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CHENOPODIUM ALBUM LINN (BATHUA): A REVIEW OF POTENTIAL THERAPEUTIC APPLICATIONS

Gauri Karwani* **and Siddhraj S. Sisodia**

Bhupal Nobles' College of Pharmacy, Udaipur, Rajasthan, 313 001, India

*Corresponding author: sandykarwani@yahoo.com

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ABSTRACT

The family Chenopodiaceae is a large family comprising about 102 genera and 1400 species. The genus Chenopodium includes varieties of weedy herbs (more than 200 species) native to Europe, Asia, and both North and South America Many of these possess therapeutic and edible properties. The Chinopodium album known as bathua sag are being used in traditional medicines. It has been found to have antipruritic and antinociceptic, sperm immobilizing agent, cryptomeridiol and 8- alpha-acetoxycyryptomeridiol as growth promoting activity. It has been found to have flavonoid as phenolic amide, hypertensive in activity, saponin , rich in iron content , cinnamic acid amide , alkaloid chinoalbicin , apocortinoid , xyloside, phenols and lignans .

Keywords *– Chenopodiaceae, Bathua, Cinnamic acid, Flavonoid.*

1. INTRODUCTION

Chenopodium album (L.) of the family *Chenopodiaceae* (Goosefoot family) belongs to the genus *Chenopodium.* It is also known as fat-hen, bathua, vastukah, chakvit. This weedy plant has various medicinal applications. It is a polymorphous, mealy white and erect herb which is 3.5m in height, and found wield in altitude of 4,700 m. The herb is a common weed during summer and winter in waste places and in the field of wheat, barley, mustard and gram, and reduces their yield. The tender shoots are eaten raw in salad or with curd; they are also cooked as a vegetable or used as an ingredient in paratha. The dehydrated leaves of bathua can also be incorporated in various conventional food items as it can improve the nutritional quality of the product as well as add variety in the diet. The dried herb is stored for future use. It is also used as fodder; pigeons consume the plant in large quantities**.** Studies carried out in different parts of the world indicate that *C. album* is a rich source of nutrients, antioxidants and important dietary elements. Vitamin C and β- carotene were detected from the young shoots and mature plants of *C. album*, indicating that these vegetables could constitute an important source of these vitamins in the diet [1].

2. TAXONOMICAL HIERARCHY

Kingdom : Plantae

Sub kingdom : Tracheobiont

Super division : Spermatophyta

Division : Magnoliop Class : Magnliopsida

Sub class : Caryophyllidae

Order : Caryophllales

Family : Chenopodiaceae

Genus : Chenpopdium L.

Specie : *Chenopodium album* Variety : *Chenopodium album* L. var [1].

3. 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 [1].

4. 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 [2].

5. PHYTOCONSTITUENTS REPORTED

b-sitosterol, lupeol, 3 hydroxy nonadecyl henicosanoate, ascorbic acid, b-carotene, catechin, gallocatechin, caffeic acid, p-coumaric acid, ferulic acid, campesterol, xanthotoxin, stigmasterol, imperatorin, ecdysteroid, cinnamic acid amide alkaloid, phenol, saponin, apocarotenoids, crytomeridiol, n-trans-feruloyl-4-O-methyl dopamine and syringaresinol. 6+ .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 %) [3, 4].

6. ACTIVITY REPORTED

6.1 Hepatoprotective Activity

Nigam and Paarakh (2011) evaluated hepatoprotective activity of *C. album* Linn against paracetamol and alcohol as hepatotoxin. Alcoholic and aqueous extracts of the *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 [5, 6].

Pal et al., (2011) investigated hepatoprotective activity of *C. album* Linn. plant against paracetamol induced hepatic injury .Biomarkers were restored to normal by administration of methanol and acetone extract of *Chenopodium album* Linn [7].

6.2 Antibacterial Potential and Antihelmintic activity

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 [8].

Singh et al., (2011) evaluated the antibacterial activities of *C. album* L. against five human pathogenic bacteria. The aqueous extract revealed strongest antibacterial activity on *Staphylococcus aureus* and methanol leaf extract showed strongest antibacterial activity on *Pseudomonas aeruginosa* [9].

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 polymyxa* 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 [10].

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 [11].

6.3 Spasmolytic 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, starting from 5 mg/ml and maximum effect was found at 20 mg/ml (92.86%). All the fractions were administered to rabbit's intestine at 15 mg/ml dose. The ethyl acetate and chloroform fractions of *C. album* exhibited relaxation of the intestinal muscles (43.48 and 51.52%, respectively); whereas, *n*-butanol fraction of *C. album* produced strong relaxant effect (91.18%). The contractile effect was only observed in aqueous fraction (29.41%). Overall, the activity produced by *n*-butanol fraction was found to be highly significant (by statistical analysis). Analgesic effect of the crude extract was carried out by tail flick method in mice. Significant analgesic effect was observed at 500 mg/kg dose from 30 min up till 210 min [12].

6.4 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 [13].

6.5 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 [14].

6.6 Anti-inflammatory activity

It has been established that anti-inflammatory activities of essential oils are attributable to the presence of substituent such as; limonene, linalool, linalyl acetate and α-pinene. The result revealed that the anti-inflammatory action of the oil is concentration dependent. Hence, the percentage reduction in the ear edema increases with increase in concentration of the oil. Furthermore, the oil caused significant reduction ($p < 0.05$) in the ear edema except at 0.625 mg concentration [3].

6.7 As antibreast cancer bioagent

Study was aimed to investigate the effects of Chenopodium album (leaves) on the growth of estrogen dependent (MCF-7) and estrogen independent (MDA-MB-468) human breast cancer cell lines. The different solvent extracts (petroleum ether, ethyl acetate and methanol) were assessed for their cytotoxicity using TBE (Trypan blue exclusion) and MTT [3-(4, 5-dimethyl thiazol-2-yl)-2, 5-diphenyl tetrazolium] bioassay. These cells were cultured in MEM (minimum essential medium) medium and incubated with the dilution series of extracts (10- 100 mg/ml) in CO(2) incubator at 37_oC for 24 h. Among the various extracts studied for two cell lines, methanolic extract of C. album (leaves) exhibited maximum antibreast cancer activity having IC(50) (the concentration of an individual compound leading to 50% inhibition) value 27.31 mg/ml against MCF-7 cell line. Significant percent inhibition (94.06%) in the MeOH extract of C. album (leaves) at 48 h of exposure and concentration 100 mg/ml ($p < 0.05$) against MCF-7 breast cancer cell line, indicates the presence of some structural moiety responsible for this observed antiproliferative effect. In vivo study and structural elucidation of its bioactive principle are in progress. Our findings highlight the potential of this plant for its possible clinical
use to counteract malignancy development as antibreast cancer bioagent [15].

6.8 Sperm-immobilizing agent

Chenopodium album seeds was assessed for its sperm-immobilizing and contraceptive efficacy in mammals. Spermicidal efficacy was evaluated by a modified Sander–Cramer test. The mode of spermicidal action was tested by (1) supravital and double fluoroprobe staining of sperm, (2) hypoosmotic swelling tests and (3) transmission electron microscopy. Contraceptive efficacy was evaluated by intrauterine and vaginal application of *Chenopodium album* seeds in rats and rabbits, respectively, followed by their mating and evaluation of pregnancy outcomes. The minimum effective concentration of *Chenopodium album* seeds that induced instantaneous immobilization of rat spermatozoa in vitro was 2 mg/mL. The mechanism of *Chenopodium album* seeds action involved disintegration of sperm plasma membrane and dissolution of acrosomal cap causing sperm death. Fertilization of oocytes and establishment of implantation were prevented in the uterine horn that was administered with *Chenopodium album* seeds , while these events occurred unhindered in the untreated contralateral side. In rabbit, intravaginal application of *Chenopodium album* seeds significantly blocked the establishment of pregnancy. *Chenopodium album* seeds possesses appreciable spermicidal potential, which may be explored as an effector constituent of vaginal contraceptive [16].

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