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A REVIEW STUDY ON CLITORIA TERNATEA

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ABSTRACT

Clitoria ternatea Linn is a perennial climbing herb native to the tropical Asia known for its antidpression and memory enhancer qualities. There are diverse parts of the plant. Tannins, resins, starch, taraxerol, taraxerone, alkaloid, flavonoids, saponins, proteins, anthocyaninsand carbohydrates are the documented bioactive constituents of this plant. In traditional medicine, people use the living plant to treat many conditions such as fever, ear aches, migraines, indigestion, headaches, throat infections, urinary tract infections, mouth infections, eye infections, skin infections, leprosy or constipation. Several pharmacological characteristics are attributed to different extracts like anti-inflammatory, antipyretic, antidiabetic, antioxidant, antistress, immunomodulatory, larvicidal, proteolytic, anthelminthic, diuretic, antimicrobial and memory-improving effects. With that; the aim of this review is to give a detailed description of studies written about phytochemistry, pharmacognosy and traditional uses of this plant looking primarily at pharmacological actions.

KEYWORDS: *Clitoria ternatea*, Botanical description, Phytoconstituents, Cultivation, Research Investigation.

INTRODUCTION

Therapeutic Herbs have been obtained from nature for ages. This gift of God can cure numerous sicknesses on man, animals and even plants. Worldwide, they provided

pharmaceuticals to all medical systems, as they were the main suppliers of drugs as well as the other historical medical systems. Many plants and herbs can be used to manage different diseases in different medical traditions. For example, Aparajitha is named as one of the important herbs in all Ayurvedic ancient writings. This is an attractive plant with two colors. Aparajitha is the latter name for Clitoria ternate belonging to the Fabaceae (Pipilonaceae) family. (figure 1) Probably tropical Asia is where the plant comes from. It is primarily found in the lowland tropical regions of Africa, Asia, and Central America. At low and medium elevations there are populated regions where it occurs.[3,12]

Ayurveda explains the medicinal properties of plants primarily through the concepts of rasa (taste), guna, virya, vipaka, and karma. It also demonstrates the following: guru, Snigda, sara, pischila in guna, ushana in virya, Madhura in vipaka, medhakrita, swarkara, and grahabhutadidosharain karma. The terms “medhakrita” and “swarkara” denotes intellectual stimulation, “helps improve voice activity “and “grahabhudadidoshara “denote treatment for a variety of mystic diseases, which which are classified as bacterial or viral illnesses. Convolvulus pluricaulis choisy, Canscora decuussata schult. Clitoria ternate linn, and Evolvulus alsinoides linn. Are the four plants that Indian Ayurvedic practitioners consider to the shankhpushpi based on flower morphology and nootropic potential. There are reports that insect bites and skin conditions can be treated using flower juice. The roots have been described as bitter, refrigerant, ophthalmic, laxative, diuretic, cathartic, aphrodiastic, and tonic.[26]

Kentucky and Arkansas. It is frequently seen in places like the Turks and Caicos Island, Jamacia, and Puerto Rico. It can be found across India; however, it is most common in the Andaman Islands and southern India up to 1500 meters in elevation.[3,29]

Figure 1: **Plant of *Clitoria ternatea.***

Geographical distribution

Geographical Distribution clitoria genus is inconsequential, indigenous climber and a common garden flower found throughout the tropical and subtropical regions of the world. Presently the class ended up uncommon in sticky and sub-humid lands of Asia, America, and Africa additionally in semi-arid tropical Australia.[12,3] It grows from sea level to 1800 and also grown as an ornamental in the warmer parts of the world and outspread from about 20-degree North latitude to the Salta district in Argentina at about 24-degree South latitude.

In contrast to sudan, where it is planted for fodder or grazing, and Kenya, where it is grown in combination with Chloris Gayana, Africa is home to its growth in grassland, frequently on seasonally flooded black clays and ancient cultivations.[3,13]

Botanical description

Vernacular names

The clitoria plant's floral form reflects the name of its genus. Since the shape [of] this plant's blossoms is similar to that of a human female clitoris, the genus name "*clitoria* "in Latin refers to "clitoris," and the species name "*Ternatea*" is derived from the island of Ternate in Eastern Indonesia. Similar to this distinct vernacular name for the blooms in different languages are derived from references to a woman's vaginal organ. Ashpota, Aparajita saukarnika, Ardrakarni, Girikarnika, Supuspi, Mohanasini vishadishaghni, Shwetanama, Vishnu-kranta, Ashwakhura are among the Sanskrit texts found in india.[3,12,25,28]

Hindi, Beng and Oriya	Aparajita or Aparajit.
Sanskrit	Ashphota, Aparajita Saukarnika,Supuspi.
Gujarat	Koyala, Garani, and Bismar
Kannada	Satugadagida, Billisaiuga.
Telugu	Sankhupuvvu, Gilarnika, Neela- ghentana, Dintana.
Tamil	Kuruvilai, Kakkanam, Kakatan, and Kavachi.
Punjab	Dhanattar
Rajasthan	Titlimatar, Koyalri
Marathi	Gokurna
Malayalam	Shankapushpam, Malai-amukki, Aral
English	Pigeon wings,mussel shell – climber, Butterfly-pea, and blue pea vine

In other countries: Butterfly-pea (Australia), Blue -pea, Cordofan-pea, honte (French), Blaue klitorie (German), Fula criqua, Clitoriaazul (portugese), Azulejo, Conchitis, Papito, Zapatico de la retina, Zapotillo, Conchita azul, Campanilla, bandera, Choroque, Lupita, pito de Parra, Bejuco de conchitas (Spanish) Cunha (Brazil), Pokindang (Philippines), Zapatillo de la retina,

Kordofan pea (sudan), Nagar hedi (Kannada), Mavi kelebek sarmasigi (Turkish).

Taxonomical classification

Kingdom	Plantae
Phylum	Angiosperm
Order	Fabales
Familiy	Fabacea
Genus	*Clitoria*
Species	*C. ternatea*
Other species ofClitoria	*Clitoria albiflora* Mattei
	Clitoria amazonum Benth
	Clitoria Andrei Fantz
	Clitoria angustifolia kunth
	Clitoria annua J. Graham
	Clitoria arborea Benth

Cultivation

Growing *Clitoria ternatea* from seed is simple. To prepare the seeds, softly file their surface in the spring and soak them in water for the entire night. Plant them 2 cm deep the following day, either directly or as seedlings. To prevent them from being devoured by birds or destroyed by other animals, I prefer to nurture seedlings. When planting in the ground, cover the area with the upper portion of a clear plastic container that has its lid removed for protection. Usually, it takes two to three weeks for the seeds to sprout. Plant the seedlings in the ground, up against a wall or trellis, in a spot that receives full sun or partial shade, once they are at least 4-5 cm tall. The plant takes ninety days to start flowering. It blooms from early summer to late autumn; however, it may appear slow at first until the flowers begin to form.[9]

Soil: *Clitoria* may thrive in a broad variety of soil types, including calcareous soils, from deep alluvial to sandy (pH range 5.5-8.9). Although it grows well in moderately rich soils as well, it is particularly well suited to heavy clay alkaline soils. Because *Clitoria ternatea* prefers rich, moist soil with a 2:1:1 ratio of peat moss to loam and part sand or perlite, the soil must always be consistently moist for healthy growth.[3,12]

Water: It thrives in arid regions like Kordofan in the Sudan and can withstand some drought in Zambia, but it also does well with irrigation. It needs about 400 mm of water annually. Because of its nature, *C. ternatea* may withstand brief flooding but not protracted inundation or water logging.[3]

Sunlight: It can grow in full sun most of the time, although it can tolerate some shade.[3]

Temperature: It requires a moderate temperature, down to 25degree Celsius, although it is not suitable for areas that have frequent or severe frosts. Despite having a limited tolerance for frost, it does well in hot summer months.[3]

Fertilizer: *C. ternatea* is often cultivated in phosphorus (p) and sulphur (s) -containing soil. If sown in infertile soils, however, fertilizer may be needed.[3]

Propagation: It develops quickly in warm, humid weather and includes about 20 % hard seed, depending on the seasonal conditions in which it is generated. It is physically picked by hand and reproduced by cuttings from seed.[3,27] Since Clitoria ternatea seeds have difficult seed coats covering them, they cannot ingest water or sprout; by the by, after six months in capacity, 15-20% of the seeds can sprout. Additionally, germination and early plant growth have been enhanced by the application of hot water, sulfuric acid(H2SO4), potassium hydroxide, and soaking in a 100 mg/L solution of sodium cyanide (NaCN). Mechanical scarification raised the germination of 6-month-old seed from 30 % to 71%.[3,12]

COLLECTION

For about a day, the flower is at their peak of bloom, after which they can be picked and preserved for use. But it like to collect mine a few days later, after the blossoms have begun to dry on the vine and have shrunk. Then, just gently tug on the end of the bloom, leaving the developing pod behind, to harvest them with ease. This has the benefit of letting the pods develop, dry on the vine, and then be harvested to save the seeds. If you intend to save seeds, pay close attention to the pods since they occasionally have a tendency to dry out and shrivel quickly, spilling their seeds.[9]

Storage

The dried flowers should be kept in a glass jar with a descant within. Store the jar at room temperature, Shielding it from light.[9]

Phytoconstituents

According to reports, plant parts used since ancient-times include roots, seeds, and leaves.[31,11] Pentacyclic triterpenoids, namely taraxerol and taraxerone, are the main phytoconstituents of *Clitoria ternatea*.[11,4,5] The presence of ternatins, alkaloids, flavonoids, saponins, tannins, carbohydrates, proteins, resins, starch, taraxerol, and taraxerone is shown

by phytochemical screening of the roots.[11,24] For the purpose of determining the amount of taraxerol in *Clitoria ternatea Linn*; a new straightforward, sensitive, selective, and accurate high performance thin layer chromatography method has been devised. The analysis was carried out on aluminium thin layer chromatography plates.[11,18] From *Clitoria ternatea Linn*, a variety of secondary metabolites, such as triterpenoids, flavonol glycosides, anthocyanins, and steroids, have been identified.[11,19]

The seeds contain an alkaloid, ethyl D- galactopyranoside, p-hydroxycinnamic acid polpeptide, a highly basic protein called finotin, delphinidin-3,3,5-triglucoside, essential amino acids, pentosan, water soluble mucilage, adenosine, an anthoxanthin glucoside, greenish yellow fixed oil, a phenol glycoside, 3,5.7.4-tetrahydroxy- flavone-3-rhamoglycoside, an alkaloid, 6% ash, and a toxic alkaloid. It has been demonstrated that it is homologous to plant defensins and contains antifungal proteins as well.[11] Aabgeena et al. observed that human B erythrocytes treated with trypsin were agglutinated by a lectin found in the seeds of *Clitoria ternatea*. An attempt was made to use a different, very productive purification technique for the *Clitoria ternatea lectin*, or CTL, which is found in the seeds of this member of the Leguminosae family, when it was discovered that the purified lectin would be a useful tool for cancer research. [11,14]

Uses

In Ayurveda "sankhapushpi" is one of the formulations which consists of the seeds and roots of *C. ternatea*, which can be used as a 'nerve tonic' and laxative. It has been used for the treatment of various neurological disorders as an active ingredient in 'Medhya Rasayana'. By various group of persons, it is considered as medicine which is useful in skin diseases, eye and throat infections also in urinary disorders, ulcers and antidote activity.[3,2]

Root: The roots are said to be have cooling, laxative, diuretic, anthelmintic, and anti-inflammatory qualities. They also have a harsh, bitter, or caustic taste. According to scientific research, C. ternatea extracts can increase acetyl choline levels and acetyl choline esterase activity in rat brains in a way that is comparable to the common cerebral mediction pyritinol. C. ternatea is also employed in additional therapies for a variety of illnesses, including infections, anthelmintic, an antidote to animal stings, urinogenital diseases, and bodily aches. C. ternatea roots help with bronchitis, recurrent fever, and severe asthma.[3,23,8]

Seed: *Clitoria ternat*ea seeds can be applied internally or externally for medical purpose.

When administered orally with hot water in powderd form together with ghee and fennel, fried seeds are advised in cases of ascites.[3,19] Because they function as a purgative, cathartic, and laxative when combined with ginger power, seeds are used to treat digestive issues' Additionally, seeds are prescribed for rheumatic infections, spleen problems, coughs, and heapatic illnesses. The seeds are safe for arthritis, colic, dropsy, and visceral abdominal pain.[3]

Leaves: They have laxative, emetic, diuretic, and antiperiodic properties. When combined with salt to make a paste, the leaves are also highly helpful in treating mastoid lymph node irritation. It is possible to reduce the toxins by using the juice form. Fresh leaves, when combined with ginger juice, can help with hepatic fever, excessive perspiration, and inflammation of the surrounding glands and area around the ear. They can also be used in juice form with regular salt.[3,23]

Flower: It is suggested that flowers be used to cure snake bites and scorpion stings. Root-based flower decoctions are regarded as emmenagogues in Cuba.[3,23] A floral infusion is used to encourage menstruation and trigger specific contractions. Additionally, digestive issues and chlorosis are treated with flowers. The ethanolic extract of flowers considerably decreases the serum sugar level in mice with experimentally induced diabetes.[3,19]

Stem: Stem is suggested as a treatment for scorpion's stings and snake bites. The phytochemicals found in the plants stem are mostly thought to be brain tonics, but they can also be helpful for skin conditions, urinary issues, eye and throat infections, and other conditions.[3,19]

Research investigation

Pharmacological research study information

Anthelmintic activity: An ethanolic and aqueous extract of *C. ternatea* leaves, at a concentration of 100mg/ml, exhibited anthelmintic activity. Eisenia foetida was used in this experiment at three different doses (100, 50, and 25 mg/ml) of ethanolic and aqueous extracts, respectively. The main goal of the study was to compare the anthelmintic activity of *C. ternatea* leaf extracts in vitro using both aqueous and ethanolic extracts. For this reason, the investigation entailed timing the worm's paralysis (P) and death (D). The paralysis and death times for the aqueous extract were found to be 18+_ 1.57 and 53.33+_0.33, respectively, whereas the ethanolic extracts showed 12.33+_0.80 and 32.33 +_0.71,

respectively, during determination.[3,27]

Antihistaminic activity: The ethanolic extract of the roots of *C. ternatea* exhibited dose - dependent antihistaminic action. The antihistaminic effect of the *C. ternatea* root (ECTR) ethanol extract was assessed in mice with clonidine and haloperidol-induced catalepsy at dosages of 100, 125, and 150 mg/kg IP. Mice were given clonidine, an α2 adrenoreceptor agonist, which caused dose-dependent catalepsy. Histamine H1 receptor antagonists prevented this condition, whereas H2 receptor antagonists did not. Several asthmatic disorders are brought on by clonidine, which causes mast cells to produce histamine. Haloperidol, a non-selective D2 dopamine antagonist, predominantly causes catalepsy by blocking dopamine receptors In the straistum. The substances that cause an increase in dopamine transmission prevent catalepsy brought on by haloperidol.[3,21]

Hypoglycaemic effect: The effect of orally administered aqueous extracts (400mg/kg body weight) of *C. ternatea* leaves and flowers were examined in control and test group of rats on insulin, glycosylated haemoglobin and serum glucose. The aqueous extracts of *C. ternatea* leaves and flowers significantly increased the liver and skeletal muscle glycogen, the activity of the glycolytic enzyme and glucokinase serum insulin but to reduce the serum glucose, glycosylated haemoglobin and the activities of gluconeogenic enzyme, glucose-6-phosphatase. After all the biochemical tests, the group of leaf extract treated rats indicated essentially the same profile as those treated with the group of flower extract.[3,10]

Antipyretic activity: Assessment of the antipyretic capability of the blue flowered variety (Fabaceae) Methanolic extract of *C. ternatea L.* Root (MECTR) on albino rat's normal body temperature and yeast-induced pyrexia. Following a subcutaneous injection of yeast suspension (10 ml/kg body weight) for 19 hours, a rise in the rectal temperature was noted. Atdoses of 200, 300 and 400mg/kg body weight, and yeast- provoked high temperature, the extract significantly lowered normal body temperature in a dose dependent manner. Up to five hours after the medicine was administered, the impact persisted. The extract's anti-pyretic efficacy was found to be equivalent to that of paracetamol, a common antipyretic.[3,6]

Botanical research study information

Morphological evaluation

The leaves have a distinct smell, are green, and are bitter. They have an obviate shape, are pinnatifid, have a symmetric base, an emarginate apex, and measure 6-11 cm in length and 5-

7 cm in breadth.

Microscopical evaluation

Clitoria ternatea Linn leaf transverse section reveals covering trichomes on both surfaces. A single layer of cells with a thick cuticle covers the cells that make up the upper and lower epidermis. Collenchymatous cells trail the upper and lower epidermis. Polygonal tabular cells make up the upper epidermis, which is followed by a layer of palisade cells. A loosely arranged layer of 3-5 layers of cells represents the spongy mesophyll. There are crystals of calcium oxalate in parenchyma calls. A single layer of border parenchyma, also known as the bundle sheath, covers the vascular bundle and contains lignified xylem vessels. The preparation of the surface revealed the existence of cicatrix and parasitic stomata with wavy epidermal walls.

Chemical research study information

Estimation of total sugar

Using a spectrophotometer (Thermo electronic, Double Beam UV-VIS spectrophotometer), the total amount of sugar in the medication was determined using the montgometry technique.[17,30] After preparing a 10% homogenate of the plant tissue in 80% ethanol, the mixture was centrifuged for 15 minutes at 2000 rpm. The resulting supernatant was produced up to a known volume (10 ml, or based on the anticipated sugar concentration). After taking a 0.1 ml aliquote, 0.1 ml of 80% phenol and 5 ml of concentrated H2SO4 were added. After cooling, the absorbance at 490 nm can be measured. D-glucose served as the reference standard. A graph representing the optical density (OD) and concentration of various standard D-glucose dilutions (0.01, 0.02, 0.03, 0.04 and 0.05 mg/ml) was treated to create the standard curve. Using a formula, the percentage of sugar was determined. Con. at UV × Ext value × 100/1000 equals sugar percentage.[17]

Estimation of total starch

Using a spectrophotometer (Thermo electronic, Double Beam UV vis spectrophotometer), the total amount of starch in the medication was determined using the Montgomery technique.[17,30] After preparing a 10 % homogenate of the plant tissue in 80% ethanol, the mixture was centrifuged for 15 minutes at 2000 rpm. Added 4 millilitres of distilled water to the residue, which had been macerated with a glass rod for 15 minutes while heated in a water bath. 3 ml of 52% perchloric acid was added to each sample, and the samples were centrifuged for 15 minutes at 2000 rpm. This allowed for the extraction of the supernatant up

to a specified volume, usually 10 ml. A 0.1 ml sample was obtained, and 5 ml of concentrated H2SO4 and 0.1 ml of 80 % phenol were added to it. After cooling, the absorbance at 490 nm was observed. With a formula the starch % was determined. Concentration at UV × Extractive Value × 100/1000 equals sugar percentage.[17]

Estimation of total phenolic content

Bray and Thrope were used to calculate the amount of total phenolics present in the drug.[17,20] A stock solution of 1 mg/ml methanolic plant extract was prepared. 0.5 ml of the stock solution was taken in the test tube and added 10 ml distilled water and 1.5 ml folin reagent, kept for 5 minutes, then added 4 ml of 20 % Na2CO3 to make the volume up to 25 ml with distilled water, and kept for 30 minutes. The OD (optical density) was measured at 765 nm the Thermo electronic Double Beam UV VIS Spectrophotometer. Gallic acid was utilized as astandard at various dilutions (0.2, 0.4, 0.6 and 0.8 µg/ml). The following formula was used to determine TPC in percentage terms: Concentration in 1 millimeter × Extractive Value × 100/1000 = TPC.[17]

Estimation of flavanoid content

Woisky and salatino were used to calculate the total flavonoid content of the medication.[17,7] A 1mg/ml methanolic plant extract stock solution was made. In a test tube, 0.5 ml of the stock solution was combined with 0.5 ml of 2% methanolic AICI3, and the volume was increased to 5 ml using methanol. The presence of flavonoids was indicated by the color yellow. Using the spectrophotometer (Thermo Electronic, Double Beam UV-vis spectrophotometer), find the optical density (OD) at 420 nm. As a standard, a solution of quercetin was serially diluted at 4, 8, 12, 16, and 20 µg/ml. The following formula was used to determine TFC in percent: TFC = conc. In 1 ml × Ext. value × 100/1000.[17]

CONCLUSION

"*Clitoria ternatea*: A perennial Twining Herbal Medicine plant "focuses on emphasizing the wide range of pharmacological properties and traditional medicinal uses of *Clitoria ternatea*. The document reviews the phytochemistry, pharmacognosy, and pharmacological aspects of the plant to provide comprehensive information on its traditional usage for treating various conditions and its potential benefits due to active chemical components such as tannins, alkaloids, flavonoids and others. It underscores *Clitoria ternatea* 's significance in Ayurveda and other medical systems and its importance as a natural source of medicine with properties including antiinflammatory, antidiabetic, antioxidative, antistress and memory enhancing

effects. The plants use in treating a variety of health issues ranging from fever to diabetes is also highlighted, signifying its value as a therapeutic herb.

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