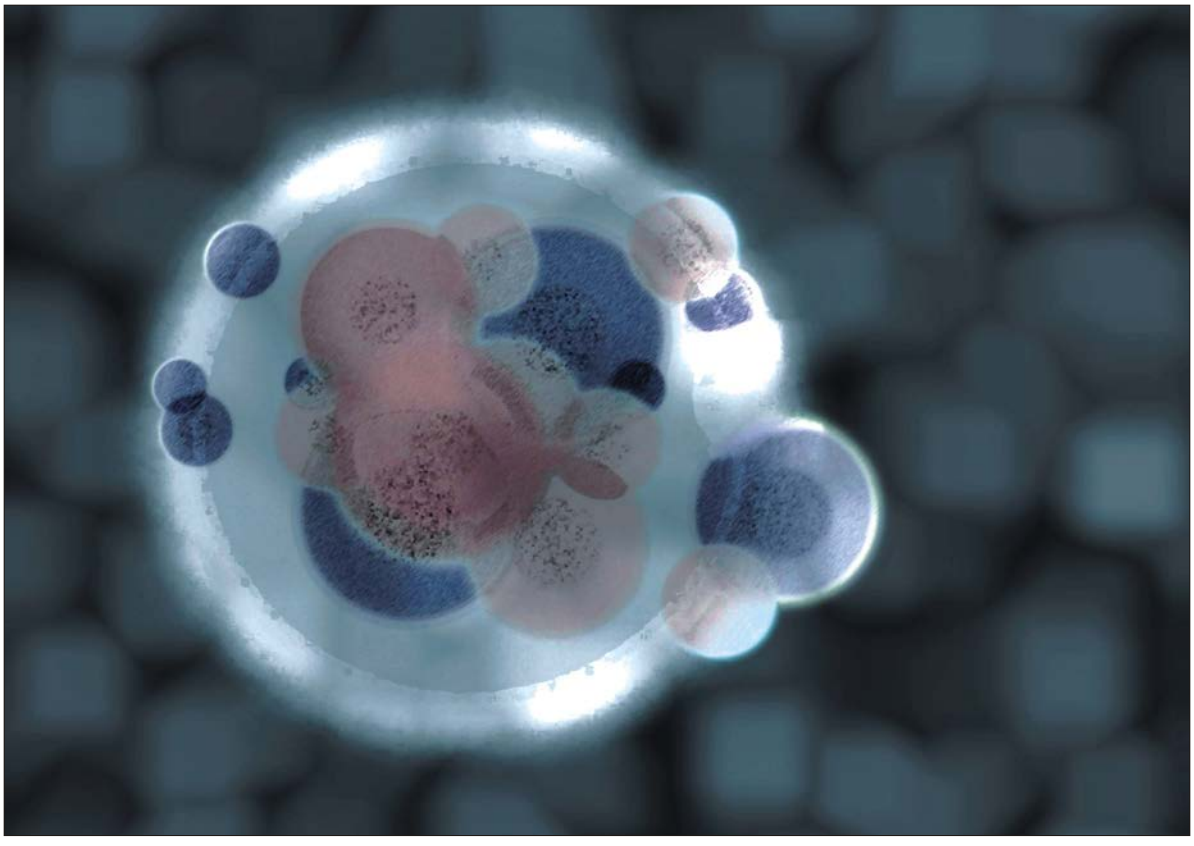

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Pharmacological Evaluation of an Ethnomedicinal and Endangered Desert Plant: *Mimosa hamata*

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Abstract: Plant derived medicinal products have been used for centuries in every culture throughout the world. *Mimosa hamata* possesses a vast ethnomedicinal history of heuristic medical value. Ethnomedicinal use of *Mimosa hamata* has been known since time immemorial and this plant were used to cure diseases and to maintain good health. *M. hamata* whole plant are used in traditional systems of medicine for treating various diseases. *M. hamata* exhibited higher antioxidant, antibacterial, antifungal and antiviral activities. Some bioactive constituents of this plant were thoroughly reviewed and discussed based on literatures. *M. hamata* has been claimed as folk medicinal plant but little is known about the phytochemicals and pharmacognostical information. There is a need to review this plant in order to provide scientific information for its application in traditonal and biological medicinal system.

Key words: *Mimosa hamata*, ethnomedicine, traditional medicine, bioactive

INTRODUCTION

Plants are important source of phytochemicals and phytopharmaceuticals, used to prepare various herbal drugs. The numbers of plants are used as folk remedies in different countries and are source of many potent and powerful drugs or natural product medicines (Srivastava *et al*., 1996; Raja *et al*., 2010).

A variety of secondary metabolites are found in plants which may have useful effect for mankind (Kamboj, 2000). The present study was focused to evaluate the bioactive compounds and beneficial uses of *M. hamata*. Plants play important role in Indian traditional system of medicines (Iwu *et al*., 1999). However, several secondary metabolites such as alkaloids, flavonoids, steroids, phenolics, terpenes, volatile oils etc., are usually present in plants and some phytocompounds are responsible for the pharmacological effects (Vyas *et al*., 2012). Herbal products have proved to be reliable source of large amount of drugs which are used in the treatment of numerous diseases. Synthetic drugs are effective but they fall behind the undesired properties and may generate frequent side effects. So, herbal drugs have no side effect, affordable and easily accessible than synthetic drugs (Jasuja *et al*., 2012a, b). However, the clinical study is mandatory to herbal drugs before being recommended for human being. According to the evaluation of WHO (2003), 80% people of the world still depend on traditional medication system for primary health care (Santos *et al*., 1995; Bizimenyera *et al*., 2007). Recently, researchers are emphasizing on valuation and description of phytoconstituents of plant against various diseases based on their traditional claim given in ayurveda. Isolation and identification of the bioactive compounds of plants have always been a challenging task for researchers (Bairwa *et al*., 2011). *Mimosa hamata* is an Ayurvedic plant which belongs to family Mimosaceae (Touch me not) which is used in several traditional medicines to cure various diseases. In Hindi, the plant is commonly known as chilati, Jinjani, jijni, ali, alaili, korindum, gulabi babul, liptti, bander ki rakhi and hooked Mimosa. The herb is a largely shrub and small tree distributed throughout the region of India. The genus of *M. hamata* has about 400 species distributated in the world (Barneby, 1992). The whole plant of *M. hamata* is very useful for various pharmacological and biological activities. A paste of leaf powder are applied to burn, over glandular swelling and also used in dressing for sinus, sores and piles (Nadkarni and Nadkarni, 1954). The whole plant of *M. hamata* are generally used for urinary complaints and used as a tonic against general weakness (Jain *et al*., 1997a; Katewa and Galav, 2005). Keeping in view the tremendous pharmacological activities and wealth of literature available, *M. hamata* plant may be utilized to alleviate the symptoms of variety of diseases. Moreover, crude extract of *M. hamata* has several

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medicinal application, herbal drugs can be developed after extensive exploration of its bioactivity, mechanism of action and pharmacotherapeutics. Now-a-days *M. hamata* has become a rare species in aravalli and semi arid zones of Rajasthan. This plant was commonly found earlier but now it became an endangered species in Delhi and other regions of India. For the protection of plant, it is necessary that seeds of rare, endemic and endangered plant *M. hamata* must be collected in proper season and implant in nursery for germination. Healthy plantlets will be then transferred in to the field for better plantation. The literature and availability of *M. hamata* especially in Rajasthan (India), makes it an attractive plant for further research.

Plant profile

***Mimosa hamata* willd**

Taxonomy: *Mimosa hamata* falls under the scientific classification as follows:

Scientific classification:

- Kingdom-Plantae
- Phylum-Spermatophyta
- Subphylum-Angiospermae
- Order-Fabales
- Family-Mimosaceae
- Genus-*Mimosa*
- Species-*Hamata*
- Synonym-*Mimosa armata*

- **Habit:** Shrub
- **Habitat:** Moist deciduous forest
- **Ecological status:** Rare
- **Distribution:** It is found in open sandy places throughout the area, often gregarious and abundant. *Mimosa hamata* mainly distributed in the arid zones of Rajasthan, Punjab, Delhi, Central and South India (Fig. 1)

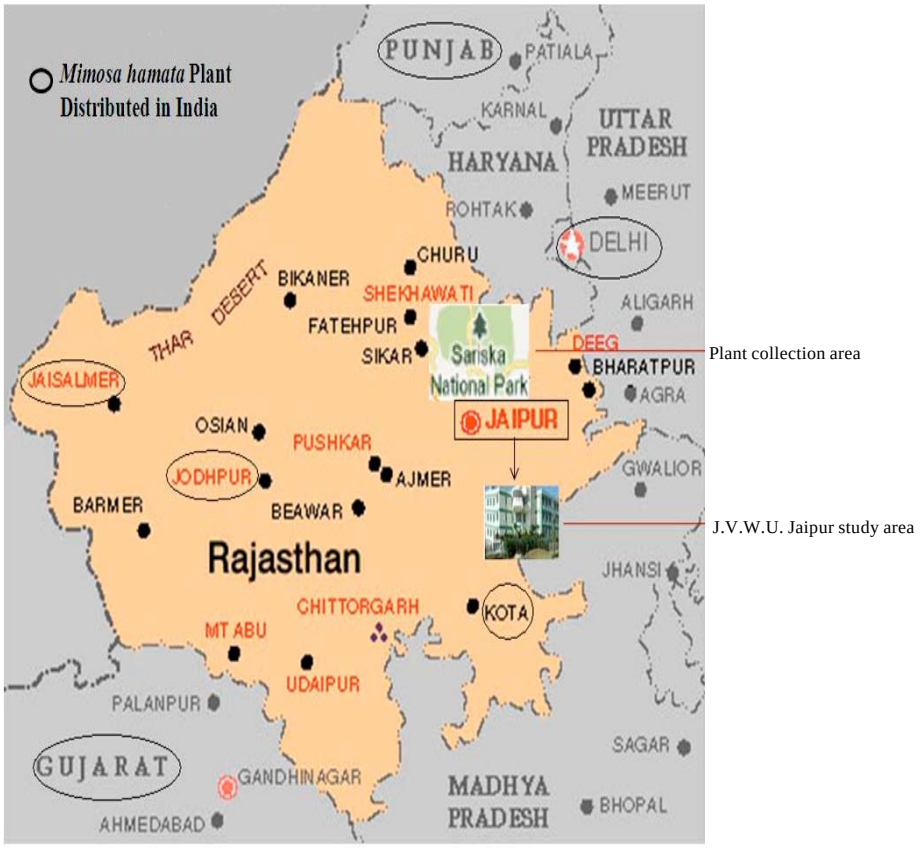

Fig. 1: Location map of *M. hamata* distribution in India. *M. hamata* plant was collected from Sariska National Park located at East Longitude -76°26'13", North Latitude-27°19'3", 450-500 m above sea level, weather: Temp. 5-28°C in winter, Alwar District, Rajasthan, India

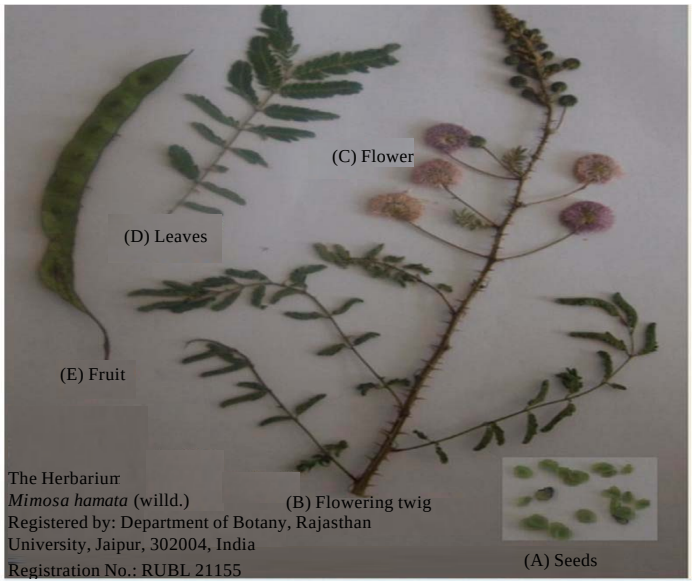

Fig. 2: Different parts of *M. hamata*

Morphology: A much branched, small size tree, armed shrub; branches downy with numerous; straw coloured, curved or straight prickles. Leaves 2-pinnate, 1.5-5 cm long; main rachis pubescent, sometimes prickly; stipules 3 mm long, hairy; pinnae 3-6 pairs, 0.6-2.5 cm long, leaflets 12-24, leaflets acute, mucronate, more or less glabrous rounded at base; petiolules very short. Calyx 2.5 mm long, shortly toothed. Corolla pink, 3 mm long, divided nearly half way down; lobes ovate-oblong, stamens 8. Ovary stalked, pubescent. Pods 5-7×1.5 cm, falcate, consisting of 4-8, one-seeded joints, pubescent joints falling off the persistent, prickly sutures. Seeds 6×4 mm, chestnut-brown (Fig. 2). Flowering and fruiting time period of *M. hamata* plant are August to November and December to February according to Indian conditions. *M. hamata* have botanical variations among other species of *Mimosa* such as *M. pudica* and *M. himalayana* Syn. *M. rubicaulis* (Caius, 1980; Bhandari, 1990; Agharkar, 1991; Verma *et al*., 1993; Singh *et al*., 1996; Paranjpe, 1999).

Constituents: The tremendous potential of medicinally important plant contain a broad range of bioactive compounds such as some bioactive constituents have been reported in the different parts of *M. hamata*. It contains an alkaloid mimosine, tannin, ash, calcium oxalate crystals, nitrogen, phosphorus, potash and calcium. Leaf powder of this plant also has albuminoids, carbohydrates, fiber, ash, mimonoside A-C (Fig. 3), gallic acid (Fig. 4) and ethyl gallate (Fig. 5). 4-Ethylgallic acid has been identified

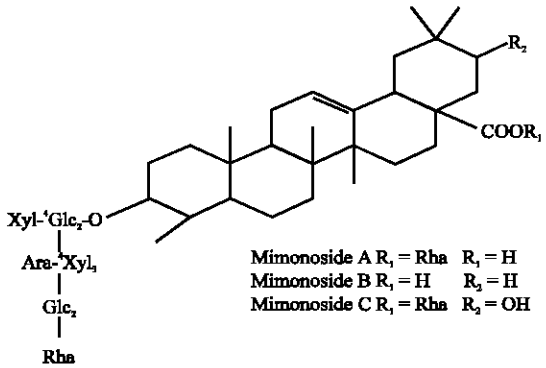

Fig. 3: Mimonoside A, B, C (Jain *et al*., 1997a)

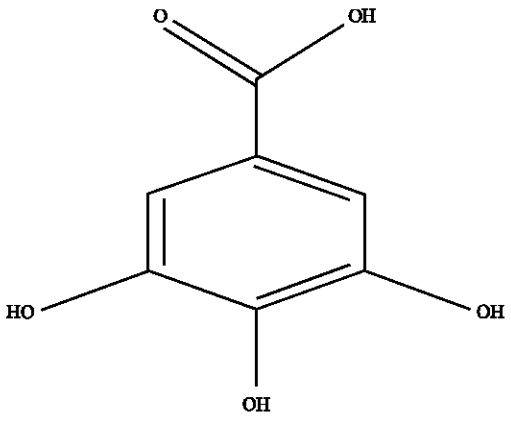

Fig. 4: Gallic Acid (Mehta *et al*., 1988)

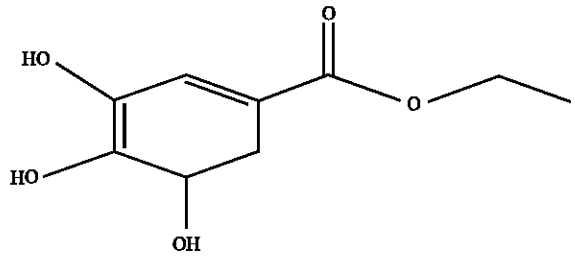

Fig. 5: Ethyl gallate (Mehta *et al*., 1988)

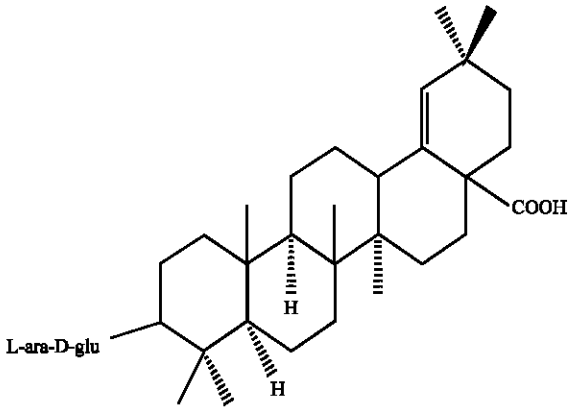

Fig. 6: 3-O-L Arabinosyl-D-Glucosylmorolic acid (Jain and Arora, 1997)

from the flowers of *M. hamata* and *M. rubicaulis* and bark contains tannin (Hussain *et al*., 1979; Mehta *et al*., 1988; Jain *et al*., 1997a). Hydroxy-and polyhydroxybenzoic acid are also found in seeds of *M. hamata* (Khadem and Marles, 2010). A new triterpenic saponin A and B isolated from the roots of the *Mimosa hamata* willd. has been assigned a partial structure 3-O-L-arabinosyl-D-glucosyl morolic acid (Fig. 6) (Jain and Arora, 1997) and 3-O-D-glucosyl-L-rhamnosyl marolic acid (Fig. 7) (Jain *et al*., 1997b) on the basis of chemical and spectral studies. Phytochemical compound saponins are isolated from methanolic extract of roots of *M. hamata* have antimicrobial activity against bacteria and fungi and also active against viruses.

Ethnomedicinal uses: *Mimosa hamata* (Fig. 8) is one of the indispensable medicinal plant used in the Indian system of medicine (Ayurveda) for the treatment of diverse diseases such as fever, diarrhea, coagulant, dysentery, jaundice, wounds, piles, tonic in urinary complaints, blood-purifier and paste of leaves is applied over glandular swellings and paste of roots with linum oil and gugul is unguent (Gupta *et al*., 2010). Seed powder and leaf juice of *M. hamata* boiled in buffalo milk is given as a tonic in general weakness and also sexual debility in

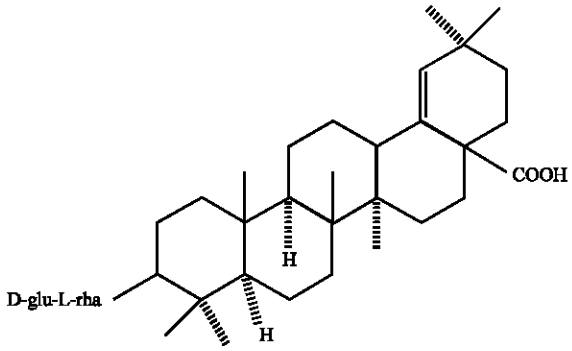

Fig. 7: 3-O-D-Glucosyl-L-rhamnosyl morolic acid (Jain *et al*., 1997b)

Fig. 8: *Mimosa hamata* (Photo: Richa Saxena, Sariska National Park; Alwar 22- 9-2012)

males. Fresh leaf extract is applied to check bleeding from the wound and ulcer (Singh and Pandey, 1998; Katewa and Galav, 2005). Some study reported that oral admnistarion of root juice (10-12 mL) twice a day for three days may be cure in diarrhea. *M. hamata* plant is used in different areas especially in Maharashtra as a ritual attached with child birth. On the 5th day of child birth, a diety is worshipped using leafy twig of *M. hamata* (Arati) and *Ziziphus mauritiana* (Borati) (Pawar and Patil, 2008). On the basis of ethnomedicinal evidence, different parts of this plant are used in the treatment of various diseases (Table 1).

Pharmacological activity

Antimicrobial activity: Medicinal plants are rich source of therapeutically useful phytochemical constituents that have the potential of being developed in to potent antibacterial and antifungal agents (Bessong *et al*., 2006;

Table 1: Benificial uses of *M.hamata*

Part used	Medicinal uses	Mode of administration	References
Root	Paste of roots with linum oil and gugul is unguent Have contraceptive efficacy used in leucorrhoea, menorrhagia, stomach pain and in diarrhoea The roots are tied to the arm and keep it wet with water for the treatment of Jaundice	External	Gupta *et al.* (2010), Meena and Rao (2010), Harihar and Kotresha (2012)
Seed	Seed powder boiled in buffalo milk and used as a tonic in general weakness and also sexual weakness in males Used as a tonic for blood purification	Oral	Shekhawat and Anand (1984), Bhandari (1990), Singh and Pandey (1998), Katewa and Galav (2005), Patel (2010), Sharma and Kumar (2011),
Stem	A glass of infusion of fresh stem is administered against snake bite	Oral	Pawar and Patil, (2008)
Leaf	Used for chronic cough and pharyngitis Paste of leaves used externally for leprosy Paste of leaves administered for headache, diarrhoea, dysentery Applid to check bleeding from the wound and ulcer	External	Jain (1991), Singh and Pandey (1998), Bhosle *et al.* (2009), Bagul and Patil (2011), Katewa and Galav (2005)
Flower	Used in menorrhagia, leucorrhoea, stomach pain and in diarrhea	External	Meena and Rao (2010)
Whole plant	Used in the treatment of skin disease	External	Maheswari *et al.* (2012)

Table 2: Antimicrobial Activity of *M. hamata*

Activity	Part	Name of extract	Microorganism	Result	Reference
Antibacterial activity	Whole plant, callus tissue	Methanolic extract Ethanolic extract Benzene extract Aqueous extract Chloroform extract	*Escherichia coli*, *Klebsiella aerogenes*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*	Positive	Hussain *et al.* (1979), Jain *et al.* (1997a) Jain *et al.* (2004)
Antifungal activity	Whole plant, callus tissue	Methanolic extract, Ethanolic extract, Benzene extract, Aqueous extract Chloroform extract Petroleum ether extract	*Aspergillus niger*, *Fusarium moniliforme*, *Rhizoctonia bataticola*	Positive	Hussain *et al.* (1979), Jain *et al.* (1997a), Jain *et al.* (2004)
Antiviral	Whole plant, callus tissue	Ethanolic extract, Benzene extract, Aqueous extract Chloroform extract Petroleum ether extract Methanolic extract	*Herpes simplex*, *Polimyelittis*, *Vesicular stomatitis*	Positive	Jain *et al.* (2004), Jain and Arora (1997), Jain *et al.* (1997a)

Obafemi *et al*., 2006). Several phytocompounds such as alkaloids, flavonoids, tannins, phenolic compounds, steroids, saponins and triterpenoids may also be used as antimicrobial activity which may be attributed to the beneficial properties of the plant (Rabe and van Stadin, 1997; Ramasamy, 2000; Santhi *et al*., 2006). Moreover, a crude ethanolic extract of arial part of *Mimosa hamata* and deproteinized leaf extract showed their inhibitory effect against microorganism such as bacteria and fungi (Attia *et al*., 1972; Mukadam *et al*., 1976; Umalkar *et al*., 1977; Hussain *et al*., 1979; Ali *et al*., 2001) (Table 2). Jain *et al*. (2004) previously reported that medicinal plant such as *Mimosa hamata* (wild.) callus and leaf extracts showed considerable antimicrobial activity (Jain *et al*., 2004). Earlier study suggested that some other medicinal plants such as *Nerium oleandaner* and *Baliospermum axillare* leaf and callus extracts also showed antimicrobial activity (Singh and Sudharshana, 2003; Hussain and Gorsi, 2004).

Antiviral activity: According to Jain *et al*. (2004), ethanolic extract of *M. hamata* are found active agent against *Herpes simplex*, *Poliomylitis* and *Vesicular stomatitis*. Petroleum ether and chloroform extracts were also exhibited potential effect against *V. stomatitis* and *H. simplex*. Earlier study revealed that in the bioefficacy of the extracts of whole plant were most effective than the fractions obtained from callus tissues. Methanolic extract of roots were also reported for their antiviral activities against *Measles, Semliki forest*, *Herpes simplex* and *Vesicular stomatitis* (Jain and Arora, 1997; Jain *et al*., 1997a) (Table 2).

Antioxidant activity: Antioxidant activity has been proposed to play a vital role in various pharmacological activities such as anti-aging, anti-inflammatory and antiatherosclerotic activity. An effective therapeutic strategy is used for the inhibition of free radical induced damage by the supplementation of herbal antioxidant drugs. Herbal products with their antioxidant activity have therapeutical potential as they can serve the purpose without any side effects that are often associated with synthetic antioxidants (Agharkar, 1991; Jain *et al*., 2009a; Bairwa *et al*., 2011). Methanolic extracts of this plant exhibited higher antioxidant activity with 6.5 μg mL^{-1} RC value as compared to the dichloromethane extracts (Singh *et al*., 2009; Jain *et al*., 2009b). Singh and Jain (2012) also revealed that extract of leaves, stem, root and

seeds of *M. hamata* have the antioxidant potential. Antioxidant activity was determined by 2, 2-Di phenyl-1-picrylhydrazyl (DPPH) assay and total phenolic content was estimated by using Folin-Ciocalteu's reagent of this plant. All tested extracts of different part of the plant possessed appreciable antioxidant activity but n-butanol extract of roots was significantly higher in total phenolic content (73.16±0.19 mg GAE/g Extract) and in antioxidant assay (IC_{50} = 5 μg mL^{-1}). Moreover, n-butanol extract of roots have higher yield (85.6%) in comparision to all other tested extracts (Singh and Jain, 2012).

Aphrodisiac activity: Recently, modern life style and various environmental exposures affect male infertility. Sexual weakness in male or male infertility is increasing in all over the world. A modern medicine provides beneficial and effective treatment but some are produces negative effect on physiological processes. Plant derived drugs provides a safer way to solved various problems associated with male infertility. On the basis of traditional knowledge, *Mimosa hamata* are also used as a herbal aphrodisiac for providing ameliorating effect on sexual dysfunction. But *M. hamata* has not been clinically evaluated for their aphrodisiac activities. Many herbal aphrodisiac plants have 28.12% gap between traditional knowledge and pharmacological evidence (Mathur, 2012).

CONCLUSION

The whole plant of *Mimosa hamata* is very useful for various biological activities. Mostly leaves and seeds of *M. hamata* are used in the treatment of various human health problems in the form of traditional medicine system. This study insight the better understanding of this plant and provide beneficial health effects for consumption which may use as preliminary information and could be further studies for use in medicine. Further work is required to find out the bioactive compounds from this plant to exploit its maximum potential in the field of medicinal and pharmaceutical sciences for novel and fruitful application.

RECOMMENDATION

M. hamata is regarded as the good shrub for the medicinal purpose. This wild plant is entirely useful in various conditions. But, according to the review done, it is not spreaded all over the world. It may be found only some selected areas of the India and its pharmacological activities are not much explored. Only on the basis of traditional beliefs of ancient times, it is considered as medicinal plant. Therefore, in the coming future, this plant can be further explored for its activities to be proved and also attempts should be made to secure and cultivate this miraculous plant which will be beneficial to the society.

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