



A Review On Overview Of The Phytochemistry And Medicinal Uses Of *Gymnema sylvestre*

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Abstract :-

Gurmar, also referred to as *Gymnema Sylvester* Grows in topical forests in the parts of Africa, Central and Southern India. *Gymnema Sylvester*, an ayurvedic herb, become known as the destroyer of sugar because in ancient times, ayurvedic physician found that chewing a few leaves of *Gymnema Sylvester* lessened and sweetness of sugar. The plants leaves are frequently used in Indian proprietary medication as a diuretics and to treat diabetes. The plant has been shown to have antihelmentic, anti-oxidant, anti-obesity, immunomodulatory, anti-microbial, diuretics, anti-inflammatory and digestive benefits. The numerous pharmacological actions and applications of this plant are the primary focus of this review paper. Different parts of the plants including the root, stems and leaves have been used as stimulants, laxative, diuretics, cardiotonics and uterine tonics in traditional medical system. The main purpose of the paper is to provide an overview of medicinal qualities of the Gurmar.

Keyword:- *Gymnema sylvestre*, Pharmacological activity, Asclepiadaceae, Gymnemic acid, Anti-diabetic.

Introduction:-

Gymnema Sylvester R.Br. is a valuable plant that is commonly found in India and is a member of the Asclepiadaceae family. Southeast Asia, including Malaysia, Srilanka, Australia, Indonesia, Japan, Vietnam, topical Africa, and the Peoples Republic of China's southwest. *Periploca* of the Woods is the common name for the plant.^[1,2,3,4,5] The word "Gymnema" comes from the Hindu word "Gurmar", which means "destroyer of sugar". It is thought that this substance could balance out the excess sugar that the body produces when it has diabetes mellitus.^[6] Since ancient times, naturopathic medicine has been thoroughly investigated and is currently gaining popularity. There are approximately 45,000 plant species in India's flora, and thousands of them are significant pharmacologically.^[7]

Diabetes mellitus is a serious endocrine disorder that affects almost 10% of peoples Globally and is a major cause for concern.^[8] When the illness is severe, it affects the body's major systems and can cause complications across multiple organ systems. The traditional medications used for the treatment are oral hypoglycemic agents such as biguanides and sulphonylureas; however, a significant drawback of these medications is their unfavorable side effects. Herbal remedies are gaining popularity because they are safer to use, produce better results than commercially available drugs, and are more effective at treating medical conditions.^[9] "Miracle fruit" is one unique name for this species of plant. The Latin term for "naked" and the word "from the forest", *sylvestre*, are most likely the sources of the name "Gymnema". It comes originally from tropical Africa and Australia, as well as from central and western India. The leaves are opposite and typically oval or elliptic in shape. Little yellow flowers Grow in auxiliary and lateral umbels within cymes.

Gymnema leaves are said to be acrid, bitter, and astringent. They temporarily impair the sense of sweetness, and because of this remarkable quality, they are referred to as "GUDMAR".^[10] Due to the combination of tri-terpenes and saponins found in *Gymnema* leaves, namely Gymnemic acids, Gymnemagenin, and Gurmarin, this plant is thought to have anti-diabetic properties.^[11] Also used as food additives to prevent obesity are its leaves. In addition *Gymnema Sylvestre* possesses diuretic, stomachic, and cough suppressant qualities.^[12] Tribal people use this plants root as a snake bite remedy. It has long been a part of ayurvedic medicine.

There are 40 species in the genus *Gymnema*, which are found in Western Africa and Australia. *Gymnema* species include *Gymnema acuminatum* (Roxb.) wall, *Gymnema aurantiacum*, *Gymnema balsamicum*, *Gymnema lactiferum*, *Gymnema montanum*. Some of the important species of *Gymnema* are Hook. F., *G. sylvestre* R. Br., *Gymnema tingens* W and A, *Gymnema indorum*, *Gymnema yunnanense*, and *Gymnema spartum*. *G. sylvestre* is a powerful antidiabetic herb udes in the Ayurvedic and Homeopathic medical systems. It has also been described as an antipyretic, stomachic, astringent, diuretic, laxative, stimulant, and expectorant.^[71,72]



no.02:-Gymnema sylvestre seeds(Gudmar)



Fig no.01 :-Gymnema sylvestre Plant (Gudmar). Fig



Fig no.03 :-Gymnema sylvestre Leaf (Gudmar).

The plant's special characteristics have led to overexploitation, endangering the species. *Gymnema sylvestre* has traditionally been used to treat liver disease, constipation, and stomach issues. However, more recent research has indicated that the extract can help control blood sugar level in Type II diabetes patients. Giving a diabetic patients a *Gymnema* leaf extract causes the pancreas to release more insulin.^[13]

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophytes
Class	Magnoliopsida
Subclass	Asteridae
Order	Gentianales
Family	Asclepiadaceae
Genus	<i>Gymnema</i>
Species	<i>Sylvestre</i>

Table 1: Taxonomy of *Gymnema sylvestre*

Morphology:

A large, woody shrub that twines erratically and climbs over the tops of tall trees in forests is called *Gymnema sylvestre*. The stem is branching, hard, twining and aerial. Young branches and stems have smooth, cylindrical shapes. The opposite, glabrous, elliptic, and acuminate leaves have an acute base. Leaf has a mildly astringent and bitter flavor. It also has the amazing ability to temporarily paralyze one's sense of taste for sweet foods.^[14]

Seasons of Flowering: April and November

Winter is fruiting season: December to March

Number of Chromosome: $2n = 22$

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

Material and methods

The leaves of *Gymnema sylvestre* R. Br. (family Asclepiadaceae) which is native to Africa and India but is now found all over the world, are used to make *Gymnema*. For at least 2000 years, this herb has been used in Ayurveda medicine to treat sugar diabetes. Using a variety of floras, the plant material was correctly identified and verified.^[15,16]

Preparing plant material

Each ecotype's cleaned leaves were roughly 3kg, dried in the shade, ground into a powder, run through 40 sieves, and kept in a closed vessel for later use. The material in powder form was dried and then extracted using a Soxhlet method using petroleum ether, chloroform, and methanol for a continuous hot extraction process. The plant is a large, woody climber that is somewhat pubescent. The leaves are opposite and typically elliptic and ovate, measuring between 1.25 and 2.0 inches by 0.5 and 1.25 inches. Small, yellow flowers grow in axillary and lateral axils in cymes; terete, lanceolate follicles can reach a length of three inches. Long, ovate, obtuse, and pubescent are the characteristics of the calyx lobes. Pale yellow, campanulate, valvate, corona single, with 5 fleshy scales on the corolla. A membranous tip is formed by the anther connective, pollinia are two erect, carpels are two unilocular, and there are many ovules in the locules. Scales adnate to the throat of the corolla tube between lobes.^[5,17,18]

Pharmacogenetics research:

In Indian proprietary medicine, *G. sylvestre* leaves are commonly used to treat diabetes and as a diuretic. The leaves are also sold as *Gurmarbuti* along with the aerial parts in the majority of the nation's herbal drug markets.^[20] Thus, the following describes the features of the aerial parts, both microscopic and macroscopic.

Macroscopic features:

The stem of *G. sylvestre* is hairy and light brown, while the leaves are green in color. The leaf measures 1-4 cm in width and 2-6 cm in length. The leaves are pubescent on both surfaces, simple, petiolate, rounded to cordate base, entire margin, opposite with acute apex, and reticulate venation. The taste of the leaf is slightly astringent and bitter, and its aroma is distinctive. Additionally, it has the extraordinary ability to temporarily paralyze one's sense of taste for sweet things for a few hours.^[20,21]

Microscopic features:

1. **Petiole:** There is a horseshoe-shaped transverse section in the petiole. The epidermis is composed of single layers with a barrel shape, thick walls, and uniseriate, multicellular, non-glandular trichomes covering it. The vascular bundles are amphicribal and have three numbers, and the cortex is collenchymatous. The components of well-developed phloem include companion cells, phloem parenchyma, and sieve tubes. Tracheids, tracheidal fibers, and vessel make up the xylem. The starch grains are found in two or more groups and are polygonal, simple, or compound. The calcium oxalate rosette crystals are more prevalent in the center.^[20,22]
2. **Lamina:** The lamina's epidermal cells have a square shape, a thin cuticle, and an outer convex wall. Transversally, the epidermal cells surface is disrupted by trichomes, which are abundant on both surfaces and uniseriate, multicellular structures with two to five cells. Deeply arranged, single-layered palisade cells are found directly beneath the adaxial epidermis. Mesophyll is thick, with three to five cells per cell, and vascular bundles are amphicribal.^[20,22]

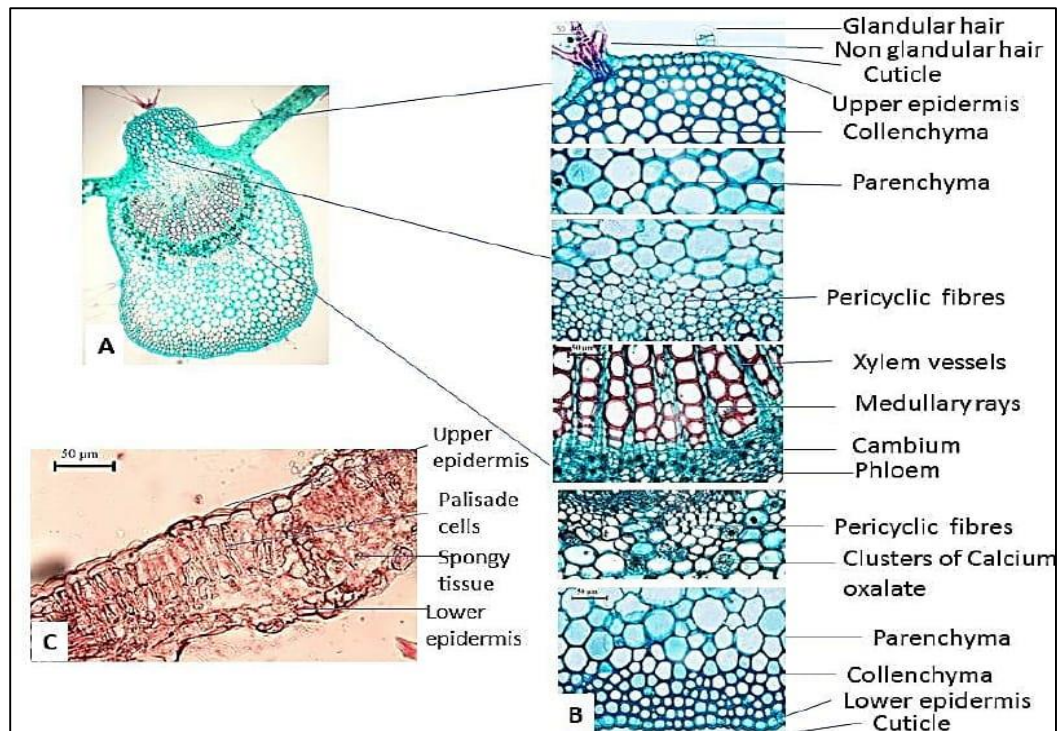


Fig no.04:- A: T.S of the leaf, B: T.S.of leaf in the midrib region, C: T.S.of leaf in the lamina.

- Stem:** The transverse section of the stem has a circular cross section. The epidermis has thick walls and a barrel-like shape. Trichomes have 185-485 μ length, 9-25 μ width, and are uniseriate, multicellular organisms. Cortical cells are laterally elongated and collenchymous, and the cork is three to five layers thick. The developed phloem is made up of companion cells, phloem parenchyma, and sizable sieve plates.
- Powder:** The powdered substance has a faint Greenish- yellow color, a bitter flavor, and a pleasant, fragrant scent. Under a microscope, it displays thick-walled, uniseriate multicellular trichomes, anomalous stomata, an idioblast with calcium oxalate rosette crystals, starch Grains and remnants of parenchymatous cells, as well as vessels, tracheids, tracheidal fibers, bast fibers, and sieve plates.

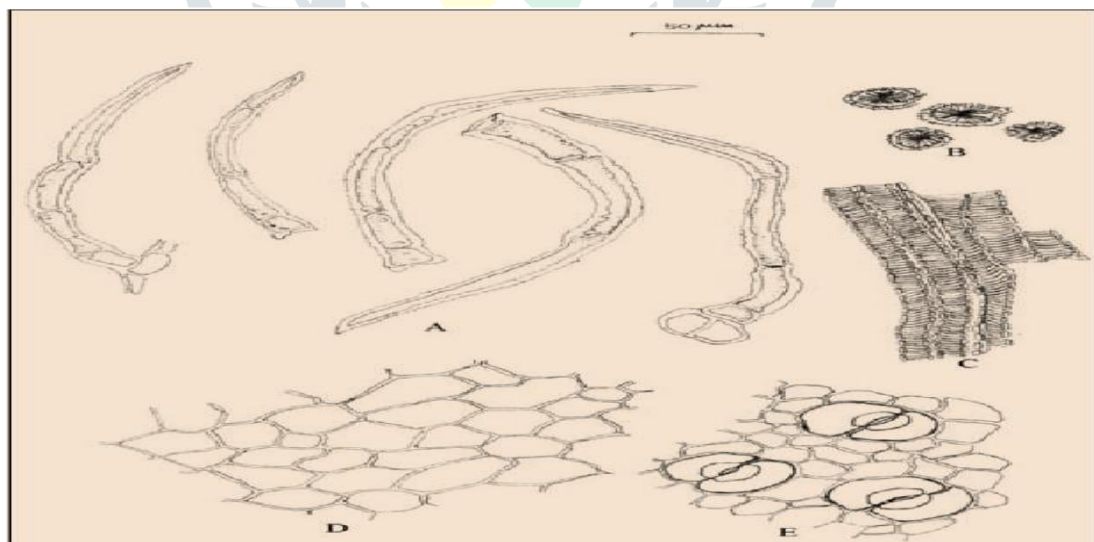


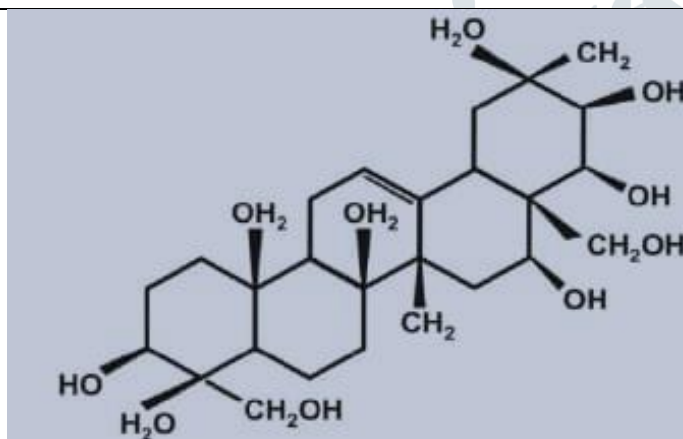
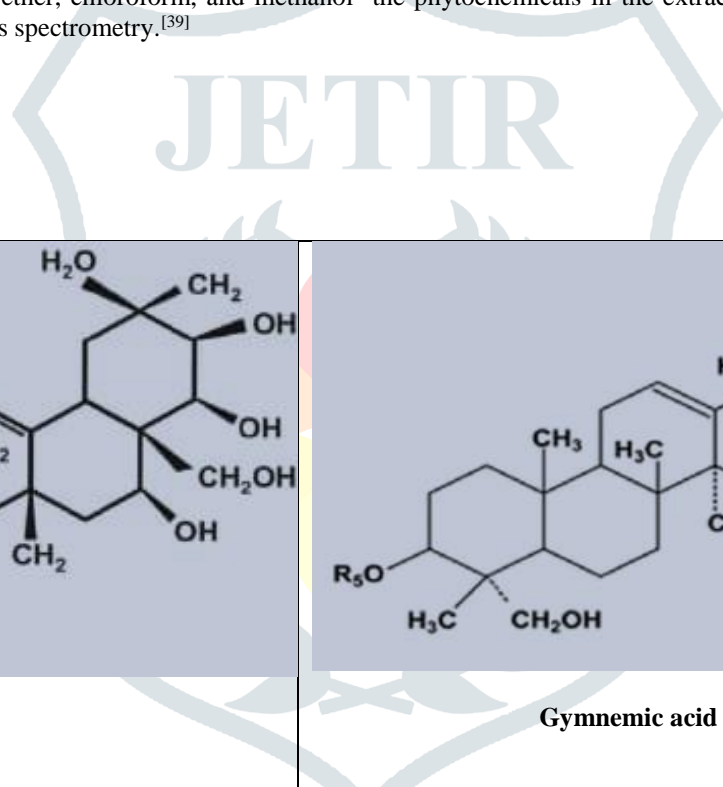
Fig no.05:- Examine the drug content of *Gymnema sylvestre* leaf powder. A: Uniseriate multicellular trochomes; B: Rosette crystals of calcium oxalate; C: Group of xylem vessels; D: Group of epidermal cells; E: Paracytic stomata.

Phytochemistry:

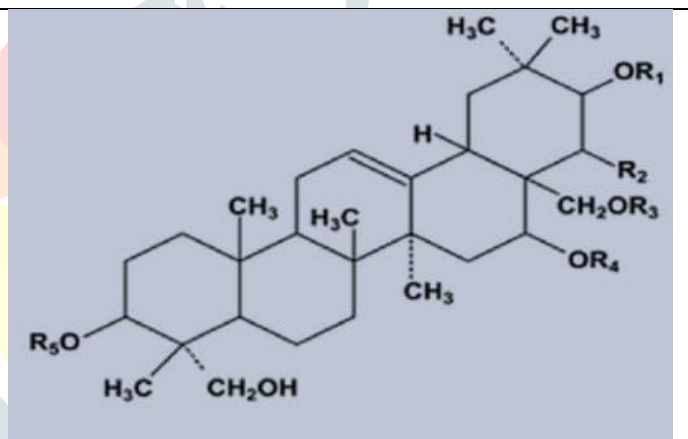
Numerous researchers have reported on various phytochemical constituents. The plant contains two resins, one of which is soluble in alcohol and the other in saponins, Gymnemic acid, stigmasterol, quercitol, and derivatives of amino acids like betaine, choline, and trimethylamine.^[23] *G. Sylvestre* leaves have triterpene saponins that fall into the dammarane and oleanane classes.^[24,25,26] Whereas dammarene saponins are Gymnemic acids and gymnemasaponins.^[24,27] Additionally, the leaves contain the following: organic acid (5.5%), paraben, calcium oxalate (7.3%), lignin (4.8%), cellulose (22%) and anthraquinone derivatives, albumin, carbohydrates,

tartaric acid, formic acid, butyric acid, and inositol alkaloids.^[28,29] The acylated derivatives of deacylgymnemic acid (DAGA), a 3-O-β-Glucouronide of Gymnemenin (3β, 16β, 21β, 22α, 23,28-hexahydroxy-olean-12-ene), that are present in Gymnemic acids include tingly, methylbutyryl, and others.

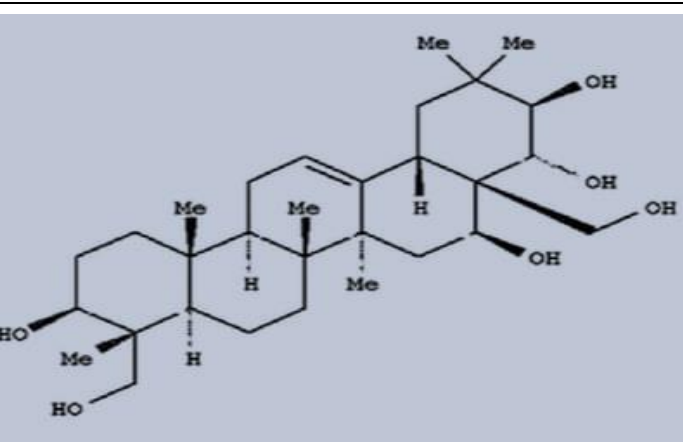
G. Sylvester leaves contain anthraquinones and their derivatives, as well as acidic Glycosides.^[24] Whereas the molecular structures of Gymnemic acids A2 and A3 contained both Galactose and Glucuronic acid, Gymnemic acid A1 was found to contain only Glucuronic acid A1.^[30] Additionally, a hot water extract of dry G. Sylvester leaves was used to isolate and characterize a series of Gymnemic acids (Gymnemic acid I, II, III, IV, V, VI, and VII).^[31,32] G. Sylvester produced the significant 35 amino acid peptide Gumarin, which has a molecular weight of 4209.^[33] Gymnemic acids I-VII, Gymnemosides A-F, and Gymnemasaponins are the different forms of Gymnemic acids, also known as saponins. Gymnemic acids, (+) quercitol, lupeol, (-) amyrin, stigma sterol, and other substances have been found in G. sylvester.^[34] Gymnemic acid A, also known as Gymnemenin, is composed of Gymnemic acids A1, A2, A3 and A4. This ingredient is a hexahydroxy-triterpene D-Glucuronide that esterifies with acids.^[35] Later on, five more Gymnemic acids-X, XI, X, VIII, and XII- were isolated and studied.^[36] This compound's ability to suppress sugar was assessed electrophysiologically using rat taste responses.^[37] This polypeptide's antisweat effect is highly particular to sweet tongue taste and is influenced by pH changes. According to reports, the polypeptide's maximum antisweat-ner property was observed in close proximity to its isoelectric points.^[37] Gumarin's correct binding to the target molecules rather than the ionic one.^[33] The other significant components that have been extracted from leaves include alkaloids and Gymnemasins A, B, C, and D.^[38] In order to identify the presence of terpenoids, Glycosides, saturated and unsaturated fatty acids, and alkaloids in three distinct leaf extracts-petroleum ether, chloroform, and methanol- the phytochemicals in the extract were also analyzed using Gas chromatography coupled to mass spectrometry.^[39]



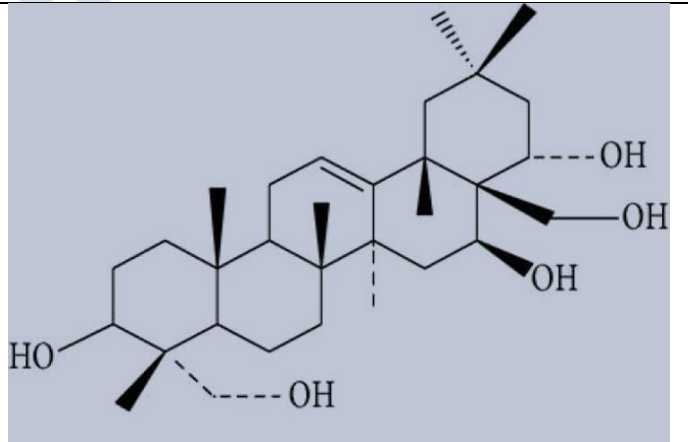
Gymnemenin



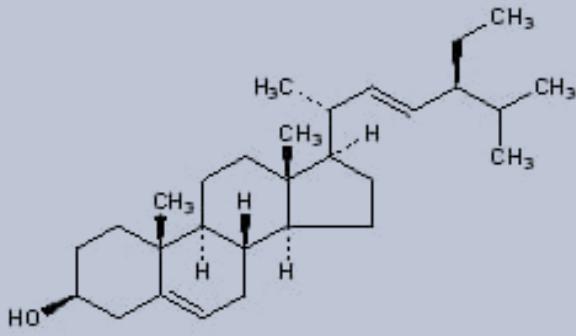
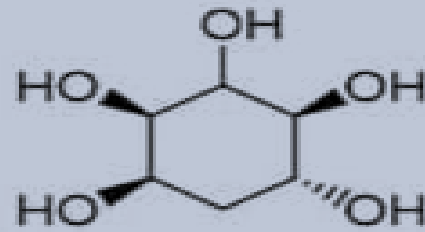
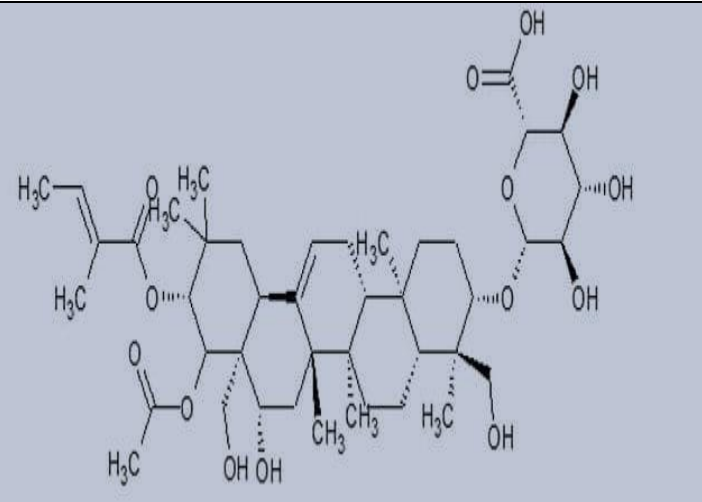
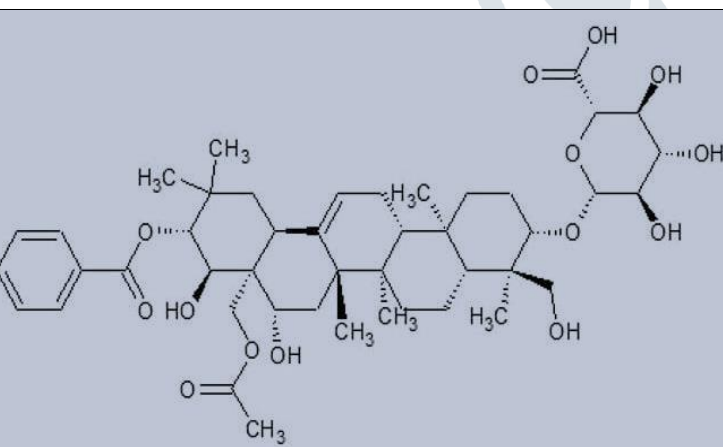
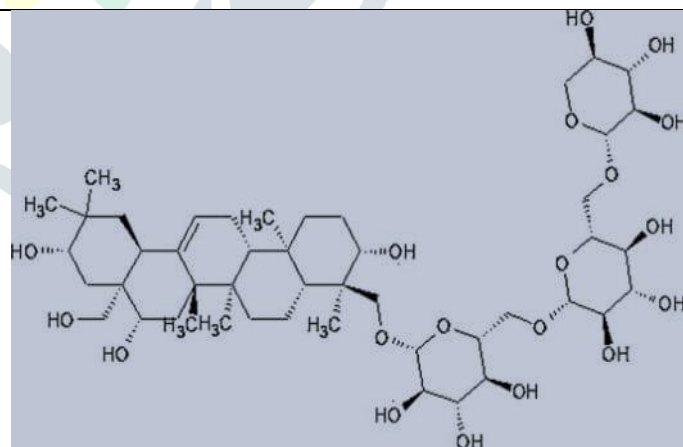
Gymnemic acid



Gymnemenin



Gymnemanol

**Stigmisterol****Quercitol****Gymnemoside A****Gymnemoside B****Gymnemoside C****Gymnemoside D**

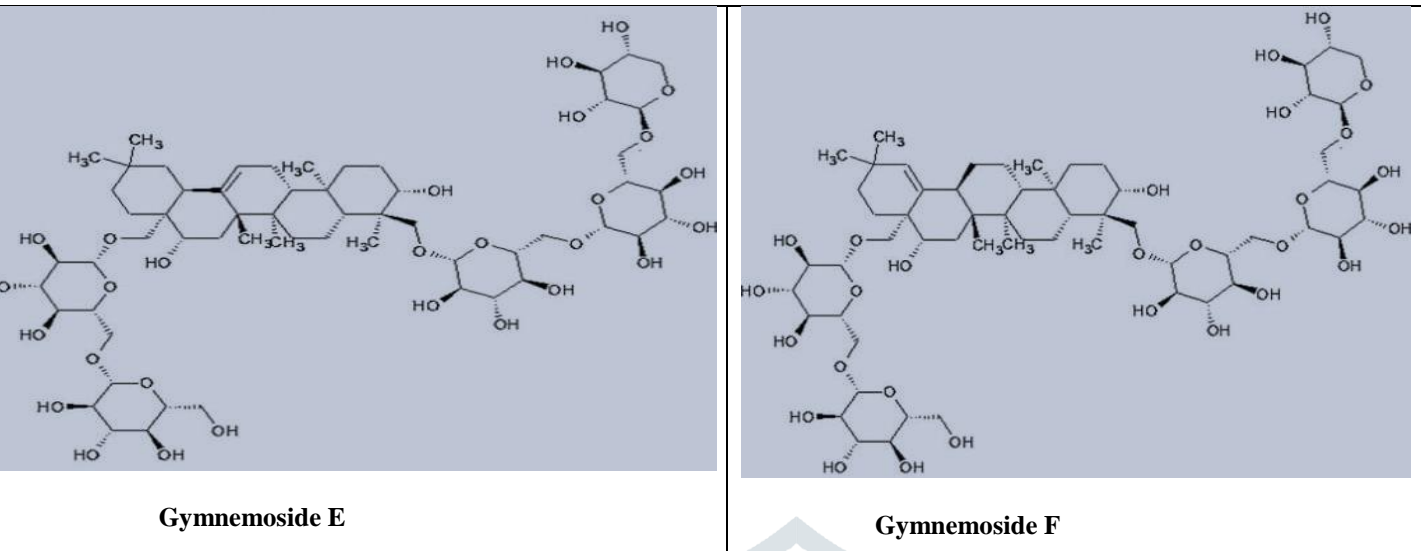


Fig no.06: Some phytoconstituent's structures that were separated from *Gymnema sylvestre*

Traditional uses:

In the traditional Ayurvedic medicine, *G. sylvestre* is used to treat both type I and type II diabetes. Additionally, it is used to treat respiratory issues, piles, chronic cough, asthma, eye complaints, cardiopathy, constipation, jaundice, and bronchitis. It is also used to treat stomach issues, urinary complaints, and breathing problems.^[40,41,42] Trials also employ it to treat and neutralize the venomous effect of snake bites.^[43] *Gymnema sylvestre* is used as a sugar destroyer in a cases of Glucosuria and other urinary diseases, according to sushruta, because chewing the leaves destroys the ability to detect the sweet tastes.etc. It's nature has been reported in a variety of ways, including that it is bitter, astringent, thermogenic, anti-inflammatory, digestive, liver tonic, diuretic, stomachic, stimulant, anthelmintic, laxative, cardio tonic, anti-pyretic, and uterine tonic.etc. It helps with bleeding disorders, hepatitis, constipation, renal and vesicle calculi, dyspepsia, asthma, bronchitis, amenorrhea, conjunctivitis, and leukoderma.^[2,40,41,42,44] The medication is also a component of several ayurvedic preparations, including Mahakalyanakaghrtam, Varunadi kasaya, Ayaskri, and Varunadighrtam.^[44]

Pharmacological uses:

One of the important medicinal plants, *G. sylvestre*, is well known for its anti-sweetening properties. It is used by Ayurveda to treat diabetes as well as the other conditions listed below.

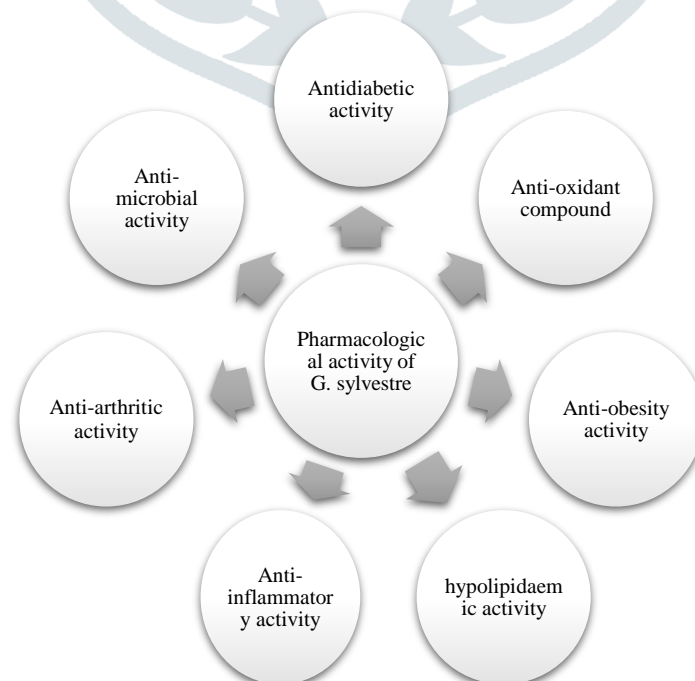


Fig no. 07: Pharmacological activity of *G. sylvrstre*

- Anti-diabetic activity:** The leaves of *G. sylvestre* were shown to lower urine Glucose in diabetics nearly a century ago, which was the first scientific validation of the plant's use in human diabetes.^[45] I.e. Paliwal et al., looked at the potential benefits of Gudmar leaf powder on blood Glucose level in an animal study. Gudmar powder is useful in lowering postprandial and fasting blood Glucose level because no harmful effects were noted on the subject's health.^[46] Secondary metabolites are found in *Gymnema sylvestre*. Oleanane and dammarane saponins are examples of these metabolites. There are two kinds of oleanane saponins: Gymnemic acid and *Gymnema* saponins. Two aglycone saponins, such as *Gymnemagenin* and *Gymnestrogenin*, make up *Gymnema* saponins.^[47] These secondary metabolites all possess anti-diabetic qualities. In addition of these triterpenoid saponins, other components that inhibit diabetes include anthraquinone, flavones, and flavonoids such as epicatechin, apigenin, luteolin, kaempferol, hentriacontane, pentatriacontane, phytotin, resins, tartaric acid, formic acid, butyric acid, lupeol, and Glycosides related to β -amyryn. The anti-diabetic properties of anthraquinones and their derivatives, alkaloids (conduritol, *Gymnamine*, 2α and β chlorophyll polypeptide, *Gurmarin*, d-quercitol, *stigmasterol*, *nonacosane*, *paraben*, calcium oxalate, cellulose, lignin, etc.) are also present.^[48,49]
- Anti-oxidant compounds:** *Gymnema sylvestre* contains a variety of antioxidants, including flavonoids, tannins, alkaloids, phenols, cinnamic acid, folic acid, ascorbic acid, butyric acid, and tartaric acid.^[50,51]
- Anti-obesity activity:** It is possible that *G. sylvestre* aids in weight loss because of its capacity to regulate blood sugar levels.^[52] An assessment of the anti-obesity potential of a standardized *G. sylvestre* extract, niacin-bound chromium, and hydroxy citric acid has been conducted through changes in body weight, body mass index (BMI), appetite, serum leptin levels, lipid profiles, and excretion of urine fat metabolites. This study demonstrated that hydroxy citric acid, niacin-bound chromium, and *Gymnema sylvestre* extract can be combined to provide a safe and effective weight loss formula that can help reduce excess body weight and BMI while supporting normal blood lipid levels.^[53] The levels of cholesterol, LDL, HDL, and triglycerides were all improved by the extract. Significant data reduction was observed in obese rats treated with *Gymnema* extract.^[54] When *G. sylvestre* was used with fenugreek, chitosan, and vitamin C, it was found to significantly reduce body weight in obese adults (body mass index of 30kg/m² or higher).^[55]
- Hypolipidaemic Activity:** *Gymnema sylvestre* exhibits hypolipidemic properties. Rats with hypolipidemia were given sufficient dosages of *G. sylvestre* leaf extract for a period of two weeks. It has been discovered that leaf extract contributes to the decrease of low density lipoprotein (LDL), very low density lipoprotein (VLDL), total cholesterol (TC), and serum triglycerides (TG). This medication's effectiveness was nearly identical to that of a typical lipid-lowering agent.^[4,56,57]
- Anti-inflammatory Activity:** The search was conducted for anti-inflammatory activity in rats using the aqueous extract of *G. sylvestre*. An important role for *G. sylvestre* in reducing inflammation was noted.^[57]
- Anti-arthritic Activity:** The saponin, triterpenoids, and steroid content of *G. sylvestre* leaves may be the cause of their anti-arthritic properties. According to the study, *Gymnema*'s aqueous and petroleum ether extracts had anti-arthritic properties.^[58]
- Anti-microbial Activity:** *Gymnema sylvestre* leaf extracts in both aqueous and methanol demonstrated strong antibacterial and antifungal properties against common microorganisms such as *Escherichia coli*, *Bacillus cereus*, *Candida albicans*, *Candida kefyr*, *Candida krusei*, and *Klebsiella pneumoniae*.^[59] Additionally, the three harmful salmonella species (*Salmonella typhi*, *S. paratyphi*, and *S. typhimurium*) were moderately active against the aqueous methanolic extract of *G. sylvestre* leaves. Out of the two extracts used, aqueous extract showed higher activity against the salmonella species.^[60] Extracts of *G. sylvestre*'s aerial parts that are ethanolic, chloroform- and ethyl acetate- based have also been shown to possess antibacterial properties against *P. vulgaris*, *E. coli*, *Klebsella pneumoniae*, *P. aeruginosa*, and *S. aureus*.^[61] By using the disc diffusion method, the antibacterial activity of *G. sylvestre* was found in petroleum ether, chloroform, acetone, methanol, and aqueous extracts. Compared to petroleum ether and acetone, methanol and chloroform extract demonstrated significantly more activity against these microorganisms.^[62]

Uses:

- The leaves of *G. sylvestre* have historically been used to treat diabetes and other conditions, while the flowers and bark are administered to treat phlegm-related illnesses.^[63]
- Widely used in naturopathic medicine to treat diabetes, the herb also shows promise in treating obesity, rheumatoid, arthritis, hyperlipidemia, Parkinsonism, and abnormally high cholesterol.^[57, 64,65]
- In addition, the plant has therapeutic value in the management of renal and vesical calculi, dyspepsia, parkinsonism, asthma, bronchitis, amenorrhea, jaundice, constipation, cardiopathy, and conjunctivities.^[66]
- *Gymnema sylvestre*'s methanolic and ethanolic leaf extract has strong antibacterial and antibiotic properties.
- The production of *Gurmar* tooth powder, marketed as ``*Gurmar* herbal tooth paste `` result of the plant's hydroalcoholic extract's promising potential. Once clinically accepted by the scientific community, these herbal formulation present new opportunities for the treatment of dental caries.^[67]
- *Gymnema sylvestre*'s methanolic and ethanolic leaf extract has strong antibacterial and antibiotic properties.
- The root juice can be used to treat snakebite, and the root bark can be used as an emetic, expectorant, and bodyache analgesic.^[69]
- The plant extract is also beneficial in the treatment of piles, colic pain, dropsy, phlegm, eye problems, cardiac and respiratory diseases.

Dosage form:

G. Sylvestre is sold as a crude plant, powder, extract paste and solid in standardized form. Along with other herbal plants, the plant material is also offered as capsules or tablets.

Adult dose: It is advised to take 25 to 75 milliliters of the liquid extract per week. After using this medication consistently for six to twelve months, the best results will be seen. In this instance, taking 8 to 12 G of leaf equivalent daily is advised. It is also prescribed as a tablet.

Pediatric dose: It cannot be advised for children in this situation due to the lack of evidence regarding its applications.^[70]

Conclusion:

Herbal medicine has a promising future in the field of nutraceuticals and novel drug therapy. G. Sylvester is a multifunctional medicinal plant with significant Global market potential. G. Sylvester plays a significant role in India and Global medicine due to its diverse ethnobotanical, traditional, and economic applications. Indian herbs are traditionally used to treat diabetes. *Gymnema Sylvestre* is a medicinal plant that can treat a variety of conditions, including diabetes, dyspepsia, constipation, jaundice, haemorrhoids, renal and vesicle calculi, cardiopathy, asthma, bronchitis, amenorrhea, conjunctivitis, and leucoderma. In order to fully investigate *Gymnema Sylvestre*'s other therapeutic uses, it will be necessary for future research to evaluate the isolated principles in a scientific manner using a variety of creative experimental models and clinical trials. This will help to understand *Gymnema Sylvestre*'s mechanism of action and search for other active constituents. *Gymnema sylvestre* R.Br has been shown to have both antidiabetic and antioxidant properties. This is due to the presence of flavonoids, phenols, tannins (phenolic compound), and triterpenoids, all of which are antioxidants. Also based on literature review, biocomponents exhibit both antidiabetic and antioxidant properties, while antioxidants also have antidiabetic properties.

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