



## Review on ethnobotany and pharmacology of *Clitoria ternatea* Linn. (Fabaceae)

Drisya MK<sup>1</sup>, Sapna Shri Kumar<sup>2</sup>

<sup>1</sup> Student, Division of Pharmacognosy and Phytochemistry Research Laboratory, Nehru College of Pharmacy, Pampady, Thiruvilwamala, Thrissur, Kerala, India

<sup>2</sup> Professor, Dean-academics, research and, placement, Division of Pharmacognosy and Phytochemistry Research Laboratory, Nehru College of Pharmacy, Pampady, Thiruvilwamala, Thrissur, Kerala, India

### Abstract

India is one of the largest producers and richest country of herbal products in the world about genetic resources of medicinal plants. Medicinal plants are the gift of god, to cure an interminable number of diseases in human beings and also other living organisms. In all ancient scriptures of Ayurveda and other Indian literature *Clitoria ternatea* /shakupushpi/Aparjita is twing herb used the traditional and folkloric medicine in various diseases. *Clitoria ternatea* is a perennial leguminous herb that has significant interest based on its agricultural and medicinal applications when range from use as a fodder and nitrogen-fixing crop and as a source of an eco-friendly insecticide. This review, explains the ethnobotany and phytopharmacology of *Clitoria ternatea* Linn.

**Keywords:** *Clitoria ternatea* linn, fabaceae, ethnobotany, phytochemistry, pharmacology

### Introduction

Medicinal plants are focus on the health of each individual. The medicinal value of these plants are lies in some chemical substances that construct a specific physiological action on the human body and these chemical substances are called phytochemicals. India is sumptuously furnishing with a wide variety of medicinal value plants. Therefore, these plants are widely used either directly or indirectly as pharmaceutical preparation of modern medicine [1]. *Clitoria ternatea* Linn. is a perennial twinning climbing herbaceous plant, the family belongs to Fabaceae [2]. It is distributed throughout tropical equatorial Asia and latter in Central America, East and West Indies, Bangladesh, India [3]. *Clitoria ternatea* is a plant having a variety of ethnic medicinal uses [4]. The flower of this plant has deep – blue and white colour usually used as a natural colourant in food preparation and also acts as a food source for the livestock due to its taste and nutritive value [5]. Traditionally *Clitoria ternatea* is used in the treatment of various ailments like Jaundice, migraine, tumours, eye infection, skin disorders, asthma, fever, constipation, and also cures sexual ailments like infertility and gonorrhoea [6]. The various part of *Clitoria ternatea* is used for the treatment of bacterial infection, fungal infection, inflammation related to women disorders [7]. A recent study shows that the plant having an anthelmintic, antiulcer, antidepressant, antimicrobial and antioxidant [8]. The preliminary phytochemical screening reveals that *Clitoria ternatea* contains tannins, carbohydrates, saponins, triterpenoids, phenols, flavonoids, glycosides, proteins, alkaloids, anthraquinone, cardiac glycoside, volatile oil, and steroids [9].

### Taxonomical Classification

**Kingdom:** Plantae

**Phylum:** Angiosperms

**Division:** Tracheophyta

**Subdivision:** Spermatophytina

**Class:** Magnoliopsida

**Order:** Fabales

**Family:** Fabaceae

**Genus:** *Clitoria*

**Species:** *Clitoria ternatea* Linn. [9, 10]

### Synonyms

*Clitoria albiflora* Mattei

*Clitoria bractrata* poir

*Clitoria mearnsii* De Wild

*Clitoria zanzibarensis* vatke [11]

### Regional Names

**English:** Butterfly blue pea

**Malayalam:** shankapusam

**Hindi:** Aparajita

**Sanskrit:** Girikarnika

**Tamil:** kavachi

**Gujarathi:** Garani

**Telugu:** Dintana [4, 9]

### Plant Distribution

*Clitoria ternatea* is an indigenous climber and an ornamental plant found widely distributed throughout the tropics and Subtropics of the world. Nowadays the genus has become rare in humid and sub humid lands of Asia and America and also in semi-arid tropical Australia. The plant grows from sea level to 1800 and outspread from about 20°C North latitude to the Salta district in Argentina at about 24°C south latitude. In Africa it grows in grasslands and in Sudan grown for fodder or grazing and in America it spread from Florida to Texas. The plants were found all over India, especially in Southern India up to an altitude of 1500 m and in Andaman Islands [12].

## Plant Description

*Clitoria ternatea* are zygomorphic pea shaped flowers with 2 tubular calyxes consisting of 5 sepals. The showy corolla consists of 5 free petals and 2 wrinkled wings. The Corollae are most seen dark blue in colour and also occur in white and various blue and white shades. The flower includes the physical properties like colour structure and position varies from species to species. The flower of this plant is axillary having 0.8 to 1.2 cm long pedicle and calyx 13 to 20 mm long and corolla 38 to 50 mm and oblong and seeds are 8 to 11 pods. The leaves are pinnate with 5 or 7 leaflets and 1 to 6 mm long and the petioles are 15 to 30 mm long. The physicochemical properties of root of plant are buffy brown and characteristic odour and taste is bitter. The advantageous of the roots fix the nitrogen; therefore, this plant used to improve the soil quality [9].

## Parts Used

Flowers, seeds, leaves, stem, Root [9].

## Ethnomedical Uses

*Clitoria ternatea*, a traditional Ayurvedic medicine has been used for centuries as a memory booster, antistress, anxiolytic, antidepressant, and sedative agent. The plant having wide range of secondary metabolites like triterpenoids, flavanol, glycosides, steroids, anthocyanins, and its extract covers a lot of pharmacological activities including antimicrobial, antipyretic, anti-inflammatory, analgesic, blood platelet aggregation – inhibiting [13]. The root of the plant is used in the treatment of various diseases like indigestion, constipation, fever, arthritis and eye ailments. The decoction or powder of root is given in rheumatism and also ear diseases and root juice of the white flowered is blown up the nostrils. In Ayurveda the root, seeds and leaves are widely used as a brain tonic. The flowers of the plant are used as an antidote for snake bite and scorpion bite [14]. The root powder is used as one of the ingredients in preparation of an ointment “SULAK” to treat leprosy. The seeds of this plant are used in swollen joints and considered for colic, dropsy. The seed powder is used for constipation as it mixed with pepper [15].

## Phytochemistry

Phytochemical screening of medicinal plants is very significant in identifying new source of therapeutical and industrial importance [8]. The leaves of the plant contain sitosterol, kaempferol-3-monoglucoside, kaempferol-3-rutinoside, kaempferol-3-neohesperidoside, kaempferol-3-o-rhamnosyl-(1,6)-glucoside, galactoside. The leaves contain lactones, apargitin, and clitorin. Essential oil, colouring matter and, mucilage from leaves were also reported [16]. It is reported that the root of the plant contains taraxerol and taraxerone, pentacyclic triterpenoids and flavanol glycoside 3,5,4-trihydroxy-7-methoxyflavonol-3-O- $\beta$ -D-xylopyranosyl-(1,3)-O- $\beta$ -D-galactopyranosyl (1,6)-O- $\beta$ -D-glucopyranoside and seeds contain  $\beta$ -sitosterol,  $\alpha$ -sitosterol adenosine, hexacosanol, and anthoxanthin glucoside. It is also confirmed that the flowers contain ternatins A1-3, B1-4, C1-5, D1-3 [17]. In addition the presence of myricetin 3-O-(2-O-alpha-rhamnosyl-6-O-malonyl)-beta-glucoside and flavonoids in the petals was investigated with LC/MS/MS [9].

## Pharmacology

### Anthelmintic activity

The leaves of the plant show anthelmintic activity in ethanolic and aqueous extract at the dose of 100mg/ml. This study was performed at 3 different concentration like 100,50,25 mg/ml of these respective solvents by using *Eisenia foetida*. The study aimed an invitro comparative study of aqueous and ethanolic extract of leaves. This study aimed an invitro comparative study of aqueous and extracts of leaves. This study involved in the determination of time of paralysis (p) and time of death (D) of the worms. While determination of both extracts it was observed that the activity of ethanolic extract of the plant was found more aqueous extract [4].

### Antihistaminic activity

Antihistaminic activity was done in roots of *Clitoria ternatea* by using ethanolic extract. This activity can be evaluated by using clonidine and haloperidol induced catalepsy in mice at doses of 100,125,150 mg/kg IP. The Dose Dependent catalepsy was induced in mice by clonidine is responsible for the release of histamine from mast cells that is responsible for the different asthmatic conditions. Haloperidol [non-selective D<sub>2</sub> dopamine antagonist] induces catalepsy due to blockade of dopamine receptor in striatum. The agent that are responsible for the increase in dopamine transmission inhibit the haloperidol-induced catalepsy. The findings proved that the ethanol extract of *Clitoria ternatea* root and chlorpheniramine maleate inhibit clonidine induces catalepsy when compare to control group. The study explains that agents increasing dopamine transmission inhibits haloperidol induced catalepsy and ethanol extract of *Clitoria ternatea* possess antihistaminic activity [4].

### Immunomodulatory

The study was done in seed and root of the *Clitoria ternatea*, the effects on humoral immune response was investigated in SRBCS-Sensitized rats. While, the effect on cell mediated immunity were studied by measuring delayed type hypersensitivity (DTH) that is response in SRBC-Sensitized rats. *Clitoria ternatea* seeds and root extracts reveals that have significant immunosuppressive effects and immunomodulatory effects on *Clitoria ternatea* on humoral, cell mediated is attributed to decreased immune cell sensitization [8].

### Antimicrobial activity

The study is done in leaves and roots of *Clitoria ternatea* by using methanolic extracts were tested for their antibacterial activity against different pathogenic drug resistant Gram positive and Gram negative. The leaf was showing the powerful antibacterial activity against the E-coli and vibrio cholera than the root extract of the plant [15].

### Anti-inflammatory activity

The study was done in root of *Clitoria ternatea*. The protein albumin denaturation was followed for the study. The 5 ml of reaction mixture consisted of 0.2 ml of egg albumin that are taken from fresh hen's egg, 2.8 ml of phosphate buffered saline having PH of 6.4 and 2 ml of different concentration of extracts of *Artemisia vulgaris*, therefore the final concentration become 15.625,31.25,62.5,125,250,500,1000  $\mu$ g/ml. Similar volume of double distilled water should be taken as control. After that the

mixture were incubated at  $37 \pm 2^\circ\text{C}$  in a BOD incubator for 15 minutes and heated at  $70^\circ\text{C}$  for 5 minutes. Then cooling, their absorbance was measured at 660 nm in an UV-VIS spectrophotometer. Then the percentage inhibition of protein was calculated.

$$\% \text{ inhibition} = 100 \times (\text{At}/\text{Ac} - 1)^{[18]}$$

#### **Antioxidant activity**

The flower of *Clitoria ternatea* shows that they have Antioxidant activity. The study are done by using aqueous extract and ethanolic extract. Aqueous extract was shows stronger antioxidant than ethanol extract. This was performed by DPPH Scavenging test method <sup>[4]</sup>.

#### **Wound Healing activity**

The study was investigated using excision, incision and dead space models in rats. The root and seed extracts are improved wound healing property by orally by gavages as applied topically as ointment <sup>[4]</sup>.

#### **Cytotoxic activity**

The methanol extract of stem, leaves and seeds of *Clitoria ternatea* are cytotoxicity activity in a brine shrimp lethality bioassay test. The  $\text{LC}_{50}$  value of the crude methanol extract of plant part are observed. The experiment shows the plant parts having cytotoxic activity <sup>[4]</sup>.

#### **Antidiabetic activity**

The study reveals that potential of *Clitoria ternatea* flowers is used as natural substances to reduce blood glucose level. A report stated that the glucose level are tested in diabetic rats decreased after 14 days of administering the flower extract with 150 mg/kg body weight. Administration of flower and leaf extracts on these extracts are injected with alloxan that decreased level of serum glucose, urea, blood glucose, triglycerides. Moreover, the extracts of flowers showed a positive antidiabetic activity against hyperglycaemic and hyperlipidaemic condition <sup>[5]</sup>.

#### **Neuropharmacological activity**

The study is done in root by using aqueous extract. An investigation published on improving cognitive behaviour from *Clitoria ternatea* root. Administration of 100mg/kg of aqueous root extract increased acetylcholine content in hippocampus of neonatal rats. The incubated of neonatal rats' pups with 50 and 100 mg/kg of aqueous extract of roots for 30days shows improvement of retention of passive avoidance and spatial learning <sup>[5]</sup>.

#### **Antipyretic activity**

Antipyretic potential of the methanolic extract of root of *Clitoria ternatea* on normal body temperature and yeast-induced pyrexia in albino rats. After 19 hours of yeast suspension (10 ml/kg body weight) observes that increasing in rectal temperature. The extract of the root shows a significant reduction in normal body temperature at doses of 200,300 and 400 mg/kg body weight and this effect are extended up to 5 hours after the drug administration <sup>[4]</sup>.

#### **Antiasthmatic activity**

The ethanolic extracts of root of the *Clitoria ternatea* was evaluated using the milk induced leucocytosis and eosinophilia in mice, egg albumin mast cells degranulation in rats and passive cutaneous anaphylaxis in rats. There are significant decreased in milk induced leucocytosis and eosinophilia, protection against egg albumin induced degranulation of mast cell in mice and inhibition of area of blue dye leakage in passive cutaneous anaphylaxis in rats are observed while treatment with ethanolic extract of *Clitoria ternatea* roots <sup>[17]</sup>.

#### **Hepatoprotective activity**

The methanolic extract of *Clitoria ternatea* leaf at the dose of 200 mg/kg in mice shows the protective effect against paracetamol induced liver toxicity by decreasing the levels of aspartate aminotransferase, bilirubin and. alanine aminotransferase. According to previous studies the hepatoprotective effect of white and blue *Clitoria ternatea* leaves extracts was evaluated in carbontetra chloride induced hepatotoxicity in rats. The studies observed that the white coloured flower showed more hepatoprotective activity than compare to blue flower Clitoria leaves <sup>[19]</sup>.

#### **Local Anaesthetic effect**

The ethanolic extract of aerial parts of *Clitoria ternatea* was evaluated using corneal anaesthesia in rabbits and plexus anaesthesia in frogs. The observation shows that 10 % solution of plant extract produced abolition of foot withdrawal reflex in frog but did not show any surface anaesthetic effect on rabbit cornea <sup>[19]</sup>.

#### **Anticancer activity**

Invitro cytotoxic effect of petroleum ether and ethanolic flower extract of 10,50,100,200,500  $\mu\text{g}/\text{ml}$  of plant was studied using trypan blue dye exclusion method. These two extracts exhibited Dose Dependent cell cytotoxic activity. The concentration 10 $\mu\text{g}/\text{ml}$  of petroleum ether shows 8 % reduction was observed in 500 $\mu\text{g}/\text{ml}$ . By using ethanolic extract 10 $\mu\text{g}/\text{ml}$  concentration possessed 1.33 % reduction in cell count, while at 500 $\mu\text{g}/\text{ml}$  80% reduction in cell count was observed <sup>[11]</sup>.

#### **Conclusion**

*Clitoria ternatea* possess a significant number of advantageous and natural properties against several diseases and ailments in the human body. The plant is a multitude of medicinal applications reported so far from various *Clitoria ternatea* preparation are impressive. The whole plant and its various extracts cover a lot of pharmacological activities. It is to be concluded that the paper reviewed *Clitoria ternatea* as promising medical plant with wide range of medicinal properties and also pharmacological activities which could be utilized in several medical applications because of its effectiveness and safety.

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