



Traditional And Modern Pharmacological Applications Of *Emilia Sonchifolia*: An Integrated Review

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INTRODUCTION

Plants are the primary source of many medicines, and they are crucial to human and plant health in particular. Many plants and herbs are well known for their therapeutic and curative properties. The use of different plants as medicinal plants in the healthcare system has become crucial everywhere in the world. MPs (medicinal plants) are very important in the medical field because of their greater adaptability and compatibility with the human body, which means they have fewer side effects and are more widely accepted. It has been shown that the majority of commonly used medications contain plant extracts as a primary ingredient. As active ingredients, many of them contain bioactive components that are extracted from plants. The medicinal properties of MPs have been uncovered through a number of studies through the investigation of conventional and therapeutic treatments. The most widely used medications that are believed to be derived from PEs (plant extracts) include aspirin, digoxin, pilocarpine, quinidine, physostigmine, morphine, reserpine, ephedrine, taxol, colchicine, vincristine, aspirin, and tubocurarine. It is impossible to overlook MPs' enormous significance anywhere in the world. Certain secondary compounds derived from plants, like those found in pawpaw, mango, citrus, and *Emilia sonchifolia*, may be highly effective against parasites and infections.⁽¹⁾ ²The herbaceous *Emilia sonchifolia* grows to a height of 10 to 40 cm. It features simple lyrate-pinnate leaves with a broad terminal lobe and corymbose-headed purplish flowers. The fruits are long and packed with seeds. The plant is pantropical and may have originated in South Asia; the hermaphrodite flowers are pollinated; the advanced ripe fruits develop from August to October. The annual herb *Emilia sonchifolia* (Lin.) is a shaggy plant that is mostly found in Asian nations. It has been noted to have anti-fever, antimicrobial, analgesic, and anti-inflammatory properties; anticancer; antioxidant; antidiabetic; and anti-cataract properties. Antinociceptive effect and anticonvulsant activity.

This plant is one of the ten sacred flowers of Kerala, known as "Dasapushpam," and is primarily used in Ayurveda.⁽³⁾ Wounds are defined as injuries to the skin or other body tissues; these include cuts, scrapes, scratches, and punctures. Many herbs and plant extracts are used to treat wounds by Indian tribes and folklore traditions.

Plants or plant-derived active ingredients need to be identified and developed in order to treat wounds; several plant medicines are currently being investigated in this respect. The body's natural reaction to tissue damage is wound healing, and plants have a lot to offer in this regard (Smitharani et al., 2017).⁽⁴⁾ A complex series of cellular processes that culminate in the restoration of health is known as healing. The plant's juice and herb can be used to treat a variety of conditions, including tonsillitis, fevers, cough, bronchial problems, piles, worm infections, diarrhoea, edema, and diabetes.⁽⁵⁾



Figure 1: *Emilia sonchifolia*

Phytochemical constituents of *Emilia sonchifolia*

According to Edagha et al. (2014)⁽⁶⁾, there were different levels of lowly, moderately, and highly present phytochemical compounds in *E. sonchifolia*, including alkaloids, flavonoids, saponins, tannins, terpenes, and cardiac glycosides (Table 1). There are very few reported components from this plant. Two pyrrolizidine alkaloids, known as senskirkine and doronine, were given to the aerial sections.⁽⁷⁾ The aerial part also contains vitamins like niacin and riboflavin, as well as pyrrolizidine alkaloids, senkirkine, and doronine.⁽⁸⁾ Phenobarbitone is a well-known anticonvulsant drug used to treat all forms of epilepsy in humans, with the exception of absence seizures. It is especially effective in treating status epilepsy at 10–20 mg/kg.⁽⁹⁾ The aerial parts of the plants were found to contain quercetin, rutin, kaempferol 3- β -galactoside, ursolic acid, n-hexacosanol, and tricotane, as reported by Srinivasan and Subramanian in 1980⁽¹⁰⁾. However, rhamnetin, isorhamnetin, luteolin, tricin-7-O-beta-D-glucopyranoside, 8-(2"-pyrrolidinonedi-methoxyflavone-2'-O-beta-D-glucopyranoside, succinic acid, fumaric acid, p-hydroxybenzoic acid, 4-hydroxy isowedelolactone, and uracil were all produced by the Etsy fraction of 90% extract of aerial parts, albeit not all of them. Similar beta-sitosterol and palmitic acid were extracted from the entire plant by Gao et al. (1993)⁽¹¹⁾. Along with two other identified compounds, Yadava and Raj (2012) reported the existence of flavones glycoside 3,7,3'4'-tetrahydroxyflavone-3-O-beta-D-xylopyranosyl-(1-3)-O-beta-D-galactopyranosyl-(1-4)-O-alpha-L-rhamnopyranoside. In the seeds are isoptin 5'-methyl ether and luteolin-7-O-beta-D-glucoside. *Emilia sonchifolia* seeds were found to contain three major compounds, according to Yadava and Raj (2012). These three compounds are Gehuain (isoflavone), Mearnsetin-3-O- α -L-rhamnopyranose, and Kaempferol 3-O- α -L-rhamnopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside.⁽¹²⁾

Table 1: Phytochemical constituents of *Emilia sonchifolia* (Trease and Evans (1989); keys: + = lowly present, ++ = moderately present, +++ = highly present, - = absent).

Phytochemical	<i>Emilia sonchifolia</i>
Alkaloids	+++
Flavonoids	++
Phlobatannins	-
Saponins (Frothing's test)	+
Saponins (Fehling's solution+ Na ₂ CO ₃)	++
Tannins	++
Terpenes	+
Anthraquinones	-
Deoxysugar	-
Cardiac glycosides	++

Emilia sonchifolia's medicinal benefits in ethnomedicine

Asian ethnomedical reports place a strong emphasis on Emilia sonchifolia's traditional and folklore medicinal uses. It is one of the "Ten Sacred Flowers" of Kerala state, India, and traditional healers use it mostly to treat cancer and other cancerous conditions.⁽¹³⁾ The plant known as "Setumbakmerah" was widely used in Malaysia and was thought to be a common component of "Ulam," a traditional vegetable salad. The leaves can be eaten, and in Bangladesh, they're traditionally used to make salad.^(14,15) In India, the raw stem and leaves of the plant are consumed as a salad or cooked vegetable. The plant is recognized in ethnomedicine for its ability to treat a variety of conditions, including malaria, gastrointestinal cancers, rashes, diarrhoea, night blindness, sore throats, measles, and inflammatory diseases. It is also used to treat eye and ear problems. E. sonchifolia decoction is used to treat infantile tympanites as a febrifuge and bowel relaxant. A specific part of the E. sonchifolia plant was used to treat a variety of ailments, including cuts, wounds, asthma, ophthalmia, inflammation, and breast cancer. The plant's leaves were also used to treat conditions like sore throats, eye inflammation, and night blindness.⁽¹⁶⁻¹⁸⁾ The antinociceptive properties of the plant's aerial part have long been recognized in the liquid extract. The plant has also been shown to have anti-anxiety, anti-cataract, anti-hepatoprotective, and anti-convulsant qualities. Tribes manufacture medicine by pressing the juice of an entire crushing plant.⁽¹⁹⁾ The significant reduction in pain that the plant extract exhibits may be explained by the presence of analgesic principles derived from the chemical components of the extracts interacting with the prostaglandin pathways.

Pharmacological activities of Emilia sonchifolia

Anti-inflammatory activity

The body's intricate defensive reaction to a variety of outside stimuli, including allergies and injuries to any area of the body, is inflammation. Uncontrolled inflammatory responses are the main cause of a wide range of illnesses, including allergies, cardiovascular problems, gastrointestinal disorders, metabolic syndrome, autoimmune diseases, and cancers. The circumstances pose a serious financial risk to individuals and society as a whole.⁽²⁰⁾

Among the many medications available for controlling and minimizing inflammatory episodes are steroids, nonsteroid anti-inflammatory drugs, and immunosuppressant; however, each is known to have unfavourable effects. In practice, though, we try to take the least amount of medication required to achieve optimal efficacy and the least amount of side effects.⁽²¹⁾ The production of prostaglandins, which mediate the inflammatory response, requires the inhibition of cyclooxygenase (COX). Thus, suppression of COX isoforms (COX-1 and COX-2) is being studied to discover new anti-inflammatory medications. In molecular docking studies, the pyrrolizidine alkaloid doronine, which is present in Emilia sonchifolia, binds to COX-2, indicating that it could serve as a substitute for anti-inflammatory drugs that are currently on the market.⁽²²⁾

Antimicrobial activity

The antimicrobial activities of E. sonchifolia root extracts against the test microorganisms were evaluated qualitatively in a number of prior studies using a zone of inhibition and minimum inhibitory concentration. The outcomes were contrasted with those of the standard medications, tetracycline and oxacillin, for fungi and bacteria, respectively. Aspergillus niger root extract exhibited moderate activity against Pseudomonas aeruginosa, Mucor racemosus, and Salmonella typhi, while Emilia sonchifolia root extract demonstrated significant activity against Bacillus cereus, Streptococcus faecalis, and the bacteria Staphylococcus aureus. The differing levels of inhibitory activity of the methanolic extract of the studied species' root could be explained by the specificity of the bacterial and fungal strains.⁽²³⁾ Microbiological diseases are anticipated to be treated by phytochemicals with sufficient antibacterial efficacy. Even at low concentrations, it has been noted that several species in the Asteraceae family exhibit superior inhibitory effects against fungi and bacteria. They are mentioned in Ayurvedic texts like Vaidya Manorama and Arogya Kalpadruma and have been used since the beginning. Many Ayurvedic formulations contain whole plant preparations or sections of the plant, as well as polyherbal combinations, which are known to revitalize the body and treat a variety of ailments.

These outcomes matched those of Nwadinigwe and Alfreda (2011),⁽¹²⁾ who also found that the growth of these bacteria was significantly inhibited by 100 mg/mL of Bryophyllum pinnatum stem extract. However, in comparison to the other bacteria and fungi tested, the methanol extract of E. sonchifolia's root portion likewise exhibited noticeably higher inhibitory activity. Numerous studies substantiate the claim that methanol extracts, as opposed to other alcoholic solvents, exhibit stronger antimicrobial activities in a wide range of medicinal plant species. Alcohol-based extracts are reported to have antimicrobial, cytotoxic, and

aqueous properties, as well as anti-Dalton's lymphoma ascites (DLA) and anti-Ehrlich ascetic carcinoma (EAC) properties.⁽²⁴⁻²⁷⁾

Antioxidant activity

Reactive oxygen species (ROS) and oxidative damage are inevitable in biological systems and are protected against by the antioxidant defence mechanism. While the generation of ROS can be essential for a number of cellular functions (such as immune response and signalling), it is more frequently associated with cellular damage to components like proteins, lipids, and nucleic acids.⁽²⁸⁾ Humans have evolved extremely sophisticated antioxidant systems (both enzymatic and nonenzymatic), which function in concert with one another to protect the body's organs and cells from damage caused by free radicals. The antioxidants can be obtained through diet, nutritional supplements, or endogenous means. Certain dietary substances that increase endogenous activity but do not balance free radicals can also be categorized as antioxidants.

SOD, CAT, and GPx are the three enzymatic antioxidants that work the best. Vitamins E and C, thiol antioxidants (lipoic acid, thioredoxin, and glutathione), melatonin, carotenoids, naturally occurring flavonoids, and other substances are examples of nonenzymatic antioxidants.

Plants have expanded a number of defence mechanisms to fend off oxidative damage. Enzymes that fight inflammation are important for this type of defence. SOD is the most often researched, as it deals with the first line of defence. The majority of the enzymes that shield plants from oxidative stress are members of the diverse SOD family.⁽²⁹⁾

Compared to kaempferol, glycosides containing more hydroxyl groups exhibited greater antioxidant activity. Therefore, it's possible that the higher concentrations of rutin and quercetin in *E. sonchifolia* plants contributed to their superior antioxidant activity, which mitigated adverse effects and shielded them from oxidative damage.

Erythropoietic and hepatoprotective activity

According to reports from Edagha et al. (2014)'s⁽³⁰⁾ haematological studies, experimental animals treated with *E. sonchifolia* (650 mg/kg B.wt.) showed decreased haemolytic activity in comparison to normal control animals. Additionally, they have mentioned that the plant extract's saponins may be the cause of this activity. Rather than acting on the lipid phase, saponins improve the haemolysis of red blood cells by increasing the water transport by the water channel aquaporin. This leads to alterations in the structure of the red blood cell membrane by lowering cholesterol levels, which in turn affects how susceptible the membrane is to damage. However, in vitro research has shown that flavonoids possess antioxidant, antidiarrheal, anti-allergic, anti-inflammatory, antimicrobial (antibacterial), anti-cancer, antiviral, and antifungal properties.⁽³¹⁾ As a result, the extract exhibits a dynamic interaction of agonistic and synergistic effects. The extract is also abundant in alkaloids, and the majority of plants contain a variety of alkaloids. First, their mixture is extracted, and then specific alkaloids are identified. In medicine, a variety of alkaloids are still frequently used as salts that contain the following: Reserpine as an antihypertensive; codeine as an analgesic and cough medicine; quinine as an antipyretic and antimalarial; morphine as an analgesic; Ergot alkaloids as an antihypertensive, vasodilator, and sympathomimetic;⁽³²⁾

Numerous cytokine molecules may be involved in the enhancement of immunological parameters, induction of stem cell proliferation and differentiation, and well-regulated induction of antibody responses by *E. sonchifolia*.⁽³³⁾ Research findings indicate that the plant's ability to modulate immunity is a result of both humoral and cell-mediated immune responses.

Additionally, the extract boosts CTL activity in tumor-bearing animals, suggesting a greater role for the immune system mediated by cells in tumor defence. Consequently, the plant may function as a nontoxic immunomodulator; as an immunomodulator, *E. sonchifolia* does not appear to increase immunity relative to the rats in the untreated group, but rather it stimulates and optimizes the immune response. Clinical research controls the body's defence mechanism against pathological symptoms, thereby providing significant scientific support for its traditional and conventional therapeutic usefulness in treating a variety of diseases. Additionally, the plant's immunopharmacological properties may result from the unique activity of specific chemicals that are abundant in the plant or from the synergistic action of several active components.⁽³⁴⁾

Antiviral, antitumor activity, and gastrointestinal disorders

The antiviral activity of 3,7,3'-tetrahydroflavone-3-O- β -D-xylopyranosyl-(1-3)-O- β -D-galactopyranosyl-(1-4)-O- α -L-rhamnopyranoside against the Japanese Encephalitis virus was reported by Yadav and Raj (2012) in vitro (Vero cells). At 62.5 μ g/ml, the compound showed 50% antiviral activity.

The antioxidant and antitumor qualities of the flavonoid fraction isolated from the entire *E. sonchifolia* plant were reported by Cibir et al. (2006). In comparison to quercetin, the flavonoid fraction's antioxidant capacity was assessed by measuring its ability to inhibit Cu²⁺-induced lipoprotein oxidation in human serum and measuring the amount of superoxide produced. The findings demonstrated the plant's flavonoids' strong anticancer and antioxidant properties.

A study looked at the molecular mechanisms behind the induction of apoptosis in human colorectal cancer cells treated in vitro with the methanol extract. The extract inhibited cell growth in a concentration- and time-dependent manner, suggesting that extract-induced apoptosis in cancer cells may involve both intrinsic and extrinsic apoptotic pathways.

It has been reported that *Emilia sonchifolia* is highly effective in treating gastrointestinal issues, particularly dysentery and diarrhoea. *Emilia sonchifolia* leaves are widely used as a folk remedy for diarrhoea in Africa and have been used to make herbal tea. According to Essien et al. (2009)⁽³⁵⁾, this plant's roots have an anti-diarrhoea effect, and the flower buds may also lessen pain from dental decay in the mouth. Numerous flavonoids, terpenes, and alkaloids contribute to these effects; however, more research is required to firmly establish the significance of these compounds on the mode of action.

CONCLUSION

Emilia sonchifolia's phytochemical evaluation revealed a wide range of chemical components that are noteworthy for their potential multifaceted pharmacological effects, including antimicrobial, analgesic, antioxidant, anti-inflammatory, anticancer, hepatoprotective, and anxiolytic properties. However, since the plant is regarded as edible and is mostly used as a main ingredient in salads in many Asian and other countries, the presence of pyrrolizidine alkaloids was the main cause for concern. Docking of molecules Research on the pyrrolizidine alkaloids found in *Emilia sonchifolia*, such as senkirkine and doronine, show encouraging inhibitory effects on cyclooxygenase 2 (COX2), an enzyme that plays a crucial role in inflammation. Pyrrolizidine alkaloids are thought to be hepatotoxic at higher doses, which may cause hepatic damage. Liver dysfunction is the cause of toxicity symptoms. Therefore, more research is required to thoroughly examine the plant's toxicity prior to its use in ethnomedicine and to support its use as a health food. Before it was used in ethnomedicine, this review provides a clear picture of its traditional use and other plant activities.

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