Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2024; 13(5): 568-573
Received: 13-07-2024
Accepted: 14-08-2024

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Pharmacological relevance of *Clitoria ternatea* (Aparajita): A review

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DOI: https://doi.org/

Abstract
Stigmast4-ene-3, 6-dione, proteins, alkaloids, antharaquinone, anthocyanins, cardiac glycosides, proteins, carbohydrates, saponins, triterpenoids, phenols, flavonoids, and volatile oils and steroids were all present in *Clitoria ternatea*. In addition to many other pharmacological effects, the plant demonstrated antioxidant, hypolipidemic, anticancer, anti-inflammatory, analgesic, antipyretic, antidiabetic, central nervous system, antibacterial, gastrointestinal antiparasitic, and insecticidal properties. Because of its efficacy and safety, *Clitoria ternatea* was reviewed in the study as a promising medicinal plant with a broad spectrum of pharmacological activity that might be used in a number of medical applications.

Keywords: *Clitoria ternatea*, pharmacological effects, efficacy, medicinal plant

Introduction
Intelligence is regarded as the most crucial component of a successful job in the age of intellectual property rights. Achieving the intended goals in human existence also requires emotional stability, self-assurance, and well-directed Mana functions. It's nothing more than Medha, which is made up of the aforementioned elements. Medhya Rasayana medications have been reported by Ayurveda for encouraging the various Medha components—Dhi, Dhrti, Smruti, and Mana—to function in a healthy way as well as the illness of intelligence and Mana. One of the herbs used in Medhya Rasayana is aparajita. cited in classical literature. Despite being cited as a Medhya drug, Aparajita, which is recognized as Cliroria ternarea, is not utilized in "Maharashtra" for this reason. It is referred to as "Shankhapuspi" in southern India. Aparajita is widely accessible in Maharashtra; however, it is used because the Medhya medication has not yet been well studied. Reviewing the plant Aparajita in Ayurvedic classical sources, such as Samhita, Commentaries, Nighantu, and Chikitsagranth, is the aim of this work [1]. Therefore, this review is a critical evaluation of the knowledge currently available on pharmacognosy, ethnobotanical and ethnomedical applications, and medicinal uses as documented in traditional medical systems that have been passed down orally or in writing. The pharmacological, toxicological, and secondary metabolite research of this beneficial herb are also reviewed [2].


Plant Profile

Commom Name: Asian pigeonwings, bluebellvine, blue pea, butterfly pea, cordofan pea, Darwin pea [2].

Scientific classification
Kingdom: Plantae
Order: Fabales
Family: Fabaceae
Subfamily: Faboideae
Genus: *Clitoria*
Species: *ternatea* [3]

Description
The pentamerous zygomorphic pea-shaped blooms of *Clitoria ternatea* have a tubular calyx made up of five sepals that are fused together for roughly two thirds of their length. One huge, spherical banner, two wrinkled wings that are frequently half the length of the banner, and two white keels that help shield the floral organs make up the conspicuous corollae, which has five free petals. The slender, flattened pods have pointed tips and usually hold ten or so seeds. Palmitic acid (19%), stearic acid (10%), oleic acid (51–52%), linoleic acid (17%), and linolenic acid (4%) are all present in the seeds. According to reports, the seed has about 500 calories per 100 grams. C. ternatea yields oblong, whole, pinnate compound leaves with emarginate tips. On both leaf surfaces, the epidermis is made up of a single layer of cells with trichome outgrowths and a thick layer of cuticle protecting them. The upper epidermis is covered with a layer of palisade cells, lignified xylem, and paracytic stomata. C. ternatea has a deep root system that allows it to withstand drought for up to 7–8 months. The roots also develop huge nodules for fixing nitrogen [4].

Distribution
Originating in Tropical America, the species has spread throughout the tropics, including the warmer regions of India, including Kalyani (West Bengal), Bhubaneswar (Odisha), Venkataramannagudem (Andhra Pradesh), Ernakulum (Kerala), Anand (Gujarat), Mandsaur (Madhya Pradesh), Akola (Maharashtra), and Udaipur (Rajasthan) [5].

Traditional Uses
For ages, the traditional Ayurvedic medication *Clitoria ternatea* (Family: Fabaceae) has been utilized as a nootropic, memory booster, antistress, anxiolytic, antidepressant, anticonvulsant, tranquilizer, and sedative [6].

Phytochemistry
Pentacyclic triterpenoids, such as taraxerol and taraxerone, are the primary phytoconstituents present in the plant. The roots phytochemical screening reveals the presence of tannins, alkaloids, flavonoids, ternatins, saponins, Taraxerol, proteins, starch, carbohydrates, resins and taraxerone. The seeds contain an alkaloid, ethyl D-galactopyranoside, 3, 5, 7, 4-tetrahydroxyflavone-3-rhamoglycoside, p-hydroxycinnamic acid polypeptide, a highly basic protein called finotin, a bitter acid resin, tannic acid, pentosan, water-soluble mucilage, adenosine, an anthoxanthin glycoside, adenosine, adenosan, pentosan, essential amino acids, pentosan, and 6% ash [7]. Kaempferol 3-O-(2-O-α-rhamnosyl-6-O-malonyl), myricetin 3-O-(2″, 6″-di-O-α-rhamnosyl), and quercetin 3-O-(2-O-α-rhamnosyl-6″-O-malonyl)-β-glucoside-β-glucoside was extracted from *Clitoria ternatea* petals [8]. The primary phenolic components identified in C. ternatea flowers are ternatin anthocyanins and several flavanol glycosides of myricetin, rutin, kaempferol, and quercetin that are separated in a hydrophilic extract. Meanwhile, a lipophilic extract also identifies a number of phytosterols, which including campestrerol, stigmasterol, β-sitosterol, and sitostanol, as well as some fatty acids (palmitic acid, stearic acids, petroselinic acid, linoleic acid, arachidic acid, behenic acid, and phytanic acid), α-tocopherol and γ-tocopherol [9].

Reported activities
D. Sugumar *et al.* (2021) reported the anti-inflammatory and anti-arthritic activity of ethanolic extract of *Clitoria ternatea* roots (EECT) in carrageenan and histamineinduced paw edema in Female Wistar rats. In both carrageenan and histamine-induced inflammation, EECT demonstrated a substantial decrease in the mean paw edema volume. EECT's effectiveness in treating rheumatoid arthritis was evaluated in Wistar rats using an arthritic model produced by Freund's complete adjuvant (CFA). By evaluating paw edema and methodically grading arthritis symptoms, the anti-arthritic effect of EECT was ascertained. After day 7, there was a noticeable reduction in paw diameter in the groups treated with EECT (200 and 400 mg/kg) and diclofenac (10 mg/kg). Paw diameter was significantly reduced by EECT (400 mg/kg) and Diclofenac (10 mg/kg) starting on day 14 when compared to the CFA control. The changed biochemical, haematological (Hb, RBC, and WBC), and antioxidant (SOD, MDA, CAT, and GSH) parameters further supported the anti-arthritic action. Additionally, there was a noticeable reduction in joint damage with EECT (400 and 200 mg/kg) [10].
Wee Sim Choo *et al.* (2022) evaluated the Antioxidant, cytotoxic, and antibacterial activities of *Clitoria ternatea* flower extracts. An effective column chromatography technique was use to separate the anthocyanin-rich fraction from the flower and its cytotoxic, antioxidant, and antibacterial properties was studied. The total anthocyanin content (TAC) of the fraction with the highest TAC to total phenolic content (TPC) ratio of 1:6 was more effectively enriched by amberlite XAD-16 column chromatography than by C18-OPN. Using LC-MS analysis, a total of 11 ternatin anthocyanins were identified in the anthocyanin-rich fraction. With an IC_{50} value of 0.86±0.07 mg/mL using the 1, 1-diphenyl-2-picrylhydrazyl (DPPH) assay, the anthocyanin-rich fraction's antioxidant activity was more effective in the chemical-based assay than in the cellular antioxidant experiment utilizing RAW 264.7 macrophages. Using the human embryonic kidney HEK-293 cell line, an in vitro cytotoxicity test revealed that the anthocyanin-rich fraction was more damaging than the crude extracts. Compared to crude extracts, the anthocyanin-rich fraction also exhibited stronger antibacterial activity against Escherichia coli, Bacillus cereus, and Bacillus subtilis [11].
Manali Deb Barma *et al.* (2022) investigated the *In-vitro* Study of Anti-inflammatory and Antioxidant Activity of *Clitoria ternatea* Extract Mediated Selenium Nanoparticles. The green synthesis of nanoparticles has raised healthy practices and produced an economical, environmentally friendly method for synthesizing non-materials. Antioxidant activity was examined using the DPPH radical scavenging test. In comparison to the control, the produced nanoparticles demonstrated superior anti-inflammatory activity at 50 ml, with an inhibition percentage of 85.5% and the highest antioxidant activity, scavenging 89.1% DPPH. Because of their environmentally friendly synthesis, nontoxicity, and biocompatibility, selenium nanoparticles made from *Clitoria*

ternatea may be utilized as potential candidates for biomedical and environmental applications [12].

Md. Abu Saleh *et. al.* (2023) reported Antioxidant, Cytotoxicity, Antimicrobial Activity, and In Silico Analysis of the Methanolic Leaf and Flower Extracts of *Clitoria ternatea*. Applying the leaf extract (200 µg/ml) to E. coli demonstrated a significant inhibition zone of 13.00±1 mm, demonstrating the leaf extract's strong antibacterial qualities. Additionally, the leaf and flower extracts demonstrated significant biofilm inhibition efficacy against S. aureus, with corresponding inhibition percentages of 54% and 58%. Regarding antioxidant activity, the leaf and flower extracts demonstrated significant DPPH free radical scavenging properties. In particular, the leaf extract demonstrated a significant level of activity at 150 µg/ml of 62.39%, but the flower extract attained 44.08% at the same dose. When compared to the leaf extract, the foral extract showed a much greater mortality rate of 93.33% at a dosage of 200 µg/ml in our investigation that also assessed the effect on brine shrimp. By molecular docking approaches possible therapeutic targets were indentified, concentrating on the acbR protein (5ENR) linked to antibiotic resistance in E. coli. Compounds D1 (CID-14478556), D2 (CID-6423376), and D3 (CID20393) that were separated from the C. ternatea leaf extract showed binding energies of −8.2 kcal/mol, −6.5 kcal/mol, and −6.3 kcal/mol, respectively, in this research. Furthermore, the molecules E1 (CID-5282761), E2 (CID-538757), and E3 (CID-536762) from the following extract showed binding energies of -5.4 kcal/mol, -5.3 kcal/mol, and -5.1 kcal/mol, respectively [13].

Wahyu Widowati *et al.* (2023) evaluated antidiabetic effect of *Clitoria ternatea* extract (CTE) through antioxidant, anti-inflammatory, lower hepatic GSK-3β, and pancreatic glycogen on Diabetes Mellitus and dyslipidemia rat. To examine the CTE compounds, LC-MS/MS was employed. Rats were fed a high-fat diet for 28 days, after which they were given streptozotocin and nicotinamide to induce diabetes mellitus. The findings showed that CTE included inositol, 2-hydroxycinnamic acid, delphinidin-3-O-(6-O-p-coumaroyl), and (+) catechin 7-O-β-glucoside pyruvic acid and glucoside. For 28 days, CTE at 200, 400, and 800 mg/kg of BW, glibenclamide, and simvastatin were administered to rats with diabetes mellitus and dyslipidemia. In rats with diabetes mellitus and dyslipidemia, CTE raised pancreatic CAT, SOD, and protein levels while lowering pancreatic MDA, IL-18, pancreatic glycogen gene expression, liver GSK-3β protein expression, and pancreatic IL-6 protein expression. It also increased insulin levels, decreased serum glucose, and improved liver histology [14].

Wahyu Widowati *et al.* (2024) reported Antidiabetic and hepatoprotection effect of *Clitoria ternatea* flower (CTE) through antioxidant, anti-inflammatory, lower LDH, ACP, AST, and ALT on diabetes mellitus and dyslipidemia rat. Rats were given a high-fat diet (HFD) and propylthiouracil (PTU) for 28 days in order to cause dyslipidemia. Nicotinamide (NA) and streptozotocin (STZ) were used to cause diabetes mellitus. For 28 days, rats were given different dosages of CTE in addition to simvastatin and glibenclamide. In rats with diabetes mellitus and dyslipidemia, the study found that CTE decreased the levels of MDA, LDH, ACP, AST, ALT, IL-1β, and CRP while increasing the levels of SOD, CAT, and liver proteins. This implies that CTE may be helpful in the treatment of DM [15].

Anindita Behera *et al.* (2023) investigated the Antidiabetic and antioxidant effect of magnetic and noble metal nanoparticles of fresh flower aqueous extract of *Clitoria ternatea* by *in-vitro* and *in-vivo* models of a streptozotocin-induced diabetes model. The levels of the diabetes enzymes α-amylase, α-glucosidase, and xanthine oxidase were significantly reduced by the cobalt oxide and gold nanoparticles. The enhanced potential of antioxidant activity was also demonstrated by investigations of both nanoparticles' antioxidant activity conducted in vitro and in vivo. Both nanoparticles demonstrated anti-diabetic effects in in vivo experiments by markedly raising insulin levels. The reduction of serum cholesterol, triglycerides, HDL, VLDL, LDL, and creatinine content was demonstrated by the cholesterol profiling of both nanoparticles, indicating a lower risk of macrovascular problems linked to diabetes. In contrast, cobalt oxide nanoparticles did not have the same protective impact as gold nanoparticles [16].

Poungrat Pakdeechote *et al.* (2021) reported Butterfly Pea Flower *Clitoria ternatea* Extract (CT) Ameliorates Cardiovascular Dysfunction and Oxidative Stress in Nitric Oxide-Deficient Hypertensive Rats. For five weeks, male Sprague Dawley rats were fed L-NAME (40 mg/kg, drinking water) and either lisinopril (2.5 mg/kg/day) or CT extract (300 mg/kg/day) orally. Flavonoids were identified as the primary phytochemical constituents of the CT extract. In rats given L-NAME, the CT extract reduced their elevated blood pressure. In the aortic rings and mesenteric vascular beds of rats treated with L-NAME, supplementing with CT extract improved the vasorelaxation responses to acetylcholine and the contractile responses to sympathetic nerve stimulation. Treatment with CT extract partially reduced the development of left ventricular hypertrophy and dysfunction in L-NAME mice. In L-NAME rats, the CT extract reduced elevated oxidative stress, decreased plasma nitrate/nitrite levels, and relieved upregulated endothelial nitric oxide synthase expression. It inhibited the expression of tumor necrosis factor-alpha, nuclear factor-kappa B, NADPH oxidases 2, plasma angiotensin II, cardiac angiotensin II type 1 receptor, and elevated levels of serum angiotensin-converting enzyme activity [17].

Ajay Kumar Garg *et al.* (2023) investigated the Antianxiety Studies on methanolic extract of Leaves of *Clitoria ternatea* in Swiss Wister Rats. The neuroprotective impact of *Clitoria ternatea*, an elevated plus maze, and protocol were used to evaluate the behavioral alteration in trained rats. For assessing rodents' memory, learning, and anxiety the EPM was used. In a dark and quiet environment, animals were positioned in the middle of the device. The amount of time spent in both closed and open arms was noted. Alprazolam (2.5 mg/kg p.o.) was used as the positive control, and Swiss wister rats were administered various dosages of the leaf extracts. The results of the study show that higher dosages of methanolic extract 300 mg/kg have strong anti-anxiety properties and are similar to alprazolam's effects [18].

P. Muralidharan *et al.* (2021) reported Neuroprotective effects of ethanolic root extract of *Clitoria ternatea* against propionic acid-induced behaviour and memory impairment in autistic rat model. Glutamate and serotonin estimates were also carried out in vitro using a homogenate of isolated rat brain tissue. The ethanolic root extract shown encouraging effects against propionic acid-induced autism in the elevated plus maze test and object recognition. The extract treatment at two different doses (250 mg/kg and 500 mg/kg, respectively) prevented this damage significantly meaning that extract-treated groups demonstrated a dose-dependent improvement in novel object recognition. In rat brain homogenate, extract

treatment also significantly decreased the concentration of various neurotransmitters, such as glutamate and serotonin, in a dose-dependent way when compared to Group II [19].

Parichat Prachaney *et al.* (2021) investigated the effect of *Clitoria ternatea* aqueous flower extract (CT) on blood pressure and renal alterations in N^{ω}-nitro-l-arginine methyl ester hydrochloride (l-NAME)-induced hypertensive male Sprague Dawley rats. Lisinopril and CT aqueous floral extract reduced l-NAME-induced hypertension. CT flower extract or lisinopril co-treatment reduced the glomerular extracellular matrix buildup, renal fibrosis, and elevated serum creatinine levels seen in l-NAME-induced hypertensive mice. Also, CT flower extract or lisinopril co-treatment reduced elevated nicotinamide adenine dinucleotide phosphate oxidase 4 (Nox4) protein expression and elevated plasma angiotensin II (Ang II) in the kidneys caused by l-NAME. Additionally, in l-NAME-induced hypertensive rats, CT flower extract and lisinopril therapy decreased lipid peroxidation and increased kidney and plasma malondialdehyde levels [20].

Vilásia Guimarães Martins *et al.* (2022) reported biodegradable sodium alginate films loaded with 10–40 % *Clitoria ternatea* extract (CTE) anthocyanin-rich extract to preserve and monitor food freshness. The addition of 40% CTE produced films with antibacterial action against E. coli, and the alginate films demonstrated biodegradable characteristics in soil and beach sand within 15 days. The food simulant test showed that the loaded films exhibit good compatibility with aqueous and acidic foods due to the release of higher levels of polyphenols and anthocyanins. The films showed great colorimetric potential due to their ability to change color at different pH (pink-green), ammonia gas (blue-green), and sterilization process (blue-yellow). The incorporation of CTE into alginate films improved the thermal stability of the materials due to intermolecular interactions and crosslinking of polymeric networks. The blue tint of the film containing 40% CTE (F40) turned to purple and green when it was used to check the freshness of milk and meat products (pork and shrimp), respectively [21].

Graziela Bragueto Escher *et al.* (2020) investigated the Phenolic composition by UHPLC-Q-TOF-MS/MS and stability of anthocyanins from *Clitoria ternatea* blue petals. In the CLE and PPE extracts, UHPLC-Q-TOF-MS/MS provided a tentative identification of twelve compounds, being the six ternatin anthocyanins and derivatives of delphinidin that give C. ternatea petals their blue hue. The 3, 3′, 5′-triglycosides of malonylated delphinidin make up the ternatin structure. The antioxidant activity against the DPPH radical was maintained by the anthocyanins' color shifts and color reversibility between pH 2.25 and pH 10.20 in the direct/reverse spectrophotometric titration. In both the presence and absence of fructooligosaccharides, the aqueous extracts at pH 3.6 and 5.4 demonstrated thermal stability with activation energies greater than 99 kJ/mol. The extracts at pH 5.4 that were exposed to light were protected from anthocyanin photodegradation by the addition of fructooligosaccharides [22].

Zhimin Xu *et. al.* (2016) reported bioactive phytochemical profiles in both butterfly pea petals and seeds and also emphasise the role of those bioactive compounds in anticancer activity. Of the fifteen phenolics found in the seeds, the quantities of epicatechin, sinapic acid, and hydroxycinnamic acid derivatives were greater than 0.5 mg g^{-1}. A collection of ternatins, flavone glycosides, and delphinidin derivatives were found in the petals. Four phytosterols as well as a- and c-tocopherols were present in the seeds and petals. But compared to the petals, the seeds had a significantly larger concentration of b-sitosterol or c-tocopherol. The most prevalent fatty acid in the seeds and petals was linoleic acid, but the petals included phytanic acid. It was assessed how reduced HEp-2 human carcinoma cell viability was affected by lipophilic and hydrophilic extracts of the seeds [lipophilic extract of the butterfly pea seeds (LBS) and hydrophilic extract of the butterfly pea seeds (HBS)] and petals [lipophilic extract of the butterfly pea petals (LBP) and hydrophilic extract of the butterfly pea petals (HBP)]. Both HBS and HBP had a much greater impact on reduced cancer cell viability than either LBS or LBP, however HBS had a far greater effect than HBP. The findings suggested that extracts from butterfly pea seeds and petals might be useful in the creation of functional foods [23].

Asad Ullah *et al.* (2019) investigated Molecular Docking and Pharmacological Property Analysis of Phytochemicals from *Clitoria ternatea* as Potent Inhibitors of Cell Cycle Checkpoint Proteins in the Cyclin/CDK Pathway in Cancer Cells. Four phytochemicals from *Clitoria ternatea*—kaempferol, myricetin, p-hydroxycinnamic acid, and quercetin—have been selected for this study in order to examine their potential as inhibitors of two cell cycle checkpoint proteins, Cyclin Dependent Kinase-2 (CDK-2) and Cyclin Dependent Kinase-6 (CDK-6) in the Cyclin/CDK pathway. Myricetin and quercetin docked with CDK-6 and CDK-2, respectively, with greater affinity. The ADME/T test and drug similarity property analysis use a computer method to examine the pharmacological and physicochemical characteristics of potential therapeutic compounds. P-hydroxycinnamic acid outperformed myricetin and quercetin in ADME/T and drug similarity property study. Thus, the most promising result from this experiment is P-hydroxycinnamic acid [24].

Yolin Angel *et al*. (2024) evaluated phytochemical profiling, in silico modelling, and in vitro biological activity assessment of Topical antifungal keratitis therapeutic potential of *Clitoria ternatea* flower extract. Using FTIR and GC-MS, structural features and the identification of important compounds were examined. Using well plate and broth dilution methods, the minimum fungicidal concentration (MFC) and minimum inhibitory concentration (MIC) of *Clitoria ternatea* flower extracts were ascertained. Microscopic analysis was used to determine the biofilm inhibitory activity, while CAE-EI and MTT assays were used to determine the anti-irritant and cytotoxic qualities. The flower extract of *Clitoria ternatea* demonstrated efficient biofilm inhibition at a dose of 250 µg/mL. The results showed that the MIC and MFC values were 500 and 1000 µg/mL, respectively. Up to 3 mg/mL, the CAE-EI and MTT tests showed no discernible cytotoxic or irritating effects. Compounds such as 9, 9-dimethoxybicyclo [3.3.1] nonane-2, 4-dione demonstrated high corneal permeability and strong and stable interactions with endo β 1, 4 xylanase, glucanase, and fungal virulence cellobiose dehydrogenase, as well as human TNF-α and Interleukin IL-1b protein targets linked to corneal inflammation. The results suggest that C. ternatea flower extracts could be used to create a safe and efficient substitute for existing topical FK medications [25].

Dwivedi S. *et al.* (2020) reported Development and Evaluation of Herbal Cream Containing Hydro-Alcoholic Extract of *Clitoria ternatea* Roots Used for the Treatment of Vaginal Infection. To confirm the effectiveness of the created formulation, a number of evaluation parameters were

conducted after the chosen hydroalcoholic extract, and several excipients were combined using the aforementioned formula. The highest drug level, 99.42%, was discovered in F5. The formulation F5 exhibits a maximum release of 96.28% at 8 hours, according to the drug release profile results [26].

Shweta Tripathi *et al.* (2023) investigated the Intra-specific pharmacognostic biochemical screening of various populations of *Clitoria ternatea* using liquid chromatography/tandem mass spectrometry product ion scanning (LC-MS^2 PIS). The CT leaf contained mass fragments of acetylcholine, choline, caffeic acid, gallic acid, ferulic acid, kaempferol, and D-L valine, according to the targeted mass spectrum acquired by tandem mass spectrometric analysis. These mass groupings fall into four classes: amino acids, neurotransmitters, flavonoids, and phenols. The Odisha population, which was gathered from Cuttack, fared better than the other twelve populations based on the high degree of relative intensities of targeted nootropic compounds. Additionally, groups acclimated to comparable climates exhibit a strong link with one another, according to correlation matrix data. Two groupings of 13 populations were identified using hierarchical cluster analysis. There were eleven populations in the first group, while the second group was divided into two populations: one from Udaipur, Rajasthan, and the other from Cuttack, Odisha [27].

Bee Lynn Chew *et al.* (2023) reported The Effects of 2, 4-Dichlorophenoxyacetic Acid on The Induction of Callus from Cotyledon and Hypocotyl Explants of *Clitoria ternatea*. Callus scoring and morphology were evaluated at week eight of culture after cotyledon and hypocotyl explants from two-week-old seedlings were placed in half-strength MS medium supplemented with 2, 4-D at varying dosages (0.5 mg/L to 2.5 mg/L). The results showed that for both cotyledon and hypocotyl explants with friable callus morphology, the treatment of 0.5 mg/L 2, 4-D produced the highest percentage of callus induction (100%) and the highest callus score. Compared to hypocotyl explants, which had a relative callus score of 1.80±0.12, cotyledon explants had a higher score of 3.03±0.20. Thus, this study serves as a foundation for further research on the formation of C. ternatea cell suspension cultures for the generation of useful secondary metabolites connected to the plant's capacity to improve memory [28].

Conclusion

Clitoria ternatea (Family: Fabaceae), popularly referred to as "Butterfly pea, " is a traditional Ayurvedic medicine that has been used for millennia as a sedative, tranquilizing, antidepressant, antistress, anxiolytic, memory enhancer, and nootropic. It has yielded a diverse array of secondary metabolites, such as triterpenoids, flavonol glycosides, anthocyanins, and steroids. In addition to their antibacterial, antipyretic, anti-inflammatory, analgesic, diuretic, local anesthetic, antidiabetic, insecticidal, and blood platelet aggregation-inhibiting qualities, its extracts also have vascular smooth muscle relaxing characteristics. This plant has long been used in traditional Ayurvedic medicine to treat a variety of illnesses, and scientific research has verified that these uses are still relevant today.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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