Alkaloidal content, medicinal and remedial properties of *Peganum harmala* L. (*P. harmala*)

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Abstract

Background: This review article analyzes the medicinal and remedial properties of *Peganum harmala* L. [Nitrariaceae] also known as *P. harmala*, Syrian rue, wild rue, harmal seeds, and Esfand. *P. harmala* is a medicinal plant and its seeds have been known to alleviate symptoms of diabetes mellitus, depression, and liver damage; seed extracts also have antioxidant and disinfectant properties [Figure 2]. Burning *P. harmala* seeds releases disinfectant properties and is also believed to ward off the "evil eye" in Iranian culture.

Objective: The central focus of this review article determines the positive influence of *P. harmala* (methanolic, alkaloidal, and dry seed extracts) as a remedial agent for diabetes mellitus, cancer, depression, and liver damage, in various *in vitro* and *in vivo* studies.

Methods: Content for this review article was gathered searching for "*P. harmala*;" "*Peganum harmala* L.;" "Esfand;" "rue;" "*P. harmala* remedies;" "alkaloids and *P. harmala*;" and "harmala seeds" through electronic databases such as PubMed, Science direct, Elsevier and Google Scholar. Journals included Journal of Traditional Chinese Medicine, African Journal of Pharmacy and Pharmacology, and Phytomedicine.

Results: Fifty-eight articles, including research articles and *in vitro* studies, were reviewed to better understand the remedial properties of *P. harmala*. Studies were focused on the therapeutic components of *P. harmala* and:

- Diabetes mellitus
- Cancer
- Depression
- Liver damage
- Antioxidant properties
- Disinfectant properties

The multifunctional capabilities of *P. harmala* are a result of the alkaloidal content. The alkaloidal content of *P. harmala* is a strong candidate for anticancer therapies, as alkaloidal activity was found to delay cell growth in rats with induced UCP-Med carcinoma, Med-mek carcinoma, and UCP-Med sarcoma [8]. Other *in vitro* studies in animals have found *P. harmala* to improve liver damage. The antihyperglycemic components in the alcoholic extract of *P. harmala* position the plant to be a candidate for treating insulin resistance and type 2 diabetes mellitus [1]. Tests on β-carboline alkaloids in *P. harmala* have also helped determine the positive and negative influence of monoamine oxidase (MAO) enzyme inhibition [Figure 1].