

***Eclipta alba* (L.) A Review on its Phytochemical and Pharmacological Profile**

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Summary

Eclipta alba (L.) is small branched annual herbaceous plant with a long history of traditional medicines uses in many countries especially in tropical and subtropical regions. The herb has been known for its curative properties and has been utilized as antimytotoxic, analgesic, antibacterial, antihepatotoxic, antihemorrhagic, antihyperglycemic, antioxidant, immunomodulatory properties and it is considered as a good rejuvenator too. Recent studies showed an antivenom property & corrosion pickling inhibitor action on mild steel in hydrochloric acid. A wide range of chemical compounds including coumestans, alkaloids, thiopenes, flavonoids, polyacetylenes, triterpenes and their glycosides have been isolated from this species. Extracts and metabolites from this plant have been known to possess pharmacological properties. This contribution provides an comprehensive review on ethnomedicinal uses, chemical composition, and the pharmacological profile as medicinal plant.

Introduction

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, desmethylwedelolactone⁴³, furanocoumarins, oleanane & taraxastane glycosides⁴⁵.

ETHNOPHARMACOLOGY:

Eclipta alba (L.) has been used in various parts of tropical and sub-tropical regions like south America, Asia, Africa. There are three kinds or *Eclipta alba*-the white-flowering, the yellow-flowering, and the black-fruited, but all three grow throughout India by marshes, rivers, and lakes or on the foothills of the Himalayas. It is an active ingredient of many herbal formulations prescribed for liver ailments and shows effect on liver cell generation. It is used as a tonic and diuretic in hepatic and spleen enlargement. It is also used in catarrhal jaundice and for skin diseases¹. The alcoholic extract of the plant has shown antiviral activity against Ranikhet disease virus⁴¹. The plant is commonly used in hair oil all over India for healthy black and long hair³⁴. The fresh juice of leaves is used for increasing appetite, improving digestion⁴⁰ and as a mild bowel regulator. It is commonly used in viral hepatitis to promote bile flow and protect the parenchyma and popularly used to enhance memory and learning²⁸.

The plant has a reputation as an antiageing agent in Ayurveda⁴². It is used as a general tonic for debility. Externally it is used for inflammation^{10, 11}, minor cuts and burns and the fresh leaf-juice is considered very effective in stopping bleeding²⁵. Leaf juice mixed with honey is also used for children with upper respiratory infections and also used in eye and ear infections. It is a source of coumestans-type compounds used in phytopharmaceutical formulations of medicines prescribed for treatment of cirrhosis of the liver and infectious hepatitis⁴³. It is widely used in India as a cholagogue and deobstruent in hepatic enlargement, for jaundice and other ailments of the liver and gall bladder¹. The water extract of *Eclipta prostrata* (whole plant) exhibited the most potent inhibitory activity against HIV-1 integrase (HIV-1 IN)⁴⁷. Vedic Guard, a polyherbal formulation is a synergistic combination of 16 medicinal plant extracts contains *Eclipta alba* as a major ingredient⁴⁶. Charaka advises taking the juice of *Eclipta alba* with honey to prevent the onset of senility, and its oil as the best medicated massage oils for rejuvenation therapies.

PHYTOCHEMISTRY:

Eclipta alba (L.) contains wide range of active principles which includes coumestans, alkaloids, flavonoids, glycosides, polyacetylenes, triterpenoids. The leaves contain stigmaterol, β -terthienylmethanol, wedelolactone, demethylwedelolactone and demethylwedelolactone-7-glucoside⁴³. The roots give hentriacontanol and heptacosanol⁴⁴. The roots contain polyacetylene substituted thiophenes. The aerial part is reported to contain a phytosterol, β -amyrin in the n-hexane extract and luteolin-7-glucoside, β -glucoside of phytosterol, a glucoside of a triterpenic acid and wedelolactone in polar solvent extract⁴⁴. The polypeptides isolated from the plant yield cystine, glutamic acid, phenyl alanine, tyrosine and methionine on hydrolysis. Nicotine and nicotinic acid are reported to occur in this plant⁴⁴.

Coumestan:

Coumestan is an organic compound that is a derivative of coumarin. Coumestan forms the central core of a variety of natural compounds known collectively as coumestans. Coumestans, including a coumestrol and phytoestrogen are found in a variety of plants. Because of the estrogenic activity of some coumestans, a variety of syntheses have been developed that allow the preparation of coumestans so that their pharmacological effects can be explored. The major coumestan isolated from *Eclipta alba* includes wedelolactone 0.5-0.55% and desmethylwedelolactone¹⁴.

Terpenoids and their glycosides:

Taraxastane triterpene glycosides, named eclalbasaponins VII-X were isolated, along with four oleanane glycosides eclalbasaponins I-VI. The structures of eclalbasaponins VII-X were characterized as $3\beta,20\beta,16\beta$ and $3\beta,20\beta,28\beta$ trihydroxytaraxastane glycosides, and their sulphated saponins¹⁵. Two oleanane-type glycosides eclalbasaponin

I and eclalbasaponin II along with the ubiquitous steroid, stigmasterol were isolated from an n-hexane extract of the stem bark of *Eclipta prostrata*¹⁶. From the whole part of *Eclipta alba* Hassk., six new triterpene glycosides, named eclalbosaponins I-VI, were isolated these structures were characterized as echinocystic acid glycosides and those of V –VI were revealed to be sulphated saponins¹⁷.

Alkaloids:

Contemporary clinical tests showed that the herb contains the alkaloid ecliptine.

Bioassay-guided fractionation of the MeOH extract of *Eclipta alba* using three yeast strains (1138, 1140, and 1353) resulted in the isolation of eight bioactive steroidal alkaloids (1–8), six of which are reported for the first time from nature. The major alkaloid was identified as (20*S*)(25*S*)-22,26-imino-cholesta-5,22(*N*)-dien-3 β -ol (verazine, 3), while the new alkaloids were identified as 20-*epi*-3-dehydroxy-3-oxo-5,6-dihydro-4,5-dehydroverazine (1), ecliptalbine [(20*R*)-20-pyridyl-cholesta-5-ene-3 β ,23-diol] (4), (20*R*)-4 β -hydroxyverazine (5), 4 β -hydroxyverazine (6), (20*R*)-25 β -hydroxyverazine (7), and 25 β -hydroxyverazine (8). Ecliptalbine (4), in which the 22,26-imino ring of verazine was replaced by a 3-hydroxypyridine moiety, had comparable bioactivity to verazine¹⁸.

Volatile oils:

The volatile components were isolated from the aerial parts of this plant by hydrodistillation and analysed by GC–MS. A total of 55 compounds, which were the major part (91.7%) of the volatiles, were identified by matching mass spectra with a mass spectrum library (NIST 05.L). The main components were as follows: heptadecane (14.78%), 6,10,14-trimethyl-2-pentadecanone (12.80%), *n*-hexadecanoic acid (8.98%), pentadecane (8.68%), eudesma-4(14),11-diene (5.86%), phytol (3.77%), octadec-9-enoic acid (3.35%), 1,2-benzenedicarboxylic acid diisooctyl ester (2.74%), (*Z,Z*)-9,12-octadecadienoic acid (2.36%), (*Z*)-7,11-dimethyl-3-methylene-1,6,10-dodecatriene (2.08%) and (*Z,Z,Z*)-1,5,9,9-tetramethyl-1,4,7-cycloundecatriene (2.07%)¹⁹.

Saponins:

From the whole plant of *Eclipta alba*, a new triterpene saponin, named eclalbatin, together with alpha-amyrin, ursolic acid and oleanolic acid were isolated. The structure of eclalbatin has been established as 3-O-beta-D-glucopyranosyl-3-beta-hydroxy-olean-12-en-28-oic acid, 28-O-beta-D-arabinopyranoside (1) on the basis of chemical and spectral data²⁰. Dasyscyphin C was isolated from *Eclipta prostrate* which were studied on the HeLa cells for the anticancer activity¹².

BIOACTIVITY:

Eclipta alba is a plant used in folk & traditional medicine for cirrhosis and infectious diseases¹. It is believed to prevent aging and rejuvenate hair, teeth, bone, memory, sight, hearing. The plant was known to possess significant antifungal and insecticidal properties. The biological properties of the plant are treated under two subheadings: (i) pharmacological properties (ii) insecticidal properties and other biological properties.

PHARMACOLOGICAL PROPERTIES:**Crude extract:**

The crude extract has been found to have wound healing properties. It 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 enzymes²¹. 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^{22,23}. The leaf extract showed hypolipidemic activity in atherogenic diet induced hyperlipidemic rats⁷. It has antimicrobial and antioxidant properties²⁴. 3% extract of *Eclipta alba* is used in pille formulation with other ingredients. It has been reported to decrease bleeding time²⁵. Leaf extract has been used in edema. It is used in the treatment of paronychia²⁶.

Antihepatotoxic properties:

The hepatoprotective effect of the ethanol/water (1:1) extract of *Eclipta alba* has been studied at subcellular levels in rats against CCl₄-induced hepatotoxicity. *Eclipta alba* significantly counteracted 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 enzymes²¹. Bi-herbal ethanolic extract (BHEE) from the leaves of *Eclipta alba* and seeds of *Piper longum* at a dose level of 50 mg/kg body weight was administered orally once for 14 days which restored elevated serum marker enzymes such as SGOT, SGPT, ALP, LDH, ACP, GGT and 5' Nucleotidase, due to CCl₄ treatment. All the biochemical parameters like total protein, total bilirubin, total cholesterol, triglycerides, and urea were also restored towards normal levels⁵. Hepatoprotective activity of methanolic extract and sub fractions of leaves and the chloroform extract and sub fractions of roots of *Eclipta alba* 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 and respectively causing 72.8% & 47.96% reduction of lysosomal enzyme. The triterpenoid eclabasaponin fraction from methanolic extract of leaves produced significant (78.78%) and the alkaloidal fraction (60.65%) reduction of carbon tetra chloride induced increase in lysosomal enzyme in blood. Coumestan fraction and triterpenoidal saponin fraction from the chloroform extract of roots produced very significant (75.6%) and (52.41%) respectively reduction of carbon tetra chloride induced increase in lysosomal enzyme levels in blood⁶.

Antihyperlipedemic properties:

It has been reported that in the atherogenic diet induced hyperlipedemic model, the aqueous leaf extract of the *Eclipta prostrata* was given orally to the rats which significantly reduced total cholesterol, triglycerides, total protein. There was a significant elevation in the high density lipoprotein cholesterol levels. 200mg/kg of extract showed better results compared to 100mg/kg⁷. Animal model containing Charles River Sprague-Dawley CD rats (specific pathogen-free/viral antibody-free Crj/Bgi male, 180 ± 10 g) were fed experimental diets supplemented with 0 mg (control), 25 mg (E25), 50 mg (E50), or 100 mg (E100) of a freeze-dried butanol fraction of *E. prostrata* per kilogram of diet for 6 weeks which reported significant reduction of serum triacylglycerol and total cholesterol, low-density lipoprotein-cholesterol levels and elevation in the high-density lipoprotein in the E50 and E100 groups respectively when compared with the untreated control group⁸.

Antioxidant properties:

The antioxidant effects of *Eclipta prostrata* was reported when 50mg/kg and 100mg/kg dose were fed orally into Charles River Sprague-Dawley CD rats which reduced serum hydroxyl radical (nmol/mg protein per minute) and serum lipid peroxide (nmol/mg protein) levels compared to untreated group. 100mg/kg dose significantly reduced Carbonyl content of oxidatively modified proteins⁸. Antioxidant activity of *Eclipta prostrata* was determined by FRAP, radical scavenging activity, reducing activity, and DPPH assay. The antioxidant capacity was increased by increasing the concentration of the extracts from 25 to 100mg/ml²⁷. The antioxidant activity of the hexane, ethyl acetate, ethanol and water extracts of *E. prostrata* was determined by ferric thiocyanate (FTC). FTC method was used to determine the amount of peroxide formed and that react with ferrous chloride (FeCl₂) to form a reddish ferric chloride (FeCl₃) pigment. In this method, the concentration of peroxide decreases as the antioxidant activity increases. Hexane, ethyl acetate, ethanol and water extract at various concentration (50, 100, 250 and 500 in µg/mL), showed antioxidant activities in a concentration dependent manner. Ethanolic extract at the concentration of 500 µg/mL showed (77.62%), which is close to the reference compound α-tocopherol (80.06%)²⁴.

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 modulator²⁸. 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 significant³⁰. 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. 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*²⁹.

Analgesic and Anti-inflammatory activity:

Albino wistar rats was used to investigate anti-inflammatory activity in which methanolic extract was administered orally. 100 and 200 mg/kg showed significant anti-inflammatory activity in carrageenin and egg white induced hind paw edema in rats which was compared with indomethacin (10 mg/kg) and cyproheptadine (8 mg/kg)³¹. Analgesic effect was studied on albino mice using ethanolic and alkaloidal extract of *Eclipta alba*. Standard experimental models such as the tail clip method, the tail flick method and the acetic acid induced writhing response were used which showed both the ethanol extract as well as the total alkaloids produced good analgesic activity in all the different models of analgesia used. The total alkaloidal fraction was the most efficacious in all models tested^{10,11}.

Antidiabetic activity:

Leaf suspension of *Eclipta alba* (2 & 4g/kg) orally in alloxan induced diabetic rats resulted in reduction in blood glucose level, glycosylated hemoglobin. There was decreased activity of glucose-6 phosphatase and fructose1,6-bisphosphatase, and an increase in the activity of liver hexokinase. Thus oral administration of *Eclipta alba* suspension possess potent antihyperglycemic activity³². *Eclipta alba* as an ingredient in polyherbal formulation Pan-five were scientifically and clinically proved to possess Antidiabetic and diuretic activity by acting upon pancreas by restoration and regeneration of pancreatic β -cell activity³³.

Hair growth & 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 an main ingredient in the preparation of herbal formulation for hair growth³⁵. 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 ether extracts were better than the positive control minoxidil 2% treatment³⁴.

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 models¹³. Coumestans are also known to act as phytoestrogens. These compounds are present in soyabeans and clover. In many countries it is used as diet which act as chemopreventive agent in breast and prostate cancer¹⁴.

Dasyscyphin-C (saponins) a newer isolated compound from *Eclipta prostrata* reported to have anticancer-cytotoxic activity¹². It was tested under invitro conditions in HeLa (Human cervical carcinoma) & vero cell lines. At the concentration of 50µg/ml it showed a good anticancer-cytotoxic activity on HeLa cells¹². A rat hepatic stellate cell line (HSCs) was used as in-vitro assay system, the methanolic extract of aerial parts of *Eclipta prostrata* showed significant inhibitory activity on HSCs proliferation⁹.

Combination therapy:

Eclipta alba (whole plant), *Mimosa pudica* (whole plant), *Vitex negundo* (whole plant), and *Solanum nigrum* (aerial parts) possessed styptic and anti-inflammatory properties and help in regeneration of the vascular endothelium³⁶. Combination of Herbs like *Anethum sowa* (Shatapushpa), *Piper longum* (Pippali mool), *Valeriana wallichii* (Tagar), *Cassia fistula* (Aragvadh), *Withania somnifera* (Ashwagandha) and Triphala (A herbal combination of three fruits) with *Eclipta alba* (Bhringaraj) pacify the aggravated Vata dosha and combination with *Elaeocarpus ganitrus* (Rudraksha), *Herpestris monniera* (Brahmi) showed a tranquilizer effect³⁷. Herbal mixture containing *Phyllanthus nigrum*, *Picrorrhiza kurroa*, *Zingiber officinale*, *Boerhaavia diffusa*, *Andrographis paniculata*, *Cichorium intybus*, *Emblica officinalis*, *Embelia ribes*, *Terminalia chebula*, *Terminalia arjuna*, *Piper longum* with *Eclipta alba* is used as a good digestive tonic³⁸. Galactin Vet Bolus a polyherbal ingredient containing *Eclipta alba* increased the yield of milk in the Holstein and jersey crossbred cows². *Eclipta alba* with *Acacia catechu* leaves reduced severe hepatotoxicity³.

Other pharmacological activities:

It has been reported that the importance of free carboxylic acid at C-28 position in echinocystic acid derivatives from the methanolic extract *Eclipta prostrata* showed antifibrotic activity⁹. Ethanolic and ethyl acetate fractions of *Eclipta prostrata* were tested for its antibacterial activities against *Escherichia coli*, *Klebsiella pneumoniae*, *Shigella dysenteriae*, *Salmonella typhi*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *Staphylococcus aureus*²⁴. *Eclipta prostrata* is combined with a non-plant material which is used to bath children suffering from malnutrition for 9 days and used as self medication by AIDS patients in southern Thailand^{22,40}. 16 parts of *Eclipta prostrata* (bhringaraj), 1 part of Triphala formula {*Emblia officinalis* (amalaki), *Terminalia chebula*, (haritaki), *Terminalia bellerica* (bibhitaki)}, 1 part of *Caltropis gigantean* (arka) and 1 part of *Smilax officinalis* (sariva) mixed with 80 parts of sesame oil and boiled to make a medicated oil which is reported to be used in skin diseases³⁹.

Conclusions

Eclipta alba offers a remarkable activity for curing of many diseases. It has a wide range of chemical constituents. Clinical investigations have been done on pharmacological activities like hepatotoxicity, proliferative, diabetic, hypolipemic etc. It has a greater potential to inhibit the growth of the bacteria and fungus. Further investigation of the plant can increase the isolation of the newer molecules which will be helpful for the study of the pharmacological activities and to discover from the plant thus preventing the human and the economic losses in the environment.

Sl.No.	Parts	Chemical constituents
1	Leaves	Wedelolactone[1.6%], Desmethylwedelolactone, Desmethylwedelolactone-7-glucoside, stigmaterol
2	Roots	Hentriacontanol, Heptacosanol & Stigmaterol, Ecliptal, Eclalbatin.
3	Aerial parts	β -amyrin & Luteolin-7-O-glucoside, Apigenin, Cinnaroside, Sulphur compounds, Eclalbasaponins I-VI
4	Stems	Wedelolactone
5	Seeds	Sterols, Ecliptalbine (alkaloid)
6	Whole plant	Resin, Ecliptine, Reducing sugar, Nicotine, Stigmaterol, Triterpene saponin, Eclalbatin, Ursolic acid, Oleanolic acid

Table 1 Parts containing chemical constituents of *Eclipta alba*

Sl.No	Chemical constituents	Pharmacological activities
1	Wedelolactone	Antihepatotoxic ⁴⁸ , Antibacterial ²⁴ , Trypsin Inhibitor, Antivenom ⁵⁰
2	Eclalbosaponins	hair revitalizing ³⁵ , Antiproliferative ^{12,14} , Antigiardial ²²
3	Demethylwedelolactone	Antihepatotoxic ⁴³ , Antihemorrhage ²⁵ , Antivenom ⁵⁰ , Dye (cosmetic) ⁵¹
4	Dasyscyphin C	Antiviral, Anticancer ¹²
5	Eclalbatin	Antioxidant ⁴⁷
6	Ecliptalbine, verazine	Lipid lowering, Analgesic ¹⁸

Table 2 Pharmacological activities of the chemical constituents of *Eclipta alba*

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