Journal of Chemical and Pharmaceutical Sciences

Journal of Chemical and Pharmaceutical Sciences-JCHPS (2024) 17 (2): 42-50
Online ISSN: Online 2349-8552, Print ISSN: 0974-2115
Review Article | Pharmaceutical Sciences | MCI Approved | Peer-Reviewed | Referred | OA Journal |

Traditionally Active Herb: *Eclipta Alba*

V. Asha Jyothi*, Uzma Quadri[a] and Giridhar Vedantam[1]

[1]Department of Dravyaguna (Ayurveda Pharmacology), Guru Gorakshnath Institute of Medical Sciences, Faculty of Ayurveda, Mahayogi Gorakhnath University Gorakhpur, Uttar Pradesh India 273007.
*Department of pharmacology, Shadan Womens College of Pharmacy, Khiratabad, Hyderabad.

Received: 16 Oct 2023 / Accepted: 4 Nov 2023 / Published online: 01 Apr 2024
*Corresponding Author Email: ashajyothivadlapudi@gmail.com

ABSTRACT

The World Health Organization appreciated the importance of medicinal plants for public health care in developing nations. *Eclipta alba* (Bhringaraja) having important role in the traditional Ayurvedic and Unani systems of holistic health and herbal medicine of the east. Theprincipal constituents of *Eclipta alba* are coumestan derivatives like wedololactone [1.6%], demethylwedelolactone, desmethyl-wedelolactone-7glucoside and other constituents are ecliptal, ß-amyrin, luteolin-7-O-glucoside, hentriacontanol, heptacosanol, stigmasterol. All the parts of *Eclipta alba* and chemical constituents are used as anticancer, antileprotic, analgesic, antioxidant, antimyotoxic, antihemorrhagic, antihepatotoxic, antiviral, antibacterial, spasmogenic, hypotensive, ovicidal, promoter for blackening and growth of hair

KEY WORDS: Eclipta alba, Bringraj

INTRODUCTION:

Herbal Medicine is also known as botanical medicine or phytomedicine. In the early twentieth century herbal medicine was a prime healthcare system as antibiotics or analgesics were not available. With increasing use of allopathic system of medicine, herbal medicine gradually lost its popularity among people, and it was based on the fast therapeutic actions of synthetic drugs. Almost a century has passed, and it has witnessed limitations of the allopathic system of medicine. Lately herbal medicine has gained momentum, and it is evident from the fact that certain herbal remedies are more effective as compared to synthetic drugs. As herbal medicinal products are complex mixtures which originate from biological sources, great efforts are necessary to guarantee a constant and adequate quality. By carefully selecting the plant material and a standardized manufacturing process the pattern and concentration of constituents of herbal medicinal products should be kept as constant as possible as this is a prerequisite for reproducible therapeutic results.[1]

CLASSIFICATION:

PLANT NAME: *Eclipta Alba*
Kingdom: Plantae.
Division: Mangnoliophyta.
Class: Mangnoliosida.
Order: Asteraceae.
Genus: Eclipta.
Species: Alba.
Family: Asteraceae

Popular Name(s): Babri, Galagara, Gunta-kalagara, Kaikeshi, Karisha-langanni, Karisirang kanni, Kesharaji, Kesuri, Kesuria, Kesutti, Maka, MochkandParts Used**:** Herb, roots,leaves.Vernacular names:Sanskrit - Bhringaraj; Hindi - Bhangra; English - Bhringaraj; Bengali-Kesuti; Marathi - Maka; Tamil - Garuja; Unani - Bungrah; Chinese – Lichang.
Organoleptic Character:

Journal of Chemical and Pharmaceutical Sciences -JCHPS (2024) 17 (2): 42-50
Online ISSN: Online 2349-8552, Print ISSN: 0974-2115
Review Article | Pharmaceutical Sciences | MCI Approved | Peer-Reviewed | Referred | OA Journal |

(a) Appearance: Powder
(b) Color: Green
(c) Smell: Slight, Characteristic
(d) Taste: Not bitter

HABITAT: Throughout India & Southwestern America. It is found in various parts of tropical and sub-tropical regions of south America, Africa, Asia, It is widely distributed China, Thailand, and Brazil.[2,3,4]

BOTANICALDISCRIPTION OF THE PLANT:

Eclipta Alba (L)Hassk commonly known as false daisy and Bhringraj, is a plant belonging to the family Asteraceae. It is a perinial herb usually found separating easily in moist tropical countries. The branches are hairy, reddish brown and can grow up to 40 cm high. The roots are found growing at the thickened nodal points, the leaves are opposite lance like toothed edge and hairy when the leaves are cut with iron knife, it turns the sap black. The flowers are white small and arranged in small clusters. The flowering stock arises from the axis of the leaves. The floral heads are 6-8mm in diameter solitary, white, archon compressed and narrowly winged. The dry fruit is formed by the fusion of two carpals which don't break open and each has just one seed. Roots well developed cylindrical and grayish, taste.[1,4] Chemical constituents are Wedelolactone (I), di-methyl wedelolactone (II), polypeptides, polyacetylenes, thiophene derivatives, steroids, triterpenes and flavinoids.[2,3]

MORPHOLOGY:

It is a small shrub found growing horizontal on the ground.

STEM: Black in color.

LEAVES: 1-4 inch long and 1/2-1-inch broad simplelance like with toothed margin n hairy.

FLOWER: White in colour 0.17-0.35 in diameterarranged in small clusters.

FRUITS: 0.1 inch in length having hairs on posterior surface and cypsela.

SEEDS: Are very small very similar to cumin seeds.

Taste: Bitter, hot, sharp and dry.[2,3]

Parts used and their chemical constituent:

Leaves: Stigmasterol, aterthienymethanol, Wedelolactone [1.6%], Desmethylwedelolactone, Desmethyl-wedelolactone-7glucoside.[5]

Roots: Hentriacontanol14, Heptacosanol11 & Stigmasterol4, Ecliptal.[10-11]

Aerial part: ß-amyrin & Luteolin-7-0-glucoside5, Apigenin, Cinnaroside, Sulphur compounds.[8]

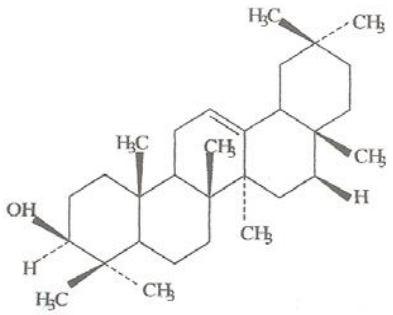
Stems: Wedelolactone·6**,**

Seeds: Sterols.[6]

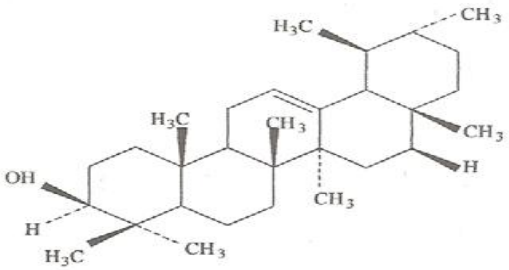
Twigs: Alkaloid.[7]

Journal of Chemical and Pharmaceutical Sciences -JCHPS (2024) 17 (2): 42-50
Online ISSN: Online 2349-8552, Print ISSN: 0974-2115
Review Article | Pharmaceutical Sciences | MCI Approved | Peer-Reviewed | Referred | OA Journal |

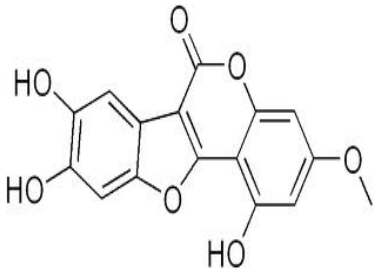
Whole plant: contain large amounts of resin, Ecliptine, Reducing sugar[6,] Nicotine, Stigmasterol, Triterpene saponin, Eclalbatin with alpha-amyrin, Beta Amyrin, Wedelelctone, Diethyl Wedelelactone, Ursolic acid, Oleanolic acid, Stigmasterol, Apigenin, Leutolin, Diosmetin, 3 O-Methyllorobol.[9,19]



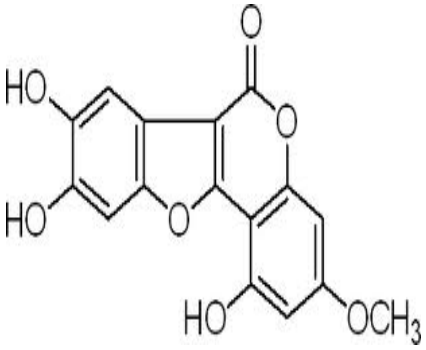
Structure of α-amyrin



Structure of β-amyrin

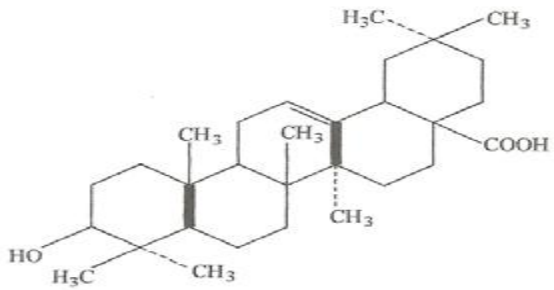


Wedelelactone.

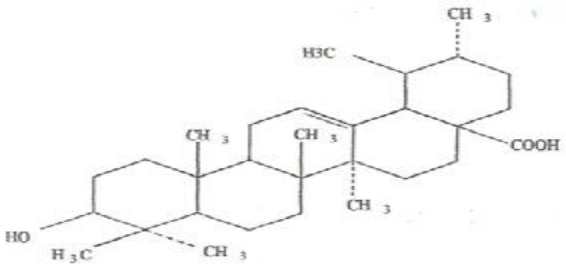


Diethyl wedelelactone.

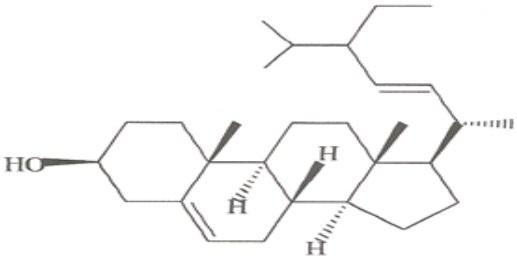
Journal of Chemical and Pharmaceutical Sciences -JCHPS (2024) 17 (2): 42-50
Online ISSN: Online 2349-8552, Print ISSN: 0974-2115
Review Article | Pharmaceutical Sciences | MCI Approved | Peer-Reviewed | Referred | OA Journal |



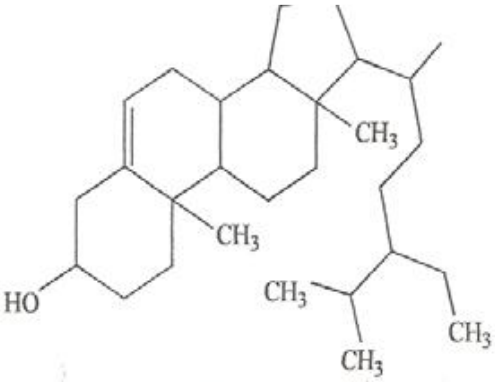
Structure of Oleanolic acid



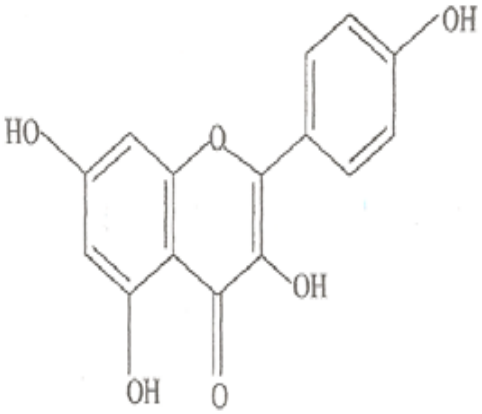
Structure of Ursolic acid



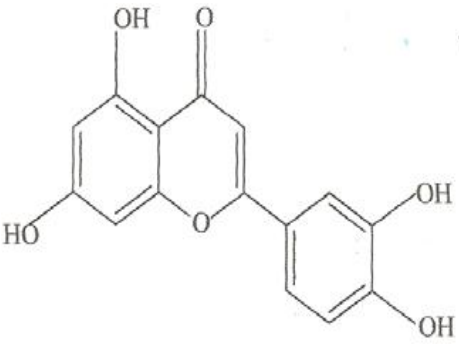
Structure of Stigmasterol



Structure of β-sitosterol

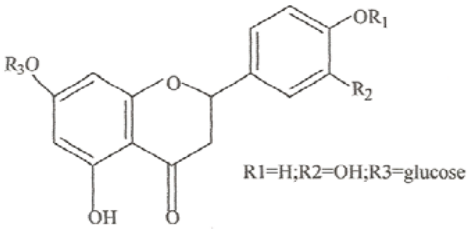


Structure of Apigenin

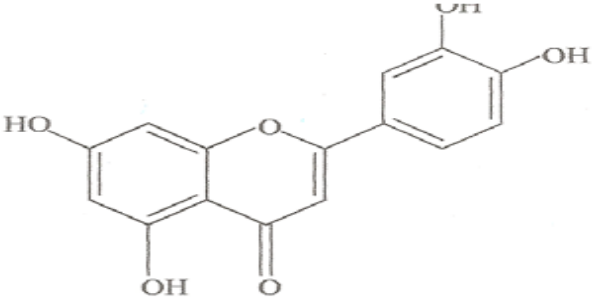


Structure of Luteolin

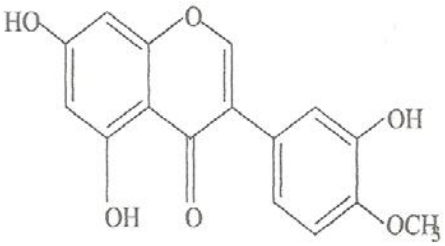
Journal of Chemical and Pharmaceutical Sciences -JCHPS (2024) 17 (2): 42-50
Online ISSN: Online 2349-8552, Print ISSN: 0974-2115
Review Article | Pharmaceutical Sciences | MCI Approved | Peer-Reviewed | Referred | OA Journal |



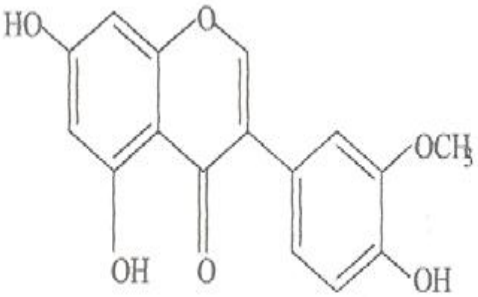
Structure of Luteolin-7-glucoside



Structure of Diosmetin



Structure of 3-hydroxybioachanin A



Structure of 3'-*O*-methyllorobol

Crude Extract:

The crude extract has been found to have wound healing properties. It has been reported to counteract CCl4-induced inhibition of the hepatic microsomal drug metabolizing enzymes. The loss of hepatic lysosomal acid phosphatase and alkaline phosphatase by CCl4 was significantly restored by *Eclipta alba.* The study shows that hepatoprotective activity of Eclipta Alba is by regulating the levels of hepatic microsomal drug metabolizing enzymes[12]. The fresh plant is used as self-medication by AIDS patients in southern Thailand and showed potential as a therapeutic agent against Giardia intestinalis infections[13,14]. The leaf extract showed hypolipedemic activity in atherogenic diet induced hyperlipedemic rats[15]. It has antimicrobial and antioxidant properties[16]. 3% of extracts of Eclipta alba is used in pilex formulation with other ingredients. It has been reported to decrease bleeding time. Leaf extracts have been used in edema. It is used in the treatment of paronychia[17].

Journal of Chemical and Pharmaceutical Sciences -JCHPS (2024) 17 (2): 42-50
Online ISSN: Online 2349-8552, Print ISSN: 0974-2115
Review Article | Pharmaceutical Sciences | MCI Approved | Peer-Reviewed | Referred | OA Journal |

C.N.S. activity

Recent studies indicated that the aqueous extract of *Eclipta alba* and its hydrolyzed fraction at a dose of 300 mg/ kg and 30 mg/kgp.o, respectively showed nootropic activity in rats.[19]

Hepatoprotective Property:

Leaves and roots are used as hepatic tonic rejuvenates hair, cirrhosis, earaches, hepatitis, headache and enlarged spleen. Studies on the hepatoprotective activity on methanolic extract and sub fractions of leaves and the chloroform extract and sub fractions of roots of *Ecliptaalba* was carried out using carbon tetrachloride- induced liver damage and Lysosomal enzymes level in wistar albino rats. The methanolic extract of leaves and the chloroform extract of roots of *Eclipta alba* showed significant activities ($P<0.01$) and ($P<0.05$) respectively causing 72.8% & 47.96% reduction of lysosomal enzyme. The triterpenoid Eclabasaponin fraction from methanolic extract of leaves produced significant ($P<0.001$) (78.78%) and the alkaloidal fraction ($P<0.05$) (60.65%) reduction of carbon tetra chloride induced increase in lysosomal enzyme in blood. The Coumestan fraction (CF) and Triterpenoid saponin fraction (RTF) from the chloroform extract of roots produced very significant ($P<0.01$) (75.6%) and ($P<0.05$) (52.41%) respectively reduction of carbon tetra chloride induced increase in lysosomal enzyme levels in blood.[17]

Analgesic Activity: -

A variety of analgesics are used for the treatment of acute and chronic pain in different disease states. A narcotic or a non-narcotic analgesic that does not cause respiratory depression and addiction is needed. In Ayurveda a large number of indigenous drugs have been mentioned possessing analgesic properties (e.g. Guggul, Erand, Rasna, Bhringaraj, Methika, Palandu and Prasikayavani). The present experimental research work was undertaken to determine the analgesic activity of the total ethanol extract of *Eclipta alba*, and also the isolated alkaloids of *Eclipta alba* in albino mice by using standard experimental models such as the tail clip method, the tail flick method and the acetic acid induced writhing response. The results from this study show that both the ethanol extract as well as the total alkaloids produce good analgesic activity in all the different models of analgesia used. The total alkaloidal fraction was the most efficacious in all models tested. And significant value <0.05.[18]

Anti Inflammatory Activity: -

The anti-inflammatory effect of the plant of Eclipta alba (Family – Asteraceae) was evaluated using carrageenin, mediators such as histamine and serotonin induced paw oedema, and cotton pellet induced granuloma tests for their effect on acute and chronic phase inflammation models in rats. Maximum inhibition (55.85%) was noted at the dose of 500 mg/kg after 3 hr of drug treatment in carrageenin induced paw oedema, whereas the Indomethacin (standard drug) produced 61.30% of inhibition. In the chronic model (cotton pellet induced granuloma) the CEEA and standard drug showed decreased formation of granuloma tissue by 49.7,41.5,22.1% and 53.48 % respectively. The results indicate the potent anti-inflammatory effect and therapeutic efficacy of Eclipta alba extract on animal models, which is compared with indomethacin. Experimental groups were compared with control $p<0.001$.[19]

Immunomodulatory activities:

It has been reported that protection of neuronal tissues may be possibly due to the immunomodulatory action of *Eclipta alba*. Therefore, *Eclipta alba* can serve as a potential memory modulator[21]. Experimentation made to assess the immunomodulatory activity of methanol extracts of whole plant of E. alba (1.6% wedelolactone) at five dose levels (dose-response relationship) ranging from 100 to 500 mg/kg using carbon clearance, antibody titer and cyclophosphamide immunosuppression parameters significantly increased phagocytic index and antibody titer and the F ratios of the phagocytic index and WBC count were also significant[23]. The aqueous leaf extract Eclipta alba was fed into a fish (tilapia, Oreochromis mossambicus) at 0, 0.01, 0.1 or 1% levels as a diet for 3 weeks. After each week, non-specific humoral (lysozyme, antiprotease and complement) and cellular (myeloperoxidase content, production of reactive oxygen and nitrogen species) responses and disease resistance against Aeromonas hydrophila were noted which resulted in increased activity of non-specific immune parameters. Significance value is <0.01. The

results indicate that dietary intake of E. alba aqueous leaf extract enhances the non-specific immune responses and disease resistance of O. mossambicus against A. hydrophila.[20]

Antidiabetic activity and antioxidant activity: -

In the present study the hypoglycemic and antioxidant effects of methanolic extract of Eclipta alba in alloxan induced diabetic model in albino rats was examined. Diabetes mellitus was induced by injecting alloxan monohydrate dissolved in normal saline at the dose rate of 120 mg / kg b.wt. intraperitoneally as a single dose in rats Diabetes was confirmed after a fortnight by estimating serum glucose level and rats with blood glucose level more than 200 mg/dl were selected for study. The animals received methanolic extract of Eclipta alba at the dose rate of 100, 200 and 400 mg/kg body weight per os for next four weeks. Glibenclamide was used as a reference drug at 600 g/kg body weight per os. Serum glucose was estimated at weekly intervals and urea, creatinine, cholesterol and triglycerides were assayed at the end of experiment period. Antioxidant efficacy was evaluated by carrying out lipid peroxidation, enzymatic and non-enzymatic assays in liver homogenate. Treatment with methanolic extract of Eclipta alba brought about a significant reduction in serum glucose ($P<0.01$) at the dose rate of 400 mg/kg body weight. The elevated serum biochemical parameters due to diabetes were significantly reduced by methanolic extract at the dose rate of 400 mg/kg body weight. Further, the increased levels of lipid peroxidation, catalase and superoxide dismutase were reduced significantly ($P<0.05$) whereas decreased content of reduced glutathione was corrected to normal by methanolic extract at 400 mg/kg body weight dose.[21]

Hairgrowth & Alopecia:

Eclipta alba is used in hair oil preparations since it promotes hair growth and maintains hair black. 10%w/v of Eclipta alba was a main ingredient in the preparation of herbal formulation for hair growth[25]. Alopecia is a dermatological disorder with psychosocial implications on patients with hair loss. *Eclipta alba* is a well-known Ayurvedic herb for hair growth. In the reported work Petroleum ether & ethanolic extracts were incorporated into oleaginous cream (water in oil cream base) and applied topically on shaved denuded skin of albino rats. The time (in days) required for hair growth initiation as well as completion of hair growth cycle was recorded. Minoxidil 2% solution was applied topically and served as positive control for comparison. The result of treatment with 2 and 5% petroleum extracts were better than the positive control minoxidil 2% treatment .[22]

Anticancer activity:

Methanolic extract of *Eclipta alba* was evaluated for its anticancer activity against Ehrlich Ascites Carcinoma (EAC) in Swiss albino mice. On day 1, the extract of *Eclipta alba* at a dose of 250 and 500 mg/kg body weight were administered orally and continued for 9 consecutive days. The anticancer activity was examined by determining the tumor volume, tumor cell count, viable tumor cell count, nonviable tumor cell count, mean survival time and increase in life span in experimental animal models. The extract increased the life span of EAC treated mice and restored the hematological parameters as compared with the EAC bearing mice. Thus, study revealed that the methanolic extract of *Eclipta alba* showed anticancer activity in the tested animal models[13]. Coumestans are also known to act as phytoestrogens. These compounds are present in soyabeans and clove Presently in the study Eclipta alba ethanolic plant extract has been used for screening the anti-cancer activity in-vitro and the results obtained, gives the evidence that the ethanolic extract inhibit the growth of colon cancer cells at concentrations that showed no apparent toxicity effect against normal cells. P value <0.05.[23]

Anti-Microbial Activity:

Antimicrobial assay of solvent extracts was performed by Disc diffusion method. Lawn culture of *Escherichia coli*, *Micrococcus roseus* and *Pseudomonas flavescens* were developed on nutrient agar plates using sterile cotton swabs. The sterile disc (5mm) was saturated with various plant extracts. Disc with solvents were used as control and the respective antibiotic disc Gentamycin used as positive control. The sterile impregnated disc with plant extract were placed on the agar surface with flamed forceps and gently pressed down to ensure complete contact of the disc with the agar surface. After the incubation at 37°C for 24h the size of the inhibi-tion zone was measured. Antibacterial

activity was determined by measuring the diameter of the zone of inhibition for each strain, controls were included that comprised pure solvents instead of the extract.[24,25]

TOXICITY STUDIES:

In studies conducted by the alcoholic extract of *E.alba* shows no signs of toxicity in rats and mice and the minimum lethal dose was found to be greater than 2.0g/kg when given orally and intraperitonially in mice.[16]

Acute Oral Toxicity study was performed according to OECD 425 (OECD, 2001)[11]. Animals were administered with single dose of extract and observed for mortality for 48 hours study period (short term) toxicity. Based on short-term profile of drug, the lethal and safe doses of the extract for animals was determined as per as OECD guideline [11]. The $LD_{50}$of the test extract was calculated using AOT 425 software provided by Environmental protection agency, USA.[26]

Sno	Part	Activity	Model	Extract	Animal Species	Dose	P Value	References
1.	Roots & Leaves	Hepatoprotective	Tetracholoride induced liver damage	Methanolic,	W.A Rats		<0.01 <0.05	V.K.Lal, AmitKumar et al. (2010)[17]
2.	Leaves	Analgesic	Tail Clip, Tail Flick, AAIW	Methanolic,	Albino Mice		<0.05	SawantM,Isaac JC et al. (2004)[18.]
3.	leaves	Anti inflammatory	Carragenan induces paw edema		W.A Rats	500 mg/kg	<0.001	S. Sureshkumar et al. (2005)[19]
4.	Plant	Immunomodulatory		Methanolic,	W.A Rats	50-500 mg/kg	<0.001	M.G. Jayathirtha et al.(2004)[20]
5.	Leaves	Anti Diabetic	Allxon induced D	Methanolic,	W.A Rats	100, 200, 400 mg/kg	<0.05	V. Hemalakshmi et al. (2012)[21]
6.	Leaves	Hair Growth		Petrolium ether and Ethanolic	W.A Rats			R. K. Roy et al.(2008)[22]
7.	Plant	Anti-Cancer	EAC	Methanolic	SA Mice	250-500 mg/kg	<0.05	R.B Desireddy et al. (2012)[23]
8.	Plant	Anti-Microbial	Disc diffusion method					Prabhsimran Singh et al.(2010)[24]

REFERENCES:

1. Introduction of Herbal Medicine and its ImportantBy: Pharma Tips | Views: 5234 | Date:24-Apr-2011. Journal of microbiology and biotechnology research 2011 1 (3):75-79 CODEN (USA- JMBRB4)
2. Indian Herbal Pharmacopoeia, Vol-I, A Joint publication of regionallab, Jammu-Tavi, 1998, 85.
3. Khare, C. P., Encyclopedia of Indian Medicinal plants, Springer-VerlagBerlin Heidelberg, New York, 2004, 197.
4. Sharma PC, Yelne MB Denn's TJ. Database on Medicinal plants used in Ayurveda, Vol-2 (Central council for research in Ayurveda and Siddna, New Delhi): 2001;115.

5. Khare, C. P., Encyclopedia of Indian Medicinal plants, Springer-VerlagMehra, P. N & Handa, S. S., Pharmacognosy of Bhringrajaantihepatotoxic drug of IndianOrigin, Indian J. Pharm., Vol-30,1968, 284.
6. Willaman, J. J. & Li, H. L., Alkaloid bearing plants and their containedalkaloids, Lloydia, J. Nat. Prod. Suppl., Vol-3, 1970, 33.
7. Bohlmann, F. & Zdero, C., Polyacetylene Compounds. Parts 173, Constituents of *Eclip erecta*, Chem. Ber., Vol-103, 834-841.
8. Upadhyay, R.K., Pandey, M. B., Jha, R. N.& Pandey, V. B., Eclalbatin, a triterpene saponin from *Eclipta alba*, J. Asian. Nat. Prod. Res., Vol-3, 2001, 213-217.
9. Singh, P., Naturally occurring thiophene derivatives from *Ecliptaalba* species, Bioact, Mol., Vol-7, 1988, 179-186.
10. Jain, S. & Singh, P., A dithienylacetylene ester from *Eclipta erecta*Linn., Indian J. Chem., Vol-27 B, 1988, 99-100.
11. Wagner, H. & Fessler, B., In vitro 5- Lipoxygenase inhibition by*Eclipta alba* extracts and the coumestan derivative wedelolactone,Planta Med., Vol-52, 1986, 374-377.
12. Daniel, M., Medicinal plants chemistry and properties, Oxford andIBH Publishing Co.Pvt. Ltd., New Delhi, 2006, 149.
13. Leal, L. K., Ferreira, A. A., Bezerra, G. A., Matos F. J.& Viana, G. S.,Antinociceptive, anti-inflammatory and Bronchodilator activities of Brazillian medicinal plants containing coumarin, a comparative study, J. Ethnopharmacol., Vol-2, 2000, 51-59.
14. Chopra, R. N., Chopra, I. C., Handa, K. L & Kapur, L. D., IndigenousDrugs of India, 2nd edition, Academic publishers, Calcutta, 1958, 78.
15. Singh, B. Saxena, K., Chandan, B., Agarwal, S., Bhatia, M.Anand, K.K.,Hepatoprotective effect of ethanolic extract of *Eclipta alba*on experimental liver damage, Phytother. Res., Vol-7, 1993, 154-158.
16. Joshi, S. G., Medicinal plants, Oxford and IBH Publishing Co. Pvt.Ltd., New Delhi, 2004, 81. Shyam. S. Agrawal et.al (2004)
17. V. K. Lal1, Amit Kumar1, Prashant Kumar2, Kuldeep Singh Yadav3Screening of Leaves and Roots of *Eclipta alba* for Hepatoprotective ActivityArchives of Applied Science Research, 2010, 2 (1) 86-94
18. Sawant M, Isaac JC, Narayanan S. Analgesic studies on total alkaloids and alcohol extracts of Eclipta alba (Linn.) Hassk. Phytother Res. 2004 Feb;18(2):111-3.
19. S.Sureshkumar, T.Sivakumar, M.J.N. Chandrasekar1 And B.Suresh1evaluation of Anti –Inflammatory Activity of Eclipta alba in Rats Ancient Science of Life ,January, February, March - 2005 Pages 112 – 118.
20. M.G. Jayathirtha[a], S.H. Mishra[a], Preliminary immunomodulatory activities of methanol extracts of*Eclipta alba* and *Centella asiatica* Volume 11, Issue 4, 2004, Pages 361–365.
21. V. Hemalakshmi, P. Thejomoorthy, P.Sriram and L.N. Mathuram, Hypoglycemic And Antioxidant Activities Of Methanolic Extract Of Eclipta Alba In Experimentally Induced Diabetes Mellitus In Rats Tamilnadu J. Veterinary & Animal Sciences 8 (4) 215-226, July - August, 2012.
22. R. K. Roy, Mayank Thakur, V. K. DixitHair growth promoting activity of *Eclipta alba* in male albino rats Springerlink August 2008, Volume 300, Issue 7, pp 357-364.
23. R.B Desireddy*, Naga Sowjanya.G, Lavanya Latha Reddy K, Sowjanya. T. SCREENING OF ECLIPTA ALBA EXTRACTS FOR ANTICANCER ACTIVITY International Journal of Research and Development in Pharmacy and Life Sciences Available online at http//www.ijrdpl.com October - November 2012, Vol. 1, No.4, pp 203-205.
24. Prabhsimran Singh Sandhu1, Kawalpreet Kaur1, Varish Ahmad2, Lokesh Kumar2, Pradeep Kumar2, M. Salam 3, M. A. Khan Screening of Antimicrobial activity of Aqueous extracts of Leaves, Flower and Stem of Eclipta alba International Journal of Drug Development & Research October-December 2012 | Vol. 4 | Issue 4 | ISSN 0975-9344.
25. International Journal of Microbiology Research ISSN: 0975-5276 & E-ISSN:097 9174, Volume 4, Issue 5, 2012, pp.-227-230. Available online at http://www.bioinfo.in/contents.php?id=27 OECD. 2001.
26. The OECD Guidelines for Testing of Chemicals, 425. Acute oral toxicity test. Paris: Organization of Economic Co-operation Development.