Eclipta alba (L.) Hassk., A Promising Medicinal Herb for Holistic Health: An overview

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Abstract

Eclipta alba (L.) Hassk. is a member of the family Asteraceae. It is known as 'false daisy'. *Eclipta alba* (L.) is a medicinal herb, used traditionally for so long in Siddha, Unani and Ayurveda systems of medicine. It is extensively distributed in India, Thailand, Brazil, and China. Morphologically, it is a prostate herbal plant which is much branched with roughly distributed hairs, growing annually. Only the white color species out of four different types, is harvested and used for medicinal purposes. The therapeutic potential of *Eclipta alba* is due to the presence of various phytochemicals or because of the complex synergistic interaction among two or more constituents of plant, making it a potential herb for the therapy of different diseases. It consists of various constituents, some of them are coumestan derivatives, terpenoids, alkaloids, flavonoids, sterols, volatile oils, terthienyl aldehyde, fatty alcohols, saponins, phenolic acids. These phytoconstituents show various pharmacological activities potential for treating the diagnosed disease. Various studies have been accomplished, such as antimicrobial, anti-viral,

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hypocholesterolemic, diuretic, anti-diabetic, anti-cancer, antioxidant, cerebroprotective, hepatoprotective, immunomodulatory, bronchodilator, anti-inflammatory, antipyretic, anti-venom, neuroprotective and anti-epileptic activity, and some are unexplored. The molecular mechanisms of anti-cancer and apoptotic activities have been extensively clarified. Some reports showed the inhibitory effect of *E. alba* against the HIV virus. Various commercial products are available as powdered form or oil, mainly used for strengthening of hairs. There is no sign of toxicity seen, when taken in a dose-dependent manner.

Keywords

Eclipta alba, Bhringraj, Hepatoprotective, Coumestan, Wedelolactone, Antimicrobial, Saponin, Anti-cancer, Immunomodulatory

1. Introduction

Plants have been used as a base of ancient experienced traditional Ayurvedic medicine systems that have been in trust and continue to supply new remedies to mankind. Although, the effect of herbal medicines is mostly delayed but effective as they represent safety measures to their synthetic complement part with various side effects. The ethnomedicinal herbs used for the therapy for many diseases are economically and easily available to human beings. Because they were a part of the physiology of the plant system thus being easily uptake and metabolized by humans. The usage of various synthetic chemical compounds is now decreasing as compared to the use of plants in medicine as they show symptoms or any side effects. That is why people are more encouraged to use natural compounds extracted from plants. Hence, to explore herbal alternatives with dose-dependent study is a need of the hour and *Eclipta alba* (L.) Hassk., with its multiple pharmacognosy benefits, is a very promising medicinal herb for the same (Figure 1).

1.1. Synonym

Eclipta alba L., is a member of family Asteraceae. 'false daisy' is a commonly known name in English; Bhringoraj or Bhringraj/ Bhrangra in Hindi and "Bhringraja" and "Tekarajah" in Sanskrit (Table 1).

Figure 1: *Eclipta alba* L. (Bhringraj) plant

1.2. Occurrence

It is extensively dispersed in India, Thailand, China and Brazil. It is also observed in most of the eastern countries like Philippines, Malaysia, Nepal, Sri Lanka and Indonesia, where it can flourish abundantly in paddy fields, moist clay ground-bunds, tanks in plains, water courses and hilly areas (Roy et al. 2008).

Table 1: Taxonomy of *E. alba* (National Plant Data Center)

Kingdom	Plantae
Subkingdom	Viridaeplantae
Infrakingdom	Streptophyta
Division	Tracheophyta
Subdivision	Spermatophytina
Infradivision	Angiospermae
Class	Magnoliopsida
Superorder	Asteranae
Order	Asterales
Family	Asteraceae
Genus	Eclipta L.
Species	*Eclipta alba* (L.) Hassk.

2. Morphology

Morphologically, the outer appearance of *Eclipta alba* is a prostrate herbal plant-type, with many branches possessing rough hairs, growing annually. Root is tap

root type. Stem is cylindrical, branched with brown color nodes and white trichomes. Leaves are sessile to sub-sessile, oppositely grown, on an average of 1.2-2.3 cm broad, and 2.2-8.5 cm long, generally linear but lanceolate, oblong, or narrowly elliptic, entire or short-toothed margin, acute or sub-acute, with notified hairs on both the upper and lower surfaces of leaf (Singh et al. 2008; Keil 2012).

The inflorescence (Figure 2) is a heterogamous head (peduncle of 0 mm or >15 mm in length) with campanulate involucre of bracts of 4-10 mm in diameter, and phyllaries of 4-5 mm, biseriate bracts, and broad from outer; receptacle flat with slender plumose palea (Singh et al. 2008; Keil 2012).

Unisexual (pistillate) parts of the plant are ray florets, and bisexual ones are disc florets. Pappus is extremely small, corolla of the pistillate flower (1.5-3 mm) is ligulate and corolla of bisexual flowers (1.5-2 mm) tubular with five lobes; stamens-pentamerous, epipetalous and syngenesious; inferior unilocular ovary. Achenes of ray florets are triquetrous (having three edges) and warted, and achenes of disc florets are compressed (Neeraja and Margaret 2012; Keil 2012). The fruit is of 1.7 – 2.2 mm in diameter, obovate, smooth or tubercled; pappus (<=0.2 mm). Chromosome number is diploid (2n = 22) (Keil 2012; Jepson 2021).

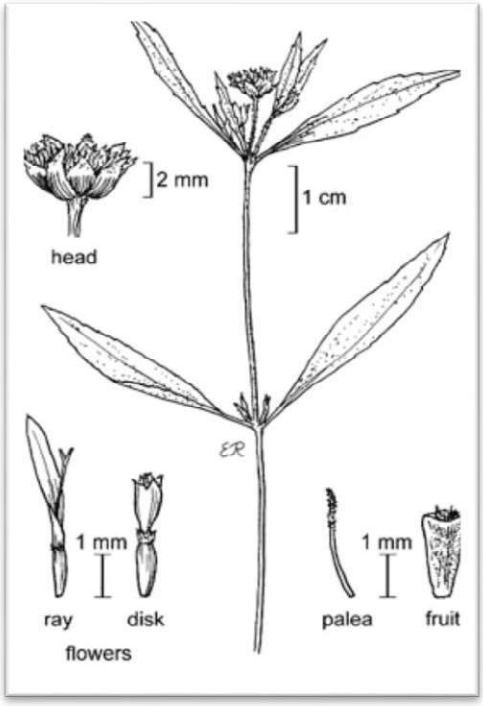


Figure 2: Inflorescence of *Eclipta alba* L.

(Keil 2012)

2.1. Varieties

Eclipta alba have four main varieties, based on the color of their bloom, i.e., white, yellow, red, and blue. The white and yellow flowers are assumed to be salient in ethnomedicine, but it's only the white species of Bhringraj, which is mostly cultivated for its therapeutic medicinal use and other benefits. It grows violently in moist places

as an excessive growing weed, mainly in India, because it can be comfortably harvested. The flower and leaf extracts of this potential therapeutic herb, which can be applied in a variety of ways, are both externally and internally used for various afflictions (Chiranthanut et al. 2013).

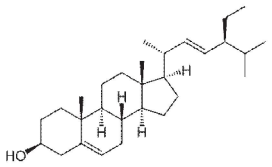
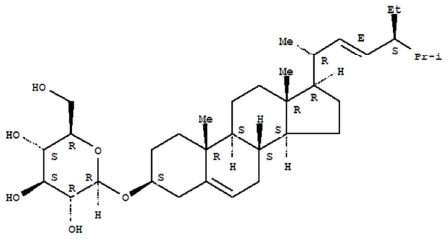
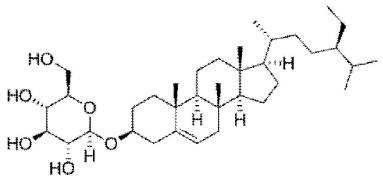
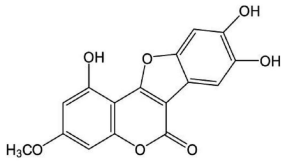
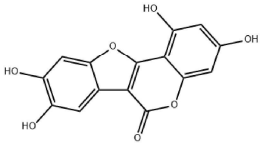
3. Natural Phytocompounds

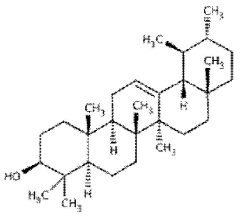
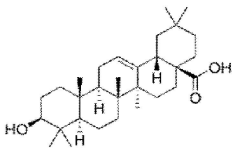
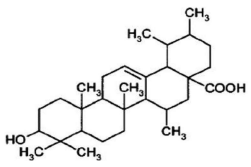
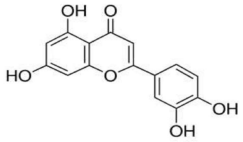
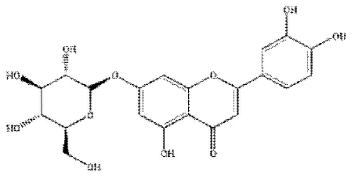
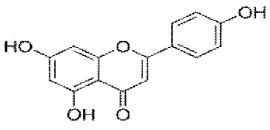
It is mentioned in The Ayurvedic Pharmacopoeia of India and the Indian Herbal Pharmacopoeia as a potential hepatoprotective agent (Roy et al. 2008). An exclusive extent of chemical compounds is present in *E. alba*, some of them includes coumestans, triterpenes and their glycosides, alkaloids, flavonoids, thiopenes, polyacetylenes, which have been isolated from this specific white colored *Eclipta* plant species. Due to their polarity, these constituents are being isolated in different solvent, either polar or nonpolar solvent.

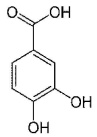
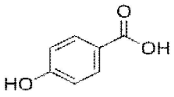
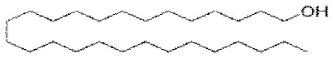
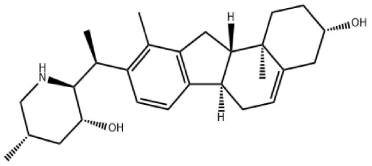
Various phytoconstituents are being reported, which are found in different extracts of *E. alba* (Table 2). These phytocompounds are of different nature, based on their family they are being included in. Coumestans are the most abundant phytocompounds present in the plant of *E. alba*. Phytoconstituents such as wedelolactone and its derivatives (demethylwedelolactone and demethylwedelolactone-7-glucoside) are included in the family Coumestan. Terpenoids such as α-amyrin, oleanolic acid and ursolic acid are present. There are also the glycosides of terpenoids present, and are classified in different classes, namely, eclalbosaponins I–X, and ecliptasaponins C and D. Another family of sterols including Stigmasterol and its derivative (Stigmasterol-3-O-glucoside) and daucosterol. Fatty alcohols including hentriacontanol and heptacosanol. Ecliptal is the only phytoconstituent included in the family terthienyl aldehyde. Alkaloids such as verazine, Ecliptalbine, [4β-hydroxyverazine], [25β-hydroxyverazine], [(20R)-25β-hydroxyverazine] are included. Flavonoids such as luteolin, apigenin, luteolin-7-glucoside, orobol (isoluteolin) are present. Sesquiterpene lactones are also present in it. Many volatile oils are present in different extracts of Bhringraj, such as heptadecane; 6,10,14-trimethyl-2-pentadecanone; n-hexadecanoic acid; eudesma-4(14),11-diene; phytol; 1,2-benzene-diacarboxylic acid; diisooctyl ester; pentadecane; (Z,Z)-9,12-octadecadienoic acid; octadec-9-enoic acid; (Z)-7,11-dimethyl-3-methylene-1,6,10-dodecatriene; (Z,Z,Z)-1,5,9,9-tetramethyl-1,4,7-cycloundecatriene. Its extract exhibited presence of different saponins, polyacetylinic compounds

and Phenolic acids (Mithun et al. 2011; Upadhayay et al. 2001; Zhang et al. 1996; Zhang and Chan 1997).

Table 2: Structure and molecular formulation of some phytoconstituents present in *E. alba* (Jahan et al. 2014; Neeraja and Margaret 2012)

S. No.	Name of Phytoconstituents	Chemical Formula	Structure
1.	Stigmasterol	$C_{29}H_{48}O$	
2.	Stigmasterol-3-O-glucoside	$C_{35}H_{58}O_6$	
3.	Daucosterol	$C_{35}H_{60}O_6$	
4.	Wedelolactone	$C_{16}H_{10}O_7$	
5.	Demethyl wedelolactone	$C_{15}H_8O_7$	

6.	α-Amyrin	$C_{30}H_{50}O$	
7.	Oleanolic acid	$C_{30}H_{48}O_3$	
8.	Ursolic acid	$C_{30}H_{48}O_3$	
9.	Luteolin	$C_{15}H_{10}O_6$	
10.	Luteolin-7-glucoside	$C_{21}H_{19}O_{11}^-$	
11.	Apigenin	$C_{15}H_{10}O_5$	

12.	Protocatechuic acid	$C_7H_6O_4$	
13.	4-hydroxybenzoic acid	$C_7H_6O_3$	
14.	Heptacosanol	$C_{27}H_{56}O$	
15.	Ecliptalbine	$C_{27}H_{39}NO_2$	

4. Biological Properties

Various pharmacological properties of *E. alba* have been reported in recent years, either due to the presence of variable phytoconstituents or because of the synergistic interaction between them. *Eclipta alba* is mainly used as diuretic, hypotensive, hypocholesterolemic activity (Rangineni et al. 2007), antiviral (Mors et al. 2000), antimicrobial (Prabhu et al. 2011), antioxidant (Udayshankar et al. 2019), anti-cancer potential (Chaudhary et al. 2011), cerebroprotective properties (Mansoorali et al. 2012), hepatoprotective (Saxena et al. 1993), immunomodulatory activities (Jayatirtha and Mishra 2004), antidepressant (Mishra et al. 2013), analgesic activity (Thorat et al. 2009), anti-inflammatory (Arunachalam et al. 2009), anti-snake venom

properties, neutralize toxic (Udayashankar et al. 2016), nervine tonic (Thakur and Mengi 2005), anti-diabetic, hair growth promoter, and in alopecia treatment (Datta et al. 2009).

Table 3: Chemical phytoconstituents and biological properties in different parts of *E. alba* (Shekokar et al. 2017; Jaglan et al. 2013)

S. No.	Plant Part	Phytoconstituents	Biological properties
1.	Leaves (Juice)	Wedelolactone and its derivatives, stigmasterol, α-terthienymethanol	Dizziness, asthma, skin diseases, colic and liver affections, allergic urticaria, inflatulence, bronchitis, blurred vision, enlarged glands, vertigo
2.	Roots (Powder)	Ecliptal, hentriacontanol, heptacosanol and stigmasterol	Wounds in cattle, liver tonic, emetic, purgative, anti-ulcers
3.	Shoot (Juice)	Sulphur compounds, luteolin-7-0-glucoside, eclalbasaponins, I-VI cinnaroside, apigenin, ß-amyrin, ethyl-2,6-dihydroxy-4-methoxybenzoate and merulinic acid C (Sun et al. 2010).	Inhibit the cell division, hair revitalizing, anti-giardial properties
4.	Stem (Paste)	Wedelolactone	Anti-venom, antihepatotoxic, trypsin inhibitor, anti-bacterial
5.	Seeds	Sterols	Tonic, aphrodisiac, sexual debility
6.	Whole plant (Paste)	Stigmasterol, reducing sugar, resin, ecliptine, nicotine, ursolic acid, triterpene saponin, oleanolic acid, eclalbatin with α-amyrin	Anemia, rejuvenating tonic, antiseptic, splenic and liver enlargements, hyperacidity, gastritis, anti-catarrhal, deobstruent, spasmogenic, hypotensive and detoxer

5. Phyto-pharmacological Properties

Eclipta alba plays a key role in the very traditional systems of medicines, i.e., Ayurveda, Sidhha and Unani (Mansoorali et al. 2012) as Bhringoraj, Bhangraa, and Karissalaankanni, respectively. *E. alba* is considerably a weed, with various ethnomedicinal importance (Khare 2007). Different parts of Bhringraj exhibited a diverse range of pharmacological activities as mentioned below.

5.1. Antimicrobial activity

E. alba possesses such phytoconstituents which could be used as therapy against many diseases, naturally toxic to microorganisms. These phytoconstituents, being easily extracted out, could be used for other multiple functions, and are available easily at low cost, which they consider safe to consume for humans also. *Eclipta alba* can be used to treat various diseases like pimples, sore throat, food borne infections, urinary tract infection, typhoid and nosocomial infections. Phytoconstituents responsible for antimicrobial property present in Bhringraj include coumarins, quinones, tannins, simple phenols, phenolic acids, terpenoids, flavones, flavonoids, flavanols, alkaloids, polypeptides, essential oils and lectins (Cowan 1999). Different shoot parts of *E. alba* represented antimicrobial properties against nine microbial species extracted in different solvent phases. Prabhu et al. (2011) reported that the antibacterial effect of *E. alba* methanolic extract by disc diffusion method at different concentrations on five human pathogenic bacteria viz., *Staphylococcus aureus, Klebsiella oxylata, E. coli, Salmonella paratyphi, Pseudomonas aeruginosa,* and antifungal effect on fungi such as *Candida albicans, Aspergillus niger, A. flavus,* and *Penicillium citrinum.* Its extract showed effective antimicrobial activity when extracted in butanol as well as ethyl acetate too. So, *Eclipta* proved to be a cost effective potential antimicrobial agent that may serve as a source for the treatment of various infectious diseases as antimicrobial compounds.

5.2. Anti-oxidant activity

The significance of antioxidants in today's scenario is increasingly high due to their multiple roles to control or decrease the harmful effects of oxidative stress caused by innumerable factors these days. Natural antioxidant compounds enhance the antioxidant activity of the plants as they have the ability to reduce and scavenge free radicals from the medium. *Eclipta* is rich in polyphenol compounds like phenols, flavonoids, and flavanols and the well-known compound in *E. alba*, which is, wedelolactone (Tripathi et al. 2021). When extracted in methanol as well as petroleum ether, it exhibits better antioxidant activity (Thenmojhi and Jayanthi 2019). *Eclipta* also showed metal chelating activity that acts like a secondary antioxidant.

The water extract of *E. alba* also protects epidermal and dermal fibroblasts (mouse fibroblasts) cells against cytotoxicity caused by UV radiations when given in a specific concentration with chlorogenic acid. This study demonstrated the results as

the *E. alba* water extract has a potential in scavenging 1,1-diphenyl-2-picrylhydrazyl (DPPH), superoxide radicals and chelating ferrous ions. Aqueous extract of *E. alba* has the potential to absorb both UV-A and UV-B radiations (Chan et al. 2014) providing it as an excellent antioxidant property.

Therefore, these given results show the ethnomedicinal use of *E. alba* as a potential antioxidant source, which could be used in sunscreen creams and other cosmetics with no other harmful effects.

5.3. Anti-diabetic activity

Extract of *Eclipta alba* possesses an antidiabetic effect in association with the inhibition of α-glucosidase and aldose reductase (Jaiswal et al. 2012). Chethan et al. (2014) also reported that the methanolic extract of *E. alba* showed inhibition of α-glucosidase and α-amylase enzymes *in vitro*, which are accountable for the breakdown of oligosaccharides into simple monomeric units.

Similarly, the anti-diabetic action was studied in alloxan-induced diabetic rats, by using 2-4 g/kg of leaf suspension of *E. alba* orally. It was observed that, there was significant reduction in blood glucose level and glycosylated hemoglobin A as well as decreased activity of glucose-6-phosphatase and fructose-1,6-bisphosphatase and further enhanced in the activity of liver hexokinase (Ananthi et al. 2003).

5.4. Anticancer activity

Eclipta alba shows promising anti-proliferating activities against cancerous cells. Coumestans, phytoconstituents of *E. alba*, are also known to act as phytoestrogens. In most parts of the world, this plant is being used in their daily food diet. It is also a protective agent during chemotherapy in mammary gland cancer and prostate adenocarcinoma. Dasyscyphin-C (a phytoconstituent of saponin family), having *in vitro* anti-cancer and cytotoxic activities reported (Khanna et al. 2008) in Human cervical carcinoma (or HeLa cell line) and Vero cell lines in a dose-dependent manner, at a concentration of 50 μg/ml.

Anticancer activity of *E. alba* methanolic extract was experimentally appraised when injected in Swiss albino mice having Ehrlich Ascites Carcinoma (EAC) type cancer. They determine the viability of tumor cells, their cell count, average growth rate and the increase in lifespan *in-vitro*, which results in restoring the hematological parameters (Gupta et al. 2005).

Vyanktesh et al. (2019) reported *E. alba* as a potential agent of inhibiting the multiplication of cancerous cells. The whole plant aqueous extract was extracted

in-vitro, to check its effect on Human liver cancer cell line (HepG2) by sulforhodamine B (SRB) assay. Results estimated that 15% of aqueous extract of *E. alba* exhibited the average rate of growth inhibition of about 68.74 %.

Chaudhary et al. (2011) also studied anti-cancer potential of hydro-alcoholic extracts of *E. Alba* by MTT [3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide] assay and phase contrast study. They reported that it has the ability to control the division of kidney (A-498), liver (HepG2) and brain (C6 glioma) cancer cell lines in a concentration-based manner.

Wedelolactone (a type of coumestan) found in Bhringraj may be revealed as a novel remedial agent in provision for *in vitro* human prostate cancer (Sarveswaran et al. 2012). Wedelolactone did not cause any impact on the viability of normal prostate epithelial cells (PrEC) at the concentrations which could eliminate the prostate cancer cells, and there is no effect on normal cells other than cancerous cells. But some studies show contradiction to this report and stated that wedelolactone did not exhibits antitumor properties, but found ecliptasaponin-C or eclalbasaponin-I shows inhibition of hepatoma cancer cell SMMC-7721 proliferation in a dose-dependent manner (Liu et al. 2012; Manvar et al. 2012).

5.5. Hepatoprotective properties

E. alba has the potential to cure liver disorders, evaluating different biochemical parameters. Some parameters are catalase (CAT), superoxide dismutase (SOD), lipid peroxide (LPO), glutathione reductase (GR), glutathione peroxidase (GPx), α-tocopherol and ascorbic acid. This plant practically showed protection against liver damage in rats and mice for treating the infective hepatitis and liver cirrhosis by reducing hydropic degeneration, centrilobular necrosis, and fatty change of the hepatic parenchymal cells. Mostly the coumestans constituents such as wedelolactone and its derivative, demethylwedelolactone, are accountable for the capability of anti-hepatotoxic properties in CCl_4 – galactosamine and phalloidin induced liver damage in rats (Jaglan et al. 2013).

Another study showed the hepatoprotective effect by the 50 % ethanol extract of *E. alba* in rats against CCl_4-induced hepatotoxicity at sub-cellular level. The *E. alba* extract containing phytoconstituents, are remarkably compensated for the CCl_4-induced inhibition of the membrane bound glucose-6-phosphatase and hepatic microsomal drug-metabolizing enzyme (amidopyrine N-demethylase). But the reversal of very high potentiality of obstruction of another drug-metabolizing enzyme,

aniline hydroxylase, failed. However, the loss of alkaline phosphatase and hepatic lysosomal acid phosphatase caused by CCl_4, was consequently restored by plant extract (Saxena et al. 1993).

5.6. Hair growth promoting activity

This has been clinically proven that its herbal procedure consisting of various phytocompounds will enhance the hair growth and stop the hair loss. So, due to its hair growth promoting activity it is also known as "Kesharaj" and has been explored commercially in well-known products like "Indulekha". A poly-herbal formula methodology used, applied in Wistar albino rats, containing Chinese hibiscus/China rose, bhringraj and Jatamasi showed excellent results in hair growth promoting activity. Time for the hair growth initiation and for complete hair growth were remarkably reduced and resulted in greater number of hair follicles exhibiting favorable results (Dutta et al. 2009)

Ethanolic extract and petroleum ether extract of *E. alba* has also been tested in albino rats for enhancing the hair growth activity (Jahan et al. 2014).

5.7. Analgesic activity

In Ayurveda a large number of indigenous drugs with the analgesic properties have been enlisted that include Bhringaraja too. This is of much importance as a narcotic or a non-narcotic analgesic that would not cause respiratory depression and addiction, and may be used as an alternative to morphine (Pandey et al. 1997). Sawant et al. (2004) reported that alkaloidal and ethanolic extract of *Eclipta alba* shows significant analgesic activity on albino mice by reducing the pain.

5.8. Immune-modulating activity

E. alba methanolic extracts have shown the potential of immune-modulatory activity (Jayatirtha et al. 2004). Wedelolactone and its derivative (dimethyl wedelolactone) being extracted from *E. alba*, exhibits the potential to inhibit the activity of trypsin *in vitro* (Syed et al. 2003).

5.9. Anti-inflammatory and bronchodilator activity

Thorat et al. (2009) reported that *E. alba* extract possesses potential anti-inflammatory and bronchodilator activities, because of the presence of coumarin compounds. Coumarin compound like wedelolactone, demethylewedelolactone-7-glucoside and nor-wedelolactone contribute for anti-inflammatory and bronchodilator activity (Leal et al. 2000; Arunachalam et al. 2009).

The isolation of wedelolactone inhibits lipopolysaccharide-induced caspase-11 expression in *in-vitro* cultured cells by inhibiting NF-κB-mediated transcription. Kobori et al. (2004) also shows that wedelolactone is an inhibitor of IKK. IKK is a kinase, which is condemnatory for the inducing of NF-κB by mediating phosphorylation and degradation of IκBα (IκBα is a nuclear factor of kappa polypeptide gene enhancer in B-cells inhibitor).

5.10. Anti-snake venom

Wedelolactone obtained from aqueous extract of *E. alba*, was analyzed for anti-myotoxic and anti-hemorrhagic potential against the crotalid venoms by snake bites in Brazil. With *Eclipta alba* aqueous extract and by pre-incubation with wedelolactone on mycotoxins namely bothropasin, crotoxin, and bothropstoxin were neutralized significantly by immediate exposure to the muscles *in vitro* as well as *in vivo* experiments. Intravenous administration of the plant extract or wedelolactone to the bloodstream directly resulted in the rise in plasma creatine kinase activity induced by the crotalid venoms or the mycotoxins and it got attenuated or less effective. The aqueous extract and wedelolactone have shown to inhibit the effect of hemorrhage caused by *Bothrops jararaca* venom too. It also inhibits the phospholipase A2 (PLA2) activity of crotoxin and the proteolytic activity of *B. jararaca* venom (Melo et al. 1994). Inhibition of PLA2 is of immense pharmacological and therapeutic research interest as these enzymes are involved in a wide variety of pharmacological activities, such as anticoagulant, hemorrhagic, cardiotoxic, myotoxic, neurotoxic and edema-inducing effects. Production of secondary metabolites such as wedelolactone and its derivatives, with activity against PLA2s, further enhanced in *E. alba* by genetic engineering using *Agrobacterium rhizogenes* LB9402. This genetically engineered strain found to be useful for reducing the activities of PLA2, myotoxic as well as neurotoxic effects of the *B. jararacussu* and *Crotalus durissus terrificus* snake venom (Carvalho et al. 2013; Diogo et al. 2009).

5.11. Neuroprotective

A common neurological disorder which results in abnormal electrical activity of the brain is called Epilepsy. When there is a sharp increase in electrical activity in the brain, it causes a temporary disturbance in the communication among neurons. It will negatively affect the patient's life mentally. The methanolic extract of *E.* alba improves cognitive deficits and attenuated epileptic seizures as well. Luteolin and

eclalbasaponin II, flavonoid and steroid of *E. alba* respectively, are being used to prevent attenuated epileptic seizures, and have neuroprotective properties (Tambe et al. 2017; Guenne et al. 2020). Its hydroethanolic extract significantly exhibits antioxidant power (Mansoorali et al. 2012) so has the ability to protect against cerebral ischemia (reperfusion injury that causes neural loss).

5.12. Antiviral activity

Research study done by Manvar et al. (2012) gives a report on Hepatitis C virus (HCV), in which he used *E. alba* extract. The analysis of its phytocompounds showed the presence of three compounds, namely, wedelolactone, apigenin, and luteolin. Its extract showed the dose dependent potential for the inhibition of replication of HCV *in-vitro* cell culture denoting that the plant or isolated component from *E. alba* have the potential to inhibit the HCV (Manvar et al. 2012).

6. Ethnomedicinal and Other Uses

Folk medicinal and tribal medicinal practitioners use Bhringraj to treat a variety of diseases like respiratory tract disorders (including asthma), gastrointestinal disorders, liver disorders (jaundice), fever, hair fall and hair greying, spleen enlargement, skin diseases and cuts and wounds (Jahan et al. 2014). *Eclipta alba* in combination with a non-plant material, is being used to bathe malnourished children. It is also being used as a self-medication to treat Acquired Immuno-deficiency Syndrome (AIDS) patients, in the area of Southern Thailand (Sawangjaroen et al. 2005). Some of the commercial products of Bhringraj are mentioned in the Table 4.

Table 4: Commercial products of Bhringraj

S. No.	Product	Usage
1.	Khadi Natural Ayurvedic Amla and Bhringraj Hair Cleanser (Shampoo)	It stops greying and dandruff and an excellent hair tonic
2.	Baidyanath Mahabhringraj Tel, Indulekha Bringha Oil, Aloe Veda Distil Bhringraj Scalp Tonic, Meghdoot Ayurvedic MahaBhringraj Oil Biotique Bio Bhringraj Therapeutic Oil, Jovees Bio-Advanced Bhringraj and Olive Hair Oil and Schwabe B&T 7oL Nourishing Scalp Hair Oil	It will nourish and condition your scalp deeply, thereby strengthening the roots of the hair. It also controls dandruff, prevents hair fall, and promotes hair regrowth. It can also revitalize dull and brittle hair and prevent premature greying with it.

3.	Bhringraj asava by Baidyanatha, Sandu, Dabur	It is one of the Ayurvedic medicines use to treat emaciation, excessive tiredness, relieves cold cough and bronchitis, boost immunity, natural aphrodisiac
4.	Bhringraj powder by Natural Herbs	Excellent natural hair tonic
5.	Eclipta tinctura by Tropilab Inc.	Hepatoprotective effect, anti-ulcer activity and effective in jaundice in children (Wagner et al. 1986)

7. Conclusion

Bhringraj has been used as a medicine for so long traditionally by folklore, showing different types of ethnopharmacological properties. Various medicinal systems like Ayurveda, Siddha, Unani, Homeopathy and Chinese as well, use this *E.* alba as an alternative herbal medicine for treating many human diseases. *E. alba* can be broadly used as functional food and traditional medicine. A wide range of phytochemical compounds being isolated by using different types of solvents based on their polarity. These phytoconstituents are triterpenes and their glycosides, coumestans, alkaloids, thiopenes, flavonoids, polyacetylenes, which is being extracted out only from the white species of bhringraj, that has been extensively explored for various biological activities. Different parts of *E. alba* possess biological activities such as antimicrobial, diuretic, hypocholesterolemic, antioxidant, hepatoprotective, anti-cancer, bronchodilator, cerebroprotective, immunomodulatory, anti-inflammatory, analgesic, anti-viral, anti-venom and anti-diabetic activity. The leading bioactive molecules or phytoconstituents responsible for these pharmacological activities are wedelolactone, ursolic acid, oleanolic acids, luteolin and apigenin. These molecules could be further used as drug molecules after isolation, as they are creating information on pharmaceutical trials against numerous diseases such as skin diseases, cancer, arthritis, gastrointestinal disorders, liver disorders and several other ailments.

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