Clitoria ternatea

Scientific name

*Clitoria ternatea* L.

Synonyms

*Clitoria albilora* Mattei  
*Clitoria bracteata* Poir.  
*Clitoria mearnsii* De Wild.  
*Clitoria tanganicensis* Micheli  
*Clitoria zanzibarensis* Vatke

Family/tribe


Common names

butterfly-pea (Australia); blue-pea, cordofan-pea, honte (French); blau Klitorie (German); clitoria-azul (Portuguese); azulejo, conchitis, papito, zapatico de la reina, zapotillo, conchita azul, campanilla, bandera, choroque, lupita, pito de parra, bejuco de conchitas (Spanish); cunha (Brazil).

Morphological description

*C. ternatea* is a vigorous, strongly persistent, herbaceous perennial legume; stems fine twining, sparsely pubescent, suberect at base, 0.5-3 m long. Leaves pinnate with 5 or 7 leaflets; petioles 1.5-3 cm long; stipules persistent, narrowly triangular, 1-6 mm long, subulate, prominently 3-nerved; rachis 1-7 cm long; stipels filiform, to 2 mm long; leaflets elliptic, ovate or nearly orbicular, 1.5-5 cm long, 0.3-3 cm wide, with apex acute or rounded, often notched, and base cuneate or rounded, both surfaces sparsely appressed pubescent. Flowers axillary, single or paired; colour ranges from white, mauve, light blue to dark blue; pedicles 4-9 mm long, twisted through 180° so that the standard is inverted. Bracteoles persistent, broadly ovate or rounded, 4-12 mm long. **Calyx** 1.7-2.2 cm long with a few fine hairs; tube campanulate, 0.8-1.2 cm long; lobes triangular or oblong, 0.7-1 cm long, acute or acuminate. Standard obovate, funnel-shaped, 2-5.5 cm long, 2-4 cm wide, notched or rounded at apex, blue with a pale yellow base, or entirely white, a few fine hairs at apex. Pods linear-oblong, flattened, 4-13 cm long, 0.8-1.2 cm wide, with margins thickened, and style persistent, sparsely pubescent when mature, pale brown, dehiscent when dry. Seeds 8-11/pod, oblong,
somewhat flattened, 4.5-7 mm long, 3-4 mm wide, olive brown to almost black, shiny, often mottled, minutely pitted; 23,000 seeds/kg. Morphology can vary with different growing conditions. Cv. Milgarra, which has no significant distinguishing morphological characters, is normally towards the upper end of the size ranges of descriptions in the taxonomic literature.

Distribution

Native to:
Indian Ocean: Mauritius.

Introduced to:
Now widespread throughout humid and sub-humid lowlands of Asia, the Caribbean, Central and South America, and more recently in semi-arid (600–800 mm) tropical Australia.

Uses/applications

Multiple uses. Originally selected as a cover crop. Widely planted as an ornamental on fencerows. Now used for short and medium-term pastures and as green manure, cover crop and protein bank. Increases soil fertility to improve yields of subsequent crops (maize, sorghum, wheat) when grown as green manure or ley pasture. Also used for cut-and-carry and conserved as hay. Hay suitable for goats in Sudan. Used as a revegetation species on coal mines in central Queensland, Australia. Ornamental and medicinal uses.

Ecology

Soil requirements

Adapted to a wide range of soil types (from sands to heavy clays) of moderate fertility but is extremely well adapted to heavy clay alkaline soils, and especially on clay soils which are too shallow for leucaena (*Leucaena leucocephala*). Adapted to pH 4.5-8.7 but prefers medium to high pH. Some suggested tolerance to salinity, but lower than, for example, siratro (*Macroptilium atropurpureum*).

Moisture
Requires summer rainfall of 500 mm over 3 months but grows best between 700-1,500mm AAR. Drought tolerant and will survive in years which have only 400 mm rainfall and a dry season of 5-6 months or longer even if heavily grazed. Some tolerance of short term flooding but not prolonged inundation or waterlogging.

**Temperature**

Warm (wet) season growth up to 2,000 m in equatorial Africa and to latitude 24ºS. Tolerates average daily temperatures down to 15ºC but not suited to districts with severe or frequent frosts. Production is limited more by low average daily temperatures or a short growing season than by light or even heavy frosts. Will regrow from stems following light frost or from the plant base after heavy frost. Essential to establish mature woody plants prior to frost, some of which will survive, depending on severity of the frost.

**Light**

Normally grown in full sunlight but moderately shade-tolerant, being used as a cover crop in coconut plantations and under rubber.

**Reproductive development**

Flowers can develop in 4-6 weeks after sowing and continue to flower while temperature and moisture are adequate. Flowering can occur throughout the year given sufficient soil moisture and frost-free conditions. Of 58 accessions planted in January at 19ºS, first flowering occurred 7-11 weeks after sowing. Subsequent flowering events overlapped pod set and fill. Predominantly self-fertile but with some out-crossing.

**Defoliation**

Tolerant of heavy rotational grazing, but not constant heavy defoliation. Frequent trampling by cattle will damage the stems. Growing tips and axils of stems must be left to develop new leaves. Because of its high palatability it is better managed as short-term pasture under rotational grazing. Optimum cutting interval of 56 days at heights of 5 or 10 cm for total yield of DM and protein.

It has persisted for 14 years and spread under heavy dry season grazing in infertile vertisols in northwestern Queensland, Australia. For persistence, must be allowed to set seed. In protein bank, cattle should be allowed to graze for only 2-3 hours each day.

**Fire**

Temperature and duration of the fire (governed by fuel load, air temperature, soil moisture and wind) will largely decide survival of butterfly pea after fire. A hot fire has the ability to kill plants completely. Cooler fires may kill some stems, or all above ground material, in which case the plant may reshoot from surviving stems or from the plant base. Fire destroys litter, reduces cover and opens the canopy to light,
which can increase the germination and establishment of both weeds and butterfly pea seedlings.

Agronomy

Guidelines for the establishment and management of sown pastures.

Establishment

Best results are achieved by planting into soil moisture (2-6 cm), in narrow rows (15-50 cm apart) at about 2-4 kg/ha for long-term pastures and about 6 kg/ha for short-term pastures to achieve plant densities of 5-10 plants/m². Excellent results can be achieved when sown as a crop using conventional planters and presswheels to achieve good soil/seed contact. For optimum yield as a green manure crop, use a seeding rate of 12 kg/ha. As a component of grass-legume pastures, can also be planted behind a blade plough or using a "crocodile seeder". Soil temperatures between 16 and 36ºC are required for good establishment. Weed competition will delay establishment but, once established, Clitoria can smother most weeds.

Seed should be inoculated with Tropical Group M rhizobium. Mechanically scarify seed with a high hard seed content (>30%) when soil conditions favour immediate germination, or use unscarified seed with a high hard seed percentage when staggered germination is desired, eg. planting behind a blade plough or when using a crocodile planter. Butterfly pea establishment is considered a much lower risk on heavy textured soils because of the large seed size and greater weed tolerance than alternatives such as leucaena (Leucaena leucocephala). Use of pre-emergent herbicide such as imazethapyr, 2-8 weeks prior to sowing is desirable to achieve successful control of weeds during establishment in old cropping areas.

Fertiliser

Not normally used when sown on suitable soils, but P and S may be required on infertile soils.

Compatibility (with other species)

Rapid climbing growth suggests that Clitoria will combine better with tall and tussock grasses than with creeping ones. It has been used as a leguminous mulch within elephant grass (Pennisetum purpureum) to improve the grass protein levels. When grown together, Clitoria increased total forage protein content and total DM without reducing yield of the grass. Sown as a pure stand as short-term (2-3 year) rotation with crops.

Companion species

Grasses: Has been grown successfully with elephant grass (Pennisetum purpureum), and forage sorghums (Sorghum bicolor) and millets as well as Panicum maximum. Also sown with pangola (Digitaria eriantha).
Factsheet - Clitoria ternatea

http://www.tropicalforages.info/key/Forages/Media/Html/Clitoria_ternatea.html

as a pasture, and Andropogon gayanus and Dichanthium aristatum. It has been grown successfully with Cenchrus ciliarus and Chloris gayana as a revegetation species on coal mines.

Pests and diseases

Fungal leaf diseases (e.g. Cercospora, Colletotrichum, Odium and Rhizoctonia) have been recorded in cool wet weather but rarely as a serious problem. Minor susceptibility to various leaf-eating caterpillars and grasshoppers. Most lines (variably) susceptible to root nematode Meloidgyne incognita.

Ability to spread

Will not spread in grazed pastures. Commonly C. ternatea pastures are sown as pure legume pastures and are progressively invaded by vigorous pasture grasses as soil-N levels build up.

Weed potential

Natural spread is unlikely as the plants are very palatable and the seedlings do not compete well with existing vegetation.

Feeding value

Nutritive value

Excellent nutritive value with high protein and digestibility (up to 80%) with nitrogen concentrations of 3.0% N for leaf and 1.5% N for whole plant. Leaf had consistently low ADF (c. 20%) and high N (c. 4%) in Queensland.

Palatability/acceptability

Very palatable thus requiring grazing management to persist.

Toxicity

Seeds are a strong purgative.

Production potential

Dry matter

1-15 t/ha/yr DM; cv Milgarra yielded 4,200 kg/ha DM after 4 month's growth. Under dryland conditions in the sub-humid tropics, ley pastures of cv. Milgarra in cropping systems generally produce 2-6 t/ha/year DM.

Animal production

Liveweight gains of 0.7-1.3 kg/ha/day recorded for steers grazing pure Clitoria pastures in central Queensland, Australia. In northern Australia, cattle grazing para grass (Brachiaria mutica) and C. ternatea pasture gained 0.68 kg/head/day, a higher gain than for stylo (Stylosanthes) or centro (Centrosema) mixtures with para grass.
Genetics/breeding
Diploid $2n = 16$; largely self-fertile (eg. cv. Milgarra) but some accessions must be at least partially outcrossing as segregating genotypes have been identified within natural populations. Homozygous blue and white and heterozygous blue-flowering genotypes have been identified. Emasculation is easily performed with tweezers to make crosses, however no breeding programs have been conducted.

In Australia, the morphological and agronomic variation of 58 accessions of *C. ternatea* have been described (Reid and Sinclair 1980) and the adaptation and agronomy of introductions in northern Australia have been reported. Accessions have been evaluated for adaptation to cooler, sub-tropical environments and for persistence under grazing.

Seed production
Hand harvest where economical, but can achieve 700 kg/ha by mechanical harvesting methods (direct-heading). Irregular pod maturity affects best time of harvest as some pods will have shattered while flowers and green pods are still present.

Herbicide effects
Herbicides such as bentazone (post-emergence) and imazethapyr (post-planting) are commonly used to control weeds during early establishment in northern Australia. Invading grasses may also be controlled using selective grass killers such as fluazifop or sethoxydim.

Strengths
- Easy to establish, including on heavy clays and surface-crusting soils.
- Palatable and high nutritional value.
- Good for fertility restoration.
- High forage and seed production.
- Moderate tolerance of salinity and sodicity.

Limitations
- Requires moderate fertility soils.
- Requires careful grazing management for persistence.
- Generally requires replanting every 5-8 years due to increasing dominance of invading grasses.

Other comments

Selected references


**Internet links**

http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl?clitoria+ternatea

**Cultivars**

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Country/date released</th>
<th>Details</th>
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<tbody>
<tr>
<td>'Milgarra' (Q 17476)</td>
<td>Australia (1991)</td>
<td>Composite line with CPI 47187 and Q 7006 and the Australian naturalised lines of Q 17401, Q 24717, Q 24718 and Q 24719 as main components with a number of minor components.</td>
</tr>
<tr>
<td>'N 63118'</td>
<td>Sergipe, Brazil</td>
<td>Cultivar used in agronomic trials at Sergipe.</td>
</tr>
<tr>
<td>'SC-134'</td>
<td>Cuba</td>
<td>Cultivar used in Cuban agronomic trials.</td>
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</table>

**Promising accessions**
<table>
<thead>
<tr>
<th>Promising accessions</th>
<th>Country</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>CPI 13844 and CPI 30196</td>
<td>Western Australia</td>
<td>CPI 13844 is a Sri Lankan accession with good basal branching. CPI 30196 is an accession from southern India. Both performed well in agronomic trials in northern Western Australia.</td>
</tr>
<tr>
<td>CPI 47187 and CPI 49963</td>
<td>Queensland, Australia</td>
<td>Highly productive in small plots on vertisols in northeast Queensland, Australia.</td>
</tr>
<tr>
<td>CPI 49706 and CPI 61151</td>
<td>Queensland, Australia</td>
<td>Highest seed yields (1.2 t/ha) of 56 accessions grown in small plots in northern Queensland.</td>
</tr>
<tr>
<td>CPI 72531, CPI 50973, CPI 70337, CPI 37456, Q 4116 and CPI 47187</td>
<td>NSW and Queensland, Australia</td>
<td>Highly productive in small plots on vertisols in subtropical, eastern Australia. Produced up to 2 times the yield of cv. Milgarra in regions with shorter growing seasons due to low temperature. CPI 50973 was also evaluated in South Sulawesi, Indonesia.</td>
</tr>
<tr>
<td>ILCA 9291</td>
<td>Uganda</td>
<td>High yield in subhumid zone of Uganda.</td>
</tr>
<tr>
<td>CAZR I466, 752, 1433 and IGFR I23-1, 12-1, 40-1</td>
<td>Jodhpur, India</td>
<td>Tested as promising in arid zone, Jodhpur, India.</td>
</tr>
<tr>
<td>ILCT 249, 278</td>
<td>India</td>
<td>Best yield and crude protein content of 8 accessions in Indian environments.</td>
</tr>
<tr>
<td>MP 009, ILCA 9281, ILCA 9282</td>
<td>East Africa</td>
<td>Good persistence in semi-humid and semi-arid sites in coastal lowlands.</td>
</tr>
</tbody>
</table>
Axillary flowers and pinnate leaves (5-7 leaflets).
Axillary flower and pod, and pinnate leaves (5-7 leaflets).