.

Poor control of *C. caeruleum* (as a weed) was achieved when mature plants were sprayed with metsulfuron at 10 g/ha and 20 g/ha, glyphosate at 10 g/ha and 20 g/ha, paraquat at 560 g/ha and diuron + paraquat at 560 + 560 g/ha. However, combinations of metsulfuron + glyphosate or paraquat at 10 + 560 g and 20 + 560 g achieved effective control 4 weeks after application.

Fosamine at 0.75–1 kg ai/ha provided excellent suppression of *C. caeruleum* for 8–12 weeks to reduce competition in planting sites for rubber and oil palm. Efficacy depended on the vigour of the plants at the time of spraying.

Strengths

- High DM production.
- Excellent cover crop in humid-tropical tree plantations.
- One of the most shade tolerant tropical legumes.

Limitations

- Essentially unpalatable to grazing livestock.
- Slow to establish.
- Weed potential.

Internet links

https://www.cabi.org/isc/datasheet/14059

https://uses.plantnet-project.org/en/Calopogonium_caeruleum_(PROSEA)

Selected references

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Cultivars

Though commercially available in SE Asia, no cultivar has been released to date.

Promising accessions

CPI 28107 Evaluated in Australia. Poor palatability to cattle in grazing trial in northern Australia.

CIAT 7471, CIAT 8130, CIAT 8511, CIAT 8512, CIAT 8702 Evaluated in Colombia. High yield on acid, infertile ultisol, highest palatability among 38 accessions.