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A REVIEW ON PHYTOPHARMACOLOGICAL SIGNIFICANCE OF *ECLIPTA ALBA*

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ABSTRACT

Nature has been a source of medicinal agents for more than thousands of years and herbal therapy predominates in traditional systems of medicine. *Eclipta alba* Hassk is an important small branched annual herbaceous plant in Ayurveda described first by Bhavprakasha and is widely used for treating various ailments in the Indian system of medicine. Aim: Aim of this review is to provide comprehensive information on the pharmacological activities of various part of *Eclipta alba* Hassk. Setting and design: This is a contribution which provides a comprehensive review on ethnomedicinal uses, chemical composition, and the pharmacological profile of *Eclipta alba* Hassk. as an important medicinal plant.

Keywords: *Eclipta alba*, Traditional uses, phytochemistry, pharmacology.

INTRODUCTION

Conventional medicines play an important role in health services around the world. About three quarters of the world's population is dependent on different parts of medicinal plants and its extracts for wellbeing In India. Medicinal plants have been used in folk medicine since date back in different part of the world against a variety of diseases (Satish A et al., 2016).

Eclipta alba (Asteraceae) is an annual herbaceous plant, commonly known as false daisy. It is an erect or prostrate, much branched, roughly hairy, annual, rooting at the nodes; the leaves are opposite, sessile and lanceolate. It is also known as Bhringaraj and Karisilakanni, which is found a common weed throughout India ascending up to 6000 ft. The genus name comes from the Greek word meaning "Deficient," with reference to the absence of the bristles and awns on the fruits. The specific *Eclipta alba* means white which refers to the color of the flowers. Main active principles consist of coumestans like wedelolactone, desmethylwedelolactone, furanocoumarins, oleanane & taraxastane glycosides (Mithun NM *et al*., 2011).

Classification (Sanjivani S *et al*., 2017; Goutam M *et al*., 2018**)**

Botanical name	:	*Eclipta alba*
Common name	:	Bhringaraj
Kingdom	:	Plantae
Division	:	Tracheophyta
Class	:	Magnoliopsida
Order	:	Asterales
Family	:	Asteraceae
Genus	:	*Eclipta*
Species	:	*Alba*

Fig. 1: Plant of *Eclipta alba*

Traditional uses

In ayurvedic medicine, the leaf extract is considered a powerful liver tonic, rejuvenative and especially good for the hair. A black dye

obtained from *Eclipta alba* is used for dyeing hair and tattooing. *Eclipta alba* also has traditional external uses, like athlete foot, eczema and dermatitis, on the scalp to address hair loss and the leaves have been used in the treatment of scorpion stings. In India, it is grown alongside of rice fields and its leaves are used in preparing food (Shafi P *et al*., 2016).

Chemical Constituents of Parts of *Eclipta alba*

S.NO	Parts	CHEMICAL CONSTITUENTS
1.	Leaves	Stigmasterol, a-terthienymethanol, Wedelolactone [1.6%], Desmethylwedelolactone, Desmethyl-wedelolactone-7-glucoside (Upadhyay RK *et al*, 2001).
2.	Roots	Hentriacontanol, Heptacosanol& Stigmastero, Ecliptal
3.	Aerial parts	ß-amyrin & Luteolin-7-0-glucoside, Apigenin, Cinnaroside, Sulphur compounds (Sikroria BC *et al*., 1982).
4.	Stems	Wedelolactone
5.	Seeds	Sterols
6.	Whole plant	Large amounts of resin, Ecliptine, Reducing sugar6, Nicotine, Stigmastero, Triterpene saponin, Eclalbatin together with a-amyrin, Ursolic acid, Oleanolic acid (Singh P *et al*., 1988)

Biological Activites of Parts of *Eclipta alba*

1.	Seeds	Sexual debility, Tonic, Aphrodisiac (Khare CP *et al*, 2004).
2.	Juice of Leaves	Skin diseases, allergic Urticaria, Asthma, Inflatulence, Colic and liver affections, Bronchitis, Enlarged glands, Dizziness, Vertigo, Blurred vision
3.	Paste of leaves	Applied over swelling
4.	Powder	Bronchitis, Cough, Rheumatism and Skin diseases
5.	Decoction	Invigorate the liver, Graying of hair, To staunch Bleedings, Spermatorrhoea, Menorrhagia (Chopra RN *et al*., 1958).
6.	Paste of herb	Healing effect, Headache, Toothache
7.	Root	Liver tonic, Emetic, Purgative, Antiseptic to ulcers, Wounds in cattle
8.	Whole plant	Rejuvenating, Age-sustaining tonic, Detoxifying, Deobstruent, Antiseptic herb in vitiated blood, Anaemia, Splenic and liver enlargements, Catarrhal jaundice, Hyperacidity, Gastritis, Dysentery, Anticatarrhal, Spasmogenic, Hypotensive properties (Joshi SG *et al*.,) 2004.

Hepatoprotective Activity

200 mg/kg body weight of isolated fraction of *Eclipta alba* was found to be hepatoprotective against CCl4 induced hepato damage in rats. The experimental protocol was performed as per CPCSEA guide lines. The results in the present study indicate that 200 mg/kg body weight doge of the plant extract was able to reduce major elevated biochemical parameters due to the changes associated with CCl4 induced liver damage in the experimental rats (Joshi SG et al., 2008).

Alcoholic extract of E. alba was found to have good antihepatotoxic activity as assessed in CCl_4-induced liver damage in albino rats through liver to body weight ratio, pentobarbitone sleep time, serum levels of glutamate pyruvate transaminase (GPT) and glutamic oxaloacetic transaminase (GOT), alkaline phosphatase (ALP), and bilirubin. In CCl_4-administered rats, there was an increase in liver weight, pentobarbitone sleep time, and elevated GOT, GPT, SALP, and serum bilirubin levels. The alcoholic extract at a dose of 200 mg/kg significantly reversed these effects (Murthy VN *et al*., 1992).

Hepatitis C virus (HCV) inhibitory activity has been reported for *E.alba* extract. Phytochemical analysis of the extract revealed the presence of three compounds, namely, wedelolactone, luteolin, and apigenin. These compounds exhibited dose-dependent inhibition of HCV replicase in vitro, and anti-HCV replication activity in the cell culture system. The results suggest that the plant or individual components have the potential to be used against HCV (Manvar D *et al*., 2012).

Ethanol extract of whole plant was tested for hepatoprotective effect against paracetamol-induced hepatotoxicity in mice. Treatment with 100 and 250 mg of the extract per 100 kg body weight showed significant reductions in paracetamol-induced serum alanine aminotransferase (ALT, also known as GOT) levels. At the same time, histopathological studies showed marked reductions in paracetamol-induced fatty degeneration and centrizonal necrosis in liver of extract-treated mice (Tabassum N *et al*, 2004).

An alcoholic extract of freshly collected *Eclipta alba* exhibited dose-dependent (62.5–500 mg/kg p.o.) significant hepatoprotective activity against carbon tetrachloride-induced liver injury in rats and mice as determined through various tests like hexobarbitone-induced sleep, zoxazolamine-induced

paralysis, bromsulfalein (BSP) clearance, serum levels of transaminases, bilirubin, and protein (Singh B *et al*., 1993).

In CCl_4-induced hepatotoxicity in rats, methanol extract of leaves and chloroform extract of roots of *E. alba* showed significant reductions of lysosomal enzymes in serum from the elevated levels induced by carbon tetrachloride. At the same time CCl_4-induced elevated serum GOT, GPT, ALP, and bilirubin levels were also restored towards normalization with administration of both extracts (Lal VK *et al*., 2010).

Aqueous extract of leaves of the plant has been found to offer hepatoprotectivity against paracetamol-induced liver damage. Paracetamol-induced increases in TBARS were reduced by the aqueous extract, and paracetamol-induced decreases in GSH were also reversed by the extract. Catalase was also decreased in paracetamol-treated groups, which was also reversed by coadministration of the extract (Parmar SR *et al*., 2010).

The alcoholic and aqueous extract of *E. alba* leaves was tested for hepatoprotective activity against paracetamol-induced liver damage in albino rats. The alcoholic extract demonstrated significant hepatoprotective effects. The alcoholic extract-treated rats of group III revealed marked hepatoprotection as there was significant reduction in SGOT, SGPT, ALP, total bilirubin, and direct bilirubin and a significant increase in total protein and albumin as compared to paracetamol treated group (Narayanasamy K *et al*., 2005).

A polyherbal formulation (Ayush-Liv.04) containing *E. alba* (along with Clitoria ternatea, Asparagus racemosus, Alpinia galanga, and milk tuttam, i.e., copper containing stone) showed hepatoprotective activity against CCl_4 and ethanol induced liver damage in rats. Elevated levels of serum AST, ALT, ALP, acid phosphatase, and bilirubin were significantly lowered in the polyherbal formulation-administered rats (Narayanasamy K *et al*., 2005).

The ethanolic extract of a polyherbal formulation containing leaves of Melia azadirachta, seeds of Piper longum, and whole plants of *E. alba* has been evaluated for hepatoprotective effects against CCl_4-induced hepatic damage in male albino rats. The substantially reduced levels of SOD, CAT, GPx, GST, and glutathione reductase (GR) due to CCl_4 were restored to normal with the extract (Kavitha M *et al*., 2011).

Anti diabetic activity

Oral administration of leaf suspension of *E. alba* (2 and 4 g/kg body weight) for 60 days results in significant reduction in blood glucose, glycosylated hemoglobin HbA(l)c. The extract decreases the activities of glucose-6- phosphatase and fructose-1,6-bisphosphatase, and increase the activity of liver hexokinase. Thus, oral administration of *Eclipta alba* possess potent antihyperglycemic activity (Ayodhya S *et al*., 2014).

Memory Enhancing Activity

The plant has been reported to contain phytosterol, β-amyrin, triterpenes such as ecalbatin, echinocystic acid, ursolic acid, flavones such as Luteolin and coumarin such as wedelolactone. Studies was conducted by. The studies concluded that the ethanolic leaf extact of *Eclipta alba* has memory enhancing activity. Luteolins may be responsible for minimizing cognitive deficits due to cholinergic dysfunctioning. Memory enhancing activity is evaluated by elevated plus maze. Significant reduction in transfer latency indicates that the plant extract have memory enhancing activity (Mathew G *et al*., 2017).

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/kg p.o., respectively showed nootropic activity in rats (Thakur VD *et al*., 2005).

Anti-inflammatory, Analgesic and Antipyretic activity

Eclipta alba (L.) Hassk. (Sanskrit: Bhringaraj) found to contain phytochemicals wadelolactone, eclalbatin, ursolic acid, apigenin, ecliptalbine, verazine and α – amyrin having anti-inflammatory and analgesic properties. Single dose of 500 mg/kg Eclipta alba produce statistically significant anti-inflammatory and almost similar central analgesic activity with disease control and morphine sulphate (5mg/kg s.c.) respectively. The extract did not shown peripheral analgesic and antipyretic activity. Conclusion – Ethanolic extract of leaves of *Eclipta alba* has anti-inflammatory and central antinociceptive activity (Narendrakumar P *et al*., 2017).

Analgesic activity of alcoholic extract of *E. alba* has been determined through tail flick, hot plate, and writhing methods in rats and mice. In all three methods, the extract at a dose of 200 mg/kg demonstrated significant analgesic and antinociceptive effects (Pandey PS *et al*., 1997).

Hydroalcoholic extract of the plant showed significant antinociceptive activity in acetic acid-induced writhing tests in rodent model at a dose of 200 mg/kg p.o. The extract further showed analgesic effects in formalin tests, with

the inhibition occurring in the second phase of the response (Leal L *et al*., 2000).
The anti-inflammatory effect of the plant was evaluated using carrageenan, 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. The results indicated potent anti-inflammatory activity of the plant in all the models tested (Kumar SS *et al*., 2005).

Antibacterial Activity
The aqueous extracts of *Eclipta alba* showed good activity against *S.pyogenes, B.cereus, E.coli* and *P.aeruginosa.* If the dilution was above 1000µg/ml the extract were considered inactive against S.aureus, K.pneumoniae, P.mirabilis and S.typhi. MBC results were similar to MIC results but in the case of MBC the confirmation was made by absence of growth in culture plates after 24 hrs of incubation at 37ºC. A potent antibacterial and hepatoprotective drug could probably be formulated from the plant extract of *Eclipta alba* to combat the effects of bacterial and hepatotoxic infections (Manoj KP *et al*., 2011).

Antioxidant Activity
The present study investigated the antioxidant potential of the ethyl acetate fraction of the aerial parts *Eclipta alba* L. Hassk (EA) which was widely used as hepatoprotective plant. EA was orally administered at doses of 50, 100 and 200 mg/kg (n=6) for 7 days in male Charles Foster rats. The extent of hepatoprotective potential of *E. alba* was studied by assessing the biochemical parameters like lipid peroxides (LPO), superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), glutathione reductase (GR), ascorbic acid and α-tocopherol in the liver of rats. Oral administration of the EA significantly decreased LPO and elevated the activity of antioxidant enzymes SOD, CAT, GPx and GR as well as endogenous levels of ascorbic acid and α-tocopherol in the liver of male Charles Foster rats. This study has revealed the significant antioxidant potential of *Eclipta alba* in rat liver (Sandeep majumdar A *et al*., 2010).

Miscellaneous activity
An alcoholic extract of the plant showed antinociceptive effect in a dose of 200 mg/kg in rats (Pandey PS *et al*., 1997). The plant has been reported to possess antinociceptive, anti-inflammatorry and bronchodialator activites, due to the coumarin compounds18. Further studies reported confirmed analgesic activity of *Eclipta alba* (Sawant M *et al*., 2004). Preliminary studies revealed the immunomodulatory activity of methanolic extract of *Eclipta alba* (Jayatirtha, MG *et al*., 2004). Wedelolactone and Demethylwedelolactone isolated from Eclipta alba exhibited trypsin inhibition in vitro. Both compounds showed potent activity with IC50 values of 2.9 and 3.0 µg/ml, respectively (Syed S *et al*., 2003).

Toxicity Studies
In studies conducted the alcoholic extract of *Eclipta 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 (Singh B *et al*., 1993).

Diuretic activity
Aqueous and alcoholic extracts of the leaf of *Ecilepta prostrata* leaves were tested for diuretic activity in rats. The parameters studied on individual rat were body weight before and after test period, total urine volume urine concentration of Na+, K+ and Cl-. *Ecilepta prostrata* leaves (100mg/kg of body weight) showed increase in urine volume, cation and anion excretion. Furosemide was used as reference diuretic, the plant extracts did not appear to have renal toxicity or any other adverse effects (Vipan K *et al*., 2015).

Anticovulsant Activity
E. alba ethanolic leaf extracts at doses of 50, 100, 200, and 400 mg/kg, p.o., were studied for anticonvulsant and muscle relaxant activity on maximal electroshock-induced seizures (mes), rotarod, and traction test, respectively, in rats. at doses of 200 and 400 mg/kg, the extract reduced seizures induced by mes, decreased the duration of tonic hind limb extension (thle) (by 76.2 and 89.8%, resp.), and decreased motor coordination showing anticonvulsant and muscle relaxant activity (Mishra S *et al*., 2014).

Hair Growth Promoting Activity
Petroleum ether and ethanol extract of *E. alba* has been tested in albino rats for promoting hair growth activity. The extracts were incorporated into oleaginous cream (water in oil cream base) and applied topically on shaved denuded skin of male albino rats. The extracts significantly reduced hair growth time by half, as compared to nontreated control animals. Quantitative analysis of hair growth after treatment with petroleum ether extract (5%) exhibited greater number of hair follicles in anagenic phase (69 ± 4) which were higher as compared to control (47 ± 13) (Roy RK *et al*., 2008).

A polyherbal formulation containing *E. alba,* Hibiscus rosa-sinensis, and Nardostachys jatamansi exhibited excellent hair growth activity in Wistar albino rats. Hair growth initiation time and time required for complete hair growth were significantly reduced. Treatment with the formulation resulted in greater number of hair follicles in the anagenic phase(Thorat RM *et al*., 2009).

Neuropharmacological Activities

The aqueous and hydroalcoholic extracts of *E. alba* have been evaluated for sedative, muscle relaxant, anxiolytic, nootropic, and antistress activities at doses of 150 and 300 mg/kg, p.o. The findings indicated nootropic activity of the aqueous extract (300 mg/kg, p.o.) and its hydrolyzed fraction (30 mg/kg, p.o.). The aqueous extract and the hydrolyzed fraction were observed to provide protection against cold restraint induced gastric ulcer formation and also normalized the white blood cell count in the milk induced leukocytosis challenge model (Thakur VD *et al*., 2005).

Aqueous extract of *E. alba* has been tested for its ability to reduce aggression through foot shock-induced aggression and water competition tests. Minimization of aggression in both tests was observed with the extract at doses of 100 and 200 mg/kg (Lobo OJF *et al*., 2008).

Anthelmintic Activity

The methanol extract of whole plant of *E. alba* was evaluated for its anthelmintic potential against the earthworm Pheretima posthuma at doses of 25–100 mg/mL. The extract exhibited paralysis of worms at doses of 50, 75, and 100 mg/mL and caused death of worms at 75 and 100 mg/Ml (Ghule SC *et al*., 2011).

Antiulcer Activity

The ethanolic extract of *E. alba* has been examined for its antiulcer effects in several ulcer models in rats, like cold resistant stress (CRS) and pylorus ligation (PL). The extract administered orally twice daily at doses of 50, 100, and 200 mg/kg was found to dose-dependently and significantly reduce ulcerative lesions. At the same time, extract administration led to significant attenuation of lipid peroxidation and elevated levels of catalase activity. Antisecretory activity of the extract was evidenced by significant reduction in gastric volume, acid output, and increase in gastric pH when compared to control (without extract) rats (Kumar SP *et al*., 2012).

The methanolic extract of *E. alba* also showed antiulcer activity in ulcers induced in thirty- six-hour fasted Sprague Dawley rats by aspirin or ethanol or pylorus ligation plus aspirin treatment. In all the three separate experiments the group receiving oral administration of *E. alba* prior to ulcer induction showed highly significant reduction in the occurrence of gastric ulcers as well as gastric inflammation (after 4 h of treatment) as compared to the control groups. The extract activity was comparable to the activity of the proton pump inhibiting drug rabeprazole (Banerjee A *et al*., 2005).

Anticancer activity

The anticancer potential of hydroalcoholic extract of *E. alba* has been evaluated. The extract inhibited the cell proliferation in dose-dependent manner in HepG2, A498, and C6 glioma cell lines with an IC_{50} of 22 ± 2.9, 25 ± 3.6 and 50 ± 8.7 µg/mL, respectively.

The expression of matrix metalloproteinases (MMP) 2 and 9 was down regulated significantly. Additionally, downregulation of nuclear factor κB (NFκB) was also observed. DNA damage was observed following 72 h of extract treatment, leading to apoptosis (Chaudhary H *et al*., 2011).

Juice obtained from *E. alba* was shown to inhibit the migration of HCC-S102 (hepatocellular carcinoma) cells. In various human cancer cell lines of different tissue origins (liver, lung, and breast), the juice inhibited migration of all the cell lines with IC_{50} values ranging from 31–70 µg/mL. Thus the plant has potential for preventing cancer metastasis (Lirdprapamongkol K *et al*., 2008).

The ethyl acetate, methanol, and aqueous extracts of whole dried plants of *E. alba* were assessed for their inhibitory effects on the human lung epithelial adenocarcinoma cell line (HCC-827) using the MTT assay. Dose-dependent reductions in viable cell count were noticed with all three extracts with the ethyl acetate extract showing the most potency. All extracts induced apoptosis in the cancer cells (Chauhan N *et al*., 2012).

Antimicrobial Activity

Various solvent (petroleum ether, benzene, chloroform, acetone, methanol, and aqueous) extracts of *E. alba* were found to be active against clinical isolates from oral cancer cases. These isolates included various bacteria like *Staphylococcus aureus, Escherichia coli, Staphylococcus epidermis, Pseudomonas aeruginosa, Klebsiella pneumoniae, Proteus mirabilis*, and *Proteus vulgaris* and funguses like *Candida albicans* and *Aspergillus fumigates* (Panghal M *et al*., 2011).

Ethanol and ethyl acetate extracts of leaves of the plant have been found to be active against *E. coli, K. pneumoniae, Shigella dysenteriae, Salmonella typhi, P. aeruginosa, Bacillus subtilis, and S. aureus* with Minimum Inhibitory Concentrations (MIC) ranging from 4.5 to 90 µL/Ml (Karthikumar S *et al*., 2007).

Snake Bite

Extract of *E. alba* has been shown to inhibit snake venom phospholipase A2 activity of Crotalus durissus terrificus venom. The inhibitory activity has been attributed to the coumestans, wedelolactone, and demethylwedelolactone, present in the extract (Diogo LC *et al*., 2009).

CONCLUSION

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.

This review presents some phytochemicals and detailed pharmacological information of *Eclipta alba* suggesting that the traditional uses of the plant are scientifically valid. Researchers are exploring the therapeutic potential of this plant as it has more therapeutic properties which are not known. This review article suggests that E.alba has been effective in treatment for afore mentioned life threatening diseases. In future the standardization and stabilization studies on *Eclipta alba* extract can be carried out which can help in proving it to be a promising source in neutraceutical as well as pharmaceutical industry.

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