The immune system is a remarkably versatile defense system that has evolved to protect animals from invading pathogenic microorganisms and to eliminate disease. Immunostimulation is required when host defense mechanism has to be activated under the conditions of impaired immune response or when a selective immunosuppression is desired in situations like autoimmune disorders. ROS is also involved to regulate immune system and significantly affect immunomodulation. Allopathic drugs as immunomodulators show various side effects but situation is differ for medicinal immunomodulators. Clitoria ternatea, vigorous, strongly persistent, herbaceous perennial legume, show significant immunomodulatory activity and antioxidative properties and can be used commercial with no side effect to replace Allopathic drugs.

Key Words: Immunomodulatory, Antioxidative, Clitoria ternatea


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One link between ROS and immune system is a phenomenon known as respiratory burst. This is a process where phagocytic immune cells, such as neutrophils or macrophages, generate potent oxidant bactericidal agents, hypochlorous acid, O$_2^-$, H$_2$O$_2$ and OH$^-$ to kill or destroy foreign molecules (Knight, 2000). Macrophages also release ROS as signaling messengers to other immune cells (Knight, 2000). It is possible that enhanced levels of ROS can lead to immune cell deregulation and result in apoptosis. Furthermore, Kobayashi et al. (1995) has proposed B-cells, and possibly NK cells and peripheral T cells, contain a superoxide generating system identical to that in phagocytes. Although the rate of O$_2^-$ generation is much lower than in phagocytic cells, the capability is present for these immune cells to generate ROS. Reports have indicated that certain chemical exposures can result in the alteration of secondary messengers, such as free radicals or ROS, and these alterations have been linked to the induction of apoptosis in immune cells (Kobayashi et al., 1995). Free radicals influence gene expression, regulate cellular responses to cytokines, as well as proliferative events of a cell.

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*, 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* 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 (Staples, 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 milligram per gram dry weight, starch 42±0.35 milligram per gram dry weight, protein 21±0.49 millgram per gram dry weight, phenol 43±0.13 milligram per gram dry weight and protein 41±0.14 milligram per gram dry weight. Its stem contain sugar 112±0.30 milligram per gram dry weight, starch 53±0.47 millgram per gram dry weight, protein 39±0.13 millgram per gram dry weight, phenol 37±0.56 milligram per gram dry weight, and protein 18±0.35 millgram per gram dry weight while leaf contain sugar 120±0.35 milligram per gram dry weight, starch 26±0.40 millgram per gram dry weight, protein 58±0.48 milligram per gram dry weight, phenol 18±0.35 millgram per gram dry weight, and protein 16±0.40 millgram per gram dry weight (Shekhawat and Vijayvergia, 2010).

Ethanol extract of *Clitoria ternatea* showed presence of terpenoid, flavonoid, tannin and steroid which may act as antioxidant principals (Rai Kiranmai, 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 tertiain, alkaloids, flavonoids, saponins, tannins, carbohydrates, proteins, resins, starch, taraxerol and taraxerone (Trease and Evans, 1983). Leaves contain 3 monoglucoside, 3-rutinoside, 3-neohesperidoside, 3-0-rhamnosyl Glycoside, kaempferol-3-o-rhamnose, aparinajin, betasitosterol, and essential oil. Flower contains delphinidin-3,5-diglucoside, delphinidin-3β-glucoside, and malvidin-3β-glucoside, kaempferol, p-coumaric acid Rootcontains β-carotene, stigmaster-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-inflammatory and analgesic activities (Parimaladevi et al., 2003). It enhances the memory and increases acetylcholine content and acetyl cholinesterase activity in rats (Rai et al., 2001; Rai et al., 2002). The study for evaluation of ethanol extract of Clitoria ternatea 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 of dose 30mg/kg of rat failed to show any significant effect in both animal models of anxiety.

Clitoria ternatea 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 to presence of lenticels, colour light brown, fracture fibrous, taste bitter.

**Immunomodulation effect:**

Clitoria ternatea seed and root alcoholic extracts showed profound immunosuppressive 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 leaf and flower were evaluated by oral administration of aqueous extract of Clitoria ternatea 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 tertilin 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 properties:**

Oxidative stress is among the major causative factor of many chronic and degenerative diseases (Vadlapudi, 2010). In concern to anti-oxidative studies, CT petals have been recognized to possess anti-oxidant activity (Kankonen et al., 1999; Shan, 2005; 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, diphenylicrylhydrazyl (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-inflammatory (Parimaladevi et al., 2003), anti-oxidant (Chauhan et al., 2012), immunomodulatory, hypoprotective (Solanky and Jain, 2011). 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 oxidative properties as it have 90 per cent scavenging effect in DPPH assay and >1000 µmol/g FRAP value (Kruawan and Kangsadalampai, 2006). It has purgative, diuretic, laxative properties (Chauhan et al., 2012).

Ramswamy 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.

**REFERENCES**


Phyllanthus emblica (2) July, 2015:

J. Institution Chemists seeds.

Eugenia jambolana, 10

Clitoria THAKUR ternatea 7.

and the CNS. 30

Clitoria ternatea Linn root extract treatment during growth 1

Clitoria 97

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flower petal extracts and J. Pharm. Sci., J. Oil Technologists ANA (3) : 529-536.

Clitoria ternatea cv.

SINGH Egyptian J. Forensic

Clitoria Indigenous drugs of India (1): 122-129.


Clitoria ternatea root extract enhances acetylcholine content in rat hippocampus. Fitoterapia, 73 (7-8): 685-689.


