

REVIEW

Accentuating the prodigious significance of *Eclipta alba* – An inestimable medicinal plant

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Abstract: *Eclipta alba* is a small branched perennial herb, which has been used as a traditional medicine in different countries mainly in tropical and subtropical regions of the world. The plant *E. alba* plays a significant role in the ayurvedic, traditional and unani systems of medicine. It is popularly known as “Bhringaraj”. The herb has been known for its medicinal value and has been used as an analgesic, antimyotoxic, antihepatotoxic, antibacterial, antioxidant, antihemorrhagic, antihyperglycemic and immunomodulatory and also recognized as a reincarnated plant. Broad range of chemical constituents have been detached from *E. alba* including coumestans, alkaloids, thiopenes, flavonoids, polyacetylenes, triterpenes and their glycosides. Pharmacological activities have been seen in the metabolites and extracts of this plant. Therefore this herb produces robust curative lead compounds, which would be propitious for humanity. The purpose of this review recapitulates all data related to *E. alba* considering its prodigious medicinal importance.

Keywords: *Eclipta alba*, antihepatotoxic, coumestans, alkaloids.

INTRODUCTION

Medicinal plants have immense significance for the health care of mankind. These plants contain some phytochemicals that have medicinal value to yield specific physiological activities on human beings. Tannins, flavonoids, phenolic compounds and alkaloids are the major bioactive composites of these plants (Hill, 1952). Traditional medical practices play a fundamental role in the culture of many fostering countries. Traditionally, either in the form of simple plant raw material, pure form of crude extracts or mixtures was used in all medical products. According to recent studies there are several thousands of plants that have a medicinal value (Farnsworth and Soejarto, 1991). Through multidisciplinary pathways integrating ethnobotanical, botanical, phytochemical and biological techniques take precedence to discovery of drugs from plants (Newman *et al.*, 2000). Against many pharmacological targets, plants yield novel principal molecules to boost up the drug discovery system. For the development of drugs, *E. alba* provides us new advantageous molecules against to distinctive pharmacological points.

E. alba (Fam: Asteraceae) is a small branched perennial herbaceous plant along with a history of traditional medicines uses in various countries especially in tropical and subtropical regions of the world. Throughout India, it commonly grows as a natural weed, in Himalayas arises

to 1800 m, commonly found in regions of upper northern plains, in grazing lands, Chota Nagpur roadsides and in territories of Orissa and Bihar, Punjab, Western India, South India (Sharma *et al.*, 2001). It is perpendicular or prone, many are branched, perennial, almost hairy, rooting at the buds, opposite leaves, stalkless and simple leaves (Mithun *et al.*, 2011). It is commonly found in India, China, Taiwan, Philippines, Japan and Indonesia (Neethi and Kothari, 2005). Its botanical name has been declared as *E. alba* haaski, syn. *E. prostrata* Linn (Kritikar and Basu, 1933). It is commonly known as “Bhringaraj” in Sanskrit, “Bhangra” in English and “Karichalankanni” in Tamil. *E. alba* also popularly known as “false daisy”. False Daisy is generally found growing on barren land. Leaves of this plant are 2.5-7.5 cm long. On a long stalk, it has small white daisy like flowers and short, prostrate or circular, brown stem. It has been reported that *alba* grows in India, Bengal, Sri Lanka, Myanmar, Malaysia, Japan, China, Korea, Hong Kong (Kritikar and Basu, 1933) and Pakistan (Stewart, 1972). In Ayurvedic medicine, use of *E. alba* gains greater prosperity. Hindus use bhringaraj in their Shradh, the custom for bestow honor to a latterly perish person. *Eclipta alba* is also integrated in Hindu’s “Ten Auspicious Flowers” (Somnath *et al.*, 2010).

Pharmacological magnitude of *E. Alba*

The whole plant is especially beneficial for ringworms, used as a hair colour, for liver and spleen enlargement, hepatitis, jaundice, alopecia and as a conventional tonic (Manju *et al.*, 2011). The plant has an acerbic, acute,

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warm and dry taste in ayurveda and has a remedy for “Kapha” and “Vata” imbalances (Mahesh *et al.*, 2004). Many herbal products composed of *E. alba* are accessible for the remedy of viral hepatitis and jaundice, and for hepatoprotective activity this plant has been broadly studied (Wagner *et al.*, 1986; Saraf *et al.*, 1991; Singh *et al.*, 1993; Saxena *et al.*, 1993; Singh *et al.*, 2001). Its common usage in India as a deobstruent (anti-blocking) and cholagogue (promoting bile flow) in jaundice, liver enlargement and other maladies of gall bladder and liver has been declared (Orning *et al.*, 1980). Armor against the myotoxic effects of snake venome are analyzed in the alcoholic and aqueous extracts of *E. alba* (Mors *et al.*, 1989). In addition, it has also been reported that *E. alba* exhibits anti-inflammatory, anti-nociceptive and bronchodilating activities (Leal *et al.*, 2000). In Ayurveda (a traditional Indian system of medicine), this plant has been noted for eminence anti-aging properties and also commonly used to enhance the memory and learning. *E. alba* is an adventurous plant for the care of hair, use of this plant can stimulate the growth of hair and also check the hair loss (Neethi and Kothari, 2005).



Fig. 1: *E. alba* (Jadhav *et al.* 2009)

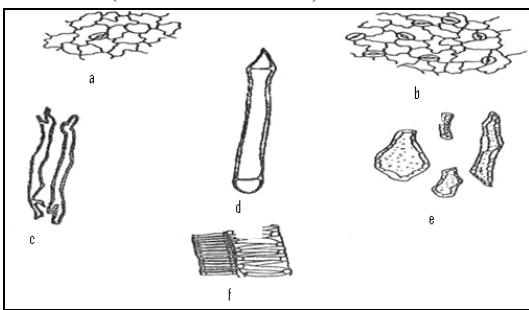


Fig. 2a: showing upper epidermis, b: lower epidermis, c: fiber, d: covering trichomes, e: stones cells and f: vessels of *E. alba* (Jadhav *et al.*, 2009)

From *E. alba*, four composites have been detached, of which two were distinguished as alpha-terthenyl and stigmasterol. Alpha-terthienyl is a symbolic component for hepatoprotective activity (Han *et al.*, 1998; Songchow Lin *et al.*, 1998). *E. alba* has a significant use in catarrhal jaundice, chronic skin diseases and widely used as a diuretics in spleen and hepatic enlargement and as a tonic. Antiviral activity has been declared from the alcoholic extracts of plant against Ranikhet disease virus. This plant is generally used as hair oil for long, strong and healthy black colour hair in all over India. The fresh juice of leaves reported to play a significant role in promoting digestion, as an appetite catalyst and as placid bowel regulators (Baskaran and Jayabalan, 2005). This plant has therapeutic effects against insomnia and vitiligo (Leucoderma) and the leaves of *E. alba* has been declared for their antihyperglycemic activity (Ananthi *et al.*, 2003). The roots of *E. alba* were found to be capable of wound healing (Patil *et al.*, 2004). It has been mentioned that *E. alba* acquires hypotensive and myocardial depressant effects and ethanolic extracts of *E. alba* have an antioxidant potential against various free radicals (Gupta *et al.*, 1976; Ashish *et al.*, 2011). It has been reported that intake of *E. alba* in combination with black cumin is helpful to reduce the sugar levels. Leaves of *E. alba* have been found to be the affluent source of natural dyes (Murali *et al.*, 2002; Sarg *et al.*, 1981). In Asia, this plant has been used as a conventional medicinal plant, for the prevention of atherosclerosis and hyperlipidemia. It has a therapeutic value for the treatment of peptic ulcer and also is beneficial to boost up appetite and body weight of tuberculosis patients. Immunomodulatory activity has also been reported. Anthelmintic activity has been reported from the aqueous and ethanolic extracts of *E. alba*. But ethanolic extracts of *Eclipta* exhibit profuse significant anthelmintic activity as compared to the aqueous extracts and Albendazole (Somnath *et al.*, 2010). This plant has also been used for the relief of toothache and headache (Wealth of India, 1952; Lim and Guzman, 1968; Indian Herbal Pharmacopoeia, 1998; Cherallier, 1996; Kirtikar and Basu, 1975). It is reported that plant is externally used for ulcers and as an antiseptic for wounds in cattles in Punjab and Gujarat district (Nahid *et al.*, 2004). The extracts of this plant are beneficial for uterine haemorrhage and menorrhagia. Development of Ehrlich’s ascites carcinoma cell lines suppressed by the use of an ethanolic extracts (5%) of *E. alba*. It is also reported that *E. alba* has an influence on central nervous system (Kritikar and Basu, 1975). It has been mentioned that armor of neuronal tissues probably due to the immunomodulatory activity of *E. alba*. Hence, this plant can assist as a potential memory modulator (Otilia *et al.*, 2007). A novel detached component Dasyscyphin-C (saponins) from *E. alba* revealed to have anticancerous activity (Khanna and kannabiran, 2008). It has been mentioned that *E. alba* also contains coumarin compounds which acquires anti-inflammatory and

bronchodilator activities (Jadhav *et al.*, 2009). *E. alba* is used as a common medicine for infectious diseases (Scott, 1998). Its antifungal and insecticidal properties has also been known. It has been concluded that *E. alba* inhibits aging and rejuvenate hair, bone, teeth, memory, sight and hearing (Mithun *et al.*, 2011). Honey, Adrak (*Zingiber officinale* Rosc.) and Kali mirch (*Piper nigrum* Linn) have been declared to be an effective antidotes and cotton seeds and oil declared as a substitute of *E. alba* (Usmanghani *et al.*, 1997; Hakim, 1937). Protracted usage of *E. alba* may be noxious to individuals with enthusiastic personality (Usmanghani *et al.*, 1997). In herbal medicines, it has been reported that *E. alba* is used for the treatment of different kidney diseases (Somnath *et al.*, 2010). *E. alba* is also noted to have a significant role in osteoblastic bone formation, and may lead towards the increment of bone-forming drugs (Lin *et al.*, 2010). Leaf extracts of *E. alba* have found to confer the hypolipidemic activity (Dhandapani *et al.*, 2007). Triterpenoids and saponins are significant chemical components found in *E. alba* for leishmanicidal activity and antiproliferative activity (Zhao *et al.*, 2001; Lee *et al.*, 2008; Venkatesan *et al.*, 2009). The extracts of plant reported to yield a symbolic defence against stress induced variations (Thakur and Mengi, 2005).

Phytochemical constituents

E. alba (L.) consists of expansive ambit of active constituents including alkaloids, coumestans, glycosides, flavonoids, triterpenoids and polyacetylenes. The leaves of *E. alba* have been reported to contain wedelolactone, demethylwedelolactone, demethylwedelolactone -7-glucoside, stigmasterol and β -terthienylmethanol (Wagner *et al.*, 1986). It has been declared that the roots of *E. alba* provides heptacosanol and hentriacontanol and also contains thiophene acetylenes like 5I-senecieryl oxymethylene-2-(4-isovaleryloxybut-3-ynyl)-dithiophene, 2-(3-acetoxy-4-chloro-but-1-ynyl)-5-(pent-1,3-diynyl) thiophene, 5I-tigloyloxymethylene-2-(isovaleryloxybut-3-ynyl)-dithiophen, stigmasterol, E.1 β -amyrin, phytosterol, in the n-hexane extract and β -glucoside of phytosterol, luteolin-7-glucoside, a glucoside of a triterpenic acid and wedelolactone in extracts of polar solvent has been notified in the aerial parts of this plant. Cinnaroside, apigenin and sulfur compounds have been also found in aerial parts of *E. alba*. On hydrolysis, the polypeptides detached from the plant succumb glutamic acid, cystine, tyrosine, phenyl alanine, and methionine. It has also been declared that *E. alba* contains nicotine and nicotinic acid (Jadhav *et al.*, 2009). Seeds of *E. alba* subsume alkaloids and sterols (Mehra and Handa, 1968) and stems of *E. alba* comprise of wedelolactone (Khare, 2004), wedelic acid, methanol, L-terthienyl, apigenin, luteolin (Williamson, 2002). Whole plant of *E. alba* consists of E. 1 [a terthienyl aldehyde], 2-angeloyloxy methylene-5I-[but-3-en-1-ynyl] dithiophene, 5- isovaleryloxy methylene-2-(4-isovaleryloxy-but-3-ynyl) dithiophene (Daniel, 2006)

isoflavonoids, wedelolactone, desmethy-lwedelolactone, 7-O-glucoside (Williamson, 2002).

The herb is an affluent source of ascorbic acid and also involves alkaloids and ecliptine. The plant is an excellent source of thiophene derivative which has been found to be effective against nematodes (Somnath *et al.*, 2010). *E. alba* consists of thiophene derivatives like E. 1 (Singh 1988), and derivatives of coumestan such as demethylwedelolactone and wedelolactone which are the active constituents (Wagner, 1986). In root parts, several dithienylacetylene esters (I, II, III) are revealed (Jain and Singh, 1988). Saponin composites such as alkaloids (Williaman and Li, 1970) eclalbosaponins I-IV, oleanane type triterpenoids, triterpene saponin eclalbatin (Upadhyay *et al.*, 2001), echinocysticacid, eclalbasaponin II, eclalbasaponin V, eclalbasaponin I and eclalbasaponin III (Varghese *et al.*, 2010) have also been reported. Blood thinning type composite (Coumestan) specifically wedelolactone and dimethyl wedelolactone have been uninhabited as a paramount effective constituents of *E. alba* and these constituents demonstrate anti-hepatoprotective activity (Wagner *et al.*, 1986; Franca *et al.*, 1995). It has been reported that intake of *E. alba* in combination with black cumin is helpful to reduce the sugar level.

Coumestans

Coumestan is a natural composite which is a derivative of coumarin. Coumestan configures the cardinal base of various organic compounds collectively known as coumestans. Many plants comprise of coumestans including phytoestrogen and coumestrol. Two main active coumestans have been detached from *E. alba* namely wedelolactone and desmethylwedelolactone (Neerja *et al.*, 2008). Wedelolactone (W) and Demethylwedelolactone (DMW) acquire persuasive antihepatotoxic activity and suggested for the cure of cirrhosis and hepatitis (Murphy *et al.*, 1979).

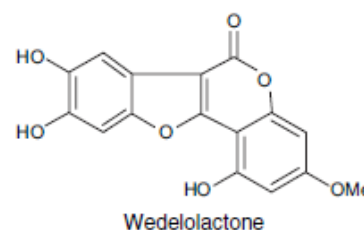


Fig. 2: Structure of wedelolactone demethylwedelolactone

Saponins

A novel triterpene saponin called eclalbatin, along with ursolic acid, alpha-amyrin and oleanolic acid have been desolated from the whole plant of *E. alba*. On the basis of spectral and chemical details, the eclalbatin structure has been constituted as 3-O-beta-D-glucopyranosyl-3-beta-hydroxy-olean-12-en-28-oic acid, 28-O-beta-D-arabinopyranoside (1) (Upadhyay *et al.*, 2001). Recent

studies concluded that isolated triterpenoids saponins from this plant have immunosuppressant, anti-microbial, antitumorigenic and anti-venom potential (Liu *et al.*, 2000; Pithayanukul *et al.*, 2004; Sawangjaroen *et al.*, 2005; Zhang and Guo, 2001; Zhao *et al.*, 2001; Wiart *et al.*, 2004).

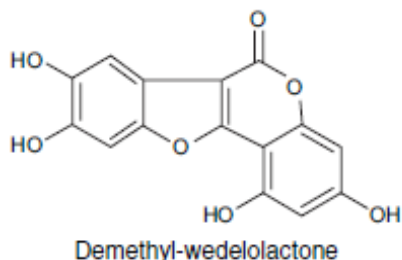


Fig. 3: Structure of (Padma *et al.*, 2007)

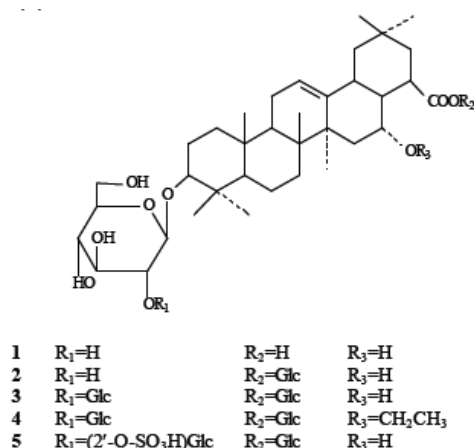


Fig. 4: Structure of saponins 1-5 (Tang *et al.*, 2001)

Alkaloids

Recent studies revealed that *E. alba* comprises of alkaloid-ecliptine. Eight bioactive steroidal alkaloids (1-8) have been isolated through fractionation of methanolic extract of *E. alba* by employing three yeast strains (1138, 1140, and 1353), from which six steroidal alkaloids were revealed first time from nature. The main alkaloids have been classified as (20S)(25S)-22, 22(N)-dien-3 β -ol (verazine, 3), 26-imino-cholesta-5, although the novel alkaloids were identified as 20-epi-3-dehydroxy-3-oxo-5,6-dihydro-4,5-dehydroverazine (1), *E. albina* [(20R)-20-pyridyl-cholesta-5-ene-3 β , 23-diol] (4), (20R)-4 β -hydroxyverazine (5), 4 β -hydroxyverazine (6), (20R)-25 β -hydroxyverazine (7), and 25 β -hydroxyverazine (8) (Maged *et al.*, 1998).

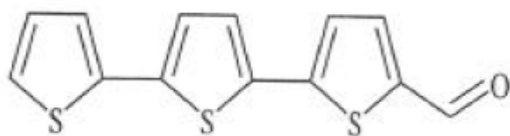


Fig.5: Structure of E. 1 (Jadhav *et al.*, 2009)

Terpenoids and their glycosides

Taraxastane triterpene glycosides, called eclalbasaponins VII-X have been isolated, along with four oleanane glycosides eclalbasaponins I-VI. The configuration of eclalbasaponins VII-X were analyzed as 3 β ,20 β ,16 β and 3 β ,20 β ,28 β trihydroxytaraxastane glycosides and their sulphated saponins (Shoji *et al.*, 1997). From stem bark, of *E. alba*, two oleanane-type glycosides eclalbasaponin I and eclalbasaponin II along with the pervasive steroid and stigmasterol have been isolated (Mohammad *et al.*, 2005). Six novel triterpene glycosides, called eclalbosaponins I-VI. Structures were analyzed as echinocystic acid glycosides and those of V-VI have been declared to be sulphated saponins (Shoji *et al.*, 1994). The occurrence of flavones of apigenin and luteolin, as the flavone-7-O-glycoside and the flavone-C-glucosides are the active colorant in *E. alba* (Padma *et al.*, 2007).

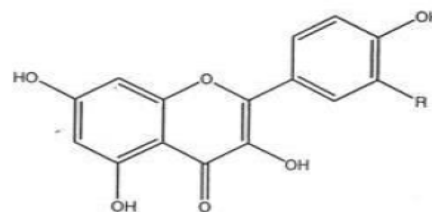


Fig. 6: Structures of Apigenin, R=H and Luteolin, R=OH (Jadhav *et al.*, 2009)

Volatile components

Through hydro distillation process, volatile components have been isolated from the aerial parts of *E. alba* and identified by GC-MS of 55 components which comprise 91.7% of the volatiles, have been analyzed by comparing mass spectrum library (NIST 05.L) with mass spectra. The major constituents found were as follows: heptadecane (14.78%), 6,10,14-trimethyl-2-pentadecanone (12.80 %), n-hexadecanoic acid (8.98%), pentadecane (8.68%), eudesma-4(14), 11-diene (5.86%), phytol (3.77%), octadec-9-enoic acid (3.35%), 1,2-benzenedicarboxylic acid diisooctyl ester (2.74%), (Z,Z)-9,12octadeca-dienoic acid (2.36%), (Z)-7,11-dimethyl-3-methylene-1,6,10-dodecatriene (2.08%) and (Z,Z,Z)-1,5,9,9-tetramethyl-1,4,7-cycloundecatriene (2.07%) (Xiong *et al.*, 2010).

Supplementary biological activities

Ethanollic and ethyl acetate extracts of *E. alba* have been analyzed for their antibacterial activities against *Klebsiella pneumonia*, *Shigella dysenteriae*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Salmonella typhi* and *Staphylococcus aureus* (Karthikumar *et al.*, 2007). In southern Thailand, AIDS patients have been noted to use *E. alba* mixing with a non-plant material as a self-medication and also used to shower children agonized from malnutrition for 9 days (Sawangjaroen *et al.*, 2005; Cheryl Lans, 2007). It has been suggested that by combining different medicinal plants like parts of *Triphala formula* (*Embolica officinalis* (amalaki), *Terminalia chebula*, (haritaki), *Terminalia*

Table 1: A summary of active constituents and biological activities of vibrant constituents of *E. alba*

| S. No. | Active constituents | Biological activities | References |
|--------|------------------------|---|---|
| 1. | Wedelolactone | Anti-bacterial, Anti-venom, Anti Hepatotoxic, Trypsin Inhibitor | (Vianna-da-Silva <i>et al.</i> , 2003), (Karthikumar, 2007), (Nazim Uddin <i>et al.</i> , 2010) |
| 2. | Demethylwedelolactone | Anti-venom, Anti-Hepatotoxic, Anti-haemorrhage, Dye | (Mukherjee and Poddar, 1976), (Wagner <i>et al.</i> , 1986), (Vianna-da-Silva <i>et al.</i> , 2003), (Meena <i>et al.</i> , 2010) |
| 3. | Eclalbatin | Antioxidant | (Tewtrakul <i>et al.</i> , 2007) |
| 4. | Eclalbosaponins | Antiproliferative, Antigiardial, Hair revitalizing | (Neerja <i>et al.</i> , 2008), (Sawangjaroen <i>et al.</i> , 2005), (Rupali <i>et al.</i> , 2009) |
| 5. | Ecliptalbine, Verazine | Analgesic, Lipid lowering | (Maged <i>et al.</i> , 1998) |
| 6. | Dasyscyphin C | Anticancer, Antiviral | (Khanna and Kannabiran, 2008) |
| 7. | Coumarin | Anti-inflammatory, Bronchodilator | (Jadhav <i>et al.</i> , 2009) |

Table 2: Chemical constituents present in different parts of *E. alba*

| S. No. | Parts | Chemical Constituents | References |
|--------|--------------|--|----------------------------------|
| 1. | Seeds | Alkaloids (Ecliptalbine), sterols | (Mehra and Handa, 1968) |
| 2. | Roots | Ecliptal, Eclalbatin, Hentriacontanol, Heptacosanol & Stigmasterol | (Jadhav <i>et al.</i> , 2009) |
| 3. | Stem | Wedelolactone, wedelic acid, methanol, Lterthienyl, apigenin, luteolin | (Williamson, 2002) (Khare, 2004) |
| 4. | Leaves | Wedelolactone (1.6%), demethylwedelolactone, Stigmasterol demethylwedelolactone-7- glucoside | (Wagner <i>et al.</i> , 1986) |
| 5. | Aerial parts | Apigenin, Eclalbasaponin I-VI, Cinnaroside, sulphur compounds, Luteolin-7-0-glucoside & β -amyirin | (Jadhav <i>et al.</i> , 2009) |
| 6. | Whole plant | Nicotine, Resins, Reducing agents, Eclalbatin, Oleanolic acid, Ecliptine, Triterpene saponin, Ursolic acid | (Williamson, 2002). |

belerica (bibhitaki)), *E. prostrata* (bhringaraj), *Caltropis gigantea* (arka) and *Smilax officinalis* (sariva) when mixed with sesame oil and boiled, the mixture resulted in a medicated oil, which is a remedy for skin diseases (Bensky and Andrew, 1986).

Poly- therapy

It has been noticed that leaves of *Acacia catechu* in combination with *E. alba* are helpful to curtail serious hepatotoxicity (Rolf and Ruediger, 2009). A herbal amalgam consisting of *Picrorrhiza kurroa*, *Phyllanthus nigrum*, *Boerhaavia diffusa*, *Zingiber officinale*, *Andrographis paniculata*, *Embelia officinalis*, *Terminalia arjuna*, *Cichorium intybus*, *Embelia ribes*, *Terminalia chebula*, *Piper longum* along *E. alba* is used as an excellent digestive (Bruce *et al.*, 2000). The whole plants of *E. alba*, *Mimosa pudica*, *Vitex negund*, and aerial parts of *Solanum nigrum* acquire astringent, anti-inflammatory properties and also assist in regeneration of the vascular endothelium (Sahu and Srivastava, 2001). A combination of *Piper longum* (Pippali mool), *Anethum sowa* (Shatapushpa), *Valeriana wallichii* (Tagar), *Withania somnifera* (Ashwagandha), Triphala (A herbal mixture of three fruits) and *Cassia fistula* (Aragvadh) with *E. alba* conciliate the intense Vata dosha and in combination with *Herpestris monniera* (Brahmi) and *Elaeocarpus ganitrus*

(Rudraksha) exhibited tranquilizer effect (Haveliwala, 1963). It has been declared that in Jersey and Holstein, out bred cows production of milk can be enhanced by the use of Galactin Vet Bolus, a polyherbal substance contains *E. alba* (Baig and Bhagwat, 2009).

CONCLUSION

E. alba gives us significant activities to elixir various diseases. Broad range of chemical constituents have been found in this plant. *E. alba* has also a great pharmacological importance. Antioxidant, hepatoprotective, anti-bacterial, antivenom, anti-proliferative, antifungal, anti-inflammatory activities have also been reported. Further research on *E. alba* can boost up the isolation of novel compounds which will be beneficial to study pharmacological activities and for the betterment of health.

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