



Review Article

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CUSCUTA REFLEXA (DODDER PLANT): A CRITICAL REVIEW ON THE MEDICINAL PLANT USED IN AYURVEDA

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ABSTRACT

Cuscuta reflexa is a parasitic plant which belongs to family Convolvulaceae. It is commonly known as dodder plant, amarbel, akashabela. Traditionally it is called miracle plant. It is rootless, perennial, leafless climbing parasitic twining herb which takes food from host plant with help of special organ called haustorium. This review article will collect the detailed description of synonyms, vernacular name, habitat, botanical description, ethno-medicinal uses, properties, chemical constituents, pharmacological uses of *Cuscuta reflexa* from different classical Ayurvedic literature as well as modern research journals. This review article deals with Antihypertensive, Antidiabetic, Antioxidant, Hair growth promoting, Antimicrobial, Spasmolytic, Antitumor, Anti-arthritis, Nephroprotective, Antiviral, Anti-inflammatory, Antipyretic effect of *Cuscuta reflexa*. More researches should be done in this plant to explore its mode of action and uses.

Keywords: *Cuscuta*, Amarbel, Ayurveda, Ethnomedicine.

INTRODUCTION

Medicinal plants have been used since ages in traditional medicines due to their therapeutic potential and the search in medicinal plants have led to the discovery of novel drug candidates used against various diseases¹. *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. It grows as homoparasite². *Cuscuta reflexa* is rootless, leafless, perennial parasitic twining herb of Convolvulaceae family, commonly known as amarbel or dodder. It has no chlorophyll and cannot make its own food by photosynthesis. Dodder plant has the ability not only to recognize its host plant but also to move towards its prey with significant precision and efficiency. Dodder plant can also choose an appropriate host between many plants on the basis of volatile compounds release by the host plant as their normal process of transpiration³. It spread from one host plant to another, and on each victim, they twin and cling tightly with special branching organs called haustorium. Haustorium penetrates the host and connect to the host xylem as well as to the host phloem and absorb from it both water and elaborated food stuff such as sugar and amino acids⁴. It is believed that the parasitic herbs extract healthy and potential sap from the host plant and if their host plants are medicinal plants then these parasitic herbs show many similar properties to host plants. *Cuscuta* species feeding on commonly used medicinal herbs are given special attention by traditional healers. It lives its entire life without attachment to the ground and grows with the help of seeds which are minute and produced in large quantities. Seeds have a large coating and survive in the soil for 5-10 years⁵.

Stems very long, rather stout, closely twining, branched, glabrous, pale greenish yellow, sometimes dotted with red. Flowers solitary or in umbellate clusters of 2-4 or in short

racemes; pedicels short, glabrous, usually curved (rarely 0); bracts 1.5 mm. long, ovate-oblong, obtuse fleshy. Calyx divided almost to the base; lobes 3 mm. long, slightly unequal, broadly ovate, obtuse, glabrous and fleshy. Corolla white; tube 6-8 by 4 mm., almost cylindrical; lobes 2.5-3 mm. long, deltoid, acute, reflexed; scales almost at the base of the corolla -tube, large, oblong, subquadrate or somewhat obovate, fimbriate and incurved at the apex. Stamens in the throat of the corolla- tube; filaments scarcely any; anthers about ½ - exerted beyond the top of the corolla-tube. Ovary ovoid; style simple, very short and thick; stigmas 2, distinct, large thick and fleshy, 1.5 mm. long, ovoid. Capsules 6-8 mm. diam., depressed-globose, glabrous, circumscissile near the base. Seeds 2-4, large, black, glabrous³. *Cuscuta reflexa* is investigated for Antihypertensive, Antidiabetic, Antioxidant, Hair growth promoting, Antimicrobial, Spasmolytic, Antitumor, Antiviral, Anti-inflammatory, Antipyretic effect.

IN AYURVEDIC LITERATURE

Cuscuta reflexa has no any reference in Vedic and Samhita Kala. It is mentioned in following Nighantu

Bhavprakash Nighantu

In Bhavprakash Nighantu synonyms akashavalli, amarvallari, khavalliare described. It is itikta (bitter) and kashaya (astringent), malasangrahak (stool binder), pichchhil (sticky), netraroganashak (eye disorders), jathragnavardhak (appetizer), hridya(cardiotonic) and destroys the pitta (bile), kapha(cough) and aamnashak(undigested food)⁶.

Raj Nighantu

The synonyms akashavalli, khavalli, asprsha, vyomvallika are mentioned. The synonym of Akash(Sky) co joint with valli (climber) word makes the synonym "akashavalli". Akashavalli

has madhurrasa (sweet taste). It is pittashamak (cholagogue), rasayana (rejuvenator), balavardhak (strengthen body) and has the properties of divyaausadhies (Divine power).⁷

Nighantu Adarsh

The plant is distributed with the name of aakashbel and amarbel. It is found on some trees as parasite and mentioned under karpurtwakadivarga. It is balya (strengthen body), keshya (hair strengthening), vranropan (wound healer) and vrishya (aphrodisiac)⁸.

Shankar Nighantu

The synonyms are akasvalli, amerbel, akashbel and aaloklata. Its taste is bitter, yellow colored with white flower. The dose is 1 to 12 masa. The properties are pichchhil (sticky), netrarognashak (eye disorders), jathragni vardhak (appetizer) and hridya (cardiotonic). It spreads over Ber and Aadu trees. It is a rootless climber so it is called as Akashbel⁹.

Madanpal Nighantu

It is mentioned under Abhayaadivarga. Synonyms are akashvalli, amarvallari and amarbel. It has grahini (astringent), tikshna (penetrating), and pichchhil (sticky)- rog nashak property¹⁰.

BOTANICAL CLASSIFICATION OF CUSCUTA REFLEXA

Kingdom Plantae
 Subkingdom Tracheobionta
 Superdivision Spermatophyta
 Division Angiospermes
 Class Eudicots
 Subclass Asterids
 Order Solanales
 Family Cuscutaceae
 Alternate Convolvulaceae
 Genus *Cuscuta*
 Species *reflexa*¹¹

SYNONYMS

akashavalli, amarvallari, khavalli, asprsha, vyomvallika, aakashbel, amarbel, aaloklata.

VERNACULAR NAMES

Hindi	-	Amarbel
Bengali	-	Swarnlata
Malyali	-	Nirmuli
Gujrati	-	Akasbel
Telugu	-	Nulutega
Tamil	-	Erumaikkottan
Persian	-	Aftimoon
Assamese-		Akakhilata
English	-	Dodder ¹²

HABITAT

This parasitic plant climbs over the trees and shrubs. *Cuscuta* is found in the temperate and tropical regions of the world with huge species diversity in tropical and subtropical regions. It is found throughout about 6 species are found abundant in Bengal plains¹³. It is usually found in India and Ceylon up to an altitude of 2348 m. It is also found in Afghanistan, Malaysia, Nepal and Thailand. It grows on thorny, non thorny and other shrubs, sometimes completely covering bushes and trees. *Cuscuta*

reflexa spread from one host to another, and on special branching organs called houstoria¹⁴.

BOTANICAL DESCRIPTION

Cuscuta reflexa is parasitic climber slender stem and branches¹⁵. Stems very long, rather stout, closely twining, branched, glabrous, pale greenish yellow, sometimes dotted with red. Flowers solitary or in umbellate clusters of 2-4 or in short racemes; pedicels short, glabrous, usually curved (rarely 0), bracts 1.5 mm. long, ovate-oblong, obtuse fleshy. Calyx divided almost to the base, lobes 3 mm. long, slightly unequal, broadly ovate, obtuse, glabrous and fleshy. Corolla white; tube 6-8 by 4 mm., almost cylindrical; lobes 2.5-3 mm. long, deltoid, acute, reflexed; scales almost at the base of the corolla – tube, large, oblong, subquadrate or somewhat obovate, fimbriate and incurved at the apex. Stamens in the throat of the corolla-tube; filaments scarcely any; anthers about 1/2 - exerted beyond the top of the corolla-tube. Ovary ovoid; style simple, very short and thick; stigmas 2, distinct, large thick and fleshy, 1.5 mm. long, ovoid. Capsules 6-8 mm. diam., depressed-globose, glabrous, circumscissile near the base. Seeds 2-4, large, black, glabrous¹⁶.

ETHNOMEDICINAL USES OF CUSCUTA REFLEXA

The rural people of Chhattisgarh use its juice in jaundice by mixing it with milk¹⁷. Its paste is used in the treatment of Gout¹⁸. The juice of plant mixed with the juice of *Saccharum officinarum* is used in the treatment of jaundice¹⁹. 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. Stems of *Cuscuta reflexa* is also used in constipation, flatulence, liver complaints and bilious affections. *Cuscuta reflexa* is also applied as a hair growth promotor²⁰. Seeds are said to be tonic, diaphoretic and demulcent and are used to purify the blood. The cold infusion of seeds is given as a depurative and carminatives in pain and stomach ache²¹.

CHEMICAL CONSTITUENTS

Cuscutin, quercetin, amarbelin, amino acids, cuscutaline, scoparone, melanettin, hyperoside, aromadendrin, taxifolin, astragalin, myricetin, kaempferol, apigenin 7-O- glucoside, luteolin, quercetin, 6,7 – dimethoxy -2H-1 benzopyran -2-one, 3-(3,4- dihydroxyphenyl) -2- propen- 1- ethanoate, 6,7,8-trimethoxy- 2H- benzopyran- 2- one, 3-(4- O- β- D-glucopyranoside- 3,5- dimethoxyphenyl)- 2- propen- 1 –ol β- sitosterol, α- amyryl, β- amyryl, β- amyryl acetate, α- amyryl acetate, oleanolic acetate, oleanolic acetate, oleanolic acid, luteol, 3β- hydroxyolean- 12(13)- enetriecanoate and heptadecanoate, coumarin, 3,4-O- dicaffeoylquinic acid, 3-Ocaffeoylquinic acid, D- mannitol, myricetin 3- O- α- rhamnoside²². Dulcitol, laurotetanine (alkaloid) it creates convulsion, if used in a large quantity then cause death²³. Dulcitol, sitosterol, carotenoids, flavonoids²⁴, violaxanthin, lutein, lycopene, carotene, α-cryptoxanthin²⁵ Choline kinase²⁶, benzofuran 2, 3, dihydro-, 2-methoxy-4-vinylphenol and 2-propenoic acid, 3-(4-hydroxyphenyl)-methyl ester²⁷.

The main active principles presented in the plant are cuscutalin (1%) and cuscutin (0.02%). The plant also contains wax and reducing sugars. The seeds contain amarvelin, resins, oil (3%) and reducing sugars. These constituents are reported to vary with the host on which the dodder parasitizes. On *Santalum album*, it yields D-mannitol, while on *Glycomis triphylla* luteolin or kaempferol, and dulcitol on others. An important cell

wall degrading enzyme, pectin methyl esterase in A and B forms have been isolated from the filaments containing haustorium²⁸.

PHARMACOLOGICAL ACTIVITIES

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 mechanism²⁷. 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 blockage³⁰.

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 alterations³¹.

Antioxidant activity

In vitro antioxidant activity of *Cuscuta reflexa* 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 fractions³². Synthesized phytochelatins and carried out modulation of antioxidants in response to cadmium stress in *Cuscuta reflexa*. The effects of cadmium on growth, the antioxidative enzymes namely catalase peroxidase glutathione reductase, glutathione and phytochelatins were found in callus and seedling of *Cuscuta reflexa*³³.

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 reported³⁴.

Spasmolytic action

Aqueous and alcoholic extracts of *Cuscuta reflexa* stem have got a relaxant and spasmolytic action on small intestine of guinea pig and rabbit. Also, the extracts exhibited acetyl choline-like action³⁵.

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 action³⁶.

Antitumor activity

Administration of Aqueous and ethanol extracts of *Cuscuta reflexa* whole plant at doses of 200 and 400 mg/kg body weight resulted in a significant ($p < 0.05$) decrease in tumor volume and viable cell count but increased non-viable cell count and mean survival time, thereby increasing the life span of the tumor-bearing mice. Restoration of hematological parameters – RBC, Hb, WBC, and lymphocyte count to normal levels in extract treated mice was also observed³⁷.

Anti-arthritic and nephroprotective effect

Antiarthritic activity of Aqueous and Methanol extracts of *Cuscuta reflexa* 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 $\mu\text{g/mL}$ 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 phytoconstituents³⁸.

Anti-inflammatory activity

Alcoholic and aqueous extract of stem of *Cuscuta reflexa* 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 h as compared to standard drug Ibuprofen 96.36%. Thus this study revealed that the selected extracts of *Cuscuta reflexa* exhibited a significant anti-inflammatory activity in carrageenan induced paw oedema model in rats³⁹.

Antimicrobial activity

Ethanolic whole plant extracts obtained from *Cuscuta reflexa* 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 $\mu\text{g/mL}$, 300 $\mu\text{g/mL}$, 400 $\mu\text{g/mL}$ or 500 $\mu\text{g/mL}$), 500 $\mu\text{g/mL}$ 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 $\mu\text{g/mL}$ (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 *Cuscuta reflexa* 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 *Cuscuta reflexa* do possess significant antimicrobial properties⁴⁰.

Hair growth activity

The petroleum ether and ethanolic extract of *Cuscuta reflexa* were given at the dose 250 mg/kg in male swiss albino rats. Cyclophosphamide (125 mg/kg) was used to induce alopecia. This study was shown to be capable of promoting follicular proliferation or preventing hair loss in cyclophosphamide-induced hair fall⁴¹.

FORMULATION

Akashvalli arka⁴²

DISCUSSION

This review article reveals that *Cuscuta reflexa* is a very important medicinal plant. It is called miracle plant in ethnobotany. *Cuscuta reflexa* is a parasitic plant belong to the Convolvulaceae family. Its depend upon host plant for nutrients, water & carbohydrates. *Cuscuta* lacks roots or leaves but possesses specific penetrating organs, called haustorium. It causes huge loss to the crop plants every year. Still *Cuscuta reflexa* have some medicinal properties including antispasmodic, antidiabetic, antimicrobial, antiviral, antihypertensive, muscle relaxant, antioxidant, hair growth promoting activity, antipyretic and antitumor. As evident by a number of studies cited above. Different parts are used to treat different diseases and have important place in the Ayurveda. The plant needs to be explored more so that more formulations can be proposed and used practically for treatment of diseases.

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