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RESEARCH ARTICLE

A BROAD REVIEW ON SHATAVARI (*ASPARAGUS RACEMOSUS*) : QUEEN OF ALL HERBS

Dr. Lalita Dahiya¹, Dr. Rajesh Sharma² and Dr. Sakshi Sharma³

1. PG Scholar (Ayu). Dravyaguna Department, A & U Tibbia College & Hospital, Karol Bagh, New Delhi.
2. Associate Professor (Ayu), H.O.D, Dravyaguna Department, A & U Tibbia College, Karol Bagh, New Delhi.
3. Senior Research Officer (Ayu), Ayurveda Central Research Institute, West Punjabi Bagh, New Delhi.

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Abstract

Asparagus racemosus Wild. (fam. Asparagaceae¹) also named as shatavari is used in Indian Ayurveda over centuries. It is also called as "herb's queen"². *A. racemosus* helps to balance vata and pitta, improve the reproductive and digestive health, helps in diabetes mellitus, reduce the stress levels, controls high cholesterol and triglyceride levels. It is widely used in infertility, cancer, depression, oedema, infection like bacterial or fungal, epilepsy, kidney disorders, chronic fevers, excessive heat, stomach ulcers and liver cancer, increases milk secretion in nursing mothers and regulates sexual behaviors. All the parts have pharmaceutical properties, but the stems, roots and leaves are mostly used as medicine. Its major constituents are steroidal saponins. Roots consist of Isoflavones, racemosol, polysaccharides, asparagamine, mucilage and many vitamins A, B1, B2, C, E, Mg, P, Ca, Fe, and folic acid³. This article is to review the chemical constituents and pharmacological activities to understand how asparagus have potential to cure diseases.

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Introduction:-

A. Racemosus is used since Pre-vedic times and remarkably mentioned in our natural herbal system i.e. ayurvedic literatures. It grows 1-2 m long and its roots goes in gravelly, rocky soils high up in piedmont plains, at 1300-1400 m elevation⁴. Some of the medicinal properties of *A. Racemosus* are antispasmodic, anti-allergic, anti-neoplastic activities, anti-oxidant, anti-diabetic, anti-malarial, hepatoprotective, enhance immune responses, anti-arthritis, anti-inflammatory, anti-periodic, Antiulcerogenic action, immunomodulatory, antistress, Anti-diarrhoeal, Antidepressant, anti-leprotic, anti-abortifacient activity, antibacterial, antipyretic and analgesic. saponins are mainly present in its roots, for example, shatavarin I-IV, the glycosides of sarsasapogenin⁵. It has secondary metabolites which includes steroids, alkaloids, dihydrophenanthrene derivatives, flavonoids, furan derivatives and essential oils.

Scientific classification⁶

Kingdom	Plantae
Clade	Angiosperms
Clade	Monocots
Order	Asparagales
Family	Asparagaceae

Corresponding Author:- Dr. Lalita Dahiya

Address:- PG Scholar (Ayu). Dravyaguna Department, A & U Tibbia College & Hospital, Karol Bagh, New Delhi.

Subfamily	Asparagoideae
Genus	Asparagus
Species	A. racemos

Vernacular names

Sanskrit	Satavari
Hindi	Satavari, Shatawar or Satmuli
Bengali	Shatamuli
Marathi	Shatavari or Shatmuli
Gujarati	Satawari
Telegu	Toala-gaddalu or Pilli-gaddalu
Tamil	Shimaishadavari or Inli-chedi
Malayalam	Chatavali
Kannada	Majjigegadde or Aheruballi
Madhya Pradesh	Narbodh or atmooli
Kumaon	Kairuwa
Rajasthan	Norkanto or Satawar
Nepal	Kurilo

Shatavari stands for “curer of a hundred diseases.

Geographical Source

It is widely spread across the earth and found in tropical Africa, Australia, Sri Lanka and south of India, but India is highest producer of Shatavari. This plant is counted in one of the endangered species.

Cultivation and Morphology

Crops mainly require the tropical, hot and humid climate. Black soil is preferred for cultivation. Minimal irrigation is required. Harvesting can be started from 1.5-2 years till 10-15 years. A racemous plant usually blooms in June to July. Morphology of A. Racemous is:

Roots:

5-15 cm long, 2 cm thick, externally silvery white (ash color), internally white, longitudinal wrinkle upon drying, 18-24 layer cortex, 42-47 middle tuberous root, turns brown on drying⁷

Seeds:

Hard and brittle, black color.

Fruit:

Small, round, globular, 3-lobed, purplish black pulpy berries, turn from raw green to ripened blackish purple.

Flower:

Small and uniform in size, white flower having spikes with pink tinge, pollinated by bees, aromatic, unisexual

Phytochemicals

A. racemosus consists of wide variety of chemicals in which major component is steroidal saponins along with alkaloids, flavonoids, dihydrophenanthrenederivatives, furan derivatives and some of the volatile components.

Parts	Chemical constituents ^[8,9,10,11,12,13,14,15]
Roots	Rutin, asparagan, Asparagamine A, 9,10- dihydro 1, 5 methoxy- Quercetin3 glucouronides, 8-methyl-2, 7- phenenthrenediol, Racemofuron, ncoumertans, Shatavarin V. Shatavarin I-(steroid glycosides), Immunoside, Sitosterol, Shatavari, Secoisolariciresinol, diosgenin, Racemosol, 4- trihydroisoflavine 7-0-beta-D- glucopyranoside, Sterols, Alkaloid, Tannins, carbohydrates, Flavonoids, isoflavones, coumestans, prenylated. Lactones, Amino acids and rutin, Undecanylcellanoate, 4,6-dihydroxy-2-0 (2- hydroxyl isobutyl) benzaldehyde
Flowers	Rutin, Diosgenin, Quercetin, hyperoside

Fruits	Quercetin, rutin, Hyperoside, Racemoside A, B, & C
Leaves	5-hydroxy-3,6,4'-trimethoxy-7-O-β-D-glucopyranosyl-[1→4] -O-α-D-xylopyranoside, Quercetin-3-glucuronide
Shoot	Sarsasapogenin and kaempferolThiophenes, thiazole, ketone, Undecanylecetamote, aldehyde, Gamma linoleinic acids

Compound Structure of ShatavarinIV¹⁶

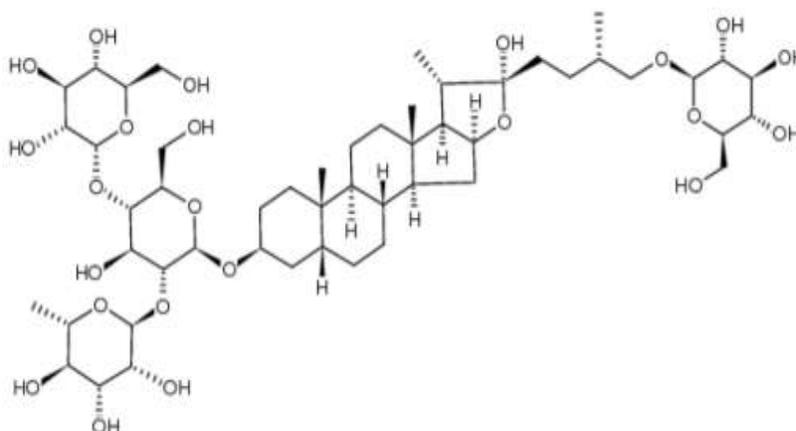


Fig:- Shatavarin IV.

Medicinal Effects of Plant parts

Leaves	Cholinesterase, Antiparasitic
Shoots	Antiinflammatory, Antidiabetic and Diuretic
Whole Plant	Antimicrobial and Cytotoxic, Nephroprotective, Hepatoprotective
Aerial Parts	Urolithiasis, Hypolipidemic, Antiasthmatic and Antifertility
Seeds	Antiparasitic

Pharmacological Activities

Galactagogue effect

Root extract of this plant in Ayurveda prescribe to increases milk secretion²⁰ during lactation¹⁹. Tablets like Ricalax and lactare having *A.racemosus* shown to increase in milk and growth of mammary gland in females complaining about milk deficit during lactation. In other study, the alcoholic extract of roots at 250 mg/kg administered intramuscularly shown high yield and increase in mammary gland lobuloalveolar tissue in primed rats. This is due to promote action of released corticosteroids and increase in prolactin²¹.

Antioxidant effect

In lab^[22,23,24], the mitochondrial membrane of the rat liver shows the antioxidant effect induced by the free radical generated on exposure to gamma rays in plant extract of *A.racemosus*. GPX and GSH enzyme activity enhanced so protein oxidation and lipid peroxidation is inhibited.

Diuretic effect

Diuretic property highlighted by Ayurveda is proven in vitro by aqueous extract of roots having 3 dose vials 800mg/kg, 1600mg/kg and 3200 mg/kg conducted on rats after acute toxicity tests. Diuretic property is observed in extract at 3200mg/Kg without any acute toxicity²⁵.

Antiparasitic and Antibacterial effect

Alcoholic extract of roots has antibacterial effect against *Staphylococcus aureus* and *Escherichia coli* whereas aqueous solution²⁶ does not have any impact. Fungitoxicity against three plant fungi viz., *Helminthosporium sativum* (60.7%)²⁷ *Colletotrichum falcatum* (58.2) and *Fusarium oxysporum* (60.7%) is shown by root juice. The methanol fraction of the leaves using the disc diffusion test at a concentration of 4000 and 5000 ppm²⁸ inhibits *Proteus vulgaris*. Antibacterial activity against *Staphylococcus* is shown by the fresh plant juice. The extract of the plant showed moderate toxicity against *Rhizoctonia solani*²⁹.

Antilithiatic effect

A. racemosus ethanolic extract reduce oxalate, calcium and phosphate ions in urine which are the main cause of renal stone formation. Christina et al studied antilithiatic effect of A. racemosus Willd on ethylene glycol induced lithiasis in male albino Wistar rats³⁰.

Adaptogenic and anti-ulcer activity

A. racemosus induce a property to enhance the ability to changes according to environment. It belongs to rasayana herbs hence increase the cellular immunity. The extract of A. racemosus when compared with the Ranitidine then reduced gastric secretion, low ulcer patches and free acidity was observed. Satavarimandur, formulation of A. racemosus given in the dose of 1.5 g, twice daily for a month displayed noteworthy improvement in symptoms of peptic ulcer³¹ and healing of peptic ulcers was endoscopically verified.

Antifertility

A. racemosus is known as female tonic in Ayurveda. It increases the libido, cure inflamed and dry tissues in sexual organs, ovulation and follicleogenesis enhancement, conception preparation of womb, miscarriages prevention. It also treats leucorrhoea and menorrhagia.

Cytotoxicity, analgesic and antidiarrheal activities

In acetic acid induced writhing in mice, the ethanol extract possess noticeable inhibition of writhing reflex 67.47% ($P < 0.01$) with 500 mg/kg body weight. The plant extract showed antidiarrheal activity in castor oil induced diarrhoea in mice. It increased mean latent period and decreased the frequency of defecation with number of stool count at dose of 250 and 500 mg/kg body weight, respectively comparable to the standard drug Loperamide at dose of 50 mg/kg body weight. Also, the brine shrimp lethality test showed significant cytotoxic activity of the plant extract (LC_{50} : 10 μ g/mL, LC_{90} : 47.86 μ g/mL)³².

Biochemical activities [34,35,36,37,38,39,40,41]

Bio-activity	Procedure Of Action
Anticarcinogen activity	Steroidal saponins used for apoptosis inducing study
Antidepressant activity	Roots methanolic extract is used
Antihepatotoxic potential	Alcoholic extract of root have antihepatotoxic properties
Cardiovascular activity	Alcoholic extract from its roots
Dyspepsia properties	Powder of dried root of A. racemosus. and the A. racemosus fresh root juice
Galactagogue properties	A. racemosus root extracts Ricalex tablets (Aphali pharmaceutical Ltd. Ahmednagar) lactare (TTK Pharma, Chennai)
Immunomodulant activity	Polysaccharide fraction is used
Neural Disorders activity	Extract potential examined against Kainic Acid (KA) - striatal neuronal damage and induced hippocampal
Respiratory action	Roots alcoholic extract at higher doses
Uterus properties	Roots extracts Ethyl acetate Acetone is used

Trace Elements in A. Racemosus⁴²

Metal	Leaves (mg/mg)	Roots (mg/Kg)
Zinc	53.0 \pm 0.2 to 165.0 \pm 3.2	44.0 \pm 0.2 to 148.0 \pm 1.2
Lithium	28.0 \pm 0.6 to 48.0 \pm 1.6	18.0 \pm 0.2 to 58.0 \pm 3.8
Copper	15.0 \pm 0.6 to 34.0 \pm 0.5	14.0 \pm 0.1 to 23.0 \pm 0.3
Calcium	1346.0 \pm 0.3 to 6153.0 \pm 1.6	961.0 \pm 0.6 to 2115.0 \pm 3.2
Manganese	14.0 \pm 0.4 to 84.0 \pm 0.7	5.0 \pm 1.4 to 62.0 \pm 2.5
Potassium	5460.0 \pm 0.2 to 10842.0 \pm 2.5	2652.0 \pm 0.4 to 13260.0 \pm 3.5
Iron	505.0 \pm 0.2 to 2040.0 \pm 0.3	211.0 \pm 0.5 to 1493.0 \pm 0.2
Sodium	127.0 \pm 0.6 to 745.0 \pm 0.3	199.0 \pm 0.5 to 490.0 \pm 20
Cobalt	85.0 \pm 0.3 to 88.0 \pm 0.2	84.0 \pm 0.3 to 122.0 \pm 1.5

Anti cancer property

The protective effect of mammary cell carcinoma is exhibited by the root extract of the A. racemosus. The tumor cell death is inferred by the steroidal component of A. racemosus which is investigated for its apoptotic activities. In

Vivo an experimental model of Ehrlich ascites carcinoma³³ tumor bearing mice was evaluated to check the anticancer activity of Shatavarins (shatavrin IV) and same has been evaluated by MTT assay using MSCF-7 (human breast cancer), A-498 (Human Kidney carcinoma) cell lines and HT-29 (human colon adenocarcinoma). The above experiments showed that the extracts are having potential anti-cancer activities.

Formulae Containing A.Racemosus

Drug	Content of A. racemosus	Medicinal property
Abana® ^{43,44,45,46,47}	Each tablet has 10 mg Shatavari root extract	Hypertension, hyperlipidemic, Platelet aggregation inhibition, angina Adjuvant in cardiac risk factor
Diabecon® ^{48,49,50,51,52}	Each tablet has 20 mg Shatavari root extract	Early retinopathy, Microalbuminuria, Monotherapy in non-insulin-dependent diabetes mellitus
Lukol® ^{53,54,55}	Each tablet has 40 mg Shatavari root extract	Leucorrhea, Malaise, Backache associated with leucorrhea and Pelvic inflammatory disease
Geriforte® ^{56,57,58}	Each tablet has 20 mg Shatavari root powder	Geriatric stress, anxiety disorders, Stress related anxiety, Prolonged illness, and convalescence
Renalka® ⁵⁹	5 mL syrup has 50 mg shatavari root extract	Burning micturition, Cystitis, Dysuria, Hematuria, UTI
Menosan® ^{60,61}	Each tablet has 110 mg Shatavari root extract	Natural menopause, Surgical menopause
Himplasia® ⁶²	Each tablet has 80 mg Shatavari root powder	Benign prostatic hyperplasia
EveCare® ^{63,64,65}	5 mL syrup has 32mg shatavari root extract	Dysmenorrhea, Menorrhagia, Metrorrhagia, Oligomenorrhea

A.Racemosus (Shatavari) ayurvedic indications

Shatavari also known as Shatapadi, Dveepika, Satamuli, Satavirya, Vari, Sukshmapatra, Indavari, Peevari, Madabhanjani, Bahusuta, Rushyaprokta, Narayani, Atirasa, Dveepishatru, and Urdhavakantaka.

Ayurveda's has mention shatavari in many medical remedies like Deepana, Pachana, Rochana, Anulomana, Vamana, Vayasthapana, Jvara, Kasahara, Shwasha, Amahara, Dahahara, Prameha, Truptihara, Mehahara, Rasayani, Balya, Gulmajit, Hikkanigrahana, Kantya, Triptighno, Hridaya, Chakusya, Garbhaprada, Vamanopaga, Shonitasthapana, Pandu, Sangrahini, Kustha, Kamala, Medhya, Varnya, Kshyajit, Krimihara, Kanthya, Arsha, Krichra, Pushtida.

ShatavariAyurvedic Formulation

Shatavari Guggulu⁶⁶

Guggulu pacifies Vatadoshas, stimulates neuromuscular actions, muscles strengthening, nerve revitalization and treats condition like paralysis and hemiplegia. It has shatavari, giloy, ashwagandha, padmaka, pippali, saunf, ajwain, sonth, gandhaprasarni, gokshura, rasna, kachur, shuddhaguggulu, cow's ghee. Small Vatakam of all ingredients (fine powdered mixture with ghee) can be stored in a glass jar as medicine. 1-2 Vatakam with water/warm milk can be taken twice a day in empty stomach or 1 hour before a meal or 2 hours after a meal.

Shatavari Kalpa⁶⁷

ShatavariKalpa is amalgamation of shatavari and elaichi to enhance breast milk production and reduce pain and fatigue. It balance the vatta and pitta dosha. It improve immunity and stamina in menstruation, during pregnancy and post-natal. 4g shatavar, 0.05g elaichi, 5.95g sugar in each 10 gm formulation. Sieve the sun dried grinding powder of sugar and elaichi and mix with melted sugar. Cooled solution can be rolled into small granules and stored in container. It is used as anti-inflammatory, antioxidant, carminative, estrogenic, galactagogue.

Dose is 1-2 tsf two times a day with warm milk.

Effect on Doshas⁶⁸

Shatavari have Snigdha (oily) and Guru (heavy) guna which leads to appeases the pitta (fire and air) doshas. It has Madhur (sweet) and tikta rasa (bitter). It has sheetavirya (cold potency) and Madhurvipaka (sweet metabolic taste) which often aggravates kapha (earth and water) doshas.

Shatavari Ayurvedic dosages⁶⁹

Churna (powder)	¼ to ½ tsp consumed twice a day, mixed with milk, juice, or warm water.
Arishta (Aqueous Tincture)	1-2 tsf, twice a day
Vati (Tablet/ Capsule)	1-2 vatis, twice daily
Kashayam (Juice)	2-3 tsf once a day
Avaleha (Paste)	¼ - ½ tsf

Conclusion:-

Asparagus racemosus is an important medicinal plant from ancient times. It is used for making allopathic, ayurvedic and homeopathic medicines. In this review a brief evaluation of *Shatavari* properties are discussed to explain the practical clinical applications of various parts of the plants. Considerable work has been done to explore the biological activity and medicinal applications of the plant and major studies were reported using root extracts of the plant; still the active principle involved behind these activities needs to be explored. There are several therapeutic applications viz. antioxidant, diuretic, antidepressant, antiepileptic, antitussive, anti-HIV, immunostimulant, hepatoprotective, cardio-protective, antibacterial, anti-ulcerative, neurodegenerative. Several studies have been conducted on different parts of *A. racemosus*, this plant has developed as a drug by pharmaceutical industries. The uniformity of quality and quantity both are prime important for this medicinal plant as it depends on active principle in it.

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