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A PHANEROGAMIC PARASITE - *CUSCUTA REFLEXA* ROXB. : A REVIEW

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ABSTRACT

The present review article emphasizes on host range of *Cuscuta reflexa* Roxb. in Pune district of Maharashtra state, India. It includes physiological, biochemical, anatomical, pathological and pharmacognostic, aspects regarding this phyto-parasitic species.

Key words : *Cuscuta reflexa* Roxb., host diversity, anatomy, physiology, management, medicinal uses

A number of flowering plants are found to be parasites on other plants causing considerable damage to the host plant. Most of the parasitic plants belong to families Loranthaceae, Convolvulaceae, Scrophulariaceae, Orobanchaceae, Lauraceae, Santalaceae and Balanophoraceae.

The partly independent parasites are called as hemi-parasites. They possess chlorophyll and are dependent on the host only for water and mineral nutrients. The hemi-parasites look like normal green plants. Their modified roots are anchored in the stems and branches of the host plant. The parasite damages host by reducing the amount of water and mineral contents, which sometimes results into the death of host plants or plant parts.

There are some parasitic angiosperms, which lack chlorophyll pigments and are thus dependent on host for nutrients. These plants may however contain other pigments, such as xanthophyll and carotenoids. These are known as obligate parasites, in the sense that they cannot grow apart from the host. The leaves of these parasites are reduced to scales and their root system shows marked modification. The genus *Cuscuta* and *Orobanche* are the best examples of such obligate parasites.

Cuscuta :

Cuscuta is a genus of family Convolvulaceae. It is flowering plant, most often called as 'Dodder' in English. *Cuscuta* Linn. (Cooke, 1967) is a leafless yellow or reddish, twining, parasitic annual plant. Stems slender, sometimes filiform. Flowers small, white or rose coloured, sessile or pedicellate, solitary or in lateral fascicles or short racemes, bracts small or zero. Calyx usually deeply divided, segments - 5 (rarely 4), distinct or connate at the base, sub-equal. Corolla campanulate ovoid or globose, usually with fimbriae or lobed scales near the base or below the stamens, lobes 5 or 4, short, imbricate in bud. Stamens 5 or 4, inserted in or below the throat of the corolla - tube, filaments short, anthers short, obtuse, partially exserted. Ovary perfectly or imperfectly 2- celled, ovules 2 in each cell, styles 1 or 2, stigmas 2. Capsule globose or ovoid, dry or succulent, circumscissile or irregularly breaking up, 4 - 2 seeded. Seeds glabrous, albumen fleshy, embryo slender, spiral, cotyledons zero or obscure. Distributed in warm and temperate regions

The genus *Cuscuta* is represented by 175 species all over the world (Mishra, 2009). All of them are obligatory parasitic. The species differ in their geographic distribution and host preferences. It is considered as a destructive weed, especially harmful to crop plants, like lucerne (*Medicago sativa* L.). *C. gronovii* is the most common dodder in India, which attack ornamental and hedge plants. It is fast developing parasite which may destroy plants completely within 2 - 3 seasons.

Seed germination and parasitism :

Dodder seeds sprout at or near the surface of soil. Before reaching to a host plant the seedling relies on food reserves in the embryo, as cotyledons are vestigial. As soon as dodder gets attached to the host plant, it gets wrapped around it and produces 'haustoria' which insert in to the vascular system. The preliminary and under-developed root system of the dodder gets degenerated in the soil.

Host range :

Cuscuta is the most wide spread and important parasitic angiosperm. It attacks trees, shrubs, herbs and crops. *Cuscuta* fruits mature, at the same time as the host fruit. Therefore its contamination into the host seeds is common. This is the major means of its spread.

During the survey undertaken by Banerjee *et al.* (1993) at Kalyani, West Bengal from 1987-90 it was observed that, *Cuscuta* grows on forest tree species such as *Acacia auriculiformis, A. Arabica, Inga dulcis, Tecoma stans, Millingtonia hortensis, Glycomis pentaphylla, Casurina equisetifolia* and *Spathodea companulata*. The parasite was active throughout the year, but its growth was more intense in winter. Out of these host species, *C. equisetifolia, M. hortensis, S. campanulata* were most affected. Initial symptoms in case of *M. hortensis* were dieback, followed by drying of branches, cracking of bark on the stem and large branches. Large trees died within 4-6 years.

During regular visits to the Valley of Flowers, National Park (Uttar Pradesh, India) Joshi *et al.* (2003) reported that, *C. europaea* Linn. grows on various flowering plants, including *Dactylorhiza hatagirea, Gentianella moorcroftiana, Swertia paniculata, Selinum teruifolium* and *Potentilla* spp. Infestation with *C. europaea* adversely affected the size and density of the medicinal plants.

Small - seeded dodder (*C. planiflora* Ten.) is a serious pest of lucerne in United States of America, which also infests other horticultural crops, resulting into lower yields (Pratt *et al.,* 2002). Rawat *et al.* (1994) reported 50 species of flowering plants from 27 families as the hosts of *C. reflexa* from Doon Valley, Uttar Pradesh. *Cuscuta* infestation in fennel (*Foeniculum vulgare* Mill.) in Tonk district of Rajasthan during rabi season of 1986-87 reduced seed yield of fennel to the extent of 14.04 to 71.52% depending on the intensity of infestation Bhati (1994).

Das and Mishra (2004) reported 44 host species of *C. reflexa* in Burdwan district, West Bengal. Fifty two species representing 46 genera and 24 families were recorded as host plants of *C. reflexa* in Uttar Dianajpur district (Ghosh and Das, 2004). Similarly 32 host species form 22 families were infected by *C. reflexa* in Purulia district (Das *et al.*, 1999). Fifteen plants were recorded as host plants for *C. reflexa* at Bankura district in the year 1997, wherein majority of host species were woody plants (Das *et al.*, 1999a).

Kanade *et al.* (2014) reported 113 species, as host plants of *C. reflexa Roxb.* (Plate 1). The hosts include ephemeral, annual, biennial and perennial plants in the form of herb, shrub, climber, liana and tree habits; and agricultural, horticultural, medicinal, weeds, forest and economically important plants. Their results indicated that, *Cuscuta* parasitize on wide variety of plants. which include *Lantana camera, Azadirachta indica, Nerium oleander, Annona squamosa, Vitex negundo, Duranta plumieri, Clerodendron inerme, Parthenium hysterophorus Albizia lebbeck, Bauhinia racemosa, Dalbergia sissoo, Delonix regia, Eugenia jambolana, Ficus bengalensis, Ficus religiosa, Mangifera indica, Manilkara achras, Melia azedarach, Michelia champaca, Millingtonia hortensis, Santalum album,* *Spathodea campanulata*, *Artabotrys odoratissimus* and *Sapindus laurifolius*.

Anatomical studies :

The size of the haustorium is specific to host plant as well as *Cuscuta* species. The haustorium reaches up to the secondary xylem. The penetration of haustorium in the host stem affected its cortex tissue, showing elongation towards parasite eg. *Cuscuta, as result of which* structure of the host stem was completely modified (Plate 2).

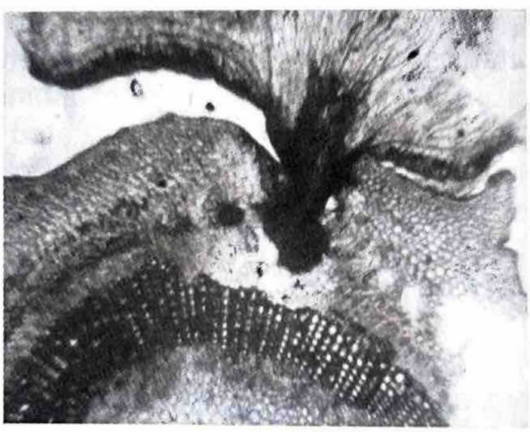
The haustoria is devoid of apical meristem and root cap. Its development takes place from cortical parenchyma without any involvement of the pericycle. In addition, during formation of the haustoria, cell elongation predominates over cell division during limited growth of haustoria (Zhuk, 1997).

The anatomical studies of *Cuscuta* undertaken by Ihl and Wiese (2000) indicated that, the formation of haustoria in *C. reflexa* is restricted to subapical region of *C. reflexa* stem. During haustorial development, the growth rate of *C. reflexa* is retarded. Dey and Pati (1998) showed that haustoria penetrates into the host by rupturing the bulliform cells or epidermal pores. However, the Information regarding parasitism of *Cuscuta* is still in its elementary stage. The mechanism of haustoria penetration is not clearly understood and very little information is available on anatomical characters of host-parasite association.

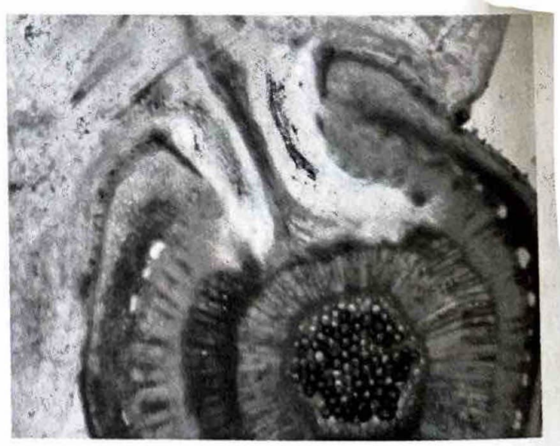
Alstonia scholaris R.Br.

Bougainvillaea spectabilis Willd.

Plate 1 : Hosts of *C. reflexa* Roxb. in Baramati area of Pune district of Maharashtra, India



Catharanthus roseus Don.



Duranta plumieri Jacq.

Plate 2 : Anatomy of infected host plant stems of *C. reflexa* Roxb. (Host plants collected from Baramati area of Pune district of Maharashtra, India).

Seed germination :

Due to hard seed coat, *Cuscuta* seeds do not germinate easily, even under wet condition (Kanade and Gham, 2011) and it needs pretreatment with sulfuric acid (H_2SO_4) for about 120 hours. Lados (1998) studied effect of temperature, pH and host plant extracts on germination of *C. trifolii* and *C. campestris*. They also observed that sulfuric acid pre-treatment promoted seed germination. Highest per cent germination (> 60 %) was obtained at the temperature within the range of 16 and 32^{0}C, and at around pH value of 5.5 i.e. acidic condition. However, there was no significant increase in per cent germinated of *C. trifolii* and *C. campestris* seeds under the influence of host plant (*Medicago sativa*) extract. Similar results were obtained by Zaki *et al.* (1998). They reported that, seed germination was better in sandy than in clay soils and due to the pre-treatment with sulfuric acid. The results obtained by Mishra *et al.* (2003) are in agreement with these studies.

Antimicrobial properties :

Antimicrobial activity of *C. reflxa Roxb.* extracts against gram negative (*Psudomonas aeruginosa* and *E.* coli) and gram positive (*Bacillus subtill* and *Bacillus licheniformis*) bacteria was confirmed by Anjum and Khan (2003). Mehra and Hiradhar (2002) observed that crude acetone extract of *C. hyaline,* at the concentration of 80 ppm, was an effective oviposition deterrent in case of common house mosquito. Antifungal activity of *C. reflexa* Roxb against *Aspergillus* sp., *Fusarium* sp., *Penicillium* sp. and *Rhizopus* sp. was studied by Jagtap *et al.* (2014) and observed inhibition of fungal growth.

Mehjabeen (2011) confirmed antimicrobial activity of *C. reflexa* against *Psedomonas aeruginosa*, *Citrobactor*, *Shigella flexneri*, *E. coli* and *Staphylococus aureus*. Butanol extract of *Cascuta* exhibited inhibitory effect against *Bacillus subtillis*, *Enterococcus faecalis* and *Psedomonas aeruginosa* (Okiei,2009). Mohammad *et al.* (1984) showed the extracts of the *C. reflexa* inhibit growth of *Helminthosporium turcicum*. However, 25 % decrease in the growth of *Fusarium moniliforme* was observed under the influence of *C. reflexa* by Yasmin *et al.* (2008). Chhabra *et al.* (2010) showed strong inhibitory effect of ethanol and methanol extracts of *C. reflexa* on most of the bacteria. In contrast, aqueous extract of *C. reflexa* failed to show antimicrobial activity. Inamdar (2011) observed that gram -ve bacteria showed more antimicrobial activity, as compared to the gram +ve bacteria. Anjum (2003) found that chloroform and petroleum ether extracts of *C. reflexa* were the most effective antifungal and antibacterial agents.

Host-parasite physiology :

C. lupuliformis obtains large amount of K, along with Ca and Na from the phloem of *Vicia sativa* L., without disturbing its mineral balance (Fer *et al.*,1990). Concentrations of P and K were higher in dodder than in host plant tissue, whereas the concentrations of Ca and Mg were much lower (Saric *et al.* 1991). Mishra and Sanwal (1995) observed that, infection of Indian rape (*Brassica campestris*) by *C. reflexa* was responsible for significantly reduced the monogalactosyl diglyceride, digalactosyl diglyceride, chlorophyll unsaturated fatty acids (linoleic acid and lenolenic acid) contents. Parasitism by *C. reflexa* reduced alkaloid content in *Lupinus albus* (Baumel *et al.*, 1995).

During the process of infection *of C. reflexa*, the host *Lycopersicon esculentum* show anatomical modifications at the infection site, which is associated with increased IAA in the tissues (Loffler *et al.*, 1999). The distribution of *C. salina* is restricted to areas of high salinity, wherein it parasitizes salt tolerant plants (Frost *et al.*, 2003). Polyphenol oxidase activity and protein content in healthy and infected stem of *Bougainvilliea spectabilis, Ficus glamarata, Vitex nugundo, Santalum album* and *Acalypha hispida* was studied by Mane *et al.* (2014) and they reported enhancement in enzyme activity as well as protein content in infected host plants. They also reported increased proline content in the host plants infected with *C. reflexa* Roxb. Though, *Cuscuta* is a parasitic plant without chlorophyll, and unable to synthesize its own food through photosynthesis, considerable literature is available on photosynthetic ability of *Cuscuta*. Choudhury and Sahu (1999) reported photosynthetic properties of *C. reflexa*. The photosynthetic cells from *C. reflexa* were studied by Hibberd *et al.* (1998) and he investigated Rubisco (ribulose-1, 5 bisphosphate carboxylase-oxygenase) and auto-fluorescence of chlorophyll. Kim *et al.* (1997) noted that, the amounts of photosynthetic pigments varied in different tissues, and were greater in apical parts, rather than in lower parts of the seedling of *C. australis*. Chlorophyll was rarely found below the 4^{th} internode from the top, and pigment contents depended greatly on light intensity. Sahu and Choudhury (2000) revealed that, chlorophyll and carotenoid contents in the *Cuscuta,* growing on the host were very low. Incubation of excised stem in the distilled water under low light (6 W) resulted in three fold increase of chlorophyll content.

Callus induction and plant regeneration *from C. reflexa* was studied by Srivastava *et al.* (2001) and pointed out that the callus had higher peroxidase activity. Catalase activity also revealed similar pattern. Tommasi *et al.* (1990) studied seedlings of *C. reflexa* synthesizes ascorbic acid (AA). Srivastava *et al.* (1995) detected starch phosphyorylase (E.C. 2.4.1.1) from the stems of *C. reflexa.* They also reported pectin methylesterase from the stems of *C. reflexa* (Srivastava *et al.* 1994). Phenolic compounds, flavonoids and alkaloids in *Cuscuta* were detected by several workers. Loffler *et al.* (1995) observed characteristic patterns of soluble phenolic constituents in *C. reflexa*. Loffler *et al.* (1993) isolated eight phenolic compounds from *C. reflexa* and *C. platyloba* such as - i) 3, 4-dicaffeoylquinic acid ii) 3, 5-dicaffeoylquinic acid, iii) 3 - dicaffeoyliquinic acid [chlorogenic acid], iv) quercetin, v) quercetin 3-0-beta - galactoside, vi) quercetin 3-0-beta-glucoside, vii) kaempferol 3-0-beta-galactoside and viii) kaempferol 3-0-beta-glucoside. Bacchi (1993) isolated three falvonoid - containing fractions from *C. racemosa* and one of their major compounds was thought to be quercetin 5,7,3', 4'-tetra-methyl ether.

Defense mechanism in host plants against *Cuscuta* :

The defense mechanisms of plants against parasites may be either through morphological or biochemical defense. Certain structural features of epidermis or its interior may greatly affect the ability of parasite to penetrate or to invade a host plant. Such morphological defense structures may be present before penetration or infection or may be produced afterwards as a result of the interaction between host and the parasite.

The biochemical defense mechanism is through the availability of biochemical substances, which interfere with growth and multiplication of the parasite. These biochemical compounds may be constitutive or adaptive. Al-Menoufi *et al.* (1991) reported that, the epidermal, cortical and pith cells of the infected host plants increase, in size. In some host plants the meristematic activity gets and some regulated. *L. esculentum* showed a hypersensitive reaction to *C. campestris*, with necrosis of host cells occurring immediately after the threads of the parasite coiled around the stem. Such a reaction is considered as a type of resistance. In case of *L. esculentum,* anatomical and chemical defense reactions have been shown by Sahm *et al.* (1995), *C. reflexa* and summarized as: elongation of epidermal, hypodermal and collenchymatic cells beneath parasitic pre-haustorium which collapse after 9 -11 days of infection forming a visible brownish plaque. This is followed by scalariform tissue with lignified and suberized cell walls. There is accumulation of soluble phenolic compounds, as well as an activities of peroxidases are stimulated. Stimulation of phenylpropanoid metabolism takes place due to wounding. All these anatomical changes were observed only during pathogenesis with *Cuscuta*.

In and around the haustorium developed by *C. reflexa* on *Phaseolus vulgaris*, cellular proliferation and accumulation of polyphenolic compounds were observed by Arnaud *et al.* (1998). Ethylene production in response to *Cuscuta* attack might be the alarming signal produced by host defense system, during which an increases in phenylalanine, ammonia - lyase and peroxidases activities were also observed.

According to Julie and Daniel (1996) *Streblus asper* Lour contained higher amounts of flavonoids, steroids and alkaloids when infected with *C. reflexa*. The work of Bringmann *et al.* (1999) studied *Ancistrocladus heyneanus* infected with *C. reflexa* showed phytoalexin production and hypersensitive reactions in the host plant leading to the degeneration of parasitic tissues.

The cell wall degrading enzymes (CWDE), (cellulase, polygalacturonase and xylanase) in the infected region of *C. reflexa,* and in different parts of resistant hosts (sweet potatoes and tomato) contained strong inhibitors of CWDE providing a defense mechanism to host against houstorial penetration (Singh *et. el.*, 1997).

The natural defense mechanism in *Parthenium hysterophorus* parasitized by *Cuscuta* spp. was studied by Dhopte (1998). He is of the opinion that *Cuscuta* spp. is unable to survive on *P. hysterophorus* because of the presence of toxic sesquiterpene lactonse. Furthermore, the infected *P. hysterophorus* reinitiated flowering after one week, indicating allelopathic reaction of *P. hysterophorus* to *Cuscuta* spp.

Furuhashi *et al.* (1995) investigated that far - red light induced mutual and self parasitism of *C. japonica in-vitro*. Blue light was less effective than far - red light because of its weak effect on induction of haustoria, although it stimulated mutual twining of stems. No parasitism was observed under white or red light, or in darkness. Similar results were reported by Tada *et al.* (1996) in *C. japonica* grown with *Vigna radiata*.

Management of *Cuscuta* :

The most successful control of dodder involves a systematic approach that combines several methods. Dodder cannot be eliminated with a single treatment or in a single year. When dodder is detected, on landscape and garden plants, immediate action is needed to reduce its infestation in these locations. Effective management requires control of *Cuscuta*, prevention of seed production, and suppression of new seedlings.

Manual removal of the weed is the most common weed control practice, but this has to be done very critically. Successful control requires increased awareness of parasitic weeds to the farmers. The use of dodder-free seeds has been recommended for preventing the spread of dodder. Planting non-host plants can be an effective means of managing a dodder infestation (Zaki *et al.*, 1998). The pathogens could be used for the biological control of *C. campestris*. Shimi *et al.* (1995) reported 23 species of *Cuscuta* gall weevils to infest various species of dodder

Pre-emergent herbicides can be applied before the dodder seed germinates, followed by close mowing, burning or spot removal of parasitized host plants to control dodder plants. Post-imergent herbicides, which are applied directly to the dodder plant to control it, but they do not selectively control dodder without injuring the host plant and are not a good choice for controlling established infestations. The herbicides, which significantly reduced germination of *Cuscuta* seeds and dodder population, without affecting host plants include Glyphosate (Dawson, 1990; 1990a; Salimi and Maillet 1998; Molnar *et al.*, 1998 and Saied *et al.*, 2003); Dinitroaniline herbicides - Pendimethalin and Prodiamine, Trifluraline, Chlorpropham, Chlorthal dimethyl by (Dawson, 1990b), Imazaquin (Liu *et al.*, 1991); Pendimethalin, Fluchloralin, Butachlor and Oxyfluorfen (Rao *et al.*, 1991); Trifluralin and Thiazopyr (Cudney *et al.* 1993); Fluchloralin and Pendimethalin (Rao and Rao ,1993); Imazethapyr (Khallida *et al.* 1993); Dinoseb, Dinoseb acetate and Diquat (Sarpe *et al.* (1996); Linuron and Dibutalin (Xi and Xi, 1996); Chlorthaldimethyl, Flurochloridone, Metazachlor, Metolachlor, Pendimethalin, Linuron, and Diuron (Vouzounis and

Americanos, 1997); Propyzamide (Rapparini and Campagna, 1998; Cioni; 1998); Pendimethalin (Mahere *et al.*, 2000); Fluchloralin (Kumar, 2000); Butralin, Imidazolinone (Hamid-El , 2003), Glyphosate and Sulfometuron (Nadler and Rubin, 2003); Flurochloridone, Sulcotrione and Mesotrione (Weinberg *et al.*, 2003); Glyphosate and Squadran (Mishra *et al.*, 2004).

Weedicidal properties :

C. campestris was tested for its efficacy in controlling an exotic weed *Mikania micrantha* by Deng *et al.* (2003) and Shen *et al.* (2005). Number of leaves, stem length and dry weight of biomass decreased in the presence of *C. campestris* within 30 days. Photosynthetic rate, transpiration, stomatal conductance, water use efficiency and chlorophyll content decreased after two months due to parasitism. The parasite could rapidly extend to an area of 20 m^2, with the longest distance of 5 m, within 2 months. The *Cuscuta* inhibited growth and development of *M. micrantha*. These results indicated that, the use of *C. campestris* could be a potentially effective way of controlling *M. micrantha*. Chiu and Shen (2004) observed that *C. campestris* and *C. reflexa* were parasitizing and killing of the weeds *M. micrantha* and *Asystasia intrusa respectively* in Indonesia.

Medicinal uses :

In traditional Chinese medicine, the seeds of *Cuscuta* are called as `tu si zi', (Molony, 1998). Seeds of *C. chinensis* are used in Chinese medicine as a tonic. Those are considered as antitumour agent in the Unani system of medicine in India (Miyahara *et al.,* 1996). According to Gilani and Khalid (1992) in Pakistan C. *reflexa* is traditionally used to treat liver disorders, fevers, coughs and itches and for its carminative and anthelmintic properties. *C. Chinensis* is traditionally used in Iraq as purgative, to treat dandruff and as an anti-inflammatory agent (Szykula *et al.*, 1994).

Some important medicinal uses of *Cuscuta* along with their contents, name of the disease they cure and references have been given in Table 1.

Table 1 : Medicinal uses of *Cuscuta* spp.

***Cuscuta* species**	**Part used**	**Contents**	**Uses / Disease they cure**	**Workers**
C. reflexa	Stem	i) Two coumarins, named scoparone (6,7-dimethyloxy-coumarin), and melanettin (6-hydroxy-7-methoxy-4-[4- [illegible]	Relaxant and spasmolytic properties.	Nair and Thirupurasundari, (1992)
C. reflexa	Stem	The extract of whole plant.	Blood pressure	Gilani and Khalid, (1992)
C. chinensis	Stem	n-pentacosane (1%), n-heptacosane (1.7%), n-hentriacontane (7.3%), 1-triacontanol (3.4%) and beta-sistosterol (2.4%).	CNS- depressant and antitumour agent.	Szykula *et al.* (1994)
C. chinensis	Stem	Tryptophan derivative alkaloid, named cuscutamine and 2 lignans, named cuscutosides A and B and known phenolic compounds.	Tonic (Traditional Chinese medicine)	Yahara *et al.* (1994)
C. chinensis	Seeds	Two novel acylated trisaccharides named cus-1 and cus-2, and mixture of resin glycoside – like compounds.	Tonic and antitumour activity. (Traditional Chinese medicine)	Miyahara *et al.* (1996)
C. campestris	Stem	Ethanol extract of stem.	Analgesic, antipyretic, antiinflammatory, CNS-depressant	Agha *et al.* (1996)
C. chilensis *C. micrantha*	Stem Stem	Quinolizidine alkaloids (matrine 78.61%, sophoranol 2.98% and methylcytisine 1.32%), Kaempferol (0.1%) and a low kaempferol –3-0 – glucoside.	Treatment of inflammatory tumours and for abortion.	Ruben *et al.* (1995)
C. reflexa	Stem	Crude water extract of stem (contains 9 pure identified compounds).	Anti-HIV activity	Mahmood *et al.* (1997)
C. chinensis	Seeds	Methyl 4-hydroxy-3, 5-dimethoxycinnamate, caffeic acid, quercetin, kaempferol and calycopteretin	Antioxidative property	Kwon *et al.* (2000)
C. japonica	Stem	3,5-Di-O-caffeoylquinic acid, methyl,3,5-Di-O-caffeoylquinate, 3,4-Di-O-caffeoylquinic acid, and methyl 3,4-Di-O-caffeoylquinate	For the antihypertensive action.	Oh *et al.* (2002)
C. chinensis	Seeds	Resin glycoside and cuscutic resinoside A, along with 5 known compounds.	A stimulator of breast cancer cell proliferaction.	Umehara *et al.* (2004)

C. reflexa	Stem	---	Eczema, heart weakness, liver and spleen disease.	Panigrahi and Sahu (2000)
C. reflexa	Buds	---	Hepatoprotective activity.	Pradhan *et al.* (2005)
C. reflexa	Stem	Plant decoction	i) Headache, hair fall and rheumatism. ii) Arthritis in knees. iii) Puerperal fever.	Trivedi (2002)
C. reflexa	Stem	---	Skin disease itching, in liver diseases and in acidity.	Desai (1975)
C. reflexa	Stem Seeds	--- ----	Expectorant,carminative, tonic, anathematic, purgative, diaphoretic, diuretic, blood, anti-inflammatory, Sedative, diuretic, cure hic-cough,	Kirtikar and Basu, (1991)

References :

Al-Menoufi, O. A., F. M. Ashton, J. K. Ransom, L. J. Musselman, A. D. Worsham and C. Parker (1991) *"Proceedings of the 5th international symposium of parasitic weeds", Nairobi, Kenya. 24 - 30 June, pp 293.*

Anjum, N. and Z. Khan (2003) *Pakistan Journal of Botany* **35**(5): 999.

Arnaud, M. C., P. Thalouarn and A. Fer (1998) *Les Phanerogames Parasites* (French) **192**(1): 101.

Banerjee, K., D. C. Khatua and N. Mukherjee (1993) *Indian Forester* **119**(9) : 760.

Baumel, P., W. D. Jeschke, N. Rath, F. C. Czygan and P. Proksch (1995) *Journal of Experimental Botany* **46**: 1721.

Bhati, D. S. (1994) *Journal of Species and Aromatic Crops* **3**: 152.

Bringmann, G. J., M. Schlauer, B. Ruckert, B. Wiesen, K. Ehrenfeld, P. Proksch and C. Czygan (1999) *Plant Biology* **1**: 581.

Chhabra, S., J. Thakaral, P. Kamboj and Y. Paliwal (2010) *Pharamacognosy Journal* **2**: 293.

Chiu, S. B. and H. Shen (2004) *Planter* **80**(934): 31.

Choudhury, N. K. and D. Sahu (1999) *Photosynthetica* **36**(1-2): 1.

Cioni, F. (1998) *"Proceeding of Giornate Fitopatologiche", held at Scicli e Ragusa, Italy* 3-7 May 387-392.

Cooke, Theodore, C. I. E. (1967) *"Flora of the presidency of Bombay",* Botanical Survey of India, Culcutta, Vol. II, 290.

Cudney, D. W., S. B. Orloff and J. S. Reints (1992) *Weed Technology* **6**(3): 603.

Das, D., R. B. Ghosh, D. Avik, U. K. Maji, D. Das and A. Dutta (1999a) *Environment and Ecology* **17**: 763.

Das, D., H. Ruma, D. Avik, U. K. Maji, D. Das, R. Hazra, A. Dutta (1999) *Environment and Ecology* **17**: 479.

Dawson, J. H. (1990) *Weed Technology* **4**(4): 876.

Dawson, J. H. (1990a) *Weed Technology* **4**(4): 880.

Dawson, J. H. (1990b) *Weed Technology* **4**(2): 341.

Deng, X., H. Feng, W. Ye, Q. Yang, K. Xu, H. Cao, Q. Fu, X. Deng, H. L. Feng, W. H. Ye, Q. H. Yang, K. Xu, H. L. Cao and Q. Fu (2003) *Journal of Tropical and Subtropical Botany* **11**: 117.

Desai, V. G. (1975) *"Aushadhi Sangraha",* Rajesh Prakasjan, Pune, India.

Dhopte, A. M. (1998) *Annals of Plant Physiology* **12**(1): 80.

Fayad, A. H, K. M. Hameed and A. H. Al-Ani (1990) *Arab Journal of Plant Protection* **8**(1): 5.

Fer, A., H. Benharrat, L. Rey and S. Renaudin (1990) *Academie des Science* (French) **310**(4): 113.

Frost, A., J. C. Lopez-Gutierrez and C. B. Purrington (2003) *American Journal of Botany* **90**(7): 1032.

Furuhashi, K., M. Kanno and T. Morita (1995) *Plant and Cell Physiology* ***36**(3): 533.*

Ghosh, P. and D. Das (2004) *Envornment and Ecology* **22** (Spl. - 3): 459.

Gilani, A. H. and A. Khalid (1992) *International Journal of Pharmacognosy* **30**(4): 296.

Hamid-El, M. M. A. (2003) *Egyptian Journal of Agricultural Research* **81**(4): 1735.

Hibberd, J. M., R. A. Bungard, M. C. Press, W. D. Jeschke, J. D. Scholes and W. P. Quick (1998) *Planta* **205**(4): 506.

Ihl, B. and K. Wiese (2000) *Flora Jena (Ger*man Journal)**195**(1): 1.

Inamdar, F. B. (2011) *International Research Journal of Pharmacy* **2**(4): 214.

Jagtap, M. D. A. S. Asabe, A. B. Telave, B. S. Mali, S. J. Chavan and M. B. Kanade (2014*) Central European Journal of Expt. Biol.* **3(3)**: 30.

Joshi, S. K., G. Sanjay and S. Gairola (2003) *Current Science* **84**(10): 1285.

Julie, S. and M. Daniel (1996) *National Academy Science Letters* **19**(9-10): 185.

Kanade, M. B. and S. K. Gham (2011) *Advances in Plant Sciences* **24**(II): 705.

Khallida, R., S. P. S. Beniwal, Z. Fatemi and M. C. Saxena (1993) *FABIS Newsletter* **33**: 30.

Kim, J. S., H. H. Kwak, B. C. Kim and K. Y. Cho (1997) *Korean Journal of Weed Science* **17**(3): 314.

Kirtikar, K. R. and B. D. Basu (1991) *"Indian Medicinal Plants",* Lalit Mahan Basu, 49, Leader Road, Allahabad, India 1740.

Kumar, R. M. (2000) *Journal of Research ANGRAU* **28**(3): 1.

Lados, M. (1998) *Acta Agronomica Hungarica* **46**(4): 317.

Liu, Z. Q., A. Fer and F. M. Lecocq (1991) *Weed Research Oxford* **31**(1): 33.

Loffler, C., F. C. Czygan and P. Proksch (1999) *Plant Biology* **1**(6): 613.

Loffler, C, A. Sahm, V. Wray, F. C. Czygan and P. Proksch (1993) *Planta Medica* **59**: 7.

Loffler, C, A. Sahm, V. Wray, F. C. Czygan and P. Proksch (1995) *Biochemical Systematics and Ecology* **23**(2): 121.

Mahere, J., P. K. Yadav, R. S. Sharma and J. Mahere (2000) *Indian Journal of Weed Science* **32**(34): 216.

Mahmood, N., S. Piacente, A. Burke, A. Khan, C. Pizza (1997) *Antiviral Chem. and Chemotherapy* **8**(1): 70.

Mane, S. P., M. B. Kanade, A. B. Telave, B. S. Mali, S. J. Chavan and A. A. Mali (2014) *Flora and Fauna* **20**(2): 276.

Mehjabeen, A. (2011) *Pak. J. B.* **4**(3): 1773.

Mehra, B. K. and P. K. Hiradhar (2002) *Journal of Environmental Biology* **23**(3): 335.

Mishra, J. S. (2009) *Indian J. Weed Sci.* **41**(1&2): 1.

Mishra, J. S., M. Bhan, B. T. S. Moorthy and N. T. Yaduraju (2003) *Indian Journal of Weed Science* **35** (3/4): 281.

Mishra, J. S., M. Bhan, B. T. S. Moorthy and N. T. Yaduraju (2004) *Indian Journal of Weed Science* **36**(3/4): 278.

Mishra, S. and G. G. Sanwal (1995) *Journal of Plant Physiology* **146**(3): 303.

Miyahara, K., Du-XiaoMing, M. Watanabe, C. Sugimura, S. Yahara, T. Nohara and X. M. Du (1996) *Chemical and Pharmaceutical Bulletin* ***44**(3): 481.*

Mohammad, R., A. N. Masoud and M. A. R. Bhatti (1984) *Pakistan J. Agric. Res.* **5**(4): 236.

Molnar, F., B. Gyulai and M. Czepo (1998) *Novenyvedelem* (Hungarian) **34**(7): 379.

Molony, D. (1998) *Complete Guide to Chinese Herbal Medicine,* Berkeley Books, New York.

Nadler, H. T. and B. Rubin (2003) *Weed Research Oxford* ***43**(5): 341.*

Nair, A. G. R. and G. Thirupurasundari (1992) *Fitoterapia* **63**(4): 381.

Oh, H., D. Kang, S. Lee, H. Lee, H. Oh, D. G. Kang, S. Lee and H. S. Lee (2002) *Journal of Ethnopharmacology* **8**(1-2): 105.

Okiei, W., M. Ogunlesi and M. A. Ademoye (2009) *Journal of Applied Sciences* **9**: 4076.

Panigrahi, A. K. and A. Sahu (2000) *Glossary of useful and economically important plants,* New central book agency (P.) Ltd. Calcutta, India 113.

Pradhan, D., P. K. Panda and P. Sunita (2005) *Hamdard Medicus* **48**(1): 129.

Pratt, R. A., H. S. Jacob, J. Dodd and J. H. Moore (2002) *13th Australian weeds conference: Weeds threats now and forever? Sheraton Perth Hotel, Perth, Western Australia 8-13 Sept.- papers and proceedings. 276.*

Rao, K. N., R. S. N. Rao, J. K. Ransom, L. J. Musselman, A. D. Worsham and C. Parker (1991) *"Proceedings of the 5th international symposium of parasitic weeds".* Nairobi, Kenya 24 - 30 June. 164.

Rao, K. N. and R. S. N. Rao (1993) *Proceedings of an Indian Society of Weed Science* International Symposium, *Hisar, India 18 20 November Vol. III: 196.*

Rapparini, G. and G. Campagna (1998) *Informatore Agrario* **54**: 61.

Rawat, A., S. Sachan, S. N. Sachan, A. Rawat and S. Sachan (1994) *Indian Journal of Forestry* ***17****(1): 73.*

Ruben, G. M., E. G. Silvia and R. C. Pena (1995) *Biochemical Systematics and Ecology* ***23****(5): 571.*

Sahm, A., H. Pfanz, M. Grunsfelder, F. C. Czygan and P. Proksch (1995) *Botanica Acta* ***108****(4): 358.*

Sahu, D. and N. K. Choudhury (2000) *Advances in Plant Sciences* **13**(1): 153.

Saied, R., S. M. Saneii and M. A. Asgarii (2003) *Acta Horticulturae* **620**: 215.

Salimi, H and J. Maillet (1998) *"Comptes rendus 6eme symposium Mediterraneen EWRS", Montpellier, France 13*-15 May 161.

Saric, M., B. Krstic and V. Momcilovic (1991) *Biochemie und Physiologie der pflanzen* **187**(2): 105.

Sarpe, N., I. Moga, M. Pocacean, I. Lungulescu, C. Roibu, G. H., Buroi, H. Brown, G. W. Cussans, M. D. Devine, S. O. Duke, Q. C. Fernandez, A. Helweg, R. E. Labrada, M. Landes, P. Kudsk and J. C. Streibig (1996) *Proceedings of the second international weed control congress, Copenhagen, Denmark 25 28 June. Vol. 14 1065.*

Shimi, P., A. H. Bayat, M. R. Rezapanah and R. Koliaii (1995) *Journal Agricultural Sciences.* ***1****(2):* 43.

Singh, A, M. Singh, A. Singh and M. Singh (1997) *Journal of Plant Physiology* **150**(5): 592.

Srivastava, S., U. N. Dwivedi and S. Srivastava (2001) *Plant Physiology and Biochemistry* **39**(6): 529.

Srivastava, S. and U. N. Dwivedi (2003) *Plant Physiology and Biochemistry* ***41****: 65.*

Srivastava, S., A. Nighojkar, Anil Kumar, S. Srivastava, A. Nighojkar and A. Kumar (1994) *Phytochemistry* **37**(5): 1233.

Szykula, J., C. Hebda, A. T. Khazraji, Z. Alsharook and P. Fischer (1994) *Fitoterapia* **65**(1): 86.

Tada, Y., M. Sugai and K. Furuhashi (1996) *Plant and Cell Physiology* **37**(8): 1049.

Tommasi, F., L. Gara, R. Liso, O. Arrigoni, G. De (1990) *Journal of Plant Physiology* **135**(6): 766.

Trivedi, P. C. (2002) *Ethnobotany*, Avishkar Publishers, Distributors, Jaipur (Raj.) India.

Umehara. K., K. Nemoto, T. Ohkubo, T. Miyase, M. Degawa and H. Noguchi (2004) *Planta Medica* **70**(4): 299.

Vouzounis, N. A. and P. G. Americanos (1997) *Technical Bulletin Cyprus Agricultural Research Institute* ***182****: 5.*

Weinberg, T., A. Lalazar and B. Rubin (2003) *Weed Science* **51**(5): 663.

Xi-Qian, Xi-Q. (1996) *Soybean Science* **15**(1): 62.

Yahara, S., H. Domoto, C. Sugimura, T. Nohara, Y. Niiho, Y. Nakajima and H. Ito (1994) *Phytochemistry* **37**(6): 1755.

Yasmin, M., K. S. Hossain and M. A. Bashar (2008) *Bangladesh J. Bot.* **37**(1): 85.

Zaki, M. A., H. S. ElMetwaly, R. A. Hassan and J. Maillet (1998) *Comptes rendus 6eme symposium Mediterraneen EWRS, Montpellier, France (French Language) 1315 May 147.*

Zhuk, A. V. (1997) *Botanicheskii Zhurnal* (Russian Journal) **82**(5): 1.