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Phyto-chemical and pharmacological investigations of Aftimoon (*Cuscuta reflexa*)

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Abstract
Cuscuta reflexa Roxb. Belongs to family Cuscutaceae and is known as Aftimoon in Unani system of medicine. The plant is parasitic found all over India up to 3000 metres of altitude and growing abundantly during rainy season on various host plants in India. Aftimoon is one of the ingredients in the preparation of various Unani compound formulations such as *Itrifal* Aftimoon, *Itrifal Ustukhudoos*, *Majoon Ushba*, *Safoof chobchini*. It has been used by Unani physicians since ages for the treatment of various ailments such as neurological disorders like melancholia, schizophrenia, epilepsy etc. It is also used for the treatment of various other disorders like hepatitis, palpitation and skin disorders etc. Different phytochemical studies reported that *Cuscuta reflexa* Roxb. Contains important chemicals like cuscutin, cuscutalin, bergenin, kaempferol, amarbelin and sterol glycosides etc. Diverse pharmacological studies of Aftimoon have been reported such as anti-inflammatory, cytotoxic, antipyretic, hepatoprotective, anticonvulsant activities etc. In this paper, an attempt has been made to summarize the information described in classical Unani text and scientific research conducted on different parts of *Cuscuta reflexa* plant.

Keywords: *Cuscuta reflexa*, Aftimoon, neurological, unani, Cuscutaceae

Introduction
Cuscuta reflexa Roxb. is an extensive climber parasite belongs to the family Cuscutaceae. It occurs throughout the plains of India. It has no roots under the ground and grows as a fresh parasite on the same plant in rainy season (Nadkarni K, 1936) [15]. It is a parasitic climber with very thin thread like stem and wraps around other plants for its nourishment. It has leaves, flowers and seeds. The thin and red colour is of best quality (Ghani, YNM) [10]. Its medicinal values are described by the ancient Unani physicians like Jalinoos, Ibn Sina etc (Ibn Sina, 1927) [21].

Scientific Classification
(United Stated Department of Agriculture (USDA))

Kingdom	:	Plantae
Subkingdom	:	Tracheobionta
Super division	:	Spermatophyta
Division	:	Magnoliophyta
Class	:	Magnoliopsida
Subclass	:	Asteridae
Order	:	Solanales
Family	:	Cuscutaceae
Genus	:	*Cuscuta* L.
Species	:	C. *reflexa*

Vernaculars
(Anonymous, 1992; Ibn Sina, 1927; Anonymous, 1986; Ibn Baitar, YNM) [1, 21, 3, 5].

English	:	Dodder
Sanskrit	:	Amarvela
Unani	:	Kasoos
Urdu	:	Aftimoon
Arabic	:	Shajarul sabagh
Hindi	:	Amarbel, Akasbel

Bengali	:	Haldi-algusi-lutta
Telugu	:	Sitama purgonalu
Gujarati	:	Akaswel

Habitat & distribution
Aftimoon (*Cuscuta reflexa*) occurs throughout the plains of India, Ceylon- Malaya and ascends the Himalayan to about 3000 meter (Kirtikar & Basu, 1975) [13]. It is also found in plains of Malaysia, Thailand, Afghanistan and Nepal. It occurs during most part of the year but flowering takes place from late October to March (Anonymous, 1992) [1].

Botanical description
Macroscopic
Aftimoon (*Cuscuta reflexa*) is an extensive climber annual parasite and leafless. It grows as homoparasite and it has very low level of chlorophyll and photosynthesis activity, completely depends over the host plant for its survival. The plant is acrid and has a bitter sharp taste. Stems are long, rather stout, closely twining, branched, glabrous, pale greenish yellow, sometimes dotted with red (Anonymous, 1992; Kirtikar & Basu, 1975) [1, 13].
Flowers solitary or in umbellate clusters of 2-4 or in short racemes, pedicels glabrous, short usually curved; bracts ovate-oblong, obtuse, fleshy and 1.5mm long. Calyx divided almost to the base, long, slightly unequal, lobes 3mm, obtuse, glabrous and fleshy. Corolla is white; tube 6-8 by 4mm; lobes 2.5-3mm, almost cylindric, acute reflexed scales almost at the base of the corolla tube. Stamens in the throat of the corolla tube; filaments scarcely; anthers about ½ excreted beyond the top of the corolla tube. Ovary is ovoid with simple, very short and thick style; stigmas 2, distinct, thick, fleshy, large and 1.5mm long. Capsules 6-8mm wide, glabrous, circumscissile near the base, depressed globose. Seeds 2-4, black, large and glabrous (Anonymous, 1992; Kirtikar & Basu, 1975) [1, 13].

Microscopic
The T.S of stem is wavy in outline and circular in shape. The outer boundary is formed by a single layer of epidermis made up of different shapes of small cells. Externally it is lined by a thin cuticle and stoma is present at some places. The epidermis is followed by 3-4 layers of cells made up of thin walled parenchymatous cells of various sizes and shapes. Brown content is seen in some of the cells. Endodermis is formed by tangentially elongated cells, often forms a complete ring but broken endodermis is seen in stem. Its cells are filled with granular mass, starch grains and calcium oxalate crystals of prism shape. The vascular bundles are simple collateral, conjoint 15-20 in numbers. Vascular bundles are arranged in a ring with the xylem on outer side surrounded by phloem in older stem and a complete ring is formed by xylem. The phloem is made up of sieve tubes, companion cells, fibre and phloem parenchyma. The internal phloem is very little. In some of the vascular bundle few cells of cambium are also present. The xylem consists of vessels, xylem parenchyma and tracheids. At the junction of xylem and phloem some schizogenous cells are seen and in the region of cortex. The large pith is formed by unlignified parenchymatous cells. (Anonymous, 1992) [1].

Part used
Whole plant (Anonymous, 2007) [2].
Stem & seeds (Anonymous, 1992) [1].

Temperament
Hot 2º Dry 2º (Anonymous, 2007; Ghani, YNM) [2, 10]
Hot 3º Dry 2º (Anonymous, 1992) [1].
Hot 3º Dry 1º (Ibn Sina, 1927) [21].
Hot 3º Dry 3º (Ibn Baitar, YNM) [5].

Dosage
3-5g (Anonymous, 2007) [2]
3.5-7g (Ibn Baitar, YNM) [5]
4-6g (Anonymous, 1992) [1]
7-14g (Ghani, YNM) [10]

Toxicity
Harmful for lungs and people of hot temperament, causes dryness, syncope, nausea and vomiting. (Ghani, YNM; Ibn Baitar, YNM) [10, 5].

Correctives
Zafran (*Crocus sativa*), Roghan Badam (Almond oil), Samagh Arbi (*Acacia arabica*) (Anonymous, 1992) [1]
Kateera (*Astragalus gemmifer*) (Ghani, YNM; Baitar, YNM) [10, 5].

Substitute
Turbud (*Ipomoea turpethum*) in equal weight. (Anonymous, 1992) [1].

Compound Formulations
Sharbat Deenar, Itrifal Aftimoon, Sikanjbeen Aftimooni, (Anonymous, 2007) [2] (Anonymous, 1992) [1].

Pharmacological Actions
- *Mushil-e-Sauda* (Purgative of black bile) (Anonymous, 1992; Anonymous, 1986) [1, 3].
- *Mushil-e-Balgham* (Purgative of phlegm) (Anonymous, 1992; Anonymous, 1986) [1, 3].
- *Musaffi Dam* (Blood purifier) (Kirtikar & Basu, 1975) [13].
- *Muhallil-e-Warm* (Anti-inflammatory) (Anonymous, 1992) [1].
- *Mufatteh Sudad* (Deobstruent) (Anonymous, 1992) [1]
- *Mudir-e-Tamth* (Emmenagogue) (Kirtikar & Basu, 1975) [13].
- *Mudir-e-Baul* (Diuretic) (Anonymous, 2007; Anonymous, 1992; Kirtikar & Basu, 1975; Ibn Baitar, YNM; Ghani, YNM; Ibn Sina, 1927) [2, 1, 13, 10, 5, 21].
- *Mulattif* (Demulcent) (Anonymous, 1986) [3].
- *Muqawwi* (Tonic) (Anonymous, 1986) [3].
- *Muqawwi Bah* (Aphrodisiac) (Kirtikar & Basu, 1975) [13].
- *Munaffis* (Expectorant) (Kirtikar & Basu, 1975) [13].
- *Kasir-e-Riyah* (Carminative) (Kirtikar & Basu, 1975) [13].
- *Qatil-e-Deedan* (Anthelminthic) (Kirtikar & Basu, 1975) [13].
- Munavim (Sedative) (Kirtikar & Basu, 1975) [13].

Therapeutic Uses
- *Malikhuliya* (Melancholia) (Anonymous, 1992; Ibn Baitar, YNM; Ibn Sina, 1927) [1, 5, 10, 21].
- *Kaboos* (Nightmare) (Anonymous, 1992) [1].
- *Junoon* (Schizophrenia) (Anonymous, 1992) [1].

- *Zof-e-Kabid* (Liver weakness) (Anonymous, 1992) [1].
- *Warm-e-Kabid* (Hepatitis) (Anonymous, 2007; Anonymous, 1986) [2, 3].
- *Deedan-e-Ama* (Intestinal worms) (Anonymous, 1992) [1].
- *Saudavi Amraz* (Ailments due to excessive black bile) (Anonymous, 1992) [1].
- *Nafakh-e-Shikam* (Flatulence) (Anonymous, 1986; Ibn Baitar, YNM) [3, 5].
- *Sara* (Epilepsy)(Ibn Sina, 1927; Ibn Baitar, YNM) [21, 5].
- *Dimaghi Amraz* (Brain disorders) (Ghani, YNM) [10].
- *Faalij* (Paralysis) (Ghani, YNM) [10].
- *Laqwa* (Facial paralysis) (Ghani, YNM) [10].
- *Khadar* (Numbness) (Ghani, YNM) [10].
- *Sartan* (Cancer) (Ghani, YNM) [10].
- *Khafaqan* (Palpitation) (Ghani, YNM) [10].
- *Amraz-e-Jild* (Skin disorders) (Ghani, YNM) [10].
- *Warm-e-Tehal* (Spleenomegaly) (Ghani, YNM) [10].
- *Waja-ul-Azlaat wa Mafasil* (Pain in muscles & joints) (Kirtikar & Basu, 1975) [13].
- *Yaraqan* (Jaundice) (Kirtikar & Basu, 1975) [13].

Phytochemical Constituents

Dulcitol, Luteolin, Quercetin A glycoside or lutcolin (Anonymous, 2007) [2]. Organic: Alkaloid, protein, flavanoids, resin, tannin, glycosides and carbohydrates. Inorganic: Aluminium, iron, calcium, sodium and potassium. (Anonymous, 1992) [1]. The seeds contain amarbelin and kaempferol Stem contain cuscutin, cuscutatin, beta-sitosterol, luteolin, bergenin and kaempferol. (Khare, 2007) [12]. Lupeol is a pharmacologically active tri-terpenoid, it has complex pharmacology in human possess anti-protozoal, antimicrobial, anti-inflammatory and chemopreventive properties. A new compound reflexin is isolated. Isorhamnetin 3-0-Neohes pheridoside– violaxanthin, lutein. lycopene, carotene, α-cryptoxanthin are reported. Swarnalin and cis-swarnalin are two tetrahydrofuran derivatives with free radical scavenging activity from the aerial parts of *Cuscuta reflexa* has been reported. (Tripathi *et al*., 2005; Dandapani & Nagrajan, 1989) [22, 8].

Physicochemical studies

(Anonymous 2006, Anonymous, 1992) [2, 1].

Foreign matter	:	Not more than 2%
Total Ash	:	Not more than 10%
Acid-insoluble ash	:	Not more than 9%
Alcohol-soluble extractive	:	Not less than 9%
Water-soluble extractive	:	Not less than 16%

TLC of chloroform extract

Solvent system Spray/reagent treatment No. of spots Rf values Toluene: Ethyl acetate (5:1.5) Dipped in Vanillin sulphuric acid reagent and heated in air oven at 105o for 10minutes 7 0.14 0.20 0.31 0.47 0.53 0.67 0.82.

Pharmacological Studies

Anti-inflammatory and cytotoxic activity

The study showed that among various extracts evaluated for cytotoxicity and anti-inflammatory activities, methanolic extract of *Cuscuta reflexa* (MECR) and its ethyl acetate soluble fraction (EAMECR) showed significant cytotoxic as well as anti-inflammatory activities which may be due to the presence of phenols, polyphenols (Udavant *et al*., 2012) [23].

Antipyretic activity

The study showed that both aqueous and ethanol extracts of *Cuscuta reflexa* dose dependently exhibited significant ($p<$ 0.05) antipyretic activity in yeast induced elevation in body temperature in rats and the effects are comparable to the reference antipyretic drug (paracetamol). The ethanol extract was found to be slightly potent than the aqueous extract. The activity may be due to presence of the above group of phytoconstituents in *Cuscuta reflexa* i.e. flavonoids and Saponins (Bhattacharya & Roy, 2010) [4].

Hepatoprotective activity

The study revealed that methanol extract of *Cuscuta reflexa* improved liver function by decreasing the serum ALT, AST and alkaline phosphatase levels in hepatotoxic rats. It also reduced the ALP as well as total bilirubin levels indicating its protective effect of liver and improvement of its functional efficiency (Balakrishnan *et al*., 2010) [6].

Anticonvulsant activity

The study showed that methanolic of *Cuscuta reflexa* significantly increased the levels of catecholamines in mice brain after a 6 weeks treatment in a dose dependent manner. The extract also significantly elevated the levels of GABA, glutamine and glutamate as compared to the control groups. The study revealed that *Cuscuta reflexa* extract possesses anticonvulsant activity (Gupta *et al*., 2003) [11].

Hair growth promoting activity

The study revealed that petroleum ether extract of *Cuscuta reflexa* exhibited promising hair growth–promoting activity as reflected from follicular density, anagen/telogen ratio, and skin sections. Inhibition of 5αreductase activity by extract and isolate suggest that the extract reversed androgen induced alopecia by inhibiting conversion of testosterone to dihydrotestosterone (Pandit *et al*., 2008) [16].

Anxiolytic activity

The study showed that methanol extract of *Cuscuta reflexa* 400 mg/kg significantly increased the time spent on the open arms and decreased the number of entries into closed arms. The extract 400 mg /kg showed significant anxiolytic effect compared to 200 mg/kg in both models. The 400 mg/kg effect was comparable to standard. Thus methanol extract of *Cuscuta reflexa* could serve as good anxiolytic agents and seems to be promising for the development of phytomedicines for anxiety (Thomas *et al*., 2015) [22].

Relaxant and spasmolytic action

The study revealed that aqueous and alcoholic extracts of *Cuscuta reflexa* stem exhibit relaxant and spasmolytic action on small intestine of guinea pig and rabbit. Also the extracts exhibited acetyl choline-like action (Prasad, 1965).

Anti-diabetic activity

The study showed that *Cuscuta reflexa* possesses significant anti-diabetic activity. The ethanolic extract prevented significant elevation of glycosylated hemoglobin *in vitro* with IC50 value being 11.25 /ug/ml that is comparable with the reference drug tocopherol. The extract produced significant decrease in blood glucose level when compared with control in alloxan induced hyperglycemic rats in the single dose experiment at the tested dose level and are comparable with the standard drug glibenclamide (Sandeep and Mittal, 2017) [18].

Antioxidant activity
The study revealed that both *Cuscuta reflexa* and *Cassytha filiformis* possess antioxidant activity, in which *Cuscuta reflexa* being more effective than the *Cassytha filiformis* in scavenging free radicals and superoxide radical (Sharma *et al*., 2012) [19].

Anti-tumor activity
The results of the study revealed that chloroform and ethanolic extract of *Cuscuta reflexa* exhibit significant anti-tumor activity in EAC-bearing mice that is comparable to that of the reference standard, 5-fluorouracil (Chatterjee *et al*., 2011) [7].

Hypoglycemic activity
Methanolic extract of *Cuscuta reflexa* Roxb. and its subsequent ethyl acetate fraction showed significant inhibition against α-Glucosidase. It is a membrane bound enzyme at the epithelium of the small intestine. Inhibition of this enzyme prolongs the absorption time of glucose in the blood after a meal (Eram *et al*., 2002) [9].

Diuretic activity
Aqueous and alcoholic extracts of *C. reflexa* showed diuretic activity in wistar rat (Sharma *et al*., 2009) [20].

Anti-HIV activity
The crude water extracts of *Cuscuta reflexa* exhibited anti-HIV activity which could be due to combinatory effects with compounds of different modes of action. The methanol extract of C. reflexa exhibited anti-bacterial and free radical scavenging activity (Mahmood *et al*., 1997) [14].

Conclusion
Aftimoon (*Cuscuta reflexa*) is one of the most important herbs used in Unani system of medicine since centuries. It has been subjected to various phytochemical investigations which have discovered important a variety of chemical constituents. Various experimental studies have proved its traditional claims and also explored novel therapeutic actions. However there is a need to explore other hidden beneficial potential of this plant.

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