

Review Article

<https://doi.org/10.20546/ijcmas.2017.611.144>**Pharmacological Profile of *Asparagus racemosus*: A Review**

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Asparagus racemosus (Shatavari) is a useful traditional medicinal plant, found to be grown throughout the tropical and subtropical parts of India. Today it is a widespread belief on the percentage of the general public that natural substances are inherently superior to man-made substances and have run a mainstream role in the wellness maintenance system for the prevention of diseases. The major bioactive constituents which impart the medicinal value of the herb are a group of steroidal saponins, sarsasapogenins, flavonoids, kaempferol, quercetin, rutin and polyphenols. The tuberous roots of this herbaceous plant are widely applied in the pharmaceutical as well as on biotechnological scale, in preparation of various herbal preparations because it possesses outstanding potential, and defence system. It is used in almost 67 Ayurvedic preparations and commonly referred as 'Rasayana' in Ayurveda due to its medicinal uses. This review deals with the *A. racemosus*, and its bioactive constituents that impart medicinal value to the herb.

Introduction

Asparagus racemosus is an important medicinal plant of tropical and subtropical India. Its medicinal use has been accounted in the Indian and British Pharmacopoeias and in indigenous systems of medicine. The genus *Asparagus racemosus* includes about 300 species around the globe. The genus is thought to be medically important because of the presence of steroid saponins and saponins in various parts of the plant. Out of the 22 species of *Asparagus* recorded in India; *Asparagus racemosus* is the single most commonly used in traditional medicine. Use of *Asparagus racemosus* was mentioned in the ancient literature of Ayurveda. It is used to rectify the gynecological problems like irregularities in menstrual cycle and sexual dysfunction. Even till today the

containing *Asparagus racemosus* are used to adjust the menstrual irregularities by Ayurvedic practitioner many formulations containing *Asparagus racemosus* are presently available in the marketplace for work. Therapeutic usage of the *Asparagus* is due to the phytoestrogenic components present in it.

Nomenclature

The plant *Asparagus racemosus* can be classified as given in the table 1.

Morphology

Shatavari is a highly branched, consisting of thorn under shrubs. It is a woody climber

plant which is 1-2 m in distance and readily grows up a documentation or over other plant. The leaves of the Shatavarilooks like pine needles, uniform and small in size. The roots of the plant have a finger like structure and are clustered in nature. It has a tiny white coloured flower while the plant itself is bittersweet in taste (Amit Chawla *et al.*, 2011) (Fig. 1).

Habitat

Racemosus shrubs contain succulent roots and rows at an altitude of 1500 m above the sea level. It is spread throughout the tropical Africa, Java, Australia, India and southern section of the china (Jayashree *et al.*, 2013).

Microscopy of *Asparagus racemosus*

Powdered microscopy

Root

Root is one of the main part of *Asparagus racemosus* which is used in the pharmacological studies. The root tuber in its powdered state is morphologically pale yellow in colour, odourless and slight sweetish in taste. The powder mainly consists of the parenchyma cells with or without the inter-cellular spaces. While more or less amount of starch grains presented in the powder, it largely consisted of the acicular rapids, rapid bundles and pericyclic fibres (Fig. 2).

The different extracts can be obtained from the employment of different solvents with the efficiency ranging from 41.25 % for alcohol extracts and 0.6 % from that of petroleum ether extracts (Mahesh Kawale *et al.*, 2014).

Anatomical structure

The Microscopic outline of the T.S section of the plant composed of the periferous cell

layers which are composed of small thin cell walls and are elongated to form the root cortex. The hair cortex can be split into two regions, namely outer cortex and inner cortex. These layers are 25-29 in number and can be present either in group or as a single entity forming the continuous to discontinuous regions in the outer regions (Nagar B. P *et al.*, 2011). The epidermal cells are much elongated with the longitudinal orientation to axis if the organ. They likewise bear a smooth surface, rapids are also present. The vascular bundle pattern is dispersed in nature with great amount of xylem vessels. These are paired and circular in nature and outline with large lumen. The flora delivers a total of twelve of these vascular bundles (Rupali Subhashrao Kaikade *et al.*, 2015).

Chemical constituents

Primary metabolites can be specified as the components which are immediately involved in normal growth and evolution, while secondary metabolites are the organic compounds that are not immediately required in the plant growth. The major bioactive components present in the plant are steroidal saponins. It mainly contains six components, Shatavarin I-VI, with shatavarin IV a major glycoside being present in the roots of the plants. The structure of shatavarin IV consist of two molecules of asparagus rhamnose along with 1 molecule of glucose and is mainly found in the leaf, fruits and roots of the plant (Amit Chawla *et al.*, 2011).

The trace elements like copper, zinc, manganese, cobalt, potassium, calcium and selenium can also be found (Mohanta *et al.*, 2003), fruits and flowers of shatavari contains flavanoids which are nothing but glycosides of quercetin, rutin and hyperosides (Kamat *et al.*, 2000).

Kaepfrol is another component along with that of sarsapogenium which can be isolated

from the woody portions of the tuberous roots (Choudhary *et al.*, 1992). Some of the essential fatty acids like gamma linoleic acids, disogenin are also obtained from this plant. (Shashi Alok *et al.*, 2013).

Pharmacological profile

Gastrointestinal effects

The powdered dried roots of *Asparagus racemosus* promote gastric emptying in healthy volunteers and its action comparable with that of the synthetic dopamine antagonist metoclopramide (Dalvi *et al.*, 1990). It has been reported that *A. racemosus* along with *Terminalia chebulaprotect* gastric mucosa against pentagastrin and carbachol induced ulcers, by significantly reducing both severity of ulceration and ulcer index (Dahanukar *et al.*, 1983).

Shatavari is primarily known to ease the pain and burning sensation as well as other dyspeptic symptoms due to the ulcers. Since it does not have any antacids or anti-secretory properties, the observed mild acid secretion can be ascribable to the changes in gastric mucosa (Singh *et al.*, 1983).

Galactagogue effect

Alcoholic extract of *Asparagus racemosus* have a significant effect on lactating mother to increase milk production and have been observed along with increased growth of the mammary gland alveolar tissue and acini. The growth of lobuloalveolar tissue and milk secretion in the estrogenic primed rats was thought to be due to the action of released corticoids or prolactin (Amit Chawla *et al.*, 2011) (Fig. 3). The galactagogue effect has also been studied in buffalo as described by Patel *et al.*, (Patel *et al.*, 1969). As described by Akansha Singh *et al.*, the effect was evaluated in 60 lactating mothers by measuring the change in the prolactin

hormone level. The study shows that the oral administration of *A. racemosus* led to thrice increase the level of prolactin than that of the control group.

Immunomodulatory activities

The use of *Asparagus racemosus* dried root powder modulates the action of the immune system. That in turn, decreases the inflammatory response. It induces the immune system to fight against immune deficiencies (like AIDS), infections and cancer. It may be helpful in obtaining higher protective antibody against different vaccinations including more effective cell mediated immune response for protection against various bacterial, viral, and other diseases. Several workers has studied the effect of *Asparagus racemosus* root extract in augmentation of humoral and cell mediated immune response providing better protection level against infections (Akansha Singh *et al.*, 2014).

Anticancer activity

Natural products have long been used for treatment against cancer. There are at least 10000 species of plants, documented to have anti-cancerous properties. As described by Shankar et.al the isolated shatavarin IV along with AR-2B containing 5.05% shatavarin IV showed potent cytotoxicity. It showed increase in non-viable cell count when compared to untreated mice of group in the study (Chitme *et al.*, 2009). Hence from various *in vitro* and *in vivo* models it can be concluded that the root extract of the plant which contains shatavari IV fraction exhibits significant activity against cancer cells.

Cardiovascular effects

Increase in serum lipid levels especially cholesterol along with the generation of reactive oxygen species are the major reasons

for development of coronary artery disease and atherosclerosis 'Abana' a herbo-mineral formulation containing 10mg *Asparagus racemosus* extract per tablet, as found to have significant hypocholerolacemic effect in rats and therefore established a potential for use as a cardio-protective agent.

The *Asparagus racemosus* root powder supplements decreased lipid peroxidation and causes a dose-dependent reduction in lipid profiles. The total lipids, total lipids, total cholesterol and triglycerides in plasma and liver as well as plasma LDL (low density lipoprotein) and VLDL (very low density lipoprotein) cholesterol decrease. Through it can be hypothesized that the hypocholesteremia is alleviated by decreasing and increasing conversion of endogenous cholesterol to bile acid (Shankar K. Mitra *et al.*, 2012).

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Antidiabetic effect

Diabetes mellitus (DM) is a major reason of disability and hospitalization that parents a

substantial burden on companies worldwide. In such circumstances, herbal medicines for the treatment of diabetes become significant. *Asparagus racemosus* roots have been reported to reduce blood glucose level in rats, and rabbits. *Asparagus racemosus* root extract causes a wide ranging stimulatory effect on physiological insulinotropic pathways (Fuller *et al.*, 1983).

Antioxidant action

Antioxidants are the moieties which are involved in the prevention of cell damage, common pathway for many diseases. As given by Aarati K the Methanolic extract of the root possess significant anti-oxidant properties when administered through the oral method.

The levels of enzymes like superoxidase dismutase, catalase and ascorbic acid increase with significant reduction in the lipid peroxidation. The antioxidant properties were mainly exhibited due to the presence of Isoflavons (Wiboonpun *et al.*, 2004).

Antiulcer effect

Ulcer is one of the burning problems in developing and even developed countries. It is induced due to imbalance among aggressive factors, especially gastric acid and pepsin, and protecting factors including gastric mucosa, bicarbonate and prostaglandin.

Asparagus racemosus is an effective antiulcerogeneric agent whose activity can easily be compared with that of ranitidine hydrochloride *Asparagus racemosus* causes an inhibitory effect on release of gastric hydrochloric acid, and protects gastric mucosal damage. Hence the roots of the Shatavari plant in the form of powder can be administered to chronic ulcer patients along with other patients (Anil Mangal *et al.*, 2004).



Fig.1a Shatavari plant **Fig.1b** Closeup on flowers

Fig.2 Powdered form of root, A – Vascular Elements, B - Tracheids fragments, C - Acicular Raphides and Raphide Bundles, D - Vessel elements, E - Starch grains

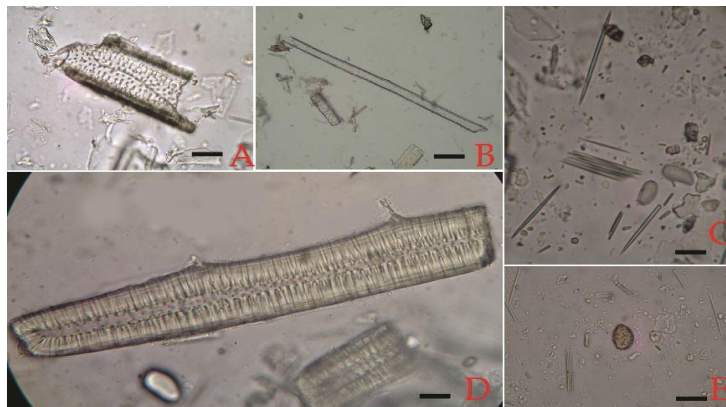
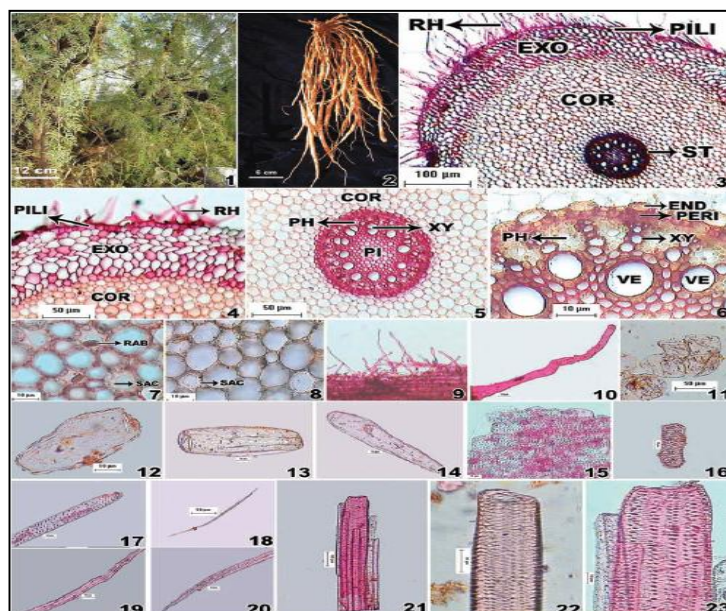


Fig.3 1 – *Asparagus racemosus* gonocladous habit, 2 - Fresh drug (root tubers), 3 - T.S of root tuber, 4 - Portion showing exodermis and cortex, 5 - portion showing stellar region, 6 - Stele enlarged, 7&8 - Portion showing cortex, raphide bundle and sap cell content, 9 to 23 - Macerate, 9 - Portion showing piliferous layer with root hairs, 10 - Unicellular root hair, 11 to 14 - Parenchyma cells, 15 to 17 - Pitted parenchyma, 18- Aseptate fibre, 19- Septate fiber, 20 - Tracheid, 21 to 23 – Vessels



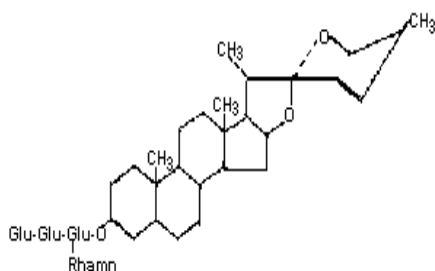


Fig.4 Satavarin I

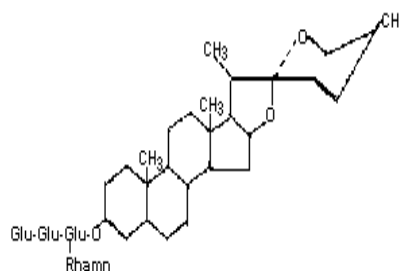


Fig.5 Sarasasapogenin

Table.1 Nomenclature of *Asparagus racemosus*

Kingdom	Plantae
Clade	Angiosperms
Clade	Monocots
Order	Asparagales
Family	Asparagaceae
Sub family	Asparagoideae
Genus	<i>Asparagus</i>
Species	<i>Aracemos</i>

Antidiarrhoeal effect

Diarrhoea can be classified as one of the major problems faced mainly in the developing countries with an estimated death rate of 2.2 million people globally, mainly in the developing countries. The fatal cases can be mainly seen in the children with the 5 years of age (Nishritha Bopana *et al.*, 2007). The ethanol and aqueous extracts of roots of *A. racemosus* exhibited a significant anti-diarrhoeal activity against the castor oil induced diarrhoea in the rats as described by the Venkatesan *et al.*, (2005). Studies have shown that the action of “prostaglandin E” caused the diarrhoea in the test subjects, hence it can be said that the action of this can be to prevent the biosynthesis of prostaglandin which in turn inhibits the diarrhoeal effect.

Antitussive effect

A. racemosus has been commonly used in the treatment of cough and in minor upper

respiratory tract infection, exhibiting the antitussive properties. In the experimental setup by Akansha Singh and Sinha (2014) the methanol extract of the roots showed activity against sulphur induced cough in mice which was likened to the codeine phosphate, a drug obtained from opium.

Hence this extract can be used against the opium based drugs, since there are no side effects like nausea, sweating, tiredness which can be observed by use of codeine phosphate associated drugs.

Aphrodisiac activity

Lyophilized aqueous extracts roots of *Asparagus racemosus* have sexual behavioral effect in male albino rats. Administration of the aqueous extracts has pronounced anabolic effect in treated animals as evidenced by weight gains in body and reproductive organs. There was a significant variation in the sexual behaviour of animals as reflected by reduction of mount latency ejaculation latency, post

ejaculatory latency, intromission latency (Mayank Thakur *et al.*, 2004).

Anti-dyspepsia effect

Dyspepsia is the condition characterised by the inability to digest, commonly stated as impaired digestion which is frequently associated with the gastritis. In small minority it can as well be the first symptom for gastric ulcer and cancer. As recorded by David S S, et.al the activity was analysed in the healthy human volunteers. The Shatavari was compared with that of Metoclopramide, which is a synthetic dopamine used in patients with dyspepsia to increase the rate of emptying of the abdomen. Hence it was found that the rate of emptying did not differ significantly. It can be reasoned that the extract can be utilised for the treatment and the side effects from the use of metoclopramide like drowsiness can be averted (Dalvi *et al.*, 1990).

Problems associated with menstruation

The constituents of *Asparagus racemosus* make it useful in menstrual disorders such as dysmenorrhea, premenstrual syndrome, irregular bleeding during peri-menopausal period and also in situations after menopause. *Asparagus racemosus* contain saponins which hinder the oxytocic activity on uterine musculature, thereby maintain the spontaneous uterine motility, confirming its utility in dysmenorrhea which comprises of painful menstruation without significant pelvic pathology.

Problems associated with menopause

A common practice to relieve menopausal symptoms is to administer hormone replacement therapy, which is not free from adverse effect. Thus women are turning to natural medication in an effort to deliver a

dependable alternative to synthetic steroidal hormones. *Asparagus racemosus* being known sources of phytoestrogen can be effective in reducing adverse menopausal symptoms (The chemical entities from plants which mimic hormone are called phytoestrogens). These are weaker than natural estrogen in action (Aarti, 2015).

Various studies have been conducted on *A. racemosus*. Shatavari is a very important medicinal plant, which can be applied in different phases of medicament which is demonstrated by its function in the traditional practices as well as several modern works. Several experiments have been taken away to explore the pharmacological activities and the potential applications of the plant in the pharmaceutical industries are countless. Hence, further detailed and systematic study must be taken out, which can provide better knowledge and understanding the pharmacological importance of this plant.

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