ANNALS OF PHARMACY AND PHARMACEUTICAL SCIENCES ☞DOI:10.15740/HAS/APPS/6.1and2/21-25
Volume 6 | Issue 1&2 | April & October, 2015 | 21-25 ■ e ISSN-2230-9438 Visit us : *www.researchjournal.co.in*

A REVIEW

A phyto-pharmacological review on *Clitoria ternatea* L.

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ABSTRACT

The medicinal plants find application in pharmaceutical, cosmetic, agricultural and food industry. The use of the medicinal herbs for curing disease has been documented in history of all civilizations. With the onset of research in medicine, it was concluded that plants contain active principles, which are responsible, for curative action of the herbs. *Clitoria ternatea* L. is a vigorous, strongly persistent, herbaceous perennial legume. Almost all parts of this plant are reported to have medicinal properties. The plant has been used traditionally to treat infertility, worm infestation, skin diseases, tonsillitis, cough, asthma etc. It is reported to be appetizer, digestant and vermicide. Many of the medicinal values are evaluated by different workers such as Anthelmintic, Anti hyperglycemic, Anti-inflammatory, Anti-diarrheal, Anti-oxidant, hepatoprotective, Immunomodulatory, Anti-histamic, cholinergic activity.

Key words : *Clitoria ternatea* L., Pharmaceutical activity

How to cite this paper : Thakur, Anupsingh, Kshirsagar, Jyostana, Chinchole, Mahadev B. and Masane, Ashwini O. (2015). A phyto-pharmacological review on *Clitoria ternatea* L. *Ann. Pharm. & Pharm. Sci.*, **6** (1&2) : 21-25.

Article chronicle : Received : *10.02.2015;* **Accepted :** *22.09.2015*

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INTRODUCTION

During the past decade, traditional systems of medicine have become increasingly important in view of their safety. Current estimates suggest that, in many developing countries, a large proportion of the population relies heavily on traditional practitioners and medicinal plants to meet primary health care needs. Although modern medicine may be available in these countries, herbal medicines (phyto-medicines) have often maintained popularity for historical and cultural reasons (Mecdad *et al*., 2011).

Clitoria ternatea L., common names including butterfly - pea, blue-pea and cordofan-pea, is a plant species belonging to the Fabaceae family. Origin and

geographic distribution *Clitoria ternatea* L. is pantropical (20 -N-24 -S). Its true origin is obscured by extensive cultivation or naturalization in the humid lowland tropics of Asia, Africa, the Pacific Islands and the Americas (Stephen and Comac, 2000). *Clitoria ternatea* white-flower and blue flower varieties (Anonymous, 2001) found in Indo-China, Philippines and Madagascar, since the flowers of the plant resemble a conch shell; it is commonly called "Shankpushpi" (Kulkarni *et al*., 1988).

Medicinally important phyto-constituents :

Concentration of primary metabolites of *Clitoria ternatea* as root contain sugar 102±0.59 mg per g dry weight, starch 42±0.35 mg per g dry weight, protein 21±0.49 mg per g dry weight, phenol 43±0.13 mg per g dry weight and protein 41±0.14 mg per g dry weight. Its stem contain sugar 112±0.30 mg per g dry weight, starch 53±0.47 mg per g dry weight, protein 39±0.13 mg per g dry weight, phenol 37±0.56 mg per g dry weight and protein 18±0.35 mg per g dry weight while leaf contain sugar 120±0.35 mg per g dry weight, starch 26±0.40 mg per g dry weight, protein 58±0.48 mg per g dry weight, phenol 18±0.35 mg per g dry weight and protein 16±0.40 mg per g dry weight (Shekhawat and Vijayvergia, 2010).

Ethanol extract of *Clitoria ternatea* L. showed presence of terpenoid, flavonoid, tannin and steroid which may act as antioxidant principals (Rai, 2010). The major phytoconstituents found in *Clitoria ternatea* are the pentacyclic triterpenoids such as taraxerol and taraxerone. Phytochemical screening of the roots showed presence of ternatins, alkaloids, flavonoids, saponins, tannins, carbohydrates, proteins, resins, starch, taraxerol and taraxerone (Trease and Evans, 1989). Leaves contain 3 monoglucoside, 3-rutinoside, 3-neohisperidoside, 3- o-rhamnosyl Glycoside, kaempferol- 3- o-rhamnosyl, aparajitin, beta-sitosterol and essential oil. Flower contains delphinidin-3, 5-diglucoside, delphinidin-3ß- glucoside and malvidin- 3ß - glucoside, kaemphferol, p-coumaric acid Rootcontains ß- carotene, stigmast- 4- ene- 3, 6, diene, taraxerol and teraxerone, starch, tannins and resins (Anonymous, 2005).

Therapeutic value :

Clitoria ternatea L. (Family: Fabaceae) a perennial twinge herb. The roots have a sharp bitter taste and have cooling, laxative, diuretic, anti-helmintic, anti-inflammatory properties; they are useful in severe bronchitis, asthma and hectic fever. The fatty acid content of *C. ternatea* seeds includes palmitic, stearic, oleic, linoleic and linolenic acids (Debnath and Chakravarti,1975; Husain and Devi, 1998; Joshi *et al.*, 1981). The seeds also contain water-soluble mucilage, delphinidin 3, 3', 5'-triglucoside useful as a food dye (Macedo and Xavier-Filho, 1992) beta-sitosterol (Sinha, 1960). *C. ternatea* possesses number of pharmacological activities such as nootropic, anxiolytic, antidepressant, anticonvulsant (Jain *et al.*, 2003), sedative (Kulkarni *et al.*,1988), antipyretic, anti-inflamatory and analgesic activities (Parimala *et al.*, 2003). It enhance the memory and increase acetylcholine content and acetyl cholinesterase activity in rats (Rai *et al.*, 2001 and Rai, *et al.*, 2002). The study for evaluation of ethanol extract of *Clitoria ternatea* L. root on Clonidine and haloperidol showed induction of catalepsy in mice. Chauhan *et al*. (2012) showed that the oral administration of ethanolic extract of *Clitoria ternatea* L. of dose 30mg/kg of rat failed to show any significant effect in both animal models of anxiety.

Clitoria ternatea L. is reported to be a good "Medhya" (toning the brain) drug mainly used in the treatment of "Masasika" roga (mental illness), but it is also said to be useful in hectic fever, severe bronchitis, asthma and remedy for snakebite (Chopra *et al.*, 1982). The root with a few tortuous branches, cylindrical, 1-5mm in thickness, a few places show cracks due topresence of lenticels, colour light brown, fracture fibrous; taste bitter.

Immunomodulation effect :

Clitoria ternatea L. seed and root alcoholic extracts showed profound immunosupressive activity in male albino rat model. The antioxidant and anti-inflammatory activities of plant may be playing major role in immuno-inhibition. The immunomodulatory activity might be attributed to the presence of flavonoid and phenolic compounds (Daisy *et al.*, 2004).

In the study immunostimulatory activities of aqueous extracts of *Clitoria ternatea* L. leaf and flower were evaluated by oral administration of aqueous extract of *Clitoria ternatea* L. to alloxan-induced diabetic rats for duration of 60 days which significantly decreased the serum glucose and cholesterol levels. The total white blood cells, red blood cells, T-lymphocytes and B-lymphocytes were significantly increased in treated animals, while monocytes and eosinophils showed an

opposite trend. These results further indicated that these plant extracts have immunomodulatory effects that strengthen the immune system (Daisy *et al.*, 2004).

Anthocyanin ternatin D1 isolated from petals of *C. ternatea* showed *in vitro* platelets aggregation inhibitory activity in rabbits. It is due to significant inhibition of collagen and ADP-induced aggregation of platelets (Honda *et al.,* 1991).

Antioxidative peoperties :

Oxidative stress is among the major causative factor of many chronic and degenerative diseases (Vadlapudi and Naidu, 2010). In concern to anti-oxidative studies, CT petals have been recognized to possess anti-oxidant activity (Kankonen *et al*., 1999; Shan *et al.*, 2005 and Hinneburg *et al.*, 2006). Extracts of *Clitoria ternatea* flowers are used in Thailand as a component of cosmetics and the chemical composition of the flowers suggested that these may have anti-oxidant activity. Aqueous extracts were shown to have stronger anti-oxidant activity than ethanol extracts (Kamkaen and Wilkinson, 2009). The antioxidant potential of aqueous leaf extracts of *Clitoria ternatea* were evaluated by determining the levels of enzymatic and non-enzymatic antioxidants. *In vitro* antioxidant capacity was also determined using different assays such as Ferric reducing power assay (FRAP), Reducing activity assay, diphenypicrylhydrazyl (DPPH) assay and Hydroxyl radical scavenging activity. The results were found to be comparable with standard antioxidants such as butylated hydroxyl toluene (BHT), ascorbic acid and rutin. This study showed that CT has significant antioxidative properties (Rao *et al.*, 2009).

Several workers reported its medicinal value such as anti-imflammatory (Parimala *et al.,* 2003), anti-oxidant (Chauhan *et al*., 2012), immunomodulatory, hypoprotective (Solanki and Jain, 2011) etc. It has more than 130 mg of GAE/g of phenols content. It has high anti-oxidative properties as it have 90 per cent Scavenging effect in DPPH Assay and >1000 µmol/g FRAP value (Kruawan and Kangsadalampai, 2006). It have Purgative, diuretic, laxative properties (Chauhan *et al*., 2012).

Ramaswamy *et al.* (2011) showed that *Clitoria ternatea* demonstrated dose dependant increase in the percentage antioxidant activity for all concentrations tested. The extract at a concentration of 5µg/ml showed a percentage inhibition of 18.96±2.02 and for 250 µg/ml it was 89.0±1.64.

Anxiolytic activities :

Oral treatment of alcoholic extract at a dose of 460 mg/kg of *Clitoria ternatea* on spatial discrimination in rats show anxiolytic activities in their comparative study with chlorpromazine (Anonymous, 2009).

The oral administration of CT (100-400mg/kg) dose dependently increased the time spent in the open arm; the time spent in the lit box and decreased the duration of time spent in the dark box. The oral administration of CT (30mg/kg) failed to show any significant effect in both animal models of anxiety. The animals treated with CT (100mg/kg) showed a significant increase in the inflexion ratio and discrimination index which providesevidence for the species nootropic activity (Chauhan *et al*., 2012).

Antihistaminic activity :

Ethanol extract of Clitoria ternatea root (ECTR) at doses 100, 125 and 150 mg/kg i.p were evaluated for antihistaminic activity using clonidine and haloperidol induced catalepsy in mice. Finding of investigation showed that chlorpheniramine maleate (CPM) and ECTR inhibit clonidine induced catalepsy significantly $P < 0.001$ when compare to control group, while CPM and ECTR fail to inhibit haloperidol induced catalepsy. Present study concludes that ECTR possesses antihistaminic activity (Taur and Patil, 2011).

Antidiarrhoeal activity :

At various doses (100, 200 and 400 mg/kg body weight) the alcoholic extract showed a remarkable antidiarrhoeal activity evidenced by the reduction in the rate of defecation and consistency of faeces as comparable to that of standard drug loperamide (3 mg/kg body weight) (Upwar *et al*., 2010).

Anti-epileptic activity :

Anti-epileptic activity studies Methanol extract from the aerial parts of Clitoria ternatea was screened by using pentylenetetrazol (PTZ) and maximum electroshock (MES) – induced seizures in mice at the dose of 100 mg/kg p.o. CT significantly delayed the onset of convulsions and also delayed the duration of tonic hind limb extension in MES-induced convulsions (Sethiya *et al.,* 2009).

Anti-microbial activities :

The methanolic extracts of the leaves and root of *Clitoria ternatea* were tested for their antibacterial

activity against different pathogenic drug resistant Gram-positive and Gram-negative clinical isolates and minimum inhibitory concentration was determined by agar dilution technique followed by estimation of zone of inhibition against the selected strains by disc diffusion technique and comparison was done with reference to the standard antibiotic ciprofloxacin. Leaf extract show stronger antimicrobial activity than root activity against *E. coli* and *V. cholera*, known for causing dysentery and *S. aureus*, causative agent of fever (Mazumder *et al*., 2007).

Mhaskar *et al.* (2010) also reported the antimicrobial activity for seed and callus extract against *M. flavus* and *S. typhi*, *E. coli* and *S. aureus*, respectively.

Anti-diabetic activity :

Oral administration of aqueous extract of CT leaves (400mg/kg body weight) and flowers (400mg/kg body weight) for 84 days showed significantly reduced serum glucose, glycosylated hemoglobin, total cholesterol, triglycerides, urea, creatinine and the activity of gluconeogenic enzyme glucose-6-phosphatase, but increased serum insulin, HDL-cholesterol, protein, liver and skeletal muscle glycogen content and the activity of glycolytic enzyme glucokinase (Terahara, 1996).

Conclusion :

The organi and aqueous extracts of *Clitoria ternatea* show Immunomodulation effect, Antioxidative peoperties, Anxiolytic Activities, Antihistaminic activity, Antidiarrhoeal Activity, Anti-epileptic activity, Anti-microbial activities, Anti-diabetic activity. The organic and aqueous extracts of Clitoria ternatea could be further exploited in the future as a source of useful phytochemicals compounds for the pharmaceutical industry.

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