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A Review on Phytochemistry and Pharmacology of *Gymnema sylvestre*

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ABSTRACT

Gymnema sylvestre plant belonging to Asclepiadaceae family popularly known as "gurmar" for its distinct property as sugar destroyer is a reputed herb in the ayurvedic system of medicine. There are different types of phytochemicals are found in *Gymnema sylvestre* from that some are responsible for sweet suppression activity includes triterpene saponins known as gymnemic acids, gymnemasaponins and polypeptide gurmarin. The herb exhibits a broad range of therapeutic effects. *Gymnema sylvestre* plant is effective natural remedy for diabetes, besides being used for arthritis, diuretic, anaemia, osteoporosis, hypercholesterolemia, cardiopathy, asthma, constipation, microbial infections, indigestion and anty-inflammatory. The herbal extract of *Gymnema sylvestre* used in dilatory supplement since it reduces body weight, blood cholesterol and information about pharmacological activity of the herb and phytoconstituents present in the *Gymnema sylvestre* plant.

INTRODUCTION:

The word Gymnema is derived from a Hindu word "Gurmar" meaning "Destroyer of sugar".[1,2] *Gymnema sylvestre* R. is herb belonging to the family Asclepiadaceae.[2,3] *Gymnema sylvestre* R. is widely distributed in India, Malesia, Sri Lanka, Australia, Indonesia, Japan, Vietnam, tropical Africa and China.[2] In India, the leaves of the *Gymnema sylvestre* plant have been used as a diuretic, stomachic, cough removal, throat trouble and pain in the eyes. *Gymnema sylvestre* is sugar destroyer and mainly used in treatment of diabetes mellitus.[4] *Gymnema sylvestre* is Gymnemic acid which has anti-diabetic, anti-sweeteners and anti-inflammatory activities.[5]

Synonym[6,7]

English – Periploca of the woods, Cowplant

Hindi – Gurmar, Gudmar

Kannada – Kadhasige, Madhunashini

Sanskrit – Meshashringi

Tamil – ShirukurumKaay, Shirukurinjan

Telagu – Gurmaar Buuti

Bengali – Mera-singi

Gujrati – Dhuleti

Malayalum – Cakkarakkolli

Marathi – Kavali

Oriya –Gudmari

Biological Source

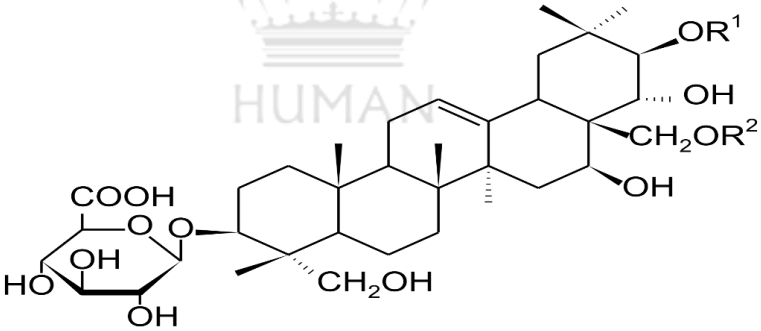
It consists of leaves of the plant *Gymnema sylvestre*, belonging to the family Asclepiadaceae.[8]

Geographical Source

Gymnema is a woody climbing plant that grows in the tropical forest of central and southern India. The woody Gymnema plant also grows in part of Africa. *Gymnema sylvestre* a family of Asclepiadaceae is a perennial plant originated in India.[9,10] It occurs from Africa east to Saudi Arabia, Vietnam, Sri Lanka, South China and from Japan to Philippines, Malaysia, Indonesia, Australia and in dry forests throughout India.[11]

Chemical Constituents

The *Gymnema sylvestre* leave mainly contains active constituent is Gymnemic acid. Gymnemic acid is mixture of closely related organic glycoside possesses anti-saccharine properties.[12] The oleanane saponins is gymnemic acid and gymnemasaponins. Dammarene saponins is gymnemosides (A to F). Gymnemasin A, B, C and D. Also contains gymnemanol (aglycone), gymmestrogenin, flavonol glycoside, sterols, d-Quercitol, Lupeol, Parabin, Glycosides and Anthraquinones.[13]

Gymnemic Acids				
Structure				
Name	Gymnemic acid I	Gymnemic acid II	Gymnemic acid III	Gymnemic acid IV
R_1	Tigloyl	2-methylbutanoyl	2-methylbutanoyl	tigloyl
R_2	Acetyl	acetyl	H	H
Chemical Formula	$C_{43}H_{66}O_{14}$	$C_{43}H_{68}O_{14}$	$C_{41}H_{66}O_{13}$	$C_{41}H_{64}O_{13}$

Biological Activity

1) Anti-diabetic activity

The anti-diabetic activity of *Gymnema sylvestre* is due to gymnemic acid which increases the insulin secretion. Proposed mechanism for the hypoglycemic action of gymnemic acid might be increased secretion of insulin from the pancreas and promotion of islet cell regeneration. Gymnemic acid inhibits the glucose receptor binding decreases glucose reabsorption. Gymnemic acid stimulates activities of enzyme responsible for glucose utilisation causes inhibition of glucose absorption from intestine.[15] It may stimulate pancreatic β-cell function, increase β-cell number and increase insulin release by increasing cell permeability to insulin.[16]

2) Anti-arthritic activity

The leaf extract of *Gymnema sylvestre* was examined for arthritic activity on albino rats. The water soluble and petroleum ether extract was found to be significantly effective in controlling arthritis.[13]

3) Anti-cancer activity

Anti-cancer activity of many plants derived saponin have already been reported.[17] Amaki et al 18 reported the inhibition of the breast cancer resistance protein using the alcoholic extract of Gymnema Sylvestre.[18] The saponins from *Gymnema sylvestre* significantly have anti-cancer cytotoxic activities on HeLa and HEPG2 cells under in vitro conditions.[19]

4) Anti-inflammatory activity

The aqueous extract of *Gymnema sylvestre* leaves tested on various inflammatory models showed anti-inflammatory activity. [2,20] The 300 mg/kg dose decreased paw oedema volume by 48.5% within 4 hrs after administration, compared to the standard drug phenybutazone (57.6%).[21]

5) Anti-microbial activity

Methanol leaf extract of *Gymnema sylvestre* showed significant anti-microbial activity against *E. coli*, *B. cereus*, *C. albicans* and *C. kefyr*.[22]

The anti-microbial activity of saponin fractions from the leaves of *Gymnema sylvestre* and *Eclipta prostrata* was evaluated against pathogenic bacteria and fungi in an *in vitro* condition.[23]

The ethanolic extract of *Gymnema sylvestre* leaves demonstrated anti-microbial activity against *Bacillus pumilis, Bacillus subtilis, Pseudomonas aeruginosa* and *Staphylococcus aureus* and inactivity against *Proteus vulgaris* and *E. coli*.[24]

6) Antidote against snake venom

Potassium gymnemate isolated from the plant was evaluated for its activity against the ATPase isolated from venom of *V. russelli* and *N. naja*.[25] Potassium gymnemate extracted from *Gymnema sylvestre*, a folk medicinal plant for snakebite, inhibited ATPase, a toxic component of the venom. ATPase and gymnemate bind at the same site(s).[26]

7) Hypolipidemic activity

Hyperlipidaemia is a well known risk factor for cardiovascular diseases. There are various drugs which are used to control hyperlipidaemia. *Gymnema sylvestre* is well known herb with various medicinal properties.[27] The administration of leaf extract to hyperlipidaemiac rats for two weeks have been found to show reduction in elevated serum Triglyceride (TG), Total cholesterol (TC), Very low density lipoprotein (VLDL) and Low density lipoprotein (LDL) cholesterol in dose dependent manner.[20] Anti-hyperlipidaemic activity of *Gymnema sylvestre* R. Br. Leaves may be due to the presence of acidic compounds, flavonoids, phenols, saponins, tannins and triterpenoids found in the preliminary phytochemical screening.[28]

8) Anti-allergic and Anti-viral activity

The aqueous extract of the leaves of *Gymnema sylvestre* possesses anti-allergic, ulcerogenic, anti-viral properties that may be due to cytoprotective mechanism.[29] The in vitro studies on albino mice proved the purified fraction obtained from aqueous extract of *Gymnema sylvestre* possess anti-stress/anti-allergic activity against milk induced leucocytosis/eosinophilia.[30]

Medicinal uses

Prolonged oral administration of *Gymnema sylvestre* produces:

i) A reduction in the insulin requirement possibly by enhancing endogenous insulin availability.

ii) An improved blood glucose homeostasis as seen by lowered HbA1c and glycosylated plasma protein levels.

iii) Better control of the hyperlipaemia associated with diabetes mellitus.

iv) A reduction in serum amylase activity.[31]

Use in obesity/weight control:

A standardized *Gymnema sylvestre* extract (GSE) in combination with niacin bound chromium (NBC) and hydroxy citric acid (HCA-SX) has been evaluated for anti-obesity activity by monitoring changes in body weight, body mass index (BMI), appetite, lipid profile, serum leptin and excretion of urine fat metabolites.[32]

Use as anti-oxidant:

The *Gymnema sylvestre* extract showed antioxidant activity by inhibiting DPPH, scavenging superoxide as well as hydrogen peroxide and reducing power ability which may be due to presence of flavonoids, phenols, tannins (phenolic compound) and triterpenoids found in the preliminary phytochemical screening.[33]

Use to lower blood sugar level:

Gymnema sylvestre is considered to have anti-diabetic properties.

As a supplement, it has been used in combination with other diabetes medications to lower blood sugar level.[34]

CONCLUSION

The *Gymnema sylvestre* popularly known as “gurmar” is a reputed herb in ayurvedic system for its distinct property as sugar destroyer belonging to the family Asclepiadaceae mainly found in the tropical forest of central and southern India, Africa, Sri Lanka, Vietnam, Japan, South China, Indonesia, Malaysia and Australia. In *Gymnema sylvestre* different types of active chemical constituents shows different types of biological activities from which the main constituent is gymnemic acid responsible for its anti-diabetic activity. *Gymnema*

sylvestre is an important plant in Ayurvedic system of medicine for its different types of medicinal activities and uses.

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