



A comprehensive Review of the Morphology, Phytochemistry and Medicinal Applications of Asteraceae Family Plants.

Dr. Anilkumar. K K, *

*Assistant Professor and HOD, NSS Hindu College, Changanacherry, Kottayam, Kerala, India Pin: 686102. Email: anilkrish09@gmail.com, kkanil123@yahoo.com

Abstract

The Asteraceae family, commonly known as the aster or sunflower family, comprises one of the largest and most diverse plant families in the world. This review study provides an extensive overview of various plants within the Asteraceae family, emphasizing their phytochemical constituents and medicinal applications. In this review, we systematically examine the phytochemistry of selected Asteraceae species, focusing on the identification and characterization of secondary metabolites, including terpenoids, flavonoids, alkaloids, and essential oils. These compounds contribute to the pharmacological properties that make Asteraceae plants valuable in traditional and modern medicine. Furthermore, the review outlines the diverse range of medicinal uses associated with Asteraceae family plants, such as anti-inflammatory, antimicrobial, analgesic, antioxidant, and immunomodulatory activities. The study also sheds light on the challenges and opportunities in the utilization of Asteraceae species in medicine, addressing issues related to sustainability, conservation, and standardization. This review provides a comprehensive understanding of the phytochemistry and medicinal applications of Asteraceae family plants, highlighting their significance in the realm of natural products and traditional healing. It serves as a valuable resource for researchers, ethnobotanists, and pharmaceutical professionals interested in harnessing the rich phytochemical diversity of this plant family for various health-related applications.

Key words: Asteraceae, Phytochemistry, anti-microbial activity, anti-inflammatory, antioxidant activity,

Introduction

Asteraceae, the one of the largest and most diverse families of flowering plants is commonly called aster, daisy, or sunflower family. The members are annual or perennial herbaceous plants with typical dicot root system and the stems erect herbaceous or rarely wooden with or without hairs. Sometimes they may contain latex or resin. Leaves are often simple, alternate, and frequently with stipules. They may vary in shape, ranging from simple entire to deeply lobed or compound. Inflorescences are often in the form of heads or capitula, which can be solitary or in clusters. The flower head is composed of numerous small individual flowers, often arranged in a central disk (disk flowers) surrounded by outer ray florets. The arrangement resembles a single flower. The flower head is enclosed by a series of bracts collectively forming an involucre. The fruits are achenes (dry one seeded cypsela fruits) and are often with a specialized structure called pappus hairs that helps in seed dispersal. The Asteraceae family is ecologically and economically important, with many species being used for food, medicine, and ornamental purpose. Its diversity and adaptability contribute to its wide distribution across various habitats globally.

Objectives of the Review

Our health culture is very much related to the medicinal plants. In Kerala most of the people are directly or indirectly depends on medicinal plants for their health issues. This review focuses on understanding the possibilities of medicinal plants in Asteraceae as an option for sustainable livelihood. The other objectives include the conservation, cultivation, and exploration of medicinal plants after knowing the habit, systematics and medicinal uses.

Materials and Methods

The study is based on the field visit of the area where the plants under study are growing naturally in abundance and their collection. A total of 5 species under 5 genera belongs to the Asteraceae family were collected and identified (Gamble, 1916). The phytochemistry, systematics, ethnomedicinal uses and pharmacological studies of identified plants were performed through online journals, research papers, books and also using search engine web sites such as Google, Google Scholar, Pub Med, Science Direct, Research gate and other online collections for the review study.

Results and Discussion

Systematics: George Bentham & Joseph Hooker's System

Division: Phanerogams; Sub Division: Angiosperms; Class: Dicotyledons; Sub Class: Gamopetalae; Series: Inferae; Order: Asterales; Family: Asteraceae/ Compositae

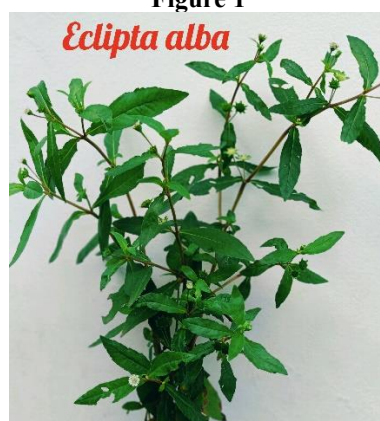
Eclipta alba

Vernacular names: Eng: Trailing eclipta; Hin: Bhamgra, Mocakand; Mal: Kannunni; kayyonni

Taxonomic description:

Eclipta alba (also known as *Eclipta prostrata*) is a species in the sunflower family (Asteraceae). It is an annual herbaceous plant with a height typically ranges from 10 to 40 cm tall. The stem is cylindrical, often slightly ribbed, and branched. The stem surface is covered with fine white hairs (pubescent). Leaves are opposite. Simple, lanceolate to ovate in shape. Both surfaces are sparsely hairy, with a more concentrated hair growth along the veins on the underside. The plant has solitary or clustered flower heads (capitula) at the leaf axils. Flower heads are small, around 6-8 mm in diameter. Flowers are of two types-Ray Florets: White, female, and generally around the edge of the flower head and Disc Florets: Yellow, bisexual, and located in the center of the flower head. Fruit type is an Achene which is small, dry, and single-seeded. The size is about 1-2 mm long. Typically the surface is smooth, sometimes with tiny hairs. The plant is widely distributed in tropical and subtropical regions around the world, often found in moist and disturbed areas such as riverbanks, roadsides, and cultivated fields. This plant is valued not only for its medicinal properties but also for its role in traditional practices and as a component of herbal formulations.

Figure 1



Medicinal Uses: In Traditional Medicine, it is used in Ayurvedic and traditional Chinese medicine for various ailments, including liver disorders, respiratory conditions, and as a general tonic.

Chemical Constituents: The chemical constituents of *Eclipta alba* include a variety of compounds such as:

1. **Alkaloids:**
 - Ecliptine
 - Nicotine
2. **Flavonoids:**
 - Luteolin
 - Apigenin
3. **Terpenoids:**
 - Ecliptalbine
 - Ecliptalbin
4. **Coumestans:**
 - Wedelolactone
 - Demethylwedelolactone
5. **Triterpenes:**
 - Eclalbatin
6. **Saponins**
7. **Steroids:**
 - Stigmasterol
 - β -Sitosterol
8. **Essential oils**

These constituents are believed to contribute to the various medicinal properties of *Eclipta alba*, such as anti-inflammatory, hepatoprotective, antimicrobial, and antioxidant activities.

Emelia songifolia

Vernacular names: Hindi-Hirankuri, English- Lilac Tasselflower or Cupid's Shaving Brush, Malayalam- Muyalcheviyan, Sanskrit- Akhukarni, Tamil- Muyalceevi.

Taxonomic description: *Emelia sonchifolia*, is an annual herbaceous plant belonging to the Asteraceae family that can grow up to 30-60 cm in height. The stems are erect, slender, and can be either branched or unbranched. They are often

reddish or purplish in color and may have a slightly hairy texture. Leaves are arranged alternately along the stem. The basal leaves are ovate to lanceolate with a toothed margin, measuring about 5-15 cm in length. The upper leaves are smaller and more lance-shaped with a more linear appearance. The surface of the Leaves can be smooth or slightly hairy. The plant produces small, solitary, or clustered flower heads (capitula) at the end of the stems or branches. Each flower head is about 1-2 cm in diameter and consists of numerous small tubular flowers. The flowers are typically lilac or purplish-pink, but can sometimes be white. They can bloom throughout the year in tropical climates. The fruit is a small achene, which is a type of dry, one-seeded fruit that does not open at maturity. The seeds are small, brownish, and have a tuft of fine hairs (pappus) that aids in wind dispersal. This plant is commonly found in tropical and subtropical regions. It thrives in open, disturbed areas such as roadsides, gardens, and fields.

Figure 2



Medicinal uses: This plant is often used in traditional medicine and has been reported to possess various therapeutic properties, including anti-inflammatory, antimicrobial, and wound-healing activities.

Chemical constituents: The plant contains a variety of chemical constituents that contribute to its medicinal properties. Some of the key chemical constituents include:

1. **Flavonoids:**

- Quercetin
- Kaempferol
- Luteolin
- Apigenin

2. **Triterpenoids:**

- Friedelin
- Taraxerol
- Taraxerone

3. **Sterols:**

- β -sitosterol
- Stigmasterol
- Campesterol

4. **Phenolic acids:**

- Caffeic acid
- Chlorogenic acid
- Ferulic acid

5. **Coumarins:**

- Scopoletin
- Umbelliferone

6. **Alkaloids:**

- Pyrrolizidine alkaloids (such as senecionine and retrorsine)

7. **Essential oils:**

- Eugenol
- β -caryophyllene

8. **Vitamins:**

- Ascorbic acid (Vitamin C)
- Carotenoids

These compounds are responsible for the plant's anti-inflammatory, antioxidant, antimicrobial, and anti-tumour activities. Studies have shown that the presence of these bioactive compounds contributes to the plant's potential therapeutic effects.

Elephantopus scaber

Vernacular names: Eng: Scarber; Hin: Gobhi; Mal: Anachuvadi

Taxonomic description: *Elephantopus scaber* Commonly known as Elephant's Foot, Prickly-leaved Elephant's Foot, found in tropical and subtropical regions, thriving in open, disturbed areas such as grasslands, roadsides, and forest edges. It is a perennial herb that usually grows to a height range from 30 to 60 cm. The stem is erect, often branching with a rough or scabrous texture. The basal leaves form a rosette at the base and they are obovate to spatulate in shape. They are larger than the stem leaves and their margins are entire to slightly serrate. The stem (cauline) leaves which are lanceolate to elliptic in shape are arranged alternately along the stem. They are also entire to slightly serrate in their margins. Both leaves have rough surface with stiff hairs. The inflorescence type Capitula (flower heads) grouped in clusters at the ends of stems that composed of several small flower heads. The involucre is cylindrical to bell-shaped with multiple layers of bracts (phyllaries). Only disc florets are present, no ray florets. The flower colour is purplish to pinkish and sometimes blue. Tubular corolla with five lobes. Pollination through insects. The fruits are dry single seeded achene with numerous capillary bristles at one end aiding in wind dispersal. It Prefers open woods, clearings, and roadsides, often found in sandy or well-drained soils. It Acts as a pioneer species in disturbed habitats, aiding in soil stabilization and succession.

Figure 3



Medicinal uses: Due to these properties, *Elephantopus scaber* has been used in traditional medicine for treating various ailments such as:

- Wounds and ulcers
- Fever
- Diarrhea
- Respiratory disorders
- Skin conditions

Chemical constituents: some of the key chemical constituents identified in this plant:

1. Sesquiterpene Lactones

- Elephantopin
- Deoxyelephantopin
- Isochlorogenic acid
- Dihydrodeoxyelephantopin
- Dihydroisodeoxyelephantopin

2. Flavonoids

- Quercetin
- Kaempferol
- Luteolin

3. Triterpenoids

- Taraxerol
- Friedelin

4. Sterols

- β -sitosterol
- Stigmasterol
- Campesterol

5. Phenolic Compounds

- Caffeic acid
- Chlorogenic acid
- p-Coumaric acid

6. Other Compounds

- Alkaloids (specific types may vary)
- Essential oils (specific components may vary)

Biological Activities

These constituents are known to exhibit a range of biological activities, including:

- Anti-inflammatory
- Antimicrobial
- Antioxidant
- Antitumor
- Antidiabetic

The presence of these bioactive compounds highlights the potential of *Elephantopus scaber* as a source of natural therapeutic agents.

Vernonia cineria

Vernacular names: Eng: Ash colonised flower; Hin: Dandoolphala, Sadori; Mal: Poovamkurunnal

Taxonomic description: *Vernonia cinerea*, commonly known as Little Ironweed or Ash-coloured Fleabane, is an erect annual herb belonging to the family Asteraceae. It typically grows up to 1 meter in height and displays various distinctive morphological features. Slender and slightly ridged stem which is smooth or sparsely covered with hairs. The leaves are alternately arranged along the stem which are variable in their shape, commonly ovate to lanceolate. They are generally 2-8cm long and 1-3 cm wide. The margin is serrate or dentate. Usually glabrous or slightly hairy on both surfaces. The inflorescence type is terminal corymbs or panicles with numerous small tubular florets. Typically, they are purplish or pinkish in colour. The involucre composed of several series of imbricate hairy bracts. Bisexual flowers with five lobed purple or pink corolla. Pappus calyx that persist in the fruits. The fruit is small, cylindrical to oblong with ribbed surface. Pappus calyx Crowned with bristles that facilitate wind dispersal.

Figure 4



Chemical constituents: The chemical constituents of *Vernonia cinerea* include a range of compounds such as:

1. **Flavonoids:**
 - Luteolin
 - Quercetin
 - Kaempferol
2. **Steroids and Triterpenoids:**
 - β -Sitosterol
 - Taraxasterol
 - Taraxerol
 - Lupeol
3. **Sesquiterpene Lactones:**
 - Vernolide
 - Vernodalol
4. **Phenolic Compounds:**
 - Caffeic acid
 - Chlorogenic acid
5. **Saponins:**
 - Various saponin compounds
6. **Other Constituents:**
 - Coumarins
 - Tannins
 - Alkaloids
 - Essential oils

Medicinal uses: These compounds contribute to the plant's pharmacological activities, which include anti-inflammatory, antioxidant, antimicrobial, and anti-diabetic properties.

Eupatorium odorata* / *Chromolaena odorata

Vernacular names: Eng: Siam weed, Bitter bush: Hin: congress grass; Mal: communist pacha, cheerampacha

Taxonomic description: *Eupatorium odorata*, now more commonly known as *Chromolaena odorata*, is a perennial herbaceous plant or shrub. It is often referred to as Siam weed, bitter bush, or Christmas bush. Young stems are soft and green, turning woody and brown as they mature. They are covered with soft hairs and can reach heights of up to 3 meters (approximately 10 feet). Leaves are simple, opposite, triangular to ovate in shape, with a broad base and pointed tip. Leaf margins are serrated or toothed and are aromatic. Small, tubular, and pale purple to lavender coloured flowers grouped in clusters called corymbs at the ends of branches. Each flower head consists of multiple florets, typically around 15-20 florets per head. Fruits are small, black or brown, ribbed achenes. Each achene is about 2-3 mm long and topped with a pappus of white bristles, aiding in wind dispersal. These morphological features contribute to the plant's invasive nature, enabling it to spread rapidly in disturbed areas, particularly in tropical and subtropical regions.

Figure 5



Medicinal uses: The chemical constituents present in this plant showed pharmacological activities, including anti-inflammatory, antimicrobial, antioxidant, and wound-healing properties. (Ajay et al,2021; T H Hanh .2011; Aba et al,2015)

Chemical constituents: The main chemical constituents include:

1. **Flavonoids:**

- Luteolin
- Quercetin
- Kaempferol
- Apigenin

2. **Terpenoids:**

- Diterpenes (e.g., Chromomoric acid)
- Sesquiterpenes
- Triterpenes (e.g., Friedelin)

3. **Steroids:**

- β -Sitosterol
- Stigmasterol
- Campesterol

4. **Essential Oils:**

- Limonene
- Caryophyllene
- Sabinene
- Germacrene D

5. **Phenolic Compounds:**

- Caffeic acid
- Chlorogenic acid
- Ferulic acid

6. **Tannins:**

- Various hydrolysable and condensed tannins

7. **Saponins:**

- Various saponin compounds

8. **Alkaloids:**

- Pyrrolizidine alkaloids (though typically in low concentrations)

some of the compounds present in this plant are toxic and contribute to the plant's status as an invasive species that can be detrimental to local ecosystems.

Conclusion:

The Asteraceae family, encompassing a diverse array of plant species, has proven to be a rich source of phytochemicals with significant medicinal potential. This comprehensive review has highlighted the extensive range of bioactive compounds, including flavonoids, terpenoids, phenolic acids, and essential oils, found within this botanical family. These compounds have demonstrated a wide spectrum of pharmacological activities, such as anti-inflammatory, antioxidant, antimicrobial, anticancer, and cardioprotective effects. The traditional uses of Asteraceae plants in various cultures underscore their longstanding significance in herbal medicine. Contemporary scientific research has begun to validate these traditional claims, offering a promising outlook for the development of novel therapeutic agents derived from Asteraceae species. However, despite the promising findings, there remains a need for more rigorous clinical trials and standardized methodologies to fully establish the efficacy and safety of these plants in modern medicine. In conclusion, the Asteraceae family holds vast potential for contributing to the field of natural medicine. Continued exploration and integration of traditional knowledge with advanced scientific research will be crucial in unlocking the full therapeutic potential of these remarkable plants. Future studies should focus on the identification of active compounds, elucidation of their mechanisms of action, and assessment of their clinical applications to pave the way for their inclusion in evidence-based medical practice.

References

1. A. Ajay, R. Kumar, S. Badhusha, K. Abhishek, S.K. Gowda, B. Ramesh Pharmacological importance of *Chromolaena odorata*: a review Int. J. Pharm. Drug Anal. (2021), pp. 8-11.
2. Aba, P.E. Joshua, F.C. Ezeonuogu, M.I. Ezeja, V.U. Omoja, P.U. Umeakuana Possible anti-diarrhoeal potential of ethanol leaf extract of *Chromolaena odorata* in castor oil-induced rats J. Complement. Integr. Med., 12 (2015), pp. 301-306, 10.1515/jcim-2014-0033.
3. M.A. Abubakar, A.C. Etonihu, P.E. Kigbu, J.E. Owuna, S.I. Audu Phytochemical and antimicrobial analyses of leaf extracts of *Ceratoteca sesamoides* and *Chromolaena odorata* Int. J. Res., 8 (2020), pp. 65-74
4. Ananthi, J., Prakasam, A. & Pugalendi, K. V., Antihyperglycemic activity of *Eclipta alba* leaf on alloxan induced diabetic rats, Yale J. Biol. Med., Vol-76, 2003, 97-102.
5. Comfort CM, Ogbonnaya AE. Effects of aqueous extracts of *Emilia sonchifolia* on liver enzyme in Dithizone induced diabetes in Rabbits. Nigeria J Animal Res. 2020;24(1):8-15
6. Cibi TR, Srinivas G, Gayathri Devi D, Srinivas P, Lija Y, Abraham A. Antioxidant and Antiproliferative Effects of Flavonoids from *Emilia sonchifolia* Linn on Human Cancer Cells. Int J Pharmacol. 2006;2(5):520-4.
7. Monago CC, Gozie GC, Joshua PE. Antidiabetic and antilipidemic effects of alkaloidal extract of *Emilia sonchifolia* in rat. Res J Sci Tech. 2010;51.
8. Muko KN, Ohiri FC. A preliminary study on the anti-inflammatory properties of *Emilia sonchifolia* leaf extracts. Fitoterapia. 2000;71(1):65-8.
9. Ogundajo AL, Ewekeye T, Sharaibi OJ, Owolabi MS, Dosoky NS, Setzer WN. Antimicrobial Activities of Sesquiterpene-Rich Essential Oils of Two Medicinal Plants, *Lannea egregia* and *Emilia sonchifolia*, from Nigeria. Plants. 2021;10(3):488.
10. Rahman A, Akter N, Rashid H, Ahmed NU, Uddin N, Islam S. Analgesic and anti-inflammatory effect of whole *Ageratum conyzoides* and *Emilia sonchifolia* alcoholic extracts in animal models. Afr J Pharm Pharmacol. 2012;6(20).
11. Roy, R. K., Thakur, M & Dixit, V. K., Hair growth promoting activity of *Eclipta alba* in male albino rats, Arch Dermatol Res, Vol-300, 2008, 357-364.
12. Sawant, M., Jolly, I. & Shridhar, N., Analgesic studies on total alkaloids and alcohol extracts of *Eclipta alba* (Linn) Hassk, Phytotherapy Research, Vol-18, 2004, 111-113
13. Shen SM, Shen LG, Lei QF, Si JY, Liu CM, Lu H. Chemical constituents contained in aerial parts of *Emilia sonchifolia*. China J Chin Materia Medica. 2012;37(21):3249-51.
14. Shylesh BS, Padikkala J. In vitro cytotoxic and antitumor property of *Emilia sonchifolia* (L.) DC in mice. J Ethnopharmacol. 2000;73(3):495-500.
15. Sikroria, B. C., Srivastava, S. J. & Niranjana, G. S., Phytochemical studies on *Eclipta alba*, J. Indian Chem. Soc., Vol-59, 1982, 905-909.
16. Singh, B. Saxena, K., Chandan, B., Agarwal, S., Bhatia, M. S. & Anand, K. K., Hepatoprotective effect of ethanolic extract of *Eclipta alba* on experimental liver damage, Phytother. Res., Vol-7, 1993, 154- 158.
17. Singh, B., Saxena, A. K., Chandan, B. K., Agarwal G. & Anand, K. K., In vivo hepatoprotective activity of active fraction from ethanolic extract of *Eclipta alba*, Indain J. phsio pharmacol. , Vol-45, 2001, 435-441.
18. Smitharani. Investigation on the Wound Healing Activity of Aqueous Extract of *Emilia Sonchifolia* (L.) DC. Int J Herbal Med. 2017;5(6):34-39.
19. T.H. Hanh, D.T.T. Hang, C. Van Minh, N.T. Dat Anti-inflammatory effects of fatty acids isolated from *Chromolaena odorata* Asian Pac.J.Trop.Med.4 (2011), pp.760-763. 10.1016/S1995-7645 (11)60189-2.

20. Yadava RN, Raj M. ChemInform Abstract: Antiviral Activity of a New Flavone Glycoside from *Emilia sonchifolia* DC. ChemInform. 2012;43(32).
21. Yoga Latha L, Darah I, Sasidharan S, Jain K. Antimicrobial Activity of *Emilia sonchifolia* DC., *Tridax procumbens* L. and *Vernonia cinerea* L. of Asteraceae Family: Potential as Food Preservatives. Malaysian J Nutr. 2009;15(2):223-31.