

**CONVOLVULUS ARVENSIS – A USEFUL WEED**MANBIR KAUR<sup>1</sup>, A.N.KALIA<sup>2</sup>I.S.F. College of Pharmaceutical Sciences and Research, Moga<sup>1,2</sup> Punjab. Email: manbirmanu@yahoo.com

Received: 3 Sep 2011, Revised and Accepted: 6 Nov 2011

**ABSTRACT**

It has been reported that the *Convolvulus* is a genus of flowering plants in Convolvulaceae family. Many of the species of this genus are problematic weeds but several members such as *Convolvulus arvensis* possess cytotoxic activity on some tumor cell lines. Pharmacologically water extract (aerial parts) of *Convolvulus arvensis* is rich in high molecular weight proteoglycan mixture (PGM), and has potent anti-angiogenesis and stimulating effects (immune system). Phytochemical studies on this plant showed the presence of Saponins, steroids, flavonoids and alkaloids, proteins and lipids.

**Keywords:** *Convolvulus arvensis*, Morning glory, Anti-angiogenesis, Field Bindweed

**INTRODUCTION**

The genus *Convolvulus* contains about 250 species. Many of the species of this genus are weeds, which can swamp other valuable plants by climbing over them, but some are deliberately grown for their attractive flowers. Field bindweed is a dicotyledonous, persistent, perennial vine of 2 m in height of the morning-glory family (Convolvulaceae) which spreads by rhizome and seed<sup>(1)</sup>. It is a weak-stemmed, prostrate plant that can twine and may form dense tangled mats<sup>(2)</sup>. Field bindweed (*Convolvulus arvensis*) is a serious perennial plant that occurs throughout the temperate regions of the world<sup>(3)</sup>. This species is among top 10 weeds of the world and is reported from about 54 countries as a weed in 32 different crops<sup>(4)</sup>. The plant is found in dry and moist soil having neutral (6.6-7.5) or alkaline pH (7.9-8.5). The weed can survive for long drought periods due to extensive root system, but prefer rich and fertile soils<sup>(5)</sup>. *Convolvulus arvensis* is commonly called as 'field bindweed' in English and 'hiran khuri' in Hindi. Other common names are 'possession vine,' 'creeping jenny,' 'creeping charlie'<sup>(2)</sup>, 'field morning-glory,' 'orchard morning-glory'<sup>(6)</sup>, 'European bindweed'<sup>(5)</sup>, 'corn-bind,' 'morning-glory'<sup>(7)</sup>, and 'small-flowered morning-glory'.

**Etymology**

*Convolvulus* comes from the Latin word *convolv*, which means 'rolling together' or 'twining'. *Arvensis* is the Latin word for 'field'.<sup>(8)</sup>

**Morphological Characters****Leaves**

The leaf is ovate-oblong to lanceolate, 1.5 cm -5 cm long and 1-3 cm wide, with an acute or mucronate apex and hastate, sagittate and cordate base. The leaf margin is entire and divided into three lobes, with lateral ones spreading and the middle one ovoid elliptical, narrowly triangular, lanceolate, oblong or suborbicular. Palmate veins begin at base of leaf and become pinnate for remainder of the leaf. The veins are depressed on the upper surface and are raised on lower surface.

**Stem**

Stems are 1.5 m or longer and are trailing, twining, herbaceous, and glabrous to pubescent. Due to twisting, they appear to be 4-5 angled.

**Flower**

Inflorescence is axillary cyme composed of one or three flowers. The pedicels are significantly longer than calyx, with hairy sepals being 2.5-5mm long. The broad funnel shaped corolla is 15-26mm long, five lobed, white or pink, and occasionally has a pinkish and whitish midpetaline bands. The flowers have five fused petals. Five stamens of unequal lengths are attached to the base of the corolla. The pistil is compound with two thread-like stigmas<sup>(4)</sup>. The flowers are hermaphrodite and pollinated by bees, flies.

**Fruit**

The fruits are capsule and 4-valved, generally 6mm long and dehiscent<sup>(9)</sup>. Capsules are glabrous containing four dark brown to black seeds.

**Seed**

Seeds are wedge-shaped, obovate to broadly obovate<sup>(10)</sup> in outline, (2.5)3.0-4.5 mm long, 2.0-3.0(3.5) mm wide, 2-3 mm thick. Dorsal side strongly arched toward the apex and sloping downward to a bluntly pointed base, two ventral sides flat or slightly concave and forming a blunt ridge (keel) where they join. Testa is dull, light to dark grey or orange-brown in colour with numerous whitish, blunt tubercles or wavy ridges. Seeds are dark brown to black, and have rough surfaces. Their shapes vary, depending on the number produced in the fruit. They are round when only one fruit is produced and progressively thinner as more are produced<sup>(11)</sup>.

**Ethnopharmacology**

The plant is reported to have used in traditional medicine system from as early as 1730s<sup>(12)</sup>. Traditionally it is used to treat skin ulcers, reducing wounds, inflammation and swelling<sup>(13)</sup>. The whole plant (without roots) is used for abdominal pain and abdominal worms in children. A tea made from flowers is laxative<sup>(14)</sup> and also used to treat muscular weakness<sup>(15)</sup>. The leaves extract is immunostimulant<sup>(16)</sup>. The plant is also reported to have diuretic effect<sup>(17)</sup>. It was also reported in folk medicine that leaves have been used in asthma<sup>(18)</sup>, jaundice<sup>(19)</sup> and as antihemorrhagic<sup>(20)</sup>.

**Phytochemical Investigation**

Phytochemical studies on this plant showed the presence of Saponins<sup>(21)</sup>, Flavonoids and caffeic acid<sup>(22)</sup>, alkaloids<sup>(23)</sup>, lipids<sup>(24)</sup>, and  $\delta$ -amino levulinic acid. Field bindweed was found to contain the tropane alkaloids tropine, pseudotropine, and tropinine and the pyrrolidine alkaloids cuscohygrine<sup>(25)</sup> and hygrine<sup>(26)</sup>.

Seeds from *Convolvulus arvensis* contained 6.7-16.5% oil. The chemical composition of oil consist of palmitic 6.6-10.0%, stearic 12.0-19.6%, oleic 21.6-30.0%, linoleic 27.8-41.3%, linolenic 6.0-9.2%, arachidic 3.3-6.4%, behenic acid 2.8-4.3%.

TLC and HPLC were applied to carry out qualitative and quantitative determination of polyphenolic compounds in the plant, such as coumarins and phenolic acids. It was identified and confirmed that umbelliferon and scopoletin were present in coumarin fraction. In the fraction of phenolic acids the occurrence of protocatechuic, caffeic, chlorogenic, gentisic, p-coumaric, p-hydroxybenzoic, p-hydroxyphenylacetic, ferulic, vanillic and salicylic acids were present<sup>(27)</sup>.

The aerial parts, roots, and flowers of *Convolvulus arvensis* were investigated for their secondary metabolites. Eleven flavonoids were detected, namely Kaempferol and its 3-O- $\beta$ -D-glucoside, 7-

O- $\beta$ -D-glucoside, 3-O- $\alpha$ -L-rhamnosyl, 7-O- $\beta$ -D-glucoside, 3-O-rutinoside, 7-O-rutinoside, 3-O- $\alpha$ -L-rhamnoside and 3-O- $\beta$ -D-galactorhamnoside as well as Quercetin and its 3-O- $\alpha$ -L-rhamnoside and 3-O-rutinoside. Four coumarins reported are 7-hydroxycoumarin (umbelliferone); 6,7-dihydroxycoumarin (esculetin); 6-methoxy-7-hydroxycoumarin (scopoletin) and 6-

methoxycoumarin 7-O-glucoside (scopoletin 7-O-glucoside). Amino acids and free sugars were also detected (28).

Phytochemical screening revealed the presence of tannins, flavonoids, unsaturated sterols/triterpenes, carbohydrates, lactones and proteins/ amino acids (29). The chemical constituents reported in *Convolvulus arvensis* are enumerated in the following table:

**Table 1: List of some reported chemical compounds in *Convolvulus arvensis***

S. no.	Compound	Chemical type	Plant part
1.	$\alpha$ amyrin	Pentacyclic triterpene	Aerial parts
2.	Campesterol	Steroid	Aerial parts
3.	Stigmasterol	Steroid	Aerial parts
4.	$\beta$ sitosterol	Steroid	Aerial parts
5.	Convovulin	resin	Root
6.	Cuscohygrine	Polyhydroxy alkaloid	Root
7.	Scopoletin	Coumarin	Aerial parts
8.	Quercetin	Flavonoids	Aerial parts
9.	Umbelliferone	coumarin	Aerial parts
10.	Chlorogenic acid		Shoot
11.	Kaempferol	Flavonoids	Aerial parts
12.	7-o- $\beta$ -D-glucoside	Flavonoids	Root, flowers, aerial parts
13.	3-o- $\beta$ -D-galactorhamnoside	Flavonoids	Roots, Aerial parts, Flower
14.	7-o-rutinoside	Flavonoids	Root, flowers, aerial parts
15.	3-o- $\alpha$ -L-rhamnosyl	Flavonoids	Root, flowers, aerial parts
16.	3-o- $\alpha$ -L-RHAMNOSIDE	Flavonoids	Root, flowers, aerial parts
17.	Kaempferol -3-o- $\beta$ -D-Glucoside	Flavonoids	Root, flowers, aerial parts
18.	Quercetin-3-o- $\alpha$ -L-Rhamnoside	Flavonoids	Root, flowers, aerial parts
19.	Esculetin	Coumarin	Roots, aerial parts
20.	Scopoletin-7-o-glucoside	Coumarin	Root, Aerial parts
21.	n-butyric acid	Lipid	Root
22.	Iso-butyric acid	Lipid	Root
23.	Palmitic Acid	Lipid	Seed oil
24.	Oleic Acid	Lipid	Seed oil
25.	Stearic Acid	Lipid	Seed oil
26.	Behenic acid	Lipid	Seed oil
27.	Arachidic acid	Lipid	Seed oil
28.	Linolenic acid	Lipid	Seed oil
29.	Linoleic acid	Lipid	Seed oil
30.	$\beta$ methylesculetin	Coumarin	Entire plant
31.	Calystegins	Alkaloid	Root
32.	Rutin	Flavanoid	Shoot
33.	Protocatechic acid	Phenolic acid	Aerial parts
34.	Caffeic acid	Phenolic acid	Aerial parts
35.	Gentisic acid	Phenolic acid	Aerial parts
36.	p-coumaric acid	Phenolic acid	Aerial parts
37.	Syringic acid	Phenolic acid	Aerial parts
38.	Vanillic acid	Phenolic acid	Aerial parts
39.	Ferulic acid	Phenolic acid	Aerial parts
40.	p-hydroxyphenylacetic acid	Phenolic acid	Aerial parts
41.	p-hydroxybenzoic acid	Phenolic acid	Aerial parts

### Pharmacology

- A purified bindweed extract is used to inhibit the growth of tumour cells, inhibit the growth of blood vessels and enhance immune function. The high molecular weight extract 1-200  $\mu$ g/egg inhibit angiogenesis in chicken chorioallantoic membranes by 73% and at the dose of 14 mg inhibited tumour growth in mice by 77% (30).
- The polyhydroxytropene alkaloid (Calystegins) from roots of naturally growing *Convolvulus arvensis* showed significant inhibitory activity towards  $\beta$ -glucosidase and  $\alpha$ -galactosidase.
- Total alkaloid extracts when administered to cats and rabbits, gave a hypertensive effect with vasodilation and an increase in the coronary circulatory rate (31).
- The roots and also a resin made from it is cholagogue, diuretic, laxative and strongly purgative. (17)
- The dried root contains 4.9% resin. The juice of the root is used in the treatment of fevers (32).
- The aqueous and alcoholic extract showed moderate diuretic, tranquilizing, hypoglycemic, antihemorrhagic activity, in addition to antibacterial and antifungal effects. The extracts were found to be safe for liver and kidney functions. They also act to relieve intestinal and uterine pain (33).
- White rats were examined for the effect of convaren-dried extract of plant *Convolvulus arvensis* L on liver bile secretory function in case of acute necrosogenic hepatitis. Convaren is proven to eliminate abnormalities of liver thus convaren is recommended for treatment of acute hepatitis (34).
- *Convolvulus arvensis* induced a dose dependent (0.4-2.8mg ml (-1) relaxation of rabbit duodenal smooth muscle (29).

## CONCLUSION

In conclusion we can say that *Convolvulus arvensis* is found to be very useful plant. By going through literature review, various pharmacological activities of this plant has been familiarized and it is also found that plant contains a wide range of phytoconstituents which needs to be explored more and more. So that the single constituent related activity can be performed.

## REFERENCES

1. Wiese AF and Phillips WM. Field bindweed. Weeds Today 1976; 7:22-23.
2. Gleason HA, Cronquist A. Manual of the vascular Plants of the Northeastern United States and Adjacent Canada. D. Van Nostrand Company, Inc., Princeton, NJ 1963.
3. Weaver SE, Riley WR. The biology of Canadian weeds. 53. *Convolvulus arvensis* L. Canadian journal of plant science 1982; 62:461-72.
4. Swan DG. Field Bindweed, *Convolvulus arvensis* L. Bulletin 0888. Washington State University.
5. Zouhar K. *Convolvulus arvensis*. In: fire effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research station. 2004
6. <http://www.fs.fed.us/database/feis>.
7. Whiteside RE. Field Bindweed. A growth stage indexing system and its relation to control with glyphosate. PhD thesis, 1979; 76.
8. Callihan RH, Eberlein JP, McCaffrey and Thill DC. Field bindweed: Biology and management. University of Idaho, Cooperative Extension System, College of Agriculture Bulletin 719. 1990
9. Bailey HL. *How Plants Get Their Names*. New York, New York, USA: Dover Publications, Inc. 1963
10. Tenaglia D. Missouri Plants, 2006.
11. [http://www.missouriplants.com/Whitealt/Convolvulus\\_arvensis\\_page.html](http://www.missouriplants.com/Whitealt/Convolvulus_arvensis_page.html)
12. The book of Field and roadside: Open country weeds, trees, and wildflowers of eastern North America by John Andrew Eastman, John Eastman.
13. Brown EO and Porter RH. The viability and germination of seeds of *Convolvulus arvensis* L and other perennial weeds. Agricultural Exp. Station. Iowa state College, Research Bulletin 294, 1942.
14. Daniel F. Austin "Bindweed (*Convolvulus arvensis*) in North America-From medicine to menace. Journal of the Torrey botanical society 2000; 127(2): 172-177.
15. Chopra IC. Chopra's Indigenous Drugs of India 2nd Ed. UN Dhur and Sons Pvt. Calcutta 12. 1958.
16. Foster s, Duke JA. A field guide to Medicinal Plants. Houghton Mifflin Co., New York, USA 1990.
17. Alan Keith Tillotson, 'selections from the One earth herbal Sourcebook' Section two: "The best of the best" Herbs Chapters 7-8, 2001.
18. Bowait MA et al. Immunostimulant effects of bindweed (*Convolvulus arvensis*) extract in rabbits. Research journal of pharmacology 2010, 4(2):51-54.
19. Chopra et al. Glossary of Indian Medicinal Plants (including the supplement). CSIR, New Delhi, India. 1986.
20. Bolus L. In "Medicinal plant of North Africa". Reference Publications Inc. 1983, 68.
21. Thomas SC. In "Medicinal Plants". Ulture utilization and phytopharmacology. Technomic Publication Co. Lancaster, Brazil 2000; 635.
22. Shahina AG. In "Hand book of Arabian medicinal plants". CRC. Press, 1994; 89-90.
23. Koczwaea M. Publ. Pharm. Communication. Pol. Academic Science 1949; 1:312.
24. Hiremath SP, Hosurkan VS et al. J Karnatak 1969; 14: 49.
25. Stoller EW and Webber E.L. Journal of Agriculture and Food Chemistry 1970; 18:361.
26. Evans WC and Somanabhandhu A. Phytochemistry 1974; 13: 519
27. Todd F G, Stermitz F R, Schultheis P, Knight A P and Traub-Dargatz J. Tropane alkaloids and toxicity of *Convolvulus arvensis*. Phytochemistry 1995; 39: 301-303.
28. Badami RC, Thakkar, Jayshree. Department of chemistry, Karnatak University, Dhawad, India. Fette, Seifen, Antrichmittel. 1984, 86(5): 203-4.
29. Krzaczek T, Bogucka Kocka A, Ryn D. Department of Pharmaceutical Botany, Skubiszewki Medical University, Lublin, Pol. Herba Polonica 2004, 50 (3/4): 17-22.
30. Atta attia H, Mounier Samar M. Department of pharmacology, Faculty of veterinary medicine, Cairo University, Giza 12211, Egypt. Journal of ethnopharmacology 2004, 92(2-3): 303-9.
31. Meng XL, Riordan NH, Casciari JJ, Zhu Y, Zhong J, Gonzalez MJ, Miranda-Massari J R and Riordan H D. Effects of a high molecular mass *Convolvulus arvensis* extract on tumor growth and angiogenesis. P. R. Health Science Journal 2002; 21: 323-328
32. Molyneux RJ, PanYT, Goldmann A, Tepfer DA and Elbein A D. Calystegins, a novel class of alkaloid glycosidase inhibitors. Arch. Biochemistry Biophysics 1993; 304: 81-88.
33. Voronina MN, Frmakol I. Toksikol 1966; 29(1): 70.
34. Manandhar NP. Plants and people of Nepal Timber Press. Oregon. 2002, ISBN 0-88192-453-9.
35. Awaad AS et al. Aromatic and Medicinal Plant Department, Desert Research center, cairo, Egypt. Asian Journal of chemistry 2006; 18(4): 2818-2826.
36. Khakimov ZZ, Tsoy IV, TashkGosVtoroimed. Inst., Tashk. GosVtoroi med. Inst. Tashkent, Uzbekistan. O'zbekistan Biologiya Jurnal 2005; 6:7-13.