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Medicinal importance of *Clitoria ternatea*

Pallavi Mahesh More and Kunal Ramesh Hake

Abstract

Clitoria ternatea contained various chemical constituents tannins, phlobatannin, carbohydrates, saponins, triterpenoids, phenols, flavanoids, flavonol glycosides, proteins, alkaloids, anthraquinone, anthocyanins, cardiac glycosides, Stigmast- 4-ene-3,6-dione, volatile oils and steroids. The *Clitoria ternatea* plant showed many pharmacological effects including antioxidant, hypolipidemic, anticancer, anti-inflammatory, analgesic, antipyretic, antidiabetic, CNS, antimicrobial, gastro-intestinal antiparasitic, insecticidal and many other pharmacological effects. This Review will highlight the medicinal importance of *Clitoria ternatea*.

Keywords: *Clitoria ternatea*, Butterfly pea medicinal plant, anticancer, antioxidant

Introduction

A large and increasing number of patients in the world use medicinal plants and herbs for health purpose. Due to changing life style the health of human being is lost day by day. Therefore, *Clitoria ternatea* scientific examination in therapeutic potential, biological properties, and safety will be useful in making wise decisions about use of *Clitoria ternatea*^[1, 2]. Some active chemical constituents of *Clitoria ternatea* involved in management of life threatening disease and disorders. *Clitoria ternatea* showed wide range of pharmacological activities including antimicrobial, antioxidant, anticancer, hypolipidemic, cardiovascular, central nervous, respiratory, immunological, anti-inflammatory, analgesic antipyretic and many other pharmacological effects^[3]. Aparajita's botanical name is *Clitoria ternatea* and belongs to Fabaceae (Pipilionaceae) family.

Plant profile

Aparajita's botanical name is *Clitoria ternatea* and belongs to Fabaceae (Pipilionaceae) family.

Synonyms: *Clitoria albiflora* Mattei, *Clitoria bracteata* Poir., *Clitoria mearnsii* De Wild., *Clitoria tanganicensis* Micheli, *Clitoria zanzibarensis* Vatke^[4].

Taxonomic classification

Kingdom : Plantae
Subkingdom : Viridaplanta
Infrakingdom : Streptophyta
Division : Tracheophyta
Subdivision : Spermatophytina
Infrodivision : Angiospermae
Class : Magnoliopsida
Superorder : Rosanae
Order : Fabales
Family : Fabaceae
Genus : *Clitoria* L.
Species : *Clitoria ternatea*^[5, 6].

Common names:

Arabic : Mazerion Hidi, Baslat el-Zuhoor;
Bengali : Aparajita,

Chinese	: die dou
English	: blue-pea, bluebellvine, butterfly-pea, cordofan-pea, Darwin-pea
French	: honte
German	: blaue Klitorie
Hindi	: Aparajita
Portuguese	: clitória-azul, clitória;
Punjabi	: Koyal;
Sanskrit	: Girikarnika, Vishnukranta;
Spanish	: conchitas papito, azulejo, zapatico de la reina, zapotillo;
Swedish	: himmelsärt
Tamil	: Kakkanam and
Telugu	: Dintena ^[4-6] .

Agronomic characteristics

Soil: *Clitoria* is well adapted to grow in wide range of soil types (in between pH range 5.5-8.9) from deep alluvial to sandy including calcareous soils. It extremely well adapted to heavy clay alkaline soils, and especially on clay soils but also grows well in moderate fertile soils ^[7]. *Clitoria ternatea* likes a rich, moist soil (peat moss: loam: part sand or perlite 2:1:1) therefore the soil should be evenly moist at all times for well growth.

Water: It requires approximately 400 mm of rainfall but also performs well under irrigation areas and grows from drier areas like Kordofan in the Sudan to the fairly drought tolerant in Zambia. Due to the nature of *C. ternatea*, it cannot tolerate prolonged inundation or water logging but can tolerate short term flooding.

Sun light: It is moderately shade-tolerant but can normally grow in full sunlight.

Temperature: It needs moderate temperature down to 25 °C but not suited to locations with frequent or severe frosts, but it stands up well in hot summer temperatures and having low frost tolerance.

Fertilizer: *C. ternatea* is normally grown in soil containing phosphorous (P) and sulphur (S) which may be required as fertilizers if sown in the infertile soils.

Propagation: It contains around 20% of hard seed according to the seasonal conditions in where it is produced and grows rapidly in warm-moist weather. It is harvested manually by hands and is propagated from seed by cuttings ^[5]. The seeds of *Clitoria ternatea* are covered by hard seed coats therefore do not germinate or imbibe water, but when stored for 6 months 15-20% germination can be obtained. The use of hot water, sulphuric acid (H₂SO₄), potassium hydroxide and soaking in 100 mg/L solution of Sodium cyanide (NaCN) has also improved germination and early plant growth while mechanical scarification increased germination of 6-month-old seed from 30% to 71% ^[8,9].



Clitoria ternatea

Biological uses of *Clitoria ternatea*

Clitoria ternatea acts as a anticancer, hepatoprotective brain stimulant or enhance the memory, useful in alcohol withdrawal CNS symptoms, antioxidant as well as antidiabetic, hypolipidemic, antihistaminic and antiasthmatic effect etc. ^[3] The whole plant and seed extracts are useful in stomatitis, piles, sterility in female, hematemesis, insomnia, epilepsy, psychosis, leucor-rhea, and polyurea ^[10]. The root bark is diuretic and laxative ^[11] and its roots possess anti-inflammatory, analgesic, and antipyretic properties ^[12]. The roots are also purgative, ophthalmic, alexiteric, anthelmintic, depurative, aphrodisiac, and are useful in indigestion, constipation, soar throat, skin diseases, eye ailments, tubercular glands, amentia, hemicrania, burning sensation, strangury, leprosy, leucoderma, elephantiasis, arthritis, bronchitis, asthma, pulmonary tuberculosis, ascites, ulcers, visceromegaly, and as a poultice for joints ^[10, 13]. The leaves are recommended for treatment of nostalgia and eruptions. The root, stem, and flower are given in snakebite and scorpion sting. The seeds are purgative, cathartic, and useful in visceralgia. In addition, butterfly pea is a highly nutritive forage legume, generally preferred by livestock over other legumes ^[14].

It is used for ornamental purpose due to its twinning growth property as well as attractive colour blue or white. The *Clitoria ternatea* yield is blue and is used as substitute for litmus ^[10].

Antimicrobial effect

Different extracts of *Clitoria ternatea* showed inhibitory effects against *Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumonia*, *Bacillus subtilis*, *Aeromonas formicans*, *Aeromonas hydrophila* and *Streptococcus agalactiae*. Ethyl acetate extracts of *Clitoria ternatea* showed maximum zone of inhibition against *A. formicans* (18 mm), *A. hydrophila* (19 mm), *B. subtilis* (19 mm) and *P. aeruginosa* (21 mm) next to that ethanol extract of *Clitoria ternatea* showed maximum zone of inhibition against *A. formicans* (18 mm) and *E. coli* (14 mm) followed by the acetone extract which showed maximum zone of inhibition against *S. agalactiae* (19 mm) and *K. pneumonia* (17 mm) ^[15].

Anticancer effect

The *in vitro* cytotoxic effect of petroleum ether and ethanolic flower extracts (10, 50, 100, 200, 500 µg/ml) of *Clitoria ternatea* was studied using trypan blue dye exclusion method. Both extracts exhibited significant dose dependent cell cytotoxic activity. For petroleum ether extract the concentration 10 µg/ml showed 8% reduction in cell count, however, 100% reduction was observed at 500µg/ml. In case of ethanolic extract, 10 µg/ml concentration possessed 1.33% reduction in cell count, while, at 500µg/ml 80% reduction in cell count was observed ^[16].

Antioxidant effects

The different solvent extracts of *Clitoria ternatea* leaf were assessed for their *in vitro* free radical scavenging potential by 1,1-diphenyl-2-picryl-hydrazyl (DPPH) radical scavenging assay. All extracts exhibited potent *in vitro* free radical scavenging activity that increased with extract concentrations. The methanol extract was found to be the most potent, followed by the chloroform and petroleum ether extracts ^[17].

Protective effects

Petroleum ether, chloroform, and methanol extracts of roots of blue and white flowered varieties of *Clitoria ternatea* (CT) were studied for their hepatoprotective potential against carbon tetrachloride (CCl₄) induced hepatotoxicity in rats. The hepatoprotective activity was assessed using various biochemical parameters like serum glutamate oxaloacetate transaminase, serum glutamate pyruvate transaminase, serum alkaline phosphatase and total bilirubin along with histopathological studies of liver tissues. The substantially elevated serum enzymatic levels of serum transaminases, alkaline phosphatase and total bilirubin were significantly restored towards normalization with the treatment of CT^[18].

Wound healing effect

The wound healing activity of *Clitoria ternatea* seed and root extracts was investigated using excision, incision and dead-space models in rats. *Clitoria ternatea* seed and root extracts significantly improved wound healing in excision, incision and dead-space models when administered orally by gavages as well as applied topically as ointment. These effects were comparable to that of cotrimoxazole ointment. The finding of the study also showed that *Clitoria ternatea* affected all three phases: inflammatory, proliferative and remodeling phases of wound healing^[19].

Gastrointestinal effect

The antiulcer potential of aqueous and ethanolic extracts of *Clitoria ternatea* was evaluated in different experimentally induced ulcer models in rats. Ethanolic extract (200 and 400 mg/kg) and aqueous extract (200 and 400 mg/kg) of whole plant were examined in pylorus ligation and indomethacin induced gastric ulcer in rats. Various parameters like volume of gastric acid secretion, pH, total acidity, ulcer index and antioxidant parameters were determined and compared between extracts, standard and vehicle control group following ulcer induction. Among different dose of alcoholic extract, high dose showed significant antiulcer activity in pylorus ligation and indomethacin induced ulceration^[20].

Central nervous effect

Seeds and leaves of *Clitoria ternatea* have been widely used as brain tonic and believed to promote memory and intelligence. The activity of *Clitoria ternatea* in Alzheimer's disease was studied to investigate its efficacy and to identify the major bioactive constituent attributing the activity. The result showed that the aqueous extract of *Clitoria ternatea* was beneficial in Alzheimer's disease through many mechanisms. The isolated compounds may act as a lead compounds for identifying new derivatives which could use for improving memory. Shankpushpi, a well-known drug in Ayurveda, is extensively used for different central nervous system (CNS) effects especially memory enhancement. Different plants were used under the name shankpushpi in different regions of India, leading to an uncertainty regarding its true source. Plants commonly used under the name shankpushpi are: *Convolvulus pluricaulis* Choisy., *Evolvulus alsinoides* Linn., both from Convolvulaceae, and *Clitoria ternatea* Linn. (Leguminosae). The memory-enhancing activity of these three plants was investigated^[21].

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