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REVIEW ARTICLE

Bhringraj's (Eclipta Alba) Ayurvedic, Phytochemical, and Pharmacological Information: A Review

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ABSTRACT

M Eclipta alba (L.) Hassk., often known as Bhringraj, is a well-researched plant that has long been utilised in Ayurveda, Unani, Siddha, and ancient Chinese medicine, among other ancient medicinal systems. This plant is found all over the world and is a member of the Asteraceae family. It has been used ethnomedically to treat skin infections, respiratory conditions, liver diseases, and hair growth. Because of its wide range of pharmacological activities and abundance of bioactive phytoconstituents, E. alba has attracted more and more scientific attention in recent years. The antioxidant, hepatoprotective, anti-inflammatory, antibacterial, neuroprotective, and anticancer properties of major ingredients are highlighted.

Keywords: Bhringaraj, Eclipta alba, Urdhvaga Amlapitta, Pitta vikara, Ayurveda, gastroprotective herb.

INTRODUCTION:

Nature is the primary source of numerous medicines for thousands of years [1, 2]. Among plants, medicinal plants are of great significance. Medicinal plants are those plants whose one or more than one part possesses substances which are medically important and are used for the synthesis of new drugs [3, 4]. Kingdom Plantae is considered as the treasure house of many important drugs. It has been a culture of using medicinal plants [5]. Initially most of the medicinal preparations were obtained from the plants only either in the simpler form or in the complex forms [6]. Drugs derived from plants are named as herbal drugs, botanical drugs, botanicals, phytomedicines, traditional medicines, herbal medicines, traditional Chinese medicines (TCMs), traditional herbal medicinal products, natural health products, or plant food supplements. These phytomedicines have advantages over synthetic drugs such as they are easily available, less expensive, safe, and efficient and have negligible side effects [7-10]. Even most of the modern drugs are derived from the natural sources like plants. As per the data resources, quarter of the medicines used in the present times in industrialized countries has been derived from tropical plants directly or indirectly [11-13]. Medicinal plants have a very rich history of their utilization to treat variety of diseases. The practice of using plants to treat diseases and get relief from physical sufferings is as old as the origin of mankind [14, 15]. As per the estimated reports of the WHO, in developed nations around 80% of the total population rely majorly on the phytomedicines for maintaining their health and fulfilling basic requirements [16-19].

India comes under the category of world biodiversity centres which is blessed with the rich medicinal plant history having more than 45,000 diverse species of plants; therefore, it is considered as Botanical garden of the world [20, 21]. Indian medicinal plants are used in many traditional systems of medicine such as Ayurveda, Siddha, Unani Folk system, and as well as allopathy [22]. Ayurveda is the most ancient traditional medicine system. There are almost 600 medicinal plants and their formulations are being in use in Ayurvedic practices for the treatment of several diseases [23]. In U.K. around 25% of population use phytomedicines in their day-to day routine. Phytomedicines are used in each and every corner of the world. Medicinal herbs are used for the healing purpose by African population [24]. In **Figure no; 01(Bhringraj)**

Medicinal plant

Africa, traditional medicines are being in use since 4000 years. These medicines served as the primary health-care system in the absence of modern medicines [25, 26]. More than 1000 species of plants are mentioned in the compendium of Materia Medica which is an ancient encyclopedia of TCM [27]. In China, medicinal plants are being in therapeutic use in dietary therapy for numerous years and thus maintaining the health [28, 29]. As per the reported data, 60 out of 104 global drugs that are used for last 37 years have been derived from the TCM plants [30]. In countries like West Africa modern drugs are not affordable by many people thus people rely on phytomedicines for cure and heal purpose [31]. About 85% of Swazis and Nigerians use traditional medicine as a health-care system [32, 33]. Approximately 27% of South African population uses traditional medicines as its main health care system. Eclipta Alba (L.) (Fig. 1) is one of most well-known and valuable medicinal plants in India. It is commonly named as false daisy and Bhringaraj and Karisilakanni. Genus Eclipta originated from the Greek word "Deficient" which means absence of the bristles and awns on the fruits [34, 35]. E. Alba (L.) belongs to the family Asteraceae. This medicinal plant has rich ethnomedicinal history. E. Alba and its therapeutic value has also been mentioned in classical text "Bhavaprakash" [36].In Ayurveda, it is named as "bhringoraaja", in Unani system; it is named as "bhangra" whereas in Siddha it is named as "karissalaankanni" [37]. E. Alba is categorized into three categories on the basis of the color of the flowers/fruits which are white-flowering, the yellow-flowering, and the black-fruiting. Each type is found in marshes, rivers, and lakes or on the foothills of the Himalayas in India [33]. This medicinal plant is mostly used in tropical and sub-tropical regions as a traditional medicine. It is also utilized as a functional food [38]. It is a very famous hepatoprotective drug and popularly called as "King of hair" [39]. The extracts of this medicinal herb are used as preventive measure or as anti-venom against snakebite. It is used to treat issues related to gastro-intestinal tract, respiratory issues, to heal cut and wounds, inflammation, and many more diseases [40-44]. Wedelolactone, demethylwedelolactone, desmethyl-Wedelolactone, furanocoumarins, oleanane and taraxastane glycosides, and 7glucoside are the primary coumestan derivatives present in E. Alba [45, 46].

Figure no; 02 Powder of Bhringraj

It belongs to the family of sunflower, an annual plant that grows about 3 metres in height. It grows forlorn, white flower, having well developed and differentiated stem, leaves, flower and root. It is generally found within the fringe of garden, field where there is a presence of moisture, warmth like wetland. It has long stalk and white coloured flowers with are solitary, winged and about 6 to 8 mm in diameter. The leaves are sessile, lance shaped and arranged in opposite orientation. It has distinct cylindrical and gray coloured roots.

Table 1 Taxonomical Classification

1.	Kingdom	Plantae
2.	Subkingdom	Viridaeplantae
3.	Division	Tracheophytina
4.	Sub division	Sermatophytina
5.	Class	Magnoliopsida
6.	Order	Astranae
7.	Family	Asteraceae
8.	Genus	Eclipta
9.	Species	Alba
10.	Common Name	Bhringraj

Table 2 Vernacular Name

1	Latin name	Eclipta Alba
2	Common name	False daisy
3	Hindi name	Bhangra, Bhangraiya
4	Marathi name	Maka
5	Gujarati name	Bhangaro
6	Arabic name	Kadim-ul-bint, Radim-el-bint
7	Punjabi	Bhangra, dodhak, Babri
8	Bengali	Kesuriya, kesuti
9	Tamil	KaiKehsi
10	Telugu	Galagara, Gunta, Galijaeru
11	Malayalam	Cajenneam, Kanni
12	Asamese	Kehraj
13	Konkani	Mako, Kajalamavu

In Ayurveda, Bhringraj has special attention because of its multidimensional and traditional applications; in modern science also, it is an important research drug due to its proven pharmacological activities. [47] Bhringraj offers protection to the liver from harmful chemicals that can damage it. It also possesses certain chemical compounds which have anti-toxic activities contributing to the regeneration of liver cells. The plant is thus commonly used as hair oil all over the India for healthy black and long hair. The fresh juice of leaves is used for increasing appetite, improving digestion and as a mild bowel regulator.

The plant has a reputation as an anti-ageing agent in Ayurveda. Eclipta Alba is used as a general tonic for debility. Externally, it is used for inflammation, minor cuts and burns and the fresh leaf-juice is considered very effective in stopping bleeding. Leaf juice mixed with honey is also used for children with upper respiratory infections and also used in eye and ear infections. Eclipta Alba is a source of coumestan type compounds used in phytopharmaceutical formulations of medicines prescribed for the treatment of cirrhosis of the liver and infectious hepatitis. [48]

Ayurvedic Properties:

The Ayurvedic properties of the plant according to the kala.

One of the most known properties of Eclipta Alba is its hepatoprotective or anti- hepatotoxic properties. Eclipta Alba (L.) Hassk. Has been widely used in India for the traditional treatment of liver disorders [50]. The coumestans- wedelolactone and dimethyl wedelolactone, isolated from this plant have been reported to exhibit anti-hepatotoxic activity in assays employing CCl_4, galactosamine and phalloidin induced cytotoxicity in rat hepatocytes [51]. Eclipta Alba powder has been found to counteract an increase in liver weight, hepatic lipid peroxidation, liver γ-glutamyl transpeptidase, serum alanine transferase, serum alkaline phosphatase and serum albumin to globulin ratio induced in rats (in vivo) by CCl_4. The tincture of the plant is used for liver and kidney problems and it is also reported to have therapeutic potential against cardiovascular disorders [52]. In recent years, microbial infections have increased to a great extent and antibiotic resistance has become an ever-increasing therapeutic problem [53]. The aqueous and alcoholic extracts of the plant are proved to confer neuropharmacological activity [54]. Screenings of anti-fungal properties have also been studied in some fungal strains like Candida tropicalis, Rhodotorula glutinis, and Candida albicans [55]. The plant Eclipta Alba performs the crucial function

of mediator of the exogenous type, to stimulate proliferation of follicular keratinocyte and at the same time retard the terminal differentiation with the help of downregulation of the expression of TGF-β1. Thus, it can be used in the treatment of certain types of alopecia [56]. Luteolin, present in the Bhringraj plant extract, plays a role in preventing epileptic seizures [57,58]. This plant has also been mentioned as a nervous tonic [59]. Pharmacological Properties: The pharmacological activities of Bhringraj were explored from different sources such as research papers, web resources, databases and books. The properties and activities were studied in depth to know the different role of the phytochemical constituents of the plants with respect to the respective pharmacological properties and are classified below:

PHYTOCHEMISTRY OF E. ALBA (BHRINGRAJ):
E. Alba (Bhringraj) contains wide range of diverse phytochemical constituents which include coumestans, alkaloids, flavonoids, glycosides, polyacetylenes, and triterpenoids, phenolic acids, saponins, sterol, sesquiterpene lactones, proteins, amino acids, carbohydrates, and many more [60-64]. Some major phytochemicals are shown in (Fig. 2).

Coumestans:
Coumestans are the main active phytochemical constituents of E. Alba which are the derivatives of coumarin. Wedelolactone, demethylwedelolactone, demethylwedelolactone-7-glucoside, isodemethylewedelol actone, and strychnolactone are the main coumestans present in the whole plant especially in the leaves. These are believed to be associated with anti-cancer properties [66-69].

Alkaloids:
The major alkaloids present in E. Alba leaves are (20S) (25S)- 22,26-imino-cholesta-5,22(N)-dien-3β-ol (verazine, 3). Other novel alkaloids reported are 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), 25βhydroxyverazine and (8), Ecliptalbine (4). While methanolic extract of the plant contains alkaoilds such as verazine, 20-epi3-dehydroxy 3-oxo-5, 6-dihydro-4, 5- dehydroverazine ecliptalbine, (20R)-4s hydroxyverazine, 4shydroxyverazine, (20R) 25s-hydroxyverazine, and 25shydroxyverazine. Some other reported alkaloids are ecliptine, nicotine, verazine, and dehydroverazine ecliptalbine [70].

Saponin:
Saponins are mainly associated with the cytotoxic activity. EclAlbatin, alpha-amyrin, ursolic acid, and oleanolic are novel triterpene saponin which has been isolated from the whole plant of E. Alba [71-73]. EclAlbatin, dasyscyphin C is present in the roots which are associated with the properties such as anticancer, antiviral, and antioxidant activity [74].

Sterols:
Stigmasterol, daucosterol, stigmasterol-3-O-glucoside, phytosterol, and β-glucoside of phytosterol are the major sterols present in E. Alba seed [75, 76]. Stigmasterol is an important sterol which is involved in the process of synthesis of major reproductive hormones like progesterone, androgens, estrogens, and corticoids [77].

Flavonoids:
Apigenin, luteolin and luteolin-7-glucoside, and orobol are the main flavonoids present in E. Alba. Apigenin and luteolin are associated with the anti-cancer properties [75].

Terpenoids and their glycosides EclAlbasaponins VII–X (taraxastane triterpene glycosides), eclAlbasaponins I–VI (oleanane triterpene glycosides), eclAlbasaponins I–VI (triterpene glycosides), ecliptasaponins C and D (triterpenoid glucosides), eclAlbatin, α-amyrin, β-amyrin, oleanolic acid, ursolic acid (triterpenoids), wedelic acid are the main terpenoids, and their glycosides present in E. Alba. Oleanolic acid, eclAlbatin, and α-amyrin, are present in the whole plant

Volatile oil:
Heptadecane, 6,10,14-trimethyl-2-pentadecanone, n-hexadecanoic acid, pentadecane, eudesma-4(14),11-diene, phytol, octadec-9-enoic ecid, 1,2-benzenediacarboxylic acid (Z)-7,11-dimethyl-3-methylene-1,6,10- diisooctyl ester, (Z,Z)-9,12 octadecadienoic acid, dodecatriene, (Z,Z,Z)-nt [77].

In Himachal Pradesh India, people use leaf decoction of E. Alba against headache. The extract obtained from the leaves is used against head lice, cold, and asthma [78]. E. Alba is a common remedy for the upper respiratory infections and eye/ear infections in children. Bhringraj oil is used all over the India for good hair [79]. In Punjab, Pakistan leaves, roots, and flowers of E. Alba are prescribed by herbal healers as a cure for liver disorders, hepatic, and spleen ailments. Leaves are used to enhance the digestion and appetite. The whole plant is used as hair tonic, whereas leaves are used to treat athlete's foot disease [80,81]. In Bahawalnagar District, Punjab, Pakistan, people use to chew E. Alba leaves to improve their eye health and they treat hypertension using the extract of this plant [82]. In Bahawalpur, Pakistan, this plant is used as a blood purifier and hair tonic. It is also used against leprosy, itching, earache, jaundice, fevers and bleeding disorder, toothache

and gum complaints, nausea, and vomiting [83]. In Odisha, India, leaves are used as an antibacterial agent [84]. The juice of E. Alba is useful for the expulsion of worms in infants. Manipuri tribes use stem decoction of this plant against liver enlargement while use extracts of leaves in cough and fever. Toto tribe of India uses it as an antidote against scorpion sting. Some communities of Odisha use it as remedy for itching, conjunctivitis and other eye problems. Tribal Societies of Anaikatty Hills, Tamil Nadu, consumes this plant against antifertility, antidote to snake bite, fever, and headache. It is used against toothache, headache, gland swelling, and elephantiasis by people of Sagar tribes, Madhya Pradesh. Asthma, bronchitis, and leukoderma are treated by consumption this plant by tribal Societies of Saurashtra, Gujarat [85]. In Chandauli District of Uttar Pradesh, people use leaves of E. Alba against dandruff along with seeds of Foeniculum vulgare [86]. In Javadhu Hills Tamil Nadu, E. Alba leaves are used for treating diabetes [87]. Gujjars of Rajaji Tiger Reserve, Uttarakhand, treat liver problems with the leaves of this plant [88]. In some areas of Tamil Nadu, people use the paste made up of leaves of E. Alba to prevent dandruff and to enhance the hair growth [89]. In some villages of Dakshin Dinajpur District, West Bengal, people use leaf and seed of this plant to treat problems related to stomach and liver, inflammation, digestion, and use it as a hair tonic [90]. In West Nimar district, Madhya Pradesh, people use oil extracted from the seeds of E. Alba to enhance the hair growth [91]. In areas around the Dandeli Wild Life Sanctuary, people

Treat warts and leprosy by applying the E. Alba leaf juice [92]. People of Warangal district of Andhra Pradesh, use this plant to avoid hair fall and provide strength to hair and to increase the appetite [93]. The people of Nandurbar tribe of Maharashtra use this plant as a remedy for menorrhagia [94]. The tribal people of Peth and Trimbakeshwar of Nashik District, Maharashtra, the leaves of E. Alba are used for treating the injuries caused by mud [95].

PHARMACOLOGICAL ACTIVITTY OF E. ALBA (BHRINGRAJA):

E. Alba (Bhringraja) has variety of phytochemical constituents present in it which exhibit various therapeutic properties. Some of its reported therapeutic uses are summarized below. Hepatoprotectivity Singh et al. conducted a study on rats and mice models in which lung injury was induced artificially by carbon tetrachloride. It was found that alcoholic extract of E. Alba (Bhringraja) exhibit hepatoprotective activity at a dosage of 62.5–500.0 mg/kg p.o. Extract restored all the changes induced by carbon tetrachloride [96]. The experimental study conducted by Naik et al., on albino rat models treated with high fatty diet to investigate the hepatoprotective activity of E. Alba (Bhringraja) demonstrated that phytochemical constituents such as Wedelolactone, demethylwedelolactone, and saponins are associated with hepatoprotectivity. It was found that these phytochemicals significantly reduced the fat deposition, mononuclear infiltration, and necrotic foci. Regeneration of hepatocytes in the liver was also stimulated by these phytochemical constituents [97]. This activity was also investigated by Ahirwar and Saxena, on albino rat models. Models were artificially induced with hepatotoxicity by carbon tetrachloride. It was found that isolated fraction of E. Alba had significant hepatoprotective potential at dosage of 200 mg/kg body weight. The protein levels were restored after the treatment with E. Alba extract. [98]. This activity was also supported by a comparative study conducted by Kumar et al., on albino rat models. In this study paracetamol was used to induce hepatotoxicity in the models. Alcoholic and aqueous extracts were comparatively investigated. It was found that alcoholic extract of E. Alba has more potent hepatoprotective activity [99]. Indhuleka and Jeyaraj performed an investigative study on animal models to find out the hepatoprotective nature of E. Alba. Models were induced with hepatotoxicity by paracetamol. Study revealed that E. Alba has potent hepatoprotective activity [100].

MORPHOLOGY [101]

Figur no; 03 Root of Bhringraj

1. **Root** – Variety of secondary branches arise from the main root up to about 7 mm in diameter, grayish, achromatic and cylindrical.
2. **Stem** – Nonwoody branched, seldom maturation at nodes, cylindrical or flat, rough due to broken white hairs, nodes, discrete, greenish and rarely brownish.

Figure no; 04 Leaf of Bhringraj

3. **Leaf** – Opposite, sessile to subsessile, 2.2 – 8.5 cm long, 1.2 – 2.3 cm wide, sometimes regular, lanceolate, sub-entire, sub-acute or acute, strigose with adpressed hairs on both the surfaces.

Figure no; 05 Flower of Bhringraj

4. **Flower** – Solitary or two together on unequal axillary peduncles; involucral bracts concerning eight, ovate, obtuse or acute herbaceous, strigose with laden hairs; ray flowers ligulate, ligule small, spreading scarcely as long as bracts, not toothed, white; disc flowers tubular corolla often four toothed; pappus absent, except occasionally very minute teeth on the top of achene; stamen five, filaments epipetalous free, anthers united into a tube with base obtuse; pistil bi-carpellary, ovary inferior, unilocular with one basal ovule.
5. **Fruit** – Achenial cypsela, one-seeded, cuneate with a narrow wing, covered with wart excrescences and brown in color.

Figer no; 06 Seeds of Bhringraj

6. **Seed** – 0.2 – 0.25 cm long, 0.1 cm wide, dark brown, hairy and endospermic.

Macroscopic Examination [102]

- **Root-** Well developed, a number of secondary branches arise from main root, upto about 7 mm in dia., cylindrical, greyish.
- **Stem** – Herbaceous, branched, occasionally rooting at nodes, cylindrical or flat, rough due to oppressed white hairs, node distinct, greenish, and occasionally brownish.
- **Leaf** - Solitary or 2, together on unequal axillary peduncles; involucral bracts about 8, ovate, obtuse or acute, herbaceous, strigose with oppressed hairs; ray flower lingulate, ligule small, spreading, scarcely as long as bracts, not toothed, white; disc flowers tubular, corolla often 4 toothed; pappus absent, except occasionally very minute teeth on the top of achene; stamens 5, filaments epipetalous, free, anthers united into a tube with base obtuse; pistil bicarpellary; ovary inferior, unilocular with one basal ovule.
- **Fruit** – Achenial cypsela, one seeded, cuneate, with a narrow wing, covered with warty excrescences, brown.

Figer no; 07 Plant of Bhringraj

- **Seed** – 0.2-0.25 cm long, 0.1 cm wide, dark brown, hairy and non-endospermic.

THERAPEUTIC USES OF E. ALBA (BHRINGRAJA):

Hepatoprotectivity Singh et al. conducted a study on rats and mice models in which lung injury was induced artificially by carbon tetrachloride. It was found that alcoholic extract of E. Alba (Bhringraja) exhibit hepatoprotective activity at a dosage of 62.5–500.0 mg/kg p.o. Extract restored all the changes induced by carbon tetrachloride [103]. The experimental study conducted by Naik et al., on albino rat models treated with high fatty diet to investigate the hepatoprotective activity of E. Alba (Bhringraja) demonstrated that phytochemical constituents such as Wedelolactone, demethylwedelolactone, and saponins are associated with hepatoprotectivity. It was found that these phytochemicals significantly reduced the fat deposition, mononuclear infiltration, and necrotic foci. Regeneration of hepatocytes in the liver was also stimulated by these phytochemical constituents [104]. This activity was also investigated by Ahirwar and Saxena, on albino rat models. Models were artificially induced with hepatotoxicity by carbon tetrachloride. It was found that isolated fraction of E. Alba had significant hepatoprotective potential at dosage of 200 mg/kg body weight. The protein levels were restored after the treatment with E. Alba extract. [105]. This activity was also supported by a comparative study conducted by Kumar et al., on albino rat models. In this study paracetamol was used to induce hepatotoxicity in the models. Alcoholic and aqueous extracts were comparatively investigated. It was found that alcoholic extract of E. Alba has more potent hepatoprotective activity [106]. Indhuleka and Jeyaraj performed an investigative study on animal models to find out the hepatoprotective nature of E. Alba. Models were induced with hepatotoxicity by paracetamol. Study revealed that E. Alba has potent hepatoprotective activity [107].

Hair growth:

Begum et al. conducted a study on nude mice to evaluate the hair growth promoting activity of E. Alba. Petroleum ether extract (PEE) along with other solvent fractions of E. Alba was topically applied on the backs of nude mice. Prominent follicular hypertrophy was observed after the treatment with PEE. In the basal epidermal and matrix cells, follicular keratinocytes number was increased. These changes support E. Alba use in the growth of hair [42]. Another study conducted by Begum et al., supported the use of E. Alba for hair growth. The study was conducted on nude mice models which were genetically suffering from hair loss due to abnormal keratinization. It was revealed from the study that topical application of methanolic extract of E. Alba had significant impact on the hair growth of mice models. It was observed that hair follicle number had increased after the treatment which shows that E. Alba is a brilliant hair growth promoter [108]

Antiepileptic Activity:

Methanol extraction of leaf powder of E. Alba Hassk. Was evaluated for its antiepileptic activity through Maximal Electroshock Test (MES) in rats. The extract was administered orally to rats for 7 days at doses of 50, 100 and 200 mg per kg body weight. One hour after the last treatment, seizures were induced in rats by delivering electroshock of 150mA for 0.2s with an electroconvulsiometer through a pair of ear clip electrodes. A decrease in duration of hind leg extension was taken as a parameter for anticonvulsant activity. Compared to controls, rats administered extract at different doses exhibited significant decrease in the duration of time spent in extensor phase in a dose-dependent manner. The antiepileptic activity was attributed to wedelolactone.[109]

Analgesic and Anti-Inflammatory Activity:

The analgesic activity of ethanol extract of E. Alba Hassk. whole plants as well as total alkaloid fraction was seen in experiments with albino mice by using standard experimental models such as the tail clip method, the tail flick method, and the acetic acid induced writhing response. The results from this study showed that both the ethanol extract and the total alkaloids produced good analgesic activity in all the different models of analgesic tested. Total alkaloid fraction showed better analgesic activity than ethanolic extract.[54] The anti-inflammatory effect of the plant was evaluated using carrageenan, mediators such as histamine and serotonin induced paw edema, and cotton pellet induced granuloma tests for their effect on acute and chronic phase inflammation models in rats. The results indicated potent anti-inflammatory activity of the plant in all the models tested.[110]

Anti-hyperlipidaemic activity:

The mainstream Ayurvedic practice in India uses Eclipta prostrata to treat hyperlipidaemia. The value of the treatment was proved by research conducted on Albino rats using the alcoholic extract of Eclipta prostrata. The dose of 150 mg/kg & 200 mg/kg body weight of the rats decreased the total triglycerides and other lipid levels in serum, liver, and heart. The control subject group was investigated with standard drugs (clofibrate/guggul); the results obtained with the rats treated with Eclipta prostrata extract were similar to that of the control subject group. This result supports the hypolipidemic activity of Eclipta prostrata and its use for the treatment of anti-hyperlipidaemia [111].

Anti-venom activity:

Eclipta Alba contributes majorly to the property of anti-venom, and the three main components of action are due to the presence of stigmasterol, sitosterol, and wedelolactone [46]. This activity has been proved to be effective against venoms of species such as Bothrops jararaca, Bothrops jararacussu, Lachesis muta [46] and C. durissus terrificus [47]. The

components of the plant utilize the mechanism such as anti-phospholipase A_2 activity and anti-myotoxic for inhibitory purposes [112,113].

Anti-bacterial activity:
urrently, many pharmaceutically important secondary metabolites are isolated from herbal plants or trees as their artificial synthesis is not economically feasible. Natural products obtained from plants serve as a major source of medicine and about 1/4th of total drugs found today come from plant origins. The methanolic and butanolic extract of Eclipta Alba shows a very effective anti-microbial activity against various species of bacteria and fungi [33]. This indicates the potential anti-bacterial nature of this plant. The anti-bacterial compounds present in this plant may serve as an affordable and new source for the treatment of infectious disease [34]. Eclipta Alba has been tested against Klebsiella pneumoniae in an in silico docking study using the software application 'Biovia Discovery Studio'. The results indicated that the glutamic acid present in the extract as a phytochemical and used here interacts with the bacterial enzyme glycerol dehydrogenase to disrupt the life cycle of the organism. Therefore, major phytochemicals evaluated for the anti-bacterial activity against Klebsiella pneumoniae in silico were glutamic acid, phenylalanine, luteolin, cystine and apigenin with glutamic acid showing the most effective interaction [114].

Anti-stress:
Chanu et al. studied anti-stress property of E. Alba in Labeo cAlbasu fingerlings in stress was induced by acid. It was observed that ethanolic extract of the plant exhibited anti-stress activity by restoring the levels of stress hormones – serum cortisol, glucose, alanine amino transferase, aspartate amino transferase – and enzymes – lactate dehydrogenase, malate dehydrogenase, ATPase, superoxide dismutase, and catalase which showed its anti-stress activity [115]

Anti-viral:
A study conducted by Manvar et al., against Hepatitis C virus (HCV) showed that E. Alba extract had significant inhibitory actions against RNA dependent RNA polymerase activity of HCV replicas in vitro whereas it caused inhibition of HCV replication in cell-culture system which showed its anti-viral potential [116].

Memory enhancer Banji et al. examined the memory enhancing activity of E. Alba. The suspension of E. Alba extract in distilled water was administered to rat models. They evaluated the transfer latency of models on an elevated plus maze. The study revealed that E. Alba is associated with memory enhancing activities [117].

Immunomodulatory:
Syed et al. evaluated the immunomodulatory behavior of E. Alba in an in-vitro study. It was found that coumestans such as Wedelolactone and demethylwedelolactone had inhibitory actions against trypsin which supports its use as an immunomodulatory agent [118]

Antioxidant activity:
The methanol and hydrolyzed extract of Eclipta Alba Hassk. Has been assessed for its antioxidant potential in both in vitro and ex vivo models. The in vitro antioxidant activity was evaluated through 2, 2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging and nitric oxide radical inhibition activity. The ex vivo antioxidant activity was determined through lipid peri oxidation inhibitory activity on mice liver homogentic by thiobarbituric acid reactive substances (TBARS) method. The methanolic extract and hydrolyzed extract both showed potent antioxidant activity in both models in proving to be powerful scavengers DPPH free radicals and nitric oxide radicals, as well as being inhibitors of lipid peri oxidation. [119]

Antimicrobial Activity:
Various solvent (petroleum ether, benzene, chloroform, acetone, methanol, and aqueous) extracts of Eclipta Alba Hassk. Were found to be active against clinical isolates from oral cancer cases. These isolates included various bacteria like Staphylococcus aures, Escherichia coli, Staphylococcus epidermis, P. aeruginosa, Klebsiella pneumoniae, Proteus mirabilis and Proteus vulgaris and funguses like Candida albicans and Aspergillus fumigatus. [120].

Cardiovascular Effect:
The effect of administration of dried E. Alba Hassk. leaf powder (3g per day) has been studied in mild hypertensive subjects. Subjects were given six capsules (500 mg powder per capsule) in three doses per day for 60 days. When compared with placebo given control groups, the results showed that Eclipta-supplemented group showed a marked reduction in mean arterial pressure by 15%, total cholesterol (17%), low-density lipoprotein fraction (24%), triglycerides (14%), very-low-density lipoprotein fraction (14%), and plasma lipid perioxides (18%). There was a marked increase in urine volume (34%), urine sodium (24%) in the Eclipta-administered group. The findings indicated that the leaf powder possessed diuretic, hypotensive and hypercholesterolemic properties and helps in the alleviation of oxidative stress induced complications in hypertensives.[121]

Skin disease:

E.Alba leaves are used to remove ectoparasites in dogs in Trinidad and Tobago. The Ayurvedic formulation containing E.Alba powder was shown to provide complete remission in 22.6% and diagnosis of disease recurrence in 89.5% of patients with eczema.

Cardio vascular effects: - Ethanol extract from E. Alba leaves and leaf capsules was tested for heart inhibitory activity in isolated frog hearts. The extracts showed negative ionotropic and negative chronotropic effects as well as reduced cardiac output. Callus extract showed a higher inhibitory effect on the heart than leaf extract at doses of 20 mg.An Ayurvedic formulation containing E. Alba Hassk. Powder has been shown to provide complete remission to 22.6% and checked the recurrence of the disease in 89.5% patients of "Vicharchika" (eczema).[122]

Hair oil:

Figure no; 08 Hair oil of Bhringraj

Bhringraj is widely used in Ayurvedic hair care to promote hair growth, prevent hair fall, strengthen hair follicles, reduce dandruff, and slow premature graying

Antidiabetic Activity:

In alloxan-diabetic rats, oral administration of leaf suspension of E .Alba Hassk. (2 and 4 g/kg body weight) for 60 days resulted in significant reduction in blood glucose (from 372.0 ± 33.2 to 117.0 ± 22.8), glycosylated hemoglobin HbA(1)c, decrease in the activities of glucose-6 phosphate and fructose 1,6-bisphosphatase, and an increase in the activity of liver hexokinase, all of these activities being beneficial for amelioration of hyperglycemia and other diabetes-related complications.[123]

Antioxidant activity:

The methanol and hydrolyzed extract of Eclipta Alba Hassk. Has been assessed for its antioxidant potential in both in vitro and ex vivo models. The in vitro antioxidant activity was evaluated through 2, 2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging and nitric oxide radical inhibition activity. The ex vivo antioxidant activity was determined through lipid peri oxidation inhibitory activity on mice liver homogentic by thiobarbituric acid reactive substances (TBARS) method. The methanolic extract and hydrolyzed extract both showed potent antioxidant activity in both models in proving to be powerful scavengers DPPH free radicals and nitric oxide radicals, as well as being inhibitors of lipid peri oxidation. [124]

Cytotoxic activity:
Herbal medicine represents an important part of traditional medicine. For the treatment of several physical, physiological and mental problems, herbal medicines are used extensively. Eclipta prostrata holds an excellent reputation of having been used as an agent of medicine. The cytotoxicity screening is a standard marker for anti-cancer activity as the anti-tumour and anti-proliferative presence of plant extract can be evaluated by it. In a major study, the carbon tetrachloride soluble fraction of methanolic extract of Eclipta prostrata showed the highest degree of cytotoxicity having LC50 of 1.318 µg/ml. It proves that Eclipta prostrata is a potent cytotoxic drug and can be used in cancer therapeutics which will be available at much cheaper costs and will be much safer than the chemotherapeutic drugs which are currently utilized for the purpose of the treatment of cancer [125]

Anti-fungal activity:
The unregulated usage of synthetic/chemical fungicides for disease management has many environmental imputations like drug resistance in the target pathogens and poses pollution issues. Eclipta Alba shows potential anti-fungal properties. It has been tested to be effective against plant fungi in vitro as well as in vivo conditions, for e.g. Sorghum grain mould pathogens such as Fusarium thapsinum, Alternaria alternata, Epicoccum sorghinum, and Curvularia lunata [126].

Anti-inflammatory activity:
Inflammation is a physical condition which is observed by swelling, redness, pain, heat and at times a loss of function as a result of infection or injury. Inflammatory mediators like complement proteins, histamine, kinins, prostaglandins and pro-inflammatory cytokines have been suggested to play a role in the mechanism of inflammation in rats [26]. Some of these mediators are considered to be inhibited by the methanolic extract of leaves of Eclipta prostrata. The anti-inflammatory activity exhibited by methanolic extract of whole plants of Eclipta prostrata has shown similar effects as that of the standard drugs such as indomethacin and cyproheptadine. The aqueous extract of Eclipta prostrata seeds showed inhibition of protein (egg albumin) denaturation in a dose dependent manner with an IC50 value of 1710 µg/ml with pure diclofenac sodium as a standard reference drug [27]. In vitro egg albumin assay is a standard technique for measuring anti-inflammatory activity and even though its effectiveness was lower than the standard drug which is a NSAID, the potential of Eclipta prostrata component(s) as a safe anti-inflammatory remedy cannot be ignored. The methanolic extracts of Eclipta prostrata leaves have proven to show the anti-oedematous property during the first phase of oedema development by inducing an inhibitory effect on the release of active pain substances such as histamine, serotonin, polypeptides, or prostaglandins Wedelolactone, an important constituent derived from the plant, is thought to suppress inflammation by inhibiting infiltration of neutrophils along with decreased MPO activity, thus regulating anti-inflammatory responses of fungal keratitis in mice. It has also proven to decrease the maturation of the pro-inflammatory IL-1β which is one of the pivotal mediators of host immune response to inflammatory stimulation [127].

CONCLUSION
For Urdhvaga Amlapitta, Bhringaraj is a holistic, safe, and natural medication. Its traditional Rasa-Guna-Veerya-Vipaka profile precisely fits the disease's Samprapti vighatana. The medication works by boosting Agni, balancing Amla-Pitta, and revitalising the stomach tissue. Large-scale experimental studies in the future may confirm its efficacy as a substitute for contemporary acid-suppressive treatments. Thus, in compliance with the tenets of Hetu viparita chikitsa and Pitta-shamana karma, Bhringaraj churna might be suggested as an adjunct or stand-alone therapy in Amlapitta chikitsa.

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