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**Lakhwinder Singh**  
Post Graduate, Department of  
Agriculture Gss Dgs Khalsa  
College Patiala, Punjab, India

**Antul kumar**  
Department of Botany, Punjab  
Agricultural University,  
Ludhiana, Punjab, India

**Anuj Choudhary**  
Department of Botany, Punjab  
Agricultural University,  
Ludhiana, Punjab, India

**Gurwinder Singh**  
Department of Botany, Punjab  
Agricultural University,  
Ludhiana, Punjab, India

## *Asparagus racemosus*: The plant with immense medicinal potential

**Lakhwinder Singh, Antul kumar, Anuj Choudhary and Gurwinder Singh**

### Abstract

The genus *Asparagus* belonging to the family liliaceae. The *Asparagus racemosus* (Shatavari or Sanspayein) is most commonly distributed species in tropical and subtropical regions of India. The folk use of Shatavari has been mentioned in traditional medicine system such as Unani & Siddh in folk and ayurvedic system British & Indian Pharmacopeias and is widely used shrub important for its sapogenin content which is the precursor of many pharmacologically active steroids. It is thought that almost all of its parts having pharmaceutical properties but roots stem and leaves are the most important parts which are used medicinally. The Shatavari is used as, "Rasayanas" to enhance the body resistance against infections and improve the immune system. It is widely used for the treatment of various ailments as it contains many different phytochemicals. The notable medicinal properties of Shatavari are anti-spasmodic, anti-oxidant, anti-diabetic, anti-allergic, anti-malarial, heap to protective, anti-neoplastic activities, enhance immune responses, anti-arthritis, antiinflammatory, anti-periodic, Antiulcerogenic action, immune modulatory antistress, Anti-diarrhoeal, Antidepressant, anti-leprotic, anti-abortifacient activity, antibacterial, antipyretic and analgesic. The purpose of this review to evaluate and explore the information about chemical constituent and its pharmacological activities for further unexplored areas in which *Asparagus* can be proved to have potential to cure diseases.

**Keywords:** asparagus, pharmaceutical, liliaceae and explore

### 1. Introduction

*Asparagus racemosus* is being used from Pre-Vedic times and mentioned in ayurvedic literature. Ayurveda systems are originated from India around 5000 years ago. It is purely based on natural herbal system. Initially it is restricted to some regions but now its spreaded around the globe and has occupied a prime position in medicine system. The ancient history of India is very rich in herbal medicine and one of the oldest. It offers a rich, comprehensive outlook to a healthy life.

Kingdom: Plantae

Division: Angiosperms

Class: Monocots

Order: Asparagales

Family: Asparagaceae; Liliaceae

Genus: *Asparagus*

Species: *Racemosus*

### A. Other Regional Names

Bengali - Shatamuli

Gujrati - Satawari

Hindi - Satmuli

Madhya Pradesh - Narbodh or atmooli

Kannada - Aheruballi

Malayalam - Chatavali

Rajasthan - Norkanto or satawar

Marathi - Shatavari or shatmuli

Sanskrit - Shatavari

Himachal Pradesh - Sanspayiin

### 2. Botanical description

The genus *Asparagus* comprises of more than 250 species distributed throughout the world out of which 22 species of *Asparagus* are recorded in India. The plant ranges up to 1500 m of altitude range and present in tropical and subtropical regions. The plant is under-shrub and grows to up to 3 metre in height. It is a spinous herb bearing numerous succulent short

### Correspondence

**Lakhwinder Singh**  
Post Graduate, Department of  
Agriculture Gss Dgs Khalsa  
College Patiala, Punjab, India

rootstocks <sup>[1]</sup>. The roots are elongated, tuberous brown in colour with tapering ends at both sides. It is 1-2 cm in thick and 25-90 cm long that appears ash silver white colour internally or externally. The plant is a woody climber known as liana bearing brown or may be whitish to grey coloured and small protective spines <sup>[19, 20]</sup>.

Asparagus leaves having resemblance with pine needles. The flowering occurs in month of February-March. The flowers are uniform and small in size. It appears white in colour having small spikes. The flower is hermaphrodite in nature and mainly pollinated by Bees. The flowers are aromatic nature with a mild fragrance by the end of April <sup>[16]</sup>. Fruits can be seen with attractive red berries. Its fruits are small, round in shape and changes from green to red colour on maturity. The Shatavari prefers to grow in moist, humid and arid conditions. Its ability to store and capture maximum moisture from dry soils is reflects its potential for replenishing fluids and bringing balance to stress in human body <sup>[16, 19]</sup>. Usually this plant prefers Black, well drained and fertile soil at a temperature of 20-30 °C. The fruits contain 2 to 3 lobed and globular in shape and changes from green to purple which appears to purple black on ripening and seeds appear to be brittle and hard. Use of *Asparagus racemosus* was mentioned by charka in Charaka samhita (the ancient literature of Ayurveda). It shows the activities of anticancer hypertensive response, Anti-abortifacient, antidysenteric, antioxytoxic, antibacterial anti-inflammatory, spasmotic, hypoglycemic, anticoagulant, antiulcer, antioxidant, antifungal and in reproductive problems <sup>[21]</sup>.

### 3. Phytochemical constituents

The Shatavari plant contains a large group of isoflavones, polysaccharides and steroidal saponins. The saponins are present in predominant form such as Shatavarin I-IV. Others phytoconstituents are 8-methoxy-5, 6, 4'- trihydroxyisoflavone 7-O-beta-D-glucopyranoside. Asparagamine, Racemosol, 9, 10- dihydrophenanthrene), Shatavaroside, Secoisolariciresinol Shatavari Immunoside this is a glycoside of Sarsasapogenin, Racemoside A Ursolic Acid, Beta-Sitosterol and Stigmaterol Genistein and Daidzein, Racemosides A-C <sup>[1, 21, 18]</sup>.

### 4. Medicinal activities associated with plant parts

Roots-Galactagogue, Estrogenic, Antioxytoxin Immunomodulators, Antidyspepsia, Antiallergic, Anticancer, Anti-inflammatory, Antidiabetic, Antioxidant, Antitussive, Hepatoprotective, Antibacterial, Antiulcer, Anti-diarrhoeal, Antilithiatic <sup>[18]</sup>.

Leaves-Cholinesterase, Antiparasitic.

Shoots-Anti-inflammatory, Antidiabetic and Diuretic.

Whole Plant-Antimicrobial and Cytotoxic, Nephroprotective, Hepatoprotective <sup>[16]</sup>.

Aerial Parts-Urolithiasis, Hypolipidemic, Antiasthmatic and Antifertility

Seeds-Antiparasitic

Flower-Diuretic

### 5. Pharmacological activities

#### A. Anti-oxidant activity

The plant extract of *A. racemosus* exhibits enhanced antioxidant effects on mitochondria membrane of rat liver induced by generating free radicals induced by gamma radiation under *in vitro* condition <sup>[11, 13, 22]</sup>. It enhances the GPX and GSH enzyme activity and inhibits the oxidation of protein and lipid peroxidation.

#### B. Cytotoxic activity

Saponins are the major class of secondary metabolites present in Asparagus. Extract of *A. racemosus* is tested against various cancerous cell lines. From the different studies authors claim that compounds that induce programmed cell death are a better developed in the extract.

#### C. Reproductive disorders

It is used to rectify the reproductive problems in females like irregularities in menstrual cycle Dysmenorrhea, amenorrhea, Uterine Bleeding, sexual debility, menopause, Dysfunctional, pelvic inflammatory disease like sexual dysfunction and endometriosis. It has been traditionally used for PMS as uterine tonic, thus it strengthens, nourishes, cleanses and causes uterus prolapse. It remove infertility and prepare the utrine wall for contraction during foetus development thus prevents the miscarriage and also helps to increase lactation by balancing the hormonal level. It is also used to increase the colestrum production in initial days of lactation <sup>[23, 25, 26]</sup>.

#### D. Antiproliferative activity

The steroidal constituents such as Shatavarin I-IV isolated from *A. racemosus* used in cancer cell lines. They were given at different concentrations to each line. The mortality rate and viability of cells were recorded parallelly in a given set of intervals <sup>[16, 12]</sup>. Two techniques are used during the experiment such as Sulforhodamine B cytotoxicity assay and M30 Cyto Death ELISA used to determine the cell viability and apoptosis rate in given carcinoma cell lines. The ability of different compounds to induce mortality was assessed <sup>[17, 26]</sup>. The assessment of cells mortality rate was based on the activity of caspase-cleavage product accumulation and cytokeratin 18 (ccCK18) in cells used in a culture medium. All HCT116 cells shows cytotoxic activity that contains saponins obtained from *A. racemosus* but rest of the sugar aglycone present in sarsasapogenin form did not show such activity. In all the tested Shatavari compounds; Shatavarin IV shows the maximum potential to reduce cell viability and mortality rate <sup>[22, 18]</sup>.

#### E. Adaptogenic and anti-ulcer activity

The plants shows the property of adaptogen (enhance the ability of body to changes according to the environment) as mentioned earlier, it belongs to rasayana herb thus improve the cellular immunity <sup>[12, 27]</sup>. The extract of *A. racemosus* compared to anti-ulcer drug- ranitidine. The comparitable decrease in amount of gastric seceation, free acidity and number of ulcer patches and acidity was examined <sup>[8]</sup>.

#### F. Teratogenic effects

By controlling methanolic extract of *A. racemosus* the teratogenic effects such as an increase in resorption of fetus, slow growth of fetal body and placental part, swelling of legs etc. can be exhibited <sup>[11]</sup>.

#### G. Anti-bacterial activity

Jagannath *et al.* 2012 and Yue *et al.* 2004 reported that under *in vitro* conditions, the methanol extract produced from the roots of *A. racemosus* have also shown extensive antibacterial efficiency against *Vibrio cholerae*, *Shigella dysenteriae*, *Pseudomonas putida* *Staphylococcus aureus*, *Shigella flexneri*, *Escherichia coli*, *Salmonella typhi*, *Salmonella typhimurium*, *Shigella sonnei*, and *Bacillus subtilis*.

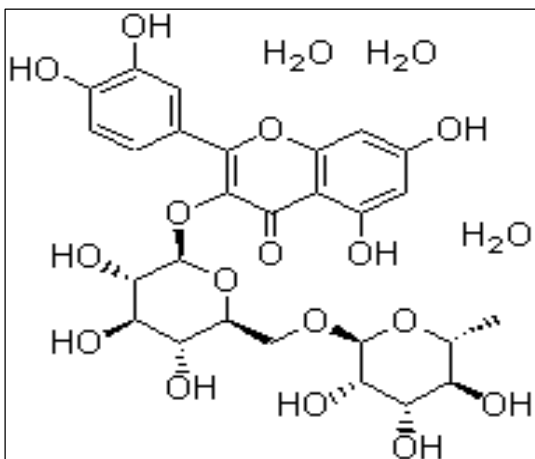
**H. Cardioprotective activity**

The supplementation of roots powder is used in lowering the total lipid concentration, peroxidation by decreasing the (cholesterol) LDL and VLDL more than 40% [19].

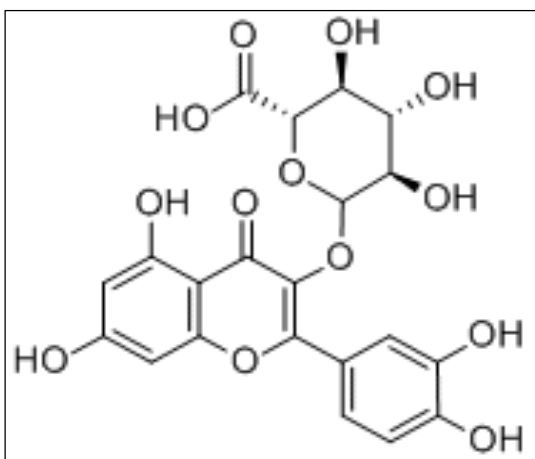
**I. Other uses of shatavari and its side effects**

Shatavari maintains hormonal balance thus healthy female reproductive system by nourishing reproductive organs, most commonly used herb for women's, supports digestive and immune system, normal milk production of breast for nursing mothers and its root also used for washing of clothes. The ample amount of Shatavari increase the body weight, Shatavari causes problems to edema patients and in some peoples may cause some pulmonary and skin problems.

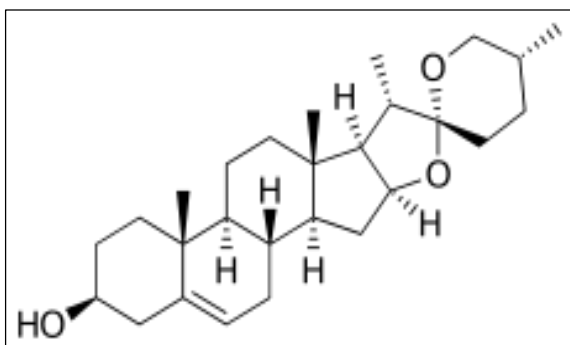
**5. Structure of compounds present in *Asparagus racemosus***



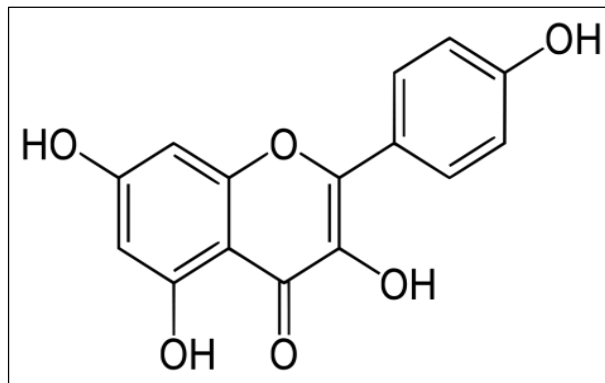
Rutin



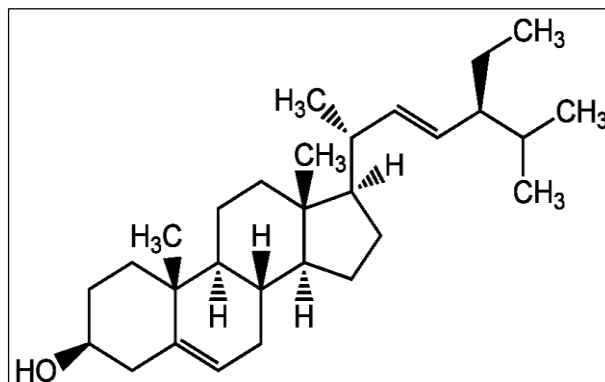
Quercetin-3-glucuronide



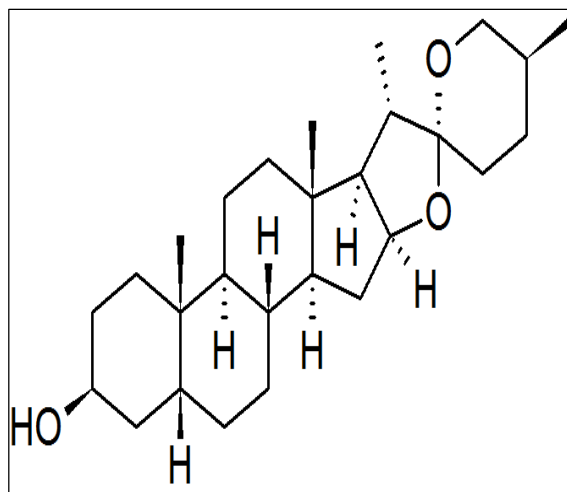
Diosgenin



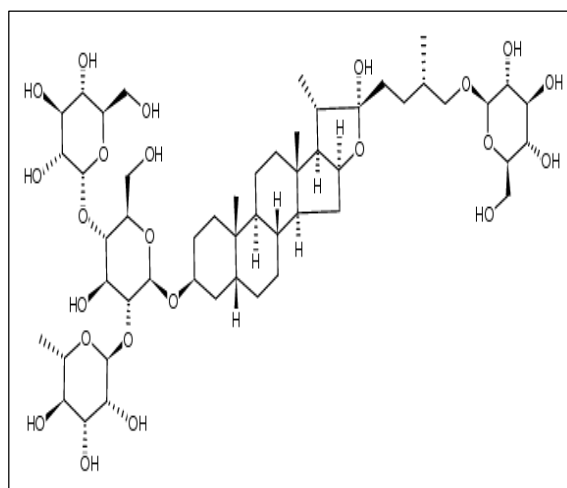
Kaempferol



Stigmasterol



Sarsasapogenin



Shatavarin IV

## 6. Phytoconstituents of *Asparagus racemosus*

**Table 1.** Phytochemicals Derived From Different Plant Parts [13, 28, 21, 27, 11, 14, 1, 3]

Sr. No	Part used	Chemical constituents
1.	Roots	Rutin, asparagan, Asparagamine A, 9,10- dihydro 1, 5 methoxy- Quercetin3 glucouronides, 8-methyl-2, 7- phenanthrenediol, Racemofuron, ncoumertans, Shatavarin V. Shatavarin I, II, III,IV (steroid glycosides), Immunoside, Sitossterol, Undecanyl cellanoate, Shatavari, 4,6- dihydroxy-2-0 (2- hydroxyl isobutyl) benzaldehyde, Secoisolaricresinol, diosgenin, Racemosol, 4- trihydro isoflavine 7-0-beta-D-glucopyranoside, Sterols, Alkaloid, Tannins, carbohydrates, Flavonoids, isoflavones, coumestans, prenylated. Lactones, Amino acids and rutin.
2.	Shoot	Sarsasapogenin and kaempferol Thiophenes, thiazole, aldehyde, ketone, Gamma linoleinic acids, Undecanyl cetamoate,
3.	Leaves	vanillin, asparagusic acid and methyl/ethyl esters
4.	Flower	Diosgenin, quercetin-3-glucuronide
5.	Fruits	Quercetin, rutin, hyperoside, Racemoside A, B, and C [9] Sarsasapogenin, the aglycone of Racemosides A-

**Table 2:** Biochemical activity and mode of action of *Asparagus racemosus* [9, 14, 26, 20, 14, 25, 18]

Bio-activity of A. Racemosus	Procedure Of Action
Adaptogen activity	<i>A. racemosus</i> extract is well known for its outstanding adaptogenic properties
Anticarcinogen activity	<i>A. racemosus</i> steroidal saponins used for apoptosis inducing study
Antidepressant activity	<i>A. racemosus</i> roots methanolic extract is used
Antihepatotoxic potential	<i>A. racemosus</i> alcoholic extract of root have antihepatotoxic properties
Cardiovascular activity	<i>A. racemosus</i> produce alcoholic extract from its roots
Dyspepsia properties	Powder of dried root of <i>A. racemosus</i> . and the <i>A. racemosus</i> fresh root juice
Galactagogue properties	<i>A. racemosus</i> ' root extracts Ricalex' tablets (Aphali pharmaceutical Ltd. Ahmednagar) lactare (TTK Pharma, Chennai)
Immunomodulant activity	<i>A. racemosus</i> polysaccharide fraction is used
In Neural Disorders activity	<i>A. racemosus</i> extract's potential examined against Kainic Acid (KA) - striatal neuronal damage and induced hippocampal
Respiratory action	<i>A. racemosus</i> roots alcoholic extract at higher doses
Uterus properties	<i>A. racemosus</i> roots extracts Ethyl acetate Acetone is used

## 7. Conclusion

*Asparagus racemosus* is an important medicinal plant studied from ancient period. At present the plant is widely used for making allopathic, ayurvedic and homeopathic medicines. Numerous specific chemical constituents of this plant are used in different pharmaceutical formulations have raised its demand. A systematic cataloguing and identification of different phytochemicals provides a meaningful way to explore the indigenous knowledge of this medicinal herb. In this review a brief evaluation of Shatavari properties are discussed in order to explain the practical clinical applications.

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