



THE PHARMACOGNOSTIC, PHYTOCHEMISTRY, AND PHARMACOLOGICAL PROFILE OF *Clitoria Ternate* (SHANKA PUSHPHI)

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ABSTRACT

The butterfly pea flower (*Clitoria ternatea*) is a widely cultivated species found in numerous Asian nations. Mainly found in tropical areas; this species originated in tropical Asia, and has since spread to various areas, including South and Central America, the East and West Indies, China, and India, where it has become established as a naturalized species. The roots, Seeds and leaves of this plant are of medicinal importance. The plant is reputed for its folkloric uses in Various diseases. The above-ground parts of the plant showed various effects on the central nervous system of mice, including properties that reduce anxiety and act as antidepressants. Alkaloids, proteins, alkaloids, anthraquinone, anthocyanins, cardiac glycosides, triterpenoids, phenols, tannins, phlobatannin, carbohydrates, saponins, Stigmast-4-ene-3,6-dione, volatile oils, and steroids were all present in *Clitoria ternatea*.

Key words:

Clitoria ternate, blue pea, Aparajita, Phlobatannin, Medha rasayana, Shanka pushphi

INTRODUCTION:

The butterfly pea flower (*Clitoria ternatea*) is a widely cultivated species found in numerous Asian nations. This perennial, climbing herbaceous plant is part of the Fabaceae family and the Papilionaceae sub-family^[1]. Mainly found in tropical areas; this species originated in tropical Asia^[2], and has since spread to various areas, including South and Central America, the East and West Indies, China, and India, where it has become established as a naturalized species. *Clitoria Ternatea* is widely spread over many countries, It is also known by many common names. For Malaysia it is 'bunga telang', while in Konkani it is 'shankhapushpa' and 'gokarna' blue-Pea, cunha (Brazil), pokindong (Philippines), Kordofanpea (Sudan), Kokkattan (Tamil), Aparajita (Bengali) and also Aparajit in Hindi^[3]. The roots, Seeds and leaves of this plant are of medicinal importance. The plant is reputed for its folkloric uses in Various diseases^[4]. The above-ground parts of the plant showed various effects on the central nervous system of mice, including properties that reduce anxiety and act as antidepressants^[5]. Alkaloids, proteins, alkaloids, anthraquinone, anthocyanins, cardiac glycosides,

triterpenoids, phenols, tannins, phlobatannin, carbohydrates, saponins, Stigmast-4-ene-3,6-dione, volatile oils, and steroids were all present in *Clitoria ternatea*^[6]. In Ayurvedic medicine, *Clitoria ternatea* has long been used to treat a variety of illnesses. Its roots are used to cure skin conditions, eye disorders, fever, arthritis, constipation, indigestion, and sore throats; its seeds are used as a laxative to treat swollen joints and colic^[7].

HISTORY:

Since ancient times, Shankpushpi has been a highly esteemed herb in Ayurveda, known for its traditional uses as a mild laxative, nerve tonic, and brain tonic to traditional Ayurvedic scriptures, it is categorized as a Medhya Rasayana, a group of revitalizing herbs that are known to improve cognition and memory.

The name Shankpushpi comes from the fact that its blossoms resemble conch shells, which are called "Shankha" in Sanskrit. This herb is highly regarded in Ayurvedic literature for its Medhya (cognitive-enhancing) qualities and is frequently used to treat Manasika Roga^[8]

CLASSIFICATION:

TAXONOMIC RANK	CLASSIFICATION
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Fabales
Family	Fabaceae
Genus	Clitoria
Species	ternate.L

Table 1: Taxonomical classification of clitoria ternate ^[9]**PHARMACOGNOSY:****Macroscopic characters:**

PARAMETER	DESCRIPTION
Size	Length: 5-20 cm width: 5-10mm
Colour	Deep blue to purple and some varieties also have white, light blue and pink flowers also
Texture	Smoothy with hair texture
Odour	Bitter taste

Table 2: Description Of Clitoria Plant ^[10]**Figure 1: Clitoria Ternate. L** ^[3]**Microscopical characteristics:**

It consists of secondary cortex, periderm, cortex, vascular tissue, phloem, xylem. The cuticle covering the top epidermis has thick walls. Tangentially elongated cells that measure 9.60cm to 19.20m in length and 7.20 to 12.00 m in width make up the single layered epidermis. ^[11] It is broken up by two types of uniseriate, bicellular, non-glandular trichomes. The upper layer is single layered epidermis. 10 to 12 rows of polygonal cells with thin walls makes the secondary cortex filled with the calcium oxalate crystals.

PHYTOCHEMISTRY:

Numerous metabolites are found in the clitoria ternate including glycosides, flavonoids, tannins, saponins, anthocyanins, and triterpenoids ^[17]

Flavonoids: Petroleum ether, ethyl acetate, methanol, and aqueous extracts have total flavonoid concentrations of 132.17, 86.52, 73.48, and 23.48 µg QE/mg of extract, respectively. Using the DPPH assay method, the extracts of Clitoria ternatea flowers were tested for antioxidant activity, and strong antioxidant activity was found ^[14]

Tannins: Tannins are polyphenolic compounds from plants that consist of two or three phenolic hydroxyl groups attached to a phenyl ring, they have large molecular size. Numerous studies have identified various anticancer properties associated with tannins ^[15]

Anthocyanins: Polar solvents are used to extract anthocyanins due to their aptitude for doing so. A lower pH was discovered to be ideal for anthocyanin extraction [26, 27]. The color of anthocyanin shifts from acid to base based on pH. ^[24]

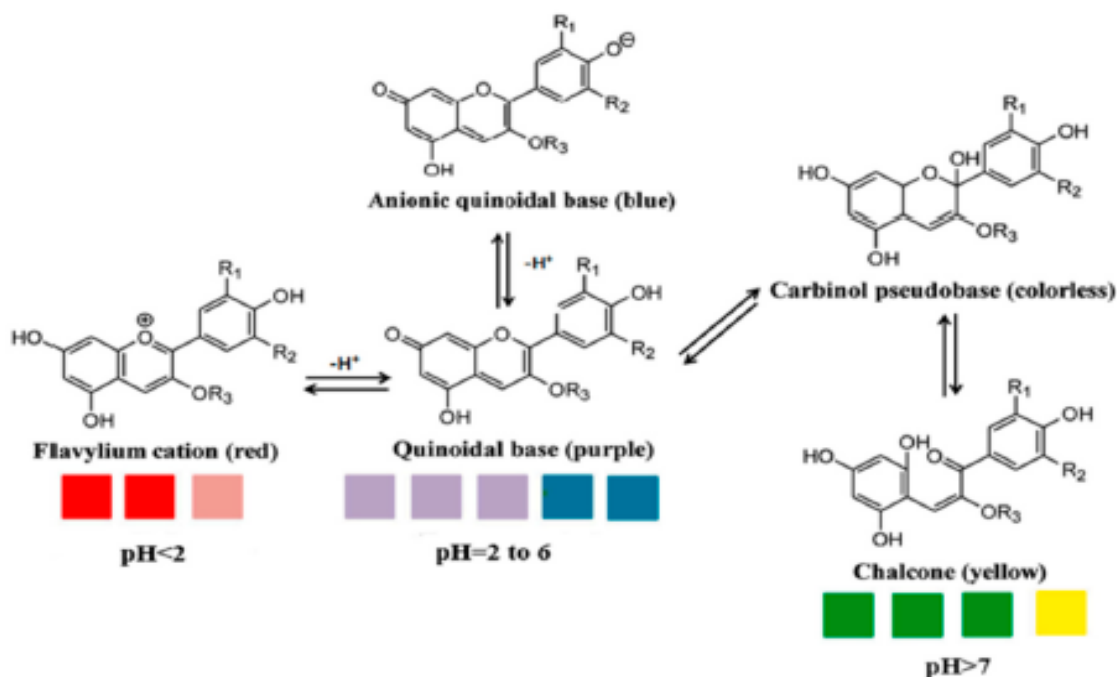


Figure :2 Anthocyanins At Varying pH^[16]

PHARMACOLOGY:

Diuretic Activity:

The diuretic efficacy of ethanol extract and powdered dried whole root was assessed, and only one intravenous dose of extract produced No change in urine volume, but a moderate rise in Na and K excretion and a fall in Cl.^[18]

Antioxidant activity: Antioxidants are the agents that can decrease oxidative stress.⁴⁶ The excessive production and/or inadequate elimination of reactive oxygen species (ROS) and reactive nitrogen species (RNS) is known as oxidative stress. The human body produces ROS, which are chemically active molecules that include oxygen.^[19]

Effect of Clitoria ternatea on general behavior:

The ethanol extract derived from the root of Clitoria ternatea shows notable neuropharmacological properties^[21]

Antimicrobial activity:

It has ability to reduce the occurrence of infectious diseases in humans and animals alike.⁴⁷ Extracts show broad-spectrum antibacterial and antifungal properties. Particularly effective against *E. coli*, *Staphylococcus aureus*, and *Candida albicans*^[28] There is a possibility that medicinal plants possess natural antibacterial properties.^[22]

Anthelmintic actions:

Agents that can kill the helminth parasites are called anthelmintic agents.⁴⁸ The crude alcoholic extract of CT and its methanol and ethyl acetate fractions demonstrated paralytic effects and also caused the death of worms, especially at concentrations exceeding 50 mg/ml, unlike

piperazine citrate, which is the standard reference. The inhibitory effect of CT leaves on free-living nematodes was evaluated using aqueous and methanol extracts.^[31]

Antibacterial effect:

The extract obtained using methanol had a significant impact on the function of *Bacillus cereus*, followed closely by *Klebsiella pneumonia*, *Proteus vulgaris*, and *Salmonella typhi*. The ethanolic leaf extract from *Clitoria ternatea* Linn demonstrated antibacterial properties against *Serratia marcescens*, *Arthrobacter chlorophenolicus*, and ESBL-producing pathogens related to enteric and urinary infections. The methanol extract of *Clitoria ternatea* exhibited a stronger antibacterial effect compared to other types of extracts.^[32]

MEDICINAL VALUE:

1. Antioxidant activity: The root extracts of *clitoria ternate* have some anti-oxidant activity have some properties on white and blue flowers. High antioxidant activity was demonstrated by biologically produced MgO-NPs from *C. ternatea* floral extracts.^[12] The plant contains high levels of flavonoids and anthocyanins (ternatins), which serve as effective free radical scavengers.^[29]

2. Central Nervous Effect Clitoria ternatea:

Ternatea extracts demonstrate encouraging outcomes in enhancing memory and cognitive abilities, displaying notable anxiolytic, antidepressant, and CNS-depressant effects. Research indicates that these extracts can increase acetylcholine levels in the hippocampus, resulting in better learning and memory performance.^[20]

3. Wound healing effect:

Agents that heal the wound quickly are called wound healing agents.⁴⁹ Extracts derived from the seeds and roots of *Clitoria ternatea* greatly enhanced wound healing in excision, incision, and dead-space models when given orally through gavage or applied as a topical ointment. The healing effects were similar to those seen with cotrimoxazole ointment.^[26]

4. Nootropic (cognitive enhancer):

Clitoria is rich in flavonoids and anthocyanins, which promote memory enhancement and cognitive performance. Traditionally utilized in Ayurveda as *medha rasayana*, or a brain tonic.^[27]

5. Antidiabetic activity:

Agents that reduce the blood sugar levels are called antidiabetic agents.⁵⁰ Methanolic extracts notably lower blood sugar levels in diabetic rats. shows properties that combat diabetes as a result of its capacity to lower blood sugar levels and improve insulin secretion.^[30]

MISCELLANEOUS:

Toxicity: CT is reported to be non-lethal up to 3 g/kg, p.o in mice and 1 g/kg (hydroalcoholic extract of CT seed and alcoholic extract of CT root) in rats [31,60,84]. Ethanolic extract of aerials parts and root of CT led to slethargy in mice at the doses of 1500 mg/kg and above, orally^[31]. Ptoxis was seen above 2000 mg/kg dose in mice. Through the intraperitoneal route, 2900 mg/kg dose was lethal within 6 hr due to severe CNS depression.^[13]

Anti-allergy: Butterfly pea flower extract has shown potential in reducing allergic responses and suppressing cough in animal studies. Its effects are mediated through the downregulation of pro-inflammatory cytokines IL-1 β and IL-6, which are key mediators in the immune response. These cytokines contribute to the transformation of respiratory epithelial cells into mucus-producing goblet cells, a hallmark of chronic respiratory conditions.^[23]

Interactions: High-Fat Meals*: Taking *Clitoria ternatea* flower extract alongside high-fat meals may assist in reducing postprandial lipemia and enhancing plasma antioxidant levels. Research indicated that overweight and obese individuals who ingested 1g or 2g of *Clitoria ternatea* extract with a high-fat meal showed decreased levels of serum triglycerides and free fatty acids.^[45]

MARKET VALUE:

Increased selling value: Butterfly pea flower-based herbal tea products are far more valuable than fresh flowers. Compared to fresh blooms, which are normally sold in small quantities at extremely low prices, a 50-gram packet of dried butterfly pea flower tea typically costs about Rp 50,000.^[25]

SUMMARY TABLE: [33-44]

S. NO	PLANT PART	ACTIVITY	EXTRACT	MODEL	STANDARD DRUG	DOSE	PARAMETER	MECHANISM	P VALUE	AUTHOR YEAR	REFERENCE
1	Root	Antipyretic	Methanolic	Yeast-induced pyrexia in rats	Paracetamol	200-400 mg/kg	Body temperature reduction	Antioxidant activity	p < 0.05	B. Parimala Devi et al., 2000	33
2	Root	Antipyretic	Methanolic	Yeast-induced pyrexia in rats	Paracetamol	200-400 mg/kg	Rectal temperature	Prostaglandin inhibition	Significant	Murugesan T et al., 2004	34
3	Leaves and Flowers	Antidiabetic	Aqueous	Alloxan-induced diabetic rats	Glibenclamide	400 mg/kg	Serum glucose, insulin, glycosylated hemoglobin, liver and muscle glycogen, glucokinase and glucose-6-phosphatase activities	Enhancement of insulin secretion and glycogen synthesis	p < 0.05	P. Daisy & M. Rajathi, 2009	35
4	Leaves	Antidiabetic	Ethanolic	Streptozocin-induced diabetic rats	Metformin	200 mg/kg	Serum glucose, insulin, antioxidant enzymes (SOD, CAT), lipid peroxidation (MDA), glycogen content	Antioxidant and insulin-mimetic effects	p < 0.05	Karuna A. Talpate, 2013	36
5	Leaves	Analgesic	Methanolic	Acetic acid-induced writhing in mice	Diclofenac Sodium	200–400 mg/kg	Writhing inhibition (%)	Central nervous system depression	p < 0.05	Shammy Sarwar et al., 2014	37
6	Leaves	Analgesic	Methanolic	Tail flick method in rats	-	100–400 mg/kg	Pain threshold latency	CNS depressant activity	p < 0.001	Manisha Bhatia et al., 2014	38

7	Leaf & Root	Antinociceptive	Methanolic	Hot plate, tail flick, formalin tests	Morphine	100/400 mg/kg	Paw licking time, latency response	Opioid receptor-mediated central analgesia	p < 0.05, 0.001	Linggam Kamilla et al., 2014	39
8	Root	Memory Enhancing	Hydroalcoholic	Morris water maze	Donepezil	100-200 mg/kg	Escape latency	Cholinergic modulation	<0.05	Dhanasekaran et al., 2017	42
9	Leaf	Antidiabetic, Hypolipidemic	Ethanolic	Streptozocin-induced diabetic rat	Glibenclamide	400 mg/kg	Glucolipid profile, antioxidant enzyme	Insulin sensitisation, lipid metabolism modulation	Significant	Kavitha R., 2018	43
10	Aerial Parts	Antidepressant	Ethanolic	Forced swim test	Fluoxetine	100-200 mg/kg	Immobility time	Monoaminergic modulation	<0.05	Natarajan P. et al., 2018	44
11	Root	Nootropic	Hydroalcoholic	Chronic cerebral hyperperfusion, rat dementia model	None	200, 300 mg/kg	Morris maze	Decreases AChE, neuroprotective effect	<0.05	Thenmoly Damodaran et al., 2020	41
12	Flower	Anti-obesity, Antioxidant	Aqueous	High fat, high fructose diet in mice	Not specified	0.25-2% w/w	Lipid profile, oxidative stress markers	Reverse cholesterol transport, antioxidant activity	Significant	Wang Yijun et al., 2022	40

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