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Clitoria Ternatea

Sanika Bhosale, Atharv Pore, Tahira Malidwale, Pallavi Gaikwad, Shamal Kadam
Nootan College of Pharmacy, Kavathe Mahankal, India

Abstract: *The plant species Clitoria ternatea, sometimes known as the butterfly pea, is a member of the Leguminosae (Fabaceae) family and has been used in traditional medicine to treat a variety of illnesses. Because the butterfly pea (Clitoria ternatea) contains flavonoid chemicals, which are mostly found in its roots, leaves, and flowers, locals frequently use it as a medicinal resource. Tannins, phlobatannin, proteins, alkaloids, triterpenoids, phenols, flavanoids, flavonol glycosides, anthocyanins, cardiac glycosides, Stigmast4-ene-3,6-dione, volatile oils, and steroids were all found in Clitoria ternatea. Antioxidant, hypolipidemic, anticancer, anti-inflammatory, analgesic, antipyretic, antidiabetic, central nervous system, antimicrobial, gastrointestinal, antiparasitic, insecticidal, and numerous other pharmacological activities were among the numerous pharmacological properties that the plant demonstrated. The pharmacological effects and chemical components of Clitoria ternatea will be highlighted in this review.*

Keywords: Phycocyanin, butterfly pea, flavonoid, blue pea, blue colorant, and beneficial food

I. INTRODUCTION

Originating in subtropical areas, the butterfly pea flower (Clitoria ternatea) is found throughout Africa, Asia, Australia, North America, South America, the Northwest, Central South, and Southwest Pacific. Butterfly peas are herbaceous or perennial climbing plants, much like vine plants. It spreads by seeds and is self-pollinating.(1) The Asian pigeonwing, or Clitoria ternatea.(2) Medicinal plants and herbs are used for health purposes by a growing number of individuals worldwide. Therefore, in order to make informed decisions regarding their use, scientific evaluation of their biological characteristics, safety, and therapeutic potential will be helpful.(3) Anthocyanins, carotenoids, chlorophyll, and other pigments that are extracted mostly from plants and microorganisms make up natural food colors.(4) Darwin pea, butterfly pea, cordofan pea, bluebellvine, or blue pea, (6) Clitoria ternatea was found to contain tannins, phlobatannin, proteins, alkaloids, triterpenoids, phenols, carbohydrates, saponins, triterpenoids, flavanoids, flavonol glycosides, anthocyanins, cardiac glycosides, Stigmast-4-ene-3,6- dione, volatile oils, and steroids, according to the preliminary phytochemical screening.(7) The anthocyanins found in butterfly pea flowers make them a natural antioxidant that is beneficial to the skin and can slow down the aging process.(8) Ayurveda It is frequently referred to as Aparajita. In India, it is occasionally mistaken for Convolvulus prostratus (Convolvulus pluricaulis).(8)

HIGHLIGHTS

– There are a lot of blue
– -colored anthocyanins in blue pea flowers, as well as polyacylated anthocyanins known as ternatins.
– –The anthocyanins found in blue peas exhibit good thermal and storage durability.
– –Blue pea flower anthocyanins are a good substitute for spirulina and gel.

Fig. Butterfly pea flower

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Scientific classification
Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Fabales
Family: Fabaceae
Subfamily: Faboideae
Genus: Clitoria
Species: C. ternatea
Binomial name :Clitoria ternatea

Description:
This perennial herb grows from a woody base and can climb or trail. Imparipinnate leaves with a terminal leaflet and two to four leaflet pairs. Oval to elliptic-oblong, up to 6.5 × 4 cm, leaflets are pubescent below and mainly hairless above. The flowers are vivid blue, axillary, resupinate, solitary or two together, and huge and beautiful. Pod linearoblong, 6–13 cm long, flattened, hairless or coarsely hairy, with a mucronate tip (9).Its flowers, which are solitary and have faint yellow patterns, are its most remarkable feature. They are a beautiful deep blue color. They measure roughly 3 cm (1 1⁄4 in) in width and 4 cm (1 1⁄2 in) in length. Some types produce pink and white blooms.(10)

Etymology:
The name Clitoria comes from the word "clitoris" because the shape of their blossoms is similar to that of a human vulva. Polish naturalist Jakób Breyne was the first to mention the genus and provide a picture of the plant in 1678. He called it Flos clitoridis ternatensibus, or 'Ternatean flower of the clitoris'.[11][12] The species' name comes from the name of the island in the northern Maluku Islands called Ternate Island, which is where botanist Carl Linnaeus's specimens were found. [13][3]

Traditional medicine:
Memory-boosting, nootropic, antistress, anxiolytic, antidepressant, anticonvulsant, tranquilizing, and sedative capabilities are among the many attributes attributed to it in traditional ayurveda treatment.[14] The plant's resemblance to the female reproductive organ has led to its association with female libido in traditional Chinese medicine.[15] Its extract has been demonstrated to lessen the severity of serotonin and acetylcholine-induced behavior in mice.[16] Its extracts have a variety of pharmacological effects, such as antibacterial, antipyretic, anti-inflammatory, analgesic, diuretic, local anesthetic, antidiabetic, insecticidal, and the ability to relax vascular smooth muscle. Numerous ailments have traditionally been treated with this plant in traditional ayurveda medicine, and scientific research has proved that these treatments are still relevant today.

Chemical constituents:
Tannins, phlobatannin, carbohydrates, saponins, triterpenoids, phenols, flavanoids, flavonol glycosides, proteins, alkaloids, antharaquinone, anthocyanins, cardiac glycosides, Stigmast-4- ene-3,6-dione, volatile oils, and steroids were all found in the plant, according to the preliminary phytochemical screening (17–18). Clitoria ternatea seeds contain a variety of fatty acids, including oleic, linoleic, stearic, palmitic, and linolenic acids. Cinnamic acid, anthoxanthin glucoside, water-soluble mucilage, delphinidin 3, 3', 5'-triglucoside, beta- sitosterol, and a very basic tiny protein called finotin were also present in the seeds (19).

Nutritional components of Butterfly Pea Flower
The presence of ternatin, an anthocyanin component, gives butterfly pea flower petals their vivid blue color. Test tube experiments have demonstrated that ternatins lower inflammation and may prevent the growth of cancer cells. (20)

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Several additional antioxidants are also present in the plant, including a) Kaemphferol: whose potential to combat cancer has been extensively studied. It may prevent the growth of cancer cells, according to research conducted in test tubes.

B) p-coumaric acid: This ingredient may help prevent disease by having antiviral, antibacterial, and anti-inflammatory qualities.

C) Delphin-3,5-glucoside: This antioxidant may help boost immunity and stimulate the death of colorectal cancer cells.

Health benefits:

Butterfly pea, or Clitoria ternatea, is a tropical plant that is well-known for both its many health advantages and its eye-catching blue blooms. It has been used for centuries in traditional medicine, especially in Southeast Asia, and is becoming more and more well-liked worldwide. Clitoria ternatea has the following health advantages, along with references:

1. Antioxidant Properties

Anthocyanins, flavonoids, and phenolic acids are among the substances found in Clitoria ternatea that have strong antioxidant qualities. By assisting in the neutralization of free radicals, these substances can lessen oxidative stress and shield cells from harm. According to studies, the plant may help prevent diseases like cancer and heart disease that are linked to oxidative stress.(21).

2. Anti-Inflammatory Effects

Since the plant has been demonstrated to have anti-inflammatory qualities, it can be used to treat inflammatory diseases like arthritis or to relieve general pain. The plant's bioactive components are responsible for its anti-inflammatory properties.(22)

3. Cognitive Enhancement

Ayurveda and other medical systems have long utilized Clitoria ternatea as a memory enhancer. It is said to enhance cognitive and memory functions in the brain. According to certain research, by halting brain degeneration, it may have neuroprotective benefits and aid in diseases like Alzheimer's.(23).

4. Anti-Anxiety and Stress Relief

Clitoria ternatea may have relaxing properties and may reduce stress and anxiety symptoms, according to several research. It is said to have adaptogenic properties that help the body cope with stress and anxiety. The plant's capacity to control neurotransmitters like serotonin may be the reason for its relaxing benefits.(24).

5. Antibacterial and Antifungal Activity

It has been discovered that Clitoria ternatea has antifungal and antibacterial qualities. The plant extract has demonstrated efficacy against a range of diseases, including bacteria such as Escherichia coli and Staphylococcus aureus. Because of this, it may be helpful in treating infections.(25).

6. Skin Health

Clitoria ternatea is utilized in skincare products to reduce skin damage and aging symptoms because of its anti-inflammatory and antioxidant qualities. Because of its capacity to combat free radicals and lessen the visibility of fine wrinkles, it is frequently included in cosmetic products.(26).

7. Anti-aging:

According to a recent study, topical application of a cream containing 5% butterfly pea flower extract can have anti-aging benefits. Additionally, it treats redness in the skin caused by allergies (27).

Culinary:

The flower is used in Southeast Asia as an ayurvedic medication and as a natural food coloring to color sticky rice and desserts such Eurasian putugal. [17] It is a key component in nasi kerabu in Kelantan, in the northeastern part of the Malaysian peninsula, which gives it its distinctive bluish hue. Etymology Distribution Cultivation Pests Diseases Uses Culinary The blooms are also fried after being dipped in butter in Thai and Burmese cuisines. The Nyonya dish Pulot

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tartal is also colored with it. (28).More recently, the blooms have been utilized to make a color- changing gin and absinthe. When combined with a carbonated mixer, such tonic water, the blue beverage's pH changes to pink.(29) To preserve the effect, this kind of gin should be kept in a dark location because organic colors are not permanent.(30) Nevertheless, it is not permitted as a food additive in the EU, and at least one gin that contained it was recalled due to

Extraction :

There are several ways to extract the components from the butterfly pea flower (Clitoria ternatea), which is abundant in anthocyanins and other bioactive substances. The butterfly pea blossom is frequently extracted using the methods listed below, along with references.

1. Solvent Extraction

One of the most popular techniques for removing bioactive substances from plants, including butterfly pea blossoms, is solvent extraction. The desired chemicals are dissolved from the plant material using polar or non-polar solvents.

Steps:

• Butterfly pea flowers are dried and ground into a powder.

• The powder is immersed in a solvent (such as water, acetone, methanol, or ethanol) for a predetermined amount of time at a predetermined temperature.

.Following soaking, the mixture is filtered to get rid of any solids, and the concentrated extract is left behind after the solvent evaporates.

Advantages:

• Easy to perform.

• Can extract a wide range of bioactive compounds(31).

2. Hot Water Extraction

Butterfly pea blooms are boiled in water to extract their bioactive ingredients, especially the anthocyanins. When aqueous extracts are needed for culinary and therapeutic applications, hot water extraction is employed.

Steps:

• After a predetermined amount of time spent boiling butterfly pea blossoms in distilled water, the extract is cooled and filtered.

• The final extract is either used straight away or concentrated for use in other applications.

Advantages:

• • Easy, affordable, aenvironmentally benign; it yields a consumable extract (32).

3. Ultrasonic-Assisted Extraction

Ultrasonic waves are used in ultrasonic-assisted extraction (UAE) to improve the extraction procedure. Bioactive substances like flavonoids and anthocyanins can be effectively extracted with this technique.. Steps:

• A solvent, typically water or ethanol, is combined with powdered flower.

• To aid in the extraction process, the mixture is exposed to ultrasonic waves at a particular frequency and power.

• The extract is filtered and concentrated following processing.

Advantages:

• More rapid than conventional approaches.

• Boosts yield through improved cell wall degradation(33).

4. Supercritical Fluid Extraction (SFE)

Using supercritical CO_2 as the solvent, supercritical fluid extraction is an extremely effective technique. It ensures little degradation when extracting delicate chemicals.

Steps:

• The extractor is filled with the plant material.

• To extract the necessary chemicals, supercritical CO_2 is fed through the plant material.

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• The system is depressurized before the extract is collected.
Advantages:
• High-quality extracts with little solvent residues are produced in an efficient and selective manner (34).

5. Maceration
In order to extract the butterfly pea blossoms' components, maceration entails immersing them in a solvent for an extended amount of time at room temperature.
Steps:
• The blossoms of butterfly peas are submerged in a solvent, usually methanol or ethanol.
• For a few days, the combination is kept at room temperature.
• The extract is obtained by filtering the liquid.
Advantages:
• Easy to use and reasonably priced; ideal for thermolabile substances (35).

Applications :
1. Dye
2. Antioxidant
3. Tea
4. Skincare
5. Hair care
6. Add-on
7. Colorant
8. Drug
9. Decoration
10. Pesticide
11. Mental clarity
12. Anti-inflammatory
13. Calming;
14. Decorative;
15. Restoring

Commercial and market trends:
1. Health and Wellness Products
• Demand for Antioxidants: Butterfly pea flower's high anthocyanin concentration, a powerful antioxidant, has made it a sought-after component in dietary supplements, functional beverages, and cosmetic products as public knowledge of the advantages of antioxidants has grown.
• Herbal Supplements: Herbal and plant-based supplements are becoming more and more popular, particularly those that address stress and cognitive wellness. Butterfly pea flower is promoted as a nootropic and anti-anxiety vitamin.

2. Natural Food and Beverage Coloring
• Natural Dyes in Food: Butterfly pea flower has carved out a place for itself in the market for natural food coloring as customers turn away from artificial food coloring. Because of its vivid blue hue and the fact that it changes color when combined with acid, it is frequently used in drinks, baked products, and desserts.
• Popular in Beverages: Particularly in the expanding market for functional drinks, butterfly pea flower is being utilized more and more in teas, cocktails, and smoothies.

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3. Beauty and Personal Care

• Natural Skincare: Butterfly pea flower's rise in the cosmetics industry has been greatly aided by the growing desire for natural and organic beauty products. Creams, serums, shampoos, and conditioners that are designed to revitalize skin and encourage healthy hair use its anti-aging and antioxidant qualities.

• Clean Beauty Trend: Butterfly pea flower is becoming a popular component in goods that are promoted as safe, non-toxic, and environmentally friendly due to the growing demand for "clean beauty" products—those devoid of artificial chemicals.

4. Culinary Exploration and Novelty Products

• Exotic and Instagrammable Products: Butterfly pea flowers' striking blue hue has contributed to their popularity in the "Instagrammable" food and drink fad, which promotes items like blue teas, cocktails, and color-changing beverages for their uniqueness and visual appeal.

• Ethnic and Fusion Foods: Butterfly pea flowers are in higher demand in international culinary markets as a result of the popularity of ethnic dishes and fusion cuisine.

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• Ethnic and Fusion Foods: Butterfly pea flowers are in higher demand in international culinary markets as a result of the popularity of ethnic dishes and fusion cuisine.

6. Global Market Penetration

• Southeast Asia: Southeast Asian nations have long utilized butterfly pea flowers, but their use is increasingly spreading outside of their original location. Butterfly pea flower is becoming more and more popular in North America, Europe, and Australia for use in food and wellness products.

• International Brand Launches: Nowadays, a lot of companies are bringing butterfly pea flower-based items to other countries. These include teas, skincare products, and even alcoholic drinks (like cocktails) that are prepared with the flower's powder or extract.

The environmental impact of Butterfly Pea Flower: When compared to crops that require more resources, Butterfly Pea Flower (Clitoria ternatea) is typically thought to have a fairly good environmental impact. Below is a summary of its effects on the environment:

1. Low Water Consumption: Butterfly pea flowers don't need a lot of water to thrive and can withstand some drought. This makes it a sustainable option, particularly in areas where water is scarce.
2. Soil Health Improvement: Butterfly Pea Flower, a legume, has the ability to fix nitrogen in the soil. By adding nitrogen to the soil naturally, this method increases its fertility for upcoming crops and lessens the need for artificial fertilizers.
3. Pesticide-Free Growth: Compared to other crops, butterfly pea flowers frequently require fewer insecticides since they are not as vulnerable to pests. This lessens chemical contamination of soil and water systems and benefits the biodiversity in the area.
4. Minimal Land Use: Butterfly pea flowers don't need a lot of fertile, expansive agricultural area to flourish because they can grow in a range of conditions, including poor soils. This lessens the strain on ecosystems and natural areas.
5. Pollinator-Friendly: Because bees and other pollinators find the blooms appealing, local ecosystems and biodiversity are supported.

II. CONCLUSION

In summary, the butterfly pea flower, or Clitoria ternatea, is a very useful and adaptable plant with many practical and ecological benefits. It is a useful supplement to sustainable farming methods because of its well-known capacity to enhance soil quality through nitrogen fixation. The plant is perfect for areas with limited water resources because of its

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low water requirements and resistance to drought. Additionally, by drawing pollinators, its expansion promotes local biodiversity and helps minimize soil erosion. Clitoria ternatea is also used in the creation of natural dyes, food, and medication, providing environmentally beneficial substitutes for manufactured goods.

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