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Chemical Composition and Medicinal Significance of *Eclipta Alba*: A Review

Sarvesh Kumar
Research Scholar, AVIPS Shobhit University, Gangoh, Saharanpur (UP) & Dept. of Pharmaceutical Sciences, H.N.B.G.U. (A Central University) Srinagar (Garhwal), India

Vijay Jyoti Kumar
Associate Professor
Dept. of Pharmaceutical Sciences, H.N.B.G.U. (A Central University) Srinagar (Garhwal, India

Ranjit Singh
Director,
AVIPS Shobhit University,
Gangoh, Saharanpur
Uttar Pradesh, India

Abstract

The plant *Eclipta alba* Hassk (Family-Asteraceae) is locally known as Bhringaraj in India. It is used as traditional medicine for the treatment of numerous ailments such as gastrointestinal disorders, respiratory tract disorders (asthma), hair loss, graying of hair, fever, liver disorders plus jaundice, skin disorders, spleen enlargement, cuts and wounds. The plant has several phytoconstituents like Wedeloactone, Eclalbasaponin, Ursolic acid, oleanolic acid, luteolin and Apigenin. Even though many of the investigational studies validated its traditional therapeutic uses, but employed uncharacterized crude extracts. Pharmacological activities of plant extracts and individual phytoconstituents have discovered anticancer, hepatoprotective, snake venom neutralizing, anti-inflammatory and antimicrobial properties. Phytoconstituents like Wedeloactone and Ursolic and oleanolic acids as well as luteolin and Apigenin can form the basis of new drugs against cancer, arthritis, gastrointestinal disorders, skin diseases, and liver disorders. The results of few pharmacological studies and bioactive metabolites already reported in *E. alba* warrant detailed investigation for its potential against diabetes, diuretics, hyperlipdemia, alopecia, oxidative stress related disorders and infections. Hence, in the view of huge remedial worth of the plant, current review is therefore bringing together all the information related to *E. alba.*

Keywords: Bhringaraj, Wedeloactone, Antioxidant, Alopecia, Antidiabetic, Anticancer.

Introduction

Medicinal plants are a rich source of antimicrobial agents and play an important role in health services around the world. *Eclipta alba* (L.) is an annual herb belonging to the family Asteraceae and is commonly known as Bhringaraj or “King of hairs”. In ayurvedic medicine, the leaf extract of *E. alba* is considered a powerful liver tonic, rejuvenating and especially good for the hair. *E. alba* also has traditional external uses, like athlete foot, eczema and dermatitis, on the scalp to address hairloss and the leaves have been used in the treatment of scorpion strings. This plant is known to have various pharmacological properties and is traditionally used in treatment of epilepsy. The juice of the plant is used for nausea. It is used for inflammation, minor cuts and burns and the fresh leaf juice is considered very effective in stopping bleeding. The leaves of *E. alba* are used against snake bites and scorpion stings. *E. alba* is a source of coumestans type compounds used in Phytopharmaceutical formulations of medicines prescribed for treatment of cirrhosis of the liver and infectious hepatitis [1]. The medicinal properties of *E. alba* are antimytotoxic, analgesic, antibacterial, antihepatoxic, antihaemorrhagic, antihyperglycemic, antioxidant, and Immunomodulator for general goodness of health. Phytochemical studies on *E. alba* discovered the presence of alkaloids like nicotine and ecliptine and bio-active steroidal alkaloids like verazine, dehydroverazine, ecliptalbine. Many hydrocarbons like Ecliptal, α-formyl terthienyl. Whole plant is said to have many triterpenene like saponin, Eclalbatin, along with α and β-amyrin, Ursolic acid, oleanolic acid and six new oleanane triterpenene glycosides, Eclalbasaponin [2].

Plant Description

Common Names [3-5]

Sanskrit- Bhringaraj and Keshraja, Marathi- Maka, Hindi- Bhangra, Tamil- Karisalankanni and false daisy, English - Trailing Eclipta, Bengali - Bheemraja, Kesuriya, Kesari, Kesuti and Keshwri, Arabia - Kadim-el-bint, Tamil - Kaikesi, Garuga and Kayanthakara. Telgue – Guntagalagara and Guntagalagara.

Taxonomic position [6-7]

Kingdom- Plantae; Division- Tracheophyta; Order- Asterales; Family- Asteraceae; Genus- *Eclipta* ; Botanical name- *Eclipta alba* (L.) Hassk.	

Eclipta alba

Habitat and Geographical Distribution [5,8]

Eclipta alba L. is a common herb distributed in tropical region, subtropical and temperate climate area of the world, most often presented in moist and wet places of China, Taiwan, Indonesia, Japan, Philippines, Bangladesh, Thailand, Brazil and India, In India Assam, Bihar, Uttar Pradesh and Manipur.

Roots

Root of *Eclipta alba* well developed a number of secondary branches arise from main, cylindrical, dia upto 7 mm, cylindrical.

Stem

Plant stem is herbaceous, cylindrical or flat, branched, occasionally rooting at nodes, rough due to oppressed white hairs, node distinct, greenish, and occasionally brownish.

Leaves

Leaves are 2.2 - 8.5 cm long, 1.2 - 2.3 cm wide, opposite, sessile to subsessile, usually oblong, lanceolate, sub-entire, sub-acute or acute, strigose with appressed hairs on both surfaces.

Flowers

Eclipta alba L. has ovate, solitary or 2, together on unequal axillary peduncles; involucral bracts about 8, obtuse or acute, herbaceous, strigose with oppressed hairs; ray flowers ligulate, ligule small, spreading, scarcely as long as bracts, not toothed, white; disc flowers 21 tubular, corolla often 4 toothed; pappus absent, except occasionally very minute teeth on the top of achene; stamen 5, filaments epipetalous, free, anthers united into a tube with base obtuse; pistil bicarpellary; ovary inferior, unilocular with one basal ovule.

Fruit

Fruits of *Eclipta alba* L. are one-seeded, Achenial cypsela, cuneate, with a narrow wing, covered with warty excrescences, brown.

Seed

Seeds of *Eclipta alba* L. are dark brown, hairy, non endospermic, 0.2 - 0.25 cm long and 0.1 cm wide.

Phytochemistry [9-10]

The medicinal properties of the plant *Eclipta alba* are ascribed to its numerous phytochemical constituents.

Qualitative Phytochemical Analysis

Preliminary qualitative phytochemical analysis show the presence of alkaloids, amino acid, anthocyanin, betaxanthin, carbohydrates, coumarin, flavonoids, glycoside, gums and mucilage, oxalate, phenolics, phlobatannins, proteins, quinines, reducing sugars, resin, saponins, starch, steroids, tannins and terpenoids in different polar and non-polar extracts of plant material different studies related to qualitative phytochemical analysis were conducted using the aqueous, methanol and n-hexane extracts of dried whole crushed plant.

Quantitative Phytochemical Analysis

Medicinal plants contain important phytochemicals and vitamins such as alkaloids, amino acid, anthocyanin, betaxanthin, carbohydrates, coumarin, flavonoids, glycoside, gums and mucilage, oxalate, phenolics, phlobatannins, proteins, quinines, reducing sugars, resin, saponins, starch, steroids, tannins, terpenoids, lignans and vitamins. The knowledge of crud phytochemicals in quantitative terms serves as a scientific data baseline for practitioners of herbal medicine. Phytochemical composition of *Eclipta alba* L. in quantitative terms is well investigated. The whole plant is dried, chopped, crushed to powder and extracted with polar and non-polar solvents.

Health Benefits

Traditional Claims [11]

Eclipta alba traditionally used as promoting hair growth and blacking of hair.

Pharmacological Properties

Anti Hepatotoxic Properties

The natural and synthetic drug is widely used as a source of therapeutics tools for the prevention or treatment of any disease. The emergence of multidrug-resistant bacteria and the potential risks of synthetic drugs to human health have renewed the interest in plant extracts. Fractions of methanolic leaves extract (72.80%) and chloroform roots extract (47.96%) of *Eclipta alba* were showed significant hepatotoxic activity [7]. According to Singh *et al* 2001, ethanolic extract of fresh leaves of *Eclipta alba* extracted by ethyl acetate for five times showed *in vivo* hepatoprotective activity [12].

Antimicrobial Activity

Bakht *et al* 2011 n-butanol fraction showed inhibitory activities against all nine (*B. cereus, E. carotovora, S. typhi, E. coli, B. subtilis, C. albicanus, K. pneumonia, P. aeruginosa, S. aureus*) microbial species [13]. The hexane extract of aerial parts of *Eclipta alba* studies was done by agar well diffusion methods showed high antibacterial activity against *S. aureus, B. cereus, E.coli, S. typhi, K. pneumoniae, S. pyogenes* and *P. aeruginosa* [14]. Borkataky *et al* showed that ethyl acetate extract of the plant *Eclipta alba* possess broad-spectrum antimicrobial activity which may be regarded as solvent-specific. The chloroform extract of leaves (32mm) and root powder (35mm) of *Eclipta alba* was found to exhibit the best inhibitory activity against *K. pnemoniae* compared to other solvents and hot aqueous extract [15]. Leaves of benzene extract exhibited good inhibitory zone of 26mm against *Shigella flexneri* and chloroform extract of root showed 28mm inhibition zone against *Bacillus subtilis* [16]. Santhosh *et al* 2015, conducted antibacterial screening of methanol extract, ethanol extract and chloroform extract of *Eclipta prostrata* L [17]. The methanol extract revealed maximum activity against *S. boydii*, *E. coli*, *S .paratyphi*, *K. pneumonia*

and *Pseudomonas* Sps [18]. Mamidala *et al* (2017) showed that methanol extract of *Eclipta alba* leaves has higher inhibition zones against *S. aureus* (16.5 mm) and *E. coli* (14.7 mm). Ethanolic extract of *Eclipta alba* whole plant have high noticeable *in vitro* anti-bacterial activity against human pathogens like *E. coli*, *S. aureus* and *P. aeruginosa* [19]. Manjit *et al* 2010 displayed more antimicrobial activity of acetone extract of *E. alba* against *S. aureus, E. coli* and *K. pneumoniae* than methanol extracts [20]. Chloroform hot aqueous extract of *Eclipta alba* leaves and root was found to exhibit best inhibitory activity against *K. pnemoniae* whereas benzene extract of leaves exhibited good inhibitory activity (26 mm) against *S. flexneri* and chloroform extract of root inhibited 28mm growth of *Bacillus subtilis* [21]. Munmi et al 2013 evaluated antimicrobial activity of petroleum ether, ethyl acetate, ethanol and aqueous extracts of *Eclipta alba* against selected strains of bacteria and fungi using agar well diffusion method. Maximum number of test strains was inhibited by the ethyl acetate extract with maximum activity against *Bacillus cereus* (22 mm). Ethanol extract show maximum activity against *Escherichia coli* (27 mm). Petroleum ether extract exhibited inhibition of only *Bacillus cereus* (10 mm) whereas aqueous extract inhibited four strains *Bacillus subtilis, Staphylococcus aureus, Bacillus cereus* and *Candida albicans* with the inhibition range between 10 mm to 11 mm [22].

Antidiabetic effect

Ethanol extract of *Eclipta alba* (EEA) on hyperglycemia and diabetic nephropathy was investigated by Jaiswal *et al* 2012 in streptozotocin induced diabetic rats. Single-dose treatment of EEA to streptozotocin-induced diabetic rats lowered the blood glucose level by 17.6% at 250mg/kg dose after 5h post oral administration. Treatment of animals after 10 weeks of STZ-treatment with EEA (250mg/kg) for 21 days significantly reduced the elevated levels of blood glucose, % HbA1C, urea, uric acid and creatinine, and significantly increased the depressed serum insulin level [23]. The extract exerted a significant inhibitory effect on alpha-glucosidase in a noncompetitive manner with an IC_{50} value of around 54mg/mL and was found inhibitory to eye lens aldose reductase with an IC_{50} value of around 4.5mg/mL [24]. Hemalakshmi *et al* (2012) tested methanolic extract of *Eclipta alba* for hypoglycemic and antioxidant activities in alloxan induced diabetic rats at three different dose levels. 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 bodyweight dose. Another study exhibited that *Eclipta alba* ethanol extract (50%) obtained by cold maceration method showed Antidiabetic effect, on hyperglycemia and diabetic nephropathy in streptozotocin-induced diabetic rats [25].

Hair growth & Alopecia

Roy et al. 2008 evaluated petroleum ether and ethanol extract of *E. alba* Hassk. for their effect on promoting hair growth in albino rats. The 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. Hair growth initiation time was significantly reduced to half on treatment with the extracts, as compared to control animals. The time required for complete hair growth was also significantly reduced. 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). The result of treatment with 2 and 5% petroleum ether extracts were better than the positive control minoxidil 2% treatment [26]. Another study was investigated the efficacy of methanol extract of *Eclipta alba* as hair growth promoter. Pigmented C57/BL6 mice, preselected for their telogen phase of hair growth were used. The methanol extract of whole plant when tested for hair growth promoting potential, exhibited dose dependent activity in C57BL6 mice. The activity was measured by studying the melanogenesis in resected skin, follicle count in the subcutis, skin thickness and surrogate markers in vehicle control and extracts treated animals. These findings suggest that methanol extract of *Eclipta alba* may have potential as a hair growth promoter [27]. A study by Datta et al. 2012 has been investigated with ethyl acetate fraction (EAF) of methanolic extract of *Eclipta alba* for hair growth promoting effect in a mouse model where alopecia-like state was produced by systemic administration of a cytostatic alkaylatic agent, etoposide. Etoposide was administered in a dose of 36 mg/kg, i.p. using two strains of mice: Swiss albino (with white body hairs) and C57/BL6 (with black body hairs) to inhibit the normal hair growing activity in a shaved area of skin 4x4 cm (4 cm2) on the dorsal (back) surface of the trunk in groups of each species of mice. EAF or its vehicle was applied topically in the form of cream on the shaved area of skin of different groups of mice in two concentrations: 1.6% and 3.2%. The main study was conducted in seven groups of six animals each for obtaining the morphological and histological data of various groups treated with two doses of EAF and the vehicle with or without administration of etoposide or its vehicle in doses as described above. Results of morphological hair growth showed that the mice treated with etoposide-induced 100% inhibition of hair growth (considered as alopecia) during a span of subsequent 30 days post-treatment period. Topical application of EAF cream in the administered concentrations produced a dose-dependent reversal of inhibition of hair growth produced by etoposide, whereas EAF vehicle applied topically as cream failed to show any such activity. The results demonstrated

that EAF of *Eclipta alba* has a potential to reverse the inhibition of etoposide-induced hair growth in both strains of the study mice [28].

Anticancer Activity

Kriengsak et al (2008) showed that arial part of *Eclipta prostrata* juice inhibited cancer and endothelial cell migration *in vitro* and also showed *in vivo* anti-angiogenic activity, without affecting cellad hesion [29]. Hydro alcoholic extract of *Eclipta alba* reported as MDR reversal agent using multidrug resistant hepatocellular carcinoma cell line (DR-HepG2) [30] Harshita et al 2013. Harshita et al 2014 displayed hydro-alcoholic extract of *Eclipta alba* (EAE) through *in vivo* experiments. Diethyl nitrosamine (DEN) and 2acetylaminofluorene (AAF) were used for liver cancer induction in animal model, whereas for MDR induction, AAF was used.EAE is a novel anticancer and potent MDR reversal agent and may be a potential adjunctive agent for tumor chemotherapy [31]. Banerjee *et al* 2005 demonstrated that methanolic extract of whole plant of *Eclipta alba* has significant reduction in gastric inflammation and with almost negligible presence of ulcerative presence damage to the gastric mucosal [32].

Antioxidant Activity

The crude extract of *Eclipta alba* was obtained by microwave-assistant extraction and purified by silica gel column chromatography in which dichloromethane–methanol–acetic acid solution was used as the eluent. Antioxidant assays showed the products had strong antioxidant and free radical scavenging activity which was close to oligomeric proantho cyanidins [33]. According to Regupathi *et al* 2015, the methanolic extract of whole plant of *Eclipta alba* had significant inhibition of *in vitro* nitric oxide scavenging, DPPH scavenging activity, lipid per oxidation and hydrogen peroxide scavenging activity. In a study, *in vitro* antioxidant activity of hydro-alcoholic extract of *Eclipta alba* was evaluated by studying superoxide radical scavenging activity, hydroxyl radical scavenging activity, nitrous oxide radical scavenging activity, 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity, reducing ability and Fe^{+2} chelating ability using standard procedure [34]. Hydro alcoholic extract of *Eclipta alba* effectively scavenged free radicals at all different concentrations and showed potent antioxidant potency and effects were in a dose-dependent manner [35].

Anti-nociceptive effect

Ethanolic extract of leaves of *Eclipta* alba (L.) Hassk shown anti-nociceptive [36]. Methanolic extract of aerial parts and roots of *Eclipta alba* inhibit the myotoxic activity of the venoms from *C. terrificus, B. jararacussu, B. jararaca* and *L. muta*, as well as various isolated myotoxic phospholipases A2 [37]. According to Santhosh et al 2015, the methanol, ethanol and chloroform extracts of *Eclipta prostrata L.* leaves, stem, and root show antibacterial activity was higher in *in vivo* root extract and very low in *in vivo* stem extract [38].

Conclusion

Extensive literature survey revealed that *Eclipta alba* L. is well reported plant in term ethnobotany, Phytochemistry and pharmacology. In recent years, pharmacological research is emphasizing on investigation of pharmacological activity of herbal extracts, isolation and identification of responsible phytoconstituents and targeted molecules, based on traditional knowledge.

Endnotes

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