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, celogenin 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 artemisinin, 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 Amaranthaceae. 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, sunishannaka (Sanskrit), indivara, survali, safed murga (Hindi), annesoppu, and kanno 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\.) growers 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
etire 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 [6,13,14].

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 [15]. In India,
the plant is well known for treatment of
mouth sores, blood diseases and used as an
aphrodisiac [16,17,18]. The seed paste is used to
cure ovarian and uterine diseases [19,20]. In
Indian folk medicine, it is widely used for the
treatment of diabetes mellitus [21]. In China,
plant is well known for cold, gastrointestinal
diseases, rheumatoid arthritis [22] and as
fertility regulating agent [23]. The traditional
Yao communities of China use the stem, leaf,
flower and seed of C. argentea L. for the	
treatment of hemorrhoids, leucorrhea, and
profuse uterine bleeding [24]. In USA, midwifery, rural Honduras practice C. argentea L. for encouraging lactation and its
decollection for hemorrhage [25]. 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 [26]. In Vietnam,
this plant is used as hemostatic herb [27]. In
screening of Taiwanese crude flower extract
of C. argentea L. was found antibacterial
effect against Streptococcus mutants [28], and
also flowers of the plant are used against
snakebite [29]. The leaves and flowers are used
as edible and are grown for such use in Africa
and Southeast Asia [30].

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 [31]. 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>Carypphyllales</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 5 cm 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>) anti-Dinitrophenyl (DNP) antibody responses in mice model</td>
<td>Acts as immunostimulating; Celosian is induced production of TNF-alpha, IL-1 beta, NO and IFN-gamma [32]. Study suggests that suppression of IgE antibody in certain allergic disorders [33].</td>
</tr>
<tr>
<td></td>
<td>Seeds</td>
<td></td>
<td></td>
<td></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>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 [35].</td>
</tr>
<tr>
<td></td>
<td>Seeds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Antimetastatic activity</strong></td>
<td>Seeds</td>
<td></td>
<td>intraportal injection of colon 26-L5 carcinoma cells model</td>
<td></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 [36].</td>
</tr>
<tr>
<td><strong>Hepatoprotective activity</strong></td>
<td>Seeds</td>
<td>Ethanol 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 [37].</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 [38].</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>Supressing free radicles possibly due to abundant polyphenols [39].</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 [38].</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 [40].</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 [40].</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. [41].</td>
</tr>
<tr>
<td><strong>Growth activity</strong></td>
<td>Leaves</td>
<td>(3Z)-hexenyl-1-O-β-glucopyranoside, (7E)-6,9-dihydromegastigma-7-ene-3-one-9-O-β-glucopyranoside, Glycosides: citrusin C, indicant, (3Z)-hexenyl-1-O-(6-O-α-rhamnopyranosyl-β-glucopyranoside, (3Z)-hexenyl-1-O-β-glucopyranoside, (7E)-6,9-dihydromegastigma-7-ene-3-one-9-O-β-glucopyranoside, bioassay of germinating lettuce seeds</td>
<td>Compounds with sugar moiety (glucose) tend to have growth promoting activity whereas those without sugar moiety may have growth inhibitory activity. [&lt;sup&gt;41&lt;/sup&gt;].</td>
<td></td>
</tr>
<tr>
<td><strong>Antibacterial activity</strong></td>
<td>Leaves</td>
<td>Disc-diffusion and MIC method by using pathogenic bacteria namely strains of E. coli, Staphylococcus, Klebsiella, Pseudomonas, Streptococcus, Shigella, Salmonella, and Vibrio</td>
<td>Suggested further study for elucidating antibacterial molecule from C. argentea L. [&lt;sup&gt;42&lt;/sup&gt;].</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Ethanolic extract; tannin &amp; alkaloids (fairly present)</td>
<td>Showed MIC to about 50mg/ml against Salmonella typhi, 50mg/ml against Escherichia coli and 100mg/ml against Staphylococcus aureus [&lt;sup&gt;43&lt;/sup&gt;].</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Ethanolic extract</td>
<td>Suggested for further study [&lt;sup&gt;44&lt;/sup&gt;].</td>
<td></td>
</tr>
<tr>
<td><strong>Diuretic activity</strong></td>
<td>Seeds</td>
<td>Ethanolic extract</td>
<td>On albino rats and human volunteers</td>
<td></td>
</tr>
<tr>
<td><strong>Antifungal activity</strong></td>
<td>Leaves</td>
<td>Ethanolic extract; tannin &amp; alkaloids (fairly present)</td>
<td>screened against pathogenic fungi namely, strains of C. albicans, T. metagophyte, M. furfur by agar-well diffusion assays</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Ethanolic extract</td>
<td>Not showed any MIC [&lt;sup&gt;43&lt;/sup&gt;].</td>
<td></td>
</tr>
<tr>
<td><strong>Wound healing activity</strong></td>
<td>Leaves</td>
<td>Ethanolic extract</td>
<td>Rat burn wound model</td>
<td></td>
</tr>
<tr>
<td><strong>Anti-diabetic activity</strong></td>
<td>Root</td>
<td>Ethanolic extract</td>
<td>Hypoglycaemic action in streptozotocin induced diabetic rats</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seeds</td>
<td>Ethanolic extract</td>
<td>Hypoglycaemic action in alloxan-induced diabetic rats</td>
<td></td>
</tr>
<tr>
<td><strong>Antimitotic activity</strong></td>
<td>Seeds</td>
<td>Moroidin- a bicyclic peptide</td>
<td>Microtubule assembly assay</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seeds</td>
<td>Celogentins D,E,F,G, H and J- bicyclic peptides</td>
<td>Inhibits the polymerization of tubulin [&lt;sup&gt;46&lt;/sup&gt;].</td>
<td></td>
</tr>
</tbody>
</table>

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*Note: MIC = Minimum Inhibitory Concentration*
Seeds

Celogentins A, B and C- bicyclic peptides

Microtubule assembly assay

Inhibits the polymerization of tubulin\(^{[51]}\).

Anti-diarrheal activity

Leaves

Ethanolic extract

Castor oil induced, Charcoal meal test and PGE2 induced diarrhea methods

Study suggests that, the antidiarrheal effect may be by reduction of gastrointestinal motility by tannins and flavonoids\(^{[52]}\).

Skin Depigmentation

Leaves

Eugenyl O-β-D-glucopyranoside (citrusin C)

External application method

Citrusin C showed strong tyrosinase inhibitory activity\(^{[53]}\).

Anti-uroolithiatic activity

Roots

Methonolic extract

Ethylene glycol induced urolithiasis Wister rat model

The extract having anti-uroolithiatic effect\(^{[54]}\).

\({\text{C. argentea L., Celosia argentea L.}}\); 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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