

# Biological prospecting of the “Hidden Diversity” of medicinal plants (*Asteraceae*) in south-eastern Rajasthan

Supriya K. Sharma<sup>1</sup> and Afroz Alam<sup>2\*</sup>

<sup>1,2</sup>Department of Bioscience and Biotechnology, Banasthali Vidyapith–304022, India.

\* E-mail: <sup>1</sup>supriya.sharma2608@gmail.com, <sup>2</sup>aafroj@banasthali.in

\*Corresponding author

Manuscript received: 01 July 2022

Accepted for publication: 12 July 2022

## ABSTRACT

Sharma S.K. & Alam A. 2022. Biological prospecting of the “Hidden Diversity” of medicinal plants (*Asteraceae*) in south-eastern Rajasthan. Geophytology 51(1&2): 143–148.

Medicinal plants have been employed in nearly all civilizations throughout the world since time immemorial. Among various uses of plants, plant-based medications are used by 3.5 billion people in emerging and developing nations, according to the World Health Organization. Approximately, 87 percent of commercialized plant medications are derived from natural resources, and over 120 essential phytochemicals are derived from plants. The most advanced family of angiosperms, i.e. *Asteraceae* holds many plants that are widely dispersed and are being utilized for medicinal purposes from ancient times across the world. Various species of this family have also conventionally been observed to act as astringents, antipyretics, and anti-inflammatory, in fevers it is used as diaphoretics, help in smooth muscle relaxation and in dealing with stomach related problems. The plants of this family are also used for the treatment of several other ailments such as bleeding, headache, dysentery, leucorrhoea, dyspepsia, haemorrhoids and many more. The range of phytochemicals obtained from the family *Asteraceae* have been discovered to be highly bioactive and possess useful activities related to human health. Despite their diversity in the phytochemical nature, most members of the family share a similar chemical known as inulin which is a natural polymer with important prebiotic properties. In addition, a wide spectrum of bioactive phytochemicals exists including coumarins, ellagic acid, sterols, flavonoids and terpenoids have been reported in the members of family *Asteraceae* with valuable medicinal impeding. An attempt has been made in this article to provide a consolidated account of useful phytochemicals found in the members of this family.

**Keywords:** *Asteraceae*, bioactive compounds, phytochemical, medicinal plants, human health care

## INTRODUCTION

Plants always hold an important position in the development of medicine for a long time, due to their capacity to produce secondary metabolites. Plants were utilised in conventional medicine to cure a variety of diseases in different ways. According to the World Health Organization, over 80% of the world’s population still uses traditional medicine, the majority of which is based on plant medicines. Plant-based medications are often less expensive than conventional

drugs, are more readily accessible, and have less adverse effects than their synthetic counterparts. Many ethnomedicinal plants have recently been studied using more contemporary methods, yielding a couple of unique compounds. These plant-derived components can be utilized to improve existing medications or create entirely new ones (Turchi et al. 2016, Eruygun et al. 2019). Most of the members of *Asteraceae* family have medicinal properties and a vast history in conventional medicine: some of them have been cultivated for edible

and medicinal reasons for over 3000 years. They are most frequent in dry and semi-arid subtropical climates, but they are well known and dispersed worldwide. Members of the *Asteraceae* family have anti-inflammatory, antioxidant, antimicrobial, and hepatoprotective properties (Achika et al. 2014). This article summarises the most recent research on the beneficial effects of plants from the *Asteraceae* family on human health. Because phytochemicals found in medicinal plants are used in herbal medicine, identifying and describing phytochemicals present in medicinal plants is crucial for optimal utilization and its conservation (Alabi & Adeyemi 2021).

### IMPORTANCE OF FAMILY *ASTERACEAE*

The *Asteraceae* family, commonly known as Compositae/Aster family/family of Sunflowers/Daisy family, is the most sophisticated and largest Angiosperm family, accounting for around 10% of all flowering plants. This includes around 32000 recognized species and 1800 to 1900 taxa dispersed throughout the globe, except Antarctica (Mandel et al. 2017). It comprises well-known plants including sunflower, dahlias, and daisies, as well as medicinal plants like wormwood, dandelion, cudweeds, etc. (Nikolic & Stevovic 2015). For example, chewing the flower heads of *Acmella oleracea* (L.) R.K. Jansen relieves toothache and controls throat and gum irritation. It is also an effective remedy for children who stammer. Calendula is a medicine made from the dried ligulate florets of *Calendula officinalis* L., which is used to treat bruises and sprains.

The flowering tops and leaves of *Tanacetum vulgare* L. generate an essential oil that is used to treat rheumatism, gout, and chronic ulcers. *Taraxacum officinale* (L.) Weber ex F.H. Wigg. (common dandelion) roots and rhizomes are the sources of the drug Taraxacum, which is used as a moderate hepatic stimulant, tonic, and laxative. *Blumea balsamifera* (L.) DC. produces an essential oil recognized as Blumea camphor, and the leaf extract is then used to treat excitement and insomnia. Colds, asthma, and coughs are treated using the leaves of *Tussilago farfara* L.

(Coughwort). *Lactuca virosa* L. latex, often known as Lactucarium, has mild sedative-hypnotic properties. Apart from these, Hay fever is caused by the pollens of *Ambrosia artemisiifolia* L. (Ragweed) and *Parthenium hysterophorus* L. (Carrot grass) which confirms the bioactivity potential. In traditional medicine, *Cichorium intybus* L. (chicory) helps diagnose inflammation and liver diseases, as well as stones, gout, appetite loss, and rheumatism. In Indian Ayurveda medicine, tonics from *C. intybus* were used to cure fever and enlarged spleen, and a decoction from the leaves was used to treat gout and rheumatism (Mulabagal et al. 2009, Jalfarinia & Jalfarinia 2019).

Antiplatelet and anticoagulant activities are induced by arachidonic acid-stimulated cyclooxygenases in *Erigeron canadensis* L. in human plasma. It also possesses potent anti-IIa properties, which are mediated by the heparin cofactor II (Michel et al. 2020). *Vernonia amygdalina* Delile is one of the economically as well as nutritionally important plants utilised for its insect repellent and anti-tumour activities in the pharmacopoeia, notably in African origin (Ugbogu et al. 2021).

### BOTANICAL CHARACTERS

Except for Antarctica, the *Asteraceae* family is found worldwide in a wide variety of biological habitats. They can be seen in forest environments, grasslands, urban green spaces and even high-altitude, but tropical climates are far less prevalent. *Asteraceae* plants have a wide range of forms. Some species, such as *Dasyphyllum excelsum* (D. Don) Cabrera in Chile and *Vernonia arborea* Buch.-Ham. in Malaysia, are trees that reach heights of more than 30 m; however, some are shrubs, such as rabbit brush or rosette trees, and the majority are perennial herbs and very few are annual herbs, ranging in height from 1–3 meters to almost sessile forms. In the Peruvian Andes, genus *Mnioides* is located which is the smallest example (Bohm & Stuessy 2001). The leaves come in a variety of shapes and sizes: some are huge, few are little and spiky, whereas some are completely absent, their function is taken up by a stem. An indumentum and hairs of various lengths and

colours cover the majority of the leaves. Most of them have a cluster of tiny blooms in a variety of hues. The Jerusalem artichoke, with its slender, golden blossoms on a tall stalk, is a good example (Achika et al. 2014, Munim et al. 2014). Because of its distinct floral and fruit characteristics, this family has had significant evolutionary and biological success. There is a unique modification in its floral characteristic that produces a fruit with a different type of calyx (called pappus) that serves anti-herbivory and dispersal purposes (Carlquist 1976, Bello et al. 2013). The capitulum, or head-like inflorescence in which the tightly packed florets are attached, is the most complicated structure in the *Asteraceae* family (Zhang et al. 2021). Two other differentiating characteristics of the family are the united anthers in a tube and the inferior ovary position (Harris 1995).

### PHYTOCHEMISTRY

Phytochemistry is a scientific discipline that investigates plant-derived chemicals. Most of these phytochemicals have been shown to improve human health and can be utilized to treat a variety of ailments. Many chemically active components in phytochemicals produce a specific function in human physiology, giving them medicinal characteristics. Biologically active phytoconstituents include glycosides, tannins, flavonoids, alkaloids, and phenolics. Plants contain more than 12,000 alkaloids, 25,000 terpenoids, and 8,000 phenolics, but many of these compounds are unknown and must be identified and tested before their health advantages can be determined (Hollman & Arts 2000, Las et al. 2003, Cechinel 2018). Phytochemical investigations have confirmed the usefulness and usage of several plants from this family for treating a variety of ailments. The majority of plants have antioxidant properties, followed by anti-hyperlipidaemia, antithrombotic, vasorelaxant, and diuretic properties, making them particularly helpful in treating many cardiovascular diseases (Michel et al. 2020).

Neves et al. (2015) identified and isolated over

40 coumarins and 30 different types of flavonoids from diverse *Pterocaulon* species. Many of these plants are thought to have ethnomedicinal use. Garsiya et al. (2019) investigated the chemical composition of aerial parts and roots of *Onopordum acanthium* L. Flavonoids, phenyl-propanoids, triterpenoids, lactones, sesquiterpene, and sterols were found in the aerial roots of this plant. Wormwood is the popular name for *Artemisia absinthium* L., a perennial herb is frequently used in biological pesticides due to its stench; nevertheless, it also has a variety of health benefits, including digestive, diuretic, depurative and balsamic characteristics. It is also used as a supplement in the treatment of leukaemia. Snake antivenom activity can be found in the plant's aerial section. *Erigeron canadensis* L. has anticoagulant and antiplatelet properties, which are induced by arachidonic acid-stimulated cyclooxygenases.

In human plasma, the preparation from this plant inhibits the formation of plasma clots in activated partial thromboplastin and prothrombin time. It also has considerable anti-IIa activity, which is mediated by heparin cofactor II (Michel et al. 2020). Milk thistle is another name for *Silybum marianum* (L.) Gaertn. Its main source is silymarin, which is a combination of silibinin A and B, and it also includes silychristin and silydianin. Milk thistle has a wide range of biological actions, including cardioprotective, hepatoprotective and cytoprotective properties. Milk thistle is an antidote and protector against a variety of biological poisons, including mycotoxin, snake venom, and even bacterial toxin. Silymarin, an antioxidant found in milk thistle, has been proven to protect against lipid peroxidation caused by aflatoxins. Silymarin also reduced the neuroinflammatory effects of lipopolysaccharide. Aside from natural toxins, milk thistle also protects against a variety of artificial toxins such as aluminium, copper, cadmium, and lead (Fanoudi et al. 2020).

Several scientists have investigated phytochemistry of different species of this family and discovered a variety of phytochemicals that are responsible for the medicinal benefits.

**Table 1.** Different plants of *Asteraceae* family studied in south-eastern Rajasthan

Serial No.	Scientific name of plants	Vernacular name	Plant's part used	Chemical composition	Medicinal properties
1.	<i>Achillea millefolium</i> L.	Yarrow	Flowers, whole plant	d-L-pinene, B-pinene, 1-limonene, 1-borneol, bornyl acetate, 1-camphor, thujone	Wounds, diuretic, useful in fever, expels kidney stones, nasal congestion, stomach related problems
2.	<i>Ageratum conyzoides</i> L.	Sahadevi, Uchanti, Appa grass	Whole plant	Friedelin, sterols, stigmasterol, caryophyllene, flavonoids, coumarin, caffeic acids, quercetin	Stimulant, analgesic, fever, tonic, good source of vitamin K, rheumatism, anthelmintic dermatitis
3.	<i>Blumea lacera</i> (Burm.f.) DC.	Kukursunga	Leaves inflorescence	Coniferyl alcohol, campesterol, triterpenes, beta-sterol, flavonoids	Stimulant, diuretic, antispasmodic, astringent, stomachic
4.	<i>Aster amellus</i> L.	Italian Star Wort	Roots	Flavonoids, sterols	Pulmonary infection, malarial infection, haemorrhages
5.	<i>Helianthus annus</i> L.	Surajmukhi	Whole plant	Helianol, chlorogenic acid, ascorbic acid, malic acid, citric acid	Diuretic, coughs, colds, malarial fever, scorpion sting laryngeal and bronchial infection
6.	<i>Gnaphalium luteoalbum</i> (L.) Hilliard & B.L. Burt.	Boro Xamra	Leaf and stem	Glucoside, tannin, phytosterol, essential oil, luteolin	Diuretic, gouts, astringent, haemostatic
7.	<i>Parthenium hysterophorus</i> L.	Gajarghas	Whole plant	Parthenin	Skin problem, rheumatism, diarrhoea, malaria urinary tract infections, neural problems, dysentery
8.	<i>Sonchus asper</i> (L.) Hill	Doodhi	Young shoot, seeds, whole plant	Saponins, flavonoids, phenols	Wounds and burns, cough, bronchitis and asthma, gastrointestinal infection, cardiovascular diseases
9.	<i>Tanacetum vulgare</i> L.	Tansy	Flowertops, leaves	b-thujone, alpha-camphor, alcohol, borneol, terpenes	Rheumatism, gouts, stimulant, tonic, chronic ulcers
10.	<i>Taraxacum officinale</i> (L.) Weber ex F.H. Wigg.	Dudhali	Whole plant	Sesquiterpene, Lactones, Monoterpene, Phytosterol, Terpenes, Coumarin	Diuretic, tonic, stomachic, and hepatic stimulant Starches are used to treat a variety of problems associated with menopause. Used in the manufacture of diabetic bread as well as for commercial production of fructose.
11.	<i>Tagetes erecta</i> L.	Genda	Leaves, flowers	Carotenoids, Flavonoids, Monoterpenoids	The leaves are used as an antiseptic and in the treatment of kidney problems, muscular pain, piles, and boils and carbuncles.
12.	<i>Tridax procumbens</i> L.	Coat buttons	Whole plant	Campesterol, polysaccharides, flavonoids, triterpenes	Haemostatic, antiseptic, skin diseases, cures ulcers and sores, juice extracted from leaves is applied on wounds.
13.	<i>Vernonia cinerea</i> (L.) Less.	Bakuci	Whole plant	Arachidic acid, Beta sitosterol, Oleic acid, sterols, uracil	Diabetes, cures kidney disorders and stones, Insomnia, cures Anhidrosis, Rheumatism
14.	<i>Artemisia nilagirica</i> (Clarke) Pamp.	Naga Douna	Whole plant	Flavonoids, volatile oils, coumarins, inulin, alkaloids, camphor, caryophyllene	Asthma, Diarrhoea, malaria, nervous problems, diuretic
15.	<i>Tagetes patula</i> L.	Genda	Whole plant	Glycosides, flavonoids, limonene	Kidney problems, muscular pain, piles, antiseptic
16.	<i>Verbesina encelioides</i> (Cav.) Benth. & Hook.f. ex A. Gray	Jungli Surajmukhi	Flowers	Alkaloids, saponins, glycosides, tannins	Spider bites, as well as gum sores and haemorrhoid therapy
17.	<i>Gaillardia aristata</i> Pursh	Blanket flower	Root	Pinene, myrcene, limonene	Treats wounds, cure painful urination, diuretic and settle fevers
18.	<i>Chondrilla juncea</i> L.	Lampri	Leaves, stem	Phenols, Sesquiterpenes lactones, Caffeoyltartonic acid, coumarins	Cures Insomnia, helps in blood purification, wound healing
19.	<i>Bellis perennis</i> L.	Daisy	Whole plant	Flavonoids, phenols	Helps in treating Bruises, fractured bones, and wounds, eye problems, skin diseases
20.	<i>Chrysanthemum grandiflorum</i> Ramat.	Guldaudi	Flowers	Flavonoids, Alkaloids, Phenolic compounds, Triterpene	Chest pain, blood pressure problems, diabetes, fever, cold, swelling, dizziness

## METHODOLOGY

The present appraisal has been compiled with the help of various relevant literature related to medicinal properties of family *Asteraceae* that are liberally available on the Internet via NCBI, PubMed, Web of Science, Google Scholar, Scopus, etc.

## RESULTS

Among huge diversity of family *Asteraceae*, only those plants that are growing in south-eastern Rajasthan were studied and their medicinal properties are presented in a tabular form (Table 1). The Table includes scientific names of taxa, their vernacular names, plant parts used, chemical composition and utility in human health.

## DISCUSSION

Nowadays, there is a growing interest in the importance of diet in human health and natural remedy therapies in the treatment of a wide range of disorders. It has been proved that a plant-based diet, which is the most reliable source of antioxidants, has a significant function in the prevention of various diseases. From dandelion roots, inulin is derived which is used in the microbiological synthesis of a high fructose syrup that can be used instead of the regular one and it helps to avoid diabetes and obesity. Because it has no narcotic effect, coffee made from dandelion roots is an excellent alternative to regular coffee. Dandelion leaf preparations are added to healthy foods and supplements for diuretic difficulties in the United States (Lis & Olas 2019).

Chicory is also a good source of novel health foods and functional foods. Chicory roots, which are abundant in dietary fibre and inulin, are a healthy substitute for white flour and fat in cracker manufacture. They are used in conjunction with a variety of low-calorie sweeteners to boost dietary fibre levels. The Jerusalem artichoke can also be used to treat a variety of ailments. The flowers are used to make tea in Russia, which serves to improve the body's immune system, offer energy, and avoid renal diseases when consumed on a daily basis. Obesity sufferers should include Jerusalem

artichoke tubers in their diet since they provide a feeling of fullness (Sawicka et al. 2020). However, more research into the *Asteraceae* family is needed to properly comprehend the multiple benefits as a disease prevention or in the development of novel medications.

## CONCLUSION

The *Asteraceae* family of flowering plants is the most diverse and cosmopolitan of all flowering plant families. Since prehistoric times, most of its species have been employed in traditional medicine. Because of the increased desire for new natural medicine sources, the *Asteraceae* family has captivated the curiosity of scientists. Anti-inflammatory, antioxidant, and antibacterial characteristics have been proven in studies, all of which are beneficial to human health. In contemporary and future herbal formulations, the plants of this family can provide huge reservoir of bioactive phytochemicals. Hence more and more efforts are required to discover the phytochemistry of unexplored plants of this family.

## ACKNOWLEDGEMENTS

The first author expresses her gratitude to Prof. Ina Aditya Shastri, Vice-Chancellor, Banasthali Vidyapith, Rajasthan for her support and encouragement. We also thank Department of Science & Technology, Government of India for providing networking support through the FIST Program at the Department of Bioscience and Biotechnology and Bioinformatics Centre, Banasthali Vidyapith, funded by Department of Biotechnology, Government of India.

## REFERENCES

- Achika J., Arthur D., Gerald I. & Adedayo A. 2014. A review on the phytoconstituents and related medicinal properties of plants in the *Asteraceae* family. *IOSR Journal of Applied Chemistry* 7: 1–8.
- Alabi Q.K. & Adeyemi W.J. 2021. *Vernonia amygdalina* (Del) as an antioxidant, aspirin toxicity, and oxidative stress. In: *Toxicology*, pp. 491–504. Academic Press.
- Bello M., Angelica A.I., Torices R. & Fuertes-Aguilar J. 2013. Floral development and evolution of capitulum structure in *Anacyclus*. *Annals of Botany* 112(8): 1597–1612.
- Bohm B. & Stuessy T. 2001. *Flavonoids of the Sunflower Family (Asteraceae)*. Springer Science & Business Media: Berlin/Heidelberg, Germany.

- Carlquist S. 1976. Tribal interrelationships, and phylogeny of the *Asteraceae*. 8: 465–492.
- Cechinel F.V. (Ed.). 2018. Natural products as source of molecules with Therapeutic Potential: Research & Development, Challenges and Perspectives. Springer.
- Eruyugur N., Kocyigit U.M., Taslimi P., Atas M., Tekin M. & Gulçin I. 2019. Screening the in vitro antioxidant, antimicrobial, anticholinesterase, antidiabetic activities of endemic *Achillea cucullata* (*Asteraceae*) ethanol extract. South African Journal of Botany 120: 141–145.
- Fanoudi S., Alavi M.S., Karimi G. & Hosseinzadeh H. 2020. Milk thistle (*Silybum marianum*) as an antidote or a protective agent against natural or chemical toxicities: a review. Drug and Chemical Toxicology 43(3): 240–254.
- Garsiya E.R., Konovalov D.A., Shamilov A.A., Glushko M.P. & Orynbasarova K.K. 2019 Traditional medicine plant, *Onopordum acanthium* L. (*Asteraceae*): Chemical composition and pharmacological research. Plants 8(2): 40.
- Harris E.M. 1995. Inflorescence and floral ontogeny in *Asteraceae*: a synthesis of historical and current concepts. The Botanical Review 61(2): 93–278.
- Hollman P.C.H. & Arts I.C.W. 2000. Flavonols, flavones and flavanols: nature, occurrence and dietary burden. *Journal of the Science of Food and Agriculture* 80: 1081–1093.
- Jafarinia M. & Jafarinia M. 2019. A review of medicinal properties of some *Asteraceae* family plants on Immune System. Rep. Health Care 5: 1–7.
- Las H.B., Rodriguez B., Bosca L. & Villar A.M. 2003. Terpenoids: sources, structure elucidation and therapeutic potential in inflammation. *Current Topics in Medicinal Chemistry* 3(2): 171–185.
- Lis B. & Olas B. 2019. Pro-health activity of dandelion (*Taraxacum officinale* L.) and its food products—history and present. *Journal of Functional Foods* 59: 40–48.
- Mandel J.R., Barker M.S., Bayer R.J., Dikow R.B., Gao T.G., Jones K.E., Keeley S., Kilian N., Ma H. & Siniscalchi C.M. 2017. The *Compositae* Tree of Life in the age of phylogenomic. *Journal of Systemic Evolution* 55: 405–410.
- Michel J., Abd Rani N.Z. & Husain K. 2020. A review on the Potential Use of Medicinal Plants from *Asteraceae* and *Lamiaceae* plant family in cardiovascular diseases. *front. Pharmacology* 11: 852. doi: 10.3389/fphar.2020.00852.
- Mulabagal V., Wang H., Ngouajio M. & Nair M.G. 2009. Characterization and quantification of health beneficial anthocyanins in leaf chicory (*Cichorium intybus*) varieties. *European Food Research Technology* 230: 47.
- Munim A., Rod M.R., Tavakoli H. & Hosseinian F. 2017. An analysis of the composition, health benefits, and future market potential of the *Jerusalem artichoke* in Canada. *Journal of Food Research* 6(5): 69–69.
- Neves B.M., Barros F.M.C.D., Poser G.L.V. & Teixeira H.F. 2015. Quantification of coumarins in aqueous extract of *Pterocaulon balansae* (*Asteraceae*) and characterization of a new compound. *Molecules*. Basel. 20(10): 18083–18094.
- Nikolic M. & Stevovic S. 2015. Family *Asteraceae* as a sustainable planning tool in phytoremediation and its relevance in urban areas. *Urban For. Urban Green*. 14: 782–789.
- Sawicka B., Skiba D., Pszczó Ą.P., Aslan I., Sharifi J. & Krochmal-Marczak B. 2020. Jerusalem artichoke (*Helianthus tuberosus* L.) as a medicinal plant and its natural products. *Cellular and Molecular Biology* 66(4): 160–177.
- Tourchi M., Arslan A. & Iranshahi M. 2016. Biological Effects of Arctiin from Some Medicinal Plants of *Asteraceae* Family. *Am. J. Life Sci*. 4: 41–47.
- Ugbogu E.A., Emmanuel O., Dike E.D., Agi G.O., Ugbogu O.C., Ibe C. & Iweala E.J. 2021. The phytochemistry, ethnobotanical, and pharmacological potentials of the medicinal plant-*Vernonia amygdalina* L. (bitter Leaf). *Clinical Complementary Medicine and Pharmacology* 1(1): 100006.
- Zhang T., Cieslak M., Owens A., Wang F., Broholm S.K., Teeri T.H., Elomaa P. & Prusinkiewicz P. 2021. Phyllotactic patterning of gerbera flower heads. *Proceedings of National Academy of Science, USA*, 118, e2016304118.