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Pharmacological Activity and Chemical Constituents of Eclipta Alba

By Dharmender Jaglan, Amandeep singh Brar & Rupamjot Gill
Chandigarh College of Pharmacy, India

Abstract- Eclipta alba is a herb commonly found throughout India. This plant is known to have various pharmacological activities and is traditionally used in treatment but it lacks adequate scientific proof of this activity and constituents responsible for it. The present paper describes the phytochemical and pharma-cological investigations of Eclipta alba.

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Pharmacological Activity and Chemical Constituents of Eclipta Alba

Dharmender Jaglan [α], Amandeep singh Brar [σ] & Rupamjot Gill [ρ]

Abstract- ***Eclipta alba*** **is a herb commonly found throughout India. This plant is known to have various pharmacological activities and is traditionally used in treatment but it lacks adequate scientific proof of this activity and constituents responsible for it. The present paper describes the phytochemical and pharma-cological investigations of** ***Eclipta alba.***

I. Introduction

Family : Asteraceae *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 specific Eclipta Alba means white which refers to the colour of the flowers. Main active principles consist of coumestans like wedelolactone, desme-thylwedelolactone (Wagner H. *et al.*, 1986), furanocoumarins, oleanane & taraxastane glycosides (Amritpal Singh.*et al.*, 2010).

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-fruiting, 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 diseases (Scott Treadway1998). The alcoholic extract of the plant has shown antiviral activity against Ranikhet disease virus (Sunita Dalal, *et al.*, 2010). The plant is commonly used in hair oil all over India for healthy black and long hair (Roy RK, *et al.*, 2008). The fresh juice of leaves is used for increasing appetite, improving digestion (Cheryl Lans, 2007) 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 learning (Otilia Banji, *et al.*, 2007).

Authors α σ ρ: Chandigarh College of Pharmacy, Landran (Mohali) M.pharmacy (Pharmacology Department).
e-mails: dharmenderjaglan@gmail.com, amandeepbrar678@gmail.com, Rjgill@gmail.com

The plant has a reputation as an antiageing agent in Ayurveda (Thakur VD, *et al.*, 2005). It is used as a general tonic for debility. Externally it is used for inflammation (Amritpal singh, et al., 2008; and Mahesh Sawant, *et al.*, 2004), minor cuts and burns and the fresh leaf-juice is considered very effective in stopping bleeding (Mukherjee DR, *et al.*, 1976). 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 hepatitis (Wagner H. *et al.*, 1986).

Figure : Eclipta Alba with White flower

It is widely used in India as a chologuague and deobstruent in hepatic enlargement, for jaundice and other ailments of the liver and gall bladder (Scott Treadway, 1998). The water extract of *Eclipta prostrata* (whole plant) exhibited the most potent inhibitory activity against HIV-1 integrase (HIV-1 IN) (Tewtrakul S, *et al.*, 2007). Vedic Guard, a polyherbal formulation is a synergistic combination of 16 medicinal plant extracts contains *Eclipta Alba* as a major ingredient (Rema Razdan, et *al.*, 2008). 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, tri-terpenoids. The leaves contain stigmasterol, β-terthienyl-methanol, wedelolactone, demethylw-edelolactone and demethylwedelolactone-7-glucoside (Wagner H. *et al.*,

1986).The roots give hentriacontanol and heptacosanol. 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 extract (Jadhav VM, *et al*., 2009). 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 plant (Jadhav VM, *et al*., 2009).

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 desmethylwedelolactone (Neerja Kaushik-Basu, *et al*., 2008).

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 3β, 20β, 16β and 3β, 20β, 28β trihydroxytaraxastane glycosides, and their sulphated saponins (Shoji yahara, *et al*., 1997). 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* (Mohammad S et al., 2005). 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 saponins (Shoji yahara, *et al*.,1994).

Alkaloids: The 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 (20S)(25S)-22,26-imino-cholesta-5,22(N)-dien-3β-ol (verazine, 3), while the new alkaloids were identified as 20-epi-3-dehydroxy-3-oxo-5,6-dihydro- 4,5-dehydroverazine (1), ecliptalbine [(20R)-20-pyridyl-cholesta-5-ene-3β,23-diol] (4), (20R)-4β-hydroxyverazine (5), 4β-hydroxyverazine (6), (20R)-25β-hydroxyverazine (7), and 25β-hydroxyverazine (8). Ecliptalbine (4), in which the 22, 26-imino ring of verazine was replaced by a 3-hydroxypyridine moiety, had comparable bioactivity to verazine (Maged S. *et al*., 1998).

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) (Xiong-HaoLin,*et al*., 2010).

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. Dasyscyphin C was isolated from *Eclipta prostrate* which were studied on the HeLa cells for the anticancer activity (Khanna, et al., 2008).

Bioactivity: Eclipta Alba is a plant used in folk & traditional medicine for cirrohosis 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.

Table 1 : Parts containing chemical constituents of *Eclipta Alba*

S.No.	Parts	Chemical constituents
1	Leaves	Wedelolactone[1.6%], Desmethylwedelolactone, Desmethyl-wedelolactone-7-glucoside, stigmasterol
2	Roots	Hentriacontanol, Heptacosanol & Stigmasterol, Ecliptal, Eclalbatin.
3	Aerial parts	β-amyrin & Luteolin-7-0-glucoside, Apigenin, Cinnaroside, Sulphur compounds, Eclalbasaponins I-VI
4	Stems	Wedelolactone
5	Seeds	Sterols, Ecliptalbine (alkaloid)
6	Whole plant	Resin, Ecliptine, Reducing sugar, Nicotine, Stigmasterol, Triterpene saponin, Eclalbatin,Ursolic acid, Oleanolic acid.

II. Pharmacological Properties

Crude extract : The crude extract has wound healing properties. The loss of hepatic lysosomal acid phosphatase and alkaline phosphatase by CCl4 was significantly restored by *Eclipta Alba.* The previous studies shows that hepatoprotective activity of Eclipta Alba is by regulating the levels of hepatic microsomal drug metabolizing enzymes (Saxena AK, *et al*., 1993). 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 (Sawangjaroen N, *et al.,* 2005 and Supinya Tewtrakul, et al., 2006). The leaf extract showed hypolipedemic activity in atherogenic diet induced hyperlipedemic rats (Dhandapani R. 2007). It has antimicrobial and antioxidant properties (Karthikumar S, *et al.,* 2007). 3% extract of Eclipta Alba is used in pilex formulation with other ingredients. It has been reported to decrease bleeding time (Mukherjee DR, *et al*., 1976). Leaf extract has been used in edema. It is used in the treatment of paronychia (Abdul viqar khan, *et al*., 2008).

Table 2 : Pharmacological activities of the chemical constituents of *Eclipta Alba*

Sl.No	Chemical constituents	Pharmacological activites
1	Wedelolactone	Antihepatotoxic (Nazim Uddin, *et al.,* 2010), Antibacterial (Karthikumar S, *et al.,* 2007), Trypsin Inhibitor, Antivenom (Vianna-da-silva NM, *et al.,* 2003)
2	Eclalbosaponins	hair revitalizing (Rupali thorat, *et al.,* 2009), Antiproleferative (Khanna, *et al.,* 2008 and Neerja Kaushik-Basu, *et al.,* 2008), Antigiardial (Sawangjaroen N, *et al.,* 2005)
3	Demethylwedelolactone	Antihepatotoxic (Wagner H. *et al.* 1986), Antihaemorrhage (Mukherjee DR, *et al*., 1976), Antivenom (Vianna-da-silva NM, *et al.,* 2003), Dye (cosmetic) (Meena AK, *et al.,* 2010)
4	Dasyscyphin C	Antiviral, Anticancer (Khanna, *et al*., 2008)
5	Eclalbatin	Antioxidant(Tewtrakul S, *et al.,* 2007)
6	Ecliptalbine	Verazine Lipid lowering, Analgesic(Maged S. Abdel-Kader *et al*., 1998)

Anti – Ulcer Activity : Eclipta Alba has the anti-ulcer activity. There are different type of herbal plants which are used to treat anti-ulcer such as The Polyherbal Formulation – RO7D consists of eleven medicinal plants namely Centella asiatica, Cassia auriculata, Cynadon dactylon, Rosa damascene, Myristica fragrans, Nelumbo nucifera, Hibiscus rosa-sinensis, Hemidesmus indicus, Glycyrrhiza glabra, Eclipta alba and Phyllanthus niruri. The Polyherbal Formulation – RO7D exhibited ($P<0.001$) significant decrease in ulcer index in both the model and significant decrease in the gastric volume in pyloric ligation rat ulcer model. The study indicates that extract RO7D has anti-ulcer activity and its anti-ulcer potential may be due to anti –secretary and cyto-protective activity. (Srinivasan D et al., 2008)

Immunomodulator activity : The protection of neuronal tissue may be possible due to the immunomodulatory action of *Eclipta Alba.* Due to methanol extract of whole plant of *Eclipta Alba* (1.6% wedelolactone), the phagocytic index antibody titer, phagocytic index and WBC count increased. Due to inhibition of non-specific humoral (lysozyme, antipr-otease and complement) and cellular (myelop-eroxidase content), the reactive oxygen and nitrogen species are produced.The dietary intake of *Eclipta Alba* aqueous leaf extract also enhance the non-specific immune response and disease resistance of o.massambicus against A.Hydrpphila. *Eclipta Alba* serve as a potential memory modulator also (Ghosh M *et al.,* 1984 And Roitt I *et al.,* 1998, Hudson L *et al.,* 1991).

Hair growth and alopecia : Eclipta Alba is a well known Ayurvedic herb for hair growth. *Eclipta Alba* is used in hair oil preparation since it promotes hair growth and maintains hair black.10%w/v of *Eclipta Alba* used as a main ingredient in the preparation of herbal formulation for hair growth. Petroleum ether and ethanolic extract were also used in oleaginous cream and applied topically (Roy R, *et al.,* 2008).

Anticancer activity : The methanolic extract of Eclipta Alba has the inhibitory effect against colon cancer due to inhibition of proliferation of cancer cells in a concentration dependent manner (Ruddon R.W, *et al.,* 1995 and St. Luke, *et al.,* 2007). 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 (Malaya Gupta, et al., 2005). 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 cancer (Neerja Kaushik-Basu, et al., 2008). Dasyscyphin-C (saponins) a newer isolated compound from Eclipta prostrata reported to have anticancer-cytotoxic activity. 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 cells (Khanna, 2008). 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 proliferation (Mi Kyeong Lee, *et al.,* 2008).

Hepatoprotective effect : Eclipta Alba is considered a powerful liver tonic. The hepatoprotective potential of *Eclipta Alba* was studied by assessing the biochemical parameters like lipid peroxide (LPO), superoxide dismutase (SOD), Catalase (CAT),

glutathione peroxide (GPx), glutathione reductase (GR), ascorbic acid and α-tocopherol. Oral administration of the Eclipta Alba significantly decreased levels of LPO and elevated the activity of antioxidant enzymes SOD, CAT, GPx, and GR as well as endogenous levels of ascorbic acid and α-tocopherol. Eclipta Alba has show protective effect on experimental liver damage in rats and mice and also used for the treatment of liver cirrhosis and infective hepatitis by reducing centrilobular necrosis, hydropic degeneration and fatty change of the hepatic parenchymal cells (Singh B *et al.,* 1993*)*. The coumestans constituents of the *Eclipta Alba* plant, wedelolactone and demethylwedelolactone, are responsible for the potent antihepatotoxic activities in CCL_4 – galactosamine and phalloidin induced liver damage in rats (Chopra R *et al.,* 1996). The ethyl acetate fraction of Eclipta Alba improves the both enzymatic and non enzymatic antioxidant status in rat liver (Singh B *et al.,* 1993). Hepatoprotective activity also expressed by *Eclipta Alba* by regulating hepatic lysosomal enzymes (Saxena A, *et al.,* 1993). 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 blood (Lal V.K, et al., 2010).

Anti-inflammatory and Analgesic activity : The extract of *Eclipta Alba* was administered orally to investigate anti-inflammatory activity (Amritpal singh, *et al.,* 2008). The anti-inflammatory activity which estimated by using carragenan induced paw oedema model.Inflammation occures due to activation of platelet activation factors and release of pro-inflammatory mediators such as prostaglandins, kinins, tumor necrosis factors and nitric acid. The extract of *Eclipta Alba* has the potent inhibitor of the pro-inflammatory transcription factors and a promising agent for the treatment of the inflammatory cascade of cardio-vascular diseases (Kaileh *et al.,* 2007).

Antidiabetic Activity : Extracts of various plant materials capable of decreasing blood sugar (Bopanna K *et al.,* 1982). The chloroform extract of *Eclipta Alba* exhibited significant anitidiabetic activity in alloxan induced diabetic rats. This extract has showed improvement in parameters like body weight and lipid profile by enhancing antioxidant defenses to protect against oxidative damage (Hodges, C *et al.,* 1989 and Nahar N *et al.,* 1993). The active principles present in *Eclipta Alba* has been reported to possess pancreatic beta cells regenerating, insulin releasing and fighting the problem of insulin resistance (Welihinda J *et al.,* 1982).

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 (Dae-Ik Kima, *et al.*, 2008).

Antioxidant properties: The antioxidant effects of *Eclipta prostrata* was reported when the level of serum hydroxyl radical (nmol/mg protein per minute) and serum lipid peroxide (nmol/mg protein) levels reduced as 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 thiocynate (FTC) (Karthikumar S, *et al.*, 2007).

Anthelmintic activity: The methanolic extract of whole plant of Eclipta Alba (L.) have the anthelmintic activity.

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 activity (Mi Kyeong Lee, *et al.*, 2008). 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 (Karthikumar S, *et al.*, 2007). 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 (Sawangjaroen N, *et al.*, 2005 and Cheryl Lans. 2007). 16 parts of Eclipta prostrata (bhringaraj), 1 part of Triphala formula {Emblica officinalis (amalaki), Terminalia chebula, (haritaki), Terminalia belerica (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 diseases (Bensky Dan, *et al.*, 1986).

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