
*Indu Sikarwar*, Manish Wanjari, Satyendra Singh Baghel, Pranav Vashishtha

1Department of Pharmacology, Shriram College of Pharmacy, S.R.G.O.C. Campus, AB Expressway, Banmore, M.P., India.  

**ARTICLE INFO**

**Article history**
Received 07/04/2013  
Available online 28/04/2013

**Keywords**
*Chenopodium album*; Bathua; Pharmacological properties; Pharmacognostical studies; Traditional uses; Meditional uses

**ABSTRACT**

*Chenopodium album* Linn. (Bathua) belongs to the family Chenopodiaceae, is an important medicinal plant in Ayurveda used in diseases of blood, heart, spleen, eye and in biliousness conditions, cough, abdominal pain, pulmonary obstruction and in nervous affections. The plant contains essential oils, besides alkaloids, trigonelline and chenopodine. Leaves are rich in potassium & vitamin C. Pharmacognostic evaluation including examinations of morphological and microscopic characters, determination of leaf constant, ash value, powder analysis, and extractive values were carried out. Phytochemical screening including qualitative chemical examinations was also carried out. Pharmacological studies on the plant revels the proven activity of its as hypoglycemic, antibacterial, spasmyloytic, antipruritic, anti-inflammatory, hepatoprotective, antioxidant, anticancer. The plant has effective pharmacological action. On the basis of recent pharmacological studies some additional medicinal properties of various species of the genus have been established. In the present paper an attempt has been made to summarize the traditional uses and reported biological activities of the genus for further studies.

**Corresponding author**

*Indu Sikarwar*,  
Department of Pharmacology, Shriram College of Pharmacy, Banmore, M.P., India.  
E. Mail- indu.py13@gmail.com


Copy right © 2013 This is an Open Access article distributed under the terms of the Indo American journal of Pharmaceutical Research, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.
INTRODUCTION

Chenopodium album L. (family: Chenopodiaceae) is herbaceous vegetable plant locally known as Bathua. It is cultivated as pot-herb and usually grown in gardens, but sometimes in corner of early grain fields in Bombay presidency and elsewhere in India (Kashmir and Sikkim). It is 0.3-3 m high erect or ascending mealy or green and reddish, inodorous, stem often striped. Leaves are very variable in size and shape reaching in cultivated plants some times 15 cm long, oblong, rhombic, deltoid or lanceolate, obtuse or acute, entire, toothed or irregularly lobulate, petioles long slender. Embryo is completely annular. The plant improves the appetite. The plant has anthelminitic, laxative, diuretic, aphrodisiac action. It is also used in abdominal pains, eye disease, throat troubles, piles, diseases of the blood, heart and spleen and biliousness [1]. The medicinal property of this plant is mainly present in leaves and seeds. Leaves are rich in essential oil mineral matters, particularly in potash salts, a considerable amount of albuminoids, and other compounds are nitrogen. The plant is recommended by Hindu physicians for correction of hepatic disorders and splenic enlargement [2]. Ethnobotanical studies of Chikar and its allied areas of District Muzzafarabad reported the folk medicinal uses of seeds and leaves of Chenopodium are given in hepatic disorder and enlarged spleen and aqueous extract of leaves is given orally against jaundice [3].

Taxonomical Hierarchy

Kingdom : Plantae
Sub kingdom : Tracheobiont
Super division : Spermatophyta
Division : Magnoliop
Class : Magnliopsida
Sub class : Caryophyllidae
Order : Caryopllales
Family : Chenopodiaceae
Genus : Chenopodium L.
Specie : Chenopodium album
Variety : Chenopodium album L. var. Album
Symbol : CHALA
Group : Dicot
Duration : Annual
Growth habit : Forbs /Herb
Botanical name : Chenopodium album

Vernacular Names

Sanskrit : Vastuka
Hindi : Bathua sag
Bengali : Chandan betu
Tamil : Parupukkirai
Telgu : Pappukura
Malyalam : Katu ayamoddakam
English : WhiteGoose foot
Gujarati : Chel, Tanko
Kannada : Hancike
Marathi : Chakvat [4, 5]
Ayurvedic Description

Sanskrit name: Vastuka
Synonyms: Yavasaka, Gauda-vastuka, Ksarapatra, sakarat
Action: Krmighna, saraka, dipana, medya, rucikara, sukrapadara, vranaropana
Uses: Arsa, pravahika, raktapitta, urustambha, vataja-kasa, raktapradara (root)\[^{4,5}\]

Habitat

*Chenopodium album* Linn (family: Chenopodiaceae) is cultivated in gardens and agricultural land; it is distributed all over South East Asia. It is found in areas around Mumbai, Kashmir, Sikkim and throughout Pakistan \[^{6}\]. It has the strong smelling herbs, about 21 species occur in India, of which a few have been introduced. A polymorphous, meanly white, erect herb, up to 3.5m in height, found wild up to an altitude of 4,700m, and cultivated throughout India \[^{7}\].

MORPHOLOGY

*Chenopodium album* commonly named as Bathua or Goosefoot. It is herbaceous, 0.3-3.5m high, erect or ascending, mealy or green or reddish, inodorous.

Stems: Stems rarely slender, angled, often striped green, red or purple \[^{8}\].

Leaves: Leaves are very variable in size and shape, reaching in cultivated plants sometimes 15cm long, oblong, rhombic, deltoid or lanceolated obtuse or acute entire, toothed or irregularly lobulated; petioles- long, slender\[^{8}\].

Flowers: Flowers are in clusters forming complex or lax paniculate often mealy spikes, which in cultivated forms become thyrsoird. Sepals- 1.5-2mm long, oblong lanceolated, keeled, closing over the thinly membranous utricle. Stigmas-2 \[^{8}\].

Seeds: 1.5 mm diameter, orbicular, compressed, with an acute margin, smooth, shining, embryo completely annular. The young plant of not more than 20cm is much esteemed as a potherb \[^{8}\].
Traditional Uses

Many species of Chenopodium are being used traditionally in indigenous systems of medicine for the treatment of numerous ailments. *C. album* improves the appetite, acts as anthelmintic, laxative, diuretic and tonic. It is also useful in biliousness, *vata* and *kapha*, abdominal pain and eye diseases. It is used in the form of pot herb in piles. The finely powdered leaves are used as a dusting powder about the external genitalia in children[^9].

Phytochemical Profile

Leaves are rich in essential oil mineral matters, particularly in potash salts, a considerable amount of albuminoids, vitamin C and other compounds are nitrogen. Analysis of the leaves gave moisture, 89.6; protein, 3.7; fat 0.4; fiber, 0.8; other carbohydrates, 2.9; and minerals, 2.6g; calcium, 150; phosphorus, 80; iron, 4.2 thiamine, 0.01; riboflavin, 0.14; niacin, 0.6; vitamin C, 35mg, carotene 1,740 µg; and energy, 30kcal /100g; zinc, 24.0; iodine, 0.98; fluorine, 6.3(dry basis); and vitamin K, 250ppm. Betalain alkaloids, phenolic acids in fruits, betain and oxalic acid in leaves[^10], oleanolic acid and sitosterol in flowers[^11], furanocoumarins w5x and saponins from the seeds[^10].

A phenolic amide has been isolated from the roots of *C. album*. Its structure was determined as N-trans-feruloyl-4-0-methyldopamine by spectroscopic evidence and chemical synthesis[^12]. Three saponins have been isolated from the roots of *C. album*[^10].

Hydrodistillation of leaves of *C. album* yielded 0.64 % v/w of essential oil. GC and GC/MS analyses of the oil revealed that it contained bulk of aromatic compounds (60.1 %). The abundant constituents of the oil were: p- cymene (40.9 %), ascaridole (15.5 %), pinane-2-ol (9.9 %), α-pinene (7.0 %), β-pinene (6.2 %) and α-terpineol (6.2 %). The content of oxalic acid in *C. album* is with a range of values from 360 to 2000 mg/100g[^13]. A new phenolic glycoside, named chenoalbuside was isolated from the methanol extract of the seeds of *C. album*[^14]. Cinnamic acid, sinapic acid, ferulic acid and their derivatives and methyl ferulate were isolated from the leaves of *C. album*. Hydro-alcoholic extract from the leaves of *C. album* after acetone precipitation, led to the isolation of 7 lignans: pinoresinol syringaresinol, lariciresinol, its derivative compound and three sesquilignans[^15]. The Kaempferol, Quercetin and their glycosides has been isolated from the aerial parts of *C. album*[^16]. The occurrence of sitosterol was encountered in the leaves and stems of *C. album*. Sitostanol and campesterol were isolated from the leaves and stems of *C. album*[^17]. 20-hydroxyecdysone was found in four species: in the aerial parts[^18], seeds[^12], leaves[^19] and roots[^20] of *C. album*. Vitamin A was isolated from *C. album* and the content was between 13,000 and 15,000 IU/ 100 mg fresh weight[^21].

Preliminary Phytochemical Studies

Successive solvent extraction values in various organic solvent were observed as petroleum ether 3.53%, benzene 2.33%, chloroform 2.83%, acetone 2.66%, methanol 5.44% and ethanol 4.55% as shown in table 1[^22].
Table 1. Successive solvent Extraction of leaves of *Chenopodium album* Linn. [22]

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Solvents used</th>
<th>Colour &amp; Consistency</th>
<th>Avg. extractive values in % w/w on dry weight basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Petroleum Ether</td>
<td>Black green oily mass</td>
<td>3.53</td>
</tr>
<tr>
<td>2</td>
<td>Benzene</td>
<td>Black Green sticky mass</td>
<td>2.33</td>
</tr>
<tr>
<td>3</td>
<td>Chloroform</td>
<td>Light green residue</td>
<td>2.83</td>
</tr>
<tr>
<td>4</td>
<td>Acetone</td>
<td>Yellow</td>
<td>2.66</td>
</tr>
<tr>
<td>5</td>
<td>Methanol</td>
<td>Yellow blackish mass</td>
<td>5.44</td>
</tr>
<tr>
<td>6</td>
<td>Ethanol</td>
<td>Brown dry mass</td>
<td>4.55</td>
</tr>
</tbody>
</table>

The proximate analysis revealed that total ash value 9.55, water soluble ash 3.85, acid insoluble ash 8.33, alcohol soluble ash 7.28, sulphated ash 10.11, stomatal no 20-23, stomatal index 4.9- 8.8, veinislet no 8-11, veinislet termination no 5.5-7 and palisade ratio 9.5-11.9 values were observed in fresh leaves.(Table -2) [22].

Table 2: Evaluation of *Chenopodium album* Linn. leaves. [22]

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameters</th>
<th>Values obtained w/w on dry weight basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ash value</td>
<td>9.55</td>
</tr>
<tr>
<td>2</td>
<td>Water soluble ash</td>
<td>3.85</td>
</tr>
<tr>
<td>3</td>
<td>Acid Insoluble ash</td>
<td>8.33</td>
</tr>
<tr>
<td>4</td>
<td>Alcohol soluble ash</td>
<td>7.28</td>
</tr>
<tr>
<td>5</td>
<td>Sulphated ash</td>
<td>10.11</td>
</tr>
<tr>
<td>6</td>
<td>Stomatal number</td>
<td>20-23</td>
</tr>
<tr>
<td>7</td>
<td>Stomatal index</td>
<td>4.9-8.8</td>
</tr>
<tr>
<td>8</td>
<td>Veinislet number</td>
<td>8-11</td>
</tr>
<tr>
<td>9</td>
<td>Veinlet Termination No</td>
<td>5.5-7</td>
</tr>
<tr>
<td>11</td>
<td>Palisade ratio</td>
<td>9.5-11.9</td>
</tr>
</tbody>
</table>

Table 3 shows the presence of saponin, tannin, lignin, protein, carbohydrates, suberin, glucoside, flavin, and traces amount of oil and absence of alkaloids & sugars in colour reaction tests of *C. album* linn [23].
Table 3: Various phytochemical tests.\textsuperscript{[23]}

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Reagents</th>
<th>Test For</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dragendorff’s Reagent</td>
<td>Alkaloid</td>
<td>Negative</td>
</tr>
<tr>
<td>2</td>
<td>Mayer’s Reagent</td>
<td>Alkaloid</td>
<td>Negative</td>
</tr>
<tr>
<td>3</td>
<td>Tannic Acid</td>
<td>Alkaloid</td>
<td>Negative</td>
</tr>
<tr>
<td>4</td>
<td>Wagner’s Reagent</td>
<td>Alkaloid</td>
<td>Negative</td>
</tr>
<tr>
<td>5</td>
<td>Hager’s 60 Reagent</td>
<td>Alkaloid</td>
<td>Negative</td>
</tr>
<tr>
<td>6</td>
<td>Phloroglucinol + HCl</td>
<td>Lignin Dark Red</td>
<td>Dark Red</td>
</tr>
<tr>
<td>7</td>
<td>FeCl\textsubscript{3}</td>
<td>Tannin</td>
<td>Black</td>
</tr>
<tr>
<td>8</td>
<td>Molisch Test</td>
<td>Carbohydrates</td>
<td>Red</td>
</tr>
<tr>
<td>9</td>
<td>Millon’s Reagent</td>
<td>Protein</td>
<td>Red ppt</td>
</tr>
<tr>
<td>10</td>
<td>Xanthoproteic</td>
<td>Protein</td>
<td>Yellow</td>
</tr>
<tr>
<td>11</td>
<td>Benedict’s Reagent after Heating</td>
<td>Sugars</td>
<td>Negative</td>
</tr>
<tr>
<td>12</td>
<td>Sample + Heating with Strong KOH + H\textsubscript{2}SO\textsubscript{4}</td>
<td>Subernin</td>
<td>Red Black</td>
</tr>
<tr>
<td>13</td>
<td>Molisch Test after Hydrolysis</td>
<td>Glucoside</td>
<td>Yellow</td>
</tr>
<tr>
<td>14</td>
<td>Plant Powder + H\textsubscript{2}O + Shake</td>
<td>Saponin</td>
<td>Large Froth (W)</td>
</tr>
<tr>
<td>15</td>
<td>Mg Powder + Conc. HCl</td>
<td>Flavin</td>
<td>Green-Black</td>
</tr>
<tr>
<td>16</td>
<td>Libermann’s Buchard Reagent</td>
<td>Steroid</td>
<td>Violet</td>
</tr>
<tr>
<td>17</td>
<td>Sudan IV</td>
<td>Oils</td>
<td>Red</td>
</tr>
</tbody>
</table>

**Pharmacological Profile**

**Anticancer Activity**

Ethanolic and aqueous extract of the leaves of *C. album* were screened for their anti cancer properties by A. Joshi and R.S. Chauhan (2012). Both the extracts showed positive results with successful control of cell’s growth. The cells were seeded with both the extracts and then allowed to grow for 24 hrs, the cell growth was inhibited and apoptotic bodies were formed within 24hrs\textsuperscript{[24]}.

**Hepatoprotective Activity**

V. Nigam and P. M. Paarakh (2011) evaluated hepatoprotective activity of aerial parts of *C. album* Linn using paracetamol and alcohol as hepatotoxin. In both experiments alcoholic [ALCA] and aqueous [AQCA] extracts of the aerial parts of *C. album* at the doses of 200 and 400 mg/Kg were evaluated for hepatoprotective activity using biochemical markers and by histopathological method. The alcoholic and aqueous extracts of *C. album* significantly restore physiological integrity of hepatocytes\textsuperscript{[25, 26]}.

A. Pal et al. (2011) investigated hepatoprotective activity of *C. album* Linn. plant (acetone and methanol extracts, in ratio of 50:50) against paracetamol induced hepatic injury in rats. Serum marker enzymes, serum bilirubin, reduced enzymic and nonenzymic antioxidant levels and elevated lipid peroxide level were restored to normal by administration of methanol and acetone extract of *Chenopodium album* Linn.\textsuperscript{[27]}
Anti-ulcer Effect

Alcoholic extract of *C. album* Linn. (Chenopodiaceae) was investigated in rats to evaluate the antiulcer activity by using three models, i.e., pyloric ligation, ethanol and cold restraint stress induced ulcers by V. Nigam and P. M. Paarakh (2011). The parameters taken to assess anti-ulcer activity were volume of gastric secretion, pH, free acidity, total acidity and ulcer index. The results indicate that the alcoholic extract significantly decreases the above parameters[28].

Spasmylytic and Analgesic activity

The plant was extracted in ethanol and fractionated in ethyl acetate, chloroform, *n*-butanol and water. The crude extract and its fractions were tested *in vitro* on intestinal smooth muscles of rabbit. The crude extract exhibited a dose-dependent increase in relaxation of smooth muscles. Overall, the activity produced by *n*-butanol fraction was found to be highly significant. Analgesic effect of the crude extract was carried out by tail flick method in mice[6].

Antibacterial Potential

Antibacterial effects of *C. album*’s ethanolic leaf extract (CAE) were investigated on Gram-positive and Gram-negative microorganisms and protective effects of CAE on both yeast and human mononuclear leukocytes’ genomic DNA upon oxidative shock were also evaluated. Total oxidative status (TOS) and the total antioxidative status (TAS) levels were determined to evaluate the antioxidant activity of CAE. It is observed that CAE protect the DNA of both yeast and mononuclear leukocytes against the damaging effect of hydrogen peroxide[29].

K. P. Singh *et al.* (2011) evaluated the antibacterial activities of *C. album* L. against five human pathogenic bacteria Viz. *Escherichia coli*, *Salmonella typhimurium*, *Staphylococcus aureus*, *Proteus vulgaris* and *Pseudomonas aeruginosa*. The aqueous extract revealed strongest antibacterial activity on *Staphylococcus aureus* and methanol leaf extract showed strongest antibacterial activity on *Pseudomonas aeruginosa*[30].

Durga Prasana Nayak *et al.* (2010) evaluated the antimicrobial activity and anthelmintic activity of various solvent extract of *Chenopodium album*. For the antimicrobial activity study, the microorganisms used include *Staphylococcus aureus* ATCC 25923, *Bacillus subtilis* UC 564, *Bacillus polymexia* 474, *Streptococcus faecalis* ATCC 29212, *Pseudomonas aeruginosa* 25619, *Salmonella typhi* 57, *Vibrio cholerae* 824, *Shigella dysenteriae* ATCC C3, *Escherichia coli* NCTC 8196, *Penicillium notatum* ATCC 11625, *Aspergillus niger* AB 41 and *Candida albicans* ATCC 18804 respectively. The anti microbial activity was found with extracts in the form of zone of inhibition (*Staphylococcus aureus* ATCC 25923 (17.3 mm), *Bacillus subtilis* UC 564 (19.7mm), *Bacillus polymexia* 474 (18.3mm), *Streptococcus faecalis* ATCC 29212 (16.7mm), *Pseudomonas aeruginosa* 25619 (17.7mm), *Salmonella typhi* 57 (16.7mm), *Vibrio cholerae* 824 (17.3mm) and *Shigella dysenteriae* ATCC C3 (17.3mm) *Escherichia coli* NCTC 8196(18 mm), *Penicillium notatum* ATCC 11625(15 mm), *Aspergillus niger* AB 41 (16.3), *Candida albicans* ATCC 18804(18.3 mm). The anthelmintic activity was evaluated on adult Indian earthworm. Observations were made for the time taken to paralyse and/or death of individual worms[31].

*In vitro* antimicrobial activities of the flowers and leaves methanolic and ethanolic extracts of *C. album* L. were also evaluated. Results showed that flowers and leaves methanolic and ethanolic extracts of *C. album* don’t have any activity against the selected bacterial strains[32].
Anti-Inflammatory activity

Hydrodistillation of leaves of *C. album* yielded 0.64 % v/w of essential oil. The essential oil displayed strong anti-inflammatory activity against 12-O-tetradecanoylphorbol-13- acetate (TPA) – induced ear edema in mice \[^{33}\].

Antipruritic and Antinociceptive effects

The ethanolic extract from the fruits of *C. album* dose dependently inhibited scratching behavior induced by 5-HT or compound 48/80 in mice. But it failed to affect hind paw swelling induced by 5-HT or compound 48/80 in mice. In addition, *C. album* significantly attenuated the writhing responses induced by an intraperitoneal injection of acetic acid and the inflammatory pain response induced by an intraplantar injection of formalin in mice \[^{34}\].

CONCLUSION

*C. album* Linn. is widely distributed throughout India. Several phytochemical studies have been reported but still it needs to progress. With the availability of primary information, further studies can be carried out like clinical evaluation, phyto-analytical studies and toxicity evaluation. The plant is preclinically evaluated to some extent. The plant appears to have a broad spectrum of activity on several ailments. Leaves of the plant have been explored for antifungal activity, spasmolytic. antipruritic, anti-inflammatory, hepatoprotective, antioxidant activity, analgesic activity, antibacterial activity, anti ulcer activity, anticancer and many other miscellaneous activities. The pharmacological studies reported in this review confirm the therapeutic value of *C. album* Linn. This also helps in setting in-house standards of the medicinal plants used extensively by herbal manufacturers.

REFERENCES