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# A COMPREHENSIVE REVIEW ON PLANT *CLEOME GYNANDRA*

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**ABSTRACT:** *Cleome gynandra* (Capparaceae) is also known as spider plant. *Cleome gynandra* is an abundantly available species and grows as a weed in common barren land and in crop fields throughout India. In all over the world in different countries it is used to treat many diseases in their traditional system, and it is also used in various traditional culinary systems for its remarkable nutritional and antioxidant properties. In India alone it is used by the traditional healers for many diseases e.g. epilepsy, irritable bowel syndrome and in protozoal and worm infections. *C. gynandra* is typically well-known herb in southern Africa reaching out from the Limpopo, the North-West, Gauteng, the Northern Cape, and Namibia. The majority of these plants pharmacologically active phytochemicals are secondary metabolites produced during cellular metabolism. *Cleome gynandra* a valuable plant in traditional medicines and potential source for developing a therapeutic agent. In this review article through various established facts regarding the medicinal applications of *Cleome gynandra* has been cited regarding the Immunomodulator, Antioxidant, Anticarcinogenic, Analgesic properties etc. Analysing all these established properties *Cleome gynandra* may be a promising drug in Future However, in-depth studies are needed on the clinical use of *Cleome gynandra* against human diseases. Besides, detailed toxicological analysis is also to be performed for its safe and efficacious use in preclinical and clinical studies as a health promoting herb.

**INTRODUCTION:** *Cleome gynandra* (Capparaceae) is also known as spider plant. *Cleome gynandra* is an erect, annual or perennial herb. It is used as a medicinal plant and can be found in all over world. It grows as a weed in paddy fields and also in roadsides and in open grass lands [1]. *C. gynandra* plant occurring throughout the tropics and subtropics of Africa. In South Africa, it is found in agricultural land and near human settlements. It is less common in areas with highly humid climate [2]. *Cleome gynandra* plant grows up to 250-600 mm tall.

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It is much branched, and the stems sometimes become woody with age. The stems are sticky due to glandular hairs and there are longitudinal lines that run parallel along the stalk [3]. The leaves are alternate, palmately compound, held by a long petiole. The lamina is composed of 3 to 5 obovate glandular-ciliated leaflets, denticulate at margin. The inflorescence is a long terminal cluster formed of many long-stalked flowers. The white to rose corolla consists of 4 spatulate petals, very slender at the base and all arranged on their back [2].

Spider plant has also been used as traditional medicine to heal a range of ailments in different communities which include food poisoning, rheumatism, inflammation, toothache, headache, bacterial infections, snake bites. These uses as traditional medicine hint at secondary plant metabolites that are health beneficial [4].

In total, 242 accessions were cultivated and morphologically characterized and analysed. The gynophore and filament, both important organs of the flower, played a key role in taxonomical identification. High morphological variation was detected in traits including plant height, pod length, leaf size, flower colour, and earliness [5]. In Thailand and Malaysia, the leaves are a popular food item fermented with rice water as a pickle known as phaksian dong. The same pickle is also eaten in the northern states of Malaysia and is known as jerukmaman [6]. It grows from seed which are dispersed and germinate during the rainy season. Although it is considered an agricultural weed, most local use it as a valuable easily grown agricultural crop. Seeds can be collected and distributed before or after tilling the soil. The plant does not require any maintenance [7].

**Plant Profile:**


**FIG. 1:** ***CLEOME GYNANDRA***

**Taxonomy [2]:**

| | |
|---|---|
| Species | *Cleome gynandra* L. |
| Kingdom | Plantae |
| Genus | Cleome |
| SubGenus | Gynandropsis |
| Class | Magnoliopsida |
| Order | Brassicales |
| Family | Cleomaceae |
| Phylum | Spermatophyta |
| Division | Magnoliophyta |
| Order | Capparales |
| SubFamily | Capparaceae |
| SubClass | Magnoliatae |

**Vernaculars:**
**Vernacular Names in India [8]:**

**Sanskrit:** Pasugandhi, Ajagandha

**Assam:** Bhutmulla

**Bengali:** Hurhuria, Shulte

**English:** Dog Mustard

**Gujarat:** Talvani, Dhelitalavan

**Hindi:** Hulhul, Hurhur, Kavalia

**Kannada:** Naram bele Soppu, Nayeetulasi

**Kashmiri:** Gandi Buti
**Malayalam:** Atunari vela

**Marathi:** Tilvan, Bhatvan, Mabli, Tilavana, Tilvant

**Oriya:** Anasorisia, anasorisa, Hulhulia

**Punjabi:** Bugra

**Tamil:** Nal valai, Nal velai

**Telugu:** Vaminta, Vayinta

**MORPHOLOGY:**
**Macroscopy:** It is an erect, annual herb up to 250-600 mm tall; much branched and sometimes becomes woody with age.

**Stem:** The stem is sticky with glandular hairs and marked with longitudinal parallel lines. Stem is granular, straited, and glandular-pubscent.

**Leaves:** Leaves are palmately compound, with 3-5 leaflets. The leaf stalk is 20-50 mm long with glandular hairs. The leaflets radiate from the tip of the leaf stalk, are 20-100 x 8-40 mm, smooth or with glands, and taper toward the base and often

with scattered multi cellular hairs on the main nerves [8].

**Inflorescence:** The inflorescence is a long terminal cluster elongating at fructification up to 40 cm. pedicels are 10-20mm long, glandular hairs.

**Flower:** The flowers are carried by a stalk of 1 to 2 cm long at the axil of a bract resembling a small subsessile to sessile leaf, tri-lobed or becoming simple to the top of the plant. Asymmetrical flower, formed of a calyx of 4 sepals, oval to oblong, 2.5 to 6 mm long, glandular, a corolla of 4 white, petals pink or lilac, spatula shape, tapered base and rounded top, 1.2 cm long and 3 to 5 mm wide. They are all four erected on their back. 6 stamens have the lower half of the filament fused at the base of the style (1 to 2 cm) and the upper half spreading freely, 1.5 to 2 cm long, purple.

**Fruit:** The fruit is a long tapered fusiform capsule, 10 cm long and 5 mm in diameter, glandular or glabrous, with many seeds.

**Seed:** Seeds round, discoid, 1.5 mm diameter, brown or black, wrinkled or reticulate tegument [9].

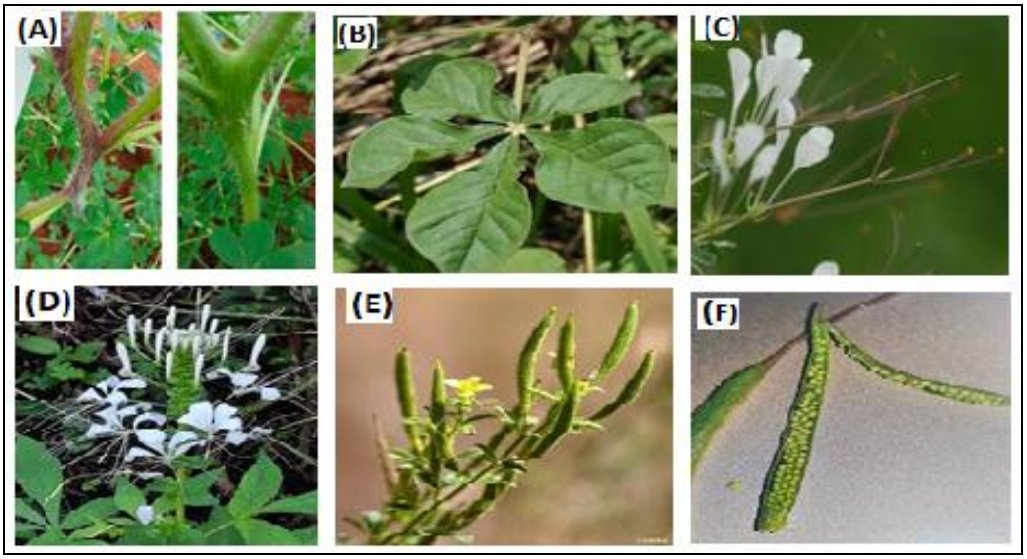



**FIG. 2: MORPHOLOGICAL CHARACTERS OF STEM, LEAF, INFLORESCENCE, FLOWERS, FRUITS AND SEED**

**Microscopy:**

**TS of Stem:** TS of stem showed single layered round epidermal cells with thick cuticle. In epidermis multi-seriate spiny non glandular trichomes, long stalked uniseriate, biseriate, triseriate and multi-seriate and short stalked capitate glandular trichomes were observed. Base of the trichomes were 3 celled to many celled in thickness. Epidermis was followed by 2-3 cell layered thick walled polygonal collenchymas cells.

**TS of Leaf:** TS of the leaf revealed the presence of prominent midrib and thick lamina. The midrib is circular, wide and thick. The epidermis has thick round shaped cells covered with a thick cuticle. In some places, epidermis in the midrib shows the presence of large multiseriate spine like and single cellular thin walled long non-glandular and short-stalked, biseriate and triseriate capitate glandular trichomes. The epidermis having two layers of thick-walled collenchyma cells.

**TS of Seed:** TS of seed showed the presence of epidermis, sub epidermis, parenchymatous cells, inner integuments and an endosperm. Epidermis was made up of vertically elongated thin-walled round and elongated cells. In some places the epidermal cells are longer but in some places, it was shorter in some places it is 2-3 cell layered.

**Powder Microscopic Studies:** Powder microscopic studies **Fig. 3** revealed the presence of simple, round and oval starch grains with closely striated margins. Brown contents were found in some parenchyma cells. Rarely druses of calcium oxalate crystals were observed in parenchyma cells, fats/fatty oil globules were also found in the fragments of endosperm cells and lipid layers of cell walls of parenchymatous cells. Powder microscopic studies further revealed the presence of long, broad cortical fibres with pitted thick cell walls [10].

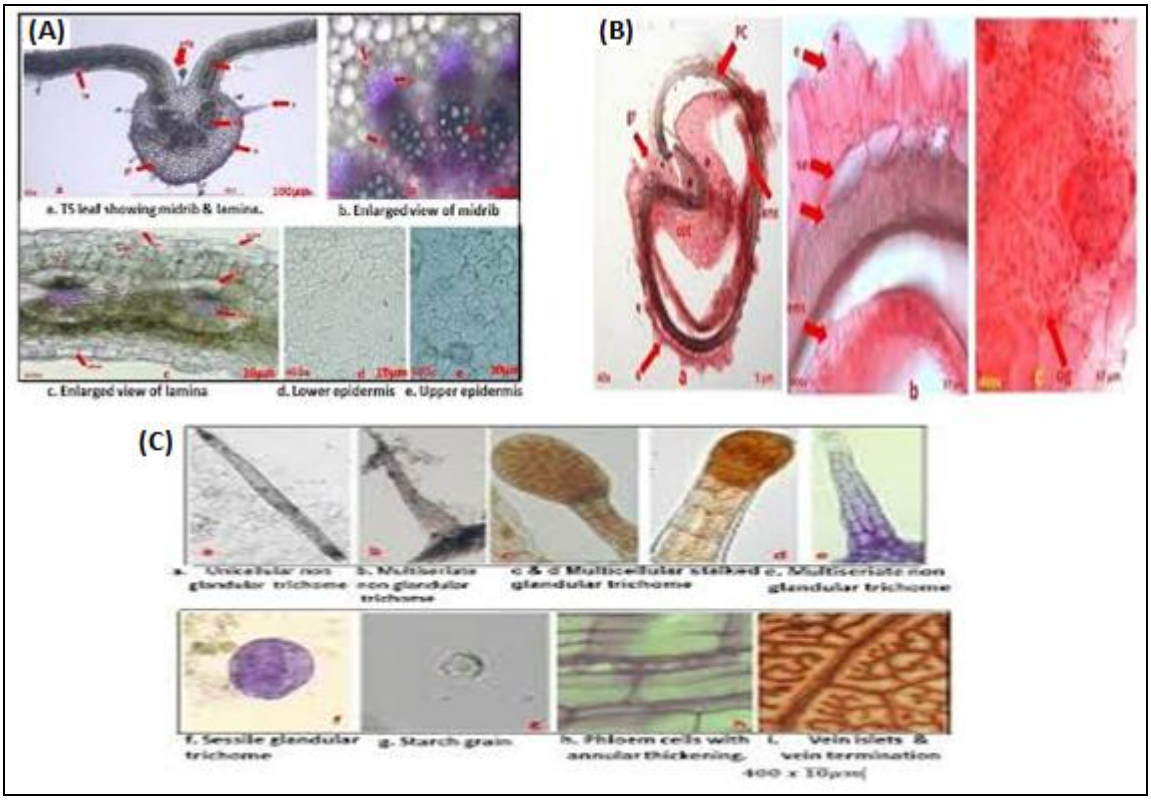
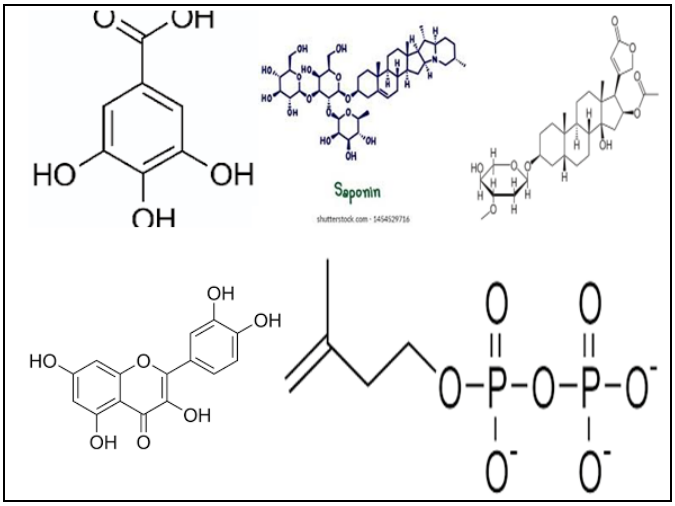



**FIG. 3: MICROSCOPIC CHARACTERS OF *CLEOME GYNANDRA* (LEAF, SEEDS, POWDER MICROSCOPY)**

**Plant Distribution:** *C. gynandra* is typically well-known herb in southern Africa reaching out from the Limpopo, the North-West, Gauteng, the Northern Cape, and Namibia. Being semi-cultivated, in the District of Eastern Cape, has most likely broadened its distribution. It is most likely a native of Africa and now broadly circulated in tropical and subtropical areas all through the world [11].

**Phytoconstituents:** The pharmacological characteristics of *Cleome gynandra* have been demonstrated to be attributed to the phytonutrient components found in the plant extract. The majority of these plants' pharmacologically active phytochemicals are secondary metabolites produced during cellular metabolism. *Cleome gynandra* was found to contain a number of phytochemical secondary metabolites through qualitative chemical analysis and they include saponins, flavonoids, tannins, alkaloids, cardiac glycosides, terpenoids and polyphenols, Flavonoids, they also contain several other bioactive compounds that contribute to its medicinal properties. Here are some additional constituents are Steroids, polysaccharides, fatty acids, vitamins (vitamin C & Beta-carotene). These additional phytoconstituents make *Cleome gynandra* a valuable plant in traditional medicines and potential source for developing a therapeutic agent [12].




**Pharmacological Activities:**

**Anti-inflammatory Activity:** *Cleome gynandra* plant is used to treat inflammation. Many steroidal, non-steroidal and Immunosuppressive drugs are used to control inflammatory symptoms and pain, they are associated with certain undesirable side effects (Flower *et al.,* 1980). With these difficulties, the field of arthritis research has progressed exponentially.

Since, the past millennium and has contributed volumes to our understanding of the herbal based anti-inflammatory agents to obtain by careful study or analysis of a drug with potential anti-inflammatory, antioxidant, anti-microbial and especially with minimum side effect [13].

**Anticancer Activity:** Anticancer activity of methanolic extract of *C. gynandra* was assessed against Ehrlich Ascites Carcinoma cell line at the doses of 400 and 200 mg/kg body weight intraperitoneally. The outcome indicated significant decline in tumour volume, viable cell count, tumour weight, and raised the life expectancy of tumour-bearing mice when compared with normal control mice. Haemoglobin, red blood cell, white blood cell, and lymphocyte count returned to the normal level in treated mice. Result reveals the extract has potent dose-dependent anticancer activity [11].

**Antioxidant Activity:** Antioxidant activities were assessed against ferric reducing power, ABTS (2, 2'- azino-bis-3-ethyl benzothiazoline-6- sulfonic acid) diammonium salt, DPPH (1, 1- diphenyl-2-picrylhydrazyl) and NO (nitric oxide) radical scavenging activities. Total phenolics, flavonoids, flavanols, proanthocyanidins, tannins, saponins and alkaloids were also investigated [14].

**Antidiabetic Activity:** Anti diabetic an antidyslipidemic activity of *Cleome gynandra* plant extract in alloxan-induced diabetic rats. The effects of orally administered ethanolic extract of *Cleome gynandra* on serum glucose and lipid profiles activity were examined in diabetic control and *Cleome gynandra* treated diabetic rats. While the activity of the blood glucose and lipid profiles, in the serum were assessed. The drugs were administered over a period of 7 days treatment.

The *Cleome gynandra* was significantly ($p<0.05$) reduced the serum glucose, elevated dyslipidemia levels, SGOT and SGPT levels, Metformin treated group, EECG-I and EECG-II groups but increased the serum HDL status in all the ethanolic extract *Cleome gynandra* treated groups, compared with normal control and diabetic control [15].

**Antifungal Activity:** *Cleome gynandra* is one such plant assumed to cure *Tinea capitis*, fungal infections. *Cleome gynandra L.* (*Isogi* in the Rufumbira, Uganda; *Eshogi* in the Runyankole/ Rukiga, Uganda, and *Akeo* in Lango, Uganda), also known as African Spider flower, African Cabbage, and Dog Mustard, is an angiosperm that belongs to the family Capparaceae. This was a controlled experimental *in-vitro* study carried out for antifungal activity at both the Pharmacy Laboratory and Mycology Unit of the Microbiology laboratory at Mbarara University of Science and Technology [16].

**Antimicrobial Activity:** Antimicrobial activity of methanolic extracts of plants was screened by disc diffusion assay against four bacteria and four fungal cultures. Streptomycin (10 g/disc) and nystatin (10 g/disc) are used as standards for bacteria and fungi respectively. Minimum inhibitory concentration (MIC) of the extracts was evaluated through micro broth dilution method. The antimicrobial potency of plant extracts was assessed by their zone of inhibition and activity index values. Total activity of extracts was evaluated to quantitatively compare the activity of two plants. Methanolic extract of *Cleome gynandra* showed maximum antibacterial activity against *Staphylococcus aureus* (IZ- 22 ± 0.22 mm, AI-0.917, MIC- 0.039 mg/mL, MBC- 0.039 mg/mL). Maximum antifungal potential was shown by *C. chelidonii* against *Candida albicans* (IZ- 25 ± 0.92 mm, AI-1.000, MIC- 0.039 mg/mL, MFC- 0.039 mg/mL). Both the extracts exhibited good antimicrobial activity with low range of MIC [17].

**Antidiarrheal Activity:** The effect of a methanol extract of the entire plant *Cleome viscosa* L. (CVME) (Family; Capparidaceae) for its anti-diarrheal potential against some of the experimental models of diarrhea in rats. CVME showed significant inhibitory activity against castor-oil-induced diarrheaand $PGE_2$- induced enteropooling in rats. The extract also showed a significant reduction in gastrointestinal motility in the charcoal meal test in rats. The results obtained establish the efficacy and substantiate the folklore claim as an anti- diarrheal agent [18].

**Hepatoprotective Activity:** *In-vitro* antioxidant and *in-vivo* hepatoprotective activities of *Cleome gynandra* ethanolic leaf and root extracts were assessed. *In-vitro* antioxidant activity was carried by DPPH, Nitric oxide, hydroxyl radical and

phosphomolybdate assays. Hepatoprotective activity was evaluated by Carbon tetrachloride (CCl4) induced hepatotoxicity in albino rats. The animals were divided into seven groups (Four test groups - Ethanolic leaf and Root Extracts of *Cleome gynandra* of 100 mg/kg and 200 mg/kg, standard silymarin (100 mg/kg), toxic control-carbon tetrachloride and vehicle). On the eight day, the blood was collected and parameters like serum glutamic oxaloacetic transaminase (SGOT), Serum glutamic pyruvic transaminase (SGPT), alkaline phosphatase (Alp) and Total bilirubin (TB) were estimated. Significant antioxidant status with good $IC_{50}$ values similar to standard ascorbic acid was obtained. A significant decrease in liver enzymes was observed in test groups comparable to silymarin. From the results obtained, ethanolic leaf extract has contributed better hepatoprotection compared with root extract in experimental rats [19].

**Anti-ulcer and Analgesic Activity:** The ethanol extract of *Cleome gynandra* Linn., was investigated for its anti-ulcer and analgesic activity. Anti-ulcer activity was evaluated by various model like Aspirin-induced gastric ulcer in rats, Ethanol induced ulcer in rats, Gastric Secretion study in pylorus ligation in rats. Analgesic activity was evaluated by acetic acid-induced writhing model in mice. The ethanol extract of *Cleome gynandra* Linn. Leaf extract at 300 mg/kg body weight. It was found to produce significant anti ulcer activity in all the models compared to vehicle control animals. Pylorus ligation showed significant reduction in gastric volume, free acidity and ulcer index as compared to control. It also showed 55.76% ulcer protection index in ethanol induced ulcer and 61.01% ulcer protection index in aspirin induced model. The Ethanol extract showed significant analgesic activity (50.00% protection) at 300 mg/kg b.wt. dose level comparable to the reference standard indomethacin (69.50% Protection) at 10 mg/kg b.wt on oral administration in mice [20].

**Antinociceptive, Cytotoxic and Antibacterial Activity:** The methanol extract of the dried leaves of *Cleome viscosa* L., Cleomaceae, was investigated for its possible antinociceptive, cytotoxic and antibacterial activities in animal models. The extract produced significant writhing inhibition in acetic acid-induced writhing in mice at the oral doses of 250 and 500 mg/kg body weight ($p<0.001$) comparable to the standard drug diclofenac sodium at the dose of 25 mg/kg of body weight ($p<0.001$). The crude extract produced the most prominent cytotoxic activity against brine shrimp *Artemia salina* ($LC_{50}$ 28.18 µg/mL and LC90 112.20 µg/mL). The extract of *C. viscosa* L. exhibited significant *in-vitro* antibacterial activity against *Staphylococcus saprophyticus*, *Shigella sonnie*, *Salmonella typhi*, *Vibrio cholera*, *Streptococcus epidermidis*, *Shigella flexneri* and *Staphylococcus aureus* with the zones of inhibition ranging from 10.76 to 16.34 mm. The obtained results provide a support for the use of this plant in traditional medicine and its further investigation [21].

**CONCLUSION:** The plant *Cleome gynandra* widely used in traditional medicine to treat conditions including food poisoning, rheumatism, inflammation, bacterial infection, and pain-related conditions. The plant is rich in vitamins, particularly vitamin C and beta-carotene, as well as protein. The plant extract has been widely studied for their various pharmacological activities like Anti-oxidant activity, Anti-inflammatory activity, Anti-diabetic activity, Anticancer activity, Cardio protective activity. Several experiments have been taken away to explore the pharmacological activities and the pharmaceutical industries are countless. Hence, further detailed and systematic study must be taken out, which can provide better knowledge and understanding the pharmacological importance of this plant.

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