**Peganum harmala: A Phyto-pharmacological Review**

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**Abstracts**: Medicinal herbs are significant sources for treating various diseases. *Peganum harmala* is used traditionally as an analgesic, anti-inflammatory, abortifacient and also used for the treatment of bronchial asthma. Several phytoconstituents have been isolated and identified from different parts of the plant belonging to the category alkaloids, flavonoids and amides. Many studies have been conducted to prove its potential as anti-bacterial, anti-microbial, anthelmintic and for cytotoxic activity. The present review aims toward forming a bridge between traditional use and modern therapeutics of *Peganum harmala*.

**INTRODUCTION**

Harmal (*Peganum harmala*) is an eastern Mediterranean region east to India. It is also known as Wild Rue or Syrian Rue because of its resemblance to plants of the rue family. It is a perennial plant which can grow to about 0.8 m tall.[1] But normally it is about 0.3 m tall.[1] The roots of the plant can reach a depth of up to 6.1 m, if the soil it is growing in is very dry. [1] It blossoms between June and August in the Northern Hemisphere. [1] The flowers are white and are about 2.5–3.8 cm in diameter (Figure 1). [2] The round seed capsules measure about 1–1.5 cm in diameter (figure 2) have three chambers and carry more than 50 seeds.[2] *Peganum harmala* was first planted in the United States in 1928 in the state of New Mexico by a farmer wanting to manufacture the dye "Turkish Red" from its seeds (Figure 3).[1] Since then it has spread invasively to Arizona, California, Montana, Nevada, Oregon, Texas and Washington. Because it is so drought tolerant, African rue can displace the native saltbushes and grasses growing in the salt-desert shrub lands of the Western U.S.[2]

**PHYTOCHEMISTRY**

Harmaline, one of the alkaloids of *Peganum harmala* The active alkaloids of Harmal seeds are the MAO-I (monoamine oxidase inhibitor A) compounds: Harmane, Harmine, The coatings of the seeds are said to contain large amounts of β-carboline alkaloids harmine, Harmaline (figure 4) Harmalol, Tetrahydroharmine, Vasicine (figure 5), Vasicinone, Vasicine. Total harmala alkaloids were at least 5.9% per dried weight, in one study. [2] The stems of the plant contain about 0.36% alkaloids, the leaves about 0.52%, and the roots up to 2.5%. Harmine and harmaline are reversible inhibitors of MAO-A (RIMA).[3]

A new oxamide, N,N’-[3-hydroxy-5-methyl)phenyl]-oxamide has been isolated from an aqueous extract of *Peganum harmala* seeds.[4] The structure was established together with harmine (7-methoxy-1-methyl-9H-pyrido[3,4-b]-indole), harmaline (4,9-dihydro-7-methoxy-1-methyl-3H-pyrido[3,4-b]indole) and harmalol (4,9-dihydro-1-methyl-3H-pyrido[3,4-b]indol-7-ol).[4]

**TRADITIONAL MEDICINAL USES**

*Peganum harmala* is used as an analgesic and anti-inflammatory agent. In Yemen it was used to treat depression, and it has been established in the laboratory that harmaline, an active ingredient in *Peganum harmala*, is a central nervous system stimulant and a 'reversible inhibitor of MAO-A (RIMA)," a category of antidepressant. [5] Smoke from the seeds kills algae, bacteria, intestinal parasites and molds. *Peganum harmala* has antibacterial activity, including antibacterial activity against drug-resistant bacteria. [6] It is also used as an anthelmintic (to expel parasitic worms). Reportedly the ancient Greeks used powdered *Peganum harmala* seeds to get rid of tapeworms and to treat recurring fevers (possibly malaria). [7] *Peganum harmala* is an abortifacient, and, in large quantities, it can reduce spermatogenesis and male fertility in rats. [8] Another alkaloid harmine found in *Peganum harmala*, because of its appreciable efficacy in destroying intracellular parasites as well as non-hepatotoxic and non-nephrotoxic nature, harmine, in the vesicular forms, may be fatal and killed 1.1 million cattle in Africa in 1992. [9] *Peganum harmala* as well as harmine exhibit cytotoxicity with regards to HL60 and K562 leukemia cell lines. Ground *Peganum harmala* seeds have been used occasionally to treat skin cancer and subcutaneous cancers traditionally in Morocco. Seed extracts also show effectiveness against various tumor cell lines both in vitro and in vivo. [10]

**Antiprotozoal Activity**

It is fairly effective against protozoa including malaria. There is evidence that it may be effective against drug-resistant protozoa. [6] It is given in a decoction for laryngitis. One of the compounds found in *Peganum harmala*, vasicine (peganine) has been found to be safe and effective against *Leishmania donovani*, a protozoan parasite that can cause potentially fatal visceral leishmaniasis. [6] Peganine hydrochloride dihydrate, besides being safe, was found to induce apoptosis in both the stages of L. donovani via loss of mitochondrial transmembrane potential.

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hepatotoxic and non-nephrotoxic nature, harmine, in the vesicular forms, may be considered for clinical application in humans. [9] One study using the medicinal plant *Peganum harmala* showed it to have a lifesaving effect on cattle infected with the protozoal East Coast fever which can be 100% fatal and killed 1.1 million cattle in Africa in 1992. [9]

**Anticancer Activity**

The beta-carboline alkaloids present in medicinal plants, such as *Peganum harmala* and *Eurycoma longifolia*, have recently drawn attention due to their antitumor activities. Further mechanistic studies indicate that beta-carboline derivatives inhibit DNA topoisomerases and interfere with DNA synthesis. [11] *Peganum harmala* has antioxidant and antimutagenic properties. [11] *Peganum harmala* as well as harmine exhibit cytotoxicity with regards to HL60 and K562 leukemia cell lines. [11] Ground *Peganum harmala* seeds have been used occasionally to treat skin cancer and subcutaneous cancers traditionally in Morocco. [11] Seed extracts also show effectiveness against various tumor cell lines both in vitro and in vivo. [11]

**REFERENCES AND NOTES**
