THE CHEMICAL COMPOSITION AND PHARMACEUTICAL ROLE OF *CLITORIA TERNATEA*: A REVIEW

Abstract

Clitoria ternatea is one of Asia most significant medicinal plants. It is known to contain various constituents that are helpful in treating different types of diseases like skin disease, sore throats , tumors , sight weakness, chronic bronchitis, dropsy, goiter, leprosy, mucous disorders etc. Ayurveda has made extensive use of this plant. This plant was used as an antitode in the past to treat things like sore joints, urinary problems, snake bites etc. In terms of pharmacology, it has anti-carcinogenic, anxiolytic, analgesic, anti-inflammatory, anti-microbial, anti-depressive, nephroprotective, anti-stress, anthelmintic, larvicidal , antihyperglycemic , antioxidant , antihistaminic activities. Plant also plays a pivotal role in food and textile industry as coloring agent. In this review, we discussed about the chemical composition and pharmaceutical role of Clitoria ternatea and furthermore we had also mentioned how it can used for human health benefits. In addition, it also has ornamental importance. This review also covered the nutritional as well as the industrial application of this plant. As now a days specifically after COVID-19, people have become health conscious and try to move towards the plant-based food products as well as the drugs formed from the plant (medicinal) due to its no or very less side effects and the easily availability as well as the cost effectiveness. Due to low cost of the plant-based products and its potential positive effect over the health, the plant attracted the attentions to write the review due to its high potential effect and usefulness, but very limited studies are available on this. The study will also include the most updated researches.

Keywords: *Clitoria ternatea; Anthocyanin; pharmaceutical; Darwin pea; butterfly pea*

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I. INTRODUCTION

An enormous and extending number of people use restorative plants and spices for wellbeing reasons from one side of the planet to the other. Settling on shrewd conclusions about their utilization will accordingly profit from logical assessment of their therapeutic potential, organic highlights, and wellbeing (Vickers and Zollman, 1999; Abdullaev, 2002). Many significant medications and physiologically active substances have been created from traditional medicinal herbs. The plant shown a wide variety of pharmacological properties like antibacterial, anti-inflammatory, antipyretic, antioxidant, anticancer, cardiovascular, analgesic, respiratory, immunological and more such similar pharmacologic actions.

Clitoria ternatea is a perennial ever lasting plant. It is an angiosperm and growing form of climber , vine and liana with an uneven shape. It is a lean mounting legume which has small, easy hairs on stem. The plant, commonly known as butterfly pea, has profound roots and attractive flowers5-7 elliptic, 2.5–5 cm long, stalked, alternately arranged leaflets make up the pinnate foliage. Each thin, membranous leaflet measures 2.5–5 cm in length and 1.5–3.5 cm in width. Clitoria ternatea flowers are shaped like a funnel, 4 by 3 cm, found in both single and paired states, base with blue and yellow or complete white, standard obovate, notched or rounded at apex. They bloom in a range of colours from white to light blue to dark blue to pink. (Poh, 2019). These flowers are often utilized as food colours in various dishes like Nasi Kerabu, a traditional dish from Kelantan, Malaysia, and are known commercially as Bunga telang. Its fruits are linear-oblong pods, 5-11cm in length and 0.7-1cm in width, with a prolonged sharp tip (Ramaswamy et al., 2011).

Clitoria ternatea grows well in humid or sub-humid habitats with mean annual temperature range of 15 to 28 degree celcius. It also displays drought tolerance. Usually grown in full sun but soberly shade tolerant, adjusted to varied soil types with 5.5 to 8.9 pH (Poh, 2019). It works well as a cover crop and also as a rich manure, and it enhances soil quality by fixing nitrogen. It produces high yields quickly after cutting and displays amazing regeneration. The plant was originally found in tropical Asia. Livestock and cattle prefer Clitoria ternatea over other legumes because it is a very tasty fodder plant.

As long as there has been human civilization, numerous medications and chemicals (based on plants) have been used to cure various ailments and symptoms. Clitoria ternatea is one among these. Aparajita, often known as medha, is a medication that boosts memory and intelligence. It can also be used to treat severe diseases like tumours, lung diseases like bronchitis, goitre, leprosy, mucous conditions, and skin diseases. (Ramaswamy *et al*., 2011) Extracts of distinctive plant parts have different effects on different test microorganisms because of its nature, mode of action and anti-microbial activity. One of the essential components in the production of various medicines such as "SULAK" and its bam for treating disease is root powder. (Srivastava *et al*., 2009). The plant demonstrated numerous pharmacological activities, including insecticidal, antimicrobial, hypolipidemic, analgesic, antipyretic, anticancer, anti-inflammatory, gastro-intestinal antiparasitic, and many other pharmacological actions. Numerous species of Clitoria are used medicinally to increase fertility, control menstrual flow, treat gonorrhoea, and arouse sexual urges. (Snafi, 2016).

The primary objective of this review is to summarize the pharmaceutical uses of *Clitoria ternatea* in perspective of health issues as well as to explore their nutritional and pharmaceutical content.

1. Botanical Classification

Kingdom	Plantae
Division	Tracheophta
Class	Magnoliopsida
Order	Fabales
Family	Fabaceae
Genus	Clitoria L.
species	Clitoria ternatea

(Sahanas and Akhila., 2014)

2. Others Name

Language	Names
Arabic	Mazerion Hidi, Baslat el-Zuhoor
Bengali	Aparajita
French	Honte
German	Blaue Klitorie
Sanskrit	Girikarnika, Vishnukranta
Spanish	Conchitas papito, azulejo, zapatico de la reina, zapotillo

(Sahanas and Akhila., 2014)

II. TRADITIONAL USES

Since past, the Plant and its parts, for example, leaves, stems, bark, blossoms, organic products, roots and seeds were utilized remedially. The underlying foundations of this plant were utilized in treating monks, development of the stomach viscera, sore throat and skin sicknesses, epilepsy and craziness. They were likewise utilized as laxative, however not by and large prompted since it caused torment and gritting. They were demulcent and given in persistent bronchitis. Root in organization with honey and ghee suggested for youngsters to work on intellectual capacities, solid strength and coloring tonics. The juice extracted from the roots of the white-blossom served to explode the nostrils which proved as an effective solution for issues like hemicrania. The root (dry and powdery) were additionally tracked down successful in ailment, and ear-sicknesses (Moris, 1999). In the Indian state of Assam, juice of the leaves of butterfly pea in addition to salt is applied on ears in migraine and expanding of adjoining organ to ease torment. Bloom juice was utilized as a cure for snake nibble. Seeds were additionally utilized for enlarged joints, squashed seeds with cold or bubbled water for urinary issues. 50 gm of squashed seeds is taken with water (daily for three days). As per Rajshahi region in Bangladesh, the seeds are risen in water and focused with the help of texture, 1/32 kg of the stressed water to be consumed for 7 days in issues concerning urinary passage. Constipation was relieved by combining Clitoria ternatea seed powder with pepper.

III. PHYTOCHEMICAL CONSTITUENTS

Clitoria ternatea was found to contain various phytochemicals, including tannins, phlobatannin, unstable oils, starches, saponins, heart glycosides, triterpenoids, phenols, flavanoids, anthocyanins, flavonol glycosides, antharaquinone, proteins, alkaloids, stigmast-4-ene-3,6-dione, and also in steroids (Lijon *et al*., 2017).

1. Chemical Constituents

- **Leaves** contain 3 monoglucoside, 3-o-rhamnosyl Glycoside, 3-rutinoside, kaempferol-3-orhamnosyl, neohisperidoside, beta-sitosterol, aparajitin, and rejuvenating oil.
- **Roots** have ß-carotene, starch, stigmast-4-ene-3, tannins and pitches, 6, diene taraxerol and teraxerone, flavonoids.
- **Blossoms** comprise of delphinidin-3, kaempferol, 5-diglucoside, malvidin-3ß - glucoside, delphinidin3ß-glucoside, and p-coumaric corrosive.
- **Seeds** have greenish-yellow fixed oil, linoleic, palmitic, oleic, stearic, and linolenic acids.

IV. THE PHARMACEUTICAL ROLE OF CLITORIA TERNATEA

1. **Anxiolytic Activity:** Alcoholic concentrate of butterfly pea at a centralization of 460 mg/kg stretched the time period to go through the labyrinth as brought about by chlorpromazine in rodent (Chauhan *et al*., 2012). This showed an extensive impact on uneasiness. The expression proportion and segregation list additionally expanded , giving confirmation about nootropic activity of the species'.

2. **Anti-Inflammatory And Analgesic Activity:** The Aparajita flowers' oil extract (60-80c) shown anti-inflammatory effectiveness at both doses (200 and also at 400 mg/kg of body weight) (P 0.01) (Chauhan *et al*., 2012). *Clitoria ternatea's* methanol extract shows antipyretic efficacy, when administered in rats, found to decrease the oedema and the vascular permeability prompted via carrageenin and acidic corrosive individually.

3. **Anti-Microbial Activity**: Analysis was done on the effectiveness of methanolic concentrates of Clitoria ternatea's leaves and roots as antibacterial agents against various pathogenic drug-safe Gram-positive and Gram-negative clinical segregates. (Chauhan *et al*., 2012). Leaves exhibit antibacterial action against Escherichia coli and Vibrio cholera, can cause diarrhea, and Staphylococcus aureus, which causes fever. The antibacterial movement of leaf was a lot more grounded than that of the root remove. Quercetin might add to the action of leaf extract. Another examination found that the most extreme zone of hindrance for *Clitoria ternatea* crude extract against Escherichia coli at 0.75 mg focus was 22±0.5 mm , and the base zone of restraint for Micrococcus flavus was 14±1.0 mm. According to Haskar et al. (2010), the callus extract had the smallest zones of tolerance (121mm) and the biggest zones (162mm) against Salmonella typhi and Escherichia coli and Staphylococcus aureus, correspondingly. Use of agar well dissemination against Gram-negative germs was used to assess the antibacterial activity of heavy drinkers and fluid concentrates from in vitro generated calli. Shigella dysenteriae and Salmonella spp.,

which cause intestinal fever, were shown to have antibacterial activity (Shahid et al., 2009). In addition, Klebsiella pneumoniae and Pseudomonas aeruginosa were adversely affected by the antibacterial effects of the unrefined methanol concentrates (Shekawat and Vijayvergia, 2010). Rough concentrate of *Clitoria ternatea* seeds exhibited intense antimicrobial movement. Leucoderma is dealt with explicitly with the root of this plant (Pendbhaje *et al*., 2011).

4. **Anti-Carcinogenic Activity**: According to recent studies, plants and their constituent parts can hinder growth development, prompt apoptosis in disease cell, and suppress tumour angiogenesis. The most popular herbal remedies also have the ability to interfere with cell cycle progression, boost immune function, and inhibit tumour growth (Lijon *et al*., 2017). *Clitoria ternatea* extracts have a good correlation with cancer-suppressing or anti-carcinogenic efficacy from other plant extracts (Ramaswamy *et al*., 2011). It was discovered that the pure lectin might be used as a tool for cancer research (Lijon *et al*., 2017).

5. **Anti-Depressive Activity**: It was discovered that the butterfly pea extract has nootropic, anxiolytic, anti-depressant, and anti-stress properties. The nootropic medications improve memory, learning, and intellectual ability (Gupta *et al*., 2010 and Mukherjee *et al*., 2008). *Butterfly pea* is used to treat symptoms including syncope, vertigo, and brain weakness since it has been reported to have a tranquillizing impact on the brain. Plants effect on mental way of behaving, uneasiness, melancholy, stress, and seizures has been explored. The methanolic concentrate of this plant was found to have nootropic, anxiolytic, anti-depressant, anti-convulsant, and anti-stress activities by employing Pentylenetetrazol (PTZ) and maximal electroshock (MES) (Taranalli *et al*., 2000).

6. **Nephroprotective**: It has been demonstrated that administering an ethanol extract of the *Clitoria ternatea* plant can protect the kidneys against the nephrotoxicity caused by APAP. It gives exploratory proof that *Clitoria ternatea* expanded the myocardial cancer prevention agent catalysts level, monitored histoarchitecture and improved heart execution after APAP organization announced in assessment of phytoconstituents, nephro-defensive and cell reinforcement exercises of Honte (Sarumathy *et al*., 2011).

7. **Calming Activity:** (Chauhan et al., 2012) Rat and mouse models of cold restraint stress (CRS)-induced ulcers, lithium-induced head twitches, hypothermia caused by clonidine, respiratory arrest caused by sodium nitrite, and catalepsy caused by haloperidol were used to assess the anti-stress action of aerial components.

8. **General Behavior:** *Clitoria ternatea* root concentrate in ethanol shows neuropharmacological activity (Gupta, 2010). The ethanol extract (100 and 150mg/kg) reduced unconstrained movement, decreased exploratory personal conduct standard as estimated by the head plunge and Y-labyrinth test, and decreased muscle relaxation as estimated by the rotarod, 30 degree celcius inclined screen, and traction tests. These outcomes demonstrated huge neuropharmacological action (Boominathan *et al*., 2003).

9. **Larvicidal Activities:** The most encouraging mosquito larvicidal activity was exhibited by *Clitoria ternatea*. With LC50 values of 65.2 and 54.4 ppm for Anopheles stephensi,

Anopheles aegypti, and Culex quinquefascitus, correspondingly, the methanol concentrates of Aparajita seed eliminate were potent against the hatchlings of each of the three species of animals (Chauhan et al., 2012; Pendbhaje et al., 2011).

10. **Anthelmintic Activities:** The anthelmintic activity of *Clitoria ternatea* has been the subject of various examinations. According to Chouhan, it was shown that the rough alcoholic concentrate of the plant and its ethyl acetic acid derivation and methanol divisions impressively caused worm paralysis and demise, when contrasted with the reference of standard piperazine citrate. Repressive impact of the leaves of Aparajita was evaluated utilizing watery and methanol remove on free living nematode. In another review, the antihelmintic impacts of *Clitoria ternatea's* blossoms, leaves, stems, and roots on grown-up Pheretimaposthuma worms from India were surveyed. In contrast with different concentrates, the root's methanol extract is the best and takes the least amount of time to paralyse and kill worms. From blossoms to roots to leaves to stems, potency grows (Chauhan *et al*., 2012).

11. **Antihyperglycemic:** *Clitoria ternatea* exhibited anti-hyperglycemic activity (Patil *et al*., 2011).

12. **Diuretic Activity:** The dried form of root (powdered) was tried for diuretic activity, and just a solitary I.V. portion of the concentrate created a gentle expansion in urinary discharge of Cl , K, and Na. Oral dosing likewise had an observable effect (Chauhan *et al*., 2012).

13. **Urinary System:** Aparajita causes an increase in urination. Decoction is utilized for ulcers and antidotal properties and even in dysuria and urine problems (Pendbhaje *et al*., 2011).

14. **Antioxidant:** According to Kamkaen and Wilkinson, Thai beauty care products contain *Clitoria ternatea* (butterfly pea) bloom extracts, and in light of their synthetic cosmetics, it's conceivable that these concentrates have cell reinforcement properties. *Clitoria ternatea* aqueous concentrates have higher cancer prevention agent action than the extracts of ethanol.

15. **Anti-Histaminic:** *Butterfly pea* demonstrated anti-histaminic action in mice ((Taur and Patil, 2010). In addition to this, *Clitoria ternatea* is used to treat filariasis, eye infections, to regulate menstrual flow, to prevent abortion and stabilise the foetus (white form is administered orally after being mashed in milk). It is viewed as a beneficial mind tonic, and in Ayurveda, "Sankhapushpi," a formulation, the roots and seeds of Butterfly pea are utilized as an alterative, laxative, and "tonic of the nerves." Sexual health issues are also treated with it (Pendbhaje *et al*., 2011).

16. **Anti-Diabetic :** Watery concentrate made from the leaves and blossoms of Clitoria ternatea caused significant drops in serum glucose, glycosylated haemoglobin, complete cholesterol, fatty acids, urea, and creatinine while increasing serum insulin, HDL cholesterol, protein content, liver and skeletal muscle glycogen, and the activity of the glycolytic chemical glucokinase (Terahara et al., 1996; Daisy et al., 2009).

17. **Miscellaneous:** Regarding the behaviour of Jersey crows that are breastfeeding, it was discovered that the target plant was effective as nitrogen additions to the diet of Napies grass. Using polar (ethanol) and non-polar (benzene) concentrates of Aparajita seeds (75 and 100 mg/kg), intraperitoneally, it was attempted to treat milk-induced leucocytosis and eosinophilia in mice. Significant suppression was noted. The milk-actuated leucocytosis was shown to be dose-dependent in the ethanol and benzene extracts. However, ethanol extracts demonstrated dose-dependent reduction of eosinophilia in milk-induced eosinophilia but benzene extract did not. This leucocytosis and eosinophilia inhibition suggests *Clitoria ternatea* has anti-allergic potential (Taur *et al*., 2009).

18. **Effect on Digestive System:** It functions as a moderate laxative, cholagogue, and an antiemetic. As a result, it is used to treat piles, jaundice, dyspepsia, and emesis. It is also used to treat ulcers of pylorus duodenum etc (Pendbhaje *et al*., 2011). ACT AS

V. NATURAL COLORANT IN FOOD AND TEXTILE

Anthocyanins exist in their blue structure (the anionic quinoidal base) in fluid and antacid arrangements. Notwithstanding, the variety rapidly disperses and is frequently of low force because of the presence of dreary hemiacetal. To make a dish seriously engaging, blossoms are utilized as a characteristic food colorant that is added to pastries and, surprisingly, in grains like rice and porridge (Karel et al., 2018).

VI. ORNAMENTAL IMPORTANCE

Eye-catching color of Aparajita is carried into the home, garden, and ornamental crops, increasing their value. The Butterfly Pea has a lot of beneficial qualities, and India also uses it as a good source of feed for animals. It serves as a versatile feed legume because of its non-toxic leaves and thin stem (Karel et al., 2018).

VII. VALUE ADDITION IN FOOD INDUSTRY

In Southeastern Asia (Indonesia and Malaysia) and Madagascar, Clitoria ternatea is utilized as a food color or plunged in hitter or rotisserie as wastes. Refreshments can be prepared from wonderful blue blossoms as Natural beverage and tea, ready to serve drinks brimming with cell reinforcements and phytonutrients. Natural dyes have experienced a resurgence as a result of growing environmental awareness of the health risks posed by synthetic dyes. The utilization of normal colors as key substitutions for engineered colors has expanded. Butterfly pea blossoms, which produce tone, have been utilized to concentrate on variety extraction and can be utilized as a wellspring of color in shading industry (Karel et al., 2018).

VIII. CONCLUSION

In the study, Clitoria ternatea was examined as a potential medicinal herbal plant with an extensive range of pharmaceutical activities that might be used in a variety of medicinal applications due to its efficacy and safety. Information offered in this review will serve as a

guide in providing knowledge about various active ingredient of this plant responsible for its pharmaceutical effects.

REFERENCES

[1] Abdullaev, F. I. (2002). Cancer chemopreventive and tumoricidal properties of saffron (Crocus sativus L.). Experimental biology and medicine, 227(1), 20-25. https://doi.org/10.1177/153537020222700104
[2] Al-Snafi, A. E. (2016). Pharmacological importance of Clitoria ternatea–A review. IOSR Journal of Pharmacy, 6(3), 68-83.
[3] Banerjee, S. K., & Chakravarti, R. N. (1963). Taraxerol from clitoria ternatea linn. *Bulletin of the Calcutta School of Tropical Medicine*, *11*, 106-107.
[4] Banerjee, S. K., & Chakravarti, R. N. (1964). Taraxerone from clitoria ternatea linn. *Bulletin of the Calcutta School of Tropical Medicine*, *12*, 23.
[5] Boominathan, R., Devi, B. P., & Mandal, S. C. (2003). Studies on neuropharmacological effects of Clitoria ternatea Linn. root extract in rats and mice. Natural Product Sciences, 9(4), 260-263.
[6] Chauhan, N., Rajvaidhya, S., & Dubey, B. K. (2012). Pharmacognostical, phytochemical and pharmacological review on Clitoria ternatea for antiasthmatic activity. International Journal of Pharmaceutical Sciences and Research, 3(2), 398.
[7] Daisy, P., Santosh, K., & Rajathi, M. (2009). Antihyperglycemic and antihyperlipidemic effects of Clitoria ternatea Linn. in alloxan-induced diabetic rats. Afr J Microbiol Res, 3(5), 287-291.
[8] Devi, B. P., Boominathan, R., & Mandal, S. C. (2003). Anti-inflammatory, analgesic and antipyretic properties of Clitoria ternatea root. Fitoterapia, 74(4), 345-349. https://doi.org/10.1016/S0367-326X(03)00057-1
[9] Gupta, G. K., Chahal, J., & Bhatia, M. (2010). Clitoria ternatea (L.): Old and new aspects. J Pharm Res, 3(11), 2610-2614.
[10] Juma, H. K., Abdulrazak, S. A., Muinga, R. W., & Ambula, M. K. (2006). Evaluation of Clitoria, Gliricidia and Mucuna as nitrogen supplements to Napier grass basal diet in relation to the performance of lactating Jersey cows. Livestock Science, 103(1-2), 23-29. https://doi.org/10.1016/j.livsci.2005.12.006
[11] Kamkaen, N., & Wilkinson, J. M. (2009). The antioxidant activity of Clitoria ternatea flower petal extracts and eye gel. Phytotherapy Research, 23(11), 1624-1625. https://doi.org/10.1002/ptr.2832
[12] Lijon, M. B., Meghla, N. S., Jahedi, E., Rahman, M. A., & Hossain, I. (2017). Phytochemistry and pharmacological activities of Clitoria ternatea. International Journal of Natural and Social Sciences, 4(1), 1-10.
[13] Mhaskar, A. V., Prakash, K., Vishwakarma, K. S., & Maheshwari, V. L. (2010). Callus Induction and Antimicrobial Activity of Seed and Callus Extracts of Clitoria ternatea L. Current trends in biotechnology and pharmacy, 4(1), 561-567.
[14] Morris, J. B. (1999). Legume genetic resources with novel value added industrial and pharmaceutical use. Perspectives on new crops and new uses, 196-201.
[15] Mukherjee, P. K., Kumar, V., Kumar, N. S., & Heinrich, M. (2008). The Ayurvedic medicine Clitoria ternatea—From traditional use to scientific assessment. Journal of ethnopharmacology, 120(3), 291-301. https://doi.org/10.1016/j.jep.2008.09.009
[16] Mukherjee, P. K., Kumar, V., Mal, M., & Houghton, P. J. (2007). Acetylcholinesterase inhibitors from plants. Phytomedicine, 14(4), 289-300. https://doi.org/10.1016/j.phymed.2007.02.002
[17] Nawaz, A. H. M. M., Hossain, M., Karim, M., Khan, M., Jahan, R., & Rahmatullah, M. (2009). An ethnobotanical survey of Rajshahi district in Rajshahi division, Bangladesh. American Eurasian Journal of Sustainable Agriculture, 3(2), 143-150.
[18] Neelamma, G., Swamy, B. D., & Dhamodaran, P. (2016). Pharmacognostical, Phytochemical and pharmacological perspective of Clitoria ternatea L. International Journal of Current Trends in Pharmaceutical Research, 4, 159-165.
[19] Patil AP and Patil VR (2011). Clitoria ternatea Linn. An Overview. International Journal of Pharmaceutical Research, 3: 20-23.
[20] Pendbhaje, N. S., Sudheendra, G., Pathan, S. M., & Musmade, D. S. (2011). Ethnopharmacology, pharmacogosy and phytochemical profile of Clitorea ternatea Linn: an overview. Pharmacologyonline, 3, 166-175.
[21] Poh, N. A. B. A. (2019). Research of the ecology and morphology of Clitoria ternatea.

[22] Ragupathy, S., & Newmaster, S. G. (2009). Valorizing the'Irulas' traditional knowledge of medicinal plants in the Kodiakkarai Reserve Forest, India. Journal of Ethnobiology and Ethnomedicine, 5, 1-13.
[23] Ramaswamy, V., Varghese, N., & Simon, A. (2011). An investigation on cytotoxic and antioxidant properties of Clitoria ternatea L. International Journal of Drug Discovery, 3(1), 74-77.
[24] Sarumathy, K., Rajan, M. D., Vijay, T., & Jayakanthi, J. (2011). Evaluation of phytoconstituents, nephro-protective and antioxidant activities of Clitoria ternatea. Journal of Applied Pharmaceutical Science, (Issue), 164-172.
[25] Satyavati, G. V., Raina, M. K., & Sharma, M. (1976). Medicinal Plants of India, vol. I, IndianCouncilof Med. Res., New Delhi, India, 1976, 201-6.
[26] Sethiya, N. K., Nahata, A., Mishra, S. H., & Dixit, V. K. (2009). An update on Shankhpushpi, a cognition-boosting Ayurvedic medicine. Zhong xi yi jie he xue bao= Journal of Chinese integrative medicine, 7(11), 1001-1022. DOI: 10.3736/jcim20091101
[27] Shahid M, Shahid A and Anis M (2009). Antibacterial potential of the extract derived from leaves of medicinal plants Pterocarpus marsupium Roxb.,Clitoria ternatea, Korean Medical Database,Oriental Pharmacy and Experimental Medicine,174-181.
[28] Shahnas, N., & Akhila, S. (2014). Phytochemical, in vitro and in silico evaluation on Clitoria ternatea for alzheimer's disease. PharmaTutor, 2(9), 135-149.
[29] Shekhawat, N., & Vijayvergia, R. (2010). Evaluation of antimicrobial potential of some medicinal plants against plant and human pathogens. J. Pharm. Res, 3(4), 700-702.
[30] Sikdar, M., & Dutta, U. (2008). Traditional phytotherapy among the Nath people of Assam. Studies on Ethno-Medicine, 2(1), 39-45. https://doi.org/10.1080/09735070.2008.11886313
[31] Taranalli, A. D., & Cheeramkuzhy, T. C. (2000). Influence of Clitoria ternatea extracts on memory and central cholinergic activity in rats. Pharmaceutical biology, 38(1), 51-56. https://doi.org/10.1076/1388-0209(200001)3811-BFT051
[32] Taur, D. J., & Patil, R. Y. (2009). Effect of Clitoria ternatea seeds extract on milk-induced leucocytosis and eosinophilia in mice. Journal of Pharmacy Research, 2(12), 1839-1841.
[33] Taur, D. J., & Patil, R. Y. (2010). Antihistaminic activity of Clitoria ternatea L. roots. Journal of basic and clinical pharmacy, 2(1), 41.
[34] Terahara, N., Oda, M., Matsui, T., Osajima, Y., Saito, N., Toki, K., & Honda, T. (1996). Five new anthocyanins, ternatins A3, B4, B3, B2, and D2, from Clitoria ternatea flowers. Journal of Natural Products, 59(2), 139-144.
[35] Vickers, A., & Zollman, C. (1999). Herbal medicine. Bmj, 319(7216), 1050-1053. https://doi.org/10.1136/bmj.319.7216.1050
[36] Srivastava, V., Khan, S. A., & Banerjee, S. (2009). An evaluation of genetic fidelity of encapsulated microshoots of the medicinal plant: Cineraria maritima following six months of storage. Plant Cell, Tissue and Organ Culture (PCTOC), 99, 193-198.
[37] Karel, A., Kumar, H., & Chowdhary, B. (2018). Clitoria ternatea L. a miraculous plant. International Journal of Current Microbiology and Applied Sciences, 7(9), 1-4.

