REVIEW ARTICLE

A review: *Martynia annua* Linn., folklore plant with its phytochemical profile and pharmacological activities

Sakshi Bhardwaj, Sonal Dubey

Department of Pharmaceutical Chemistry, Krupanidhi College of Pharmacy, Bengaluru, Karnataka, India

ABSTRACT

Martynia annua Linn. is a well-known small herbaceous annual plant which being used in Indian traditional medicines for epilepsy, inflammation, and tuberculosis. *M. annua* L. known to possess so many pharmacological activities as analgesic, antipyretic, antibacterial, anthelmintic, anticonvulsant, antifertility, antinociceptive, central nervous system depressant, antioxidant, and wound healing activity. A wide range of phytochemical constituents have been isolated from the plant so far. This review article explores the traditional values of this plant along with pharmacognostical, phytochemical, pharmacological, and future aspects.

Keywords: Devil's claw, Kakanasika, *Martynia annua* L., Martyniaceae

Introduction

Drugs derived from plants secured importance in recent years because of their unrefuted efficacy as phytomedicines. The principle constituents or active compounds present in these natural plants serve as templates, lead molecules or as intermediates for synthetic drugs. During the past decade, plants have gained importance in the field of medicine. A large number of populations depend on the traditional practitioners, who are dependent on medicinal plants to meet their primary health care needs. Herbal medicine retained their image for historical and cultural reasons. Since the usage of these herbal medicines has increased regarding their quality, safety and efficacy in industrialized and developing countries.[1,2] *Martynia annua* belongs to family Martyniaceae, is an annual glandular hairy herb which is commonly known as Bichu or Ulatkanta (Hindi), Bichchhu, Devil's Claws (English), Kakanasika (Sanskrit), and Vichchida (Gujarati).[3] Leaves opposite, broadly ovate to deltoid, 9-22 × 9-20 cm, base cordate, apex acute, margins repand-dentate sticky as often covered with glutinous dew-like substance.[2] Flowers large, foxglove-shaped, pink and dark-purple blotched with yellow inside. They are tubular shaped 4-6 cm long, borne in 10-20 flowered racemes. This glandular hairy annual herb growing up to 0.9-1.2 m in height. Fruits are green, oblong 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 recurved hooks when dry. Claws are shorter than the body of the fruit. Seeds are flat, elongated brown to black, two seeds to each pod, usually remaining inside the pod.[3] Racemes are long, erect, and terminal. Corolla is glandular hairy with very oblique mouth lobes.[4,5] It is mostly used in epilepsy, inflammation, and tuberculosis and also applied locally to tuberculosis glands of camel's neck. The leaves and fruits are biologically active part of this plant.[6,7]

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Taxonomy of *M. annua* L.

A. Taxonomy of *M. annua*[8]	B. Vernacular Names of *M. annua*[8]
Kingdom: Plantae	Tamil: Thelkodukkukkay, Puli-nagam
Phyllum: Magnoliophyta	English: Devil's claw, Tiger's claw
Order: Lamiales	Hindi: Hathajori, Bichu, Ulat-kanta
Family: Martyniaceae	Malayalam: Puli-Nakam
Genus: *Martynia*	Telugu: Garudamukku, Telukondicchhettu
Species: *Martynia annua*	Marathi: Vinchu
	Gujarati: Vichchida
	Konkani: Shernui

(a) Flower part (b) Fruit part (c) Plant part

Correspondence: Dr. Sakshi Bhardwaj, Krupanidhi College of Pharmacy, Chikka Bellandur, Carmelaram Post, Varthur Hobli, Bengaluru - 560 035, Karnataka, India, E-mail: bhardwajsakshi1@gmail.com

Native

M. annua L. commonly grows in wastelands, rubbish heaps, and road sides.[9,10] It is found in the tropical and sub-tropical region of America, Mexico, Burma, West Pakistan, and throughout India.

Phytochemical investigation

In phytochemical studies, it has been observed that methanolic extracts of leaves of *M. annua* contain a higher amount of chemical constituents.[11] The aqueous and alcoholic extracts (by gas chromatography-mass spectrometry) have shown the presence of 28 compounds in which oleic acid is present in the high amount. Other major biological compounds include glycosides, flavonoids, alkaloids, tannins, saponins, anthocyanins, amino acid, steroids, and phenols.[12,13]The seeds of *M. annua* contain 10.35% of semidrying oil and fatty acids (palmitic acid, stearic acid, lineolic acid, oleic acid, and arachidic acid), pelargonidin-3-5-diglucoside, apigenin and apigenin-7-O-glucuronide;[14] leaves have been reported to possess chlorogenic acid, luteolin, p-hydroxy benzoic acid, and gentisic acid;[15] flowers are reported to have cyanidin-3-galactoside.[16] Structures of some chemical constituents are given below in Figure 1. *M. annua* whole plant has medicinal value[17] as its leaves are use in epilepsy and applied locally to tuberculosis glands of camel's neck, its leaves juice use as gargle for a sore throat; fruits considered as alexiteric and useful in inflammation, while the ash of fruit mixed with coconut oil applied on burns, fruit is also used as local sedative, paste of its nut when applied to the bites of venomous insects shows beneficial effects. Leaf paste of this plant is used on the wounds of domestic animals.[3] Seed oil applied on abscesses and for treating itching and skin affections.[16]The seeds of *M. annua* recommended by The Ayurvedic Pharmacopoeia of India for arresting of graying of hair.[17]The root extract has fungicide activity against *Acaulo sporascrobiculata* and *Sclero cystissinuosa*.[3] This plant is also used by Santal tribals (India) for hair loss, scabies, sores, fever and carbuncles on the back. Besides these, the stem of the plant is used by Tantriks in some parts of India.[18]

Pharmacological activity of *M. annua*

M. annua showed many pharmacological activities, yet its curative efficacy has been assessed only for few cases. The present review explores the pharmacological potential of the plant.

a. Analgesic and antipyretic activity
   Analgesic and antipyretic activities of *M. annua* were evaluated by Kar *et al*.[19] Analgesic activity was evaluated using petroleum ether, chloroform, ethanol and aqueous extracts of *M. annua* fruits 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 has been also observed that the petroleum ether and chloroform extracts exhibit greater analgesic and antipyretic activities as compared to another extract.
b. Wound healing activity
   Santram and Singhai[20] have evaluated the wound healing potential of ethanolic extract of *M. annua* leaves using excision and incision model on rats. Histopathological study of ethanolic extract also showed better angiogenesis, matured collagen fibers, and fibroblast cells as compared to the control group. The phytochemical studies demonstrated that the methanol fraction mainly contains flavonoid and luteolin responsible for enhancement of the wound healing process due to the free-radical scavenging mechanism.
c. Antibacterial activity
   Sermakkani and Thangapandian[11] have evaluated antibacterial activity of chloroform, ethyl acetate and methanol extract of *M. annua* leaves (MEMA) against gram-positive and Gram-negative bacteria. All the extracts show antibacterial activity against different bacteria. Chloroform extract produces higher antibacterial activity against *Proteus vulgaris*, *Bacillus thuringensis*, and *Bacillus subtilis* while ethyl acetate extracts potentially effective against *Salmonella paratyphi* A., *S. paratyphi B*, *Proteus mirabilis*, *P. vulgaris*, and *Klebsiella pneumonia*, whereas the methanol extracts show greater antibacterial activity toward *P. vulgaris*, *B. subtilis*, *S. paratyphi* B and *Pseudomonas aeruginosa*. The antibacterial activity was carried out using Disc Diffusion method in which all solvent extract were used as 100% concentration alone.
d. Anthelmintic activity
   Nirmal *et al*.[21] have reported anthelmintic activity of the petroleum ether extract of *M. annua* roots against earthworms *Pheriti maposthuma*, exhibited potent anthelmintic activity compared to standard drug Albendazole. Gupta *et al*.[22] also reported anthelmentic activity of *M. annua in vitro* using its leaves extract.
e. Anticonvulsant activity
   Babu *etal*.[7] reported anticonvulsant activity of MEMA on maximal electroshock (MES) and pentylenetetrazole (PTZ) induced seizure's models in albino rats. The MEMA at a dose of 200 mg/kg and 400 mg/kg have shown 66.31% and 82.731% protection, respectively, against MES induced seizures as compared to standard drug diazepam 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 PTZ induced epilepsy. However, the anticonvulsant activity of MEMA was due to the potentiation of neurotransmitter within the brain.
f. Antioxidant activity
   Nagda *etal*.[23] were reported antioxidant activity of the methanol and aqueous extracts of *M. annua* leaves by 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 method. The results showed that the methanolic extracts produced higher antioxidant activity than the aqueous extract.
   Rameshroo *et al*.[24] also reported *in vitro* antioxidant activity of *M. annua* from its fruit oil. DPPH radical and superoxide radical methods were used where IC50 being 87.56 µg/ml and 106.80 µg/ml, respectively. The oil of *M. annua* exhibited 87.25 ± 1.13 mg/100 g of total polyphenol content. The outcomes justify the oil of *M. annua* is a potential source of natural antioxidants.
g. Antifertility activity
   Mali *etal*.[25] reported antifertility activity of 50% MEMA root with significant decreases in the weights of testes, seminal vesicle,

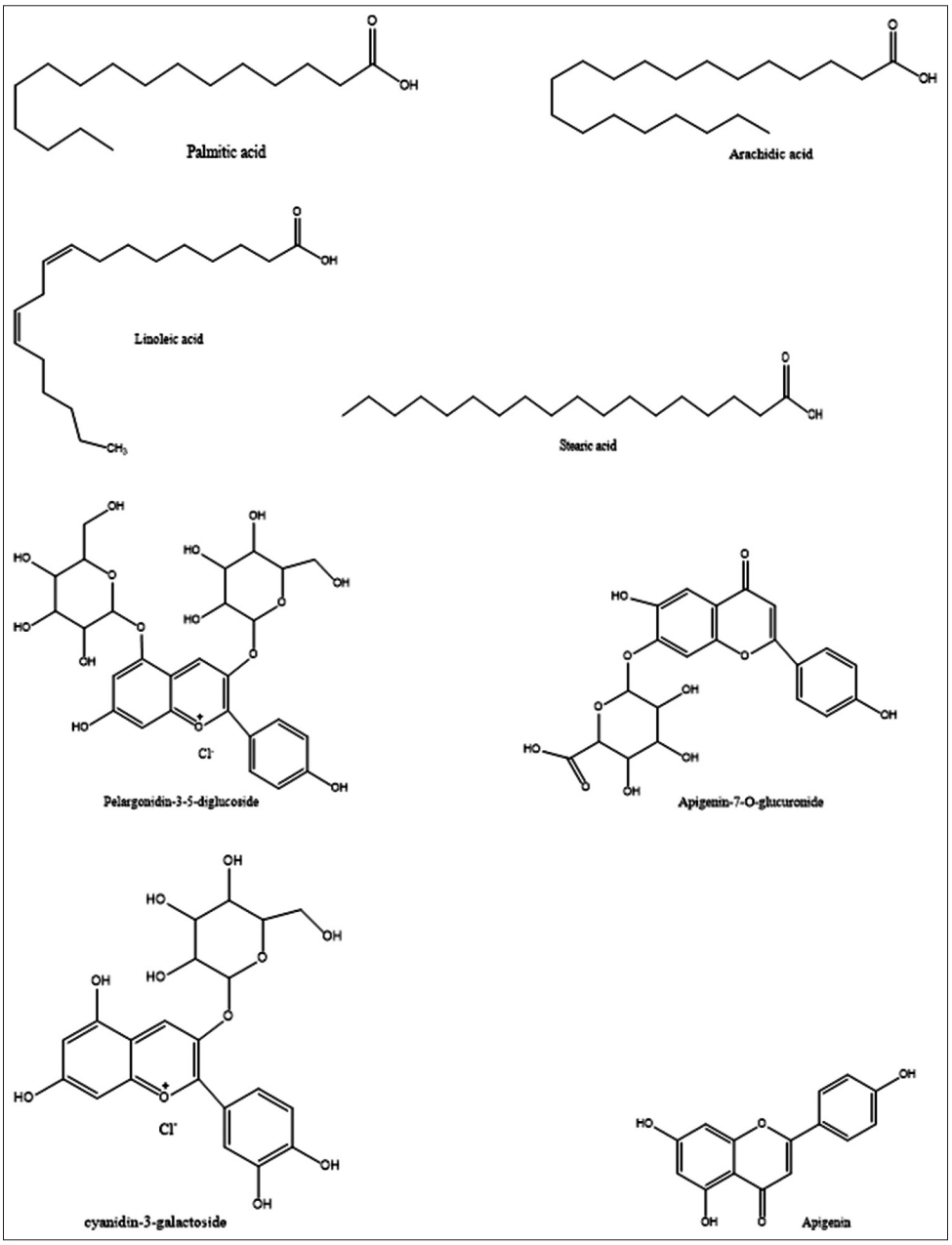

Figure 1: Chemical structures of phytochemicals of *Martynia annua* Linn.

epididymides and ventral prostate on male rate. Moreover, reduction in epididymal sperm count, motility, testicular sperm count, ratio between delivered and inseminated females, number of fertile males, and number of pups has been observed. Significant reduction in serum concentration of luteinizing hormone and testosterone support the antifertility activity of extracts. This showed more significant antifertility activity because no alterations in hematological parameters recorded.

h. Antidiabetic activity

Antidiabetic activity investigated by Saiyad and Gohil[26] using MEMA flower in streptozotocin (STZ) and STZ-nicotinamide (STZ-NIC) induced diabetes in Wistar rats. MEMA showed excellent reductions in blood glucose, glycosylated hemoglobin and triglyceride levels and increased HDL levels in diabetic rats (after 21 days). A result showed that the methanolic extract of *M. annua* exhibited significant antidiabetic activity in STZ and STZ-NIC induced diabetic rats.

i. Antinociceptive activity and central nervous system (CNS) depressant activity

Bhalke *et al*.[27] evaluated antinociceptive and CNS depressant activity of petroleum ether, ethyl acetate and methanol root extracts of *M. annua*. Among all extracts, petroleum ether extracts at the dose of 50 mg/kg, i.p. showed the significant increase in reaction time in hot plate method and also showed the more inhibitory effect on writhing induced by acetic acid against all extracts and standard drug pentazocine and and paracetamol, respectively. It further showed a significant reduction in the locomotors activity when compared with standard drug

diazepamn and it potentiates pentobarbitone sodium-induced sleeping time up to 215.34%.

j. Gastroprotective activity

Jain and Bhandarkar[28] reported gastroprotective activity of MEMA leaves in rats with 200 mg/kg and 300 mg/kg body weight on ethanol-induced gastric ulcer. Results were observed by calculating ulcer index based on lesion index and pH which showed significant inhibition on the ulcer lesion index in rats hence effect of ethanol extract with 300 mg/kg dose significantly ($p<0.05$) change the gastric volume, ulcer index, and pH.

Conclusion

On the basis of our literature survey, we have concluded that *M. annua,* a plant which is grown up in rubbish heaps and waste places being used as an important medicinal plant since a long period of time. Emerging evidence from its pharmacological activity studies suggests that search is still continuing for harnessing active compounds from nature in combating human illnesses and it also leads the path to search out new active natural and novel semi-synthetic or synthetic compounds. A wide range of medicinal value described in Ayurvedic literature, imperative that more investigations and unexploited potential are needed to develop more clinically and pharmacologically active compounds from this plant.

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