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Review Article

Cleome viscose: A Review on Ethnobotany and Pharmacology Uses

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ABSTRACT

Herbal medicine is the oldest form of health care system known to mankind. Herbs had been used by all cultures through history. Herbs are the potential source of chemical constituents that have a high therapeutic value. Herbal medicines are now in high demand in the developing world for primary health care not because they are cheap but also for better cultural acceptance, better compatibility with the human body and minimal side effects. This review summarizes the research on *Cleome viscose* Linn. (Capparidaceae), commonly known as "wild mustard or dog", is an annual sticky herb that is found in all plains of India and throughout the tropics of the world. The whole plant and its parts (leaves, seeds, and roots) are widely used in traditional and folk medicine systems. In traditional systems of medicine, the plant is reported to have beneficial effects such as anthelmintic, antiseptic, carminative, antiscorbutic, sudorific, febrifuge and cardiac stimulant. Following the various traditional claims for the use of C. viscosa (CV) as a cure for numerous diseases, researchers have made considerable efforts to verify their usefulness through scientific pharmacological examinations. Pharmacological studies have shown that CV has several notable biological activities, such as anthelmintic, antimicrobial, analgesic, antiinflammatory, immunomodulatory, antipyretic, psychoprotein, wound healing, antimalarial, antiemetic, antitumor, antioxidant, antidiarrheal and hepatoprotective. The present review is an effort to consolidate the traditional, ethnobotanical, and pharmacological information available in C. viscosa.

Keywords: Cleome viscose, pharmacology activity, traditional uses.

INTRODUCTION

It is a weed distributed throughout the tropics of the world and the plains of India[1]. The plant is a yearly, sticky herb with a strong penetrating odor, and is clothed with glandular and straightforward hairs. It grows approximately 30-90 cm high and is branched. The leaves are 3-5 foliate, obovate, and obtuse, gradually becoming shorter upward. The blossoms are yellow, axillary, growing out into a lax raceme. The fruits are capsules, compressed and hairy throught, while the seeds are finely transversely striate, subglobose, and become brownish-black when ripe[2]. CV is known by several names like wild mustard, dog mustard, and sticky cleome. In India, the plant is known by several vernacular names like Hul-Hul, Kanphuti, Talwani, Pivala tilvana, and Pashugandha. The plant is a famous solution for an assortment of sicknesses as archived in ethnobotanical reviews and customary medicinal frameworks, for example, Ayurveda and Unani[3]. Following the popular folk claims of cures for various diseases, the plant has been scientifically explored to justify its potential as a therapeutic agent. The present review is an exhaustive exposition of traditional uses and ethnobotanical and pharmacological research carried out on the plant, which may clarify the multifaceted part of this restorative herb.

Traditional Uses

Plants have been utilized as a wellspring of solution by humankind since old circumstances. Indigenous information of numerous conventional groups has been defined, archived and in the long run wind up plainly sorted out frameworks of drug, for example, Ayurveda, Siddha, Unani and different frameworks outside India.

In the ayurvedic system of medicine, CV is considered to have cooling, stomachic, diuretic, laxative and anthelmintic properties[4].

It is said to be useful in the treatment of fevers due to malaria, fevers due to indigestion, skin diseases, leprosy, blood diseases and complaints of the uterus[5]. It is also documented to treat "Kapha" (phlegm), and to cure ear pain and ulcers[6]. In the Unani system of medicine, the seeds of the plant are documented as anthelmintic and detergent, and are administered to treat fever and diarrhea[7]. The juice of leaves is beneficial for ear pain, malaria and piles[5].

Ethnobotanical Uses

In recent years, ethnomedicinal studies have received much attention, highlighting the many little known and unknown medicinal uses, especially of plants origin. Obviously, they deserve to be evaluated by modern scientific methods such as phytochemical analysis, biological investigation and clinical trials[8]. Almost all parts of CV are documented to possess medicinal benefits in

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ethnobotanical surveys conducted by researchers are summarized in Table no.1

The leaves are used for the treatment of ear pain[9,10,11,12,13], Headache[14], boils[15], ulcers[16] and wounds.[17,18] The seeds are documented as beneficial in helminth infections[11], fever, diarrhea[19,10], seizures[20], and skin diseases[21]. In Sri Lanka, CV roots and seeds are considered to be heart stimulant and are administered internally in cases of snake bites. Leaves are used by Australian aborigines to relief headache[5]. In Israel, the plant is used for the treatment of diabetes[22].

Pharmacological activities

CV has been scientifically evaluated for various pharmacological activities and has been found to possess significant activities such as anthelmintic, antimicrobial, analgesic, antiinflammatory, immunomodulatory, antipyretic, psychoprotein, wound healing, antimalarial, antiemetic, antitumor, antioxidant, antidiarrheal and hepatoprotective. The various pharmacological activities reported for the plant are summarized following.

Analgesic activity

After the folk claim, the analgesic activity of the CV methanol extract was evaluated in mice using the acetic acid-induced writhing and the tail flick, tail clip and tail immersion methods. The results of the study showed significant activity of the extract at the concentration of 400 mg/ml as compared to reference standard diclofenac sodium[23]. In another research, aqueous extract from CV of seeds was evaluated for its analgesic activity in mice and found to possess significant activity[24]. Several studies shown Cleome viscosa analgesic and antiemetic activity. It was evaluated that the fixed oil of the seeds of Cleome viscosa has analgesic and antiemetic activity. Activities were evaluated using the acetic acid-induced contortion test in mice (intraperitoneally) and the chicken emetic model (oral treatment), respectively. Analgesic activity was checked by mouse contortion assay and antiemetic activity was measured by the chick emetic model. It was concluded that Cleome viscose seed oil has peripheral analgesic and antiemetic activities.[25] A study was investigated to evaluate the analgesic effect of *Cleome viscose* Linn. In experimental animal models. The number of writhes were decreased at doses (75 mg / kg body weight, 100 mg / kg body weight, 125 mg / kg body weight) of *Cleome viscose* Linn. Fixed oil seeds compared to aspirin treatment and control. Fixed oil at doses of 75 mg / kg body weight, 100 mg / kg body weight, 125 mg / kg body weight) decrease the number of writhes by 91.69%, 92.33% and 96.0%, respectively. At a dose of (150 mg / kg body weight) the group of aspirin-treated mice had writhings. However, the control group had 62 contentions, so the positive effect of aspirin was that it decreased writhes by 82.42%. The acetic acid-induced writhing method is an effective method for evaluating peripherally active analgesics[26].

Antiemetic activity

A study was conducted to evaluate the antiemetic effect of Cleome viscose Linn. Fixed oil in young chicks. Oil fixed at doses of 75 mg / kg body weight, 100 mg / kg body weight and 125 mg / kg body weight reduced the retches number by 84.43%, 85.56% and 91.77% respectively. At a dose of (150 mg / kg body weight) the group of chicks treated with chlorpromazine had 47 retches. However, the control group had 68 retches, so chlorpromazine reduced the pathways by 30.56%. Cleome viscose Linn. Seed oil inhibited emesis to a greater extent than chlorpromazine. Based on these results, it can be said that the fixed oil of Cleome viscose Linn. It has antimetic potential and is comparable with chlorpromazine, which can relieve nausea[26].

Anthelmintic activity

The crude alcohol and aqueous extracts of the seeds of CV for their proclaimed anthelmintic activity using *Pheretima posthuma*- and *Ascardia galli* as test worms. Various concentrations (10–100 mg/mL) of each extract were tested in the bioassay, which involved the determination of time of paralysis and time of death of the worms. Both the extracts exhibited considerable anthelmintic activity in a dose-dependent manner. The most significant activity was observed at the highest concentration of 100 mg/mL against both types of worm[27].

Antidiarrheal activity

A study was conducted to evaluate the effect of methanol extract of the whole plant for its antidiarrheal potential against some of the experimental models of diarrhea in rats. CVME showed significant inhibitory activity against diarrhea induced by castor oil and prostaglandin E_2 (PGE_2) -induced enteropooling in rats. The extract also showed a significant reduction in gastrointestinal motility in the charcoal meal test in experimental animals. From the results obtained it was clarified that Cleome viscosa Linn is an effective antidiarrheal agent[28].

Anti-inflammatory activity

The CV methanol extract was evaluated for its anti-inflammatory potential against rat foot edema induced by carrageenan, histamine and dextran. Diclofenac sodium (20 mg / kg), a non-steroidal anti-inflammatory agent, was included as a standard for comparison. The results of the investigation demonstrated the significant activity of the extract compared with the standard reference utilized[29].

Antimalarial activity

Saxena et al. (2000) carried out an ethnomedical survey and found that the Santhal tribes of Madhya Pradesh, India use the smoke from CV leaves to repel mosquitoes. After folkloric use, ethanolic extract of leaf was evaluated for its larvicidal activity against larvae of 2nd and 4th instar larvae of *Anopheles stephensi*, a vector of malaria in India, and was found to have a decent larvicidal action[30].

Antimicrobial activity

The toxicity of aqueous extract of CV leaves against fungi causing *Epidermophyton floccosum*, *Trichophyton mentagrophytes* and *Microsporum gypseum* by inverted Petri dish technique method. The results found to possess significant mycotoxic activity of the plant[31]. The aqueous extract of aerial parts of the plant at concentrations of 30 and 40 mg / mL for antimicrobial activity and the results of the study demonstrated maximum inhibition against *Aeromonas hydrophila* and *Bacillus cereus*[32]. The hexane extract from the leaves and stems of CV for biological activities such as antibacterial, antifungal, contact

insecticide, and nematicide. The extract was found to be a potent antibacterial agent according to the autobiographical TLC assay. Isolation studies directed by activity of the active antibacterial compounds led to a 14-membered ring, cembranoid diterpene, which was identified as one of the effective agents. Minimumm inhibitory concentration (MIC) of 5.0 µg / spot and 1.0 µg / spot were found for diterpene in *Bacillus subtilis* (Gram-positive) and *Pseudomonas fluorescens* (Gram-negative). The diterpene did not inhibit the growth of the fungus *Cladosporium cucumerinum*. The extract possesses a pyrethroid type of contact insecticidal activity in adult *Cylas formicarius* (Coleoptera: Curculionidae). The extract has also shown high nematocidal activity, with a percentage of the Abbott value of 72.69 on the parasitic nematode of the *Meloidogyne incognita* Chitwood plants[33]. In other study *C. viscosa* shows very high inhibition zone diameters against *Aeromonas hydrophila* and *Bacillus cereus*[34]. Flavonoid glycoside that is, quercetin 3-0- (2 "-acetyl) -glucoside isolated from *C. viscosa* shown antimicrobial activity towards the gram-positive bacteria Mainly to *Staphylococcus aureus*[35]. Both the leaves and the stems of CV shown anti-bacterial and antifungal activity due to the presence of a 14-membered diterpene cembranoid. It showed a minimum inhibitory concentration value (µ / spot) of 5.0 µ / spot and 1.0 µ / spot against *Bacillus subtilis* (Gram-positive) and *P. fluorescens* (Gram-negative) respectively. LNA isolated from C. viscosa root exudates shown antimicrobial activity against E. coli bacteria, (2-amino-9 [4-oxoazetidin-2-yl] nonanoic acid, $C_{12}H_{22}N_2O_3$, molar weight 242) isolated from the root exudates of CV showed antimicrobial activity against bacteria that is, *E. coli, Pseudomonas aeruginosa* And *S. aureus* and fungi *Aspergillus fumigatus, Aspergillus niger* and *Aspergillus tamarii*. Interestingly, at a dose of 500 ppm and above, *P. aeruginosa* and *S. aureus* were totally inhibited while *E. coli* remained unaffected. On the other hand, the growth of *A. niger* and *A. tamarii* was stimulated while *A. fumigated* were not affected. This pure compound showed concentration-dependent inhibitory activity on rice, gram and mustard seeds[36]. The ethanol extract of leaf and flowers of CV investigated for antimicrobial activity. Both extract exhibited a broad spectrum of antimicrobial activity, particularly significant against against *Escherichia coli, Proteus vulgaris* and *Pseudomonas aeruginosa*, while the leaf extract showed moderate activity against pathogenic fungi[37].

Antioxidant activity

The whole plant CV showed that the plant. It contains some bio principals that, they have a strong antioxidant activity with strong anti-inflammatory activity, analgesic activity and moderate CNS depressive activity. Therefore, the CV could be considered a important source of antioxidant activity[38,39,40].

Antipyretic activity

The antipyretic activity of *C. viscosa* methanolic extract (CVME) at normal body temperature and yeast-induced pyrexia in albino rats. The CVME, at doses of 200, 300 and 400 mg / kg body weight p.o., showed a significant reduction in normal body temperature and elevated temperature caused by yeast in a dose-dependent manner. The effect was also extended up to 5 h after drug administration. The CVME was found to be comparable to that of paracetamol (150 mg / kg p.o.), used as a reference standard in the study[41].

Antitumor activity

A study was conducted to evaluate the anticancer effect of *Cleome viscose* Linn. in experimental animal models. After 24 hours of tumor inoculation, the extract was administrated at doses of 200 mg / kg and 400 mg / kg body weight per day for 14 days. The mice were sacrificed after administration of the final dose and 18 hours of fasting. The effect of *Cleome viscose* Linn. methanolic growth of murine transplantable tumors and the life span of Ehrlich ascites carriers of carcinoma host was studied in the current study. Significant reduction in tumor volume, packed cell volume, and viable cell count due to *Cleome viscose* Linn was observed in methanolic extract. It also causes enhancement in the life span of Ehrlich ascites carcinomas bearing mice. In extract-treated mice, the hematological profile was converted to more or less normal levels. From the results obtained it was clear that *Cleome viscose* Linn. The methanolic extract causes a significant antitumor effect in Ehrlich ascites carcinomatous mice[42].

Gastroprotective activity

In-vitro susceptibility of 18 HP strains to methanol extracts of 20 spice plants and foods used in traditional Thai medicine, including CV, for the treatment of gastrointestinal disorders. The plant methanol extract showed an inhibitory effect on the growth of PH with a minimum inhibitory concentration of 50 g / ml and was found to possess gastroprotective activity[43].

Hepatoprotective activity

A study was carried out to evaluate the hepatoprotective potential of CV aqueous seed extract against carbon tetrachloride (CCl_4) induced liver damage in Wistar rats. The extract (200 mg / kg) was orally administrated to animals with CCl_4 induced hepatotoxicity and silymarin (200 mg / kg) was given as the reference standard. The extract treated group of rats showed a significant reduction in the serum enzyme aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), γ-glutamyl transpeptidase and lipid peroxidase and an increase in glutathione (GSH) reduction (in comparison with the control group) treated with CCl_4. In addition, histopathological observations supported significant extract protection, similar to that of the positive control, silymarin[44]. The ethanolic extract of C. viscosa leaves (Linn.) Showed hepatoprotective activity against thioacetamide-induced[45] and paracetamol induced hepatoxic albino rats. It restores major liver function viz. serum total bilirubin (TBL), total protein, alanine transaminase (ALT), aspartate transaminase (AST) and alkaline phosphatase (ALP) activities. Similarly, the seeds of C. viscosa contain coumarinolignoids a mixture of three compounds (cleomiscosins A, B and C) that showed significant hepatoprotective effects against hepatotoxicity induced by CCl_4 in albino rats[45]. The ethanolic extract

Table 1: Ethnobotanical uses of *Cleome Viscosa* Linn.

Part of the pant	Use	Reference(s)
Leaves	Boils	Maheshwari et al.,1980
	Earache	Singh,1945; Sharma et al.,1979; Singh & Pandey, 1980; Shah,1984; Sudhakar & Rolla, 1985
	Headache	Ramchandran & Nair, 1981
	Ulcers	Rajwar,1983
	Wounds	Bedi, 1978; Singh et al., 1987
Seeds	Helminthic infections	Singh, 1945
	Convulsions	Shah et al., 1983
	Fever and diarrhea	Malhotra & Moorthy, 1973; Sharma et al., 1979
	Skin diseases	Purohit et al., 1985
Roots	Cardiac stimulants	Kirtikar & Basu, 1984
	Diabetes	Yaniv et al., 1987

from the aerial parts of C. viscosa shows gastroprotective activity in different gastric ulcer models C. Viscosa also has free radical scavenging activity[46]. The study was performed to evaluate the antifibrotic activity of *Cleome viscose* Linn. ethanolic extract. Carbon tetrachloride was used to induce hepatic fibrosis in rats. Observing the level of hepatic hydroxyproline, thiobarbituric acid and serum enzymes the abundance of liver fibrosis was evaluated. The levels of hydroxyproline, thiobarbituric acid and serum enzymes were elevated and total platelets reduced after the administration of carbon tetrachloride. The level of hydroxyproline, thiobarbituric acid level and serum enzyme level were reduced after treatment with two different doses of *Cleome viscose* Linn. ethanolic extract. By *Cleome Viscosa* Linn. ethanol extract liver weight was reduced that was increased after administration of the carbon tetrachloride which causes collagen deposition. From the result obtained it was clear that *Cleome viscose* Linn. ethanolic extract is an effective antifibrotic drug[47].

Immunomodulatory effects

The immunomodulatory effect of aqueous and ethanol, extracts from aerial parts of CV was investigated in mice. The evaluation of the immunomodulation was performed by various hematological and serological tests. Both extracts showed significant immunosuppressive activity, causing a marked decrease in the number of white blood cells and spleenic lymphocytes. It was also observed that the phagocytic index and the cellular and humoral responses decreased[48]. The *in-vivo* assessment of coumarino-lignoids isolated from CV to evaluate their immunomodulatory potential. The results showed that coumarino-lignoids possessed significant immunomodulatory activity[49].

Mutagenicity

The CV seeds oil was assayed by the Ames mutagenicity assay using strains of *S. typhimurium* strains TA 98 and TA 100, with and without metabolic activation with S-9 mixtures prepared from livers of rats pretreated with sodium phenobarbitone. The results clearly exhibited that the oil had no mutagenic activity[50].

Psychopharmacological

The methanol extract of the whole plant was assessed for different psychopharmacological actions such as general behavior, exploratory behavior, muscle relaxant activity, and phenobarbitone-induced sleeping time, and the effect on normal body temperature in rats and mice. The extract was found to cause a reduction in spontaneous activity, a decrease in exploratory behavioral pattern by the head dip and Y-maze test, a reduction in muscle relaxation by rotarod, 30 ° inclined screen, and traction tests, and the significant lowering of body temperature. In addition, CVME significantly potentiated the phenobarbitone-induced sleeping time[51]. The different psychopharmacological actions such as general behavior, exploratory behavior, muscle relaxant activity and phenobarbitone-induced sleep time and effects on normal body temperature in rats and mice, Cleome viscosa Linn. The methanolic extract was evaluated. There was a reduction in spontaneous activity, a decrease in the pattern of exploratory behavior by the head dip and Y-maze test, reduction in muscle relaxant by rod rotation, 30-degree inclination screen and traction tests and reduction of body temperature after administration of the extract. The extract also causes a significant improvement in phenobarbitone-induced sleep time. At doses of 200-400 mg / kg Cleome viscose Linn. The methanolic extract shown a significant psychopharmacological effect[52]. A study was investigation to evaluate the anticonvulsive activity of *Cleome viscose* Linn. seeds extract by maximal electroshock induced seizure (MES) test and pentylenetetrazole (PTZ) induced seizure test. Significant activity was demonstrated by both the ethanol extract and aqueous extract of seeds in the convulsions induced by MES and PTZ[53].

Wound healing activity

The leaves and whole plant of CV are used as a folk remedy to cure wounds, ulcers, inflammations and skin infections. The present investigation was undertaken to evaluate the healing property of the leaves and the whole plant of Cleome viscosa on the experimentally induced excision wound model in rats. Studies on wound healing models revealed that the methanolic extract of CV has significant wound healing activity[54]. In other study CV increases the expression of basic fibroblast growth factor and type III collagen in rat cutaneous wound after topical application. The present study explored the healing properties of CV methanolic extract using wistar rat cutaneous excision wound model. The rate of wound contraction, quantification of hydroxyproline, and histopathological examination of wound granulation tissue was performed to evaluate the property of wound healing. From this investigation, it was revealed that the topical application of methanolic extract of Cleome viscose

significantly accelerated the rate of wound contraction (95.14%, 24 postoperative days), increased hydroxyproline content (3.947 mg / 100 mg tissue), And an improved histopathology of wound Tissue compared to control groups[55].

Miscellaneous

The CV had anti-inflammatory activity and could inhibit destruction of articular cartilage that corresponded to the traditional medicine and supported using these medicinal plants for osteoarthritis of knee treatment in Thai Medicine[56].

CONCLUSION

Pharmacological examinations in CV have demonstrated that their organic and aqueous extracts having a variety of multidimensional, such as an anthelmintic, antimicrobial, analgesic, antiinflammatory, immunomodulatory, antipyretic, psychoprotein, wound healing, antimalarial, antiemetic, antitumor, antioxidant, antidiarrheal and hepatoprotective activities pharmacological activities. CV also used in Thai medicine system in treatment of Osteoarthitis of knee. It is also reported that the plant contains a wide range of chemical components. The availability primary screening, new studies on CV should be designed to investigate the molecular mechanism (s) of action of isolated phytoprinciples using specific biological detection models and clinical trials, and also for discover novel leads from them. Furthermore, studies should extend to standardize various extracts of CV for the purpose of use in herbal formulations specific. The data presented here emphasize the potential of traditional medicine *Cleome viscose*.

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