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A Review On The Clitoria Ternatea Linn;A Medical Climber Of India

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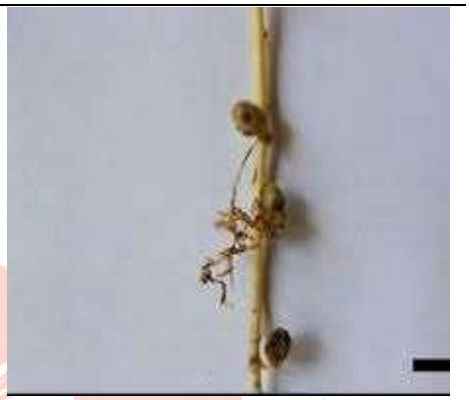
- ***Abstract:*** Owing to its abundant physiologically active compounds, this plant is often employed in traditional healing practices. Both its aerial and subterranean parts are used to address conditions such as dyspepsia, diabetes, hypertension, retinal damage, and swelling. Research has shown that flower extracts from Clitoria ternatea possess cytotoxic, antibacterial, antioxidant, anti-inflammatory, and antidiabetic effects that benefit human health. The flowers of Clitoria ternatea are both safe and effective, offering a diverse array of therapeutic applications, making them compelling candidates for functional food development. Clitoria has produced various primary and secondary metabolites, including clitorin, aparagitin, triterpenoids, anthocyanins, steroidal glycosides, and flavonols. This article reviews many of the pharmacological benefits of Clitoria ternatea, highlighting its hepatoprotective, cytotoxic, antiplatelet, anticonvulsant, antianxiety, antistress, antioxidant, anti-inflammatory, hyperlipidemic, antidiabetic, analgesic, and nootropic properties. Clitoria ternatea presents a potential source of therapeutic compounds for managing multiple health issues based on its established efficacy.

- ***Keywords*** *: clitoria ternatea, antimicrobial ,Ayurveda ,Pharmacological properties phytochemicals,traditional*

• INTRODUCTION

Clitoria ternatea is a plant that falls under the fabaceae family and is commonly found in various countries. There are 58 species of Clitoria ternatea distributed globally, including locations like India, Sri Lanka, Malaysia, the Philippine Islands, Australia, Indonesia, South Africa, and surrounding areas in the Indian Ocean. The Ayurvedic system of medicine, one of the oldest medicinal practices, has been utilized for centuries in India. Clitoria ternatea is a prominent Ayurvedic remedy employed for treating a range of ailments. In Hindi, it is commonly referred to as Aparajita and Koyal, while in English, it is known as butterfly pea. The seeds typically take about 1-2 weeks to germinate, with flowering occurring roughly 4 weeks after germination. The blue coloration of the butterfly pea flowers is indicative of the presence of anthocyanins. This plant is notable for having beneficial effects on the body from all its parts. The flowers are rich in polyacylated anthocyanins and flavonol glycosides known as ternatins. The blue tint of Clitoria ternatea flowers is often used as a natural coloring agent in various culinary preparations. The flowers offer health benefits, including antioxidant properties, antidiabetic effects, anti-inflammatory characteristics, anticancer properties, antimicrobial effects, antibacterial properties, and insecticidal capabilities.

- **Plant Description:**

• PLANT DESCRIPTION		
Plant Parts	**Description**	**Image**
Leaf	Leaves are imparipinnate,linear,leaflets 5-7,elliptical,ablong,obtuse.2.5-5 cm long, pinnately 5-7 foliolate,stipule small,prtiolel.5-3 cm;stipels small,bristle like,leaflets broadly elliptic or almost ovate.	
Root(Bark)	Branched tap root system having nodules.As a legume,its roots from a symbiotic association with soil bacteria known as rhizobia.The root of the butterfly pea plant have nodules that are round or irregular in shape and range in size from 0.5-0.1 cm thick.butterfly pea has deep root and is tall,slender,climbing legume.	
Flowers	Its solitary flowers bloom in colours ranging from white to pink, light or dark blue funnel shaped 4- 3cm.single or paired standard abovate,notched or rounded at apex,blue with yellow base or entirely white.	
Seeds	Seeds are non endospermous and kidney shaped.each pod contain 6 to 10 seeds are olive brown to black,shiny and often mottled.	
Pods	The pods are 5-7 cm long flat pods.They are edible when tender.The pods of the butterfly pea plant are flat,narrow,and linear ablong,with a long,pointed tip And 7cm wide.	

- **MORPHOLOGICAL CHARACTERISTICS:**

Pea flowers measure approximately 4 cm in length and 3 cm in width, featuring 5 petals, 2 wings, and 2 keels, along with a bright yellow banner in the center. The pea plant is a climbing legume with slender leaves that range from 2.5 to 5 cm long and 1.5 to 3.5 cm wide. It is classified as an evergreen plant with a fibrous root system. Its large nodules are capable of fixing nitrogen into a form that can be utilized by the plant community, thanks to rhizobia bacteria. Clitoria ternatea is a perennial plant that propagates through black seeds. It is vibrant in color, and its pods are approximately 7 to 11 cm long. In the food industry, both the roots and leaves are utilized for medicinal and herbal beverages. Butterfly pea powder stands out as the most renowned product globally, derived from blue pea flowers.

- **TAXONOMIC CLASSIFICATION**

- Kingdom : Plantae
- Phylum: Angiosperms
- Class: Magnoliosida
- Order: Fabales
- Family: Fabaceae
- Subfamily: Papilionoideae
- Genus: Citoria
- Species: Ternatea (Linnaeus)

- **SYNONYMS:**

It has been known by various common names like,

- Clitoria albiflora
- Clitoria bracteata
- Clitoria mearnsii
- Clitoria tanganicensis
- Clitoria zanzibaresis

- **VERNACULAR NAME:**

In India	Other countries
*Sanskrit: Ashphota, Aparajita Saukarnika, Ardrakarni, Girikarnika, Supuspi, Mohanasini Vishadoshaghni, Shwetanama, Vishnu-Kranta, Ashwakhura. *Hindi, Bengali, and Oriya: Aparajita or Aparajit. *Gug: Bismar, Garani, Koyala *Kannada: Billisaiuga, Satugadagida. *Telugu: Dintana, Gilarnika, Neela- ghentana, Sankhupuvvu. *Tamil: Kakkanam, Kakatan, Kavachi, Kuruvilai. *Punjab: Dhanattar. *Rajasthan: Koyalri, Titlimatar. *Marathi: Gokurna Malayalam.: Aral, Shankapuspam, Malai-amukki. *English: Butterfly pea, Blue pea vine, Mussel-shell climber, Pigeon wings.	*In other countries: Butterfly-pea (Australia); Blue-pea, Cordofan-pea, honte (French); blaue Klitorie (German); Fula criqua, Clitoriaazul (Portugese); Azulejo, Conchitis, Papito, Zapatico de la reina, Zapotillo, Conchita azul, Campanilla, bandera, Choroque, Lupita, pito de parra, Bejuco de conchitas (Spanish); Cunha (Brazil); Pokindang (Philippines); Zapatillo de la reina (El Salvador); Kordofan pea (Sudan); Nagar hedi (Kannada); Mavi Kelebek

- **PHYTOCONSTITUENTS OF PLANT:**

Butterfly pea produces 25-30 tons of dry matter each year per acre under favorable conditions. Because of its elevated calcium content, the C. ternatea plant is utilized to create herbal beverages that are a great source of calcium.

- Le**af** :

The leaves consist of 21.5% fiber and have a protein content ranging from 21.5% to 29%. Kaempferol and clitorin have been extracted from the leaves. Additionally, the leaves contain various compounds such as 3-monoglucosides, 3-rutinoside, 3-neohesperidoside, 3-o-rhamnosylglucoside, 3-o-rhamnosylgalactoside of kaempferol, and kaempferol-3-rhamnosyl-rhamnosylglucoside. They also include aparajitin and β-sitosterol. The flowers, which are blue, contain delphinidin-3,5-diglucoside, delphinidin-3β-glucoside, its 3-methyl derivative, malvidin-3β-glucosides, kaempferol, and cyanidin chloride. A lactone known as aparajitin is found in the leaves.

Leaves of clitoria ternatea plant

- **Root:**

The roots of the plant include taxaxerol and taxaxerone. The bark of the roots is composed of seresin. The root nodule is rich in leucine, valine, and alanine, along with α-amminobutyric acid, glutamic acid, arginine, ornithine, histidine, and γ-amminobutyric acid.

ROOT of Clitoria ternatea plant

- **Seed**:

The seed contains a cotyledon along with fixed oil, tannic acid, glucose, and a bitter-tasting granular starch as its primary component. Two unique compounds, anthoxanthin and sitosterol, have been isolated from the seeds. Additionally, the seed oil yields linoleic, stearic, palmitic, and linolenic acids. A nearly identical makeup was identified in the oils derived from blue and white flowers. Hexacosanol, cinnamic acid, and neocleoprotein—sharing certain amino acid sequences with insulin—are also present in the seeds. These seeds have a remarkably high protein content (1525%). Moreover, the seeds contain p-hydroxycinnamic acid, flavonol-3-glycoside, adenosine, 3,5,7,4-tetrahydroxyflavone-3-rhamnoglucoside, polypeptide, and hexacosanol.

Seeds of Clitoria ternatea plant

- **Flower**:

Two acyl groups were identified as E-4-0-β-D-glucopyranosyl-p-coumaric acid and 6-0-malonyl-D-glucopyranose. Additionally, six ternatins (A1, A2, B1, B2, D1, and D2) found in the C. ternatea flower were separated using reverse phase High Performance Liquid Chromatography (HPLC). The white flowers produced only kaempferol. The petals of C. ternatea L. contain various flavonol glycosides that have been isolated, including kaempferol 3-O-(200O-α-rhamnosyl-600-O-malonyl)-β-glucoside; quercetin 3-O-(200-O-arhamnosyl-600-O-malonyl)-β-glucoside; myricetin 3-2G-rhamnosylrutinoside; and quercetin 32G-rhamnosylrutinoside. Cyanine chloride and kaempferol have been identified in the flowers. The separation of six acylated anthocyanins (A, B, C, D, E, and F) from the petals of blue flowers has been accomplished, along with a partial characterization of kaempferol and its 3-glucosides, robinin, quercetin, and 3-glucoside. The blue flowers of the C. ternatea plant also contain lobelinins, which exhibit a substituted pattern of 3,5,3,5-tetraglucoside. Deacylternatin has also been found in the petals of blue flowers.

butterfly pea

- **PHARMACOLOGICAL ACTIVITY:**

1. Anthelmintic activity :

Anthelmintic activity was observed in both ethanolic and water-based extracts of C. ternatea leaves at a dosage of 100 mg/ml. This assessment utilized Eisenia foetida and was conducted at three different concentrations (100, 50, and 25 mg/ml) of the ethanol-based extracts. The main objective of the study was to evaluate and compare the anthelmintic effects of leaf extracts of C. ternatea in vitro, using both water and ethanol-based extracts. Consequently, the research required measuring the time it took for the worms to become paralyzed (P) and to die (D). For both types of extracts, the times recorded for paralysis (P) and death (D) for the aqueous extract were 18 ± 1.57 and 53.33 ± 0.33, while the ethanolic extracts showed times of 12.33 ± 0.80 and 32.33 ± 0.71, respectively. Ultimately, the ethanol-based extract of C. ternatea demonstrated greater efficacy in anthelmintic activity compared to the water-based extract.

2.Anti Diabetic activity :

The anti-diabetic effects of ethanolic extracts were assessed in rats. Rats that consumed ethanol-based extracts of flowers over a three-week period exhibited a significant reduction in serum sugar levels in diabetes-induced models, attributed to the inhibition of galactosides and glucosides activities, while no effect on fructosidase activity was recorded. The hypoglycemic effects of methanol, water, petroleum ether, and chloroform extracts from Clitoria ternatea leaves were investigated in streptozotocin-induced diabetic rats, examining both acute and subacute outcomes. The extracts of Clitoria ternatea, administered at doses of 200-400 mg/kg, notably diminished the hyperglycemic response in diabetic rats induced by streptozotocin, with the 400 mg/kg dose demonstrating considerable hypoglycemic effects, whereas the 200 mg/kg dose also lowered glucose levels, albeit not as significantly as the 400 mg/kg dose. The acute effects of the methanol extract revealed that both 200 and 400 mg/kg had similar outcomes initially; however, after 30 minutes, the 200 mg/kg dose showed a minor decrease in blood glucose levels. The subacute analysis indicated that, with prolonged use of the extract, the 200 mg/kg dosage was more effective at managing blood glucose compared to the 400 mg/kg dosage.

3.Anti-inflammatory activity, Anti-pyretic activity and analgesic activity :

The extract from the leaves and flowers of C. ternatea has been recognized for its anti-inflammatory properties. Ethanol and petroleum ether extracts demonstrated pain-relieving effects, with the ethanol-treated extracts providing relief lasting between 1.5 to 2 hours. Flavonoids play a crucial role in the anti-inflammatory, analgesic, and antipyretic properties of C. ternatea. The methanolic extract from the roots of C. ternatea at doses of 200, 300, and 400 mg/kg body weight effectively normalized body temperature, which had increased due to yeast provocation, in a dose-dependent manner. Narcotic medications are often used for treating inflammatory and pain issues, but they tend to be expensive and may have negative side effects. Natural remedies, particularly those derived from C. ternatea, could provide a more affordable and practical alternative. Additionally, a separate study indicated that the oral administration of methanolic root extract from C. ternatea significantly reduced carrageenan-induced

4)Antidepressant activity :

The methanol extract of C. ternatea administered at doses of 100 and 400 mg/kg orally has demonstrated an antidepressant effect in the tail-suspension test in mice. The extract of C. ternatea notably reduced the length of time spent motionless at doses of 100 and 400 mg/kg. The decrease in motionlessness duration was more pronounced at the 400 mg/kg dose of C. ternatea compared to fluoxetine at 10 mg/kg administered intraperitoneally. In another study, the ethanol extract of C. ternatea roots also exhibited antidepressant effects at doses of 150 and 300 mg/kg. Findings from earlier research suggested that two compounds, (Z)-9,17-octadecadienal and n-hexadecanoic acid, extracted from the roots of C. ternatea could serve as potential lead compounds for developing novel selective MAO-A inhibitors, presenting a herbal solution for treating psychiatric disorders such as depression and anxiety.

5.Neuro-pharmacological activity :

C. ternatea has been found to possess neuroprotective properties, which may be associated with its antioxidant and anti-inflammatory effects. It has demonstrated potential in thwarting neurodegenerative diseases and enhancing cognitive function. C. ternatea is known to serve as a beneficial brain tonic primarily utilized for promoting mental well-being. Research indicates that the intraperitoneal administration of alcohol extracts from the steam, flowers, leaves, and fruit of C. ternatea to rodents has displayed sedative effects and diminished alertness.

6.Anticonvulsant activity :

An imbalance between excitatory and inhibitory neurotransmitters can lead to seizures. Drugs that enhance GABA levels in the brain may exhibit anticonvulsant properties in experimental seizure models. The maximal electroshock (MES) test is recognized as a standard method for evaluating antiepileptic medications in cases of generalized tonic-clonic seizures. The methanol extract from the aerial parts of CT demonstrated anticonvulsant effects at a dosage of 100 mg/kg, administered orally, in both pentylenetetrazole (PTZ) and MES-induced seizures in mice, delaying the onset of convulsions and shortening the duration of tonic hind limb extension, respectively. These findings indicate the potential use of CT as an antiepileptic medication; however, the extract from the aerial parts of CT did not show efficacy against PTZ and MES-induced seizures in rats.

7)Antioxidant activity :

Antioxidants function as scavengers of free radicals, hinder lipid peroxidation, and mitigate other processes mediated by free radicals, thereby safeguarding the human body from numerous diseases linked to radical reactions. A variety of phenol-based antioxidants, including tannins, coumarins, xanthenes, and more recently procyanidins, have been introduced to capture free radicals in a dose-dependent manner and are thus considered beneficial in addressing pathologies. Phenolic compounds represent a vast and varied group of phytochemicals that encompass many different families of aromatic secondary metabolites found in plants. They are recognized for their diverse physiological effects in humans, such as inhibiting platelet aggregation, lowering the risk of coronary heart disease and cancer, and protecting against oxidative damage to lipids and low-density lipoproteins.

8)Nootropic activity :

Based on the studies conducted, the ethanol extract of C.pluricaulis, along with its ethyl acetate and aqueous fractions, was found to exhibit nootropic effects. Two different dosages of 100200 mg/kg/p.o of both ethyl acetate and aqueous fractions were administered to separate groups of rats. The results indicated that both dosages of C.pluricaulis were effective in enhancing memory and learning abilities in rats. This effect was evaluated using active and passive avoidance paradigms, with Cook and Weidley's pole climbing apparatus and the elevated plus-maze serving as experimental models. Additionally, another study assessed the nootropic properties of Shankhpushpi. Three plants—C.pluricaulis, C.ternatea, and Evolvulus alsinoides—were examined for their nootropic activity through the Porsolt's swim despair, RPM, and actophotometer models. The findings revealed that all three plants demonstrated anxiolytic, CNS depressant, and nootropic activities, but C.pluricaulis stood out as a significant source for enhancing memory.

9)Anti-microbial activity :

Using the leaf-disc method and feeding deterrent with Spilosoma oblique Walker as the test insect, the C. pluricaulis plant was bio-assayed. A novel compound, 29-oxodotriacontanol, was extracted from the chloroform fraction of the plant, which was identified as a significant antifeedant component, while another compound, tetratriacontanoic acid, was discovered for the first time in this species. The antimicrobial assessment was conducted against Extended Spectrum Beta Lactamase (ESBL) producing strains of Salmonella enteritidis, Salmonella typhimurium, Klebsiella pneumoniae, Enteropathogenic E. coli, Uropathogenic E. coli, and Pseudomonas aeruginosa sourced from patients suffering from urinary tract infections and acute gastroenteritis. The disc diffusion method was employed to examine the activity of the mentioned extracts. The water, methanolic, and chloroform extracts of C. ternatea flowers exhibited activity against uropathogenic Escherichia coli, Enteropathogenic Escherichia coli, Enterotoxigenic Escherichia coli, Salmonella typhimurium, Klebsiella pneumoniae, and Pseudomonas aeruginosa.

- **FORMULATIONS**

PRODUCT	COMPANY
1.Body Lotion 	Earth Ritual
2.Fruit Syrup 	World of mart
3.Herbal blue pea toothpaste 	Ayurvedic sanjivan

4)HERBAL TEA 	BLUE TEA
5) Beauty Mask 	Teami
6)Herbal Soap 	Herbal Witch

- **CONCLUSION:**

This article explores Clitoria ternatea as a valuable medicinal plant known for its diverse pharmacological effects, making it suitable for various medical uses owing to its effectiveness and safety. The butterfly pea flower (Clitoria ternatea) is utilized to prepare a nutrient-dense tea or herbal extract. Indigenous to Southeast Asia, this plant is abundant in polyphenols and antioxidants such as anthocyanins, which give it its vibrant blue hue. Its advantages include anti-inflammatory and antibacterial characteristics. It provides protection for the brain, skin, and eyes; aids in digestion; and supports respiratory and metabolic processes. Clitoria ternatea has been noted for its nootropic, anti-stress, anxiolytic, antidepressant, sedative, antipyretic, anti-inflammatory, analgesic, and antidiabetic properties.

- **REFERENCES**

1. Gupta RK, Lal LB (1968) Chemical components of the seeds of *Clitoria ternatea*. Indian J Pharm 30: 167-169.

2. Kelemu S, Cardona C, Segura G (2004) Antimicrobial and insecticidal protein isolated from seeds of Clitoria ternatea, a tropical forage legume. Plant Physiol Biochem 42: 867-873.

3. Kulshrestha DK, Khare MP (1967) Chemical investigation of the seeds of *Clitoria ternatea*. Curr Sci 36: 124-125.

4. Kulshrestha DK, Khare MP (1968) Chemical study of *Clitoria ternatea* seeds. Chemische Berichte 101: 2096-2105.

5. Terahara N, Saito N, Honda H, Toki K, Osajima Y (1989a) Structure of ternatin D1, an acylated anthocyanin from *Clitoria ternatea* flowers. Tetrahedron Lett 30: 5305- 5308.

6. Terahara N, Saito N, Honda H, Toki K, Osajima Y (1989b) Structures of *Clitoria ternatea* pigments Tennen Yuki Kagobutsu Toronkai Koen Yoshishu 31: 324331.

7. Terahara N, Saito N, Honda T, Toki K, Osajima Y (1990a) Acylated anthocyanins of *Clitoria ternatea* flowers and their acyl moieties. Phytochemistry 29: 949-953.

8. Terahara N, Saito N, Honda T, Toki K, Osajima Y (1990b) Further structural elucidation of the anthocyanin, deacylternatin, from Clitoria ternatea. Phytochem 29: 3686-3687.

9. Terahara N, Saito N, Honda T, Toki K, Osajima Y (1990c) Structure of ternatin A2, one of Clitoria ternatea flower anthocyanins having unsymmetrical side chains. Heterocycles 31: 1773-1776.

10. Terahara N, Saito N, Honda T, Toki K, Osajima Y (1990d) Structure of ternatin A1, the largest ternatin in the major blue anthocyanins from *Clitoria ternatea* flower. Tetrahedron Lett 31: 2921-2924.