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PHYTOCHEMICAL AND PHYTOTHERAPEUTIC ACTIVITIES OF *CELOSIA ARGENTEA*: A REVIEW

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ABSTRACT

Medicinal plants have been used basically in all cultures as a source of medicine. They have been used for thousands of years to flavour and conserve food, to treat different health issues and to prevent diseases including epidemics. Active compounds produced during secondary metabolism usually posses the biological properties of plant species used throughout the globe for various purposes, including treatment of infectious diseases. Based on the medicinal values, *Celosia argentea* (*Amaranthaceae*) has been chosen for this study. *Celosia argentea* plays an important role in traditional medicine to cure several disorders such as fever, diarrohea, mouth sores, itching, wounds, jaundice, gonorrhea, inflammation, bleeding piles, bleeding nose, cold, gastrointestinal diseases, haematological, gynecological, uterus disorders, rheumatoid arthritis, sores, ulcers, skin eruptions, snakebite and as an abortifacient. A variety of phytoconstituents are isolated from the *Celosia* species which include phenols, tannins, flavonoids, cardiac glycosides, steroids, phytosterols, phlobatannins, carbohydrates, lipids, amino acids, peptides, phenolic acids, novel triterpenoid saponins-celosin E, F and celosin G together with a known compound cristatain, betalains, nicotinic acid, celogentin A–D, H, J,K, alkaloids which include celogenamide A, moroidin, celosian, citrusin C, amaranthin, isoamaranthin, betalamic acid, miraxanthin V (Dopaamine-BX), 3-methoxytyramine-BX and (*S*)-Tryptophan-BX. This plant has potential pharmacological values screened various pharmacological activities, suchas anti-inflammatory, immune-stimulating, anticancer, hepatoprotective, antioxidant, wound healing, antimitotic (antitumor), antiviral, anti-microbial activity and skin depigmentation, antidiabetic, antinociceptive effect and antibacterial activities which are reported in different parts of the plant extracts. This review gives in brief details of the ethnobotanical,

phytochemical and pharmacological investigations on the *C.argentea* species. It is an attempt to study for further research.

KEYWORDS: Epidemics, Amaranthin, Hepatoprotective, Pharmacological, Tannins.

INTRODUCTION

Herbal medicines are being used by nearly about 80% of the world population, primarily in developing countries for primary health care. Assessing the current status of health care system in adequacies of synthetic drugs is likely to be more glaring in the coming years. Ayurveda is a traditional Indian Medicinal System practiced for thousands of years. Considerable research on pharmacognosy, chemistry, pharmacology and clinical therapeutics has been carried out on ayurvedic medicinal plants. Natural products, including plants, animals and minerals have been used in the treatment of human diseases. The current accepted modern medicine or allopathy has gradually developed over the years by scientific and observational efforts of scientists. However, the basis of its development remains rooted in traditional medicine and therapies. Selection of scientific and systematic approach for the biological evaluation of plant products based on their use in the traditional systems of medicine forms the basis for an ideal approach in the development of new drugs from plants (Sachin Parmar *et al.*, 2010).

The *Celosia* species belongs to *Amaranthaceae*. The generic name is derived from the Greek word *kelos*, meaning "burned," and refers to the flame-like flower heads. There are more than seventy different species identified and among all including *C. argentea* are routinely used as leafy vegetable (Uusiku *et al.*, 2010). Thus we have selected one medicinal plant *Celosia argentea.* This study will give details of phytochemical and phytotherapeutic activities.

Celosia species have been designated as a quantitative short-day plant, alternate entire or rarely lobed leaves. *C. argentea* is 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 2 X 6cm, although those on flowering shoots are slightly longer. Even the green foliage may contain large amounts of betalain pigments. Plant bears often pinkish or white flowers which are small in size and they are dense erect spikes, 8 to 12 millimeters in length, borne in solitary, erect, stout, dense, white, purple or pink, glistening spikes. They are about 3 to 30 centimeters long and 1.5 to 2 centimeters in thick, without

petals. Sepals are 6 millimeters long, and so longer than the bracts. It contains membranaceous fruits *C. argentea* flowers yield large numbers of seeds that are about 1 mm in diameter and are normally black in colour. The Cockscomb flower blooms from late summer through late fall. *C. argentea* plant is an annual dicotyledon (Ron *et al.*,1995; Jain 2005). The plant of *Celosia argentea* is shown in Figure 1A.

Fig. 1. A: Plant of *Celosia argentea*, B. Inflorescence (spikes) of *Celosia argentea*

Geographic Distribution: *C. argentea* plant is known worldwide, its use for food is geographically much more limited. The plant is common in West Africa, from Sierra Leone to Nigeria. It is also known in Ethiopia, Somalia, Kenya, other parts of East Africa, Mexico and Central Africa. *C. argentea* is an important cultivated vegetable in the rainforest zone of Nigeria, Benin, Cameroon, Gabon, and Togo. The wild form (sometimes referred to as *C. trigyna*) is a pot herb throughout the Savanna area of tropical Africa. *C. argentea* grows as a weed during rainy season throughout India and other tropical regions of the world mainly Sri Lanka, Yeman, Indonesia, America and West indies.

Taxonomy

Division : Magnoliophyta
Kingdom : Plantae
Clade : Angiosperms
Order : Caryophyllates
Family : Amaranthacea
Genus : *Celosia*
Species : *Argentea*

Morphology

Flower : In spikes, dense, cylindraical, pink turning white

Fruit : A Capsule, globose .seeds 12, reticulate

Leaf Apices : Acute

Leaf Arrangement : Alternate spiral

Leaf Bases : Cuneate

Leaf Margins : Entire

Leaf Shapes : Elliptic

Leaf Types : Simple

Habit : An erect, glabrous profusely branched annual herb

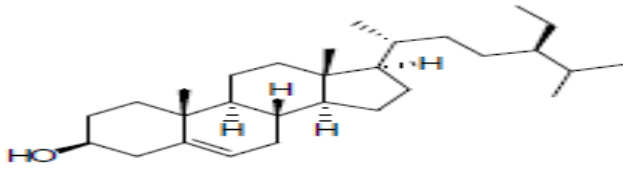
Common Names: *C. argentea* is commonly named as semen celosiae, celosia, silver cock's comb, cock's comb, quail grass, woolflower. In India locally named as sitivara, vitunnaka, sunishannaka, indivara, survali, safed murga, annesoppu, and kanne hoo. Plumed Cockscomb, Silver Spiked Cockscomb, Wheat Celosia, Kombada, Chare Maguri, Kukura-joa-phul, Mesor, Lasor, lagos spinach.

Medicinal Therapeutic uses of *Celosia Argentea*

- Poultice of leaves, coated with honey, used as cooling application to inflammed areas and painful affections such as buboes and abscesses.
- Seeds are used to soothe gastrointestinal disorders and are antipyretic, improve vision, relieve fever associated with liver ailments.
- Seeds when in decoction or finely powdered, and are considered antidiarrheal and aphrodisiac.
- The juice of the seeds forced into the nostrils helps to cure epistaxis.
- Whole plant is used as antidote for snake-poison.
- Roots are used for colic, gonorrhea and eczema.
- Decoction of seeds with sugar is prescribed against dysentery.
- Flowers and seeds are used for bloody stools, hemorrhoidal bleeding, leucorrhea and diarrhea.
- Seeds are traditionally used to treat jaundice, gonorrhea, wounds and fever.
- In Sri Lanka, leaves were used for inflammations, fever and itching.
- Seeds are used for fever and mouth sores.
- In China, flowers and seeds are used in treatment of gastroenteritis and leucorrhea.

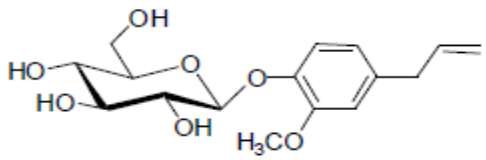
Phytochemical Screening

Carbohydrates: Carbohydrates are the polyhydroxylated aldehydes and ketone, which are apparent result of photosynthesis. Sucrose as a carbohydrate, disaccharide has been accounted along with b-sitosterol (Xue *et al.*, 2011) in seeds of *Celosia argentea* which serves as storage of energy.

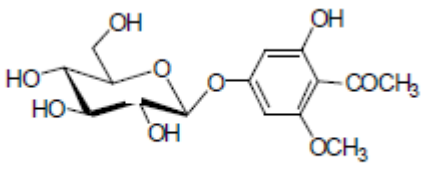


β-Sitosterol

Phenols and Phenolic acid: Phenols and phenolic acids are the secondary metabolites which are synthesized from carbohydrates in plants. Plant phenolics are a structurally diverse set of compounds responsible for organoleptic properties of plants. These are found to possess a wide range of therapeutic activity. They occur in plants in the form of simple phenolic acids or as complex structures associated with the oxygenated heterocyclic ring, such as benzoic acid derivatives, stilbenes, tannins, lignans, anthocyanins, flavonoids and coumarins (Harborne *et al.*, 1990). The six compounds including Eugenyl O-β- D-glucopyranoside (citrusin C) were isolated from the leaves of *C. argentea* which shows Tyrosinase inhibitory and superoxide scavenging activity. The six compounds isolated from the leaves of *C. argentea* showed good skin depigmentation effect. A phenolic glycoside, 4-*O*- β-D-glucopyranosyl-2-hydroxy-6-methoxyacetophenone along with ten known compounds were isolated from the plant *C. argentea* (Sawabe *et al.*, 2002).



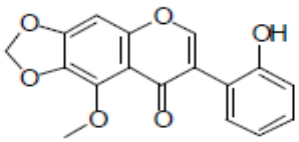
Eugenyl-*O*-β-D-glucopyranoside (citrucin C)



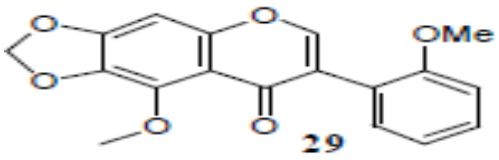
4-*O*-β-D-glucopyranosyl-2-hydroxy-6-methoxyacetophenone

Flavonoids: Flavonoids, another important class of phenolics featuring the linkage of two benzene rings by a chain of 3 carbon atoms, so as to form pyran or pyrone ring, play predominant role in plant physiology and serve as light screens, antioxidants, enzyme inhibitors, precursors of toxic substances and pigments (Harborne *et al.*, 1990; Mc Clure *et al.*, 1986) Flavonoids play an important role in a plant as a defense and signaling compounds

in reproduction, pathogenesis and symbiosis. The two isoflavones, 5-Methoxy-6,7-methylenedioxy-2'-hydroxyisoflavone and its 2'-methoxy derivative: tlatlancuayin were isolated from aerial parts of *C. argentea* (Jong *et al.*, 1995).



5-Methoxy-6,7-methylenedioxy-2'-hydroxyisoflavone



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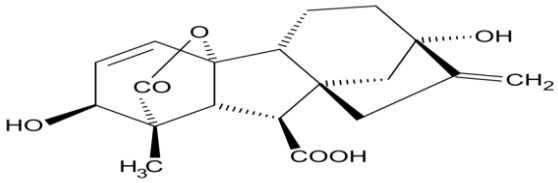
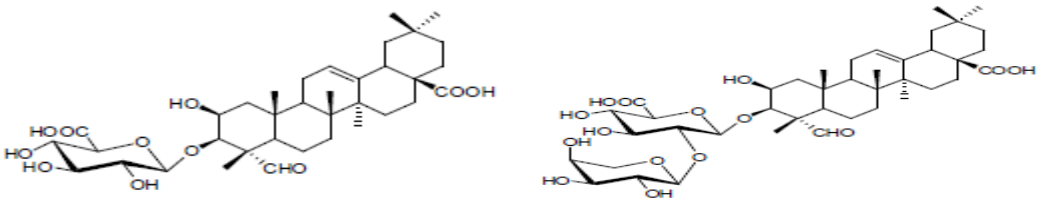
Tlatlancuayin

Diterpenes: Diterpenes, C_{20} are a group of compounds that consists of 4 five carbon (C_5) units called isoprene. These compounds are well known for their pharmacological, toxicological activities and bitter taste. Gibberellic acid is a simple gibberellin, a tetracyclic diterpene acid and acts as plant hormone. Similar effect was observed for promoted seedling by oligogalacturonic acids (Suzuki *et al.*, 2002).

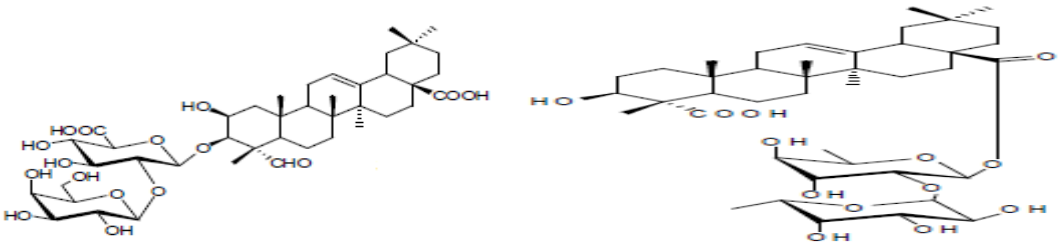


Gibberellic acid.

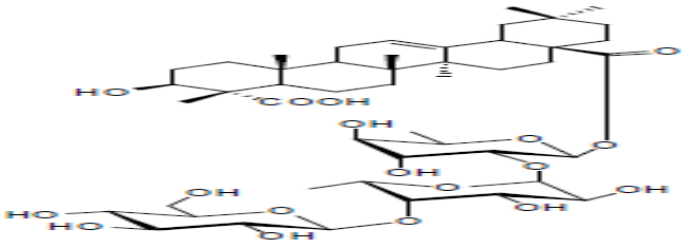
Steroids: Sterols, structurally comprised of perhydrocyclopenta-(O) phenantherene ring system, are widely distributed in higher plants. Phytosteroids represent a wide range of polarities especially, in account of its existence of polar, non-polar conjugates and the possibility of charged forms. Steroids contain a specific arrangement of four cycloalkane rings that are joined to each other. Steroidal saponins are close with triterpenoid saponins and broadly distributed in secondary metabolites of plant. Steroidal saponins, Cristatain, with four other saponins, Celosin A, B, C, and D were isolated from the seeds of *C. cristata* (Wu *et al.*, 2011).



Cristatain Celosin A



Celosin B Celosin C



Celosin D

Phytochemistry of *Celosia argentea:* Phytochemical compounds present in C.argentea are betalains, nicotinic acid, celogenamideA, celogentin A–D, Celogentin-H, celogentin-J and celogentin -K, moroidin. Flavonoid acts as a defense and signaling compounds in reproduction, pathogenesis and symbiosis. Isoflavones such as 5-Methoxy-6,7-methylenedioxy-2'-hydroxyisoflavone and its 2'-methoxy derivative: tlatlancuayin were obtained from aerial parts of *C. argentea* (Thangarasu *et al.*, 2002) .The six compounds including Eugenyl O-â- D glucopyranoside (citrusin C) which is obtained from the leaves of *C. argentea* shows Tyrosinase inhibitory and superoxide scavenging activity. A phenolic glycoside, 4- O- â-D-glucopyranosyl-2-hydroxy-6- methoxyacetophenone along with ten known compounds were isolated from the plant *C. argentea* (Shuos *et al.*, 2010). Diterpenes, C_{20} are a group of compounds that consist of 4 five carbon (C5) units called isoprene. *C. argentea* contains numerous kinds of amino acids, and their constituents.

Minerals are essential in plant growth and development, and in managing human health. Some necessary trace elements for bio-system such as Fe, Mn, Cu, and Zn, involved in metabolism, and are closely related to immune function. *C. argentea* subsists of over eighteen minerals (Zheng *et al.*, 1995) in which the contents of Al, Fe, Ni, Mn, Cu, K, Ti, and Se were far high. A study on minerals of *C.argentea* showed that the content of Fe, Mn, Cu, and Zn were 197, 56, 30, and 160 mg/g, respectively. Apart from the above mentioned compositions, other compounds like Lutein and β-carotene (Belanger *et al.*, 2010) were also isolated from *C. argentea*. These compounds are well known for their pharmacological, toxicological

activities and bitter taste. There is a promising interest in the *C. argentea* for its effective phytochemical constituents and also its potential pharmacological activities.

Pharmacological Uses of *Celosia Argentea:* Pharmacological activities with our increasing knowledge of chemistry and advancements in related experimental conditions, we have started to use scientific methods to expose the truth about pharmacological mechanisms of various subjects such as *C. argentea*. Increasing attention on *C. argentea*'s pharmacological activities and its mechanism on hepato-protection, anti-infection, anti-tumor, anti-diabetes, anti-oxidant, and its therapeutic effect on eye diseases have indicated that *C. argentea* has enormous potential for further study and exploitation.

Anti-hepatotoxic activity: The water extract of *C. argentea* was investigated for hepatoprotective effect in comparison of *Cassia obtusifolia, Cucurbita moschata* and *Curcuma aeruginosa.* In the study it was found that among the other species the water extract of *Celocia argentea* is the most effective (Hase *et al.*, 1996). These experiments were carried out on the CCl_4 induced and D-galactosamine/ lipopolysaccharide, induced liver injury in mice. In same context Celosian found in seed are also found to inhibit increase of serum enzymes (GPT, GOT, LTH) and bilirubin levels. The Celocian induced the tumor necrosis factor-alpha (TNF-α) production in mice along with production of interleukin-1 ß (IL-1 ß) and nitric oxide (NO) in macrophage cell line J_{774}.1 in a concentration-dependent manner (1 to 1000 micrograms/ml). Significant hepatoprotective effects was implicit due to the antioxidant capability of *Celocia argentea* and proved by CCl4 induced hepatotoxicity in mice, using celosin A 32 and celosin B 33 celosin C 34 and celosin D 35 with oral doses 1.0, 2.0 and 4.0 mg kg^{-1} (Xue *et al.*,2011).

Antibacterial activity: In early 1969, *C. argentea* was reported to exhibit antibacterial activity against *Bacillus subtilis, S. aureus, Salmonella typhi, Escherichia coli, Agrobacterium tumefaciens,* and *Mycobacterium tuberculosis* (Bhakuni *et al.*, 1969). Further, (Gnanamani *et al.,* 2003) researched the antibacterial activity of *C. argentea* leaf extracts on eight burn pathogens, finding that the alcohol extract of *C. argentea* showed sensitivity in the order *Shigella sp., Pseudomonas sp., Staphylococcus sp., Streptococcus sp., Vibrio sp., Klebsiella sp., E. coli* and *Salmonella sp*. Regretfully, the promising antibacterial compounds is not clear, and the goal of elucidating their active antibacterial compounds will be part of the focus of this study.

Wound healing activity: The healing efficacy of alcohol extract of *C. argentea* in an ointment formulated (10% w/w) using a rat burn wound model. This result confirmed that, a salutary action of the *C. argentea* extract on wound healing, and also suggested that this may be due to mitogenic and motogenic promotion of dermal fibroblasts (Priya *et al.*, 2004) *C. argentea* is considered as one of wound healing medicinal plant in India along with various medicinal plants like, *Aloevera*, *Azadirachta indica, Carica papaya, Cinnamomum zeylanicum, Curcuma longa, Ocimumsanctum, Nelumbo nucifera,* and others (Santosh *et al.*, 2012).

Therapeutic effect on eye diseases: For a long time, *Semen celosiae* has been used as an effective herb for treating eye diseases, especially in China and Japan. Compatible with other herbs (*Radix rehmanniae*, *Radix scrophulariae*, *Semen plantaginis* etc.,) *Semen celosiae* is being used to treat ceratitis, epipephysitis, iridocyclitis, opticatrophy.

(Huang *et al*., 2004b) researched the effects of four Chinese herbs, which pass through the liver channel, on improving eye sight and on protecting oxidative injury of lens and apoptosis of lens epithelial cells, finding that by improving the anti-oxidant ability of lens, the water extract of *Semen celosiae* could decrease the oxidative damage of lens, inhibit lens epithelial cells apoptosis, and reduce lens opacity, better than Catalin eye drops. Lens opacities in Semen Celosiae group were much lighter than that in Fenton group. The content of SOD, GSH and GSH-Px in the lenses of *Semen celosiae* group were higher than Fenton group ($p < 0.01$). Another study on these four Chinese herbs focused on their regulation of gene expression related apoptosis of LEC (Huang *et al.*, 2004a), in which, both Bcl-2 and Bax in LEC were expressed, and the Bcl-2 was a higher one than Bax. Compared with the normal group, the expressions of both Blc-2 and Bax in the H_2O_2 group were changed, in which the Blc-2 expression decreased while the Bax expression increased, while compared with H_2O_2 group, the Blc-2 expression increased and the Bax expression decreased, which were more approximate to the normal ones and more potent than Pirenoxine sodium. Due to the absence of blood normal vessel, lens obtained the nutrient substance from circumstance. Under normal conditions, the concentration of amino acid in lens is higher than surroundings, especially the acidic amino acid such as glutamic acid. When the lens in the situation of cataract, the content of free amino acid has reduced, the content of trace elements such as zinc, selenium, and cuprum has also reduced. With respect to *C. argentea* in these constituents, it might improve eyesight by adjusting the metabolism in lens.

(Liu *et al*., 2007) observed the treatment of 20% water extract of *C. argentea* on senile cataract, compared with an effective drug, Catalin eye drops, the therapeutic effect of Semen Celosiae on senile cataract was not significant. Intimately, with iontophoresis group, the number of improvement by Semen Celosiae was eighteen eyes (Catalin eye drops: twenty eyes; the total eye diseases was twenty, respectively), while in the eyedropper application group, the number of improvements by Semen Celosiae was seventeen eyes (Catalin eye drops: nineteen eyes; the total eyes diseases was twenty, respectively). In both administration routes, there were no iriditis, cornea injury, or choroiditis side effects.

Anti-inflammatory activity

The in vivo study investigated that, the flavonoid fraction from alcoholic extract of the leaves of *C. argentea* for anti-inflammatory activity in animal models like carrageenan induced rat paw edema acute inflammatory and cotton pellet induced chronic inflammatory methods (Santosh *et al.,* 2008). Further a study revealed the triterpenoid saponins were isolated from the seeds of *C. argentea* and named as celosin E,F,G, and cristatain. These active constituents are screened for their anti-inflammatory activity by *in vitro* methods (Wu *et al.*, 2011).

Anti-cancer activity

The triterpenoid saponins were isolated from the seeds of *C. argentea* and named as celosin E, celosin F, G, and cristatain. These active constituents are screened for their anti-cancer activity by in vitro methods (Rukshana *et al.,* 2013).

Anti-tumor and immunomodulatory activities

A number of studies revealed that *C. argentea* is a potent agent for tumor treatment. Hayakawa *et al*., researched the anti-metastatic effect of Semen Celosiae extracts, finding that intraperitoneal administration of Semen Celosiae extract for seven days before tumor inoculation significantly inhibited liver metastatis caused by intra-portal injection of colon 26-L_5 carcinoma cellsin dose-dependent manner. *In vitro* experiments showed that water extract of *C. argentea* also mediated macrophages to produce white blood cells to lodge (Hayakawa *et al.,* 1998). The anti-tumor foundation of *C. argentea* is due to the characteristic of immune regulation, including induced IL-12, IL-2 and IFN resulting to the immune state of B dominance and activation of the cells to achieve the antitumor state. Co-culture of celosian and Con A increased IFN-y secretion two-fold compared with Con A alone, indicating that celosian not only activates macrophages but also affects T-cells function. Another study showed significant immunomodulating activity of aerial parts of *C. argentea*

(Devhare *et al.*, 2011). The 70% ethanol extract and water extract were screened for delayed type hypersensitivity, neutrophil adhesion test, and cyclophosphamide-induced myelosuppression to assess the effect on immunity in Swiss albino mice. In the existing reports on antitumor activity of *C. argentea*, triterpenoidsaponins are the most frequently reported class of compounds. Celosin A was reported to be effective in the apoptosis of human cervical cancer HeLa cell l (Huang *et al.*, 2013) and HepG2 Cell (Cheng *et al.*, 2013), (Wu *et al*., 2011) tested four triterpenoidsaponins (celosin E–G and cristatain) from *Semen celosiae* for their antitumor activities toward five human cancer cell lines, finding that all four triterpenoidsaponins had a certain degree of inhibition of cancer cells. The antitumor activity of cristatain was more potent than others.

Anti-diarrhoeal activity: *C. argentea* could effectively inhibit castor oil induced diarrhea and charcoal meal induced diarrhea. (Sharma *et al.*, 2010) evaluated the anti-diarrhoeal effect of *C. argentea* leaves extract by using castor oil induced diarrhea, charcoal meal test, and Prostaglandin E (PGE) induced diarrhea models. Results suggested that the extract of *C. argentea* leaves inhibited diarrhea within a dose of 100 to 200 mg/kg and that it may act centrally and may inhibit PGE to give anti-diarrhoeal effects. The extract of *C. argentea* leaves showed protection against PGE_2 induced enteropooling which might be due to the inhibition of the synthesis of prostaglandins, and decreased the propulsive movement in the charcoal meal study, particularly at the dose of 200 mg/kg, it becomes more efficacious than the standard drugatropine (2 mg/kg).

Anti-diabetic activity: An alcoholic extract of *Celosia argentea* seeds is used for the treatment of diabetes mellitus. The evaluation of anti-diabetic activity was verified by blood glucose and body weight of alloxan-induced diabetic rats. Continual administration of the seed extract significantly reduced the blood glucose in alloxan-induced diabetic rats for two weeks with prevention of body weight lost (Vetrichelan *et al.*, 2002; Barlocco *et al.*, 2002).

Antiurolithiatic activity: Antiurolithiatic activity of ethanolic extract of *Celosia argentea* (seed) in rats was evaluated by (Joshi *et al.*, 2012) The result of the study showed that groups treated with 250 kg and 500 kg of *Celosia argentea* extract showed significant anti urolithiatic activity compared with the standard and *Celosia argentea* demonstrated a potent prophylactic effect on formation of kidney stone confirming the folklore about its antiurolithiasis activity.

Immunological activity: The Celosian, one of the chemical constituent of *C. argentea* shows immunostimulating activity. Celosian is an acidic polysaccharide from the seeds of this plant. Celosian found to be a potent antihepatotoxic agent for chemical and immunological liver injury models in animals. Celosian is an immunostimulating agentbecause a study shows that it induced production of tumor necrosis factor-alpha (TNF-alpha), interleukin-1 β, nitric oxide (NO) and γ interferon on various *in-vitro* experimental methods (Hase *et al.*, 1997).

Antifungal activity: Fungal study using plant seed oil n- hexane extract of *C. argentea* was studied by (Diéméléou *et al.*, 2013) who observed that *C.argentea* seed oil showed antifungal activity against *Aspergillus fumigatus, Candida tropicalis* and *Trichophyton mentagrophytes* with minimal inhibitory concentration of 50% and therefore concluded that these characteristics should be exploited for possible applications in the food supplement, pharmaceutical and cosmetic industries.

IgE antibody suppression activity: The work of (Imaoka *et al.*, 1994) on effects of *C.argentea* and *Cucurbit amoschata* extracts on anti-DNP IgE antibody production in mice showed that Anti-DNP IgE production was markedly suppressed but IgG responses were not affected. It was also found that mitogenic activity occurred in *C.argentea* extract dose dependently in vitro. They concluded that these results suggest that *C. argentea* extract may be more useful than *Perilla frutescens* extract (PFE) for the suppression of IgE antibody in certain allergic disorders.

Anti-oxidant activity: (Subba and Basnet 2014) studied the antimicrobial and antioxidant activity of some indigenous plants of nepal and reported that the ethanol extract of whole plant (*C. argentea)* showed promising antimicrobial activity against tested microorganisms (*S. aureus, K. pneumonia, P. vulgaris, E. coli*) and moderate antioxidant activity. When the *invitro*-antioxidant study of methanolic extract of *C. argentea leaves* was studied by (Urmila *et al.*, 2013). They observed that plant leaf exhibited *invitro* antioxidant activity in DPPH, NO and H_2O_2 radical scavenging activities models and concluded that the phytochemical constituents present in the plant extract may be responsible for showing the anti-oxidant properties. (Malomo *et al.*, 2011) conducted an *in vitro* and *in vivo* antioxidant activity of the aqueous extract of *C. argentea* leaves and reported that 10 mg/ml of the extract inhibited linoleic acid oxidation for ascorbic acid. In addition, 2 mg/ml of the extract produced a membrane stabilizing activity against indomethacin. Phytochemical screening had revealed the presence of alkaloids, saponins, cardiac glycosides, cardenolides, phenolics, and

flavonoids. Other results indicated that the aqueous extract of *C. argentea* leaves attenuated Cd-induced oxidative stress in the animals, with the best result at 400 mg/kg body weight. Tannin was not detected in aqueous extract used in this study but was detected in ethanolic extracts of the works of (Verma, and Demla 2012). The antioxidant activity of selected Nigeria green leafy vegetables was conducted by (Odukoya *et al.*,2007) Who reported that *Celosia argentea* showed the highest antioxidant activity of all the plants studied and also contains ascorbic acid, total phenols and therefore concluded that high consumption of vegetables containing phenolic antioxidants may slow down the process of degenerative diseases. A novel *C.argentea* saponins compounds extracted from *C.argentea*, namely *Celosia argentea* C and D and showed that in animal experiments, these new compounds might be developed for the medicaments capable of preventing and treating hepatic diseases, cardiovascular and cerebrovascular diseases, metabolic diseases, dementia, depression or anxiety.

Anti-mitotic activity: Anti-mitosis in the moroidin celogentin families in Semen Celosiae has been reported. It was reported that moroidin strongly inhibited the polymerization of tubulin, and the inhibitory activity of the tubulin polymerization by moroidin was more potent than that of colchicine (Morita *et al.*, 2000). Next, related studies indicated that all of celogentins A–H, J, and moroidin possess a certain degree of anti-mitotic activity. Some of them were rivals to vinblastine and are even more potent. Among them, celogentin C is the more potent in inhibiting tubulin polymerization than vinblastine (Kobayashi *et al.*, 2001; Hayato *et al.*, 2003). This difference of bioactivity among celogentins and moroidin might be related to the ring size and conformation suitable for interaction with tubulin.

Other bioactivities: *C. argentea* has other pharmacological activities. The alcohol extracts of *C. argentea* promote cell motility and proliferation of primary dermal fibroblasts at 0.1–1g/ml but did not alter these responses in primary keratinocytes. In an initial examination of molecular mechanisms, the *C. argentea* extract did not alter fibroblast and keratinocyte responses to the wound repair-associated epidermal growth factor receptor ligands. This may be due to mitogenic and motogenic promotion of dermal fibroblasts. (Ying Tang *et al.*, 2016).

CONCLUSION

Celosia argentea (Cockscomb) is an admired Asian, tropical, brilliant colors weed and documented for its diverse applications. This review has focused for collection of recent phytochemical and ethnopharmacological information about the plant. A number of chemical

compounds including oleanane-type triterpenoid saponins (celosin H, I and J), cristatain, celosin E, celosin F, celosin G have been isolated from *Celosia argentea.* Phenols, flavonoids, diterpenes, saponins, alkaloids, glycosides, as well as micronutrients like Mg, Ca, S, P, K and Fe have been identified from the plant. This plant has potential pharmacological values screened various pharmacological activities, suchas anti-inflammatory, immune-stimulating, anticancer, hepatoprotective, antioxidant, wound healing, antimitotic (antitumor), antiviral, anti-microbial activity and skin depigmentation, antidiabetic, antinociceptive effect and antibacterial activities which are reported in different parts of the plant extracts. Finally this article reveals that, reported *Celosia* argentea has wide range of phytochemicals and therapeutical applications will be effective for the further research and progression. Thus, there remains a tremendous scope for further scientific exploration of *Celosia* argentea to establish their therapeutic efficacy and commercial exploitation.

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