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ETHNOMEDICINAL CLAIMS AND PHARMACOLOGICAL STUDIES OF CLITORIA TERNATEA LINN: A REVIEW

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ABSTRACT:

Clitoria ternatea Linn., known as Aparajita in ayurvedic literature, is a herbaceous medicinal plant used to treat several kind of ailments by tribal groups all over India. Many pharmacological studies have been carried out to investigate the properties of C. ternatea Linn. Ethnomedicinally, this plant can be mentioned as an important herb, because more than 16 tribal groups all over India are using this herb for their disease conditions such as diabetes mellitus, tuberculosis, pneumonia, whooping cough, cough, goiter, leprosy, as an antidote, as a medico sexual drug , syphilis, leucorrhoea etc. The drug is attributed with laxative, purgative, diuretic, aphrodisiac and antidote activities. Many experimental studies also have been carried out with C. ternatea Linn. such as anti-hyperglycemic, antioxidant, hepatoprotective, antimicrobial, antipyretic, anthelmintic, analgesic, anti-inflammatory, nootropic, neuroprotective activities. In the present study, a review of ethnomedicinal claims of C. ternatea Linn. has been done and it is correlated upon reported pharmacological activities.

Key words: Clitoria ternatea, Ethnomedicine, Pharmacology.

INTRODUCTION

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The botanical source of classical drug namely *Aparajita* is referred to *Clitoria ternatea* Linn. (Fabaceae) is also popularly used in tribal as a folk medicine.

This is a perennial twining herb, stem terete, more or less pubescent.[1] Climber with slender downy stems.[2] Leaf unipinnate, imparipinnate , rachis 7.5- 12.5 cm long with 2- 3 pairs of opposite leaflets .[3] Stipules minute, linear, petiole ½

- 1 inch long.[2] Leaflets elliptic to oblong, obtuse or somewhat emerginate, 2.5-6.3 cm long and 2- 3.8 cm broad, the terminal leaflets being biggest in size, entire, glabrous or with few short oppressed hairs, veins more prominent at the lower side. Base obtuse or acute, petiolute short 2- 3 mm long, stipule filiform, two at the base of the terminal leaflets and one in others. Colour pale yellowish green with astringent and slight bitter in taste.[3] Flowers axillary, solitary, pedicels 8- 13 mm long, bracts small, linear, bracteoles long, roundish, obtuse. Calyx, teeth lanceolate, corolla 3.8- 5 cm long, standard bright blue or sometimes white with an orange center. Pods 5-10 cm by 8- 13 mm, flattened, nearly straight, sharply beaked, seeds 6- 10, yellowish brown, smooth.[1] This plant can be found in tropical zone from Himalaya to Ceylon, Burma and Malaysia.[2]

Clitoria ternatea Linn. is native to the Island of Ternate in the Molluca archipelago. [4] It was originated from tropical Asia and later was distributed widely in South and Central America, East and West Indies, China, India where it has become naturalized[5]

Major chemical component of the plant of *Clitoria ternatea* Linn. is Aparajitin. Other chemical components are such as β Sitosterol , Kaempferol -3-0-rhamnosyl (1 -6) glucocide, Kaempferol -3-0- rhamnosyl (1-6) galactoside , Stigmast -4-ene-3-6 dione, Kaempferole -3-glucoside, Kaempferole -3- rutinoside, Kaempferole -3-neohesperidoside, Clitorin.[6]

MATERIALS AND METHODS

The description about *Clitoria ternatea* Linn. (*Aparajita*) delineated in ethnomedicinal claims along with the observations made with various reported pharmacological studies were compiled for analysis. The available various published literature related to ethnomedicinal claims, research journals and internet based information about the pharmacological activities is compiled and analyzed.

OBSERVATION & RESULTS:

Aparajita has been mentioned in several disease conditions as a tribal claim, such as diabetes mellitus, goiter, leprosy, tuberculosis, leucorrhoea, syphilis, abscess, boils etc. Tribal groups are using leaves, roots, seeds and flowers in the juice, powder, paste and decoction form. Tribal groups living in Uttar Pradesh, Assam, Bihar, Tamil Nadu, Rajasthan, Manipur and Eastern Nepal are using *Aparajita* as a tribal medicine. Details of ethnomedicinal claims are summarized in the below table.

Table1: Ethnomedicinal claims of *Clitoria ternatea* Linn. in summarized form.

	Parts used	Dosage form	Disease	Application	Tribal group
1.	Roots	Powder	Goiter	Externally	Inhabitants of Dhasanvally, Bundelkhand region of Uttar Pradesh.[7]
2.	Flower	Juice	Diabetes Mellitus	Internally	[8]
3.	Seeds Roots		Purgative Laxative, Diuretic	Internally Internally	Amaravati Ta Usil[9]
4.	Seeds Roots Leaf	 Juice	Purgative Diuretic To remove fish	Internally Internally Externally	Kanyakumari district in Tamil Nadu[10]

			bone in neck		
5.	Root	Paste	Dog, Fox bite	Internally	Rajbanshis, Assam.[11]
6.	Fresh leaves (8-10)	Crushed with 2-3 pepper	Tuberculosis	Internally- once a day for one Month	Raebareli district, Uttar Pradesh[12]
7.	Flower- white variety		Leucorrhoea		Tharus of Basti district in Uttar Pradesh[13]
8.	Seed	Paste	Syphilis	Externally- apply on testes	Damor and Danka tribes, Rajastan[14]
9.	Root - white variety Leaves- both varieties	Extract with *Acorus calamus* Paste	Cough Abscess and Boils	Internally Externally	Kanikkars of South India[15]
10.	Fresh root	Juice with fresh Goat milk	Medico sexual	Internally	Maitei community in Manipur state[16]
11.	Root	Paste	Leprosy		Tribal people in Western Bihar[17]
12.	Root and Seed		Purgative, Diuretic and Snake bite		Biratnagar of the Terein of Eastern Nepal[18]
13.	Root Root	Pounded with rice water and ghee Extract	Insanity Whooping cough	Inhale Internally, twice a day	Immigrant Muslims of Bingaigaon district, Assam[19]
14.	Leaf	Extract	Pneumonia	Apply on gum for 5 Days	Sonowal Kacharis of Brahmaputra valley, Assam[19]
15.	Root Root	Paste Powder with cow milk	Syphilis Dog bite	Locally Internally	Meena tribal people of Jaipur District of Rajasthan[20]
16.	Leave	Powder with milk	Aphrodisiac	Internally	[21]

Pharmacological Review

Effectiveness of alcoholic extracts of aerial and root parts of *C. ternatea* at 300 and 500 mg/kg doses orally in rats in attenuating electroshock-induced amnesia. Extracts at 300 mg/kg dose produced significant memory retention, and the root parts were found to be more effective. Its influence on central cholinergic activity by estimating the acetylcholine content of the whole brain and acetylcholinesterase activity at different regions of the rat brain, viz., cerebral cortex, midbrain, medulla oblongata and cerebellum studied.[22] A study showed that Ethanolic extract of *Clitoria ternatea* (EECT) leaves (200 and 400 mg/kg) was found to cause significant increase in spatial working memory ($P < 0.05$), spatial reference memory ($P < 0.001$) and spatial working-reference ($P < 0.001$) in retention trials on Y maze, Morris water maze and Radial arm maze respectively. Data indicates that *Clitorea ternatea* Linn. tenders protection against diabetes induced cognitive decline and merits.[32] Methanolic extract of *Cltoria ternatea* Linn. was studied for its effect on cognitive behavior, anxiety, depression, stress and convulsions induced by pentylenetetrazol (PTZ) and maximum electroshock (MES). The study showed that nootropic activity, anxiolytic activity, anti-stress, anti-depression activities and

anti-convulsion activity of the extract.[24] Methanolic extract of leaves of *Clitoria ternatea* Linn. showed promising nootropic effect in scopolamine induced amnesia in rats. Hence oral administration of methanolic extracts of leaves of *C. ternatea* Linn. has the potential to improve the memory and learning of cognitive functions. [41] Aqueous root extract of *C. ternatea* Linn. showed significant increase in proliferation and growth of neurospheres.[44]

The alcoholic extract of leaves along with stem, flowers and fruits showed analgesic activity in mice and rats.[23]

The organic solvent (Petroleum ether, Ethyl acetate and Methanol) extracts from the leaves of *Clitoria ternatea* Linn. were tested against *Bacillus cereus*, *Staphylococcus aureus* , *Klebsiella pneumonia*, *Proteus vulgaris* and *Salmonella typhi* by agar disc and well diffusion methods. The results showed promising antibacterial activity against the tested microbial pathogens.[25] The methanolic flower extract of *Clitoria ternatea* Linn. shows antimicrobial activity, is directly proportional to concentration. As increase in concentration of solution results in an increase in zone of inhibition.[30] Methanol and chloroform extracts of *Clitoria ternatea* Linn. blue flowers exhibited activities against extended-spectrum beta lactamase (ESBL) producing uropathogenic *E. coli*, Enterotoxigenic *E. coli*, Enteropathogenic *E. coli*, *Klebsiella pneumonia* and *Pseudomonas auriginosa*. [38]

The study indicated that the crude alcoholic extract and its ethyl acetate and methanol fractions (Roots) significantly demonstrated paralysis and also caused death of worms especially at higher concentration of 50 mg/ml, as compared to standard reference piperazine citrate.[26]

The ethanolic extract of *Clitoria ternatea* Linn. showed potent cytotoxic activity in trypton blue dye exclusion method and the extract exhibited potent antioxidant activity with an EC 50 of 36.5 µg/ml.[27] Methanolic extract of *Clitoria ternatea* Linn. var. pilosa (White variety) could be potential source of antioxidants and could have greater importance as therapeutically agent in preventing or slowing oxidative stress related degenerative diseases. [36]

Aqueous extract of *C. ternatea* Linn. leaves and flowers on serum glucose, glycosylated hemoglobin, insulin, total cholesterol, triglycerides, HDL-cholesterol, protein, urea, creatinine were examined in control and extract treated diabetic rats. Oral administration of aqueous extract of *C. ternatea* Linn. leaves (400 mg/kg bodyweight) and flowers (400 mg/kg body weight) for 84 days significantly reduced serum glucose, glycosylated hemoglobin, total cholesterol, triglycerides, urea, creatinine and the activity of gluconeogenic enzyme glucose-6-phosphatase.[28] *Clitoria ternatea* Linn. and *Vigna mungo* seed extracts significantly ($p<0.05$) decreased SGOT, SGPT, ALP and total bilirubin in both acetaminophen and CCl_4 - intoxicated rats. The *C. ternatea* Linn. root extract, showed similar results only in CCl_4 - intoxicated rats.[29] Ethanol extract of *Clitoria ternatea* Linn. and *Cassia angustifolia* leaves showed potent hepatoprotective activity against CCl4 induced hepetotoxicity in rats. [33]

Crude 50% aqueous leaf extract of *Clitoria ternatea* Linn. showed antifungal activity in relation to the activities of the studied enzymes. Fungal infections resulted in decrease in amylase, protease and

dehydrogenase activity in the respective sets which were overcomes in the extract treated sets.[31]

The methanol extract of *Clitoria ternatea* Linn. root (MECTR) blue flowered variety, was evaluated for its anti-pyretic potential on normal body temperature and yeast-induced pyrexia in albino rats. The extract, at doses of 200, 300 and 400 mg/kg body wt., p.o., produced significant reduction in normal body temperature and yeast-provoked elevated temperature in a dose-dependent manner. [34]

Alcoholic extract of the root of *C. ternatea* Linn. at graded doses (100, 200, & 400 mg/Kg body weight) was investigated for antidiarrhoeal activity in term of reduction in the rate of defecation and consistency of faeces in castor oil induced diarrhoea. At various doses (100, 200, & 400 mg/Kg body weight) the extract showed a remarkable antidiarrhoeal activity evidenced by the reduction in the rate of defecation and consistency.[35]

Ethanolic leaf extracts of *Trichosanthes dioica* Linn. and *Clitoria ternatea* Linn. is exhibiting higher degree of antihyperglycaemic activity.[37]

The study revealed that the *C. ternatea* Linn. shows significance protection against carrageenan-induced paw oedema. The analgesic activity was observed at a higher dose level.[39]Methanol extract of *Clitoria ternatea* (MECT) was administered at doses of 100 and 200mg/kg body weight for 14 consecutive days. Treatment with MECT led to a decrease in tumour volume, packed cell volume and viable count. The results suggest that MECT exhibit significant anti-tumor effects in DLA bearing mice.[40]Administration of EECT of leaves (250 mg/Kg p.o) had shown significant increase in the level of CAT, SOD, and GSH as compound to the decreased control animals, which suggests its efficacy in preventing free radicals induced damage. Study suggested that the antiulcer activity of EECT on pylorus ligation induced gastric ulcer can be due to their anti secretory activity.[42]

C. ternatea Linn. seed and root extracts showed significant immunosupressive effects as it is evident from significant decrease in primary and secondary antibody titers in SRBCs-sensitized rats, paw thickness in DTH response, and neutrophil adhesion and *in vitro* Phagocytosis.[43]

Table2: Pharmacological activities of *C. ternatea* Linn. in summarized form.

No.	Parts used	Dosage Form	Dose	Pharmacological action
1.	Roots and Aerial parts	Alcoholic extract	300mg/Kg	Memory and central Colinergic activity[22]
2.	Leave	Alcoholic extract		Analgesic activity[23]
3.	Whole plant	Methanolic extract	-	Nootropic, anxiolytic, antidepressant, anticonvulsing.[24]
4.	Leave	Organic solvents-petroleum ether, ethyl acetate, methanol		Antibacterial activity[25]
5.	Root	Methanolic extract	10-50µg/Kg	Anthelmintic activity[26]
6.	Whole plant	Ethanolic extract	36.5µg/Kg	Antioxidant activity[27]
7.	Leave and Flower	Aqueous extract	Leave- 400mg/Kg Flower- 400mg/Kg	Anti-hyperlipidemic activity[28]
8.	Seed and Root	Extracts		Hepatoprotective activity[29]
9.	Flower	Methanolic extract		Antimicrobial activity[30]

10.	Leave	Aqueous extract		Antifungal activity[31]
11.	Leave	Ethanolic extract	200 and 400mg/Kg	Neuroprotective and Nootropic activity[32]
12.	Leave	Ethanolic extract		Hepatoprotective activity[33]
13.	Root- blue variety	Methanolic extract	200, 300 , 400mg/Kg	Antipyretic activity[34]
14.	Root	Alcoholic extract	100, 200, 400mg/Kg	Antidiarrhoeal activity[35]
15.	Whole plant- white variety	Methanolic extracts		Antioxidant[36]
16.	Leave	Ethanolic activity		Antihyperglycaemic extract[37]
17.	Blue flower	Methanolic and Chloroform		Antimicrobial activity[38]
18.	Flower	Aqueous extract		Anti-inflammatory and Analgesic activity[39]
19.	Whole plant	Methanolic extract	100 and 200mg/Kg	Anticancer activity[40]
20.	Leave	Methanolic extract		Nootropic activity[41]
21.	Leave	Ethanolic extract,	250mg/Kg	Anti-ulcer[42]
22.	Seed and Root	Aqueous extract		Immunomodulatory[43]
23.	Root	Aqueous extract	200mg/Kg	Neurogenic potentials (Learning and memory)[44]

DISCUSSION

Clitoria ternatea Linn. (*Aparajita*), as an ethnomedicinal plant is used by more than 16 tribal groups all over India is using by them as an internal medicine as well as an external application and plant's leaves and roots are mainly employed.

Several pharmacological researches have been carried out on *Clitoria ternatea* Linn. and the observation indicates that the drug is possessing several activities. Alcoholic extract of aerial parts and roots of the plant showed memory retention activity and alcoholic extract of root showed anthelmintic activity. Ethanolic extracts of plant showed antioxidant activity, hepatoprotective activity and anti hyperglycaemic activity. Methanolic extracts of blue flower extracts and leave extracts showed antimicrobial activity and nootropic activity respectively. Methanolic extract of whole plant showed antimicrobial activity, anticancer activity and immunomodulatory effect analgesic, anti-diarrhoeal, anti-inflammatory, antipyretic, antifungal and neuroprotective actions are also pharmacologically observed in different animal experiments.

The tribal use of *Clitoria ternatea* Linn. (*Aparajita)* for diabetes mellitus is effective because it is pharmacologically proved for as antihyperglycaemic or hypoglycaemic effect. The anti-inflammatory, anticancer and analgesic activity of *Clitoria ternatea* Linn. can be directly correlate with conditions such as goiter, abscess and boils of tribal claims. Infectious conditions such as tuberculosis, pneumonia, whooping cough, syphilis, leprosy and leucorrhea which related to microbes can be correlated with pharmacological activities of antifungal, antibacterial, antimicrobial activities. Memory retention activity and nootropic activity of *Clitoria ternatea* Linn. is validating the tribal claim with regard to insanity. Tribal claim mentioned that *C. ternatea* Linn. is used for dog and fox bite and snake bite as an antidote, can be

interpreted with its pharmacological activities such as neuroprotective, immunomodulatory , anti-inflammatory activities.

Tribal claim mentioned that roots of *Clitoria ternatea* Linn. as laxative , but pharmacologically it had been proved as anti-diarrhoeal. Further investigations should be carried out to sort out this controversy.

CONCLUSION

Ayurvedic texts enumerated the indications like *kushtha* (skin diseases), *shwitra* (leucoderma), *shota* (inflammation), *vrana* (wounds), *sarpavisha* (snake bite poisoning), *galaganda* (cervical lymphadinoma), *netraroga* (eye diseases), *krimi* (worm infestation), *unmada* (insanity), *mutraroga* (urinary disorders), *daha* (burning sensation), *shwasa* (bronchial asthma), *kasa* (cough), *raktatisara* (blood dysentery), *shleepada* (filariasis) for *Aparajita* and Ethnomedical information documented about this plant indicates that *C. ternatea* Linn. used in the conditions like diabetes mellitus, tuberculosis, pneumonia, whooping cough, cough, goiter, leprosy, syphilis, leucorrhoea, and for laxative, purgative, diuretic, aphrodisiac and antidote activities. Recent researches produced scientific validation for certain tribal claims with regard the usage of *C. ternatea* Linn. Further research may facilitate to develop new herbal leads from the plant *Clitoria ternatea* Linn.

REFERENCES

1. Dr. BapalalVaidya , Some controversial drugs in Indian Medicine, 2nd Edition, Chaukhambha Orientalia, Varanasi, 2005, P 230-231
2. J.D Hooker ,The Flora of British India, vol. II, M/S International book publishers, India , 1879, P 208
3. Indian Council of Medical Research, Quality Standards of Indian Medicinal Plants, vol. IV , New Delhi: Indian Council of Medical Research, 2006, P 85
4. Jain N *et al* (2003) *Clitoria ternatea* Linn. and CNS, Pharmacology, Biochemistry and behavior, 75, 529- 536
5. Barik DP, Naik S.K, Mudgul A, Chand P.K (2007), rapid plant regeneration through *in vitro* axillary shoot proliferation of Butterfly pea (*C. ternatea* Linn.) a twinning legume, *in vitro*- Cell.Dev. Biol- Plant 43; 144- 148
6. Indian Council of Medical Research, Quality Standards of Indian Medicinal Plants, vol. IV, New Delhi: Indian Council of Medical Research, 2006, P 88
7. S.K Jain, B.K Sinha, R.C Gupta, Notable plants in Ethnomedicine of India - Deep publications 1991, P 76
8. T.S. Rana, K K Singh, R R Rao, Studies on Indigenous herbal remedies for diabetes mellitus in India: Ethnobotany and medicinal plants of Indian subcontinent, Editor, J.K

Maheshwari Scientific publications 2003, p118

9. V R Deshamukh, G D Muratkar, S P Rothe, Preliminary observation on the medicinal and economically important leguminous plant species from Amaravti Tehsil: Ethnobotany and medicinal plants of Indian subcontinent, Editor, J.K Maheshwari Scientific publications 2003, p 285
10. P J Rosakutty, A Stella Roslin, S Ignacimuthu, Some traditional folklore medicinal plants by Kanyakumari district (Tamil Nadu): Ethnobotany and medicinal plants of Indian subcontinent, Editor, J.K Maheshwari Scientific publications 2003, p 371
11. Kuntula Neog Barna, Iswar Chandra Barna, S Mrigen Das, Ethnobotany Rajbanishi of Assam: Ethnobotany and medicinal plants of Indian subcontinent, Editor, J.K Maheshwari Scientific publications 2003, p 610
12. K K Khanna, P K Srivastav, V Mudgul, Noteworthy medicinal plants rises from rural folklore of Raebareli district, Uttar Pradesh: Ethnobotany in South Asia, editor, S.K Maheshwari, Scientific publications, 1996, p 119
13. D. L. Saini, Ethnobotany of Tharus of Basti district: Ethnobotany in South Asia, editor, S.K Maheshwari, Scientific publications, 1996, p 142
14. V Singh, R P Pandey, Ethnomedicinal plants used for veneral and gynecological disease in Rajasthan :Ethnobotany in South Asia, editor, S.K Maheshwari, Scientific publications, 1996,p 156
15. A J A Ranjit Singh, L M Narayanan, C R Natarajan, Ethnobotany of the Kannikkars of South Tamil Nadu: Ethnobotany in South Asia, editor, S.K Maheshwari, Scientific publications, 1996,p 295
16. B K Singh Huidrom, Plants used in medicosexual purpose by Meitei community in Manipur state, India: Ethnobotany in South Asia, editor, S.K Maheshwari, Scientific publications, 1996,p 365
17. Gynesh shukla, B K verma, Roots- vital plant part to care body ailments among tribal/ rural folklore of Western Bihar: Ethnobotany in South Asia, editor, S.K Maheshwari, Scientific publications, 1996, p 392
18. M Siwakoti, S K verma, medicinal plants of Terai of Eastern Nepal: Ethnobotany in South Asia, editor, S.K Maheshwari, Scientific publications, 1996, p 427
19. S Sarkar, C M Sarma, Ethnobotanical studies on indigenous medicinal plants used by immigrant muslims of Bungaigaon district, Assam: Medicinal Plants, Ethnobotanical Approach, editor, P.C Trivedi, Agrobios (India),2006, p222

20. Manjeet S Shikhawat, M K Sharma, A study on ethanomedicinal uses of plants among the Meena tribe of Jaipur district of Rajasthan, India: Medicinal Plants, Ethnobotanical Approach, editor, P.C Trivedi, Agrobios (India),2006, p 390
21. Dr. Koppula Hemadri, A treatise of Tribal Medicine , Dr. Koppula Hemadri's House of Tribal Medicine, 2011, p 12
22. Taranalii AD, Cheoramkuzhy TC (2000): Influence of *Clitorea ternatea* Extracts on memory and central cholinergic activity in rats. Pharmaceut Biol ; 38:51-56
23. Kulkarni C, Pattanshetty JR, Amruthraj G (1998): Effect of Alcoholic extract of *Clitorea ternatea* Linn. on central nervous system in rodents. Indian J Exp Biol ; 26:957-960
24. NN Jain *et al* (2003), *Clitoria ternatea* and CNS. Pharmacol Biochem Behav ; 75:529-536
25. S.P. Anand, A. Doss and V. Nandagopalan (2011) Antibacterial studies on leaves of *Clitoria ternatea* Linn. –A high potential medicinal plant : International Journal of Applied Biology and Pharmaceutical Technology, Vol 2 (3):453-456
26. SN Khadatkar, JV Manwar, NS Bhajipale (2008) *In Vitro* Anthelmintic activity of root of *Clitoria ternatea* - .Pharmacognosy magazine (impact factor.1.11) 4 (13):48
27. V Ramaswamy, N Verghase: A Simon (2011) An investigation on cytotoxic and antioxidant properties of *Clitoria ternatea* Linn., International Journal of Drug Discovery 3(1):74-77
28. P Daisy, K Santosh, M Rajathi (2009): Antihyperglycaemic and Antihyperlipidaemic effects of *Clitoria ternatea* Linn. in alloxan-induced rats- African Journal of Microbiology Research vol. 3(5):287-291
29. YB Salanki and SN Jain (2011) Hepatoprotective effects of *Clitoria ternatea* and *Vigna mungo* against Acetaminophen and Carbon tetrachloride-induced hepatotoxic rats, Journal of Pharmacology and Toxicology 6 (1): 30-48
30. B Pahune, K Niranjane, K Danao, M Bodhe and V Rokade (2013): Antimicrobial activity of *Clitoria ternatea* Linn. flower extract and use as a natural indicator in acid base titration, J. Nat. Prod. Plant Resour, 3(2): 48-51
31. D Neela *et al* (2014) Antifungal effect of *Clitoria ternatea* Linn. leaf extract on seeds of *Pisum sativum* Linn. in relation to the activities of some enzymes. Int. J. Res. Ayurved pharm. 5(1):99-101
32. KA Talpate, UA Bhosale, MR Zambare, RS Somani (2014) Neuroprotective and nootropicactitvity of *Clitoria ternatea* Linn. (Fabaceae) leaves on diabetic induced cognitive declined in experimental animals, Journal of Pharmacy and Bio Allied Sciences, Vol. 6 (1):48-55
33. R Shanmugasundaram *et al* (2010) Hepatoprotective

activity of ethanolic extracts of *Clitoria ternatea* Linn. and *Cassia angustifolia* Vahil. leaf against CCl4 induced liver toxicity in rats, IRJP ;Vol 1 (1): 201-205

34. B Parimaladevi, R Boominathan, SC Mandal (2004) Evaluation of Antipyretic potential of *Clitoria ternatea* Linn. extracts in rats. Phytomedicine; Vol 11 (4): 323-326
35. N Upwar, R Patel, N Waseem, NK Mahobia (2010) Evaluation of Anti-diarrhoeal activity of root of *Clitoria ternatea* Linn. Research article, vol. 5(1):131-134
36. V Jadhav, S Deshmukh, S Mahadkar (2013) Evaluation of Antioxident potential of *Clitoria ternatea* Linn. IJPHS; Vol. 5(2): 595-599
37. K Kavitha , V Premalakshmi (2012) Studies on the synergetic effect of *Trichosanthes dioica* Linn. and *Clitoria ternatea* Linn. leaf extract on streptozotocine-induced Diabetic rats, IJRPBS; Vol 3(3): 1056-1064.
38. B Uma, K Prabhakar, S Rajendran (2009) phytochemical analysis and antimicrobial activity of *Clitoria ternatea* Linn. against extended spectrum beta lactamase producing enteric and urinary pathogenesis. Asian Journal of Pharmacueticle and Clinical Research;Vol. 2 (4): 94-96.
39. Shyamkumar and Bhat Ishwar (2012) Anti-inflammatory, analgesic and phytochemical studies of *Clitoria ternatea* Linn. flower extracts. International Research Journal of Pharmacy; Vol 3 (3): 208-210
40. Lijy Jcob, MS Latha (2012-13) Anticancer activity of *Clitoria ternatea* Linn. against Dalton's Lymphoma. International Journal of Pharmacognosy and Phytochemical Research;Vol 4(4); 207-212
41. Talpate KA, Bhosale UA, Zambare MR, Somani RS (2014) Neuroprotective and nootropic activity of Clitorea ternatea Linn.(Fabaceae) leaves on diabetes induced cognitive decline in experimental animals. J Pharm Bioallied Sci ;Vol 6(1):48-55
42. Nachiket S Dighe, Shashikant R pattan, Sunil A Nirmal, Shruti G Dake, Madhuri U, Shelar, Vipul V Dhasade et al (2009)A Review on Phytochemical and Pharmacological Profile of Clitoria ternatea. Pharmacologyonline 3: 204-210
43. YB Solanki, Sunita M Jain (2010) Immunomodulatory activity of Ayurvedic plant *Aparajita* (*Clitoria ternaea* Linn) in male Albino rats.Global Journal of Science Frontier Research.,;Vol. 10 (3) (ver 1.0): 2
44. Kiranmai S Rai (2010) Neurogenic potential of *Clitoria ternatea* Linn. Aqueous root extract- A basis for enhancing learning and memory. World Academy of

Science; Engineering and Technology;Vol. 4:10-22.