

Asparagus Racemosus, a Climbing Ayurvedic Medicinal Plant: Review on its Cultivation, Morphology and Medicinal Significance

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ABSTRACT

Asparagus racemosus (*A. racemosus*) is a well-known medicinal plant due its various application in Ayurveda. It contains various type of secondary metabolite active natural products (or ingredients) such as steroids, alkaloids, flavonoids, furan derivatives and essential oils. In the present scenario due to growing catastrophic effect of diseases in human life, researchers are trying to stop synthetic drugs by replacing with herbal drugs. Herbal drug treatments are in general used to provide first-line and public health provider, both to persons abode in faraway areas the place it is the only on hand wellness service, and to people residing in bad areas the place it offers the one cheap relief. In this point of view *A. racemosus* can show a new path of herbal treatment.

KEYWORDS: Shatavari, *Asparagus racemosus*, Herbal, Phytochemicals.

INTRODUCTION

Medicinal plants are the nature's gift to human being to cure disease and make healthy life. Herbal medicine is still the backbone of about 75-80% of the total population, mainly in developing nations, for primary health care because, better compatibility with the human body and fewer side effects (Barnet, 1992). In India thousands of species are known to have medicinal important and the use of different parts of several medicinal plants to cure specific ailments has been in trend since ancient times (Parekh, Jadeja, & Chanda, 2006). Herbal medication, also called botanical treatment or phytomedicine, denotes to the use of any plant's parts such as seeds, berries, roots, leaves, bark, or flowers for medicinal purposes. Shatavari means who hold potential to cure "hundred diseases or suitable to many" (Bopana & Saxena, 2007). *Asparagus racemosus* (Shatavari) is encouraged in Ayurvedic texts for the prevention and medication of gastric ulcers, dyspepsia and as a galactagogue. *A. racemosus* has additionally been used by some Ayurvedic practitioners for worried problems. It is considered as huge efficient tonic both for male and female for fertility from long time. Due to its

remarkable Pharmacological activity, in Ayurveda Sastra it is known as "Queen of herbs" Shatavari is known by various names in various parts of India and also around the globe. Use of *A. racemosus* is vindicated in ancient literature of Ayurveda (Charaka Samhita) (Chawla, Chawla, Mangalesh, & Roy, 2011). Its medicinal uses have been reported in the Indian Pharmacopoeias and British Pharmacopoeias and in traditional system of medicine such as Ayurveda, Unani and Siddha. In recent years, a large number of plant products have been inspected for their antimicrobial stuffs against bacteria and fungi. The study will also confirm if there is a biological basis to the claim that the ethnomedicinal plant has useful medicinal purposes (Cowan, 1999).

The genus *Asparagus* is existed around 300 species around the world, out of which 22 species found in India. *A. racemosus* is broadly distributed around various corner of the world (Kirtikar, 1918). Medicinal plants and herbal drugs account for a giant percent of the pharmaceutical market (Hawkins & Ehrlich, 2007).

Plant Characteristics:

Kingdom : Plantae
 Clade : Angiosperms
 Clade : Monocots
 Order : Asparagales
 Family : Asparagaceae
 Sub family: Asparagoideae
 Genus : *Asparagus*
 Species : *Asparagus racemosus* L

Various common names at various region:

Sanskrit : Satavari
 Hindi : satavari, shatawar
 Bengali : Shatamuli
 Tamil : Inli-Chedi
 Telegu : Pilli-gaddalu
 Kumaon : kairuwa
 Rajasthani : Norkanto or Satawar
 Gujrati : Satawari
 Nepali : Kurilo



Figure 1. Pictures of *A. Racemosus* Showing Flowers, Leaves, Fruits, Tuberos Roots

CULTIVATION, CHARACTERISTICS AND MORPHOLOGY

It was first botanically defined in 1799(*GRIN*). It grows one to two meters tall and desires to take root in raspy, stony soils high up in piedmont plains, at height 1300-1400 m altitude (Freeman, 2009).

Cultivation:

A. racemosus is a common and important medicinal plant which grow up all over the India, Sri Lanka, and Himalayas & over the World. Due to its various medicinal application the demand of *A. racemosus* is constantly increases, because of destructive harvesting, combined with habitat destruction and deforestation this plant fall in a risk situation. In Thailand roots of the tree have been used for treatment of spleen, liver and other internal organs (Wiboonpun, Phuwapraisirisan, & Tip-pyang, 2004). In India, generally roots are utilized as a remedy for internal pains, tumors, fever and as a tonic (Kala, 2009).

Characteristics:

A. racemosus is a woody climbing plant growing to 1-2 m in length. The leaves are small like pine needles, uniform and shiny green, flowers are white and have small spikes and in September month it fruits, producing blackish purple like globular shapes.

Economic Importance: Use as Medicines (Arnold & De Wet, 1993)

Habitat:**Africa:**

East Tropical Africa: Kenya, Tanzania
 Northeast Tropical Africa: Ethiopia, Somalia, Sudan
 East Tropical Africa: Angola, Mozambique
 Southern Africa: Namibia, Limpopo, Swaziland

Asian country:

India, Nepal, Bhutan, Pakistan, Sri Lanka, Myanmar, Malaysia

Australasia:

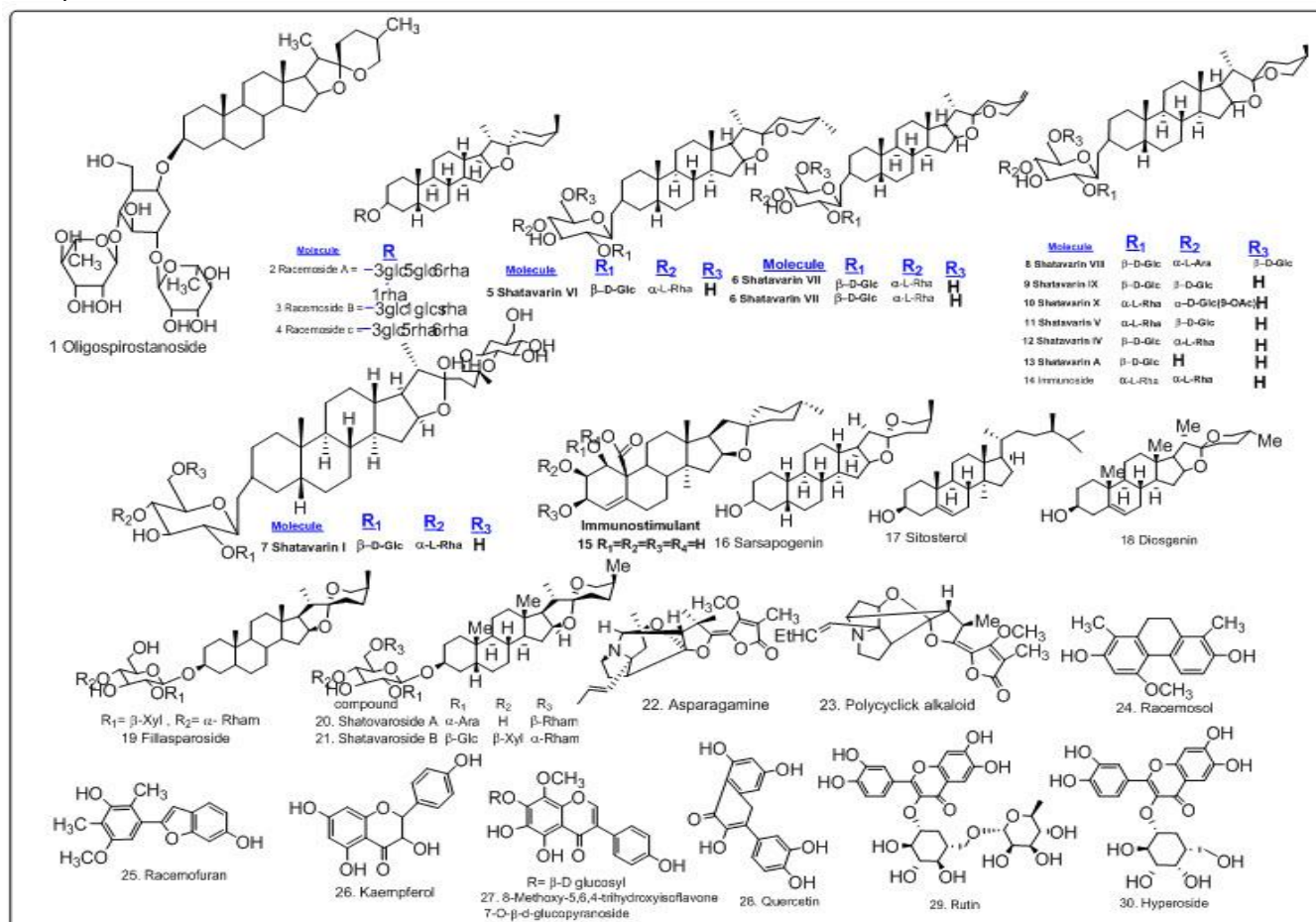
Australia Queensland, Western Australia, Northern Territory

Table 1: traces elements (alkaline earth metals & transition metals) extract from *Asparagus Racemosus*.

S.No.	Metal	Root (mg/kg)	Leaves (mg/mg)
1.	Lithium (Li)	18.0±0.2 to 58.0±3.8	28.0±0.6 to 48.0±1.6
2.	Sodium (Na)	199.0±0.5 to 490.0±20	127.0±0.6 to 745.0±0.3
3.	Potassium (K)	2652.0±0.4 to 13260.0±3.5	5460.0±0.2 to 10842.0±2.5
4.	Iron (Fe)	211.0±0.5 to 1493.0±0.2	505.0±0.2 to 2040.0±0.3
5.	Copper (Cu)	14.0±0.1 to 23.0±0.3	15.0±0.6 to 34.0±0.5
6.	Zinc (Zn)	4 4.0±0.2 to 148.0± 1.2	53.0±0.2 to 165.0±3.2
7.	Manganese (Mn)	5.0±1.4 to 62.0±2.5	14.0±0.4 to 84.0±0.7
8.	Cobalt (Co)	84.0±0.3 to 122.0±1.5	85.0±0.3 to 88.0±0.2
9.	Calcium (Ca)	961.0±0.6 to 2115.0±3.2	1346.0±0.3 to 6153.0±1.6

Phytochemicals:

A. racemosus consists of a diverse range of bio active and medicinally importance molecules in which major constituent is steroidal saponins along with alkaloids, flavonoids, dihydrophenanthrene derivatives, furan derivatives (table 1) and volatile constituents (figure 2-3). Twenty nine steroidal saponins were reported from *A. Racemosus*. An oligospirostanoside named 3-O-[α -L-rhamnopyranosyl-(1 \rightarrow 2)- α -L-rhamnopyranosyl(1 \rightarrow 4)-O- β -D-glucopyranosyl]-25(S)-spirosta-3 β oil is obtained from *A. racemosus* which on oral administration potentiated antibody synthesis and enhanced cell-mediated immune response in immune cooperated animals (Handa et al., 2003).

**Fig.2** Structures of steroidal saponins, alkaloids, dihydrophenanthrene, furan derivative, flavonoids obtained from *A. Racemosus*

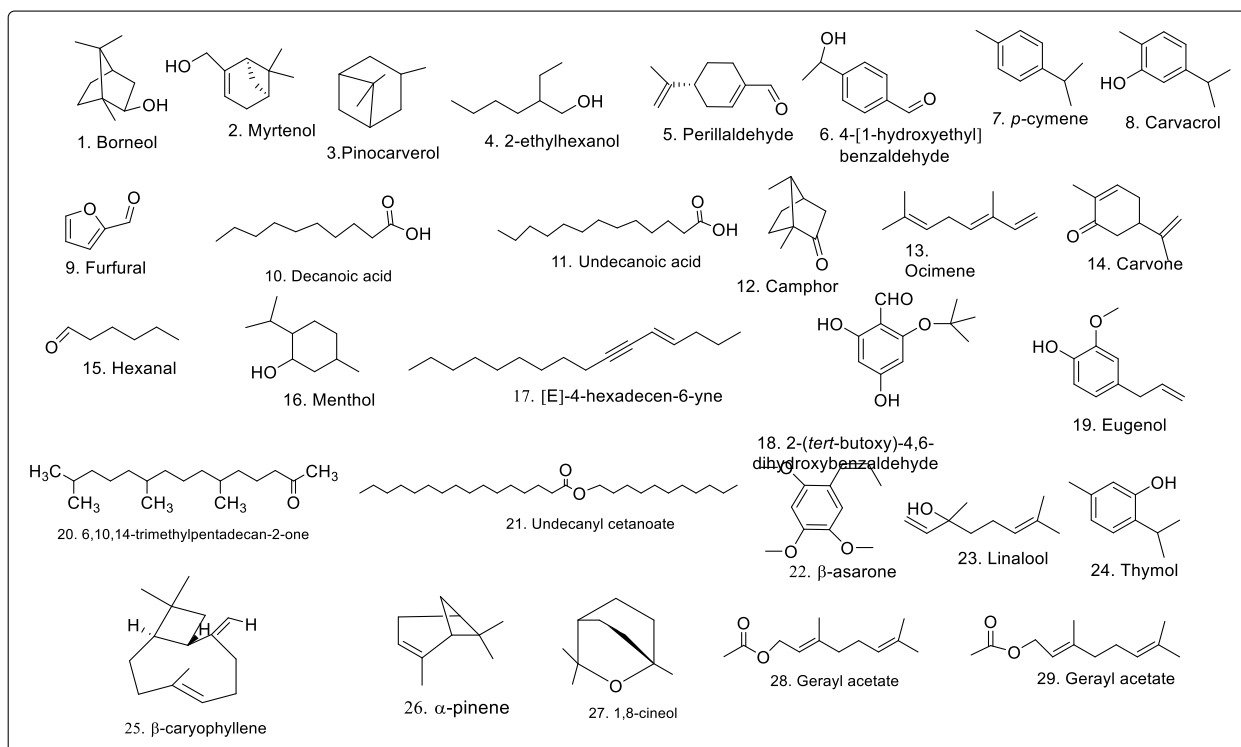


Fig.3 Structures of volatile components of *A. Racemosus*

MEDICINAL SIGNIFICANCE

Asparagus racemosus could be a principal healthful plant of tropical and semitropical India. Its healthful utilization has been pronounced within the Indian and British formulary it's very often known for its phytoestrogenic residences. In written material, *Asparagus racemosus* has been delineated as a rasayana herb and has been used unremarkably as an adaptogen to expand the non-distinctive resistance of organisms against a spread of stresses except use inside the healing of symptom and infectious disease, the plant additionally has inhibitor, immunostimulant, antidyspepsia and medicament results. The roots area unit is used in Ayurvedic medication following a programme of process and drying. It's commonly used as a female internal reproductive organ tonic, as agalactogogue (to provides a boost to breast milk), in acidity, and as a best common wellbeing tonic (Nag, Mukherjee, Roy, Paul, & Sahidul). *A. racemosus* is an outdated galactogogue both in animals and human's therapy of duodenal ulcer with *A. racemosus* was mentioned. Antioxitocin action of this plant had been recognized and immunomodulatory properties are ascribed to

the basis. The presence of antifungal and antimicrobial compounds in the higher plants is well established as they have delivered a source of inspiration for novel drug compound as plant derived medicines have made significant contribution towards human the treatment of diseases as is done in cases of Unani and Ayurvedic system of medicines.

1. Antimicrobial activity:

The bacterial organisms including Gram positive and Gram negative like different species of *Bacillus*, *Staphylococcus*, *Salmonella* and *Pseudomonas* are the main source to cause severe infections in humans. Because these organisms have the ability to survive in harsh condition due to their multiple environmental habitats (Ahameethunisa & Hopper, 2010). In the worldwide as well as in the developing countries, the most human died due to infectious bacterial diseases (Nathan, 2004). The various inorganic and organic solvent extract of *A. Racemosus* show anti-bacterial and anti-fubgal activity (Patel & Patel, 2013). The root extracts of *A. racemosus* have been investigated for antibacterial property employing standard cylinder method. Microbes used were *Bacillus subtilis*, *Staphylococcus*

aureus, *Staphylococcus weneri*, *Pseudomonas aeruginosa* and *Escherichia coli*, *Proteus mirabilis*, *Kleibsellia pneumonia*, *Pseudomonas putida*. Both gram positive and gram-negative bacteria were sensitive to the extract. Ethanolic extract of concentration 100mg/ml, 300mg/ml, 500mg/ml were prepared and their antibacterial activity was comparable to reference standard drug Gentamycin (25µg), *Staphylococcus aureus* the gram positive bacteria were most affected (Ravishankar et al., 2012). Experimental findings suggested that methanol extracts possessed high anticandidal activity against different *Candida* species. The MIC (Minimum inhibitory concentration) values were between 2.5 to 0.312 mg/ml, while MFC (Minimum fungicidal concentration) values ranged between 5 to 0.625 mg/ml (Uma, Prabhakar, & Rajendran, 2009).

2. Anticancer activity:

Cancer is a deadly disease of striking significance in the world today. It is one of the most serious health threats, responsible for the death of about seven million people in a year and a great challenge to medical science (Makar, Saha, & Singh, 2018). The root extract was shown to possess a protecting impact within the duct gland cell cancer eighty. endocrine elements of the *A. racemosus* were investigated for the apoptotic activity and inferred to possess the capability to tumour necrobiosis (Bhutani, Paul, Fayad, & Linder, 2010). Anticancer property of shatavarins (containing Shatavarin IV) which was extracted from the roots of have been evaluated by MTT assay using MCF-7 (human breast cancer), HT-29 (human colon adenocarcinoma) and A-498 (human kidney carcinoma) cell lines and in vivo experimental model of Ehrlich ascites carcinoma (EAC) tumor bearing rats (Mitra, Prakash, & Sundaram, 2012). An aqueous solution of the crude alcoholic extract of the roots extract also shows antiprotozoal activity (Alok et al., 2013).

3. Antidepressant activity:

Adaptogenic drugs are such drugs which are useful as antistress agents by enhancing non-specific resistance of the body. Although, the adaptogenic effect of *A. racemosus* is well documented, its use in psychological disorders like depression is not

scientifically evaluated. Hence, the present investigation evaluates the antidepressant effect of MAR standardized to saponins (62.2% w/w). Rats were given methanolic extract of roots of *A. racemosus* in doses of 100, 200 and 400 mg/kg every day for 7 days and then subjected to forced swim test (FST) and learned helplessness test (LH). The results showed that MAR decreased immobility in FST and increased avoidance response in LH indicating antidepressant activity (Singh, Garabadu, Muruganandam, Joshi, & Krishnamurthy, 2009).

4. Antiuro lithiatic activity:

The mice treated with ethanolic extract of *A. racemosus* at doses 800 and 1600 mg/kg significantly ($P < 0.05$) decreased the serum concentrations of calcium, phosphorus, urea and creatinine (Jagannath, Chikkannasetty, Govindadas, & Devasankaraiah, 2012).

5. Diuretic activity:

Critical toxicity study revealed no fatality even with the highest dose, and the diuretic study revealed significant diuretic activity in dose of 3200 mg/kg (Kumar et al., 2010).

6. Cardiovascular effects:

Abana, herbomineral formulation marketed by Himalaya Drugs Company, have been found beneficial for controlling hypercholesterolemia, prevention and management of coronary heart disease. The lipid-lowering capability of *A. racemosus* root extract in hypercholesteremic mice was verified and the investigation revealed that primary reason of antihypercholesterolemic effect was increased excretion of cholesterol, neutral sterols, bile acid and increase in hepatic bile acid content (Tiwari, Agarwal, Shukla, & Dubey, 1990).

7. Antineoplastic activity:

Chloroform-methanol (1:1) extract of fresh root of *A. racemosus* has been reported to reduce the tumor case in female rats treated with 7, 12 dimethyl benza. This effect is suggested to be mediated by virtue of mammatropic and/ or lactogenic (Rao, 1981).

8. Effect on central nervous system:

Neither stimulant nor depressant action of lactare on central nervous system (CNS) have been reported in albino mice. Shatavari did not produce catalepsy in experimental rats, even with massive oral doses, telling that its action may be outside the blood-brain barrier (BBB), similar to that of metoclopramide (Parihar & Hemnani, 2004).

9. Anti-inflammatory effects:

ACE inhibited topical edema in the mouse ear, following supervision at 200 mg/kg (i.p.), important to substantial reductions in skin thickness and tissue weight, inflammatory cytokine production, neutrophil-mediated myeloperoxidase activity, and various histopathological indicators. Furthermore, ACE was fruitful at reducing inflammatory damage induced by chronic TPA exposure and evoked a significant inhibition of vascular permeability influence by acetic acid in rat (Choo et al., 2009).

10. Anti-HIV effects:

A. racemosus is also known to show immunomodulatory activity. Steroidal saponin glycosides have been reported from these extracts. Compound 19 isolated from the ethanolic extract exhibited the highest anti-HIV activity as compared to other saponin glycosides 35. Glycoside 20 with two sugars exhibited weak anti-HIV activity.

11. Antihepatotoxic activity:

Ethanollic extract of root of *A. racemosus* has been exposed to significantly decrease the enhanced levels of alanine transaminase, aspartate transaminase and alkaline phosphate in carbon tetra chloride (CCl₄) induced hepatic damage in rats, indicating antihepatotoxic potential of *A. Racemosus* (Zhu, Zhang, Zhao, Wang, & Qu, 2010).

12. Gastrointestinal effects:

The dried crushed root of *A. racemosus* is used in Ayurveda for dyspepsia. Oral administration of powdered dried root of *A. racemosus* has been found to stimulate gastric emptying in healthy volunteers. Its action is reported to be comparable with that of the synthetic dopamine antagonist metoclopramide (Dalvi, Nadkarni, & Gupta, 1990). In Ayurveda, *A. racemosus* has also been mentioned for the treatment of ulcerative disorder of stomach and parinama sula, a clinical object akin to the duodenal ulcer disease

13. Antioxidant effects:

The probable antioxidant activity of crude extract and purified water fraction of *A. racemosus* against member injury induced by the free radicals generated during gama (γ) radiation were studied in rat liver mitochondria. Using an effective dose of 450

Gray antioxidant effects of *A. racemosus* extracts were studied against oxidative damage term of protection against lipid peroxidation, protein oxidation. It inhibited lipid peroxidation and protein oxidation. The antioxidant activity of P₃ fraction was more distinct against lipid peroxidation, as assessed by

thiobarbituric acid reactive substance generation, while that of crude extract was more active in inhibiting proteins oxidation (Visavadiya, Soni, & Madamwar, 2009).

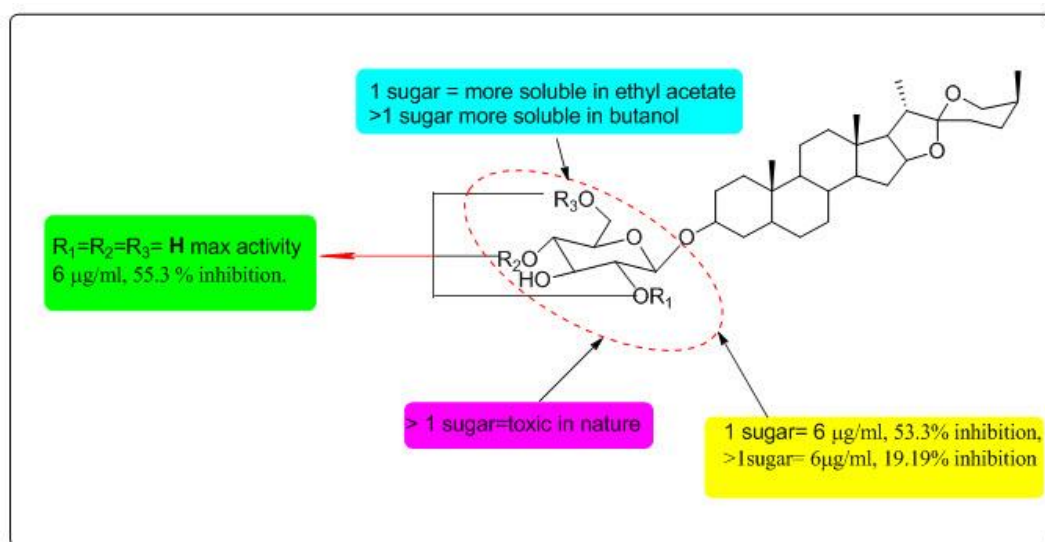


Fig.4 SAR studies of anti-HIV chemical constituents of *A.racemosus*.

14. Teratogenicity effects:

Shatvari is a herb used as a rasayna in Indian Ayurveda and is considered both male and female reproduction tonic. Methanolic extract of *A. racemosus* roots (MAR), 100 mg/kg per day for 60 d, showed teratological disorders in terms of increase resorption of fetuses, gross malformation e.g. swelling in legs and intrauterine growth. *A. racemosus* should be used pregnancy constantly as its exposure during that period may cause damage to the offspring (Goel, Prabha, Kumar, Dorababu, & Singh, 2006).

15. Increase memory and protects against amnesia:

MAR also significantly reversed scopolamine and sodium nitrite-induced increase in transfer latency on elevated plus maze indicating anti-amnesic activity. Further, MAR dose-dependently inhibited acetylcholinesterase enzyme in specific brain regions (prefrontal cortex, hippocampus and hypothalamus). Thus, MAR showed nootropic and anti-amnesic activities. *A. racemosus* extract demonstrated significant decrease in latency time during retention trials. *A. racemosus* can be recognized to their

antioxidant, neuroprotective and cholinergic properties (Ojha, Sahu, Muruganandam, Singh, & Krishnamurthy, 2010)

16. Immunostimulant activity:

Intra-abdominal sepsis is key causes of mortality following trauma and bowel surgery. Immunomodulating property of *A. racemosus* has been revealed to defend the rat and mice against experimental induced abdominal sepsis (Thatte, Chhabria, Karandikar, & Dahanukar, 1987). Oral administration of decoction of powdered root of *A. racemosus* been reported to produce leucocytosis and predominant neutrophilia along with greater phagocytic activity of the macrophages and polymorphs.

17. Miscellaneous effects:

Alcoholic extract of root of *A. racemosus* was found to have trivial diuretic effect in rats and hypoglycemic action in bunny, but no anticonvulsant and antifertility effect was observed in rats and rabbits, respectively. However, it did show some antiamoebic effect in rats.

Marketed Drugs:Table no.2 List of Marketed drugs contain *A. Racemosus*

S.No.	Product Name	Content of <i>A.racemosus</i>	Medicinal Property
1	Abana	10 mg root extract per tablet	Hyperlipidemi ccondit ions, Mild to moderate hypertension
2	Diabecon	20 mg Shatavari root extract per tablet	Microalbuminuria, Monotherapy in non-insulin-dependent diabetes mellitus
3	EveCare	32 mg Shatavari root extract per 5 ml syrup	Dysmenorrhoea, Menorrhagia Metrorrhagia, Oligomenorrhoea
4	Geriforte	20 mg Shatavari root powder per tablet	Geriatric stress, Stress related anxiety
5	Himplasia	80 mg Shatavari root powder per tablet	Benign prostatic hyperplasia
6	Lukol	40 mg Satavari root extract per tablet	Leukorrhoea, Malaise
7	Renalka	50mg Shatavari root extract per 5mL of syrup	Burning micturition, Dysuria, Hematuria
8	Menosan	110 mg Satavari root extract per tablet	Natural menopause, Surgical menopause

CONCLUSION

A. Racemosus is an important medicinal plant which used from ancient time in India, this review paper could be an answer to the people seeking for better therapeutic agents from natural sources which is believed to be more efficient with lesser or no side effects when compared to the commonly used synthetic agents.

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Conflicts of Interest: This paper has no conflict of interest

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