**Gomphrena Serrata: A Medicinal Plant**

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**ABSTRACT**

The Amaranthaceous family, which includes *Gomphrena serrata*, has a variety of species that are utilized in traditional medicine and diet. More efficacious in treating dermatitis, bronchial asthma, carminative symptoms, diarrhea, hay fever, and aches. This plant contains flavonoids, alkaloids, carbohydrates, tannins, saponins, proteins, amino acids, and phytosterols as phytoconstituents. The *Gomphrena serrata*'s color, shape, size, odor, and surface properties It was reported from *Gomphrena serrata*'s leaf and root. The lignified xylem fiber, xylem channel and cork cell, parenchyma cell, parenchymatous and collenchymatous, tracheid, and phloem were all visible under a microscope in the cross-sectional analysis. The plant possesses numerous pharmacological properties, including antimicrobial, antibacterial, anticancer, and anti-urolithiatic properties. Therefore, the plant review is helpful in providing information about pharmacological importance and medicinal uses of the plant.

**Keywords:** *Gomphrena serrata*, Phytoconstituent, Tannins, Saponins, Pharmacological activity.

**INTRODUCTION**

Among the plants is *Gomphrena serrata* L, a member of the Amaranthaceae family. Amaranthaceae is a family of about sixty to seventy alien species. The genus Gomphrena, with around 138 species are some of the important species include *G. boliviana*, *G. celosioides*, *G. globose*, *G. haenkeana*, *G. macrocephala*, *G. martiana*, *G. meyeniana*, *G. perennis*, and *G. pulchella*. Bioactive components including carbohydrates, alkaloids, steroids, glycosides, and triterpenoids are abundant in *Gomphrena serrata*. The various parts of this plant are used in India for treatment of various ailments need for the traditional healers, including treatment of asthma, diarrhea, indigestion, dermatitis, hay fever, and others. Belonging to the Amaranthaceae family, Gomphrena species is a commercially available edible ornamental and medicinal plant that is also known by the names Bachelor Button and Globe Amaranth. It includes about 120 species that can be found in Indo-Malaysia, Antarctic, and America. Brazil is home to 46 species. The Amaranthaceae is cosmopolitan family which occurs at disturbed and arid or saline areas, one of the characteristics that ensure its survival in adverse environment is the operation of C4 pathway of photosynthesis. Numerous bioactive components with a range of pharmacological characteristics and therapeutic benefits can be found abundantly in plants. The extraction and characterization of phytochemicals from plants have resulted in the discovery of novel drug entities with high therapeutic value. (Reische DL, 1998). The current article discusses *Gomphrena serrata*'s morphology, physicochemical characteristics, and pharmacological effects.

**Morphological Description**

Organoleptic evaluation of *G. serrata* root has been carried out in accordance the colour, size, odour, shape, and taste as per WHO Quality Control methods of herbal medicine. It has a buff hue, a distinct taste and smell, a smooth texture, and a thickness of 4–12 cm. For arrangements with cut or dried flowers, the *Gomphrena serrata* is prized for its distinct texture and elegance. A *Gomphrena serrata*'s height ranges from 25 to 45 cm, and the...
diameter of each tiny bloom is roughly 1 inch. Each gomphrena plant can produced dozens of showy flowers heads from midsummer to frost, displaying a serene view.\textsuperscript{[6]} Leaves are obovate-lanceolate, 2–4 X 1–1.5 cm, glabrescent above, long white shaggy hair below and obtusely apiculate and base is cuneate, Flowers are white with yellow tinge in axillary and terminal compressed and cylindrical spikes, utricles enclosed hardened perianth and Seeds are brown and shiny.\textsuperscript{[7]}

**Taxonomy**

Synonyms: Gomphrena celosioides, Gomphrena decumbens.

Botanical name: *Gomphrena serrata*

Family: Amaranthaceae

Genus: Gomphrena

Kingdom: Plantae

Order: Caryophyllidae

Species: *Gomphrena serrata*

Common name: Prostrate Gomphrena, Prostrate Globe Amaranth, Coastal Globe Amaranth.\textsuperscript{[8]}

**Overall habitat**

Degraded deciduous forests, scrub jungles, and dry pastures.

**Distribution**

**Worldwide dispersion:** It is extensively found in both tropical and native South America.

**Distribution in India:** In Assam, Bihar, Gujarat, Kerala, Karnataka, Odisha, Tamil Nadu.\textsuperscript{[9]}

**Botanical details**

**Flower:** The petals are tiny, compressed, ovate-lanceolate, actinomorphic, unscented, and bisexual. Their color is snow-white with a tinge of pink. There are two bracteoles and one deltoid-ovate, glabrous bract per bloom; the bracteoles have an uneven dentate crest. Five lanceolate, white, free tepals are present; the back is fleshy and woolly at base, while the outer two are papery and the inner three are woolly at base. Five fused stamens are located at the tip of the staminal tube, which has five lobes.\textsuperscript{[10]} The lobe incisions are separated by the yellow, glabrous, dithecous, introrse, and glabrous anthers. The ovary is globose, glabrous, greenish-white, and unilocular, along with a pendulous ovule. Two linear, equal-length, slender, glabrous, and slightly divergent stigmas are present; the style and stigmas are united and have a greenish-white color. The ovary, style, and stigma are housed in the staminal tube. The terminal leaf portion of the stigmas is 2.5 mm from the basal part of the anthers.\textsuperscript{[11]} *Gomphrena serrata* flower showed in fig. 2

**Root:** The transverse section of *G. serrata's* root revealed the presence of a cortex composed of parenchymatous cells with very small intercellular gaps and thin walls. Periderm, or two to three layers of narrow, tangentially elongated cells with dark brown granular materials, is visible in cork. It has a distinct taste and odor, a smooth texture, and a thickness of 4 to 12 cm. Its color is buff.\textsuperscript{[12]} *Gomphrena serrata* root showed in fig. 3

![Fig. 1: Gomphrena serrata Plant](image1)

![Fig. 2: Flower of Gomphrena serrata](image2)
Fig. 3: Root of *Gomphrena serrata*

**Leaves:** The leaves have an entire margin, a rounded or obtuse apex, and a basic elliptical shape and it have microscopic examination of the leaf revealed several diagnostic features, including the presence of the epidermal cells with a uniseriate multicellular covering the trichomes and anomocytic stomata, followed by 1-2 layered collenchymatous cells and it have 10-15 numbered conjoint, collateral closed vascular bundles.[13] *Gomphrena serrata* leaves showed in fig.4

Fig. 4: Leaves of *Gomphrena serrata*

**Stem:** The Stem have prostrated, procumbent, or decumbent, pilose12. Stems prostrate, decumbent, procumbent, pilose. Leaves sessile or petiolate; petiole to 0.6 cm; and blade green, obovate to oblong, 1.5–7.5 × 0.5–2.5 cm, apex rounded or obtuse, pilose-sericeous.[14] *Gomphrena serrata* stem showed in fig.5

Fig. 5: Stem of *Gomphrena serrata*

**Microscopic Studies of the root of *Gomphrena serrata*:**

The transverse section of the *Gomphrena serrata* root revealed the presence of a cortex composed of parenchymatous cells with thin walls and minuscule intercellular gaps. Additionally, cork displayed periderm, or narrow, tangentially elongated cells with two to three layers and dark brown granular matter. Phelloderm is 1-2 layered rows of tangentially elongated thin-walled cells.[15] Phloem and xylem were visible in the endodermis. Between the medullary rays is where the phloem is located. The medullary rays are biseriate in majority, uniseriate to tri seriate, and parenchymatous. There were radially distributed vascular bundles where the phloem is well developed and exhibits the existence of nonlignified phloem fibers. Xylem tissue consists of spiral xylem vessels and xylem fibers, and xylem parenchyma.[16]

**Phytoconstituents of *Gomphrena serrata* Root:**

It is containing flavonoids, volatile oil, alkaloids, tannins and phenols, saponins, steroids, Carbohydrates, acid compounds, glycoside, amino acids, and proteins.[17]

**Microscopic studies of the leaves of *Gomphrena serrata*:**

Microscopically, the leaf has shown the presence of epidermal cells with the uniseriate multicellular covering trichomes and anomocytic stomata, it followed by 1-2 layered collenchymatous cells and 10-15 numbered conjoint, collateral closed vascular bundles are the diagnostic characteristics observed by an anatomical study.[18] Using powder microscopy, the presence of lignified xylem vessels, parenchyma cells, anomocytic stomata on
the epidermis, and uniseriate multicellular covering trichomes was observed in the leaf. The investigations of the leaves also included leaf surface data i.e., quantitative leaf microscopy and fluorescence analysis.\[19\]

**Phytoconstituents of *Gomphrena serrata* leaf:**

It is containing flavonoids, volatile oil, tannins, phenols, saponins, alkaloids, steroids, Carbohydrates, acid compounds, glycoside, amino acids, and proteins.\[20\]

**Phyto constituents present in *Gomphrena serrata* plant:**

**Alkaloids:** Alkaloids are mainly biosynthetically derived from amino acids resulting in variety of chemical structures, mostly isolated from plants.\[21\] Alkaloids can be found in about 20% of plant species in small qualities and their production (including in biotechnology), extraction and processing remain major areas of research and development.\[22\] Both human treatment and an organism's natural defense depend heavily on alkaloids. Alkaloids make up approximately 20% of the known secondary metabolites founds in plants.\[24\] Alkaloids gave rise to distinctive lead compounds in medicine. Their basic characteristics include being soluble in water in acidic conditions and soluble in lipids in basic and neutral conditions. This is especially for dissolution in protonated form and membrane permeation in deprotonated form.\[25\]

**Glycosides:** Glycoside is recognized internationally and incorporates the study and application of carbohydrates which are the most abundant biomolecules on Earth.\[26\] Plants use their glycosides (such as cyanopropenyl glycoside) as pesticides.\[27\] Cyanogenic glycosides from cassava roots and yams, maize, sorghum and almond, apricot, cherries etc. liberate cyanide, which blocks cytochrome C oxidase, leading to their increased release into the cytosol, a response against herbivory.\[28\] Cardiac glycoside is conjugates of a glycone and an aglycone part. Glycone moiety can be glucose and fructose, glucuronide, rutinose and rhamnose.\[29\] Depending on the aglycone moiety, the glycosides can be of many types such as alcoholic (salicin); anthraquinone (antron and anthranol); coumarin; chromone; cyanogenic (amygdalin, linamarin, lotaustralin, dhurrin, prunasin); flavonoid (hesperidin, rutin, naringin); phenolic (e.g. arbutin); saponins (e.g. diosgenin, ginsenosides); cardiac; stevios (e.g. stevioside and rebaudioside A); iridoid (e.g. aucubin, geniposidic acid, theviridoside, loganin, catalpol); thio (e.g. sinigrin, sinalbin) etc.\[30\]

**Flavonoid:** The majority of plants have flavonoids in most of their organs. Although they are the most common secondary plant metabolites, their quantitative distribution varies from organ to organ or even plant to plant, depending on the environment. The availability of water and nutrients for the plant, the amount of sunlight it receives, the kind of soil it grows in, and the plant's age all affect the flavonoid content of the plant. The flavonoids chosen for this investigation were chosen based on how well they performed in peptic ulcer experimental models when hazardous agents were induced. Flavonoids have anti-ulcer properties that include suppressing the production of acids, raising gastric mucus and bicarbonate secretion, and inhibiting the activity and level of pepsin.\[31-33\] There have been reports of polyphenolic substances having good stomach protection and anti-ulcerogenic action. Among the cytoprotective substances who’s anti-ulcerogenic effectiveness has been thoroughly demonstrated are flavonoids. They use a number of modes of action, including enhanced mucus production, antioxidant and free-radical scavenging qualities, antisecretory activity, and prevention of Helicobacter pylori growth, to protect the stomach mucosa against a range of ulcerogenic substances.\[34\]

**Saponins:** Saponins lower blood cholesterol levels, blood glucose response, and cancer risk. A diet rich in saponins can be used to treat hypercalciuria in humans, prevent acute lead poisoning, and decrease dental caries and platelet aggregation.\[35\] The antiulcer action of the *Gomphrena serrata* aqueous extract was likely caused by the antioxidant saponins present.\[36\]

**Terpenes and Terpenoids:** Terpenes are one of the most prevalent and diverse chemical classes of natural chemicals. These volatile unsaturated
hydrocarbons are commonly found in liquid form as essential oils, oleoresins, and resins. Terpenoids are plant-based hydrocarbons with the general formula \((C_5H_8)_n\). They are divided into four groups based on the number of carbon atoms they contain: mono, di, tri, and sesquiterpenoids. Terpenoids are classified as monoterpenes (limonene), sesquiterpenes (artemisinin), diterpenes (forskolin), tetraterpenes (b-carotene), and polymeric terpenoids (rubber) based on the quantity of isoprene units in each.\[^{[37]}\] Monoterpenoids may mitigate the adverse effects of NSAIDs and stress on stomach injuries. Here, we'll mostly give an update on the roles that specific fruit monoterpenoids, triterpenoids, and pentacyclic terpenoids play in gastroprotection. Terpenoids are used to cure and prevent a variety of diseases, such as rheumatoid arthritis, cancer, cirrhosis, and arteriosclerosis, due to their antioxidant qualities.\[^{[38-39]}\]

**Vitamin E:** Tocopherols and tocotrienols are components of vitamin E, which is a fat-soluble substance. As a fat-soluble antioxidant, it stops the assembly of reactive oxygen species shaped when fat undergoes oxidation.\[^{[40]}\] Among the many biological roles that vitamin E plays, the most important and well-known one is its antioxidant action. Its alternative functions embody enzymatic activities, gene expression, and neurological functions.\[^{[41]}\] It has been proposed that vitamin E plays the most important role in cell signaling. Spinocerebellar ataxia and myopathies, peripheral neuropathy, ataxia, skeletal myopathy, retinopathy, immune response impairment, and red blood cell destruction are all brought on by vitamin E deficiency. Scientific research on vitamin E showed that it also has a power of nephroprotective activity.\[^{[42]}\]

**Tannins:** The term tannin is widely applied to complex large biomolecules of polyphenolic nature having a sufficient hydroxyl and other suitable groups such as carboxyl’s to form strong complexes with various macromolecules.\[^{[43]}\] The hydrolysable tannins are usually present in small amount in plants and are simple derivatives of gallic acid and they are classified according to the products obtained after hydrolysis gallo-tannins (gallic acid compounds and glucose) and ellagi-tannins (composed of biaryl units and glucose).\[^{[44]}\]

**Phenols:** Compounds with more or single aromatic rings coupled to a single or more hydroxyl groups are commonly called phenolic.\[^{[45]}\] The phenolic component of plants constitutes a complex mixture, and only a small number of plants have been examined systematically for their phenolic content.\[^{[46]}\] phenolic compound is ubiquitous in plant kingdom being found in all fruits and vegetables in virtually all parts of the plant but with quantitative distributions that vary between different tissues of the plant and within different populations of the same plant species.\[^{[47]}\]

**Steroids:** Plant steroids are unique class of chemical compounds that are found throughout the animal and plant kingdom.\[^{[48]}\] The addition of different chemical groups at different positions on backbone leads to the formation of many different types of steroidal compounds including sex hormones progesterone and testosterone, the anti-inflammatory steroids like corticosteroids, cardiac steroids digoxin and digitoxin, animal steroid like cholesterol, steroid glycosides.\[^{[49-50]}\] Plant steroids synthesized by cyclisation of 2,3-epoxysqualene into cycloartenol are further metabolized owing to the enzymatic conversion to produce biologically active steroids.\[^{[51]}\]

**Gomphrena serrata's pharmacological action:**

**Anticancer activity:** *Gomphrena serrata* chloroform extract was subjected to a phytochemical study, which revealed the presence of phenolic, terpenoids, flavonoids, amino acids, carbohydrates, and glycosides. They isolated the compounds oleuropein from *Gomphrena serrata*.\[^{[52]}\] The development of novel oleuropein as an anticancer agent and in-silico docking or computational studies are in the progress.\[^{[53]}\]

**Diuretic and in-vitro antiurolithiatic activities:** *Gomphrena serrata* ethanolic leaf extract’s diuretic and in vitro antiurolithiatic activities were assessed. He concluded that it was already reported that are natural products like steroids, saponins, glycosides which have been shown to possess various biological properties related to Diuretic and Anti-Urolithiatic activity.\[^{[54]}\] All the observations
provided the basis for the conclusion that the alcoholic extract of the dried leaves of *Gomphrena serrata* is endowed with Diuretic and Anti-Urolithiatic Activity.[55]

**Antimicrobial activity:** By using the Kirby-Bauer method, Dias et al. examined the pure compound of *Gomphrena serrata* and its ethanolic extract for antibacterial activity. The outcome shown significant action against Salmonella typhi and Staphylococcus aureus. Ethyl acetate and methanol extract of *G. serrata* showed anthelmintic activity against Pheretima Posthuma, Fasciola gigantica, and Taenia Solium, according to research by Dosumu et al.[56] The ethyl acetate extract displaced higher levels of antibacterial and anthelmintic activity.[57]

**Anti-inflammatory and Analgesic Activity:** Anti-inflammatory and Analgesic properties of aqueous leaf extracts of *Gomphrena serrate* (*Gomphrena celosioides*) in rats and mice were reported by Oladele et al. These two plants are having anti-inflammatory activity, which inhibit edema induced by carrageenan in the rat paws.[58]

**Antioxidant activity:** The inflammatory process induced by carrageenan increased serum levels reactive oxygen species,[59] such as thiobarbituric acid reactive substances (TBARS) which are markers of lipid peroxidation produced during stress in rats treated with carrageenan. These oxygen species play a role in the development of oxidative stress and inflammation. Ethanol extract is reduced TBARS in serum and suggesting an antioxidant activity of *Gomphrena serrate* (*Gomphrena colostomies*).[60]

**Anticonvulsant activity:** A chronic brain function disorder is epilepsy. Neurological hypothesis states that it is a self-limited, paroxysmal cerebral dysrhythmia. It is accompanied by abnormal patterns on the electroencephalograph, and severe seizure may cause a loss of consciousness.[61] *Gomphrena serrata* ethanolic extract on seizures in mice caused by maximum electric shock. The ethanolic plant extract of *Gomphrena serrata* at 400mg/kg, 600mg/kg and 800mg/kg showed significant results which indicated decreased chronic extension and stupor.[62] Herbal medicine can be a source for new therapeutics and considering the evidences of the pharmacological property described for this plant, the present investigation was under taken to evaluate the anticonvulsant activity.[63]

**Antibacterial activity:** In *Gomphrena serrata* L., alkaloids were detected. As per the earlier reports, alkaloids are a promising source of antimicrobial agent.[64] *Gomphrena serrata* L. also contain tannins and phenols which can also act against a variety of strains of bacteria.[65] Significant antibacterial activity against Bacillus cereus, Staphylococcus aureus, Escherichia coli, and Vibrio harveyi was demonstrated by both aqueous and ethanolic extract. The standard antibiotic Amoxycillin was used to compare the antibacterial activity of *Gomphrena serrata* L.[66]

**DISCUSSION**

Indian systems of medicine utilize the majority of the crude drugs which are of plant origin.[67] Prior to any plant’s identification and quality being confirmed, it is crucial that standards be established; for this reason, a thorough pharmacognostic assessment is a crucial precondition. In accordance with World Health Organization (WHO),[68] the organoleptic and histological description of a medicinal plant could be the first step towards establishing its identity and purity and should be performed before to any tests tend to be undertaken extensively utilized in conventional medicines has tremendous therapeutically potential due to its various biological activities. The prominent diagnostic characteristics of the root were xylem fibers, lignified xylem vessels, cork cells and parenchymatous cells.[69] These characters can be utilized for standardization of drugs as well as used for preparation of plant monograph and also reduces the possibilities of adulteration, when the drug is available in the powder form studies of physicochemical parameters can serve as an important source to judge the purity and the quality of crude drugs.[70] Ash readings are used to determine the crude drug's grade and purity. It implies the existence of various impurities like carbonate, oxalate, and silicate.[71] The water-soluble portion of the total ash is used to determine how much inorganic material is present in the
medications. The majority of the silica in the acid-insoluble ash is indicative of earthy matter contamination. The moisture content of drugs might be at the minimum level in order to suppress the growth of microorganisms like bacteria, yeast or fungi during storage. The extractive values are helpful to judge the chemical constituents present in crude drug and also assist in evaluation of particular constituents soluble in a specific solvent. Essential indicators that show the quality and purity of the herbal medication are total ash and acid insoluble ash. Total ash consists of physiological ash, which is derived from plant tissue itself, and non-physiological ash that is usually derived from atmosphere contaminations including sand and soil. Because plant materials typically contain a large amount of physiological ash, specifically calcium oxalate, total ash content alone is insufficient to establish the quality of herbal medicine. Thus, another indicator of the quality of herbal medicine is the acid-insoluble ash level. The phytochemical analysis of extracts viz., petroleum ether, chloroform, methanol, and water was analyzed and it indicated the presence of alkaloids, carbohydrates, saponins, tannins, proteins, amino acids, phytosterols, and flavonoids.

CONCLUSION
The studies on Gomphrena serrata elaborate the biological and medicinal applications would support the traditional usage of the plant in village sides even now. The present study might be explored the medicinal importance of the plant for further studies. Due to the fact that herbal medications are derived from a variety of sources and may vary, standardization is essential. These kinds of variations can cause spurious results in various pharmacological and phytochemical studies. Gomphrena serrata root was recognized for many therapeutical properties and therefore the current study might be beneficial to supplement the information in respect to its identification and authentication, and standardization; no such information is available for the same till date.

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