

Eclipta prostrata (L.)L.(Asteraceae): Ethnomedicinal Uses and Chemical Constituents

Subjects: **Tropical Medicine**

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Eclipta prostrata (L.) L. (Syn.: *Eclipta alba* (L.) Hassak, Family: Asteraceae) is an important medicinal plant in the tropical and subtropical regions. It is widely used in treating various diseases of skin, liver and stomach in India, Nepal, Bangladesh, and other countries.

Eclipta prostrata

Eclipta alba

ecalbasaponin

hepatoprotective

wedelolactone

1. Introduction

The use of plants in traditional medicines covers a wide range of therapeutic uses to treat the infection as well as many chronic diseases ^{[1][2][3][4]}. Many people still rely on the traditional medicine and healthcare because of their wider cultural acceptance and affordability ^[5]. The plant based bioactive compounds have been an important source of modern drugs discovery and development ^[6]. Hence, the medicinal value of various plants should be explored with their pharmacological significance and potential application in different products.

Eclipta prostrata (L.) L. (Syn.: *Eclipta alba* (L.) Hassak, Family: Asteraceae) is commonly known as False daisy or Ink plant in English and locally known as *Bhringraj*, *Bhumiraj*, *Aali jhar*, and *Nash jhar* in Nepali language (**Figure 1**) ^{[7][8]}. *E. prostrata* is a medium-sized, branched, annual herb-bearing white flower natively found in the tropical and subtropical regions of the world ^{[9][10]}. It grows mostly in moist sites such as swamp edges, river or lake banks and edge of rice-fields and easily propagated and spread throughout China, India, Nepal, Brazil and other parts of the world ^{[8][11][12][13]}. It is widely distributed in tropical and sub-tropical regions of Asia, Africa, and South America (**Figure 2**) ^{[14][15]}. Traditionally, it is used to treat different skin problems such as wounds, hair loss prevention, and dermatitis. The leaves are used to treat snakebite in India, China, and Brazil. The mixture of leaf juice and honey is used to cure catarrh in infants ^{[16][17]}. The juice of *E. prostrata* is taken orally or applied locally to promote hair growth ^[18].



Figure 1. Photographs of *Eclipta prostrata* (Photos by Basu Dev Neupane, used with permission).



Figure 2. Distribution map of *Eclipta prostrata*. (Source: GBIF, <https://www.gbif.org/species/5384950> (accessed on 1 November 2021) [15]).

Various research articles have been published regarding the chemical constituents and biological activities of different plant parts of *E. prostrata*. Critical analysis of these published scientific studies would provide the detailed understanding about the potential use of *E. prostrata* as medicine, cosmetic, and other formulations along with highlighting the gaps in research.

2. Ethnomedicinal Uses

This plant is widely used in different regions of India for the treatment of skin problems, hepatic problems such as jaundice, gastrointestinal problems, respiratory problems such as asthma, and other symptoms such as fever, hair loss and whitening of hair, cuts, and wounds, spleen enlargement, etc. [19][20]. The leaf juice is used with honey to cure catarrh in infants, shoot juice and mustard oil is taken together for diarrhea and dysentery, and the whole plant is used for the treatment of symptoms related to hepatitis, itching, hemoptysis, bleeding, hematuria, diarrhea, and diphtheria [16]. The leaves and shoots are used in preventing infection in wounds and its treatment in Nepal [7][8][11][21]. Some ethnic groups in South American countries use it to treat snakebites [22]. In Ayurveda, it is used for its

revitalizing and anti-aging properties [23]. Many ethnic groups of Bangladesh use it for the treatment of jaundice [24] [25]. The plant juice has been used to control, kill, and inhibit the growth of diseases carrying vectors such as mosquito [26][27]. Additionally, it is also used to treat different types of symptoms such as acidity, alopecia [28], gingivitis, fever, body pain, asthma, bronchitis, burns, constipation, wounds, wrinkles, edema, pimples, and other skin diseases [29][30][31][32].

3. Bioactive Chemical Constituents

Eclipta prostrata contains a wide range of active phytoconstituents, which includes coumestan derivatives, triterpene saponins, steroidal saponins, triterpenes, steroids, steroidal alkaloids, flavonoids, phenolic acids, thiophene derivatives and many other compounds. Most of the chemical analysis are reported for whole plant or aerial parts. The detailed list of these compounds is given in **Table 1** and **Table 2**. The structures of main coumestan derivatives, triterpene saponins and flavonoids are represented in **Figure 3**, **Figure 4** and **Figure 5**, respectively.

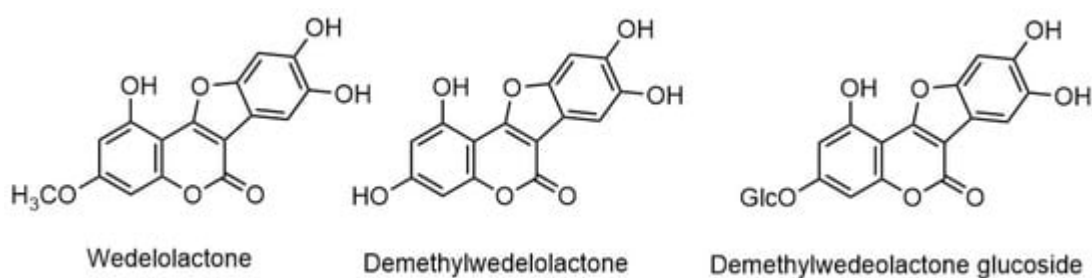


Figure 3. Structures of major coumestan derivatives.

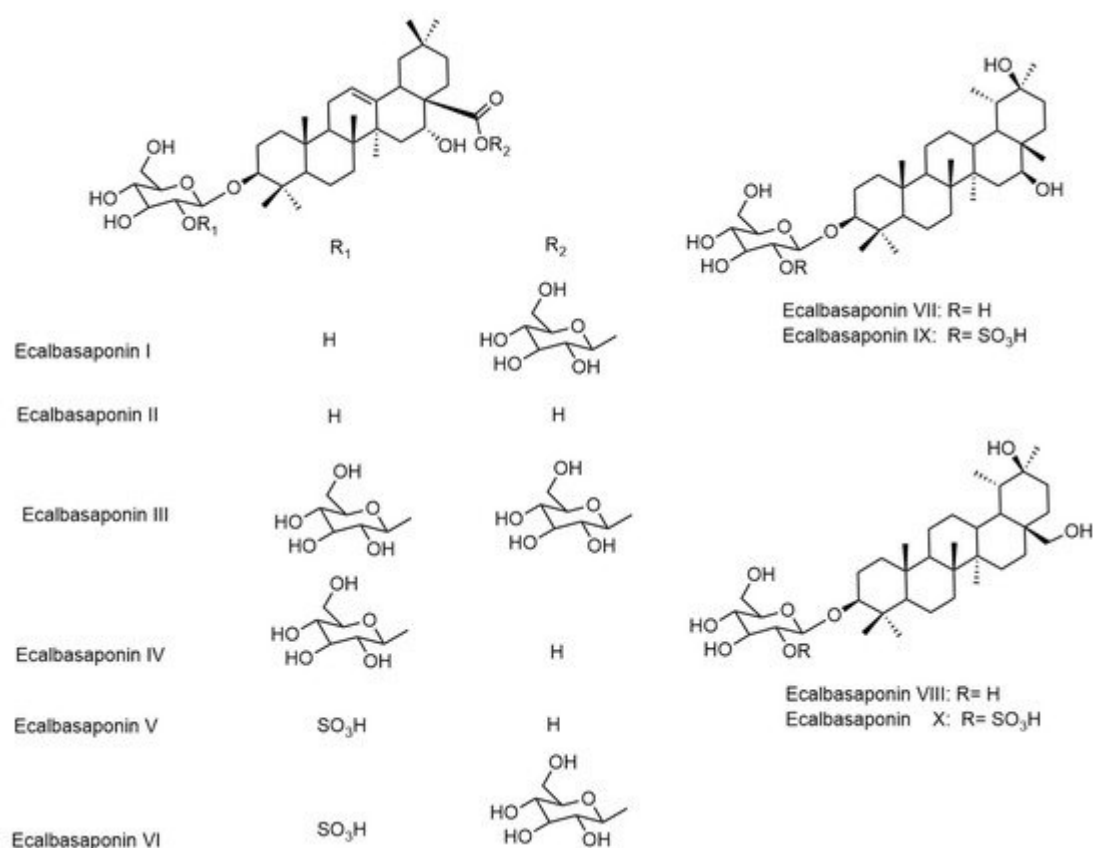


Figure 4. Structures of main triterpene saponins.

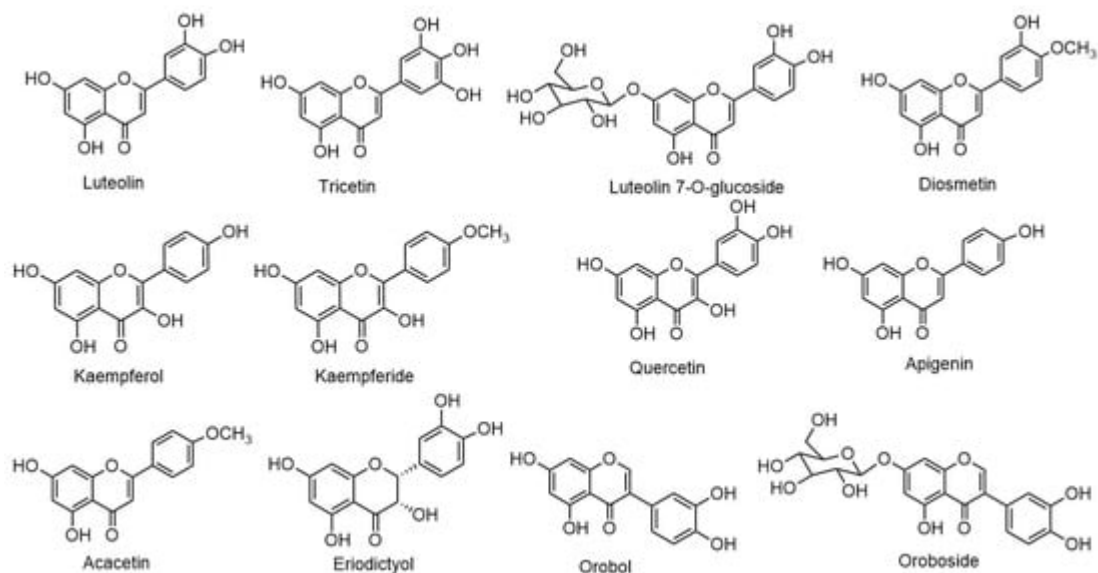


Figure 5. Structures of main flavonoids.

Table 1. Coumestan, steroid and triterpene derivatives and related compounds from various parts of *E. prostrata*.

Chemical Compounds (Class/Constituents)	Plant Parts	References
<i>Coumestan derivatives</i>		

Chemical Compounds (Class/Constituents)	Plant Parts	References
Wedelolactone	Leaves	[21] [33] [34] [35] [36]
Demethylwedelolactone	Leaves	[35] [36]
Isodemethylwedelolactone	Whole plant	[36]
Strychnolactone	Whole plant	[36]
Demethylwedelolactone glucoside	Aerial Parts	[37]
<i>Steroidal and triterpene saponins, steroidal alkaloids, steroids and triterpenoids</i>		
Eclalbasaponins I	Whole plant	[34] [38] [39]
Eclalbasaponins II	Whole plant	[34] [38] [39]
Eclalbasaponins III	Whole plant	[34] [38] [39]
Eclalbasaponins IV	Whole plant	[38] [39]
Eclalbasaponins V	Whole plant	[34] [38] [39]
Eclalbasaponins VI	Whole plant	[38] [39]
Eclalbasaponins VII	Whole plant	[38]
Eclalbasaponins VIII	Whole plant	[38]
Eclalbasaponins IX	Whole plant	[38]
Eclalbasaponins X	Whole plant	[38]
Eclalbasaponin XI	Whole plant	[38]
Eclalbasaponin XII	Whole plant	[38]
Eclalbasaponin XIII	Whole plant	[38]
Eclalbasaponin A	Whole plant	[40]
Eclalbasaponin B	Whole plant	[40]
Eclalbasaponin C	Whole plant	[40]
Eclalbasaponin D	Whole plant	[40]
Echinocystic acid	Whole plant	[40]

Chemical Compounds (Class/Constituents)	Plant Parts	References
Echinocystic acid-3-O-(6-O-acetyl)- β -D-glucopyranoside	Aerial parts	[41]
Eclalbatin	Aerial Parts	[42][43]
3 β ,25-Dihydroxy-23 <i>E</i> -lemmaphyll-8,23-diene	Whole plant	[44]
16 α -Hydroxy-olean-12-en-3-on-28,21 β -olide	Whole plant	[44]
3 β -Hydroxy-17-epi-28-norolean-12-en-16-one 3-O- β -D-glucopyranoside	Whole plant	[44]
3 β -O-(6-O-Crotonyl- β -D-glucopyranosyl)-16 α -hydroxy-olean-12-en-28-oic acid 28-O- β -D-glucopyranosyl ester	Whole plant	[44]
3-O-(2-O-Acetyl- β -D-glucopyranosyl) oleanolic acid-28-O-(β -D-glucopyranosyl) ester	Aerial parts	[45]
3-O-(6-O-Acetyl- β -D-glucopyranosyl) oleanolic acid-28-O-(β -D-glucopyranosyl) ester	Aerial parts	[45]
3-O-(β -D-Glucopyranosyl) oleanolic acid-28-O-(6-O-acetyl- β -D-glucopyranosyl) ester	Aerial parts	[45]
3 β ,16 β ,29-Trihydroxy oleanane-12-ene-3-O- β -D-glucopyranoside	Aerial parts	[46]
3,28-di-O- β -D-Glucopyranosyl-3 β ,16 β -dihydroxy oleanane-12-ene-28-oleanic acid	Aerial parts	[46]
3-O- β -D-Glucopyranosyl-(1-2)- β -D-glucopyranosyl oleanic-18- ene acid-28-O- β -D-glucopyranoside	Aerial parts	[46]
(20 <i>S</i>)(25 <i>S</i>)-22,26-Imino-cholesta-5,22(<i>N</i>)-dien-3 β -ol (Verazine)	Leaves	[47]
20- <i>epi</i> -3-Dehydroxy-3-oxo-5,6-dihydro-4,5-dehydroverazine	Leaves	[32][47]
(20 <i>R</i>)-20-Pyridyl-cholesta-5-ene-3 β ,23-diol (Ecliptalbine)	Leaves	[47]
(20 <i>R</i>)-25 β -Hydroxyverazine	Leaves	[47]
20- <i>epi</i> -4 β -Hydroxyverazine	Leaves	[47]
20- <i>epi</i> -25 β -Hydroxyverazin	Leaves	[47]
4 β -Hydroxyverazine	Leaves	[47]
25 β -Hydroxyverazine	Leaves	[47]
Lanost-5,24-dien-3 β -ol-18, 21-olide -3 β - yl tetradecanoate	Whole plant	[48]

Chemical Compounds (Class/Constituents)	Plant Parts	References
α -Amyrin	Whole plant	[43]
Ursolic acid	Whole plant	[43]
Oleanolic acid	Whole plant	[43]
3-Oxo-16 α -hydroxy-olean-12-en-28-oic acid	Aerial parts	[49]
Machaeroceric acid	Aerial parts	[34]
Silphioside C	Whole plant	[50]
Flavonoids		
Luteolin	Aerial parts	[34][41] [51]
Tricetin	Aerial parts	[34]
Luteolin-7-O- β -D-glucoside	Aerial parts	[34][41] [51]
Diosmetin	Aerial parts	[52]
Skullcapflavone II	Whole plant	[51]
Kaempferol	Whole plant	[51]
Kaempferol-7-O- α -D-rhamnoside	Aerial parts	[34]
Kaempferide	Whole plant	[51]
Quercetin	Aerial parts	[51][53]
Quercetin-3-O- β -D-glucoside	Aerial parts	[34]
Apigenin	Aerial parts	[34][41] [51]
Acacetin	Whole plant	[51]
Acacetin-7-O-rutinoside	Whole plant	[51]
Eriodictyol	Whole plant	[50]
Pyracanthoside	Whole plant	[50]
Hesperetin-7-O- β -D-glucoside	Aerial parts	[34]
3'-Hydroxybiochanin A	Aerial Parts	[37][49]

Orobol (isoluteolin)	Whole plant	[31] [34]
7-O-Methylorobol-4'-O- β -D-glucopyranoside	Aerial Parts	[34] [49] [50]
7-Dihydroxyl-3', 6'-dimethoxylisoflavone-7-O-glucoside	Whole plant	[51]
3'-O-Methylorobol	Aerial parts	[50] [52]
Pratensein	Aerial parts	[37] [49] [50]
Pratensein-7-O- β -D-glucopyranoside	Aerial parts	[41] [50]
Oroboside (Orobol-7-O- β -D-glucoside)	Whole plant	[34] [37] [50] [51]
<i>Phenolic acids</i>		
Protocatechuic acid	Leaves/Steam/Whole plant	[34] [36] [40] [43]
4-Hydroxybenzoic acid	Leaves/Steam	[34] [40] [43]
Vanillic acid	Aerial parts	[34]
Syringic acid	Aerial parts	[34]
Chlorogenic acid	Aerial parts	[34]
Syringic acid	Aerial parts	[34]
Tachinoside	Whole plant	[50]
Coniferylaldehyde	Whole plant	[50]
Leonuriside A	Whole plant	[50]
Caffeic acid	Whole plant	[50]
Ferulic acid ethyl ester	Whole plant	[50]
Caffeic acid ethyl ester	Whole plant	[50]
<i>Lignin</i>		
Ecliptalignin A		
<i>Coumarins</i>		

Psoralen	Whole plant	[51]
Isopsoralen	Whole plant	[51]
<i>Polyacetylinic compounds</i>		
(5 <i>E</i>)-Hendeca-1,5- dien-7,9-diyne-diol-4- <i>O</i> - β -D-glucopyranoside	Stem	[54]
(5 <i>E</i>)-Trideca-1,5-dien-7,9,11-triyne-3,4-diol-4- <i>O</i> - β -D-glucopyranoside	Stem	[46][54]
3- <i>O</i> - β -D-Glucopyranosyl-1-hydroxy-4 <i>E</i> ,6 <i>E</i> -tetradecene,8,10,12-triyne	Stem	[46][54]
2- <i>O</i> - β -D-Glucosyltrideca-3 <i>E</i> ,11 <i>E</i> -dien-5,7,9-triyne-1,2,13-triol	Stem	[54]
2- <i>O</i> - β -D-Glucosyltrideca-3 <i>E</i> ,11 <i>E</i> -dien-5,7,9-triyne-1,2-diol	Stem	[54]
2- <i>O</i> - β -D-Glucosyltrideca-3 <i>E</i> ,11 <i>Z</i> -dien-5,7,9-triyne-1,2-diol	Stem	[54]
<i>Substituted thiophenes</i>		
5-Hydroxymethyl-(2,2':5',2'')-terthienyl tiglate	Whole plant	[55]
5-Hydroxymethyl-(2,2':5',2'')-terthienyl agelate	Whole plant	[55]
5-Hydroxymethyl-(2,2':5',2'')-terthienyl acetate	Whole plant	[55]
5-Formyl-(2, 2:5, 2'')-terthiophene (Ecliptal)	Whole plant	[56]
5-Hydroxymethyl-(2, 2: 5, 2'')-terthiophene (α -terthienylmethanol)	Whole plant	[56]
5-Methoxy-(2, 2:5, 2'')-terthiophene	Whole plant	[56]
3'-Methoxy-2,2':5',2'')-terthiophene	Aerial parts	[41]
5-(3'',4''-Dihydroxy-1''-butynyl)-2,2'-bithiophene	Aerial parts	[41]
α -Terthienyl	Aerial parts	[41]
α -Formylterthienyl	Whole plant	[54]
α -Terthienyl methanol	Whole plant	[41][54] [56]
3'-Methoxy-2,2':5',2'')-terthiophene	Aerial parts	[41]
4-(2,2'-Bithiophen-5-yl)but-3-yne-1,2-diol	Aerial parts	[57]
Arctinol B	Aerial parts	[57]
2-(Penta-1,3-diynyl)-5-(3,4-dihydroxy-but-1-ynyl)-thiophene	Aerial parts	[57]

6-Methoxy-arctinol-b	Aerial parts	[57]
5-[l-(4-Hydroxybut-1-ynyl)]-2,20 -bithiophene-50 -carbaldehyde	Aerial parts	[57]
5-Hydroxymethyl- (2,2':5',2"-terthienyl)	Aerial parts	[57]
5'-Hydroxymethyl-5-(3-butene-1-ynyl)-2,2' -bithiophene	Aerial parts	[46][57]
3'-Hydroxy-2,2':5',2" terthiophene-3'-O-β-D-glucopyranoside	Aerial parts	[57]
Ecliprostin A	Aerial parts	[58]
Ecliprostin B	Aerial parts	[58]
Ecliprostin C	Aerial parts	[58]
Alkaloids		
Crinumaquine	Whole plant	[51]
2,3,9,12-Tetramethoxyprotoberberine	Whole plant	[51]
Lignans		
Pinoresinol-4-O-β-D-glucopyranoside	Whole plant	[50]
4,4'-Dimethoxy-3'-hydroxy-7,9':7',9-diepoxylicnan-3-O-β-D-glucopyranoside	Whole plant	[50]
Syringaresinol-4'-O-β-D-glucopyranoside	Whole plant	[50]
Lanicepside A	Whole plant	[50]
Longifloroside	Whole plant	[50]
Other compounds		
1-O-Octadecanoyl-2-O-(9Z,12Z-octadecadienoyl)-3-O-[α-D-galactopyranosyl- (1"→6')-O-β-D-galactopyranosyl]glycerol	Whole plant	[50]
(2S)-3-O-α-D-Galactopyranosyl-(1"→6')-β-D-galactopyranosyl-1,2-di-O-[(9Z,12Z,15Z)-octadeca-9,12,15-trienoyl]-sn-glycerol	Whole plant	[50]
1-O-(9Z,12Z,15Z-Octadecatrienoyl)-2-O-hexadecanoyl-3-O-[α-D-galactopyranosyl-(1"→6')-O-β-D-galactopyranosyl]glycerol	Whole plant	[50]
1-O-(β-D-glucopyranosyl)- (2S,3S,4R,8Z)-2N-[(2'R)-2'-hydroxytetracosanoyl]-8-(Z)-octadecene-1,3,4-triol	Whole plant	[50]
(2S,3S,4R,10E)-2-[(2'R)-2'- Hydroxytetracosanoylamino]-10-octadecene-	Whole plant	[50]

1,3,4-triol		
(3 <i>S</i> ,5 <i>R</i> ,6 <i>S</i> ,7 <i>E</i> ,9 <i>R</i>)-3-Hydroxy-5,6-epoxy- β -ionyl-3- <i>O</i> - β -D-glucopyranoside	Whole plant	[50]
Euodionoside A	Whole plant	[50]
Junipeionoside	Whole plant	[50]
Calaliukiuenoside	Whole plant	[50]
<i>rel</i> -(1 <i>S</i> ,2 <i>S</i> ,3 <i>S</i> ,4 <i>R</i> ,6 <i>R</i>)-1,6-Epoxy-menthane-2,3-diol-3- <i>O</i> - β -D-glucopyranoside	Aerial parts	[46]
<i>rel</i> -(1 <i>S</i> ,2 <i>S</i> ,3 <i>S</i> ,4 <i>R</i> ,6 <i>R</i>)-3- <i>O</i> -(6- <i>O</i> -caffeoyl- β -D-glucopyranosyl)-1,6-epoxy menthane-2,3-diol	Aerial parts	[46]
Siliphioside E	Aerial parts	[46]
(2 <i>E</i> ,6 <i>E</i>)- 2,6,10-trimethyl-2,6,11-dodecatriene-1,10-diol-1- <i>O</i> - β -D-glucopyranoside	Aerial parts	[46]
(2 <i>S</i>)-1- <i>O</i> -Stearoyl-3- <i>O</i> - β -D-galactopyranosyl-sn-glycerol	Aerial parts	[34]
(2 <i>S</i>)-3- <i>O</i> -(9 <i>Z</i> ,12 <i>Z</i> -Octadecadienoyl) glyceryl- <i>O</i> - β -D-galactopyranoside	Aerial parts	[34]
Bidensmenthoside A	Whole plant	[50]
Bidensmenthoside B	Whole plant	[50]
11 β ,17-Dihydroxy-beyer-15-ene	Whole plant	[44]
4 β - Hydroxy-guai-10(14),11(13)-dien-12-oic acid	Whole plant	[44]

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