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A REVIEW ON NOOTROPICS

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ABSTRACT

Nootropics are "smart drugs" that improve mental functions such as memory, intelligence, motivation, attention, concentration. Cognitive enhancement may be defined as the amplification core capacity of the brain through improving the information processing systems. Memory disabilities are a spectrum of disorders like Alzheimer's disease, Corticobasal Degeneration Creutzfeldt-Jakob Disease, Fronto-temporal Dementia, Huntington's disease, Lewy Body Dementia, Mild Cognitive Impairment, Progressive Supranuclear, Palsy, Vascular Dementia etc., and affecting people from years ago. Traditional system of herbal medicinal plants has been used to improve memory and cognitive function and to treat neurodegenerative diseases. This review will help to get an idea about the natural plants that have been tested for their nootropic potential.

Keywords: Nootropic, smart drugs, memory, intelligence, phytomedicine

INTRODUCTION

Memory refers to the processes that are used to acquire, store, retain and later retrieve information. There are three major processes involved in memory: encoding, storage, and retrieval. There are two major categories of memory: long-term memory and short-term memory. Long-Term Memory is our brain's system for storing, managing, and retrieving information.Short term memory Closely related to "working" memory, it is the very short time that you keep something in mind before either dismissing it or transferring it to long-term memory.[15,16]It is believed that herbal drugs are relatively safe and exhibit a remarkable efficacy in the treatment of chronic ailments. Poor memory, lower retention, and slow recall are common problems in today's stressful and competitive world, especially with the associated ageing process. Furthermore, the drugs currently available in the market for the treatment of various learning and memory disorders are associated with several side effects indicating need of substitute medication for an alternative system of medicine.

Natural medicine has been an effective treatment since the ancient times. Nature provides a wide variety of plants that contain medicinal properties. The powerful ingredients found in the stems, leaves, roots, flowers, and seeds of certain plants have natural healing properties that have been found to cure various health problems like memory. [30, 32] the scientific documentation of the research progress of some of the herbal drugs (Phytomedicines) that have been used in alternative system for treatment of disorders related to learning and memory is presented below.

Scientific documentation of herbs:

Ashwagandha *(Withania somnifera dunal)* Family: *Solanaceae.*[1, 2]It Medicinal uses like immunomodulation, hypolipidemic, antibacterial, cardiovascular protection. The root and berry are used to make medicine. Ashwagandha has a lot of uses. But so far, there isn't enough information to judge whether it is effective for any of them. Ashwagandha is used for arthritis, anxiety, trouble sleeping (insomnia), tumors, tuberculosis, asthma, a skin condition marked by the white patchiness (leukoderma), bronchitis, backache, fibromyalgia, menstrual problems, hiccups, and chronic liver disease.

A***libizza lebbeck*** Family *: Fabaceae*[3, 4]it reduces the release of histamines through a stabilizing effect on mast cells, mildly suppresses activity of T-lymphocytes reducing the level of allergy-inducing antibodies. Controls high blood cholesterol, Respiratory Tract Conditionsasthma, allergic rhinitis (commonly called hay fever) is an

inflammation or irritation of the mucous membranes that line the nose, eczema (internal and external), urticaria (nettle rash)

Nardostachys jatamansi *(Nardostachys grandiflora DC)* it belongs to the family: *Velarianaceae.* The roots and the rhizomes of *N. jatamansi*, as mentioned in Ayurveda, have been used in various herbal formulations including dietary supplements. This traditional drug is also used to treat epilepsy, hysteria, syncope, convulsions, and mental weakness. The decoction of the drug is also used in neurological disorders, insomnia, and disorders of the cardiovascular system. It has been reported to exhibit antidepressant, anticonvulsant and antiarrhythmic activities as well as to possess antioxidant and lipid peroxidation activities.

Polygala tenuifolia *Family*: *Polygalaceae.*[7, 8] it promotes the clearing of phlegm from the bronchial tubes. The plant is used mainly as an expectorant and stimulant to treat bronchial asthma, chronic bronchitis and whooping cough. The root is antibacterial, cardiotonic, cerebrotonic, and expectorant, hemolytic, hypotensive, sedative and tonic. It acts mainly as a tonic for the heart and kidney energies. It is taken internally in the treatment of coughs with profuse phlegm, bronchitis, insomnia, palpitations, poor memory, anxiety, depression and nervous tension. Externally it is used to treat boils and carbuncles. The root is harvested in the autumn and dried for later use. The leaves are used as a tonic for the kidneys.

Tylophora Indica (T. Asthmatics) family: *Asclepiadaceae*[11]the leaves and roots have emetic, cathartic, laxative, expectorant, diaphoretic and purgative properties. It has also been used for the treatment of allergies, cold, dysentery, hay fever and arthritis. It has a reputation as an alternative and as a blood purifier, often used in rheumatism and syphilitic rheumatism. Root or leaf powder is used in diarrhoea, dysentery and intermittent fever. Dried leaves are emetic diaphoretic and expectorant. It is regarded as one of the best indigenous substitute for ipecacuanha. The roots are suggested to be a good natural preservative of food. It is traditionally used as a folk remedy in certain regions of India for the treatment of bronchial asthma, inflammation, bronchitis, allergies, rheumatism and dermatitis. It also seems to be a good remedy in traditional medicine as anti-psoriasis, seborrheic, anaphylactic, leucopenia and as an inhibitor of the Schultz-Dale reaction. The roots are suggested to be a good natural preservative of food.

Terminalia chebula: It belongs to the family: *Combretaceae.*[17]It is commonly called as black myrobalan. Three species of

terminalia are used for medicine. These species are Terminalia arjuna, Terminalia bellerica, and *Terminalia chebula*. In traditional Ayurvedic medicine, *Terminalia chebula* is used for high cholesterol and digestive disorders, including both diarrhea and constipation, and indigestion. They have also been used for HIV infection and dysentery.

Fenugreek seeds *(trigonella foeum graecum)* it belongs to the family *Leguminoseae*. Medicinal uses of fenugreek seeds have been used in many traditional medicines as a laxative, digestive, and as a remedy for cough and bronchitis. Fenugreek may help control cholesterol, triglyceride as well as high blood sugar (glycemic) levels in diabetics. Fenugreek seeds added to cereals and wheat flour (bread) or made into gruel, given to the nursing mothers to increase milk synthesis. it also been used in memory disorders[33].

Vitis vinifera family: *Vitaceae*[36, 37]it has astringent, anti-inflammatory, detoxifying and antisclerotic properties. Seeds and leaves are astringent. The leaves have been used in traditional medicine to stop hemorrhages and minor bleedings. Ripe fruit can influence the kidneys, promoting urine flow. Along with a nourishing diet, grapes can greatly help people suffering from anemia and exhaustion. Grapes are also useful in cases of small-pox, neuralgia and insomnia. They correlated the anti-stress and antioxidant activities with the nootropic activity of the extract since the role of stress and free radicals have been implicated in the loss of memory, concentration and also in Alzheimer's disease they attributed the nootropic activity to central cholinomimetic activity apart from its free radical scavenging mechanisms

Green tea ***Camellia sinensis*** family: *Theaceae* extracts significantly improved learning and memory in older rats, with increased retention latency to enter difference in passive avoidance test. In the elevated maze test, green tea treatment resulted in a significantly more number of entries in the enclosed arm of the young and old rats. Decline in acetyl cholinesterase activity was observed in the cerebrum of green tea treated old rats in comparison to the green tea treated young rats. These results suggested the use of green tea in reversing age-related deficits, but the mechanism was unclear.

Ipomea aquaticit belongs to the family*: Convolvulaceae*. [19, 20] Used as an antidote to arsenical or opium poisoning. Plant juice is used for liver complaints. The leaves are a good source of minerals, vitamins (especially, carotene and tocopherol). Ipomoea aquatic is used to treat ringworm

infection, combat fever, and to treat asthma. The plant is used to relieve the bowels the putrefaction of the skin and uterus, and cough, the plant is used to treat asthma, to calm and to heal boils flatulence, as a tonic and inflammation for intoxication Decoction used to remedy hemorrhoids.

Pueraria tuberosa it belongs to the family: *Fabaceae*. It is a perennial woody climber and has huge tuberous roots. In Ayurveda system of medicine, its roots are used for medicinal purposes. The roots contain Steroids, Sugars, Amino acids and Sterols. Researchers have evaluated the antimicrobial properties of this plant.

Commiphora Mukul it belongs to the family: *Burseraceae*. It is commonly known as Guggul, an herbal resin of the Commiphora mukul tree also known as gum guggul. Herb Extracts (Guggul Gum) have been used for a long time in Ayurvedic medicine to treat obesity and other weight related problems it lower cholesterol levels and decrease high blood pressure. Gum the primary chemical constituents of Guggul include phytosterols, gugulipids, and guggulsterones. It was traditionally combined with other herbs for the treatment of arthritis, skin diseases, and pains in the nervous system, obesity, digestive problems, infections in the mouth, and menstrual problems.

Celastrus paniculatus it belongs to the family: *celastraceae*. According to Ayurveda, leaves are and seeds are acrid, bitter, hot, appetizer, laxative, emetic, aphrodisiac, powerful brain tonic, Oil enriches blood and cures abdominal complaints, stomachic, tonic, good for cough and asthma; used in leprosy, cures headache and Leucoderma.

Lawsonia inermis it belongs to the family: *lythraceae*. Its primary uses are various types of dyes for skin and hair People all over the world continue to use henna for cosmetic, medicinal and healing purposes. It helps reduce headaches, aches and pain, Improves blood circulation. Leaves are beneficial for mouth ulcers and blisters in the mouth.

Pongamia pinnata it belongs to the family: fabaceae.. It is used for the treatment of whooping cough, rheumatism, diarrhea, dyspepsia, gonorrhea and leprosy.

Brahmi : Bacopa monnieri (L.) Wettst. Family: Scrophulariaceae, also known as Bacopa monniera, Brahmi has great value in Ayurvedic medicine mainly used as brain and mental tonic to treat Alzheimer disease, memory loss, insanity, insomnia and other mental illness. Traditional medicinal uses of Brahmi memory enhancer, mental and physical fatigue insomnia, irritable bowel syndrome, impotence, bronchitis, coughs

and hoarsenessarthritis, rheumatism, inflammatory conditions, high cholesterol level.

Carum carvi Family: Apiaceaeit has numerous medicinal properties. It is most commonly used in cases of gastric problems, flatulence and indigestion. It has been very efficient in relief of flatulent colic in infants. Bruised fruits can be used to ease the earache. It can also be helpful, in combination with other herbs, in soothing of sore throat and laryngitis. Caraway oil can be used in the treatment of eye infections, toothaches and rheumatism.

Almonds (Prunus dulcis) family : Rosaceae are good sources of anti-oxidant nutrients. Almonds contain proteins and certain minerals such as calcium and magnesium. They are a rich source of vitamin E, dietary fiber, B-vitamins, essential minerals mono-unsaturated fats and phytosterols which have cholesterol lowering properties. Almonds are a useful food remedy for anaemia. They are beneficial in the treatment of constipation and various skin diseases like eczema, pimples. Almonds are also useful in treating gastroenteritis, kidney pains, diabetes, head lice, facial neuralgia and gastric ulcers.

In Ayurveda, **Ocimum sanctum**Linn. Family (Lamiaceae) popularly known as the sacred tulsi (holy basil) and has been in clinical use for centuries its beneficial use in the treatment of cognitive disorders such as dementia and Alzheimers disease. The probable mechanism of nootropic activity was attributed to its anti- inflammatory, antioxidant, antistress and neuroprotective effects.

Desmodium gangeticum (L.) DC. Family: Fabaceae Has a considerable reputation as a bitter tonic, anti emetic, and anticatarrhal, it was widely used in neurological disorders. Acts as nootropic by Increasing the memory power.

DATA OF HERBAL PLANTS SHOWNIG NOOTROPIC ACTIVITY IN A TABULAR FORM:

S. no	Name	Part used	Extract method	Dose	Models	Amnesia induction method	Biochemical Parameters	Types of activity reported
1.	Nardostachysjatamansi	Root	Ethanol Aqueous	500mg/kg2 50mg/kg	Rota rod Haloperidol induced catalepsy	Scopolamine	Thiobarbituric acid reactive substances Reduced glutathione Superoxide dismutase	Anticonvulsant Antioxidant Anticataleptic
2.	Terminalia chebula[17]	Fruit	Ethyl alcohol Hydroalcoholic	200mg/kg 500mg/kg	Cold restraint Stress induced ulcer	Scopolamine alprazolam	Gastric juice volume Free acidity Total acidity	Antiulcerogenic Antiatherogenic Antioxidant Anti-inflammatory Antibacterial Anticancer
3.	Fenugreek seeds[33]	Seed Leafs	Ethanol	0.2mg/kg	Tail flick	Diazepam scopolamine	Reduced glutathione Histochemical	Antidiabetic Antioxidant Antiulcer
4.	Vitis vinifera[36, 37]	Fruit Seed	Methanol Ethyl acetate	500µg/ml	Cook's pole climbing	Scopolamine	Bcarotene	Antistress Antioxidant Antifungal
5.	Ipomeaaquatic[19,20]	Leaf	Ethanol Methanol	500mg/kg 600mg/kg	Liposome	------	Acetylcholine	Antioxidant
6.	Puerariatuberosa[22]		Alcohol Aqueous	100mg/kg 400mg/kg	Elevated plus maze haloperidol	Diazepam scopolamine	Acetylcholine	Antioxidant
7.	Commiphoramukul[23, 24,25]	Resin	Ethanol Petroleum ether	200mg/kg 50mg/kg	Cholesterol acyl transferase	Scopolamine	Glutathione peroxidation of lipid	Antidiabetic Antioxidant Antiobesity
8.	Celastrus paniculatus[26, 27]	Seeds	Aqueous	350mg/kg 1050mg/kg	Elevated plus maze Amnesia rodent	Sodium nitrate Piracetam	Dopamine Serotonin	Antidepressant Antioxidant
9.	Lawsoniainermis[28, 29]	Leaf	Ethanol Methanol	0.8gm/kg 1mg/ml	Alloxan induced	Piracetam	Glutathione reductase Superoxide dismutase	Antihyperglycemic Antibacterial Antifungal Antifertility Anti-[illegible]

10.	Pongamiapinnata[31]	Flower& Seed	Ethanol Methanol	300mg/kg	Alloxan induced	Piracetam Scopolamine	Reduced glutathione Glutathione peroxidase Superoxide dismutase catalase	Antidiabetic Antibacterial Anti-inflammatory Antiviral Antiulcer
11.	Ashwagandha[1, 2]	Roots and leaves	Aqueous methanol extract of roots	50, 100, 200mg/kg	Elevated plus-maze and step down	scopolamine-induced and electroconvulsive Shock (ECS)	Acetylcholinesterase (AChE) activity, Glutamatergic and GABAergic receptors	Antioxidant, Anxiolytic, Memory enhancing, Antiparkinsonian, Antiinflammatory,
12.	Alibizzalebbeck[3, 4]	Bark, roots, Flower, pod Leaves.	Nbutanolic fraction extract	10 25 50mg/kg	Elevated plus-maze and step down	Scopolamine-induced	5-HT, DA, and GABA concentration in brain	Anti-allergic, antioxidant, anti-inflammatory, nootropic, anticonvulsant, antimicrobial, antispermatogenic and antiulcer activities.
13.	Carum carvi[6]	Fruits	Aqueous	100,200, 300mg/kg	Cook's pole climbing apparatus	Scopolamine induced amnesia	Lipid peroxidation in liver and brain homogenates.	Anti-osteoporotic, Immunomodulatory, Antidiabetic, ant mutagenic Antioxidant
14.	Polygala tenifolia[7, 8]	Roots	N butanolic fraction extract and methanol extract	25,50 mg/kg	Passive avoidance paradigms	KCN-Induced Anoxia	Acetyl cholinesterase (AChE) activity.	Antianxiety, allergic, nootropic
15.	Green tea	Leaves	Aqueous and methanol	5,10,20 35mg/kg	Elevated plus-maze and Morris water maze and step down.	Scopolamine-induced	Acetyl cholinesterase (AChE) activity.	Nootropic, Ant hyperlipidemia, antioxidant, anti-stress
16.	Brahmi	Whole plant	Aqueous Extract	40mg/kg	Foot-shock motivated brightness discrimination Response	Electroconvulsive shock (ECS). Hypothermia and hypoxia	Protein kinase activity and protein estimation in hippocampus.	Nootropic, anti-ulcer, broncho-vasodilatory, neuroprotective effect, Antioxidant

17.	Ocimum sanctum[16]	Leaves	Aqueous Extract	50,100 and 200mg/kg	Elevated plus-maze and step down	Scopolamine-induced and diazepam induced	Acetyl cholinesterase (AChE) activity.	Antibacterial, Antioxidant Anti asthmatic, nootropic
18.	Almonds[9,10]	Nuts	Aqueous Extract	150, 300, and 600 mg/kg	Elevated plus-maze and step down	Scopolamine-induced	Acetyl cholinesterase (AChE) activity	Antiemetic, antitumor, demulcent, Nutritive, nootropic
19.	Tylophra indica[11]	Leaves, roots.	Aqueous Extract	250 and 500 mg/kg	Elevated plus-maze and Morris water maze	Scopolamine-induced	-----	Anti asthamic, anti-inflammatory and anti-tumor anti-amoebic activity, nootropic
20.	Desmodium gangeticum[12]	Leaves Stem And Roots	Aqueous Extract	50,100 and 200mg/kg	Elevated plus-maze and passive avoidance paradigms	Scopolamine-induced	Acetyl cholinesterase (AChE) activity.	Antioxidant, anti-inflammatory, anti-nocipection,nootropic

Conclusion

The review focuses on several natural memory enhancing herbal plants which are today popular all over the world. The present review is aimed at compiling an up to date and comprehensive review on herbal plants showing nootropic activity and also helps the scientific community to lessen the extensive search which is an integral part of literature survey and shift the focus to unidentified plants.

References

1. Dhuley JN * Retracted:Nootropic-like effect of ashwagandha (Withania somnifera L.) in mice. Phytotherapy Research Volume 15, Issue 6, pages 524–528, September 2001.

2. Singh G *, Sharma PR, Dudhe R and Singh S. Biological activities of Withania somnifera. Annuals of biological research 2010, 1 (3): 56-63.

3. Une HD, Sarveiya VP, Pal SC, Kasture VS, Kasture SB. Nootropic and anxiolytic activity of saponins of Albizzia lebbeck leaves. Pharmacol Biochem Behav. 2001 Jul-Aug;69(3-4):439-44.

4. Chintawar SD, Somani RS, Veena S Kasture, S B Kasture Nootropic activity of Albizzia lebbeck in mice. Journal of Ethnopharmacology. 09/2002; 81(3):299-305.

5. R. K. Johri. Cuminum cyminum and Carum carvi: An update. Pharmacogn Rev. 2011 Jan-Jun; 5(9): 63–72.

6. Koppula, Sushruta; Kopalli, Spandana Rajendra; Sreemantula, Satyanarayana Adaptogenic and Nootropic Activities of Aqueous Extracts of Carum Carvi Linn(Caraway) Fruit: An Experimental Study in Wistar Rats. Australian Journal of Medical Herbalism,Volume 21 Issue 3 (2009).

7. Xue W, Hu JF, Yuan YH, Sun JD, Li BY, Zhang DM, Li CJ, Chen NH. Polygalasaponin XXXII from Polygala tenuifolia root improves hippocampal-dependent learning and memory. APS (Acta pharmacologica sinica).2009 Sep;30(9):1211-9.

8. Park JH, Kim JS, Jang DS, Lee SM. Effect of Polygala tenuifolia root extract on cerebral ischemia and reperfusion. The American journal of Chinese medicine. 2006; volume 34 isssue 1, page no: 115-23.

9. Haider, S.; Batool, Z.; Haleem, D. J. Nootropic and hypophagic effects following long term intake of almonds (Prunus amygdalus) in rats. Nutrición Hospitalaria,vol. 27, 6, 2012, pp. 2109-2115.

10. Hari jaganadha rao, Lakshmi. Therapeutic Applications of Almonds (Prunus amygdalus L): A Review. Journal of Clinical and Diagnostic Research. 2012 February, Vol-6(1): 130-135

11. Mrugaya P Kulkarni, Archana R Juvekar*. Studies on nootropic activity of roots of Tylophora indica in mice. Journal of natural remedies.Vol. 9/1 (2009) 62 – 67.

12. Joshi H, Parle M. Antiamnesic effects of Desmodium gangeticum in mice.

Yakugaku Zasshi (The pharmaceutical society of japan) 2006 Sep; vol.126 (9):795-804.

13. Preksha Dwivedi, Richa Singh, Mohd.Tabish Malik and Talha Jawaid* a Traditional Approach to Herbal Nootropic Agents: An Overview. International journal of pharmaceutical sciences and research. IJPSR, 2012; Vol. 3(3): 630-636.

14. Hanumanthachar Joshi and Milind Parle. Brahmi rasayana Improves Learning and Memory in Mice. Evidence Based Complementary and Alternative Medicine. 2006 March; 3(1): 79–85

15. JS Shah and RK Goyal Investigation of Neuropsychopharmacological Effects of a Polyherbal Formulation on the Learning and Memory Process in Rats. Journal of young pharmacists. 2011 Apr-Jun; 3(2): 119–124.

16. Reena Kulkarni, K. J. Girish, and Abhimanyu Kumar. Nootropic herbs (Medhya Rasayana) in Ayurveda: An update. Pharmacognosy Review. 2012 Jul-Dec; 6(12): 147–153.

17. SuryaPrakash DV, Sree Satya N, Sumanjali Avanigadda and Meena Vangalapati* Pharmacological Review on Terminalia Chebula. International Journal of Research in Pharmaceutical and Biomedical Sciences. Volume 3 (2). 2012.

18. Milind Parle1 and Nitin Bansal. Antiamnesic Activity of an Ayurvedic Formulation Chyawanprash in Mice Evidence-Based Complementary and Alternative Medicine Volume 2011 (2011), Article ID 898593, 9 pages.

19. Dhanasekaran.Sivaraman* and Palayan.Muralidaran. Nootropic Effect of Ipomoea Aquatica Forsk in Rat Hippocampus. International Journal of PharmTech Research IJPRIF ISSN: 0974-4304 Vol.2, No.1, pp 475-479, Jan-Mar 2010.

20. Salim Said Alkiyumi, Mahmood Ameen Abdullah,* Ahmed Salim Alrashdi, Suzy Munir Salama, Siddig Ibrahim Abdelwahab and A. Hamid A. Hadi, Ipomoea aquatica Extract Shows Protective Action Against Thioacetamide-Induced Hepatotoxicity. Molecules 2012, 17, 6146-6155;

21. Arijit Ghosh, VR Dhumal, AV Tilak, Nina Das1, Amarinder Singh, Abhijit A Bondekar. Evaluation of nootropic and neuroprotective effects of low dose aspirin in rats. Journal of pharmacology and pharmacotherapeutics. Volume: 2, issue: 1, pg.no:3-6.2011.

22. Rao NV, Pujar B, Nimbal SK, Shantakumar SM, Satyanarayana S. Nootropic activity of tuber extract of Pueraria tuberosa (Roxb). Indian J Exp Biol. 2008 Aug; 46(8):591-8.

23. G. Sudhakara1, B. Ramesh, P. Mallaiah1, N. Sreenivasulu1, D. Saralakumari1*. Protective effect of ethanolic extract of commiphora mukul gum resin against oxidative stress in the brain of streptozotocin induced diabetic wistar male rats. EXCLI journal 2012. Volume: 11. Pg.no: 576-592.

24. A. K. Singh, S. N. Tripathi, and G. C. Prasad. Response of Commiphora Mukul (Guggul) On Melatonin Induced Hypothyroidism. Anc Sci Life. 1983 Oct-Dec; 3(2): 85–90.

25. B Ramesh, R Karuna, Reddy S Sreenivasa, K Haritha, Mangala D Sai, Bhusana Rao B Sasis, D Saralakumari. Effect of Commiphora mukul gum resin on hepatic marker enzymes, lipid peroxidation and antioxidants status in pancreas and heart of streptozotocin induced diabetic rats. Asian Pacific Journal of Tropical Biomedicine Volume 2, Issue 11, November 2012, Pages 895–900.

26. Bhanumathy M, Harish MS, Shivaprasad HN, Sushma G. Nootropic activity of Celastrus paniculatus seed. Pharmaceutical Biology. 2010 Mar; 48(3):324-7.

27. M. Bhanumathy*, S. B. Chandrasekar, Uma Chandur, T. Somasundaram. Phyto-pharmacology of Celastrus paniculatus: An Overview. International Journal of Pharmaceutical Sciences and Drug Research 2010; 2(3): 176-181.

28. Gagandeep Chaudhary*, Sandeep Goyal, Priyanka Poonia. Lawsonia inermis Linnaeus: A Phytopharmacological Review. International Journal of Pharmaceutical Sciences and Drug Research 2010; 2(2): 91-98.

29. I. Abulyazid, Elsayed M.E. Mahdy, Ragaa M. Ahmed. Biochemical study for the effect of henna (Lawson ia inermis) on Escherichia coli. Arabian Journal of Chemistry Volume 6, Issue 3, July 2013, Pages 265–273.

30. Neeraj K Sethiya*, SH Mishra. Review on ethnomedicinal uses and phytopharmaco logy of memory boosting herb Convolvulus pluricaulis Choisy. Australian Journal of Medical Herbalism 2010 volume: 22(1).

31. S.R. Arote* and P.G. Yeole. Pongamia pinnata L: A Comprehensive Review International Journal of PharmTech

Research Vol.2, No.4, pp 2283-2290, Oct-Dec 2010.

32. K.Yalla Reddy, S. Mohana Lakshmi, A. Saravana Kumar. Review On Effect Of Natural Memory Enhancing Drugs On Dementia. International Journal of Phytopharmacology, 1(1), 2010, 1-7.

33. M. Mohan, A. Banekar, T. Birdi, P. Bharambe, S. Kaul, A. Patel. Nootropic and Anxiolytic Activity of Fenugreek Seeds. Journal of Natural Remedies.Volume 6, Issue 2, June 2006.

34. Vinod S Pawar, Shivakumar Hugar. Adaptogenic activity of Trigonella foenum graecum (Linn) seeds in rodents exposed to anoxia and immobilization stress. Asian Pacific Journal of Tropical Biomedicine (2012) pg.no: 208-211.

35. Dinesh Saini, Ashwani Kumar Dhingra*, Bhawna Chopra, Milind Parle Psychopharmacological Investigation of the Nootropic Potential of Trigonella Foenum Linn. In Mice. Asian Journal of Pharmaceutical and Clinical Research Vol. 4, Issue 4, 2011, Pg.no:76-84.

36. V. D. Kakad, M. Mohan, V. S. Kasture, S. B. Kasture. Effect of Vitis vinifera on Memory and Behaviour Mediated by Monoamines. Journal of natural remedies. Volume: 8, Issue: 2, 2002.

37. Satyanarayana Sreemantula, Srinivas Nammi, Rajabhanu Kolanukonda, Sushruta Koppula, Krishna M Boini. Adaptogenic and nootropic activities of aqueous extract of Vitis vinifera (grape seed): an experimental study in rat model. Bio med central complementary and alternative medicine. Volume: 2, 2005. 2; 1.