



REVIEW ON *CUSCUTA REFLEXA* ROXB.: A MIRACULOUS MEDICINAL PARASITIC HERB

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Abstract: *Cuscuta reflexa* Roxb. is a twining parasite and makes a tangled mass covering on the host plants. It is commonly known as dodder plant, amarbel, akashabela. Traditionally it is called as miracle plant. Medicinal properties of the plant are used to cure various diseases. These medicinal properties of the plant are due to the active phytoconstituents of the plants. Parasitic weed plant *Cuscuta reflexa* has been studied for the identification of its pharmacological activities. Various chemicals have been isolated from this miracle plant having therapeutic potential possessing ethnomedical and pharmacological activities. It contains important chemicals like cuscutin, cuscotalin, bergenin, kaempferol, amarbelin and sterol glycosides etc. Diverse pharmacological studies of Aftimoon have been reported such as anti-inflammatory, cytotoxic, antipyretic, hepatoprotective, anticonvulsant, nematicide, anti-androgenic, hypocholesterolemic, antiandrogenic, hemolytic, diuretic, dermatogenic, immunostimulant, antiarthritic, antiasthma and anticancer activities. In this paper, an attempt has been made to summarize the information described in classical literature and scientific research conducted on different parts of *Cuscuta reflexa* plant.

KEYWORDS: *Cuscuta reflexa* Roxb. Ethnomedicinal, medicinal herb.

Introduction

Medicinal plants are the treasure of various hidden chemicals. In the traditional system of medicines, plant sources were major resource to cure diseases. Medicinal plants are getting attraction of most of the researches for the evaluation of new drugs, because of the polyvalent action and lesser side effects of plant products. Since prehistoric era of mankind, treatment and cure of the diseases was one of the main concerns of human beings. Ayurveda completely depends on the plant systems for the evaluation of new chemical entities having therapeutic potentials. Medicinal properties of the plants are due to the active phytoconstituents present in the plants; these Phyto-constituents are alkaloids, flavonoids, glycosides, saponins, tannins, terpenoids, steroids etc. These phytochemicals possess potential health benefits, contributes in the prevention of cardiovascular diseases, cancer, osteoporosis, antioxidant activity and many more. [1]

Cuscuta is a group of 100- 170 species of yellow, orange, red or rarely green parasitic plants. *Cuscuta* belongs to the *Cuscutaceae* family and now on the basis of angiosperm phylogeny group it is accepted as belonging to morning glory family, *Convolvulaceae*. *Cuscuta* is found at the temperate and tropical regions of the world with huge species diversity in tropical and subtropical regions. *Cuscuta reflexa* is commonly called as Dodder plant, and also known as devil's hair, witch's hair, love vine, amarbel or akashabela etc. *Cuscuta reflexa* is a parasitic weed plant and also an extensive climber. *Cuscuta* grows as

holoparasite, it has very low level of chlorophyll and photosynthesis activity; completely depends over the host plant for its survival. Dodder plant sucks nutrient sap from the host plant via vascular tissue of the host plant and grows itself. This plant has no roots in the ground and it grows over the host body without touching the ground surface in its complete life span. Dodder plant has the ability not only to recognize its host plant but also to move towards its prey with significant precision and efficiency. *Cuscuta reflexa* contains a group of stems holoparasitic dicotyledonous angiosperms which affects many economically important crops. Physical connections via haustoria are formed by the parasitic plant to the stellar system of host plants. These connections serve as channel for the movement of photosynthetic solutes and water from host plant to the parasitic plant. [1, 2]

Parasitism

The word parasite suggests that “A one wheat’s at the table of another”, and “feeding beside”. The parasite is: a Climbing plant that is supported by a wall, trellis etc. A parasite could be a plant that derives some or all of its biological process requirements from another living plant. After a parasite attaches itself to a plant, it wraps itself around it. If the host contains food helpful thereto, it produces haustoria that insert themselves into the tube system of the host. The first root of the parasite within the soil then dies. Parasite cells that intrude host vessel parts were initial described by Leclere du sablon in 1887. One of such parasite could be a holo-parasitic plant botanically referred to as magnoliopsid genus *reflexa* Roxb. and it’s a special property of interesting constituents for its nutrition by penetrating into vascular tissue through haustorial tissue [1]

Habitats of *Cuscuta reflexa*

This parasite climbs over the trees and shrubs. *Cuscuta* is found within the temperate and tropical regions of the planet with huge species diversity in tropical and subtropic regions. [2] It is typically found in Asian country associated in Nursing Ceylon up to an altitude of 2348 m. It’s additionally found in Asia, Malaysia, Nepal and Thailand. It grows on thorny, non thorny and alternative shrubs, sometimes fully covering bushes and trees. *Cuscuta reflexa* unfold from one host to a different, and on special branching organs referred to as haustoria. [3]



Figure 1: Morphological appearance of *Cuscuta* sp.,

Taxonomy of *Cuscuta reflexa*

Kingdom Plantae
 Subkingdom..... Tracheobionta
 Superdivision.....Spermatophyta
 Division.....Angiosperms
 Class..... Eudicots
 Subclass..... Asterids
 Order..... Solanales

Family..... Cuscutaceae

Alternate..... Convolvulaceae

Genus.....*Cuscuta*

Species..... *reflexa*

Botanical Description

As shown in fig. no. 1 *Cuscuta reflexa* is a parasitic climber slender stem and branches.[4] Stems terribly long, rather stout, closely twining, branched, glabrous, pale yellow, typically dotted with red. Flowers solitary or in umbellate clusters of 2-4 or in brief racemes; pedicels short, glabrous, typically serpentine (rarely 0), bracts 1.5 mm. long, ovate-oblong, obtuse fleshy whorl divided almost to the bottom, lobes 3 mm. long, slightly unequal, broadly ovate, obtuse, hairless and fleshy. Curl white; tube 6-8 by four mm. nearly cylindrical; lobes a pair of.5-3 mm. long, deltoid, acute, reflexed; scales nearly at the bottom of the curl – tube, large, oblong, sub quadrate or somewhat simple, rough and incurved at the apex. Stamens are present within the throat of the corolla- tube. The filaments are very few or absent. Ovary is ovoid, vogue easy, terribly short and thick; stigmas a pair of distinct giant thick and fleshy, 1.5 mm. long, ovoid. Capsules are 6-8 millimetre in diameter, depressed-globose and glabrous. Seeds large, black and glabrous which are present in 2-4 numbers.[3]

Ethnomedicinal uses of *Cuscuta reflexa*

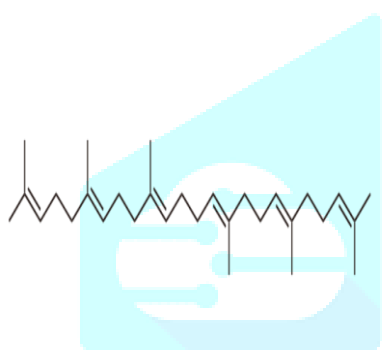
The rural people of Chhattisgarh use its juice in jaundice by mixing it with milk. Its paste is used in the treatment of Gout. The juice of plant mixed with the juice of *Saccharum officinarum* is used in the treatment of jaundice (6). The stem is used in the treatment of bilious disorder, internally in treating protracted fevers and externally in the treatment of body pain and itchy skin. *Cuscuta reflexa* stems are used in constipation, flatulence, liver complaints and bilious affections. *Cuscuta reflexa* is also applied as a hair growth promoter. The seeds are reported to be an effective tonic, diaphoretic, demulcent and are used for purification of blood. The cold infusion of seeds is given as a depurative and carminatives in pain and stomach ache (3).

Phytochemicals

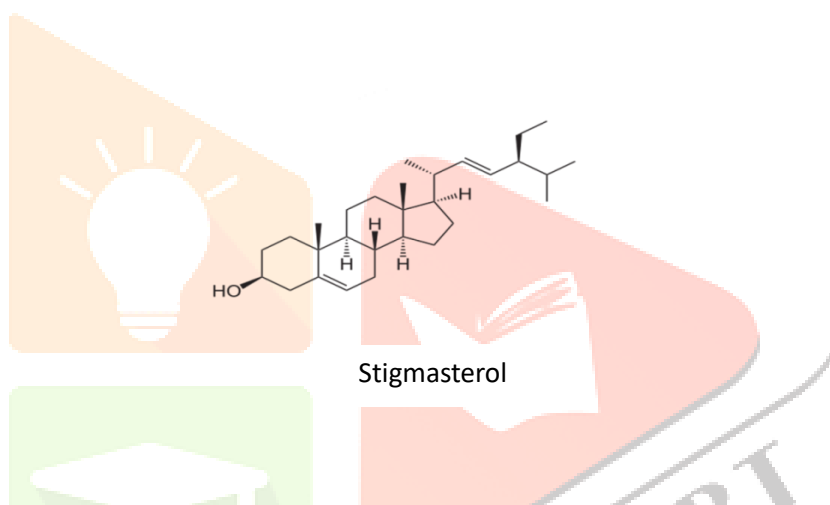
The dependence of *Cuscuta reflexa* for the metabolites on their host leads to the differential accumulation of the phytomolecules. Chemical constituents predominantly reported in *Cuscuta reflexa* are cuscutin, cuscotalin, dulcitol, mannitol, sitosterol, carotenoids, flavonoids, alkaloids, di and tri-terpenes, polyphenols, reflexin, violaxanthin, lutein, lycopene, carotene, cerotic, linolenic, oleic, stearic, and palmitic acids, phytosterols, leuteolin and its glycosides, ambebelin, amino acids, lupeol etc. The chemical constituents mainly depend on the host plants. The table no. 1 represents the major class of metabolites present and their nature of action.

Table no. 1: Bioactive molecules present in *Cuscuta* species

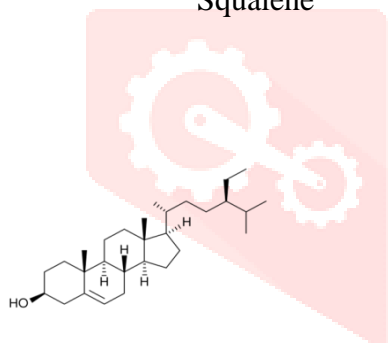
| SN. | Class of Phytochemical | Bioactive molecules | Major biological activity |
|-----|------------------------|---|--|
| 1. | Alkaloids | cuscutamine | Antitumor, Cancer preventive, Antioxidants |
| 2 | Terpenoids | Beta- Amyrin | Antibacterial, Antioxidants, Antitumor, Cancer preventive, Immunostimulant, Chemo-preventive |
| 3 | Sterol | Stigmasterol Beta sitosterol Lupeol | Antimicrobial, Anti-inflammatory, Antiarthritic, Antiasthma |
| 4 | Flavonoids | Rutin , Quercetin | Antimicrobial, Anti-inflammatory, Antioxidant |
| 5 | Phenolic compounds | Gallic acid, Tannic acid | Analgesic, Anaesthetic, Antioxidant, Antiseptic, Antibacterial, Antiviral cancer |
| 6 | Resin glycosides | cuscutic acids | Antibacterial, Antioxidants |



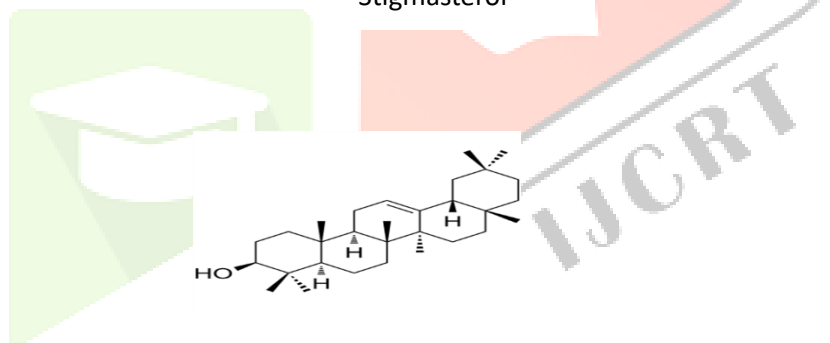
Squalene



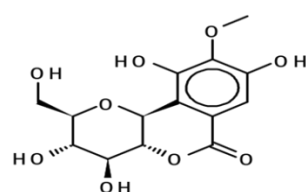
Stigmasterol



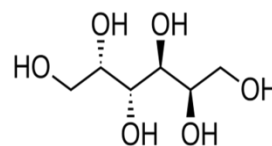
Beta sitosterol



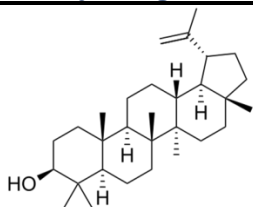
Beta- Amyrin



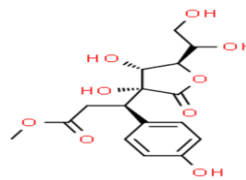
Cuscutin



Dulcitol



Lupeol



Reflexin

Pharmacological Activities

Being a parasite *Cuscuta reflexa* shows good medicinal properties. Various pharmacological activities are reported on almost every part of this plant. The in-vivo, in-vitro and ex-vivo pharmacological activities are conducted and reported by several researchers, which are as follows:

Effect on Cardiovascular system

In a series of experiments, alcoholic extracts of his plant caused a fall in blood pressure on dog. This action was not blocked by Atropine, merpyramine or propranolol, thus it could not be exerted through cholinergic, histaminergic or adrenergic mechanism (10). An ethanolic extract of the stem of *Cuscuta reflexa* caused a dose-dependent decrease in arterial blood Pressure and heart rate in pentothal-anaesthetized rats, and this Effect was not blocked by atropine. Hypotensive and Bradycardiac effects of *Cuscuta reflexa* were found to be Independent of cholinergic receptor stimulation or adrenergic Blockage. (11)

Antidiabetic effect

The methanol and aqueous extracts (200 and 400 mg/kg body wt.) showed significant reduction in blood glucose during OGTT In diabetes rats at 3h. The treatment also resulted an Improvement in body weights, decreased Hb1c and restored Lipid profile. Methanolic extracts of *Cuscuta reflexa* has significant antidiabetic effects and improves metabolic alterations(12,13).

Antioxidant activity

In vitro antioxidant activity of *Cuscutareflexa* stem extract by estimating degree of non-enzymatic haemoglobin glycosylation was measured calorimetrically at 440 nm. Ethyl acetate fraction of ethanolic extract showed higher activity than other Fractions. Synthesized phytochelatin and carried out modulation of antioxidants in response to cadmium stress in *Cuscutareflexa*. The effects of cadmium on growth, the antioxidative enzymes namely catalase peroxidase glutathione reductase, glutathione and phytochelatin were found in callus and seedling of *Cuscuta reflexa* (14).

Antipyretic activity

At the dose of 400mg/kg body weight the aqueous and ethanol extract reduced 79% and 83.8% respectively of the elevated rectal temperature as compared to reference drug Paracetamol (96.5%) after 6 hours of treatment. It appears that the antipyretic activity of *Cuscuta reflexa* may be due to inhibition of prostaglandin synthesis. Again the extracts contain flavonoids and saponins, the antipyretic potential of which has been reported (15).

Spasmolytic action Aqueous and alcoholic extracts of *Cuscutareflexa* stem have got a relaxant and spasmolytic action on small intestine of guinea pig and rabbit. Also, the extracts exhibited acetyl choline-like action (16, 17)

Anti-HIV activity

The crude water extracts of *Cuscuta reflexa* exhibited anti- HIV activity that could be due to combinatory effects with compounds of different modes of action(18).

Antitumor activity

Administration of Aqueous and ethanol extracts of *Cuscuta 2reflexa* whole plant at doses of 200 and 400 mg/kg body weight resulted in a significant ($p < 0.05$) decrease in tumours volume and viable cell count but increased non-viable cell count and mean survival time, thereby increasing the life span of the tumour-bearing mice. Restoration of haematological parameters – RBC, Hb, WBC, and lymphocyte count to normal levels in extract treated mice was also observed.(19)

Anti-arthritic and nephroprotective effect

Antiarthritic activity of Aqueous and Methanol extracts of *Cuscuta* was evaluated in vivo using formaldehyde and turpentine oil-induced arthritis models and in vitro using formaldehyde and turpentine oil-induced arthritis models and in vitro using protein denaturation methods. AMECR at 600mg/kg significantly reduced paw edema and joint swelling with maximum inhibition of 71.22% at the 6th hour for turpentine oil and 76.74% on the 10th day for formaldehyde. Likewise in vitro results corroborate significant concentration dependent increase in % protection at 800 µg/ml against both bovine serum albumin (89.30%) and egg albumin (93.51%) denaturation. This result shows that AMECR provides protection against arthritis and nephrotoxicity that might be due to the existence of phytoconstituents. (20, 21)

Anti-inflammatory activity

Alcoholic and aqueous extract of stem of *Cuscutareflexa* were evaluated for their anti-inflammatory activity in carrageenan induced paw edema model in rats, and compared to the activity of the standard drug, Ibuprofen. These extracts were given orally at a concentration of 100, 200 and 400 mg/kg bd. wt. before carrageenan injection. Both the extracts with medium and higher doses i.e. 200mg/kg and 400 mg/kg have reduced edema volume by 47.27%, 72.72% and 57.72%, 80.00% respectively at 5th hrs compared to standard drug Ibuprofen 96.36%. Thus this study revealed that the selected extracts of *Cuscutareflexa* exhibited a significant anti-inflammatory activity in carrageenan induced paw oedema model in rats (22)

Antimicrobial activity

Ethanollic whole plant extracts obtained from *Cuscutareflexa* were screened against Gram positive (*Bacillus subtilis* and *Staphylococcus aureus*) and Gram negative (*Escherichia coli* and *Salmonella typhi*) bacteria to evaluate their antimicrobial activity of the four concentrations of plant extract tested (200 µg/mL, 300 µg/mL, 400 µg/mL or 500 µg/mL), 500 µg/mL elicited the greatest zones of bacterial inhibition across three of the bacteria. In contrast, the growth of *Salmonella typhi* was not halted regardless of extract concentration. Overall, although the greatest antimicrobial activity was demonstrated to be against *E. coli* at a concentration of 500 µg/mL (24.6 ± 0.24), upon comparison to the other bacteria, both *B. cereus* and *S. aureus* reduced similar zones of inhibition upon comparison to their positive antibiotic control the ethanolic extract of *Cuscutareflexa* contains a myriad of compounds such as alkaloids, carbohydrates, glycosides, flavonoids, tannins, phenolic compounds and steroids. The authors determined that it is the flavonoid, glycosides contained within the plant which are responsible for the inherent antimicrobial activity. This preliminary investigation suggests that the ethanolic extracts from *Cuscutareflexa* do possess significant antimicrobial properties(23,24,25).

Hepatoprotective activity

Cuscuta epithimum is traditionally used as a liver tonic. Hepatoprotective activity with alcoholic extracts of stem of *Cuscuta reflexa* and aqueous extracts of stem of *Cuscuta reflexa* was studied against paracetamol induced hepatotoxicity in rats [26]. The histopathological changes (steatosis, necrosis etc.) were partly or fully prevented in animals treated with two extracts. Ethanolic extracts of *C. australis* also appeared as liver protector against acetaminophen intoxication in an animal model. The methanolic extracts of stem of *C. reflexa* were evaluated for hepatoprotective activity by observing its effects on carbon tetrachloride induced hepatotoxicity in liver histoarchitecture and alteration in certain biological parameters. Seeds of *C. chinensis* are commonly employed to nourish and improve Hepatic disorders. Oxidative stress can stimulate the development of acetaminophen induced hepatotoxicity. [27]

Anti-bacterial activity

Crude ethanolic extract of *C.reflexa* showed antimicrobial activity against *E.coli* and *S.sonnei*. *C.reflexa* collected from different sear-obial activity against *Staphylococcus aureus*, *Staphylococcus epidermidis*, *E.coli*, *Micrococcus luteus*, *Pseudomonas aeruginosa* [28]. The antimicrobial efficacy was concentratedely dependent against all the tested strains. The methanol extract of *C.reflexa* exhibited anti-bacterial and free radical scavenging activities. *Xanthomonascampestris* (XC) is a widely spread infectious agent causing a huge loss in food crops with viable symptoms and leave shedding. Aqueous decoction and infusion extract of *C.pedicellata* were evaluated forantibacterial activity against diverse pathovers of XC using invitro well diffusion method. The methanolic extract also showed promising high antimicrobial activity.

Antiepileptic and anticonvulsive activity

C.reflexa showed significantly reduction in the duration of convulsion in tonic seizure induced by pentyleneterazole in mice. It also reduces the tonic extension convulsion induced by maximum electroshock-induced convulsions [29]. The ethanolic extract has anti-convulsant property and may probably affect both the Gamma Amino Butyric Acid (GABA) aminergic- and glycine-inhibitory mechanism. The main active chemical constituent is flavonoid which is responsible for depressant activity. The processed extracts showed a significant anticonvulsive property by altering the levels of catecholamine and brain amino acids in mice.

Hypoglycaemic activity

The hypoglycaemic activity of methanol and chloroform extracts of whole plants of *C.reflexa*, investigate in oral glucose tolerance tests In Long Evans rats. Both methanol and chloroform extracts of *C.reflexa* whole plant demonstrated significant oral hypoglycaemicactivity in glucose-loaded rats. It was further reported that these two compounds act at multiple targets to ameliorate hyperglycaemia [30].

Diuretic activity

Aqueous and alcoholic extracts of *C.reflexa* showed diuretic activity in wistar rat. *C.epithymum* has mild diuretic activity and it is used to treat sciatica and scurvy. *C. europaea* seeds are used to treat psoriasis and it also has a diuretic activity. *C.reflexa* seeds are Carminative . *C. racemosa* has small diuretic activity and used for treatment of wounds [31].

Immunological activity

Ethanolic extract of *C. chinensis* showed considerable adjuvant potentials towards cellular and humoral immune responses in mice Models and can be used as vaccine adjuvant. Extract enhanced specific antibodies (IgG, IgG1 and IgG2b) to a noticeably high level by Affecting Th1 and Th2 cell functions. Kaempferol was identified as the main flavonoid of methanol fraction. Based on several research Findings, Kaempferol has potential to treat chronic inflammatory and autoimmune diseases. *C. australis* may act as an immunopotentiator for mammals by increasing the percentage of Phagocytosis.[32]

Anti-obesity activity

C. pedicellata is widely used for management of obesity. Ethanolic extract of *C. pedicellata* has significantly reduced the body weight along with serum lipid profile in high-fat diet fed rats [33]. Recently, the results proved that polyphenols are reported to possess anti-obesity activity.

Anti-aging activity

In Chinese herbal medicinal system, *C.chinensis* is an important anti-changing prescription. Polysaccharides of *C.chinensis* can exhibitant aging effects by scavenging free radicals and opposing lipid peroxidation. Ethanolic extract of *C.chinensis* significantly supposed the non-enzymatic glycosylation of D-galactose induced rat aging model [14]. Various experimental researches showed that it can regulate immune responses, prolong cell cycle, positively affect body metabolism, improve physiology of internal body organs, and stress management, which proves its anti-aging effects.

Anti-hypertensive & anti-osteoporotic activity

In Pentothal anesthetized rats, ethanolic extract of *C.reflexa* decreased arterial blood pressure and heart beat rate. Four caffeoylquinic acid derivatives were isolated from the active fraction having inhibitory effects on Angiotensin Converting Enzyme (ACE) activity. Presence of these metabolites at least in part is responsible for the anti-hypertensive activity extract. *C.chinensis* effectively boosted Tissue regeneration of damaged bones by promoting the formation of osteoblasts from their precursor cells. Five flavonoids were isolated from which Kaempferol and hyper oxide were found oestrogenic in nature [34, 21].

Hair growth promoter

C. reflexa petroleum ether and ethanolic extract was evaluated for promoting hair growth in cyclophosphamide-induced hair loss. The study shows that Groups treated with extracts of plant showed regrowth of hair. Histopathology and gross morphologic observations for hair regrowth at shaved sites revealed active follicular proliferation. It concluded that extracts of *Cuscuta reflexa* shown to be capable of promoting follicular proliferation or preventing hair loss in cyclophosphamide-induced hair fall. [35,36]

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Conclusion: *C. reflexa* is widely distributed throughout India. The plant appears to have a broad spectrum of activity on several ailments. Various parts of plant have documented properties and pharmacological evaluation. Till date several researches has been done and published on various pharmacological activities such as Antidiabetic effect, Antioxidant activity, Antipyretic activity, Anti-HIV activity, Antitumor activity, Anti-arthritic and nephroprotective effect, Anti-inflammatory activity, Antimicrobial activity, Hepatoprotective activity, Anti-bacterial activity, Antiepileptic and anticonvulsive activity, Hypoglycaemic activity, Diuretic activity, Immunological activity, Anti-obesity activity, Anti-aging activity, Anti-hypertensive & anti-osteoporotic activity of *C. reflexa*. The pharmacological studies reported in this review prove therapeutic value of *C. reflexa*. The phytoconstituents isolated from this plants are flavonoids, dulcitol, mannitol, sitosterol, lycopene, quercetin, reflexin, lutein, carotene, amarbellin, palmitic, oleic, stearic acid, linoleic acid, cuscutin, cuscutaline, kaempferol. Many of the traditional uses and other claims are scientifically and clinically evaluated. Some of the ethnobotanical and ethnopharmacological uses need scientific approach and validation so that it can provide good remedies and help mankind in various ailments.

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