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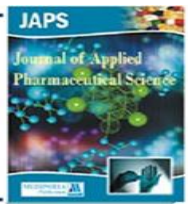

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Chemical and Medico-biological profile of *Cyamopsis tetragonoloba* (L) Taub: An overview

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ABSTRACT

Cyamopsis tetragonoloba (L) Taub is a moderate sized annual herb found throughout India as a cultivar for its pods used as vegetable. Plant is popular in indigenous system of medicines like Ayurveda, Siddha and discussed in various traditional literatures. In traditional medicines various parts such as leaves, seeds and pods are used in diabetes, asthma, inflammation, as Laxative, antibilious, appetite depressor (weight loss not observed) and hypolipidemic agent. The present review is therefore, an effort to give a detailed survey of literature on its phytochemistry, traditional and pharmacological uses.

***Key words**: Cyamopsis tetragonoloba,* Cluster bean, Guar, Traditional medicines.

INTRODUCTION

India has an ancient heritage of traditional medicines. The materia medica of India provides a great deal of information on folklore practices and traditional aspects of therapeutically important natural products. Indian traditional medicines based on various systems including, Ayurveda, Siddha, Unani, and folk literatures. The evaluation of these drugs is primarily based on phytochemical, pharmacological and allied approaches including various instrumental techniques such as chromatography, microscopy and others. With the emerging worldwide interest in adopting and studying traditional systems and exploiting their potential, the evaluation of the rich heritage of traditional medicine is essential.

In this regard, one such plant is *Cyamopsis tetragonoloba* (L) Taub commonly known as Guar (Fabaceae). The plant is a small drought resistant herb and cultivated throughout India, particularly in Haryana, Punjab, Rajasthan, Orissa, Utter Pradesh and southern part of country (Khare C P, 2007). This plant has been much appreciated for its gum obtained from endosperm of the seeds. Guar is a coarse, upright, bushy, drought-resistant summer annual plant ranging from 2-4 feet in height. It has pointed, saw-toothed, trifoliate leaves, small purplish white flowers borne along the axis of a spikelet, and hairy pods 3-4 inches long in clusters. There are both dwarf and tall cultivars. Guar flowers are self-pollinating. A mature unopened bud starts out white and then changes to a light pink as petals begin to open. Finally, the flower is deep blue (Warrier et al, 1994). In traditional system this plant has been used for various ailments, therefore the aim of this paper is to present an overview of Phytochemical and pharmacological investigation carried out on this plant.

Taxonomical classification
Domain: *Eukaryota*
Kingdom: *Plantae*

Subkingdom: *Viridaeplantae*
Phylum: *Magnoliophyta*
Subphylum: *Euphyllophytina*
Infraphylum: *Radiatopses*
Class: *Magnoliopsida*
Subclass: *Rosidae*
Superorder: *Fabanae*
Order: *Fabales*
Family: *Fabaceae*
Subfamily: *Faboideae*
Tribe: *Indigofereae*
Genus: *Cyamopsis*
Specific epithet: *tetragonoloba* - (L.)Taub.
Botanical name: - *Cyamopsis tetragonoloba* (L.)Taub.

(Source:http://zipcodezoo.com/Plants/C/Cyamopsis_tetragonoloba/**)**

Synonyms

Cyamopsis psoralioides (Lam.)dc. , *Cyamopsis psoraloides* (Lam.)dc. ,*Cyanopsis tetragonoloba* (L.)taub., *Dolichos fabaeformis* L'Her. ,*Dolichos fabiformis* L'Her., *Dolichos psoraloides* Lam., *Lopinus trifoliolatus* Cav., *Lupinus trifoliatus* Cav., *Psoralea tetragonoloba* L. (Anonyms)
Sanskrit: Kshudrashimbi, Gorakshaphalini**,** Guachh shimbhi (Source: www.plant info\HS608-MV075 Guar Cyamopsis tetragonoloba (L_) Taub.htm)
English: Cluster bean, Guar**,**
Hindi: Gawar, Gwar ki phalli.
Tamil: Kothaveray.
Malay: Kottavara, Kattamara.

CULTIVATION & DISTRIBUTION

For best growth, the guar bean requires full sunshine, flashing rainfalls that are moderately frequent and well drained soil. However, it is extremely drought-tolerant and thrives in semi-arid regions. Too much precipitation can cause the plant to become more "leafy" thereby reducing the number of pods and/or the number of seeds per pod that affects the size and yield of seeds. The crop is sown after the first rains in July and harvested in late October. It is grown principally in northwestern India, and Pakistan with smaller crops grown in the semi-arid areas of the high plains of Texas in the USA , Australia and Africa (Anonyms, 2006). The most important growing area centers on Jodhpur in Rajasthan, India. Currently India is the source of about 80% of the world production of guar gum. Several commercial growers have converted their crops to guar production to support the increasing demand for guar and other organic crops in the United States.
Varieties: Pusa Navbahar and Pusa Sadabahar. Seeds at the rate of 10 to 12 kilograms/hectares (9–11 lb/acre) are planted at a spacing of 45-60 x 20-30 cm (18– 4 x 8–12 in) in February-March and June-July. During rainy season, the seeds are sown 2-3 cm (~1 in) deep on ridges and in furrows during summer months. FYM is applied at the rate of 25 tones/ha (11.1 tons/acre). N, P2O5 and K2O recommendation for the crop is 20:60:80 kg/ha (18:53:71 lb/acre). Average yield is 5 to 6 tonnes/ha (2.2–.6 tons/acre).

TRADITIONAL USES

Leaves are used in asthma and to cure night blindness where as the pods and seed are used to cure inflammation, sprains (Khare , 2004), arthritis (Katewa et al, 2004), as anti-oxidant, anti-bilious, laxatives and in polluting boiling . As per Ayurveda the plant is used to reduce fire and can be used as cooling, digestive, tonic, galactogogue, useful in constipation, dyspepsia, anorexia, agalatia, hyetalopia and vitated condition of kapha and pitta. The Plant is also mentioned as Aperitif and Flatugenic (James, 2002).

PHYTOCHEMICAL PROPERTIES

Very little phytochemical work has been carried out on this plant. The leaves and the pods contains carbohydrates, proteins, fibers, galactomanns, ascorbic acid and condensed tannins together with, caffic acid, gallic acid, and gentisic acid, p-coumaric acid, astragalin, P-hydroxycinamyl and coniferyl alcohol. Its flavonoidal content include Quercetin, daidizein, kaemferol, and its 3-arabinosides(Khare, 2007). Wang et al 2007 has been quantified amount of various flavonols in different accessions of guar seeds by HPLC and reported 1.114 mg diadzein. 0.700 mg genistein, 0.553 mg quercetin and 14.460 mg kempherol on per 100gm basis. Authors suggest a positive correlation occurs between concentration of diadzein and genistein. However a negative correlation exist between concentration of kaemferol and diadzein and of kaempferol and genistein (Morris et al, 2007). A high concentration of kaempherol in guar seeds may expand its neutraceutical and pharmaceutical use.

Other poly phenol composition of the plant includes gallotannins, gallic acid and gallic acid derivatives, myricetin-7-glucoside-3-glycoside, chlorogenic acid, ellegic acid, 2,4,3 trihydroxy benzoic acid, texasin-7-O-glucoside and p-coumaryl quinic acid (Daniel et al, 1989). Poly phenol content of the leaves and the seeds of the plant depend on the stage of maturity. Concentration of polyphenols in seeds varies from 1.26-0.69% total phenol, 0.49-0.12 % gallic acid, 0.5-0.21% gallotannins, and 0.13-0.23% flavonols. The poly phenol content of guar leaves varied from 0.74-1.24% total phenols, 0.18-0.84% flavonols, 0.05-0.24% hydroxycinnamic acid as per dry matter of guar leaves (Kaushal et al, 1982).

Curl et al, (1986) have reported 3-epikatonic acid (3β-hydroxyolean- 12-en-29-oic acid), a tritrpeniodal saponins from the seeds of the plant which was previously isolated by Coxon et al from the guar meal, structure of which was elucidated as 3-O-{ [α-L-rhamnopyranosyl(1→2)]-[α-L-rhamnopyranosyl(**1→** 4)]-β-D-glucopyranosyl(1→2)- β-D- glucoronopyranosyl (1→)}-29-O-[α-D-glucopyranosyl (1→2)-D-glucopyranosyl (1→)]-3 β-hydroxyolean-12-en-29-oate (Coxon et al, 1980).

Gum obtained from the endosperm of the seeds contains Galactomannan a polysaccharide consists of a mannose backbone with a galactose side group, in which mannopyranose units are linked with 1β-4 linkage. Another important constituent of the guar

gum is guran which is a water-soluble entity of guar gum and responsible for its 85% composition (Kokate et al, 2007) and orthodihydrics.

Total Lipid content of guar meal was reported as 7% by weight of guar seed meal which includes; hydrocarbons sterol ester 1.1%, triacylglycerol 94.6%, free fatty acids 1.0%, partial acylglycerol 1.8%, polar lipids 0.5% of total lipds (Satya et al, 1981). Its sterol includes campesterol, Avenasterol, Stigmasterol, Sitosterol and traces of Delta-7-avenasterol, stigmast-7-enol, brassicasterol and cholesterol (Ali et al, 1977).

PHARMACOLOGICAL ACTIVITIES

Anti-diabetic effect

An aqueous extract of pods of the plant at a dose of 250mg/kg of body weight significantly reduces blood glucose level in normal and alloxane induced diabetic rats. *Cyamopsis tetragonoloba* showed marginal antihyperglycemic effect on blood glucose level in normal fasted rats, however, the blood glucose lowering effect was significant in alloxane-induced hyperglycemic rats. The fall was seen at 1hr and remained up to 3hr after administration of extract. Sub acute treatment with aqueous extract of *Cyamopsis tetragonoloba* on alloxan-induced hyperglycemic rats produced consistent reduction in blood glucose level. Authors suggest that; this effect can be attributed due to presence of flavanoids and other phenolics of the plant (Mukhtar et al, 2004).

Anti-ulcer, Cytoprotective and Anticholinergic effect

An ethanol extract of the pods was studied for its ability to inhibit gastric secretion and to protect gastric mucosa against the injury caused by pylorus ligation, hypothermic restraint stress, indomethacin and various necrotizing agents including 80% ethanol, 0.2 M NaOH and 25% NaCl in rats. The intensity of gastric lesions induced by hypothermic restraint stress and indomethacin was reduced significantly by Guar extract at a dose of 500mg/kg. It produced a marked cytoprotective effect against all the necrotizing agents used in the study. The extract not only increased the gastric wall mucus significantly but also restored the ethanol-induced depletion of nonprotein sulfhydryl content in the glandular stomachs of rats. The extract inhibits acetylecholine-induced contraction of isolated guinea pig ileum, suggesting anti-cholinergig activity (Raffatullah et al, 1994).

Hypoglycemic and Hypolipidemic effect

The effect of guar feeding was observed on serum total lipids, free and esterified cholesterol, triglycerides and phospholipids. Normal and alloxan induced diabetic guinea pigs were kept on whole seed diet of Guar for four weeks. Blood sugar and total lipids levels were also observed to be lowered in diabetics. Significantly fall in the levels of other lipids i.e. triglycerides, phospholipids and total lipids was also noticed (Shrivastava et al, 1987).

Another report indicates the effect of Guar gum obtains from endosperm of the seeds on indexes of protein absorption and utilization was also investigated along with its anti-diabetic and hypocholestremic potential. In spite of fact that diabetes elevated blood lipids in all animals, guar gum diet significantly decreases serum concentration of cholesterol and triglycerides. Further more, a concomitant increase in HDL-cholesterol with a substantial elevation of HDL/LDL cholesterol ratio was found. The most significant result of this assay was the drastic reduction of blood glucose in diabetic rats treated with guar gum diet. The gum promoted a general improvement in condition of diabetic rats, in body weight gain and indexes of protein absorption and utilization (Frias et al, 1998).

Anticoagulant activity

In a study performed by Mestechking et al (2008) low molecular weighted sulphated derivatives of galactomannan from seeds of *Cyamopsis tetragonoloba* was tested for their anticoagulant effect. In the study gallactomann was depolymerised using immobilized enzymatic prepration Celloviridin. A set of fragments having molecular weight ranging from 12.6 to 245.6 Kda were obtained. Sulphated derivatives of components of all fractions were synthesized in which the content of HSO3 (-) group was 48.05% $\pm$ 2.31. All preprations exhibited anticoagulant activity, which was tested by in-vitro & in-vivo models. The anti-thrombin activity was high up to 65-87 U/mg & did not depend on the molecular weight of sulphated derivatives.

Hemolytic activity

Hemolytic activity of a saponin rich extract prepared from guar meal was tested against chicken blood collected from mature roosters. Hemolytic assay was conducted in a 96-well micro-plate & preliminary scanning of hemolysis in culture plate at wavelength 405,455, 520 and 650 nm showed that the 100% Methanol fraction was found hemolytic until diluted to less than 0.25 mg fraction/ml. This hemolytic activity may thought to be due to effect on cell membrane permeability by forming pores in membrane, altering the sodium-potassium and calcium-magnesium ATpase activities or insertion of the hydrophobic saponin nucleus into the lipid bilayer (Hassan et al, 2010).

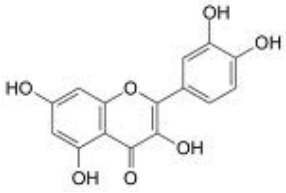
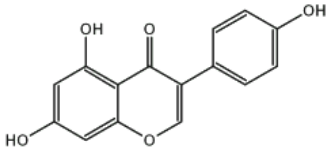
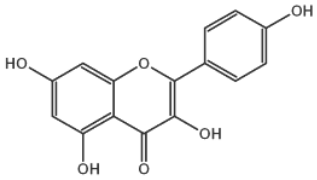
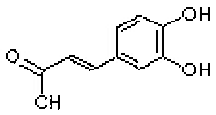
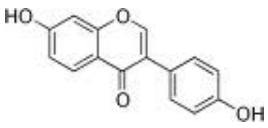
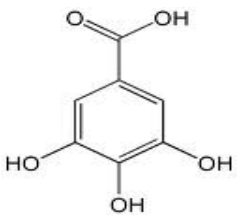
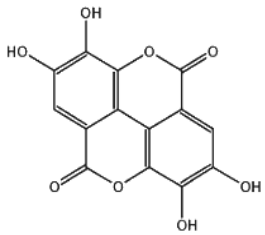
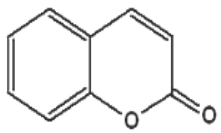
Antimicrobial activity

20%,60%,100% Methanolic extract of *C. tetragonoloba* was tested against S. aureus, Lactobacillus Spp., S. Typhimurium and E. Coli. 20 and 60% methanolic extract showed a mild antibacterial effect with lactobacillus Spp. MIC was 3.13 & 0.78 fraction/ml for 100% MeOH extract against S. aureus, lactobacillus Spp. respectively. A similar MIC was observed for 100% MeOH fraction exposed to E.coli & S.typhimurium at 1.56 & 0.78 mg fraction/ml (Hassan et al, 2010).

Anti-asthmatic activity

Alcoholic and aqueous extract of the leaves of this plant were found to inhibit histamine induced contraction of isolated guinea pig ileum preparation in-vitro at a dose of 100 µg/ml and also found to reduce bronchospasm produced by 1% histamine

Table 1: Phenolics of *Cyamopsis tetargonoloba.*

Phenols	
	
Quercetin [2-(3,4- dihydroxyphenyl)-3,5,7- trihydroxy- 4*H*- chromen- 4-one]	**Genistein [5, 7-dihydroxy-3- (4-hydroxyphenyl)-4H-1-benzopyran-4-one, 4', 5, 7-trihydroxyisoflavone]**
	
Kaempherol [3,5,7-trihydroxy-2-(4-hydroxyphenyl)-4H-1-benzopyran-4-one]	**Caffeic acid [3-(3,4-Dihydroxyphenyl)-2-propenoic acid]**
	
Diadezin [7-Hydroxy-3-(4-hydroxyphenyl) chromen-4-one]	**Gallic acid [3,4,5-trihydroxybenzoic acid]**
	
Ellagic Acid [2,3,7,8-Tetrahydroxy-chromeno[5,4,3-cde]chromene-5,10-dione]	**Coumarin [2-Benzopyrone, 2H-1-Benzopyran-2-one]**

aerosol. In histamine induced bronchospasm both the extracts at a dose of 100mg/kg showed significant increase in the mean pre -convulsive dyspnoea suggesting in-vivo antihistaminic effect of the test drug.

Both the extracts were also found to reduce exaggerated leukocytosis and eosinophil count induced by the subcutaneous injection of milk. This effect showed adaptogenic effect of the extract. The authors concluded that the, antiasthmatic activity of *C. tetragonoloba* may be attributed to its anti-histaminic, anti-allergic and adaptogenic effect (Sharma et al, 2010).

Anti-inflammatory activity

The anti-inflammatory activity of alcoholic& aqueous extract of the seeds (50 and 100 mg/kg) of the plant was assessed in acute, subacute and neurogenic inflammation against carageenan induced paw edema, formaldehyde induced paw edema, xylene induced ear edema respectively. Ethanolic extract showed significant inhibitory effect on inflammation caused by various phelogestic agents in a dose dependent manner with the maximum percentage inhibition of 85.29% against carageenen induced paw edema, 82.10% against formaldehyde induced paw edema and 60.20 % against xylene induced ear edema when compared to positive control (Sharma et al, 2010).

The anti-inflammatory activity may be correlated with its rich flavonoidal and saponin content, which showed anti-inflammatory activity in various previous reports.

CONCLUSION

There are over 400 different tribal and ethnic groups in India, which constitute about 7.5% of India's population. Tribal, rural and primitive societies have discovered solution for treatment of disease to almost all their needs and problems from the natural resources around them.[29] Hence in recent years, ethanomedicinal studies received much attention as this brings to light the numerous little known and unknown medicinal virtue especially of plant origin which needs evaluation on modern scientific lines such as phytochmical analysis, Pharmacological screening and clinical trials (Atique et al, 1985 and Jha et al, 1999).

Cyamopsis tetragonoloba possess various pharmacological activities as discussed earlier. However, it is imperative that more clinical, phytochemical and pharmacological studies should be conducted to investigate the unexploited potential of this plant.

ACKNOWLEDGEMENT

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Table 2 Sterols of *C.tetragonoloba*

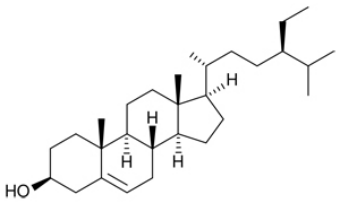
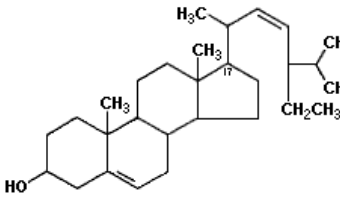
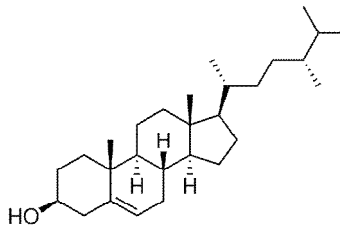
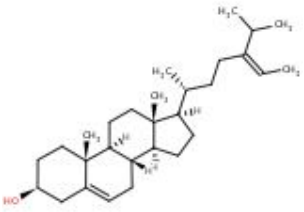
STEROLS	
	
Beta- Sitosterol	Stigmasterol
	
Campesterol	Avenasterol

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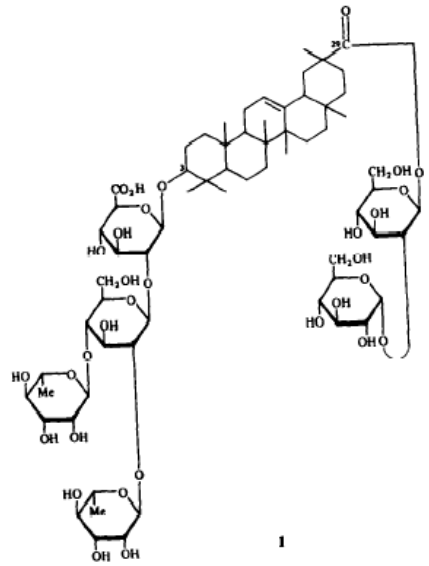
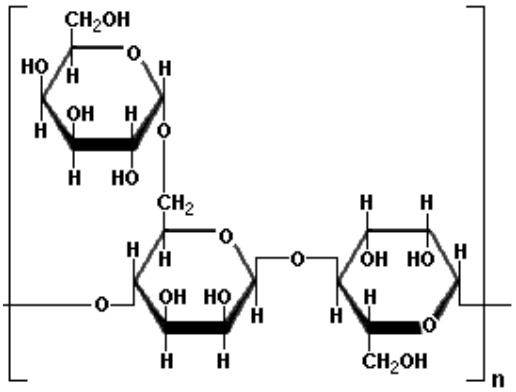
Table 3 Other Constituents.

SAPONIN

3-epikatonic acid (3β-hydroxyolean- 12-en-29-oic acid)
GALACTOMANNAN

Guran

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