Clitoria ternatea L.
Fabaceae

Marina Silalahi

Synonyms

Clitoria albiflora Mattei; *Clitoria bracteata* Poir.; *Clitoria mearnsii* De Wild.; *Clitoria philippensis* Perr.; *Clitoria spectabilis* Salisb.; *Clitoria tanganicensis* Micheli; *Clitoria ternatea* f. *fasciculata* Fantz; *Clitoria ternatea* var. *major* Paxton; *Clitoria ternatea* var. *pleniflora* Fantz; *Clitoria ternatensium* Crantz; *Clitoria zanzibarensis* Vatke; *Deguelia javanica* (Miq.) Taub.; *Derris javanica* Miq.; *Lathyrus spectabilis* Forssk.; *Nauchea bracteata* Dupuis ex Descourt.; *Nauchea ternatea* (L.) Descourt.; *Phaseolus clitorius* Noronha; *Pterocarpus javanicus* (Miq.) Kuntze; *Ternatea indica* J.St.-Hil.; *Ternatea ternatea* (L.) Kuntze; *Ternatea vulgaris* Kunth (POWO 2019)

Local Names

Indonesia: bunga/kembang telang (general), bunga teleng (Balinese), bunga teleng, kembang menteleng (Javanese), bunga biru (Lombok), bunga biru, bunga kelentit (Sumatra), bunga talang, temanraleng (Sulawesi). **Malaysia:** bunga telang, bunga klentik, telang, (general), anchan (Siamese), bunga biru (Ulunese). **Myanmar:** aug-mai-hpyu, aung-me-nyo, pe-nauk-ni. **Philiphines:** samsamping. **Thailand:** anchan (Northeast). **Vietnam:** dậu biếc. **English:** butterfly pea, blue pea (Budiasih 2017; DeFilipps and Krupnick 2008; Imayanti et al. 2019; Luu-dam et al. 2016; Maghirang et al. 2018; Miyaura et al. 2015; Mohammed et al. 2011; Rahayu and Andini 2019; Rak et al. 2019; Rosli et al. 2015).

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Botany and Ecology

***Description*:** Woody vine, twining, attaining 1–3 m in length. Stems slender, cylindrical, with lines of minute trichomes. Leaves alternate, 5–7-foliolate; leaflets opposite, 1.5–4.5 × 1–3.5 cm, elliptical or less frequently ovate or oblong, chartaceous, the apex rounded, obtuse, sometimes retuse or mucronate, the base obtuse, the margins entire; upper surface dark green, dull, puberulent, with the midvein sunken; lower surface pale green, dull, puberulent, with prominent venation; rachis 2–7 cm long; petiolules minute, pubescent; petioles 2–4 cm long, pubescent, with the base thickened; stipels filiform, 1.5 mm long; stipules lanceolate, pubescent, ca. 4 mm long. Flowers solitary, on short peduncles; pedicel 1 cm long, pubescent, with a pair of bracteoles in the middle. Calyx campanulate, 1.5–2.2 cm long, green, puberulent, the lobes lanceolate-ovate, 8–10 mm long, with the midvein conspicuous; corolla blue-violet, the standard broadly ovate, 3.5–5 cm long, retuse, with the base pale yellow and the center pale yellow inside. Legume 9–11 × 1 cm, oblong, ribbed along both margins, the apex acuminate. Seeds numerous, 5–6 mm long, oblong, flattened, dark brown (Acevedo-Rodríguez 2005) (Fig. 1).

***Phenology*:** *Clitoria ternatea*, flowering and fruiting throughout the year (Acevedo-Rodríguez 2005).

***Distribution and habitat*:** In disturbed areas, such as pastures or roadsides. Native to Africa but found widely distributed throughout the tropics and subtropics of the New World (Acevedo-Rodríguez 2005).

Fig. 1 Leaves and flower of *Clitoria ternatea* L. (Fabaceae). (Photo © Devanathan Krishnamoorthy)

Local Medicinal Uses

Indonesia: Flowers are used to make baby's eyes clear by the Betawi ethnic people (Marpaung 2020). Flowers are also used to treat eye infection by local communities in Lombok (Eni et al. 2019) and Bali (Oktavia et al. 2017), and to treat abscess by Sesaot forest West Lombok (Rahayu and Andini 2019). The Togian ethnic community in Center Sulawesi use the leaves to treat fever and the flowers to treat abscess (Tabeo et al. 2019). **Malaysia:** The Siamese community in Kelantan use whole plant uses to treat infections, burning sensation, urinary tract disorder, edema, antidote, tumor, snake bite, indigestion, cough, headache, eye diseases, and arthritis (Rak et al. 2019). **Myanmar:** The powder of whole plant and the powder of *Aristolochia indica* are mixed and administered internally to neutralize snake venom. Crushed leaf is placed on abscess on the tip of the finger and bound with moist bandage to treat infection. Root mixed with roots from other medicinal plants is used to prepare medicines to treat edema. Roots are also roasted, made into a powder, and taken with warm water to treat inflammation of the liver, inflammation of the spleen and general edema. Used in making medicines to prevent miscarriage and to treat lumps on the throat, passing and hemorrhaging of blood, vitiligo, and cataracts. Juice from the male root is taken with cold milk to treat chronic coughing. Bark root is used as purgative and diuretic. Flowers are crushed together with milk and the extract is used to paint circles around the eyes to treat sore eyes associated with infant diseases. Fruit juice from the green fruit can be dropped into nostrils to cure migraines. Seeds used to treat inflammation of the testes and hiccups (DeFilipps and Krupnick 2008). **Vietnam:** K'Ho-Cil people in Lam Dong province use the whole part for relieving constipation and for the treatment of diarrhea (Nguyen et al. 2020).

Phytochemistry

Leaves: Leaves contain β-sitosterol, kaempferol-3-monoglucoside, kaempferol-3-rutinoside, kaempferol-3-neohesperiodoside, kaempferol-3-O-rhamnosyl-(1,6)-glucoside, kaempferol-3-O-rhamnosyl-(1,6)-galactoside, and kaempferol-3-O-rhamlnosyl-(1,2)-Ochalmnosyl-(1,2)-O-[rhamnosyl-(1,6)]-glucoside (Morita et al. 1977). The leaves of white flowers have higher anthocyanin than blue flower leaves (Jayachitra and Padma 2010). **Flowers:** Flowers contain tannin, phlobatannin, carbohydrate, saponin, triterpenoid, phenol, flavonoid, flavanol, glycosides, proteins, alkaloids, anthraquinones, anthocyanins, cardiac glycosides, stigmast-4-ene-3,6-dione, essential oils, and steroids (Al-Snafi 2016). The concentration of anthocyanin is higher in fresh flower extract than the processed powder. The boiling of the flowers causes anthocyanin degradation (Purwaniati and Yuliantini 2020). The glycoside flavanol from flowers are kaempferol 3-O-(200-O-a-rhamnosyl-600-O-malonyl)-β-glucoside, quercetin 3-O-(200-O-a-rhamnosyl-600-O-malonil)-β-glucoside, and myricetin 3-O-(200.600-di-O-a-rhamnosyl)-β-glucoside (Kazuma et al. 2003). The flower yields compounds of delphinidin derivative such as ternatin B3, ternatin D3, rutin, quercetin 3-O-dirhamnoside, manghaslin quercetin 3-[2G]-rhamnosylrutinoside, ternatin B2,

ternatin B4, ternatin C2, and ternatin D1 (Nair et al. 2015). **Seeds:** The ethanol extract of seeds contain sterols, alkaloids, glycosides, saponins, tannins, carbohydrates, proteins, phenolic compound, and flavonoids (Kalyan et al. 2011). Antifungal proteins with a molecular mass of 14.3 kDa have been isolated from *C. ternatea* seeds (Ajesh and Sreejith 2014). **Roots:** The roots contain the norneolignan compounds clitorienolactones A–C, triterpenoid, and taraxerol (Vasisht et al. 2016).

Clitorienolactones A and B enhance memory and inhibit acetylcholinesterase (Vasisht et al. 2016). (Z)-9,17-octadecadienal and n-hexadecenoic acids inhibit monoamine oxidase, therefore they have potential against antidepressant, anxiety, and cognitive disorders in Alzheimer's and Parkinson's diseases (Margret et al. 2015). The alcohol extracts of aerial part and roots of *C. ternatea* increase rat brain acetylcholine content and acetyl cholinesterase activity like pyritinol (standard cerebrum protective drug) (Taranalli and Cheeramkuzhy 2000). *C. ternatea* root water extract was administered at a dose of 100 mg/kg for 30 days for neonatal rats and young adults, significantly increasing the acetylcholine content in hippocampi compared to controls (Rai et al. 2002). Flavanol glycosides 3,5,4′-trihydroxy-7-methoxyflavonol-3-O-β-d-xylopyranosyl-(1,3)-O-β-d-galac topyranosyl (1,6)-O-β-d-glucopyranoside have antimicrobial activity (Yadava and Verma 2003), while delphinidin and malvidin have activities inhibiting various types of cancers (Morris 2009). *C. ternatea* seed protein inhibits growth of microbes such as *Micrococcus luteus, Cryptococcus neoformans, Cryptococcus albidus, Cryptococcus laurentii, Candida albicans, Candida parapsilosis*, *Curvularia* sp., *Alternaria* sp., *Cladosporium* sp., *Aspergillus flavus*, *Aspergillus fumigatus, Aspergillus niger, Rhizopu*s sp., and *Sclerotium* sp. (Ajesh and Sreejith 2014). Leaf extract inhibits growth and morphogenesis of *Aspergillus niger* with a minimum inhibitory concentration (MIC) of 0.8 mg/mL and minimum concentration fungicide (MCF) of 1.6 mg/mL (Kamilla et al. 2009).

Local Food Uses

Indonesia. The Sidoarjo community in East Java province use flowers as food coloring and nutraceutical (Imayanti et al. 2019). **Malaysia.** Some communities in Malaysia use flowers as natural dyes to prepare traditional or local dishes, i.e., *nasi kerabu* and *kueh tekan* (Ezzudin and Rabeta 2008; Rosli et al. 2015). The *nasi kerabu* is traditional Malay cuisine in Kelantan, while the *kueh tekan* is a traditional dessert for local people in Batu Pahat, Johor (Ganesan et al. 2019). **Philippines.** The local communities in Palawan use the legume as a mixture in traditional food called *dinengdeng,* while flowers are used in salad (Maghirang et al. 2018). **Vietnam.** The local communities in Northern Vietnam use flowers as food coloring for sticky rice dishes (Luu-dam et al. 2016).

Biocultural Importance

Indonesia: The Bali Aga use *C. ternatea* flowers for offerings (*canang*) in religious ceremonies (Miyaura et al. 2015) and is a symbol of the vagina of a woman's body (Wijana et al. 2019).

Economic Importance

Indonesia. *C. ternatea* flowers have been traded as natural food coloring agents (Imayanti et al. 2019) and materials for religious ceremonies. **Thailand:** The local community in Nam Nao National Park uses *C. ternatea* flowers as ornament and food coloring; flowers are sold in the local market (Jarernsuk et al. 2015). The flowers have been used as a source of purple dyes in the textile industry for coloring cotton and silk in Northeast Thailand (Junsongduang et al. 2017).

References

Acevedo-Rodríguez P. Vines and climbing plants of Puerto Rico and the Virgin Islands. Contr US Nat Herb. 2005;51:254–5.

Ajesh K, Sreejith. A novel antifungal protein with lysozyme-like activity from seeds of *Clitoria ternatea*. Appl Biochem Biotechnol. 2014;173:682–93. https://doi.org/10.1007/s12010-014-0880-8.

Al-Snafi AE. Pharmacological importance of *Clitoria ternatea* – a review. IOSR J Pharm. 2016;6 (3):68–83.

Budiasih KS. Kajian potensi farmakologis bunga telang (*Clitoria ternatea*). Prosiding Seminar Nasional Kimia, FMIPA, UNY, Indonesia. 2017. p. 201–206. (in Bahasa).

DeFilipps RA, Krupnick GA. The medicinal plants of Myanmar. PhytoKeys. 2008;102:1–341. https://doi.org/10.3897/phytokeys.102.24380.

Eni NNS, Sukenti K, Aida M, Rohyani IS. Studi etnobotani tumbuhan obat masyarakat komunitas Hindu Desa Jagaraga, Kabupaten Lombok Barat, Nusa Tenggara Barat. Biotropika. 2019; 7(3):121–8. (in Bahasa).

Ezzudin MR, Rabeta MS. A potential of telang tree (*Clitoria ternatea*) in human health. J Food Res. 2008;2(5):415–20.

Ganesan S, Sabran SF, Mazlun MH. Plant diversity assessment and traditional knowledge documentation of home gardens in Parit Raja, Batu Pahat, Johor. IOP Conf Ser Earth Environ Sci. 2019;269:012018. https://doi.org/10.1088/1755-1315/269/1/012018.

Imayanti RA, Rochmah Z, Aisyah SN, Alfaris MR. Pemberdayaan masyarakat dalam pengolahan Bunga telang di Desa Panggreh Kecamatan Jabon. Kabupaten Sidoarjo: CIASTECH; 2019. p. 77–82.

Jarernsuk S, Dadookain K, Jongjitvimol T. Economic value and utilization of biodiversity in local communities at Nam Nao National Park, Phetchabun Province. NU Int J Sci. 2015;12(2):1–12.

Jayachitra A, Padma PR. Non-enzymic antioxidant activity of *Clitoria ternatea* leaf extracts in vitro. Biosci Biotechnol Res Asia. 2010;7(1):209–18.

Junsongduang A, Sirithip K, Inta A, Nachai R, Onputtha B, Tanming W, Balslev H. Diversity and traditional knowledge of textile dyeing plants in Northeastern Thailand. Econ Bot. 2017;71 (3):241–55.

Kalyan BV, Kothandam H, Palaniyappan V, Praveen AR. Hypoglycaemic activity of seed extract of *Clitoria ternatea* Linn in streptozotocin-induced diabetic rats. Phcog J. 2011;3(19):45–8.

Kamilla L, Mansor SM, Ramanathan S, Sasidharan S. Effects of *Clitoria ternatea* leaf extract on growth and morphogenesis of *Aspergillus niger*. Microsc Microanal. 2009;15:366–72. https://doi.org/10.1017/S1431927609090783.

Kazuma K, Noda N, Suzuki M. Malonylated flavonol glycosides from the petals of *Clitoria ternatea*. Phytochemistry. 2003;62:229–37.

Luu-dam NA, Ninh BK, Sumimura Y. Ethnobotany of colorant plants in ethnic communities in Northern Vietnam. Anthropology. 2016;4:158. https://doi.org/10.4172/2332-0915.1000158.

Maghirang RG, Oraye CD, Antonio MA, Cacal MS. Ethnobotanical studies of some plants commonly used as vegetables in selected provinces of the Philippines. J Nat Stud. 2018;17 (2):30–43.

Margret AA, Begum TN, Parthasarathy S, Suvaithenamudhan S. A strategy to employ *Clitoria ternatea* as a prospective brain drug confronting monoamine oxidase (MAO) against neurodegenerative diseases and depression. Nat Prod Bioprospect. 2015;5:293–306. https://doi.org/10.1007/s13659-015-0079-x.

Marpaung AM. Tinjauan dan manfaat bunga telang (*Clitoria ternatea* L.) bagi kesehatan manusia. J Funct Food Nutraceutical. 2020;1(2):1–23. (in Bahasa).

Miyaura R, Ohno T, Maenaka H, Sumiartha K, Yamaguchi H. A particular silhouette of human-influenced coconut trees in Hindu Bali, Indonesia: an ethnobotanical field note. Ethnobot Res Appl. 2015;14:405–21.

Mohammed S, Zin NM, Wahab HA, Ibrahim P, Sulaiman SF, Zahariluddin ASM, Noor SSM. Antituberculosis potential of some ethnobotanically selected Malaysian plant. J Ethnopharmacol. 2011;133:1021–6.

Morita N, Arisawa M, Nagase M, Hsu H, Chen Y. Studies on the constituents of *Formosan leguminosae.* I. The constituents in the leaves of *Clitoria ternatea* L. Yakugaku Zasshi. 1977;97:649–53.

Morris JB. Characterization of butterfly pea (*Clitoria ternatea* L.) accessions for morphology, phenology, reproduction and potential nutraceutical, pharmaceutical trait utilization. Genet Resour Crop Evol. 2009;56:421–42. https://doi.org/10.1007/s10722-008-9376-0.

Nair V, Bang WY, Schreckinger E, Andarwulan N, Cisneros-Zevallos L. Protective role of ternatin anthocyanins and quercetin glycosides from butterfly pea (*Clitoria ternatea* Leguminosae) blue flower petals against lipopolysaccharide (LPS)-induced inflammation in macrophage cells. J Agric Food Chem. 2015;63:6355–65.

Nguyen XMA, Bun SS, Ollivier E, Dang TPT. Ethnobotanical study of medicinal plants used by K'Ho-Cil people for treatment of diarrhea in Lam Dong Province, Vietnam. J Herb Med. 2020;19:100320. https://doi.org/10.1016/j.hermed.2019.100320.

Oktavia GAE, Darma IDP, Sujarwo W. Studi etnobotani tumbuhan obat di kawasan sekitar danau Buyan-Tamblingan, Bali. Bull Kebun Raya. 2017;20(1):1–18. (in Bahasa).

POWO. Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. 2019. http://www.plantsoftheworldonline.org/

Purwaniati AAR, Yuliantini A. Analysis of total anthocyanin content in telang flowers preparations (*Clitoria ternatea*) with pH differential method using visible spectrophotometry. Farmagazine. 2020;7(1):18–23.

Rahayu SM, Andini AS. Ethnobotanical study on medicinal plants in Sesaot Forest, Narmada, West Lombok, Indonesia. Biosaintifika. 2019;11(2):234–42.

Rai KS, Murthy KD, Karanth KS, Nalini K, Rao MS, Srinivasan KK. *Clitoria ternatea* root extract enhances acetylcholine content in rat hippocampus. Fitoterapia. 2002;73:685–9.

Rak AE, Tharmadurai K, Khanam Z, Omar SAS, Appalasamy S. Diversity of plants species abundantly consumed in traditional practice of Siamese community of Kelantan, Malaysia. Int Conf Adv Sci Innov. 2019; https://doi.org/10.4108/eai.18-7-2019.2288671.

Rosli N, Ismail Z, Lepun P. Plants used as natural dye by the Orang Ulu ethnics in Asap Koyan Belaga Sarawak, Malaysia. Int J Curr Res. 2015;7(8):19770–5.

Tabeo DF, Ibrahim N, Nugrahani AW. Etnobotani Suku Togian di Pulau Malenge Kecamatan Talatako, Kabupaten Tojo Una-Una, Sulawesi Tengah. Biocelebes. 2019;13(1):30–7. (in Bahasa).

Taranalli AD, Cheeramkuzhy TC. Influence of *Clitoria ternatea* extracts on memory and central cholinergic activity in rats. Pharm Biol. 2000;38(1):51–6.

Vasisht K, Dhobi M, Khullar S, Mandal SK, Karan M. Norneolignans from the roots of *Clitoria ternatea* L. Tetrahedron Lett. 2016;57:1758–62.

Wijana N, Rahmawati PI, Setiawan GAN, Mulyadiharja S. Plants of body symbols in tri mandala Tenganan Pegringsingan Village, Karangasem (in ethnobotany learning perspective). Int J Nat Sci Eng. 2019;3(1):1–11.

Yadava RN, Verma V. Antimicrobial activity of a novel flavonol glycoside isolated from the roots of *Clitoria ternatea* Linn. Asian J Chem. 2003;15:842–6.