PHARMACOLOGY OF CELOSIA ARGENTEA L.

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ABSTRACT:

Celosia argentea L. (family-amaranthaceae) is widely used in traditional medicine to cure several disorders such as fever, diarrhea, mouth sores, itching, wounds, jaundice, gonorrhea, and inflammation. A variety of phytoconstituents are isolated from the C. argentea L. which includes triterpenoid saponins, celosin E, celosin F and celosin G together with a known compound cristatain, betalains, nicotinic acid, celogenamide-A, celogenitin A–D, H, J and K. The plant having potential pharmacological values screened for its various pharmacological activities, namely, anti-inflammatory, immunostimulating, anticancer, hepatoprotective, antioxidant, wound healing, antidiabetic and antibacterial activities which are reported in the extracts of different parts and its phytoconstituents of this plant. An overview and details of the pharmacological investigations on the C.argentea L. is presented in this review.

KEY WORDS: Celosia argentea. L, Celosin, ethnomedicinal plant, ethnopharmacology

INTRODUCTION:

Human beings have been aware of medicinal plants as long ago as 3,000 BC [1]. Virtually every indigenous culture in the world uses medicinal plants in some form or other for treatment of ailments. The actual knowledge of medicinal plants is possessed by a select group of practitioners, who determine the nature of the ailments and then prescribe remedies. Although indigenous cultures possess a holistic view of ailments and their cure, medicinal plants do form a major part of indigenous medicinal or traditional medicinal practices. Since the advent of modern or allopathic medicine, traditional medicine lost quite a bit of ground, being determined to be somewhat similar to superstitious beliefs or even quackery by allopathic doctors.
However, in recent periods, traditional medicine has made a major come-back. It has been realized that a number of important modern pharmaceuticals have been derived from, or are plants used by indigenous people \[2\]. A number of modern drugs like aspirin, atropine, ephedrine, digoxin, morphine, quinine, reserpine, tubocurarine and artimisinin, are examples, which were originally discovered through observations of traditional cure methods of indigenous peoples \[3\].

The Indian sub-continent comprising of the countries India, Pakistan, and Bangladesh form one of the richest sources of traditional medicinal practices in the whole world. Overall, the alternative medicinal systems of India uses more than 7500 plant species. The various traditional medicinal systems practiced in the above countries are the well known homeopathic, Ayurvedic, Unani, and the Siddha systems of medicine with their well-defined formulations and selection of medicinal plants. Phytochemicals are used as templates for lead optimization programs, which are intended to make safe and effective drugs \[4\]. In the developed countries, 25% of the medicinal drugs are based on plants and their derivatives. Medicinal plants are the major components of all indigenous or alternative systems of medicine. Medicinal plants are sources and can be a good start for the discovery of new chemical compound \[5,6\].

The \textit{Celosia} species is a small genus of edible and ornamental plants belonging to Amaranthacea. The generic name is derived from the Greek word \textit{kelos}, meaning "burned," and refers to the flame-like flower heads. The flowers of the species are commonly known as wool-flowers, brain celosia or cockscombs, if the flower heads are crested by fasciation, it is called as Velvet flower (in Mexico). The plants are well known in East Africa’s highlands and are used under their Swahili name, mfungu \[7\]. Amongst the different plants of the \textit{Celosia} species, \textit{C. argentea} L. is an important tropical leafy vegetable crop of high nutritional and medicinal value \[8\]. An Indian origin, \textit{C. argentea} L., is a plant of tropical origin and known for its very brilliant colors and traditional uses \[9\]. It is commonly named as semen celosiae, celosia, silver cock’s comb, cock’s comb, quail grass, woolflower in English. In India locally it is named as sitivara, vitunnaka, sunishannahka (Sanskrit), indivara, survali, safed murga (Hindi), annesoppu, and kanne hoo (Kannada) \[10\]. Genetic diversity of 16 varieties of \textit{C. argentea} L. and 6 varieties of \textit{Celosia cristata} L. was investigated in China using sequence-related amplified polymorphism \[11\]. There are more than seventy different species are identified and among all including \textit{C. argentea} L. are routinely used as leafy vegetable \[12\].

**DISTRIBUTION AND DESCRIPTION:**

\textit{C. argentea} L. is known worldwide, its use for food is geographically much more limited. It is common in West Africa, from Sierra Leone to Nigeria. It is also available in Ethiopia, Somalia, Kenya, other parts of East Africa, Mexico and Central Africa. In the rainforest zone of Nigeria, Benin, Cameroon, Gabon, and Togo it is cultivated as vegetable. The wild form (sometimes referred to as \textit{C. trigyna}) is a potherb throughout the savanna area of tropical Africa. \textit{C. argentea} L. grows as a weed during rainy season throughout India, and other tropical regions of the world mainly Sri Lanka, Yemen, Indonesia, America and West indies. In India plants are chopped and used as feed for chickens and as forage for cattle \[13\].

\textit{C. argentea} L. plant is an annual dicotyledon. It is having an erect, coarse, simple, branched, smooth annual herb, normally about 0.5 to 1.5 m in height but sometimes much taller. It has
few branches, at least until it approaches the time for flowering. The leaves are alternate entire or rarely lobed, light green. They are typically 2x6 cm, although those on flowering shoots are slightly longer. Even the green foliage may contain large amounts of betalain pigments. The often brilliantly colored flowers are borne in dense heads. Most occur in spikes, and stand like spears in the garden bed. But certain cultivated forms have compact or feathery clusters due to fasciation. The flowers yield large numbers of seeds in black colour and are about 1 mm in diameter. The flowers blooms from late summer through late fall.

TRADITIONAL USES:
The whole plant is known for its usage in the treatment of diarrhea, piles, bleeding nose, inflammation, haematological, gynaecologic disorders and also as disinfectant. In India, the plant is well known for treatment of mouth sores, blood diseases and used as an aphrodisiac. The seed paste is used to cure ovarian and uterine diseases. In Indian folk medicine, it is widely used for the treatment of diabetes mellitus. In China, plant is well known for cold, gastrointestinal diseases, rheumatoid arthritis and as fertility regulating agent. The traditional Yao communities of China use the stem, leaf, flower and seed of C. argentea L. for the treatment of hemorrhoids, leucorrhrea, and profuse uterine bleeding. In USA, midwifery, rural Honduras practice C. argentea L. for encouraging lactation and its decoction for hemorrhage. In Riau province, Sumatra (Indonesia) antibacterial assay of extracts of 114 species were tested and C. argentea L. was found to have activity against cough and jaundice. In Vietnam, this plant is used as hemostatic herb. In screening of Taiwanese crude flower extract of C. argentea L. was found antibacterial effect against Streptococcus mutants, and also flowers of the plant are used against snakebite. The leaves and flowers are used as edible and are grown for such use in Africa and Southeast Asia.

PHARMACOLOGICAL ACTIVITY:
In the recent years, the use of herbal products has been increasing in developing countries. Plants have always been an attractive source of drugs. On the other hand, intricate ways of molecular interactions and bioactivity mechanisms of the extracts or their bioactive constituents provide a challenge to the scientists. The C. argentea L. displays a wide range of pharmacological activities with correlate to mechanistic possibilities over respective disorders and ephemeral overview of its pharmacological activities, has been presented in Table 3.

CONCLUSION:
The following manifestations can be made on the basis of this comprehensive perusal of literature, that the plant C. argentea L. is being used traditionally, due to their immense therapeutic potential to treat/cure various diseases. It is a rich source of bioactive compounds like, phenolics and triterpenes are present in plant and exhibit with wide range of health benefits. Many studies demonstrated significant anti-inflammatory, immune-stimulating, antidiarrheal, anticancer, hepatoprotective, antimetastatic, antioxidant, wound healing, anti-diabetic, antimitotic, antibacterial, antifungal activities and others. These pharmacological activities and identified compounds provide solid scientific evidence for some of the traditional therapeutically claims of C. argentea L.. A variety of phytoconstituents has been isolated from the different parts of C. argentea L. Thus, there remains a tremendous scope for further scientific exploration of C. argentea L. to establish their therapeutic efficacy and commercial exploitation.
REFERENCES:


Tables:

Table 1: Taxonomy of *C. argentea* L.

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Super division</td>
<td>Spermatophyte</td>
</tr>
<tr>
<td>Division</td>
<td>Magnoliophyta</td>
</tr>
<tr>
<td>Class</td>
<td>Magnoliopsida</td>
</tr>
<tr>
<td>Order</td>
<td>Carypophyllales</td>
</tr>
<tr>
<td>Family</td>
<td>Amaranthaceae</td>
</tr>
<tr>
<td>Genus</td>
<td><em>Celosia</em></td>
</tr>
<tr>
<td>Species</td>
<td><em>Argentia</em></td>
</tr>
</tbody>
</table>

Table 2: The morphological features of *C. argentea* L.\(^{[6,13]}\)

<table>
<thead>
<tr>
<th>Part</th>
<th>Macroscopic features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaves</td>
<td>Alternate, linear to lanceolate, entire and to 5cm long</td>
</tr>
<tr>
<td>Flowers</td>
<td>Small, in dense erect spikes up to 8 cm long, white to purple, without petals</td>
</tr>
<tr>
<td>Fruits</td>
<td>Membranaceous, utricles, seeds shining black and about 1.5 mm in diameter</td>
</tr>
<tr>
<td>Seeds</td>
<td>Small (between 1-5 millimeters) and round, with a black or reddish-black exterior and a thin, brittle outer skin</td>
</tr>
</tbody>
</table>
Table 3: Summary of Pharmacological activities of *C. argentea* L.

<table>
<thead>
<tr>
<th>Pharmacological activity</th>
<th>Parts</th>
<th>Extract / Possible chemical constituents</th>
<th>Screening method employed</th>
<th>Possible mechanistic action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Immunological activity</strong></td>
<td>Seeds</td>
<td>Celosian</td>
<td>Chemical and immunological liver injury model (<em>in-vivo</em> and <em>in-vitro</em>) <em>anti-Dinitrophenyl (DNP)</em> antibody responses in mice model</td>
<td>Acts as immunostimulating; Celosian is induced production of TNF-alpha, IL-1 beta, NO and IFN-gamma. Study suggests that suppression of IgE antibody in certain allergic disorders.</td>
</tr>
<tr>
<td><strong>Anti-cancer activity</strong></td>
<td>Seeds</td>
<td>Triterpenoid saponins: celosin E, celosin F, celosin G, and cristatain</td>
<td><em>In-vitro</em> methods</td>
<td>Suggested for further study.</td>
</tr>
<tr>
<td><strong>Antimetastatic activity</strong></td>
<td>Seeds</td>
<td></td>
<td>Intraperitoneal injection of colon 26-L5 carcinoma cells model</td>
<td>Anti-metastatic effect is based on its immunomodulating effect due to induction of cytokines such as IL-12, IL-2 and IFN-gamma leading to a Th1 dominant immune state and activating macrophages to the tumoricidal state.</td>
</tr>
<tr>
<td><strong>Anti-inflammatory activity</strong></td>
<td>Leaves</td>
<td>Ethanolic extract: flavonoid fraction</td>
<td>Carrageenan induced rat paw edema acute inflammatory &amp; cotton pellet induced chronic inflammatory methods</td>
<td>Flavonoids are responsible for anti-inflammatory activity.</td>
</tr>
<tr>
<td><strong>Hepatoprotective activity</strong></td>
<td>Seeds</td>
<td>Ethanolic extract</td>
<td>Carbon tetrachloride (CCl₄) induced hepatic damage in rats</td>
<td>Significant reduction in lipid peroxidation (TBARS) and an elevation in antioxidant defense parameters.</td>
</tr>
<tr>
<td><strong>Cytoprotective activity</strong></td>
<td>Whole plant</td>
<td>Boiled, cold, and methanolic extracts</td>
<td>Hemagglutination assay in bovine erythrocytes method</td>
<td>All extracts showed membrane stabilizing capacity in supports by plants antioxidant property.</td>
</tr>
<tr>
<td><strong>Antioxidant activity</strong></td>
<td>Aerial parts, Seeds, Root</td>
<td>Total phenols</td>
<td><em>In-vitro</em> antioxidant methods</td>
<td>Suppressing free radicles possibly due to abundant polyphenols.</td>
</tr>
<tr>
<td></td>
<td>Whole plant</td>
<td>Boiled, cold, and methanolic extracts</td>
<td><em>In-vitro</em> DPPH free radical assay</td>
<td>All extracts showed antioxidant property.</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Aqueous extract</td>
<td><em>In-vitro</em> ammonium thiocyanate, reducing power, and membrane stabilizing models</td>
<td>The antioxidant activity of extract may be due to phenolic and flavonoid components of the extract.</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Aqueous extract</td>
<td><em>In-vitro</em> by cadmium (Cd)- induced oxidative stress in Wistar rats</td>
<td>The antioxidant activity of extract may be due to phenolic and flavonoid components of the extract.</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Glycosides: citrusin C, indicant, (3Z)-hexenyl-1-O- (6-O-α-rhamnopyranosyl-β-glucopyranoside,</td>
<td><em>In-vitro</em> DPPH method</td>
<td>Not showed antioxidant property by glycosides of <em>C. argentea</em> L.</td>
</tr>
</tbody>
</table>

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(3Z)-hexenyl-1-O-\(\beta\)-glucopyranoside, (7E)-6,9-dihydromegastigma-7-ene-3-one-9-O-\(\beta\)-glucopyranoside, Glycosides: citrusin C, indicant, (3Z)-hexenyl-1-O-(6-O-\(\alpha\)-rhamnopyranosyl)-\(\beta\)-glucopyranoside, (3Z)-hexenyl-1-O-\(\beta\)-glucopyranoside, (7E)-6,9-dihydromegastigma-7-ene-3-one-9-O-\(\beta\)-glucopyranoside, Bioassay of germinating lettuce seeds Compounds with sugar moiety (glucose) tend to have growth promoting activity whereas those without sugar moiety may have growth inhibitory activity [41].

Antibacterial activity

Leaves
Ethanolic extract
Disc-diffusion and MIC method by using pathogenic bacteria namely strains of \(E. \) coli, \(S. \) aureus, \(K. \) pneumoniae, \(P. \) aeruginosa, \(S. \) typhi & \(S. \) typhimurium showed MIC to about 50mg/ml against \(S. \) aureus showed 50mg/ml against \(E. \) coli and 100mg/ml against \(S. \) aureus

Leaves
Ethanolic extract; tannin & alkaloids (fairly present) Screened against pathogenic bacteria namely, strains of \(A. \) flavus, \(E. \) coli, \(P. \) aeruginosa, \(S. \) typhi & \(S. \) aureus by agar-well diffusion assays

Leaves
Ethanolic extract
Suggested for further study

Diuretic activity

Seeds
Ethanolic extract
On albino rats and human volunteers

Suggested for further study

Antifungal activity

Leaves
Ethanolic extract; tannin & alkaloids (fairly present) screened against pathogenic fungi namely, strains of \(C. \) albicans, \(T. \) metagophyte, \(M. \) furfur by agar-well diffusion assays

Wound healing activity

Leaves
Ethanolic extract
Rat burn wound model Mitogenic and motogenic promotion of dermal fibroblasts [45,46]

Anti-diabetic activity

Root
Ethanolic extract
Hypoglycaemic action in streptozotocin induced diabetic rats Suggests that, extract may possess as insulin-like effect on peripheral tissues by either promoting glucose uptake or metabolism [47].

Seeds
Ethanolic extract
Hypoglycaemic action in alloxan-induced diabetic rats Suggested for further study [48].

Antimitotic activity

Seeds
Moroidin- a bicyclic peptide Microtubule assembly assay Inhibits the polymerization of tubulin [49].

Seeds
Celogentins D,E,F,G, H and J- bicyclic peptides Microtubule assembly assay Inhibits the polymerization of tubulin [50].
<table>
<thead>
<tr>
<th>Activity</th>
<th>Source</th>
<th>Compound(s)</th>
<th>Method(s)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-diarrheal activity</td>
<td>Leaves</td>
<td>Ethanol extract</td>
<td>Castor oil induced, Charcoal meal test</td>
<td>Study suggests that, the antidiarrheal effect may be by reduction of gastrointestinal motility by tannins and flavonoids.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PGE2 induced diarrhea methods</td>
<td></td>
</tr>
<tr>
<td>Skin Depigmentation</td>
<td>Leaves</td>
<td>Eugenyl O-β-D-glucopyranoside (citrusin C)</td>
<td>External application method</td>
<td>Citrusin C showed strong tyrosinase inhibitory activity.</td>
</tr>
<tr>
<td>Anti-urolithiatic activity</td>
<td>Roots</td>
<td>Methanol extract</td>
<td>Ethylene glycol induced urolithiasis Wister rat model</td>
<td>The extract having anti-urolithiatic effect.</td>
</tr>
</tbody>
</table>

*C. argentea* L., *Celosia argentea* L.; TNF-alpha, tumor necrosis factor-alpha; IL-1 beta, interleukin-1 beta; NO, nitric oxide; IFN-gamma, gamma interferon; Th1, T-helper cell 1; DPPH, 1,1-diphenyl-2-picrylhydrazyl; MIC, minimum inhibitory concentration; *A. flavus*, *Aspergillus flavus*; *E. coli*, *Escherichia coli*; *P. aeruginosa*, *Pseudomonas aeruginosa*; *S. typhi*, *Salmonella typhi*; *S. aureus*, *Staphylococcus aureus*; *C. albicans*, *Candida albicans*; *T. metagophyte*, *Trichophyton metagophyte*; *M. furfur*, *Malassezia furfur*; and PGE2, Prostaglandin E2.

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