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GYMNEMA SYLVESTRE R.BR. (GURMAR, MESHASRINGI): A REVIEW

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ABSTRACT: Medicinal plants have always drawn intellectual concerns due to their extraordinary potential to alleviate a wide range of diseases. *Gymnema sylvestre* is a woody, climbing plant of tropical forests of central and southern India and in parts of Africa. Distribution is worldwide and it is recognized in the traditional medicinal literature of many countries including Australia, Japan, and Vietnam. Some texts refer to Gymnema as *Asclepias geminata, Gymnema melicida*, and *Periploca sylvestris.* Gymnema has played an important role in Ayurvedic medicine for centuries. Its use has been confined primarily to the management of diabetes mellitus and similar hypo/hyperglycemic conditions. Despite the part used being the leaf, another common name of this species is miracle fruit. *Gymnemasylvestre R.Br*., a potent herb with active ingredients with antidiabetic and antioxidant potential, is one of the best examples. This review paper emphasizes mainly on the various pharmacological activities and various uses of this plant. *G. sylvestre* is mainly credited for excellent antidiabetic property and can also provide several other properties including antioxidant, immunomodulatory, anti-obesity, anti-microbial, anti-inflammatory, anti-hyperlipidemic activity. Different parts of *G. sylvestre* plant contain many pharmacologically active compounds like gurmarin, gymnemic acids, saponins, flavonol, glycosides, and other important compounds, enabling this plant to possess various therapeutic potentials. Traditional medicine systems have employed various portions of the plant, such as the roots, stems, and leaves, as cardiotonic, digestive, diuretic, laxative, stimulant, and uterine tonics. This paper aims to describe the various medicinal properties of the *G. sylvesre R.Br.* plant exhibits.

INTRODUCTION: During the last decade, the changes in lifestyle and junk food habits have resulted in obesity and diabetes in a large population. The market is flooded with many synthetic antidiabetic medicines for treating such diseases, but the long-term use of these drugs has resulted in many side effects.

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So, natural plant-based products are gaining importance. *Gymnema sylvestre* R. Br. is one of India's important medicinal plants widely used in treating *diabetes mellitus. Gymnema sylvestre* R.Br. is an imperative remedial woody climber belonging to the family Asclepiadaceae. 'The Milkweed family'. One special name of this plant species is 'Miracle fruit'. The name '*Gymnema'* probably derives from the Latin word meaning 'naked' and *sylvestre* means 'from the forest'.

It is native to central and western India and can also be found in tropical Africa and Australia. The leaves are opposite, usually elliptic or ovate. Flowers are small, yellow, in auxiliary and lateral

umbel in cymes. The leaves of *Gymnema* are reported to be bitter, astringent, and acrid. They temporally paralyze the sensory perception of sweet and for this amazing property it is known as "GUDMAR".

It is also known as 'Sugar Destroyer'. *Gymnema* leaves have the mixture of bioactive constituent's tri-terpenes and saponins *viz.* Gymnemic acids, Gymnemagenin and Gurmarin due to them this plant represents antidiabetic properties. Its leaves are also used in food additives against obesity. *G. sylvestre* also has Stomachic, diuretic, and cough-suppressant properties. The root of this plant is an antidote for snake bites used by tribals. It was traditionally used in Ayurveda. Due to these unique qualities, the plant has been overexploited and endangered.

Taxonomic Position:

Kingdom: Plantae

Subkingdom: Tracheobionta

Division: Magnoliophyta

Class: Magnoliopsida

Subclass: Asteridae

Order: Gentianales

Family: Asclepiadaceae

Genus: *Gymnema*

Species: s*ylvestre*

Vernacular Name:
English Name: Periploca of the woods, Ram's Horn

Hindi Name: Gudmar

Sanskrit Name: Meshashringi, Madhunashini

Other Regional Name: Kavali, kalikardori (Marathi); Dhuleti, mardashingi (Guajarati); Adigam, cherukurinja (Tamil); Podapatri (Telgu) and Sannagerasehambu (Kannada) *etc*.

Geographical Distribution: *G. sylvestre* is native to the tropical forests of central and southern India had wider distribution. It grows in the plains from the coast, in scrub jungles, and in thickets at an altitude ranging from 100 – 700 m. It is found in the Deccan peninsula, extending to northern and western India. It is abundantly found in the Kota district of Rajasthan. Some areas like Mukundara Hills National Park and Garadiya Mahadeva serve as this plant's bank.

The genus Gymnema comprises 40 species distributed from Western Africa to Australia. *G. acuminatum* (Roxb.) Wall, *G. aurantiacum*, G. *balsamicum*, *G. elegans* W&A, *G. hirsutum* W&A, *G. lactiferum*, *G. latifolium, G. montanum* Hook.f., *G. sylvestre* R.Br., *G. tingens* W&A, *G. indorum*, *G. yunnanse* and *G. spartum* are some of the important species of genus Gymnema. They are mainly distributed in the Deccan peninsula parts of northern, western India, Tropical Africa, Australia, Vietnam, Malaysia and Sri Lanka.

MORPHOLOGY: *Gymnema sylvestre* is a large woody twinning shrub growing wildly and running over the tops of high trees in forests. Stem is aerial, hard, twinning and branched. The young stems, branches are smooth and cylindrical. Leaves are elliptic, base acute to acuminate, glabrous and opposite. The taste of leaf is slightly bitter and astringent. It also possesses remarkable property of paralyzing the sense of the taste for sweet substances for few hours [3].

Flowering Season: April and November.

Fruiting Season: Winter (December- March)

Chromosome Number: 2n = 22

Botanical Synonyms: *Asclepias geminate Roxb., Periploca sylvestris Retz., Marsdenia sylvestris (Retz.)*

Propagation: *G. sylvestre* is propagated naturally by seed germination. But at the time of the release of seeds from their pods, seeds have low moisture content together with dry environment and less endosperm resulting in very low germination; thus the natural production of this plant species is very poor. Therefore, it is very essential to make an artificial propagation protocol to maintain the existence of this valuable plant. To prevent its extinction plant tissue culture technique is utilized at a large scale [4].

FIG. 1: FIRST AUTHOR COLLECTING THE HERB AND PREPARED GUDMAR POWDER

Traditional Use: According to Sushruta, *Gymnema sylvestre* was used as a sugar destroyer (due to chewing leaves which destroys the ability to identify the sweet taste) in case of glycosuria and other urinary diseases. Various reports are obtained on its nature like bitterness, astringent, thermogenic activity, anti-inflammatory, digestive, liver tonic, diuretic, stomachic, stimulant, anthelmintic, laxative, cardio tonic, anti-pyretic and uterine tonic, *etc*. It is useful in dyspepsia, constipation, hepatitis, hemorrhoids, renal and vesicle calculi, cardiopathy, asthma, bronchitis, amenorrhea, conjunctivitis and leukoderm [5-8].

Bioactive Antidiabetic and Antioxidant Compounds Antidiabetic Compounds: In *Gymnema sylvestre*, secondary metabolites are present. Such metabolites are oleanane saponins and dammarane saponins. Oleanane saponins are of two types *i.e.* gymnemic acid **Fig. 1** and gymnema saponins. *Gymnema saponins* consists of two aglycone saponins like gymnemagenin and gymnestrogenin [9]. Dammarane saponins include gymnemasides (I-VII) [10-11]. All of these secondary metabolites have antidiabetic properties. Besides these triterpenoid saponins, other antidiabetic constituents are anthraquinone, flavones, flavonoids like epicatechin, apigenin, luteolin, kaempferol, hentriacontane, pentatriacontane, phytin, resins, tartaric acid, formic acid, butyric acid, lupeol, β-amyrin related glycosides. Anthraquinones and their derivatives, alkaloids-conduritol, gymnamine, 2α and β chlorophyll, polypeptide (Gurmarin), d-quercitol, stigmasterol, nonacosane, parabin, calcium oxalate, cellulose, lignin, *etc*. also possess antidiabetic potential [12-15].

Antioxidant Compounds: Flavonoids, tannins, alkaloids, phenols, cinnamic acid, folic acid, ascorbic acid, butyric acid, tartaric acid, etc. type of antioxidants are present in *Gymnema sylvestre* [16-18].

Chemical Structure of Bioactive Compounds: In case of *Gymnema sylvestre*, gymnemic acids are triterpenoid glycosides. The central structure is aglycone gymnemagenin. This is adorned with a sugar such as glucoronic acid and with various ester groups. Gymnemic acid is not a pure, unique structure but is composed of several types of homologues or compounds of the same general formula. Gymnemic acid A comprises of A1, A2, A3 and A4. The aglycone gymnemagenin is a D-glucoronide of hexa-hydroxytriterpene. *Gymnema saponin* iii is another anti-sweet compound that consists of 23 hydroxy longispinogenin as the aglycone moiety. Another antidiabetic compound, dammarane is a tetracyclic tri-terpene saponin. Seven new dammarane saponins, named Gymnemasides i-vii, have been isolated from leaves of *Gymnema sylvestre*, together with previously known dammarane type saponins, gypenoside XXVIII, XXXVII, LV, LXII, LXIII. Antioxidants such as Terpenoids are unsaturated hydrocarbons with oxygen-containing functional group derived from terpenes. Flavonoids have 15 carbon skeleton structure that consists of two

phenyl rings (A and B) and a heterocyclic ring (C). Cinnamic acid is a white crystalline organic compound highly soluble in organic solvent. It is classified as an unsaturated carboxylic acid. Another antioxidant, folic acid also called as Vitamin B9, is white and crystalline compound. It is also known as phenolic acid or pteroglutamic acid. Tannins are esters of phenolic acid containing hydroxyl and carboxyl groups. Phenols are aromatic, white crystalline compounds where hydroxyl group is attached to carbon atom that is part of an aromatic ring [19-24].

Essential Chemical Components of *Gymnema sylvestre* and its Mode of Action in Down Regulating Blood- Glucose Level: Proposed mechanism for the hypoglycemic action of gymnemic acid might be increased secretion of insulin from the pancreas and promotion of islet cell regeneration. Hypoglycemic effects of gymnemic acids are: i) it increases insulin secretion, ii) it promotes regeneration of islets cells iii) it increases glucose utilization, it is shown to increase the activities of enzymes responsible for the utilisation of glucose by insulin-dependent pathways, an increase in phosphorylase activity, decrease in gluconeogenic enzymes and sorbitol dehydrogenase. iv). It causes inhibition of glucose absorbtion from the intestine. Gymnemic acid binds to the receptor on the intestine and stop glucose molecule from binding to the receptor and thus prevent excess glucose absorption. Gymnemic acid binds to Na+ glucose symporter in the intestine, thereby preventing glucose absorption. In case of *Gymnema saponins*, anti-sweet activity is also developed due to the presence of Acyl group, so it is an aglycone part of saponin. It also increases the amount of insulin in blood plasma. Gymnemagenin has anti-hyperglycemic activity. Gymnestrogenin's other antidiabetic activities are still not observed in various literature. Antidiabetic activities of various bioactive components are essential for Type 2 diabetes control [25-30].

Antidiabetic compounds such as anthraquinone, flavones, flavonoids like epicatechin, Apigenin, Luteolin, Kampferol, Hentriacontane, Pentri-acontane, Phytin, Resin, Lupeol, β-amyrene related glycosides, alkaloid (conduritol), α and β-chlorophyll, Stigmasterol, d-quercitol, Nonacosane, Lignin *etc*. also have antioxidant activities. Antioxidant like ascorbic acid neutralizes hydroxyl radicals, superoxide radicals, thereby proving its antioxidant nature and also showing blood sugar uptaking abilities. Both antioxidant and antidiabetic function is very helpful in Type 2 diabetes treatment. Other antioxidants like Terpenoid, Flavonoid, Cinnamic acid, Folic acid, Tannin, Phenol *etc*. also perform antidiabetic and antioxidant activity. As antidiabetic components of *Gymnema* show antioxidant activities, antioxidants also show their antidiabetic potential [31-34].

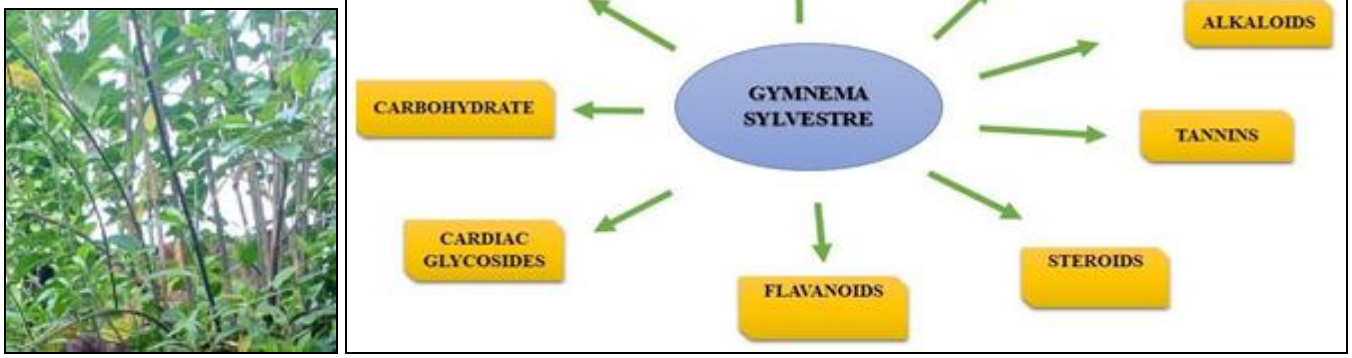

FIG. 2: CLASSES OF PHYTOCHEMICAL CONSTITUENTS PRESENT IN *G. SYLVESTRE* (KHAN ET AL., 2019)

CONCLUSION: Antidiabetic activity along with the antioxidant potential of *Gymnema sylvestre* R.Br have been reported to date due to the presence of flavonoids, phenols, and various bioactive compounds like gymnemic acid, gymnemarerin and other secondary metabolites like saponins, tannins (phenolic compounds) and triterpenoids that are antioxidants but show antidiabetic activity also.

So, we can conclude from various literature reviews that biocomponents also possess both antidiabetic and antioxidant activities and antioxidants with their antidiabetic features. As diabetes incidence increases daily, more effective research and assessment or analysis must be required to find other active phytochemical compounds with the exact active antidiabetic mechanism of action for human welfare in the near future.

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CONFLICT OF INTEREST: Nil

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