A REVIEW ON MACROSCOPICAL, PHYTOCHEMICAL AND BIOLOGICAL STUDIES ON *CONVULVULUS ARVENSIS* (FIELD BINDWEED).

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Summary

Convolvulus arvensis is a long lived deep rooted weed belongs to the family Convolvulaceae. It is commonly known as European bindweed, bindweed, creeping jenny, morning glory**,** and devil's guts. It has at least 84 common names. Field bindweed is found in a wide range of habitats: orchards, vineyards, roadsides, ditch banks, cropland, steam banks, and lakeshores. Field bindweed begins growing in the late spring or early summer and may persist until the first frost. It is most likely confused with the Ipomoea spp., Calystegia spp., Dioscorea spp, *Polygonum convolvulus* L. It is very much difficult to differentiate between all these species. The plant contains Saponins, Alkaloids, and Polyphenolic compounds Flavonoids and Tannins. It has stimulant, anti-oxidant, anticancer and laxative effect. This review shows its identification, some of the isolated compounds and its biological activities.

Keywords: Convolvulus, Convolvulus arvensis, Bindweed, Hiranpadi, Anticancer

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Introduction

Convolvulus is a genus of about 250 species of flowering plants[1] ,They are annual or perennial herbaceous vines, bines and (a few species of) woody shrubs, growing to 0.3-3 m tall. The leaves are spirally arranged, and the flowers trumpet-shaped, mostly white or pink, but blue, violet, purple or yellow in some species. Many of the species are problematic weeds, which can swamp other more valuable plants by climbing over them, but some are also deliberately grown for their attractive flowers. *Convolvulus* species are used as food plants by the larvae of some Lepidoptera species[10]**.** Previous preliminary studies have revealed that different members of the family of Convolvulaceae[22] possess Cytotoxic effects against a number of tumor cells [9]. *C.arvensis* is one of its species[34]. *C.arvensis* is a long lived deep rooted weed belongs to the family convolvulaceae. It is commonly known as European bindweed [39]**,** bindweed, creeping jenny [45], morning glory [8]**,** and devil's guts. It has at least 84 common names [22, 41, 42]**.** Most people assume weeds have no therapeutic value. However, the difference between weeds and herbs may merely be our understanding of them. Weeds are unwanted plants and are considered harmful, as they compete with crops for light, moisture and nutrients, and harbour insects and diseases harmful to crops. For farmers and agriculture specialists, weeds are unwanted plants, but for herbalists, all weeds are useful plants. Such is the case of *convolvulus arvensis*; new research is showing it has great promise as a useful, safe and nontoxic chemotherapeutic agent [29]**.** It is which spreads by rhizome and seed [45]. Field bindweed is found in a wide range of habitats: orchards, vineyards, roadsides, ditch banks, cropland [18]**,** stream banks, and lakeshores [2,11] , suggests that trees and shading help control the weed, and habitats that are most like agricultural lands (little competition, repeated disturbance and high light) are ideal for growth of field bindweed. It is a weak-stemmed, prostrate plant that can twine and may form dense tangled mats [20]**.** Field bindweed continues to cause major crop losses in the semi-arid northern and central Great Plains. It grows well, but is less troublesome and more easily controlled with herbicides in areas of highe rainfall and humidity [44]. The hormone weed killers like 2; 4-D and MCPA give good control in the year of treatment. With the correct dose and timing there is also good control in the year after treatment. Adding paraquat to 2, 4-D reduces the effect in the year after treatment. Repeated annual treatment with high doses of chlorthiamid that prevent shoot growth for the entire season are no more effective against the underground growth than the standard dose of 2,4-D [23,25].

Adulterants

It is most likely confused with the Ipomoea spp., Calystegia spp., Dioscorea spp, *Polygonum convolvulus* L. It is very much difficult to differentiate between all these species. *Polygonum convolvulus* L. (black or corn bindweed) is a hairless annual species with fibrous roots and slender climbing stems. Unlike field bindweed, its arrow-shaped leaves (2-5 cm long) are not variable in shape. The showy, funnel-shaped flowers of *Convolvulus arvensis* are unlikely to be confused with *Polygonum convolvulus*'s clusters of inconspicuous, greenish-white flowers. Out of flower, *Polygonum convolvulus* can be identified because each leaf node is surrounded by a membranous or papery sheath, characteristic of the genus Polygonum. Convolvulus does not have such sheaths. The stems of *Polygonum convolvulus* are often red and twisted [8]**.** One consistent difference seems to be in style form: that of Ipomea is small and capitates with 1-3 lobes. The style of *Convolvulus* is linear to oblong and there are always 2 lobes. Another (less reliable) difference is that the sepals of *Ipomoea* are usually unfused, and those of *C. arvensis* are always fused. *C. arvensis* may be distinguished from *Dioscorea* species by its actuate-pinnate venation with several main veins intersected by lateral secondary veins. If only a stem is available for identification, *Dioscorea* tends to twine in the opposite direction of *Convolvulus*. *Dioscorea* has inconspicuous, trimerous greenish flowers, which means the easily-identified morning glory flower of *C. arvensis* is a good distinguishing feature. Leaves of *Dioscorea* have 7-9 major veins each whereas there are only three prominent veins on individual leaves of *Convolvulus*. *Calystegia is differentiated by Convolvulus by its* smooth pollen grains and its unilocular ovary[41, 42] .Like other weeds, field bindweed takes nutrients and water that would otherwise be available to desirable species[19, 39]. It can reduce the available soil moisture in the top 60cm of soil to below the wilting point for many species[43]**.**

Habitat

Field bindweed begins growing in the late spring or early summer and may persist until the first frost. In California, it grows from May through October[21, 24, 28] suggests a growth period of June to September for the north-eastern United States. In Canada, growth begins when day temperatures are near 20°C and night temperatures are at least 14°C[43]. Seeds fall near the parent plant[35] but can be transported by water[43] or birds[33]**.**

Characters

Leaves (Fig. 1)

They are dull green with readily visible veins. The petiole is flattened, and grooved on the upper side. The first true leaves are dull green and may be covered with fine granules on the upper surface. Leaves of this species are extremely variable, possibly reflecting variability in soil moisture and fertility The most common leaf type is hastate or sagittate, which means they have distinctive arrowhead shapes with pointed lobes at the bases. Some leaves are round, ovate or oblong, and some may even be linear. These deviations from the typical leaf types may be found on plants growing in disturbed conditions[18].

C.arvensis has two varieties: *Convolvulus arvensis* var. *arvensis*. Leaves broader.

Convolvulus arvensis var. *linearifolius*. Leaves narrower

Stems (Fig no. 2)

The stems of field bindweed are slender vines that run along the ground or climb any available object. Stem length ranges from one to six feet (0.3-1.8 m), they often twine, form dense, tangled mats, and they are normally hairless but can be pubescent. The stem function is to grip with neighbouring erect plants or structures and so climbs up to get better sunlight and exposure of its flowers. Doing so, the tight twinning may kill the host plants[23].

Flowers (Fig no. 3)

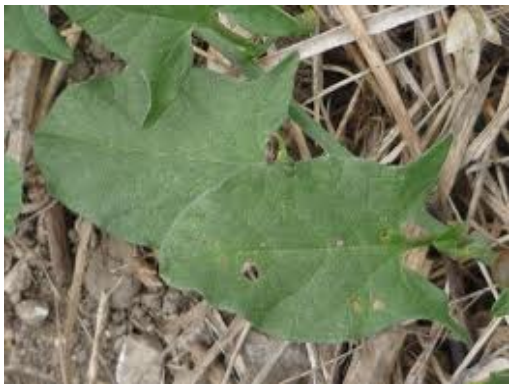
The flowers have five fused petals forming a 2-2.5 cm long funnel-like corolla. Petals are generally white to very pale pink. The sepals are approximately 5mm long, oblong and separate. Five stamens of unequal lengths are attached to the base of the corolla. The pistil is compound with two thread-like stigmas[43].

Inflorescence (Fig no. 4)

Flowers either single or in loose cymes of up to 3 flowers. Peduncle to +6cm long, with opposite to sub opposite pair of bracts at apex (subtending pedicels), pubescent. Bracts to +4mm long. Pedicels to -2cm long, with pair of opposite to sub opposite bracts in middle, pubescent to tomentose. Bracts to +/-3mm long, linear.

Fruits (Fig no. 5)

Each fruit is about 8mm wide, rounded, light brown. Seeds are dark brown to black, and have rough surfaces. They are 0.5-1.2 cm long, and their shapes vary, depending on the number produced in the fruit; they are rounder when only one is produced and progressively thinner as more are produced. Field bindweed fruits usually contain 2 seeds, but 1-4 seeds are not uncommon; an anomalous Russian specimen was found with 10 seeds in a capsule [7].



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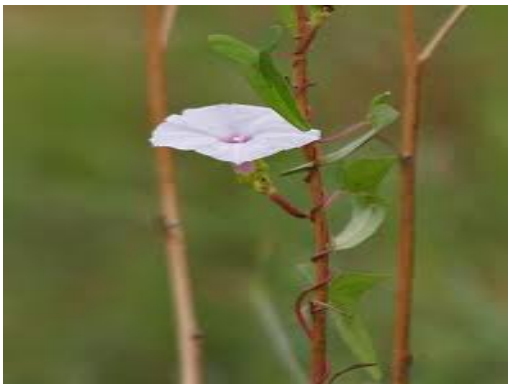

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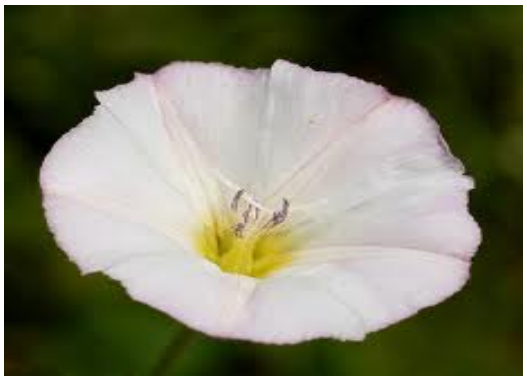

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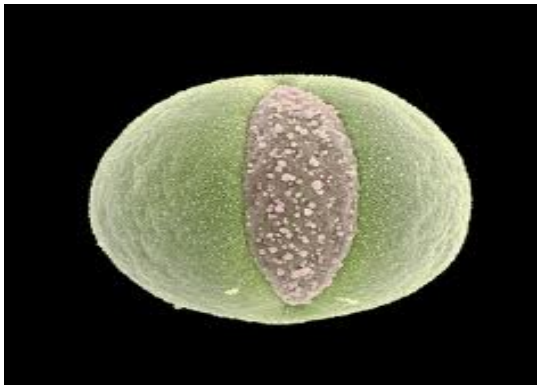

(Fig no. 5)

Roots

Field bindweed produces an extensive system of roots and rhizomes whitish in colour, cordlike, and fleshy. The primary root forms a taproot that can penetrate the soil to depths of two to ten feet (0.5-3 m). Lateral roots grow from buds along the taproot and from adventitious buds at the stem base[23, 45]**.** Field bindweed has an extensive underground root. Field bindweed's root growth has been studied since the turn of the century. Young plants

extend a taproot deep into the soil and then form lateral roots. Initially, these lateral roots function as feeding roots for above-ground growth[19].

Chemical constituents

Alkaloids are present in the water extract [9, 26]**.** Cuscohygrine and calystegines have been previously reported from *C. arvensis* roots. These alkaloids have anti-cancer activity but may also be toxic to the host at high doses. Pseudotropine, the major alkaloid, is known to affect motility and might represent a causative agent for the observed cases of equine intestinal fibrosis[40] lesser amounts of tropine, tropinone, and meso-cuscohygrine is also present. Because of the presence of these alkaloids bindweed shows toxicity in mice[38].Aerial parts of the plant contains Polyphenolic compounds Flavonoid and tannins[17]. Thirteen saponins were isolated and identified from *C. Arvensis*[14]. Flavonoid glycosides like are well distributed in the leaves : Kaempferol3-mono- glycosides and Quercetin 3-mono or di- glycosides[46]**.** Nine glycosidase activities were detected in isolated cell wall of cultured *C.arvensis* cells[30]**.** Acidic ethyl acetate extract of leaves contains phenolic compounds including p-hydroxybenzoic acid, syringic acid, vanillin, benzoic acid and ferulic acid and Flavonoid like rutin[15]. Water extract contains primarily proteins and polysaccharides[26]. Extracts of the plant largely comprised of proteoglycan molecules (PGMs)[34]**.**

Uses

The plant is reported to have used in traditional medicine system from as early as 1730s. Aerial parts of *C.arvensis* is used as laxative, wound healing, anti-spasmodic and ant haemorrhagic, anti-angiogenetic effect[3,13,16,28,34]. It was also described as a purgative and fever-reducer. It is still used in Turkey as a vegetable and condiment; in Arabic-speaking areas, the roots and leaves are still used as an anti-hemorrhagic and laxative[5]. 1-2 tsp of fresh root extract is mixed with a pinch of sugar powder in a glassful of coconut milk and given once a day for 18-21days with ground nut seeds(*Arachys hypogea*) for curing mumps[37]**.** Tumours secrete substances that block local regulatory control measures and allow for unnaturally fast growth and replication. Many natural and chemical agents have been employed with the aim to halt or block angiogenesis, in an attempt to arrest malignant growth, development and metastasis. One well-known natural substance promoted for its ability to halt tumour growth is shark cartilage. Recently, however, a natural substance from a

this weed has been found to inhibit angiogenesis 100 times more effectively than shark cartilage, and it is ubiquitous [34]**.** Extracts of *Convolvulus arvensis*, ironically known as "the cancer of weeds," hold great promise as a tool in the fight against cancer. The water extract inhibit tumour growth in a dose-dependent fashion when administered orally. At the highest dose tested, 200 mg/kg/day, tumour growth was inhibited by roughly seventy percent. Subcutaneous or intraperitoneal administration at 50 mg/kg/day also inhibited tumor growth by over seventy percent. The extract's acute LD50 in Kun Ming mice was 500 mg/kg/day when injected, indicating that tumour growth inhibition occurred at non-toxic doses. It inhibited angiogenesis in chick embryos, improved lymphocyte survival ex vivo, and enhanced yeast phagocytosis, but did not kill tumour cells in culture[26]. Cytotoxic activity is also evaluated on different extracts. Chloroform extract showed the highest Cytotoxic effect among the extracts (IC50 = 15 µg/ml) whereas ethyl acetate and hydroalcoholic extracts were less Cytotoxic against Hela cells (IC50 = 25 and 65µg/ml, respectively) [36]**.** One preparation is also available in the market named Vascustatin. It is a water extraction of the leaves of the herb Convolvulus arvensis and is rich in proteoglycan mixture (PGM). In combination with proper nutrition, it enhances the immune system's ability to maintain good health[4]**.** Toxicity of *C. arvensis* in mice had been investigated many years ago[35]. It is mildly toxic to some grazing animals. However, grazing has been used in the past as an attempt to control the weed. The amount of field bindweed that can be safely eaten by sheep, cattle, and goats is not known. It is reported to cause distress in hogs that eat it[8]. Proteins, PGM present in water extract inhibit the tumor growth and angiogenesis in chick embryo and improved lymphocyte [9, 26, 32]. Ant mutagenic activity of four saponins from *C. arvensis* is compared with a known promutagen: benzo-[a]pyrene (BaP) and mutagenic urine concentrate from a smoker[14]. The root of field bindweed, and also a resin made from the root, has agents that increase the flow of bile and its discharge from the body. Roots are also urine-inducing, laxative and strongly purgative. The dried root contains 4.9% resin. A tea made from the flowers is laxative and is also used in the treatment of fevers and wounds. A cold tea made from the leaves is laxative and is also used as a wash for spider bites or taken internally to reduce excessive menstrual flow. A green dye is obtained from the whole plant[27]**.** This weed has stimulatory effect on the immune system[6, 34]**.** Antioxidant Activity of Phenolic Rich Fraction Obtained from *Convolvulus arvensis* L. Leaves Grown in Egypt[15]**.**

Conclusion

Convolvulus is a genus of about 250 species of flowering plants belongs to the family Convulvulaceae. They are annual or perennial herbaceous vines, bines and (a few species of) woody shrubs, growing to 0.3-3 m tall. There are two varieties are available one is *Arvensis* which has broader leaves and other is *linearifolius* which has narrower leaves. It is commonly known as Hiranpadi, bindweed and European bindweed. Its identification is difficult because it is commonly adulterated with Ipomoea spp., Calystegia spp., Dioscorea spp, *Polygonum convolvulus* L.Traditionally its was commonly used as ant-helmintic in animals. Lots of research has been done on its Anticancer, Cytotoxic, laxative and stimulant action All aerial parts of *C. arvensis* has been ethno medicinally used as a therapeutic agent for a variety of diseases, as we have illustrated in this article. Moreover, numerous research works have proven its uses beyond the ethno medicinal ones in experimental animals. Its chemotherapeutic value has not been fully substantiated and the mode of action of its bioactive compounds against diseases has no yet been established. Alkaloids, Flavonoid, Tannins, Saponins, Glycosides which were isolated from this plant may be responsible for its pharmacological activities. For farmers weeds are waste plant but for herbalists all weeds are useful plants. The road ahead is to establish specific bioactive molecules from *C.arvensis* weed which might be responsible for these actions. Therefore the cultivation, collection, and further pharmacological exploration of *C.arvensis are* essential.

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