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SHORT REVIEW

Chenopodium album as a Treasure of Therapeutic and Nutritional Potential

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Abstract

Chenopodium album, locally called as Bathua or white Goosefoot, is a fast growing herb belonging to the *Amaranthaceae* family. It is widely distributed plant growing in tropical and subtropical parts of India, which is largely consumed as a leafy vegetable in the diet of a common man and also utilized as traditional medicine. The plant is rich in various phytochemicals including flavonoids, phenols, alkaloids, and saponins, immensely contributing to its medicinal properties. Additionally, it is a good source of energy, proteins, carbohydrates, ascorbic acid, beta carotene, and essential minerals such as potassium, sodium, calcium, phosphorus, and iron. It is also known for its antihelmintic, antiphlogistic, antirheumatic, antidiarrheal, antioxidant, antibacterial, contraceptive, laxative, odontalgic, and other medical qualities. The plant also provides some traditional remedies to treat digestive, peptic ulcer, and liver disorders. Different herbal preparations from the plant help to treat numerous illnesses, including kidney stones, edema, anaemia, heart disease, and jaundice. As per the reports, this herb provides 100 gm fresh weight 1.2 mg iron, 309 mg calcium. The bioactive ingredients extracted from *C. album* have exhibited potential against various pathogens, nematodes, and some agricultural pests. Due to its strong nutritive and therapeutic importance, C. *album* serves as both a functional food and a medicinal plant. Considering the significance of this herb, this article mainly highlights its importance for both nutritional and medicinal purpose to raise awareness and conservation of the species.
Major Findings: *Chenopodium album* having nutritional and medicinal properties. The leaves of the plant provide a variety of advantageous therapeutic qualities. Plant having antioxidant, antidiarrheal, antimicrobial, anticancer, anthelmintic, antiphlogistic properties, as the number of phytochemicals such asalkaloids, phenols, saponins, phytosterols, and flavonoids found in *C. album.*

Keywords: Beneficial Weed, *C. album,* Chemical Constituent, Medicinal Value, Nutritive Value, Traditional Value

1. Introduction

Chenopodium album is a rapidly growing annual weed that belongs to the *Amaranthaceae* family, and its subfamily is *Chenopodiaceae*. It is commonly known as Goose foot, White goose foot, Pigweed, Bathua. The herb is widely distributed in tropical and subtropical parts of India. The upper portion of the flowering stems have whole, lanceolate-rhomboid leaves (Figure 1). The leaves have a whitish coating on the underside and are waxy-coated, unwettable, and mealy in appearance. On a 10-40 cm long, densely branched inflorescence, the tiny flowers, which are radially symmetrical and grow in little cymes, are present (Figure 2). Peoples are using it not only as an herb veggies and animal forage however it is also used for medicinal purpose[1].

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The mixture or decoction of the leaves can be used as a purgative and anthelminthic. Additionally, it has been advocated for use in the treatment of hepatic issues and the development of spleen. The leaves are ground into a very fine powder and used to make anthelminitics. Additionally, it is applied in stomach issues, eye conditions, throat discomforts, blood, heart, and spleen ailments, as well as nausea and vomiting due to its non-toxic nature[2].

The leaf extracts of *C. album* contain a varied range of phytochemicals, including phenols, alkaloids, flavonoids, and tannins. Such phytochemical composition suggests the potential of medicinal value of the plant. Moreover, the nutritional analysis showed that *C. album* is a good source of essential nutrients. It contains significant amounts of proteins, carbohydrates, fats, vitamins (such as vitamin A and vitamin C), and minerals (including calcium, iron, and phosphorus)[3].

2. Chemical Constituent

Alkaloids, phenols, saponins, phytosterols, and flavonoids are only a few of the many phytochemicals found in *C. album*. It mostly contains the flavonoids quercetin and kaempferol. The leaves of *C. album* are a possible source of albuminoids, minerals, and essential oils, particularly potash. Saponin can be found in its root. 1, 2, and 16 apocarotenoids have been isolated using the *C. album* extract. It was determined that the novel apocarotenoids have (3R, 6R, 7E, 11E) by using spectroscopic NMR and MS analysis[4]. It was possible to identify 3-hydroxy-13 apo-alpha-carotene-13-one (1) and (6S, 7E, 9E, 11E)-3-oxo- 13apo-alpha-carotene-13-one[2]. One study with 4 *C. album* cultivars leaves were examined, and it was discovered that they contained trypsin inhibitor activity of 0.11 to 0.17 TIU/mg, total phenols of 224.99 to 304.98 mg GAE/100g, simple phenols of 72.50 to 101.007 mg GAE/100g, and tannins of 152.49 to 203.91 mg GAE/100g, as well as saponins of 0.043 to 0.867[5,6]. *C. album* leaves yielded 0.64 percent oil by weight. The following was found in (%) the oils of *C. album* leaves: Tricyclene: trace, α-Thujene: trace, α-Pinene: 7.0, Camphene: trace, Sabinene: trace, β-Pinene: 6.2, Myrecene: trace, p-Cymene: 40.9, Limonene: 4.2, Benzyl alcohol: trace,1,8-Cineole: trace, Cis-ocimene: trace, γ-Terpinene: trace, Linalool: trace, Pinane-2-ol: 9.9 , Alloocimene: trace, Citronellal: trace, Borneol: trace, Terpinen-4-ol: Trace,α-terpineol:6.2, Citronellol: trace, Ascaridole:15.5, Neral: trace, Linalyl acetate: 2.0, Geranial: trace, Borneol acetate: trace, Thymol: trace, Carvacrol: trace, Ethyl cinnamate: 3.7, Acetyl eugenol: trace, Elemicin: trace and Benzyl benzoate: trace[7].



Figure 1. *C. album* at vegetative stage.



Figure 2. Flowering stage.

3. Traditional Value

Chenopodium album Linn was said to have numerous uses in folk medicine, including those for laxatives, anthelmintics against round and hookworms, blood purifiers, and antiscorbutics[3]. For biliousness, intestinal ulcers, spleen enlargement, and hepatic diseases, an infusion is used. The herb is utilised in the *Ayurvedic* medical system to cure *vata* and *kapha*. Additionally, the plant may help with piles, appetite loss, throat problems, vision problems, and blood issues. *C. album* leaves are used as a cardiotonic and anthelmintic[8]. Leaf juice is effective for curing burns. When treating rheumatism and arthritis, decoction of aerial components is applied to the affected body parts[9]. The herb was also traditionally used as an antiscorbutic, anthelmintic against roundworms and hookworms, and as a cure for abdominal pain, eye conditions, throat issues, and cardiovascular illnesses[10,11]. Constipation can be treated with boiled tender shoot[12]. *C. album* Linn. Leaf juice and fine leaf powder were used to soothe burns and ease inflammation. The body part afflicted by arthritis and rheumatism was massaged with an alcohol-based decoction of aerial components[13].

4. Nutritional Composition

Chenopodium album is a cultivated wild green vegetable that is nourishing and nutritious[14,15]. Green leaves of *C. album* are particularly nourishing and abundant in calcium, vital amino acids, vitamin A, and vitamin C[16]. On the other hand, according to another study, *C. album*'s green leaves contain a remarkable amount of vitamin C and carotenoids[17]. It also contains a decent amount of iron, which is higher than that of spinach and cabbage but lower than that of *Amaranth* leaves[18]. Leucine, isoleucine, lysine, and vitamin C are all found in abundance in *C. album*, according to Pande and Pathak[19], as an active component. *C. album* demonstrated high resistance to salt, drought, and cold stress. The high lysine content of *C. album* is another appealing characteristic.

Reformed from Gesinski and Nowak[20].

Table 1. Nutritional content of *C. album*

S. No.	Nutrients	Quantity (per 100 gm. fresh weight)
1	Water	84.3g
2	Energy	44Kcal
3	Carbhohydrates	7.3g
4	Fat	0.8g
5	Proteins	4.3g
6	Fibre	4g
Minerals		
7	Iron	1.2mg
8	Calcium	309mg
9	Phosphorous	72mg
10	Sodium	43mg
Vitamins		
11	Vitamin A	580µg
12	Vitamin B complex	-
13	Thiamine	0.16mg
14	Panthothenic acid	0.092mg
15	Riboflavin	0.4mg
16	Niacin	1.3mg
17	Vitamin C	90mg

5. Nutritive Value

Chenopodium album, often known as Bathua, is a winter-growing plant that is popularly eaten as a green leafy vegetable in India. It is incredibly nutritious and wholesome, and it also has therapeutic qualities. This plants' leaves are used in a variety of meals, including soups, curries, and paratha. *C. album* is used to treat a wide range of nutritional deficiency-related illnesses. The seeds of these plants are consumed by numerous birds and mammals, including sparrows, chipmunks, and squirrels[21,22]. With a protein content of 4.2%, *C. album* leaves are high in essential amino acids including lysine, leucine, and isoleucine as well as calcium and vitamins A (11,000 IU/100 g) and C (80 mg/100 g)[16]. The leaves of *C. album* have high levels of vitamin C (155 mg/100 g) and carotenoids (12.5 mg/100 g), according to the amount of fibre in *C. album* was particularly noteworthy (4-6 g/100 g), and it had a higher iron content than widely eaten spinach and cabbage but not as much as amaranth leaves[17,18]. According to Pande and Pathak, *C. album* has a high concentration of

Table 2. Total amino acids content present in the seeds and green matter of *C. album*

Exogenous Amino Acids (g kg^{-1})										
	Arginine	**Pheny lalanine**	**Histidine**	**Isoleucine**	**Leucine**	**Lysine**	**Methionine**	**Threonine**	**Valine**	**Total**
Green matter	11.29	9.26	4.34	5.36	13.44	10.11	1.81	8.18	6.58	70.4
Seeds	17.18	4.90	5.28	3.34	7.58	8.07	2.27	5.35	3.72	57.7
Endogenous Amino Acids (g kg^{-1})										
	Alanine	**Glycine**	**Aspartic acid**	**Glutamic acid**	**Serine**	**Tyrosine**				**Total**
Green matter	7.96	10.92	11.59	16.83	7.92	9.54				64.8
Seeds	3.35	10.37	5.94	13.56	6.46	5.25				44.9

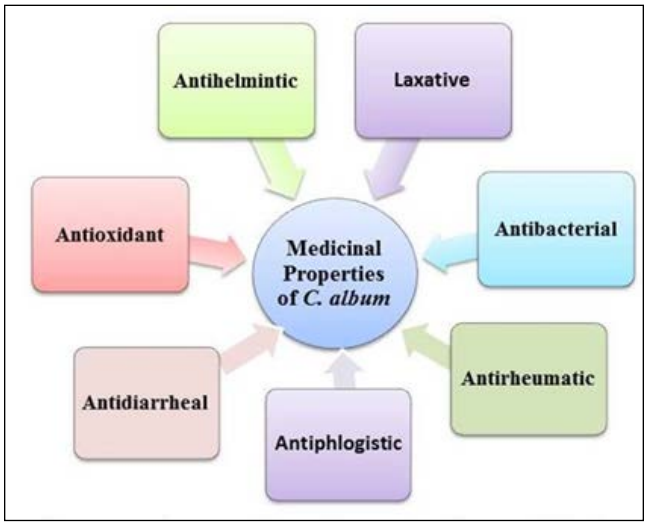


Figure 3. Medicinal properties of *Chenopodium album*.

amino acids, specifically leucine, isoleucine, lycine, and vitamin C, which are the main active ingredients[19]. To prevent excessive blood pressure, the body's Na/K ratio is a major concern. It is advised to keep the Na/K ratio under one (Food and nutrition board 2005). Because of its Na/K ratio of less than 1, use of *C. album* would likely minimise high blood pressure illnesses (Tables 1 and 2)[5].

6. Medicinal Properties

Antihelmintic, antiphlogistic, antirheumatic, antidiarrheal, antioxidant, antibacterial, contraceptive, laxative, odontalgic, and other medical qualities are among the benefits of *C. album* (Figure 3). Rheumatoid arthritis, insect bites, sunstroke, urinary tract infections, skin conditions, and more are all treated with *C. album*[21]. The leaves have been used to heal burns because they are also known to have sedative and cooling qualities[21].

6.1 Medicinal Value

Fresh *Chenopodium* leaves provide a variety of advantageous therapeutic qualities. Numerous illnesses, including kidney stones, edema, anaemia, heart disease, jaundice, and many more are treated with it. Juice from *C. album* or Bathua leaves is used as a folk remedy for intestinal parasites. Additionally, it raises haemoglobin levels and is healthy for the heart. Its leaves are beneficial for the liver, spleen, and gall bladder and are regarded as a cardiac tonic[23]. *C. album* is used to alleviate pain and muscle spasms[24]. In India, the plant is used as a purgative, diuretic, narcotic, and for relieving stiffness through infusion of the plant. It was also used to treat dyspepsia, farts, strangyry, original shortcoming, pharyngopathy, splenopathy, haemorrhoids, ophthalamopathy, cardiovascular turmoil, hepatic issue, spleen broadening, biliousness, intestinal ulcers, and general debility. It was also used as an anti-diarrheal, anti-phlogistic and anti-rheumatic, preventative (Khare CP).

6.2 Antimicrobial Properties

The pure leaf extract of *C. album* cv. *Pusa bathua* 1 was used to isolate two antiviral proteins (AVPs) called CAP-I and CAP-II, which are employed to stop the infection of their respective host plants by the *Tobacco mosaic* Virus (TMV) and *Sunhemp rosette*

Viruses (SRV)[25-26]. They differ in terms of N-terminal sequence and amino acid content. Their IC50 values also differ, and research has shown that CAP-I is 2.5 times more effective than CAP-II at preventing viral infection[25]. *Macrophomina phaseolina* is a soil-borne fungal plant pathogen with a wide host range and widespread geographic distribution. The antifungal activity of methanol and n-hexane leaf, stem, root, and inflorescence extracts of *C. album* (1, 2, 3 and 4 percent w/v) was examined against it. The fungal biomass was reduced by 60-94% by the n-hexane extracts of *C. album*[27].

6.3 Anticancer Effect

Chenopodium album (leaves) effects on the development of estrogen-dependent (MCF-7) and estrogen-independent (MDA-MB-468) human breast cancer cell lines were assessed. The greatest antibreast cancer activity was seen in a methanolic extract of *C. album* (leaves), with an IC50 value of 27.31 mg/ml against the MCF-7 cell line. At 48 hours after treatment and at a dosage of 100 mg/ml, a significant percent inhibition (94.06 %) was seen against the MCF-7 breast cancer cell line[28].

6.4 Anthelmintic Properties

Chenopodium album Linn demonstrated anthelmintic efficacy against sheep trichostrongylid nematodes by killing the worms and preventing the hatching of the eggs. The egg hatch test resulted in LC50=0.499 mg/ml for the substance. On day 5 after treatment, *C. album* AME at 3.0 g/kg demonstrated a greater rate of reduction (82.2%) in Eggs per Gramm (EPG) in faeces[29]. According to studies, *C. album* has anthelmintic properties against cyathostomins, a significant gastrointestinal nematode that affects horses.

7. Conclusion

The medicinal plant *C. album* is very significant. It has numerous medical and nutritional benefits. Because it contains more nutrients than other green leafy vegetables, we Indians eat *C. album*. Since ancient times, it has been utilised in folk medicines to treat a wide range of illnesses with great success for human health. The essay was evaluated due to its efficacy and safety, *C. album* is a medicinal plant that can be used in a variety of medical procedures. It has a lot of nutritional value. As a result, it is used to prepare a variety of nutritious food products by adding *C. album* leaf extract and powder. Many disorders can be cured with it, and it is utilised in traditional remedies to treat a variety of ailments from ancient times.

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9. Author Contribution

Neha Saini: Manuscript writing, correction and correspondence. Ankit and Diksha Nautiyal edited the manuscript. Sandeep Kumarand Rashmi T Chamoli: Data collection and review the literature. Pallavi Chauhan: Compiling the data. Smritylekha Majumder: Editing work.

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