

Gymnema Sylvestre Plant Used By Peoples of Vidisha District for The Treatment of Diabetes

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ABSTRACT: *Gymnema sylvestre* is regarded as one of the plant with potent property. Leaves of this plant is used by peoples of Vidisha district for treatment of diabetes. The active compound of this plant is a group of acids termed as GYMNEMIC ACID. Gymnemic acid have antidiabetic, antisweetener, and anti inflammatory activities. The phytoconstituents of *Gymnema sylvestre* were isolated and their chemistry and structures were studied and elucidated. The result of this investigation will be helpful for the correct botanical identification of plant and also different sources of medicine and pharmaceutical industry.

KEYWORDS: *Gymnema sylvestre*, *Gymnemic acid*, *Phytoconstituents*, *Antidiabetic*.

I. INTRODUCTION

Diabetes mellitus is a multi factorial disease which is characterized by Hyperglycemia Lipoprotein abnormalities and altered intermediary metabolism of major food substrates (Scoppola et al;2001). *Gymnema sylvestre* is a valuable herb belonging to the family *Asclepiadaceae*, and widely distributed in India, Malaysia, Srilanka, Australia, Indonesia, Japan, Vietnam, Tropical Africa and the South western region of the people's of republic of China. (Bone 2002, Ankit Saneja et al, 2010; Stocklin 1869). *Gymnema* is a woody vine like climbing plant that grows in the Tropical forest of central and Southern India. It came to be known as "destroyer of sugar" because, in ancient times, Ayurvedic physicians observed that chewing a few leaves of *gymnema sylvestre* suppressed the taste of sugar (Mitul shah 2010). The word *Gymnema* is derived from a Hindu word "Gurmar" meaning "destroyer of sugar" and it is believed that it might neutralize the excess of sugar in the body (Keshawa murthy et al 1990). *Gymnema* contains a substances that decrease the absorption of sugar from the intestine *Gymnema* may also increase the amount of insulin in the body and increase the growth of cell in the pancreas, which is the place in the body where insulin is made. Loose leaf of *Gymnema sylvestre* can be prepared as a tea and will impair the ability to taste sugar by blocking sweet receptors on the tongue (Joseph and Ellen 2005). The plant is commonly known as *Periploca* of the woods (English); *Gurmar*, *Gurmar booti* (Hindi); *Meshashringi*, *Madhunashini* (Sanskrit); *Kavali*, *Kalikardori* (Marathi); *Dhueti*, *Mardashingi* (Gujrathi); *Adigam*, *Cherukurinja* (Tamil); *Podapatri* (Telgu); and *Sannagrashambu* (Kannada). (Ankit saneja et al, 2010; Kanetkar et al, 2007; paliwal et al, 2009; Rachh et al 2010; potawala et al, 2008).

II. HISTORY

Gymnema has a long history of use in India's Ayurvedic medicine. Indian first used *Gymnema* to treat diabetes almost 2,000 years ago. Today *Gymnema* is used for diabetes (Joseph and Ellen Flannery 2005) metabolic syndrome, weight loss and cough it is also used for malaria and as a snake bite, antidote, digestive stimulant, laxative, appetite, Suppressant and diuretic. The primary application was for adult-on set diabetes a condition once described as "honey urine" and is continued to be recommended today in India. In the 1920s, preliminary scientific studies found some evidence that *Gymnema* leaves can reduce blood sugar levels, but nothing much came of this observation for decades (American botanical council P.O box 201660). Today *Gymnema* has become increasingly popular in the United states as a supportive treatment of diabetes (Bone kerry 2002).

Taxonomical classification

(Duke et al 1997 and Reichenberg -ullman 1996)

Kingdom - Plantae
Division - Magnoliophyta
Class - Magnolopsida
Order - Gentianales
Family - Asclepiadaceae
Genus - *Gymnema*
Species - *sylvestre*

Plant description

G. sylvestre is a slow growing, large perennial woody climber. It is mainly present in Tropical forest of Central and Southern India. It is also found in Banda, Konkan, Western Ghats, Deccan extending to the parts of western and northern India (Keshavamurthy et al 1990; Kritikar and Basu et al 1998; Grover et al 2002). The plant is large more or less pubescent woody climber. Rooting at nodes. The leaves are opposite usually elliptic or ovate, acuminate base acute to acuminate, glabrous. Flower are small, yellow in axillary and lateral umbel like cymes, pedicels long. The calyx lobes are long, ovate obtuse and pubescent. Corolla is pale yellow, campanulate valvate, corona single, with five fleshy scales. Scales adnate to throat of corolla tube between lobes. Anther connective produce into a membranous tip, pollina 2, erect, carpels 2 unilocular; locules many ovuled (Madhurima et al, 2009; Potawale et al, 2008; Kritikar and Basu 1998, H. Zhen et al 2001; Gurav et al 2007.)

Macroscopic and microscopic characteristics

Leaves of *Gymnema sylvestre* are green in colour and stem is hairy and light brown. Leaf is 2-6 Cm. in length and 1-4 cm. in width. The leaves are simple, petiolate, rounded to cordate base, margin entire opposite with acute apex, reticulate venation, pubescent on both the surfaces. The odour is characteristics and 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 (Madhurima et al, 2009; Agnihotri et al, 2004).

Lamina-: The epidermal cells of lamina are square shaped with outer convex wall and thin cuticle, when viewed transversally, epidermal cell surface are interrupted with trichomes, which are uniseriate, multicellular with 2-5 celled, present in abundance on both the surfaces single layered closely arranged palisade cells are present just below the adaxial epidermis V.B. are amphicribal and the mesophyll is 3-5 celled thick (Agnihotri et al, 2004; Anonymous 2003; Madhurima et al, 2009).

Stem-: The T.S. of stem is circular in out line. The epidermis is barrel shaped and thick walled. Trichomes are multicellular, uniseriate. The cork is 3-5 layered thick and cortical cells are laterally elongated and collenchymous. The phloem well developed consist of large sieve plates, companion cells and phloem parenchyma. The xylem is in the form of a continuous cylinder transverse by narrow medullary rays. The epidermis is conspicuous and the pericycle is broad (Agnihotri et al, 2004; Madhurima et al, 2009).



petiole-: T.s. of petiole is horse shoe shaped. The epidermis is barrel shaped single layered, thick walled covered with uniseriate, multicellular non glandular trichomes. The cortex is collenchymatous and V.B. are amphicribal and three in numbers well developed phloem consist of sieve tubes companion cells and phloem parenchyma. The xylem consist of vessels, tracheids and tracheidal fibres. The starch grains are polygonal simple or compound in two or many groups (Ankit saneja et al 2010; Agnihotri et al, 2004; Madhurima et al, 2009)

Material and Methods -; The leaves of *Gymnema sylvestre* were collected from village Semal Khedi which is 10 Km away from Tehsil Sironj District Vidisha and 120 km from Bhopal and 76 km away from its main city Vidisha, in the month of Aug. 2010. The plant was identified by local people of that village and authenticated by Dr. Zia Ul Hasan Professor and H.O.D. Botany Department of Saifia College Bhopal. The voucher specimen had been preserved in laboratory for future reference.

The present investigation an attempted has been made to evaluate various pharmacognostic standards like ash and extractive values, fluorescence analysis of aerial parts of the plant and preliminary phytochemical screening of *Gymnema sylvestre*.

Chemicals

All the chemicals and reagents use of analytical grade.

Macroscopic and physiochemical parameters :-

The macroscopic evaluation was carried out for shape ,size ,color ,odor ,taste and fraction of the drug .Different physiochemical value ,extractive value loss on drying, foreign organic matter ,crude ,fibre content were also determined .

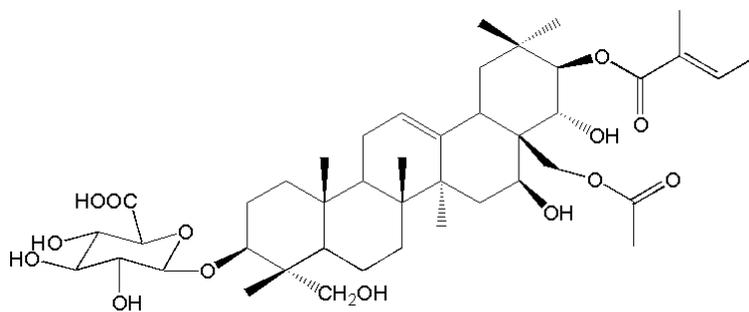
Preparation of successive extracts:

The Leaves were dried under shed ,powdered and passed through 40nm meshes and stored enclosed vessel for further use . the dried powder material (500gm) was subjected to soxhlete apparatus with petrolium Ether, chloroform , alcohol and water for continues hot extraction.the extract were concentrated under reduced pressure to obtained extract solid residue .

Phytochemistry:

The leaves of G.Sylvestre contain triterpene saponins belonging to oleanane and dammarene classes. Oleanane saponins are Gymnemic acids and Gymnema saponins , while dammarene saponins are Gymnemasides (Khramov,et al,2008; Yoshikawa et al,1992; Datio and Long 1973). Besides this other plant constituents are flavones, anthraquinones pentatriacontane , α and β - Chlorophylls , Phytin, resins, d-Quercitol ,tartaric acid, formic acid, butric acid , lupeol, β amyryn related glycosides and stigma sterol.The plant extract also tests positive for alkaloids.Leves of this plants yield acidic glycoside and anthroquinones and their derivatives (Mitulshah 2010) .The leaves contains resins albumin chlorophyll , carbohydrates tatric acid, formic acid, butyric acid , anthraquinone derivatives, inositol, alkaloids, organic acid(5.5%) parabin, calcium oxalate(7.3%) ,lignin (4 .8%) ,cellulose (22%)(Sinsheimer and Rao,1970). Gymnema leaves contains gymnemic acid as an effective substance (mitul shah,2010).The Primary chemical constituents of Gymnema include gymnemic acid, tartric acid,Gurmarine, calcium oxalate,glucose stigma stirol, betain and cholin.Few new triterpenoid saponins ,Gymnemasins A,B,C and D were also isolated from the leaves of Gymnema sylvestre(Suttisri et al,1995;Sahu et al,1996) three new oleanane type triterpene glycosides were isolated from the leaves of plants .six oleanane types saponins isolated from the leaves (Ye et al,2000,2001).

Gymnemic acid the active compound of this plant widely used as antidiabetic (Shanmugasundaram etal, 1983; Mitul shah,2010), anti sweetener(Kurihara,1992), anti inflammatory activities (Mitul Shah, 2010), anti hypercholesterolemic (Bishayee and Chatterjee,1994) ,antimicrobial(Sative et al,2003) and ethno-veterinary medicinal properties (Kalidas et al,2009). The anti diabetic array of molecule has been identified as a group of closely related Gymnemic acids (Liu et al ,1992;Sinsheimer and Manni,1965) after it was successfully isolated and purified from the leaves of Gymnema sylvestre. Later the phyto constituents of Gymnema Sylvestre were isolated and their chemistry and structure were studied and elucidated



Structure of Gymnemic acid

Mechanism of action of Gymnema Sylvestre (Gymnemic acid):

Recent pharmacological and clinical studies have shown that Gymnema sylvestre act on two side first ,the taste buds in the oral cavity second, the absorptive surface to the intestine.the structure of those taste buds which detect sugar in the mouth is similar to the structure of the tissue that absorbs sugar in the intestine .The important active ingredients of G.Sylvestre is an organic acid called Gymnemic acids . The Gymnemic acid is made up of molecules who seatom arrangement is similar to that of glucose molecules.Those molecules fill the receptor locations on the taste buds for a period of one or 2 hours, thereby preventing the taste buds from being activated by any sugar molecules present in the food, similarly the glucose like molecule in the Gymnemic acids fill the receptor locations in the absorptive external layers If the intestine , thereby preventing the intestine from absorbing the sugar molecules.It has also been noted that *G.sylvestre* takes away the bitter taste of bitter substances ,such as quinine, in much the same way that it affects the sense of sweetness associated with candies and other sweet foods .However it has no effect on pungent, salty astringent or acidic tastes. therefore when leaf extract of plant administrated to a diabetic patient , there is stimulation of the pancreas by virtue of which there

is an increase in insulin release .These compound have also been found to increase fecal extraction of cholesterol (Kanetkar et al, 2004; persaud et al , 1999).

There are some possible mechanism by which the leaf extract of G.Sylvestre (Gymnemic acid) possess its hypoglycemic acid effects are:

1. It promotes regeneration of islet cells.
2. It increases secretion of insulin.
3. It causes inhibition of glucose absorption from intestine.
4. It increases utilization of glucose as it increases the activities of enzymes responsible for utilization of glucose by insulin dependent pathways ,an increase in phosphorylase activity ,decrease in gluconeogenic enzymes and sorbitol dehydrogenase(Kanetkar et al 2007; Ankit Saneja et al 2010).

Antidiabetic activity

The first scientific confirmation of G.Sylvestre use in human diabetes came almost a century back when it was demonstrated that the leaves of G.Sylvestre reduce urine glucose in diabetes (Ankit Saneja et al,2010). In an animal study Paliwal et al have investigated that Gurmar leaf powder is effective in lowering the fasting as well as post prandial blood glucose level (Paliwal et al 2009) Sugihara et al have investigated the antihyperglycemic action of crude saponin fraction and five triterpene glycosides derived from a methanol extract of G.Sylvestre (Sugihara et al 2000). Mary sujin et al reported the antidiabetic effect of G.Sylvestre powder in the stomach of rates (Mary Sujin 2008 et al).

III. PHYTOCHEMICAL EVALUATION

Preliminary phytochemical screening of drug was carried out as per method describe by peach and tracy et al,1995. The chemical classes of constituents in the freshly prepared various extract(P. ether ,Hexane, Chloroform, Water and alcohol) were detected using standard phytochemical reagents. In general test for the presence or absence of phytochemical compound using the above methods involve the addition of an appropriate chemical agent to the extract in a test tube . The mixture is the shaken vigorously or gently as the case may be the presence or absence of Flavonoids, Alkaloids, Glycoside ,Saponins ,tannins etc. was observed.

Table-1 Phytochemical screening of the powdered stem and leaf of G. Sylvestre

S.No.	Test	Hexane	Chloroform	Ethanol	Water
1	Alkaloids	-	+	+	+
2	Terpenoids	+	+	-	-
3	Steroids	-	+	-	-
4	Coumarin	+	-	-	-
5	Tannin	+	-	-	+
6	Saponin	-	-	-	+
7	Flavonoids	-	-	+	-
8	Quinones	-	+	-	-
9	Anthraquinones	-	-	+	-
10	Phenol	+	+	+	+
11	Xanthoprotein	-	-	+	-
12	Carbohydrate	-	-	+	+
13	Glycosides	-	-	+	-
14	Fixed oil	+	+	-	-

IV. RESULT AND DESCUSSION

Phytochemical screening of the powdered stem and leaf of *G. Sylvestre* is listed in table-1. From table -1 it is clear that on the basis of polarity the extractive values of the leaves of *G. sylvestre* were analysed .The extractive value was highest in water and was recorded to be 30.56% w/w and methanol soluble extractive value was about 20.8% w/w.

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