

The Declining Status of *Glossonema variens*: Exploring the Ecological, Medicinal, and Nutritional Importance of a Threatened Plant Species

N.K. Bohra^{1*}, Ajay Kumar Katariya², Mahima Sirvi³ & Apurva Yadav⁴

^{1,2,3,4}ICFRE-Arid Forest Research Institute, Jodhpur, Rajasthan, India.
Corresponding Author Email: bohrank@rediffmail.com



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ABSTRACT

Arid zone is known to have saved useful plants which were used not only for food but also have medicinal values. *Glossonema variens* a perennial herb known as khiroli in western Rajasthan. It is known to gummer with gibberellins and other treatment but rate of germination is low i.e. 12.5%. However with higher concentration germination can be 100 percent in 3 days. It is an important food with nutraceutical properties. Beside this it is grazing food for cattle. Plant of medical importance as its fruit juice is used in treated painful muscle, cough etc. Due to invasive animals and human activity plant is in danger and there is a need to conserve and propagate it.

Keywords: *Glossonema variens*; *Glossonema edule*; Khiroli; Nutraceutical food; Medicinal plant; Desert plant; Andromonoecy; Fodder plant; Conservation; Dormancy.

1. Introduction

Glossonema variens (stocks) Benth ex. Hook f. (syn. *Mast stigma variens* stocks) belongs to family Asclepiadaceae. The plant is locally known as Dodha and its follicles (fruits) are called as khiroli in western Rajasthan. It is distributed in Arabia, Bahrain Island, Iran, Pakistan (Sindh and Baluchistan) and India (Bhandari, 1990). It occurs in western Rajasthan particularly in Jaisalmer and Barmer districts.

Glossonema variens is a small, 8-20 cm high, erect perennial herb with milky latex. It regenerates from a perennial root stock. It is much branched from near the base. Its stem is terete or more or less angular woody at the base. Its leaves are fleshy, grayish – green and pubescent with 1-2 cm long petiole. Its flowers are lemon yellow in colour, fragrant on sessile, 2-8 flowered cymes.

One study reported andromonoecy conditions i.e. perfect (hermaphrodite) female and male (staminate) flower on same plant. In the study it was observed that certain flowers had usually small rudimentary ovaries without ovules (Ali and Ali, 1996 a, b).

In *G. variens* and 8 other members of Asclepiadaceae were studied for the effect of sugar concentration on pollination and germination. It was found that in hermaphrodite flowers of *G. variens*, maximum pollination germination upto 15 percent while it was 20 percent in male flowers.

Generally flowering and fruiting in *G. variens* occurs during August to November. Normally it flowers once in a year and remains in bloom for 1-2 months depending on the availability of moisture. If rainfall is sufficient during April-May, it may flower early.

This produces 2-3 fruits per plant under sufficient moisture conditions. After dehiscence of ripe fruits, the leaves and stem dried and only the perennial-rootstock remains in the ground, which regenerates in suitable environmental conditions.

1.1. Regeneration of the plant: *Glossonema edule* a synonym of *Glossonema variens* is an important but an endangered plant in Qatar. Propagation of *G. edule* is important for biodiversity conservation. In a study seeds were treated with hot water, gibberellins, auxins and cytokinin to break the dormancy. Result indicates that heat treatment of the seeds for 1.0, 2.0 and 3.0 minutes lead to no germination and failed to break the seed dormancy.

However, gibberellic acid (GA₃), auxins (NAA) and cytokinin (BAP and 2ip) were found to be effective on germination of seeds. Light was also found to be effective on germination of the seeds. In dark 8.3 percent of seeds germinated on medium with 0.1 & 1.0 mg 1-1 GA₃ while with 2.0 mg 1-1 GA₃ treatment 12.5 percent of seeds germinated. Using 2.0 mg/litre GA₃ with continuous light resulted in 100 percent germination only after 3 days.

The effect of NAA, in different concentrations (0, 0.1, 1.0 and 2.0 mg/liter) on leaf, stem and hypocotyls explants varies. For hypocotyls 100 percent Callus formation was recorded in some of the concentration. It was highest in 1.0:2.0, 2.0:1.0 and 2.0:0.1 mg/liter auxins:cytokinin and in leaf explants 57.1 percent organogenesis was obtained with 1.0:0.1 mg/liter of auxins:cytokinin. It indicates that for breaking seed dormancy as well as for clonal propagation of *Glossonema edule* and in vitro formed plantlets might be as important source for micro- propagation of these endangered plants.

Glossonema Variens appears usually along runnels on shallow sandy gravelly soils and in depressions of rocky and grade gravelly areas of arid rangelands of Thar desert. In its natural habitat it forms association with grasses, leguminous and also grows non-leguminous parental herbs and also grows under the canopy of under shrubs and shrubs. It is associated frequently with perennial grasses like *Dactyloctenium scindicum*. Boiss, *Ochthochloa compressa* (Forssk.) Hilu and abu with *Cymbopogon jwarncusa* (Jones) Schult. In the rocky situations and with *Lasiurus scindicus* Hens. in Sand deposition / sandy soils among herbaceous leguminous species it is very much associated with *Tephrosia uniflora* pers. Which it's a suffruticose leguminous perennial herb that occurs exclusively on open rocky slopes.

Indigofera cordifolia Heyne ex Roth. is one of the associated annual leguminous seeds. *Boerrhavia diffusa* L. and *Tribulus terrestris* L. non-leguminous associates species. *Dipcadi erythraeum* also found associated with *G. variens* in rocky gravelly areas. The under shrub like, *Heliotropium rariflorum* stocks and *Seddera latifolia* Hochst & stand are also associated with *G. variens* on open rocky stopes. It abo grow under the Canopy of the sherb species like *Leptadenia pyrotechnica* (forssk) Decne and *Zizyphus nummularia* (Buen f.) wt & Arn.

In the protected rangelands, *G. variens*, exhibits the remarkable diversity in plant types particularly in size and shape of leaves, flower colour and also in size of fruits, Generally plants with crisped margin leaves with light yellow flowers are common rocky with less moisture situations. Those types of plant have leaves with more length as compared to width with little bit high moisture with sand deposition or sandy conditions plants with entire margin with dark yellow flowers were noticed in range lands. In this type more width of leaves is observed as compared to length.

1.2. Economic importance: *Glossonema variens* has several uses and its economic importance is well known as fodder and medicine.

1. Food: Its tender fruits (follicles) are known as khiroli and are eaten raw by the inhabitants and supposed to have nutraceutical properties. Its fruits were collected from rocky rangelands and are eaten by villages and normally not marketed for sell. Its unripe tender fruits are eaten raw as well as they are used as vegetables and are very delicious. Its tender leaves are also used as vegetables. Its seeds are also edible and cooked by local people (Batanouny 1981, Al Hadidi et al., 2017).

2. Fodder: Plant is grazed by wild as well as domestic animals like Sheep, Goat etc. However plants are not generally grazed by the cattle.

3. Medicine: It is an important plant of medicinal uses in traditional system. Its fruit are well known to be body toxic and energetic. Its fruits juice is used in treating painful muscles, cough and sore throat. In coastal area of Pakistan, the infusion of leaves is given for painful urination (Qasim et al., 2014, Phobo et al., 2015) reported moderate level of anti-oxidant potential soluble phenolic and ACE inhibitor activity in *Glossonema edule* from Qatar which may be useful for potentially managing hypertension and oxidation linked vascular complications.

Its edible fruit containing essential and non-essential amino acid, carbohydrate, fatty acids and flavonoids have high nutritive value (Rizk et al., 1983, 1990).

4. Other uses: Low concentration of *G. edule* has shown a stimulating effect on seed germination of *Farsetia hamiltonii* and *Savygnia parviflora* (crusiferae) at least during early germination days (Ahmed 1994).

1.3. Propagation: Seeds of *G. edule* were washed with running tap water and then they were soaked in 70 percent ethanol for 1 minute followed by treating with 10 percent Clorox (sodium hypochlorite 0.5%) with 2-3 drops of TWEEN 20 for 20 minutes and rinsing 3-4 times with distilled water. Seeds were given heat treatment and plant growth regulators (GA_3 etc) used to break seed dormancy (Koller et al., 1962). Gibberellic acid is involved both in breaking seed dormancy and in controlling the hydrolysis of the seed reserves. It is reported that presence of adequate levels of Gibberellic acid in the seed causes stimulations of the synthesis activation and secretion of hydrolytic enzyme (Khan 1971: Metivier 1979: Mayer and Poljakoff – Mayber 1969). Nagarajan and Mertia propagated *Glossonema variens* through vegetative cuttings using tender shoot and root cutting respectively.

1.4. Need for Conservation: A range of natural factors, invasive animals and human activity have been severely affecting stability of the ecosystem resulting in the degradation of plant habitats and so plant endangerment or even extinction.

Most of the threatened plant species of western Rajasthan are found in rangelands with sandy, gravelly and rocky substratum therefore more attention is to be paid to preserve the specific niche i.e. micro and macro habitats. There is a need to create awareness among the desert inhabitants on economic and ecological importance of species for their sustainable utilization and conservation. It is needed to recognize the rangeland area with distinctive patches of *Glossonema variens* as preservation plot/protected area particularly in its natural distribution cover particularly in Jaisalmer district.

Plant is in threatened in arid rangeland due to multitude of factor such as low rainfall, over grazing by domestic animals, destruction of habitat, dilution in traditional conservation practice and changes in climatic conditions.

2. Conclusion

Glossonema variens is an important plant of western Rajasthan. Due to its multipurpose uses and Ecological, Medicinal, and Nutritional Importance plant is of immense value. Due to over exploitation by various ways plants become threatened now. There is an urgent need for its conservation and propagation. Development of its propagation technique and value addition of its uses not only improve the livelihood of local habitants but also helpful in conservation of desert biodiversity.

Declarations

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Competing Interests Statement

The authors declare no competing financial, professional, or personal interests.

Consent for publication

The authors declare that they consented to the publication of this study.

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