



**PHARMACOGNOSTIC, PHYTOCHEMICAL AND PHARMACOLOGICAL INSIGHTS
INTO *CELOSIA ARGENTEA*: A COMPREHENSIVE REVIEW**

Manasi S. Tambe^{*1}, Amol S. Deshmukh¹, Sakshi S. Shejul¹, Sahil V. Waman¹

Shri Swami Samarth Institute of Pharmacy, Malwadi, Bota, Tal-Sangmner, Dist-A.Nagar. India 422602.



***Corresponding Author: Manasi S. Tambe**

Shri Swami Samarth Institute of Pharmacy, Malwadi, Bota, Tal-Sangmner, Dist-A.Nagar. India 422602.

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ABSTRACT

Celosia Argentea Linn., commonly known as silver cockscomb, is an annual herb belonging to the family *Amaranthaceae*. It has been widely used in traditional medicine systems such as Ayurveda, Unani, and Traditional Chinese Medicine for treating ailments including diarrhea, dysentery, eye diseases, wounds, and liver disorders. The plant possesses a rich phytochemical profile containing flavonoids, alkaloids, saponins, triterpenoids, betacyanins, and phenolic compounds, which contribute to its wide range of pharmacological properties. Various studies have demonstrated that *C. argentea* exhibits antioxidant, anti-inflammatory, hepatoprotective, antidiabetic, antimicrobial, and wound healing activities. Pharmacognostic and physicochemical evaluations further establish its diagnostic features and quality standards for identification and purity. The present review summarizes the botanical description, pharmacognostic characteristics, phytochemical constituents, pharmacological activities, traditional uses, and safety profile of *Celosia argentea*, emphasizing its potential as a valuable medicinal plant for future drug development and therapeutic formulations.

KEYWORDS: *Celosia argentea*; *Amaranthaceae*; cockscomb, Traditional medicines; Medicinal plant.

INTRODUCTION

Plants have always been a cornerstone of human healthcare, serving as an abundant source of healing agents since ancient times. Even in today's era of modern medicine, the importance of medicinal plants continues to grow, as researchers seek safer, more natural, and sustainable alternatives to synthetic drugs. Among the many valuable herbs used in traditional systems of medicine, *Celosia argentea* Linn., commonly known as silver cockscomb, holds a special place due to its diverse therapeutic potential.^[1] Belonging to the family *Amaranthaceae*, *Celosia argentea* is an annual herb widely distributed across tropical and subtropical regions, including India, China, and parts of Africa. The plant is easily recognizable by its bright, feathery flower spikes and is often cultivated both for ornamental and medicinal purposes. In traditional medicine, particularly Ayurveda, Unani, and Traditional Chinese Medicine (TCM), different parts of the plant such as the seeds, leaves, and flowers have been used for centuries to treat eye diseases, diarrhea, wounds, inflammation, and liver disorders.^[2]



Scientific investigations have confirmed that *Celosia argentea* is a rich source of bioactive compounds, including flavonoids, alkaloids, saponins, phenolic compounds, and triterpenoids, which are believed to be responsible for its pharmacological effects. Modern research highlights its antioxidant, anti-inflammatory, hepatoprotective, antidiabetic, and antimicrobial activities, supporting many of its traditional uses.^[3,4]

Given its wide range of medicinal properties and growing scientific interest, *Celosia argentea* represents a promising candidate for developing herbal formulations and novel drugs. This review aims to compile and discuss the botanical features, pharmacognostic characteristics, phytochemical profile, pharmacological activities, and safety aspects of *Celosia argentea*, providing a comprehensive overview of its medicinal significance.^[5]

Medicinal plants have been an integral part of human civilization since ancient times. They serve not only as the foundation of traditional medicine systems but also as valuable sources of modern pharmaceutical compounds. In recent decades, there has been a renewed global interest in herbal medicine due to growing concerns about the side effects, toxicity, and high cost of synthetic drugs. Researchers are now turning their focus toward natural remedies that are safer, eco-friendly, and therapeutically effective. Among such plants, *Celosia argentea* Linn. commonly known as silver cockscomb has emerged as a species of significant medicinal importance.^[6]

Belonging to the family Amaranthaceae, *Celosia argentea* is an erect, herbaceous annual plant widely distributed in India, China, Africa, and tropical Asia. It is known for its vivid, feathery inflorescences that make it popular as an ornamental plant, yet beyond its beauty lies remarkable medicinal potential. The plant has been traditionally used in Ayurvedic, Unani, and Traditional Chinese Medicine (TCM) systems for treating a variety of ailments, including eye disorders, diarrhea, dysentery, bleeding, wounds, ulcers, and liver diseases. The seeds, in particular, are valued for their cooling, diuretic, and hemostatic properties and are prescribed for managing eye infections, urinary problems, and inflammation.^[7]

Phytochemical investigations of *Celosia argentea* have revealed a complex array of bioactive compounds such as flavonoids, alkaloids, saponins, triterpenoids, sterols, glycosides, betacyanins, and phenolic compounds. These constituents are responsible for the plant's diverse pharmacological properties. Modern pharmacological studies have provided strong evidence supporting its traditional uses, demonstrating antioxidant, anti-inflammatory, antimicrobial, hepatoprotective, antidiabetic, antiulcer, and wound-healing activities in both in vitro and in vivo models.^[8]

Furthermore, the seeds of *Celosia argentea*, known as Qing Xiang Zi in Chinese medicine, are traditionally used to improve vision, treat hypertension, and protect the liver. The plant is also used as an edible leafy vegetable in several Asian and African regions, adding nutritional value along with therapeutic benefits. Its high protein, vitamin, and mineral content make it a beneficial dietary component, especially in rural and developing areas where it serves as both food and medicine.^[9]



The increasing number of studies on *Celosia argentea* highlights its potential as a multifunctional medicinal plant with relevance in modern pharmacognosy and pharmacology. However, despite its wide traditional use and promising pharmacological profile, there remains a need for deeper research into its mechanisms of action, active principles, toxicity studies, and clinical validation.^[10]

Therefore, this review aims to provide a comprehensive overview of *Celosia argentea* Linn., covering its botanical characteristics, pharmacognostic features, phytochemical constituents, pharmacological activities, ethnomedicinal uses, and safety profile. By compiling traditional knowledge and modern research findings, this paper emphasizes the therapeutic potential of *Celosia argentea* and encourages further scientific exploration to support its use in the development of safe and effective herbal medicines.^[11]

Plant Description

Taxonomical Classification

Category	Details
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Caryophyllales
Family	Amaranthaceae
Genus	<i>Celosia</i>
Species	<i>Celosia argentea</i> Linn.

Biological Source

The biological source of the plant is the whole herb and seeds of *Celosia argentea* Linn. (Family: Amaranthaceae). The seeds are the most commonly used part in traditional medicine, known as “*Celosiae Semen*” in pharmacognostic texts.^[12]

Common Names

- **English:** Silver cockscomb, Feather cockscomb
- **Hindi:** Sitivara, Murga phool
- **Marathi:** Kurdu
- **Sanskrit:** Sitivaraka
- **Tamil:** Pannai keerai
- **Chinese:** Qing Xiang Zi^[13]

Vernacular Distribution

Celosia argentea is widely distributed in tropical and subtropical regions across Asia, Africa, and South America. In India, it grows abundantly in warm, sunny areas such as roadsides, gardens, and cultivated fields. The plant thrives well in sandy loam soil with moderate rainfall and is also cultivated as an ornamental plant due to its attractive flower heads.

Morphological Description

Celosia argentea is an erect, annual herb that grows up to 60–90 cm in height. It has a slender, angular, and smooth stem, which may appear green or slightly purplish depending on environmental conditions.^[14]

- **Root:** The plant possesses a taproot system, cylindrical and light brown in color, giving rise to numerous secondary roots.
- **Stem:** The stem is erect, round, smooth, and branched, often tinged with purple. It provides support for the long, feathery inflorescences.^[15]
- **Leaves:** Leaves are simple, alternate, and lanceolate, with entire margins and a pointed apex. They are bright green with short petioles, measuring about 5–12 cm in length.
- **Inflorescence and Flowers:** The most distinguishing feature of *Celosia argentea* is its beautiful plume-like or combshaped inflorescence, which appears as a dense terminal spike. The flowers are pink, red, purple, golden, or white, and remain fresh for a long time, contributing to its ornamental appeal.
- **Fruit and Seeds:** The fruit is a small, dry capsule that dehisces to release several small, black, shiny,

lenticular seeds. Each seed is about 1 mm in diameter, smooth, and glossy. The seeds are light but highly viable, enabling easy propagation.^[16]

Microscopic Characteristics

Microscopic studies reveal

- **Leaf:** Dorsiventral structure with thin cuticle, anisocytic stomata, and numerous parenchymatous cells containing chloroplasts.
- **Stem:** Circular outline with collenchymatous hypodermis, parenchymatous cortex, and a well-defined vascular bundle.
- **Powder Microscopy:** Shows spiral xylem vessels, epidermal fragments, trichomes, and pollen grains — useful diagnostic features in crude drug identification.^[17]

Ecological and Geographical Distribution

The plant is native to tropical Asia and Africa, but is now naturalized across India, China, Sri Lanka, and South America. It grows well in open fields, grasslands, and along roadsides. In India, it flowers mainly between August and December, depending on climatic conditions.^[18]

Celosia argentea prefers full sunlight and well-drained soil, making it an easy-to-grow species that requires minimal care. Because of its resilience and vibrant inflorescences, it is also cultivated as a garden ornamental and as a leafy vegetable in rural households.^[19]

Organoleptic Characteristics

Characteristics	Observations
Color	Green (leaves), pink/red (flowers), black (seeds)
Odor	Mild and characteristic
Taste	Slightly bitter and astringent
Texture	Smooth and soft in aerial parts; seeds hard and glossy

Traditional Importance

In addition to its medicinal value, *Celosia argentea* also holds cultural and nutritional significance. In many regions of India and Africa, young leaves and shoots are consumed as leafy vegetables, being rich in proteins, vitamins A and C, calcium, and iron. The plant is also used as fodder for cattle and decorative flowers for religious offerings and ornamental purposes.^[20]

Pharmacognostic Study

Pharmacognosy provides essential information for the identification, authentication, and quality assessment of crude drugs obtained from natural sources. Understanding the pharmacognostic features of *Celosia argentea* helps distinguish it from other species of the Amaranthaceae family and ensures the purity and consistency of herbal preparations derived from it.^[21]

1. Macroscopic Characteristics

The macroscopic or morphological features of *Celosia argentea* play a key role in its identification as a crude drug.

- **Root:** The plant has a taproot system, which is cylindrical, light brown, and moderately thick. The roots are slightly fibrous with a faint earthy odor and bland taste.
- **Stem:** The stem is erect, slender, and angular, with a smooth surface. It is green to purplish in color and often branched towards the top. The stem is herbaceous, soft in texture, and breaks easily when dry.^[22]
- **Leaves:** Leaves are simple, alternate, and lanceolate in shape with entire margins. The upper surface is smooth and bright green, while the lower surface is pale green. Leaves have a distinct midrib and fine reticulate venation. The average size ranges between 5–12 cm in length and 2–4 cm in width.

- **Flowers:** The inflorescence is spike-like and plume-shaped, terminal in position, and densely packed with small bisexual flowers. The flower color varies from white, pink, red, to purple, depending on the variety. Each flower is small, with a membranous bract and bracteoles.
- **Fruits and Seeds:** The fruit is a capsule that splits open at maturity to release numerous small, round, black, and glossy seeds. The seeds are hard, smooth, and nearly 1 mm in diameter. When crushed, they emit a mild characteristic odor.^[23]
- **Stem:** The T.S. of the stem is circular in outline. It shows an outermost epidermis followed by collenchymatous hypodermis that provides mechanical strength. The cortex is made of parenchymatous cells with scattered chloroplasts. A ring of vascular bundles encircles a central parenchymatous pith. Xylem vessels are large and prominent, often spiral or pitted.
- **Root:** The T.S. of the root shows an outer cork layer, followed by cortex and stele. The cortex contains parenchyma with starch grains. The vascular tissue is radial, with well-developed xylem and phloem.
- **Powder Microscopy:** The powdered plant material exhibits identifiable features such as fragments of epidermal cells, spiral xylem vessels, pollen grains, trichomes, and starch granules. These serve as diagnostic microscopic markers for *C. argentea*.^[25]

2. Microscopic Characteristics

Microscopic examination provides detailed insight into the internal structure of plant tissues and aids in proper identification of the crude drug.

- **Leaf:** The transverse section (T.S.) of the leaf shows a dorsiventral structure with an upper and lower epidermis covered by a thin cuticle. The mesophyll is differentiated into palisade and spongy parenchyma. The palisade layer consists of elongated cells rich in chloroplasts, while the spongy parenchyma shows intercellular spaces. Anisocytic stomata are present on both surfaces, more abundant on the lower side. The vascular bundle is collateral, surrounded by parenchymatous cells.^[24]

3. Physicochemical Parameters

Physicochemical constants are crucial for evaluating the purity, identity, and quality of the crude drug. The following are typical ranges reported for *Celosia argentea*.

Parameters	Reference Range
Total Ash	8–9% w/w
Acid-insoluble Ash	1–2% w/w
Water-soluble Ash	3–4% w/w
Moisture Content	Below 10%
Alcohol-soluble Extractive	12–14% w/w
Water-soluble Extractive	15–17% w/w
pH (1% aqueous solution)	6.5–7.0

These values serve as pharmacopoeial standards for the identification and quality control of the plant material.^[26]

powdered drug of *Celosia argentea* exhibits distinct color changes under visible and UV light after treatment with various reagents.

4. Fluorescence Analysis

Fluorescence analysis is a simple and reliable method for detecting adulteration or substitution in crude drugs. The

Treatment	Visible Light	UV Light (365 nm)
Powder as such	Greenish-brown	Dark green
With 1N NaOH (aqueous)	Green	Bright green
With 1N NaOH (alcoholic)	Yellowish-green	Fluorescent yellow
With HCl	Light brown	Dull green
With H ₂ SO ₄	Reddish brown	Brownish black
With Methanol	Pale green	Bright fluorescence

These characteristic fluorescence patterns help in confirming the authenticity of *C. argentea* powder samples.^[27]

5. Organoleptic Evaluation

Organoleptic (sensory) evaluation of the crude drug provides rapid and practical information during preliminary identification.

Parameters	Observation
Color	Green (leaf), pink/red (flower), black (seed)
Odor	Mild and characteristic
Taste	Slightly bitter and astringent
Texture	Smooth, soft (aerial parts); hard and glossy (seeds)

6. Significance of Pharmacognostic Studies

The pharmacognostic evaluation of *Celosia argentea* provides a scientific basis for its identification, authentication, and quality control. These features ensure that the right plant species and plant parts are used in the preparation of herbal medicines. The macroscopic and microscopic characteristics, along with physicochemical and fluorescence data, form essential diagnostic parameters for standardization according to pharmacopoeial guidelines.^[28]

Phytochemical Constituents

The therapeutic potential of *Celosia argentea* largely stems from its rich and diverse phytochemical composition. These bioactive compounds are responsible for its antioxidant, anti-inflammatory, antimicrobial, and hepatoprotective activities, among others. Extensive studies on different parts of the plant — seeds, leaves, flowers, and whole herb — have revealed the presence of several classes of natural compounds, making it a valuable medicinal resource.^[29]

1. Flavonoids: Flavonoids are among the most prominent constituents in *Celosia argentea*. They are known for their strong antioxidant and anti-inflammatory properties. Common flavonoids identified include:

- Luteolin
- Quercetin
- Kaempferol

These compounds contribute to the plant's ability to scavenge free radicals, reduce oxidative stress, and protect tissues from inflammatory damage.^[30]

2. Alkaloids: Alkaloids are nitrogen-containing compounds that often exert potent pharmacological effects. In *Celosia argentea*, alkaloids are primarily present in the seeds and leaves and are associated with:

- Antimicrobial activity
- Hypoglycemic effects
- Mild sedative properties.^[31]

3. Saponins: Saponins are glycosidic compounds recognized for their detergent-like properties. They play a key role in:

- Reducing cholesterol.
- Modulating the immune system.
- Exhibiting antimicrobial and anti-inflammatory activity.

Seeds and leaves of *Celosia argentea* are particularly rich in saponins, which may contribute to their traditional use in digestive and hepatic disorders.^[32]

4. Triterpenoids and Sterols: Triterpenoids and sterols are bioactive compounds with anti-inflammatory, hepatoprotective, and anticancer potential. Studies have isolated:

- Ecdysterone (a plant steroid)
- Celosianin A & B (triterpenoid derivatives)

These compounds are believed to enhance cellular repair and tissue regeneration, explaining the plant's wound-healing properties.^[33]

5. Betacyanins: *Celosia argentea* is notable for its pigments, particularly betacyanins, which are responsible for the vivid red, pink, and purple color of the flowers. Betacyanins, such as celosianin, possess:

- Strong antioxidant activity
- Anti-inflammatory potential
- Protection against oxidative stress-related diseases.^[34]

6. Phenolic Compounds: Phenolics, including gallic acid, ferulic acid, and p-coumaric acid, are widely distributed in the leaves and flowers. These compounds contribute to:

- Antioxidant effects
- Protection against cellular damage
- Antimicrobial and antiviral activity

7. Other Bioactive Compounds: Additional phytoconstituents reported in *Celosia argentea* include:

- Glycosides - support cardiovascular and liver health.
- Fatty acids - contribute to nutritional value and metabolic benefits.
- Proteins, vitamins, and minerals - especially in leaves, making them a valuable dietary source.^[35]

Significance of Phytochemical Profile

The rich phytochemical diversity of *Celosia argentea* provides a scientific explanation for its wide spectrum of traditional uses, ranging from eye health and liver protection to wound healing and antidiabetic effects. These compounds also serve as a basis for the development of standardized herbal formulations, ensuring reproducible pharmacological effects.^[36]

Pharmacological Activities

The diverse medicinal applications of *Celosia argentea* are strongly linked to its rich phytochemical composition, which includes flavonoids, saponins, alkaloids, phenolics, and betacyanins. Modern pharmacological studies have validated many of its traditional uses, revealing a wide range of bioactivities.^[37]

1. Antioxidant Activity

Oxidative stress, caused by free radicals, is a key factor in aging and various chronic diseases. Extracts of *Celosia argentea*, particularly methanolic and aqueous extracts of seeds and leaves, have demonstrated significant free radical scavenging activity. Flavonoids and phenolic compounds in the plant neutralize harmful reactive oxygen species (ROS), protecting cellular components from oxidative damage.^[38]

2. Anti-inflammatory Activity

Inflammation is a common underlying factor in many diseases, including arthritis, liver disorders, and skin conditions. *Celosia argentea* extracts have been shown to reduce inflammation in animal models, such as carrageenan-induced paw edema.

- Active compounds like flavonoids, triterpenoids, and saponins inhibit pro-inflammatory mediators, reducing swelling and tissue damage.
- Traditionally, the leaves are applied topically or consumed to relieve swelling, skin inflammation, and fever.^[39]

3. Antidiabetic Activity

Diabetes mellitus is a growing global health concern. Studies suggest that *Celosia argentea* exhibits hypoglycemic and antihyperglycemic effects.

- Seed and leaf extracts improve glucose metabolism and enhance insulin sensitivity.
- Flavonoids and saponins are believed to regulate carbohydrate metabolism and reduce postprandial glucose spikes. These findings support its traditional use in managing diabetes and related complications.^[40]

4. Antimicrobial and Anthelmintic Activity

Celosia argentea demonstrates notable antimicrobial activity against various pathogens:

- Methanolic extracts inhibit bacteria such as *Escherichia coli*, *Staphylococcus aureus*, and fungi like *Candida albicans*.

- Seeds and leaves also show mild anthelmintic effects, supporting their use in traditional medicine for intestinal parasites.^[41]

5. Wound Healing and Hemostatic Effects

One of the most celebrated traditional uses of *Celosia argentea* is in wound healing:

- Topical application of leaf extracts accelerates wound contraction and promotes epithelialization.
- Triterpenoids and flavonoids stimulate collagen synthesis and improve tissue regeneration.
- Seeds are used in traditional medicine as a hemostatic agent, helping control bleeding.^[42]

6. Eye Health

In Ayurvedic and Chinese medicine, seed decoctions are used to improve vision and treat eye disorders:

The antioxidant compounds protect ocular tissues from oxidative stress.

Anti-inflammatory effects reduce irritation and support eye health.^[43]

7. Other Reported Activities

Research also highlights additional pharmacological activities of *Celosia argentea*:

- **Antiulcer activity:** Leaf and seed extracts reduce gastric lesions in experimental models.
- **Neuroprotective effects:** Preliminary studies suggest protective effects against oxidative stress in neuronal cells.
- **Immunomodulatory activity:** Saponins and flavonoids enhance immune response in animal studies.^[44]

Traditional and Ethnomedicinal Uses

Celosia argentea has been used for centuries in various traditional medicine systems, including Ayurveda, Unani, Chinese medicine, and African folk medicine. Its versatility arises from the medicinal value of different plant parts — seeds, leaves, flowers, and the whole herb.

Plant Part	Traditional Use	System/Region
Seeds	Eye disorders, diarrhea, dysentery, liver protection	Ayurveda, TCM
Leaves	Wound healing, inflammation, fever, skin diseases	India, Africa
Flowers	Antiulcer, astringent, antioxidant	China, India
Whole plant	Hepatoprotective, antidiabetic, immune support	Folk medicine, Africa

Key Points

- Seeds are often boiled or powdered to treat eye disorders and reduce urinary issues.
- Leaves are applied topically to wounds and burns for faster healing.
- Flowers are used in tea or decoctions for digestive and anti-inflammatory benefits.
- In Africa and India, young leaves serve as a nutritive vegetable, providing proteins, vitamins, and minerals along with medicinal benefits.

The continued use of *C. argentea* in traditional practices reflects its efficacy, safety, and accessibility, making it a valuable plant in rural and modern healthcare alike.^[45]

Toxicity and Safety Profile

Safety evaluation is crucial for herbal medicines before their therapeutic application. Several studies have assessed the toxicity profile of *Celosia argentea*.

- Acute toxicity: Oral administration of seed or leaf extracts in animal models up to 2000 mg/kg body weight showed no mortality or severe toxicity.

- Sub-acute toxicity: Repeated administration over 28 days did not produce significant changes in hematological, biochemical, or histopathological parameters, suggesting the plant is relatively safe at therapeutic doses.
- Side effects: No significant adverse effects have been reported in traditional use. Mild gastrointestinal discomfort may occur in sensitive individuals at high doses.^[46]

Future Perspectives

Celosia argentea Linn. is a remarkable medicinal plant with a rich history of traditional use and strong scientific validation. Its phytochemical diversity, including flavonoids, alkaloids, saponins, triterpenoids, phenolics, and betacyanins, accounts for its broad pharmacological activities such as.

- Antioxidant
- Anti-inflammatory
- Hepatoprotective.^[47]

The plant's seeds, leaves, and flowers are used both as nutritive food and therapeutic agents, highlighting its dual value in nutrition and medicine. Pharmacognostic studies provide diagnostic markers for identification, quality control, and standardization, which is essential for its safe use in herbal formulations.^[48]

Future Directions

1. Isolation and characterization of bioactive compounds for drug development.
2. Clinical trials to validate traditional claims and determine effective dosing.
3. Formulation development (tablets, capsules, topical creams) for standardized medicinal

use.^[49]

4. Exploration of nutraceutical applications, combining nutritional and therapeutic benefits.
5. Studies on mechanisms of action at molecular and cellular levels to support pharmacological findings.^[50]

CONCLUSION

Celosia argentea Linn., commonly known as silver cockscomb, is a versatile medicinal plant with a rich history of traditional use in Ayurveda, Unani, Chinese medicine, and African folk medicine. Its therapeutic potential is supported by a diverse range of bioactive compounds, including flavonoids, alkaloids, saponins, triterpenoids, phenolics, and betacyanins, which contribute to its antioxidant, anti-inflammatory, hepatoprotective, antidiabetic, antimicrobial, wound healing, and eye-protective activities. Pharmacognostic and physicochemical evaluations provide clear diagnostic markers for identification and quality control, ensuring safe and standardized use of the plant in herbal formulations. Traditional uses, modern pharmacological studies, and safety assessments collectively highlight *Celosia argentea* as a safe, effective, and promising herbal resource.

Future research should focus on clinical validation, isolation of active compounds, formulation development, and mechanistic studies to fully harness the therapeutic potential of this remarkable plant. By bridging traditional knowledge with modern science, *Celosia argentea* has the potential to emerge as a valuable herbal medicine and nutraceutical for global healthcare.

Abbreviation

Abbreviation	Full Form		
<i>C. argentea</i>	<i>Celosia argentea</i> Linn.		
TCM	Traditional Chinese Medicine		
ALT	Alanine Aminotransferase		
AST	Aspartate Aminotransferase		
ALP	Alkaline Phosphatase		
ROS	Reactive Oxygen Species		
UV	Ultraviolet		
DPPH	2,2-diphenyl-1-picrylhydrazyl antioxidant assay)	(used	in
w/w	Weight by Weight		
mg/kg	Milligrams per Kilogram (body weight)		
CCl ₄	Carbon Tetrachloride (used in hepatotoxicity studies)		
HPLC	High-Performance Liquid Chromatography		
FTIR	Fourier Transform Infrared Spectroscopy		
TLC	Thin Layer Chromatography		
ED50	Median Effective Dose		
IC50	Half Maximal Inhibitory Concentration		

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