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Martynia annua L.: A Review on Its Ethnobotany, Phytochemical and Pharmacological Profile

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Martynia annua L. is a well-known small herbaceous annual plant in Ayurveda as kakanasika, which is being used in Indian traditional medicines for epilepsy, inflammation and tuberculosis. This weed has been known to possess anthelmintic, analgesic, antipyretic, antibacterial, anti-convulsant, antifertility, antinociceptive, antioxidant, CNS depressant and wound healing activity. A wide range of chemical compounds including oleic acid, arachidic acid, linoleic acid, palmitic acid, gentisic acid, stearic acid, pelargonidin-3,5-diglucoside, cyanidin-3-galactoside, p-hydroxy benzoic acid, apigenin, apigenin-7-o-glucuronide have been isolated from this plant. The aim of this review article was to summarize the information related to botany, phytochemistry, traditional and pharmacological activity of the *Martynia annua* plant.

Keyword: *Martynia annua*, Martyniaceae, Kakanasika, Antifertility, Antibacterial, Wound healing.

1. Introduction

1.1 Occurrence, Botanical Description and Ethnopharmacology:

Martynia annua L. (Family: Martyniaceae), is native of Mexico and also found throughout India, in waster places, rubbish heaps and road sides. The plant is commonly known as Devil's claw (English), Bichu (Hindi), kakanasika (Sanskrit) and Vichchida (Gujarati)[1].

It is a small herbaceous, erect, branched, glandular hairy annual herb growing upto 0.9-1.2 m in hight. Leaves are large, simple, opposite, green in color, broadly ovate to triangular-ovate, glandular hairy, 9–22 × 9–20 cm, cordate at base with sinuolate-dentate margin and acute apex, sticky as often covered with glutinous dew-like substance[2].

The scientific classification of the plant is given below:

Kingdom:	Plantae
Division:	Magnoliophyta
Class:	Angiosperms
Order:	Lamiales
Family:	Martyniaceae
Genus:	Martynia
Species:	*Martynia annua*

Glandular hairs exude a slimy sap which gives the plant a clammy feel. Stems are green, robust,

branched and covered with glandular hairs. Flowers are drooping, large, pale mauve or lavender in short spikes at the end of branches. They are tubular shaped 4-6 cm long, pink and dark purple blotched with yellow inside, foxglove shaped, ill-smelling and terminate in 5 spreading lobes with a prominent spot between each lobe[3]. Fruits are oblong, green and fleshy when young, becoming black and woody when mature, 3-4 cm long, 1-1.5 cm wide tapering into a long beak (claw), which splits into two sharp re-curved hooks when dry. Claws are shorter than the body of the fruit. Seeds are flat, brown to black, elongated, two seeds to each pod, usually remaining inside the pod[3]. Racemes are long, erect and terminal. Corolla are glandular hairy with very oblique mouth lobes[4-5].

In Ayurveda, the plant is known as kakanasika, which is being used in Indian traditional medicines for epilepsy, inflammation and tuberculosis[6]. The leaves and fruits are biologically active part of this plant[7-8]. The leaves of the *Martynia annua* are edible and used as antiepileptic and antiseptic, applied locally to tuberculous glands of the neck, the juice of the leaves as a gargle for sore throat and the leaf paste for wounds of domestic animals[9-10]. The fruit is considered alexiteric and useful in inflammations while ash of fruit mixed with coconut oil applied on burns[6]. Seed oil applied on abscesses and for treating itching and skin affections[11]. The Ayurvedic Pharmacopoeia of India recommended the seed of *Martynia annua* for arresting of graying of hair[6]. The fruits of *Martynia annua* used as local sedative and also used as antidote to scorpion stings to venomous bites and stings[12]. A detailed view of the ethno-medicinal uses of different parts of the plant is given in **Table 1**.

2. Phytochemistry:

Qualitative phyto-chemical analysis of whole plant extracts of *Martynia annua* reveals the presence of glycosides, tannins, carbohydrates, phenols, flavonoids and anthocyanins[13]. GC-MS studies on both aqueous and alcohol extract shows the presence of twenty eight compounds, out of which oleic acid, constitutes the major part. Other major biological compounds include pelargonidin-3-5-diglucoside, cyanidin-3-galactoside, p-hydroxy benzoic acid, gentisic acid, arachidic acid, linoleic acid, palmitic acid, stearic acid, apigenin, apigenin-7-o-glucuronide[14].

Table -1. Ethanobotanical information on *Martynia annua* L.

S. No.	Traditional uses	Plant part	Preparation	Reference
1	Antidote to venomous stings	Leaves	Paste	[12]
2	Antifertility	Root	Extract	[16]
3	Alexiteric	Fruit	Paste	[20]
4	Applied to tuberculous glands	Leaves	Paste	[20]
5	Epilepsy	Leaves	Paste	[21]
6	Gargle	Leaves	Juice	[20]
7	Inflammations	Fruit	Paste	[20]
8	Scabies	Ripe fruit	Oil	[22]
9	Scabies	Leaves	Eaten as such	[21]
10	Sedative	Root	Paste	[22]
12	*Tinea corporis*	Fruit	Oil	[22]
13	To kill bugs	Leaves	As such	[22]

The methanolic extract of *Martynia annua* leaves shows the presence of higher amount of terpenoid, alkaloids, glycosides, steroids, tannins and saponins and moderate amount of cardiac

glycosides, phenols and anthroquinones. While, it doesn't shows the presence of flavonoids and resins[15]. The leaves mainly contain chlorogenic acid, p-hydroxy benzoic acid, snapic acid[16] and fatty acids such as palmitic acid and stearic acid[13]. The flowers of the plant mainly contain cyanidin-3-galactoside and pelargonidin-3, 5-diglucoside whilst gentisic acid are present in fruits[16]. The seeds show the presence of arachidic acid, cyclopropenoid, linoleic acid, malvalic acid, oleic acid, palmitic acid and stearic acid[4]. A detailed view of the phytoconstituents present in different parts of the plant is given in Table 2 and chemical structures of some of the phytoconstituents were shown in Figure 1.

Table 2: Phytoconstituents of *Martynia annua* L. plant

S. No.	Phyto-constituents	Type	Plant part	Reference
1	Arachidic acid	Lipid	Seed	[23]
2	Chlorogenic acid	Phenolic acids	Leaves	[13]
3	Cyanidin-3-galactoside	-	Whole plant, Flowers	[16], [14]
4	Cyclo propenoid	-	Seeds	[23]
5	HCN	Cyanogenic group	Seed	[23]
6	Linoleic acid	Lipid	Seed	[23]
7	Malvalic acid	-	Seed	[23]
8	Oleic acid	Lipid	Whole plant, Seed	[23]
9	Palmitic acid	Lipid	Seed, leaves	[13], [23]
10	Pelargonidin-3,5-diglucoside	-	Whole plant, Flowers	[16], [14]
11	Stearic acid	Lipid	Seed, leaves	[13], [23]
12	Gentisic acid	Lipid	Fruits	[16]
13	p-hydroxy benzoic acid	Phenolic acids	Leaves	[13]
14	Apigenin, Apigenin-7-O-beta- D- glucuronide	Flavonoids	Whole plant, Seed	[14], [24]

3. Pharmacological Activities:

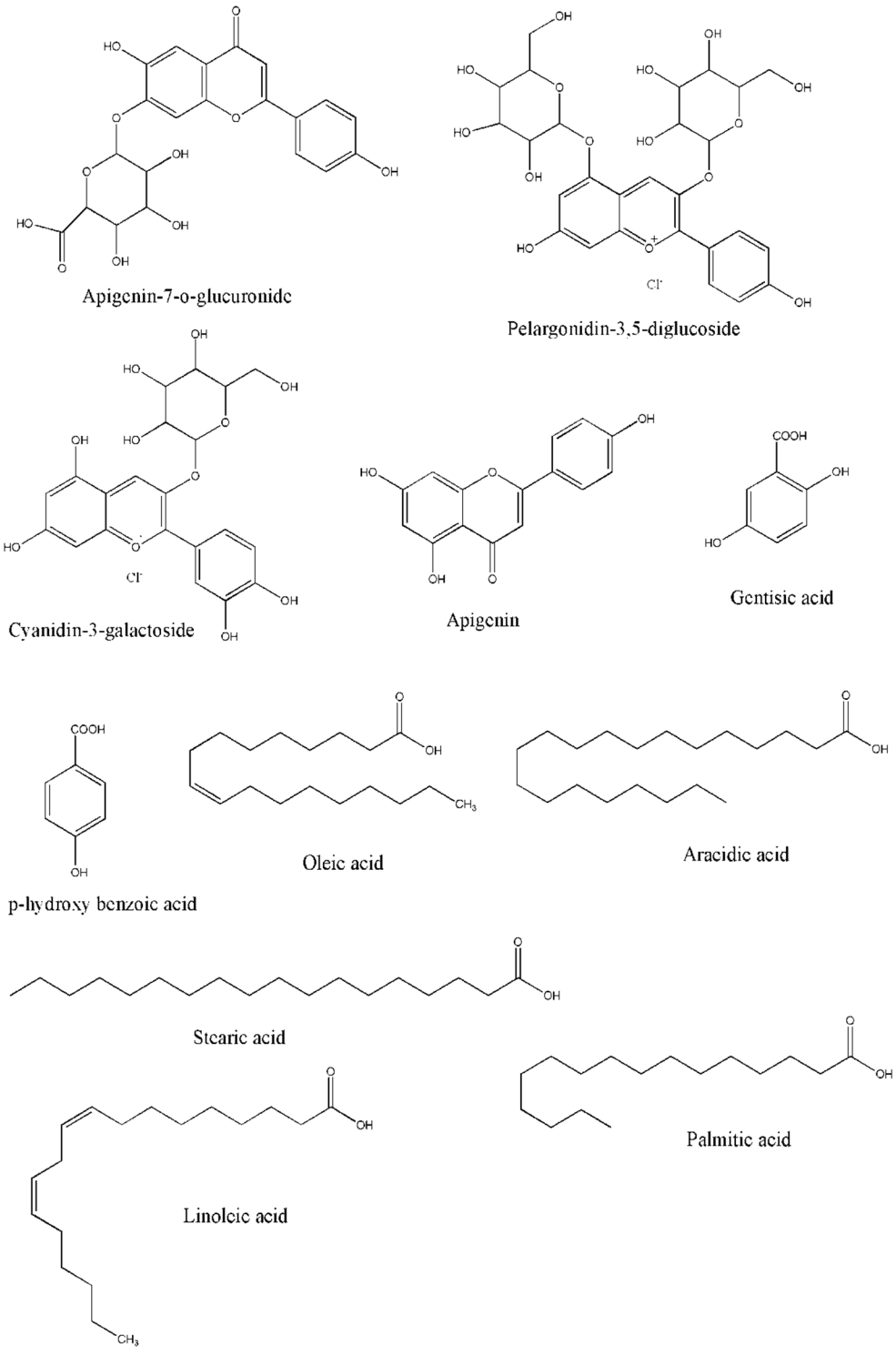
The use of *Martynia annua* as medicine is fairly large, yet, its curative efficacy have been assessed only for few cases. The present review explores the pharmacological potential of the plant.

3.1 Anthelmintic Activity: The petroleum ether extract of *Martynia annua* roots showed potent antihelmintic activity against earthworms *Pheritima posthuma* as compared with the reference drug albendazole[17].

3.2 Analgesic and Antipyretic Activity: The petroleum ether, chloroform, ethanol and aqueous extracts of *Martynia annua* fruits were evaluated for analgesic effect in Swiss albino mice using hot plate and tail flick methods and for antipyretic effect against brewers-yeast- induced hyperpyrexia in adult Wistar rats. The extracts show significant analgesic and antipyretic activity at 20 mg/kg. It was also observed that the petroleum ether and chloroform extracts exhibits greater analgesic and antipyretic activities as compared to ethanol and aqueous fruit extract of the plant[18].

3.3 Antibacterial: The chloroform, ethyl acetate and methanol extract of *Martynia annua* leaves were found antibacterial when evaluated against gram positive and gram negative bacteria. All the solvent extracts show antibacterial action respective to different bacterias. Chloroform extract shows higher antibacterial activity against *Proteus vulgaris*, Bacillus *subtilis* and *B. thuringensis*. Ethyl acetate extract was potentially effective against *Salmonella paratyphi A, Salmonella paratyphi B*, *Proteus mirabilis*, *P. vulgaris* and *Klebsiella pneumonia*, whereas the methnol extract, shows greater antibacterial potential towards *Proteus vulgaris*, *B. subtilis, S. paratyphi B* and *Pseudomonas aeruginosa*. The antibacterial activity was carried out by Disc Diffusion method in which all solvent extract were used as 100% concentration alone[15].

Figure 1: Chemical Structure of the Phytoconstituents



3.4 Anti-Convulsant: The methanol extract of *Martynia annua* (MEMA) leaves at doses of 200 mg/kg and 400 mg/kg were significantly reduced the duration of tonic hindleg extension and protect the animals from seizures. On comparing with, the standard drug phenytoin (100%) the

MEMA 200 mg/kg and 400 mg/kg have shown 66.31 % and 82.731 % protection respectively against maxima electroshock (MES) induced seizures whereas on comparison with the standard drug diazepam (100%) the MEMA 200 mg/kg and 400 mg/kg have shown 70.33% and 82.88% protection of convulsion and 83.33% and 100% protection of mortality respectively against pentylenetetrazol (PTZ) Induced epilepsy. However, the anticonvulsant activity of MEMA was due to the potentiation of neurotransmitter in brain[6].

3.5 Anti-Fertility:

The 50% ethanol extract of *Martynia annua* L. root at dose of 50 mg/kg, 100 mg/kg and 200 mg/kg body weight po, showed significant decreases in the weights of testes, epididymides, seminal vesicle and ventral prostate on male rats. Moreover, the antifertility effect was found to be dose dependent without altering general body metabolism[16].

3.6 Antinociceptive Activity and CNS Depressant activity:

The petroleum ether, ethyl acetate and methanol root extracts of *Martynia annua* were evaluated for antinociceptive and CNS depressant activity. Amongst all extracts petroleum ether extract at the dose of 50 mg/kg, i.p. showed significant increase in reaction time in hot plate method and also showed more inhibitory effect on writhing induced by acetic acid against all extracts and standard drug pentazocine and paracetamol respectively. Apart from this the petroleum ether extract at similar dose also showed significant reduction in the locomotor activity when compared with standard drug diazepam and at the dose of 30 mg/kg, i.p. it potentiates pentobarbitone sodium induced sleeping time up to 215.34%[19].

3.7 Antioxidant Activity: The methanol and aqueous extract of *Martynia annua* Linn. leaves were evaluated for antioxidant activity by *in vitro* methods, namely, reducing power assay, DPPH radical-scavenging activity, nitric oxide scavenging activity, H_2O_2 radical scavenging activity, superoxide radical scavenging assay, hydroxyl radical-scavenging activity, and total antioxidant capacity. The methanol extract was found to have higher antioxidant activity than the aqueous extract[1].

3.8 Wound Healing:

The methanol fraction of ethanolic extract of *Martynia annua* leaves shows significant wound healing effect by stimulating of wound contraction as well as epithelialization. Moreover, phytochemical studies demonstrated that the methanol fraction mainly contains flavanoid luteolin responsible for enhancement of wound healing process due to the free radical scavenging mechanism[13].

4. Conclusion:

Although the plants grown in rubbish heaps and in waste places, the herb is being used as an important medicinal plant since a long period of time. In view of the wide-ranging medicinal value of *Martynia annua* plants as described in Ayurvedic literature, it is imperative that more clinical and pharmacological trials are needed to investigate the unexploited potential of this plant.

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