



## Plant Representation, Phytochemistry and Medicinal Assets of *Asparagus Racemosus*

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**Abstract** *Asparagus racemosus* is commonly known as Shatavari having a place in the family Asparagaceae that is extensively present in tropical and subtropics of Asia, Australia, and Africa. Traditionally it was used as galactagogue, aphrodisiac, Rasayana, antiepileptic, adaptogenic, general health tonic and in numerous female reproductive system problems. Now a day's extensive research has been done for phytochemical investigation and to explore its effects to treat and manage different diseases. It has specific steroids, flavonoids, phenolic compounds, and glycosides. Extract of different parts of the plant has been approved for its both in vitro and in vivo activities. It has immunomodulatory, antidiabetic, antioxidant, anticancer, hepatic, and neuroprotective effect, antimicrobial, antiurolithiatic, aphrodisiac, memory enhancing the property, antitussive effect, etc. This review elaborated on all of its pharmacological effect, active constituents that are more responsible for multi-facet actions of *Asparagus racemosus*.

**Keywords** *Asparagus racemosus*; Rasayana; Asparagaceae, Shatavari; Phytochemical investigation

### Introduction

*Asparagus racemosus* commonly known as Shatavari" (shat: "hundred"; variety: "curer"). This common name is given to it because from ancient it was used to treat no diseases especially problems related to the female reproductive system. It was considered "A FEMALE TONIC" due to this ability in a no of research studies Shtavari is translated as "who possesses a hundred husbands or acceptable to many" or "100 spouses" but this plant does not have only utilization in problem-related to female rather it has been proved that it was found significant immunomodulatory and for many other diseases it has appreciable potential to manage as well to treat the problems. It is related to the genus *Asparagus*, has approximately 300 species but from a medicinal point of view *Asparagus racemosus* is the most cultivated specie which is present in the family Asparagaceae. It has a valuable place in "Ayurveda" where it is known as "*rasayana*" (having rejuvenation aptitude) [1-2]. All parts of plants have medicinal wealth but roots have top of the list. Shatavari also has meaning "*hundred rooted*" portray of its plentiful, extended tuberous roots present in clusters [3].

### Taxonomic Classification

Kingdom: Plantae, Clade: Angiosperms, Clade: Monocots, Order: Asparagales, Family: Asparagaceae, Subfamily: Asparagoideae, Genus: *Asparagus*, Species: *Asparagus racemes* [4].



### Plant Description

Plant with one to two-meter high, fiercely long-winded shrub looking beautiful, having widespread branches. Nodes have sickle-like green bunch of fine smooth structures. Spiked leaves with a huddle of scented flowers in extended stalk form. The basic specialty related to this plant is its extensive tuberous roots [3].

### Habitat

It is found throughout at low altitude in the shade, tropical, and subtropics of Asia, Australia and Africa. *Asparagus racemosus* most commonly cultivated species in Asia for medicinal wealth [3,5].

### Phytochemical Screening

Isoflavone having structural formula 8-methoxy-5, 6, 4'-trihydroxyisoflavone-7-O- $\beta$ -D-glucopyranoside is a new compound that has been explored from roots extract [6]. The ethanolic root extract of *Asparagus racemosus* has been screened for a new 9,10-dihydrophenanthrene derivative named racemosol (9,10-dihydro-1,5-dimethoxy-8-methyl-2,7-phenanthrenediol) [7] and kaempferol and a polycyclic alkaloid called asparagine, steroidal saponins such as shatavarins (I, IV) and sarsasapogenin (roots, leaves, and fruits) as well as ascendin (A, B), asparanin (A,B,C) were explored from the ethanolic root extract of *Asparagus racemosus* [8]. Three steroidal saponins such as racemosid A, (25S)-5 $\beta$ -spirostan-3 $\beta$ -ol-3-O- $\beta$ -D-glucopyranosyl(1 $\rightarrow$ 6)- $\beta$ -D-glucopyranosyl(1 $\rightarrow$ 4)]- $\beta$ -D-glucopyranoside, racemosid B, (25S)-5 $\beta$ -spirostan-3 $\beta$ -ol-3-O- $\alpha$ -L-rhamnopyranosyl(1 $\rightarrow$ 6)- $\beta$ -D-glucopyranosyl(1 $\rightarrow$ 6)- $\beta$ -D-glucopyranoside and racemosid C, (25S)-5 $\beta$ -spirostan-3 $\beta$ -ol-3-O- $\alpha$ -L-rhamnopyranosyl-(1 $\rightarrow$ 6)- $\beta$ -D-glucopyranosyl(1 $\rightarrow$ 4)]- $\beta$ -D-glucopyranoside has been determined and isolated by TLC from the Methanolic extract of the fruits of *Asparagus racemosus* [9]. Isolation and structure elucidation has been done by RP-HPLC and 1D and 2D NMR respectively for a new steroidal saponin, Shtavari, (3-O- $\beta$ -D-glucopyranosyl(1 $\rightarrow$ 2)]- $\beta$ -D-glucopyranosyl(1 $\rightarrow$ 4)]- $\beta$ -D-glucopyranosyl(1 $\rightarrow$ 4)]-(25S)-5 $\beta$ -spirostan-3 $\beta$ -ol from the roots of *Asparagus racemosus* [10]. With the help of different spectroscopic techniques such as TLC for isolation, IR, NMR and mass spectroscopy for molecular formula as well as for the structure elucidation of a fresh valuable sarsasapogenin glycoside is investigated from *Asparagus racemosus* is known as immunoside (C<sub>45</sub>H<sub>74</sub>O<sub>16</sub>) having significant potential to alter the immune system [11]. Root extract showed no of total phenolic contents and total flavonoids [12] as well as steroids, phytosterols, carbohydrates, tannins, anthraquinones, saponins, and glycosides [13]. By electro-spray ionization-QTOF-MS/MS and 1D and 2D NMR studies separation and structure elucidation of shatavaroside A and shatavaroside B with a known saponin, filiasparoside C, has been occurred [14]. A valuable antioxidant compound "racemofuran" has been successfully isolated from roots of *asparagus racemosus* by TLC [15]. Different parts of the plant have been screened for Ca, Mg, K, Fe, Cu, Mn, Zn, and Cu. A valuable amount of these minerals present in *Asparagus racemosus* [16].

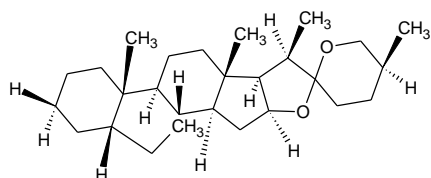


Figure 1: Sarsasapogenin

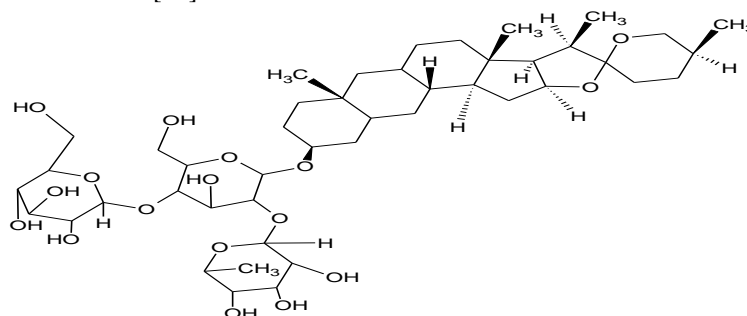


Figure 2: Shtavarin



R= Glu(2-1)Glu, Asparanin A  
 R=Glu[(2-1)Glu](4-1)Rha, Asparanin B  
 R=Glu[(4-1)Ara](6-1)Rha, Asparanin C  
 R=Glu[(2-1)Rha](4-1)Ara, Curillin G  
 R=Glu[(2-1)Glu](4-1)Ara, Curillin H

R= Glu(6-1), Adscendin A  
 R=Glu[(4-1)Rha](6-1)Rha, Adscendin B

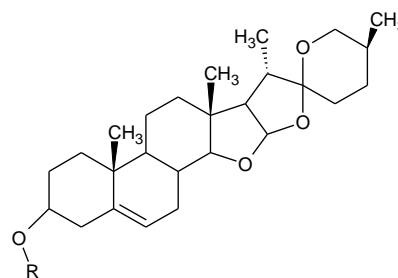


Figure 3

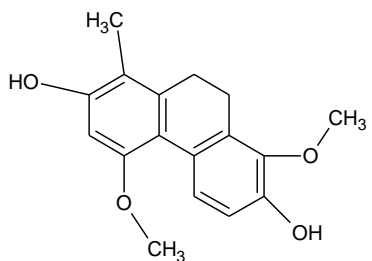


Figure 4: Racemocol

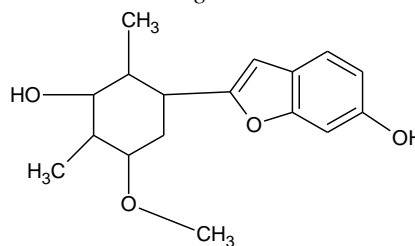


Figure 5: Racemofuran

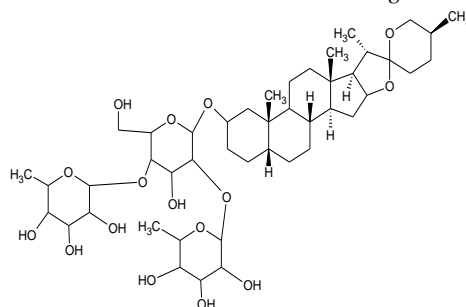
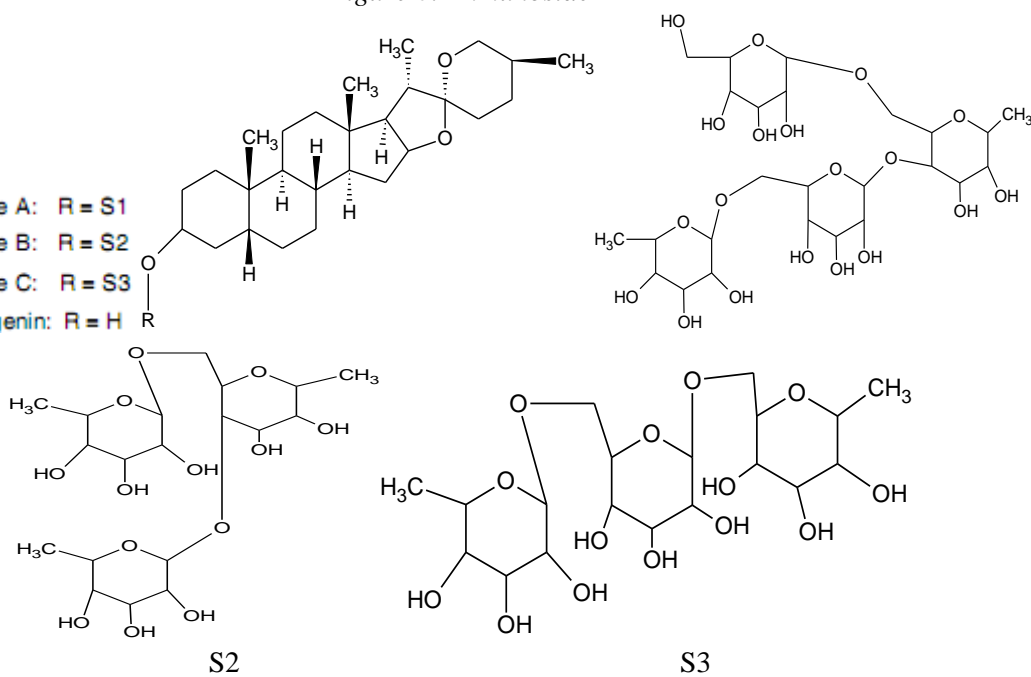


Figure 6: Immunoside

1. Racemoside A: R = S1
2. Racemoside B: R = S2
3. Racemoside C: R = S3
4. Sarsasapogenin: R = H



S1

Figure 7



## Pharmacological Properties

### Neuroprotective Effect

Alzheimer's disease and Parkinson's disease can be occurred due to exitoxicity and oxidative stress. Reactive oxygen species (ROS) are considered to be one of a major risk factor to commence and prop up neurodegeneration. It has been assessed that *asparagus racemosus* exhibits neuroprotective effect againstkianic acid induced hippocampal and striatal neuronal damage. It is experimented that kianic acid (0.25µg/ 0.5µl) cause raise in lipid peroxidation and protein carbonyl content with decline in the activity of glutathione peroxidase and reduced glutathione content in anesthetized mice. When *asparagus racemosus* was given to that mice then amplification in glutathione peroxidase activity and reduced glutathione content with dwindling in lipid peroxidation and protein carbonyl the content was observed [17]. It has been observed that *asparagus racemosus* had nonselective inhibitory action on acetylcholine esterase and butyrylcholine esterase owing to the presence of saponins in methanolic extract of roots as compared to hexane and chloroform fraction [18].

### Antitussive Effect

Methanolic extract of *asparagus racemosus* was evaluated for its antitussive effect. The experiment was done on albino mice which were divided into five groups. In each group, there were ten mice. Saline, which was a vehicle, was given to the control group in 10ml/kg per oral dose while the second and third group got *asparagus racemosus* extract 200 and 400mg/kg, p.o., respectively; and codeine phosphate (10 and 20mg/kg, p.o.) was given to the fourth and fifth group respectively. Then Sulphur dioxide was given to all these groups for one minute to induce cough and the occurrence of cough was observed for five minutes. The extract showed a dose-dependent effect against Sulphur dioxide induced cough (40 and 58.5% restraintment of cough at doses of 200 and 400 mg /kg, respectively while the standard antitussive drug codeine phosphate has 36 and 55.4% inhibition at 10 and 20mg/kg, respectively. So, *asparagus racemosus* can be used to treat cough [19].

### Immunomodulatory Effect

*Asparagus racemosus* has a valuable effect on the immune system. It was investigated by taking inbred male albino mice (4 weeks old). Mice were given ochratoxin 1.5mg/kg Oral (a group of mycotoxins produced by some *Aspergillus* species, has an immunosuppressant effect by decreasing interleukin-1 (IL-1) making by macrophages and tumor necrosis factor (TNF) was also lessened) then Crude alcoholic extract of *Asparagus racemosus* (100mg/kg) was given to the mice and the control group entertained by only distilled water. There is an increase in the production ofinterleukin-1(IL-1) and tumor necrosis factor (TNF) by macrophages was observed in mice receiving extract as compared to the control group [20]. Immunomodulatory effect was also observed in mice having tumors and receiving cyclophosphamide. Tumor itself and all the anticancer drugs have an immunosuppressant effect. Cyclophosphamide caused a decrease in platelet counts, white cell total counts, HA antibody titers, and HL antibody titers in mice. *Asparagus racemosus* showed an increase in white cell count and antibody titer. So, *Asparagus racemosus* is a good source of immunostimulant activity and as supportive therapy in cancer treatment [21]. In 2009 the immunomodulatory effect of aqueous root extract has been reported in mice. It has been observed that at 100mg/kg b.w.p.o. extract represented modulation in of Th1/Th2 immunity [22].

### Antidepressant Effect

*Asparagus racemosus* has been examined for its antidepressant effect. This effect was noticed on rodent models. Rodents received a methanolic extract of roots of *Asparagus racemosus* (MAR) standardized to saponins (62.2% w/w) in the doses of 100, 200, and 400 mg/kg daily for 7days. Then all these rodents were inspected for the antidepressant effect of the extract by performing two major tests that are forced swim test (FST) and learned helplessness test (LH). The outcome of the tests showed diminished immobility in FST and amplification of avoidance response in LH demonstrating antidepressant activity because *Asparagus racemosus* provides assistance to both serotonergic and adrenergic systems [23]. The same dose-dependent antidepressant effect was observed when the methanolic extract



(50, 100 and 200 mg/kg p.o.) was received by mice for 14 days and there was a noteworthy difference in test groups as compared to control groups.

### **Nootropic and Antiamnesic Activity**

The methanolic root extract of *Asparagus racemosus* has been evaluated for its memory-enhancing (nootropic) and anti-amnesic activity. For this purpose, male albino rats were taken and two vital tests that are the morris water maze (MWM) for nootropic and elevated plus maze (EPM) for anti-amnesic activity were applied. All the animals were pretreated with extract (50, 100 and 200mg/kg, p.o) for 7 days. Rats receiving extract showed clear variation from the control groups in the morris water maze and for anti-amnesic activity scopolamine and sodium nitrite was delivered to tested rats to produce amnesia, the elevated plus maze is applied, test groups demonstrated distinction from control group suggesting due to anticholinesterase activity, so, *Asparagus racemosus* has valuable nootropic and anti-amnesic activity [25].

### **Antiulcer Activity**

Methanolic extract of *Asparagus racemosus* has been reported for its antiulcer activity. For this study, the ulcer is induced by different ways that are gastric ulcer is produced by ethanolic restraint stress, pyloric ligation, aspirin plus pyloric ligation and by aspirin whereas duodenal ulcers are induced by cysteamine. Extract 25–100mg/kg showed a precious ulcer protection behavior in cold restraint stress, pyloric ligation, aspirin plus pyloric ligation induced ulcer and at 50mg/kg in cysteamine induced ulcer owing to its ability to produce mucin secretion, so, play an important role in rejuvenating defensive mechanism of GIT [26-28].

### **Anti Parasitic Activity**

*In vitro* anti-plasmodial and anti-leishmanial activity has been performed against 2 laboratory-adapted *Plasmodium falciparum* isolates (D6, CQ-sensitive, and W2, CQ-resistant) and *Leishmania major* (IDU/KE/83=NLB-144strain). For this study both water and methanolic extract of *Asparagus racemosus* have been screened. The methanolic extract showed antiplasmodial activity ( $32.63 \pm 2.68$  and  $33.95 \pm 2.05 \mu\text{g/ml}$  for D6 and W2, respectively) and methanol and water extract have ( $58.3 \pm 8.22$  and  $56.8 \pm 6.58\%$ , respectively) leishmanicidal activity. So, from the result it is easily depicted that *Asparagus racemosus* has valuable antimalarial activity [29].

### **Antidiabetic Effect**

From ancient times, a no of herbs is used for the management and treatment of diabetes and *Asparagus racemosus* is one of them. It has been studied that antidiabetic potential is due to its organic and inorganic elements that have a direct effect on  $\beta$  cells of islets of Langerhans for the release of insulin. For this study, male albino rats have been used as diabetic models and 95% ethanolic extract of roots has been utilized. From an oral glucose tolerance test, it is demonstrated that both organic-inorganic parts of the plant have hypoglycemic effect [30]. As it has been reported that a no of minerals is present in *Asparagus racemosus* extract. Calcium is the most important mineral for the secretion of insulin. A study is conducted on isolated perfused rat pancreas, isolated rat islet cells, and clonal  $\beta$ -cells to determine insulin secretory action of different fraction of *Asparagus racemosus*. Nonpolar fraction (ethanol, ethylacetate, chloroform) showed a significant effect on insulin secretion as compared to polar fraction that is an aqueous fraction [31].

### **Anticancer Activity**

The root extract of *Asparagus racemosus* has been screened for its anticancer activity. Apoptosis and cytotoxicity of the human colon carcinoma cell line HCT116 are considered a major indicator of this activity. It is reported that a no of compounds such as asparanine B, Shatavarin IV, immunoside, Shatavarin I, present in extract showed cytotoxic activity and the only immunoside has valuable potential for apoptosis, suggesting due to sarsapogenin and diosgenin derived steroidal constituents [32-33]. A study was conducted on rats having mammary tumorigenesis induced by DMBA treatment with 0.25%, 0.5%, 1%, or 2% of the diet of *Asparagus* root extract powder. It has been observed



that there was a dwindling in tumor production occurred when pretreatment with extract has been done [34]. In another study, it has been investigated that Shatavarin IV rich fraction (AR-2B) exhibited valuable potential against cancer both *in vitro* and *in vivo* models [35].

### Aphrodisiac Activity

The hydro-alcoholic and aqueous extracts of the roots of *Asparagus racemosus* has been evaluated for its aphrodisiac activity. The experiment was done on male albino rats at two different doses (200 and 400 mg/kg body weight) of both extracts. Different parameters were under consideration. It was observed that hydroalcoholic extract was more active from aqueous extract for all parameters. There is increase in the mount and intromission frequency and decrease in mount and intromission latency as well as grooming of genital area was observed at higher the dose of hydro-alcoholic extract in test groups as compared to control groups, so, *Asparagus racemosus* can be used for the treatment and management of sexual disorders [35].

### Antibacterial Activity

Ethanol extract of *Asparagus racemosus* has been screened for antibacterial activity along with phytochemical analysis. For antibacterial, the agar cup-plate method was used against organisms like *Staphylococcus aureus* ATCCBAA 1026, *Bacillus subtilis* ATCC 11774, *Staphylococcus wernerii* ATCC 27836, *Pseudomonas putida* ATCC 700007, *Pseudomonas aeruginosa* ATCC 10662, *Proteus mirabilis* ATCC14153, *Escherichia coli* ATCC 10536, *Klebsiella pneumonia* ATCC 33495. It has been explored that extract has considerable activity at different concentrations (100, 300 and 500mg/ml) with a zone of inhibition *Staphylococcus aureus* (18mm), *Bacillus subtilis* (13mm), *Staphylococcus wernerii* (14mm), *Pseudomonas putida* (17mm), *Pseudomonas aeruginosa* (15mm), *Proteus mirabilis* (15mm) suggesting due to the presence of alkaloids, carbohydrates, glycosides, phenolic compounds, tannins, saponins, steroids, and flavonoids [36-37]. *In vitro* antibacterial activity of methanolic extract (50, 100, 150 µg/mL) of roots of *Asparagus racemosus* has been studied by taking *Escherichia coli*, *Shigella dysenteriae*, *Shigella sonnei*, *Shigella flexneri*, *Vibrio cholerae*, *Salmonella typhi*, *Salmonella typhimurium*, *Pseudomonas putida*, *Bacillus subtilis* *Staphylococcus aureus* through the disc diffusion method. It has been investigated that extract showed dose-dependent inhibitory effect against all these strains [38].

### Antiinflammatory Activity

For this study ethanolic leaf extract has been assessed. It has been reported that ethanolic leaf extract showed a dose-dependent anti-inflammatory effect in carrageenan-induced paw edema rats. 200, 400, 600 mg/kg extract is introduced. At all these concentrations there was inhibition of inflammation but at 600mg/kg significant % inhibition (46 %) was observed in comparison with the control group because flavonoid and sterol types of compounds are present in leaf extract of *Asparagus racemosus* [39]. The methanolic root extract of *Asparagus racemosus* has been found significant inhibitor of nitric oxide (NO) production, which play an important role in inflammation. It has been investigated that *Escherichia coli* 026: B6 lipopolysaccharide (1µg/mL) induced NO production from macrophages has been dwindled by 100 µg/mL by extract ( $p < 0.005$ ), so, extract can be used for treatment and management of inflammation [40].

### Antidiarrheal Effect

It has been reported that *Asparagus racemosus* has valuable potential against diarrhea. 150, 200 and 250mg/kg, p.o. of ethanolic and aqueous extracts of *Asparagus racemosus* is given orally to the castor oil-induced diarrheal rats. There was a critical difference among rats receiving extract and control groups might be due to antimotility and antisecretory action of flavonoids on intestine and hydro electrolytes respectively or the antioxidant ability of flavonoids cause inhibitory effect on enzyme causing arachidonic acid metabolism [41]. Same experiment along with charcoal meal-induced GIT motility and intestinal fluid accumulation (enteropooling) by PGE<sub>2</sub> has been done to evaluate the effect of ethanolic and aqueous extracts of *Asparagus racemosus* at 200 mg/kg. Both these fractions had



significant ( $P < 0.05$ ) antidiarrheal effect against castor oil and antienterpooling effect of by  $\text{PGE}_2$  as well as the antimotility ability of charcoal is significantly ( $P < 0.001$ ) impeded [42].

### Effect on Sperm Count

Traditionally root juice of *Asparagus racemosus* was used to augment the sperm count and it was known as "Satamul" [43]. *In vitro* boosting of sperm count by *Asparagus racemosus* has been proved. For this study lyophilized aqueous root extract of *Asparagus racemosus* was used. Sperm count before and after incubation was observed. There was an increase in sperm count. It has been assessed that extract has potential against oligospermia, so, *Asparagus racemosus* can be used to treat sterility problems related to oligospermia [44].

### Antioxidant Activity

The antioxidant activity of *Asparagus racemosus* has been well demonstrated. A study was conducted on roots of *Asparagus racemosus* has been conducted to evaluate antioxidant potential and reason behind this activity. It was investigated that a no of compounds is present in *Asparagus racemosus* that is asparagamine A, racemosoletc. but the main compound which was responsible was racemofuran. It showed activity against DPPH with  $\text{IC}_{50}$  value of  $130 \mu\text{M}$  [15]. A research was conducted to assess *in vitro* antioxidant potential of five special fractions (ethanol, methanol, petroleum ether, n-hexane, and chloroform) of *Asparagus racemosus* roots by observing different parameters such as DPPH free radical scavenging assay, reducing power capacity assessment, cupric reducing antioxidant capacity (CUPRAC) with total phenolic and total flavonoid contents. It has been examined that  $\text{IC}_{50}$  values ( $\mu\text{g/ml}$ ) for DPPH free radical scavenging activity was as follows  $164.77 \pm 1.73$ ,  $128.73 \pm 6.0$ ,  $104.18 \pm 3.0$ ,  $70.4 \pm 3.76$ ,  $56.32 \pm 3.95$ , reducing power ability to reduce ferric to ferrous was highest for ethanol than methanol, pet-ether, and n-hexane, chloroform showed the least reducing power. Cupric reducing power value is highest for ethanol. Ethanolic fraction has potent antioxidant values because total phenol contents (mg/gm, Gallic Acid Equivalent) a is highest ( $108.78 \pm 2.77$ ) in ethanolic fraction as compared to another fraction. This study proved that *Asparagus racemosus* has a valuable antioxidant ability [12].

### Hepatoprotective Effect

To evaluate the hepatoprotective effect of *Asparagus racemosus* malignancy is induced in rats by diethylnitrosamine (DEN) (200mg/kg b wt, i.p.) once a week for 2 weeks, followed by treatment with DDT, a tumor promoter (0.05% in diet) for 2 weeks. There was the production of hepatocarcinogenesis that is an enlargement of nuclei with clumped chromatin and micronuclei, liver cell dysplasia, premalignant cells in histopathological study, Immunohistochemical observation confirmed distinct clusters of cells with p53+ foci, increase in MDA, alanine transaminase (ALT), aspartate transaminase (AST) and alkaline phosphatase (ALP) and decrease in reduced glutathione (GSH) levels, glutathione-S-transferase (GST), glutathione reductase (GR) and catalase (CAT) in rats treated with DEN followed by DDT. It has been investigated that there was the absence of malignancy and p53+ foci, the decline in MDA level and liver marker enzymes (ALT:  $p < 0.005$ , AST:  $p < 0.01$ , ALP:  $p < 0.01$ ), increased in GSH levels and enzyme activity (GST:  $p < 0.005$ , GR:  $p < 0.01$ , CAT:  $p < 0.05$ , in rats pretreated with aqueous root extract of *Asparagus racemosus* (200mg/kg body weight) indicating good hepatoprotective effect [13] Same effect with an increase in body and liver weight which was drastically reduced by lead was observed in lead-induced hepatotoxicity in rats at 50mg/kg of body weight suggesting due to antioxidant potential [45].

### Hypocholestrimic Effect

This effect was observed in streptozotocin-induced diabetic rats. There was an increase in cholesterol and triglycerides in these models. When an ethanolic extract of *Asparagus racemosus* (Wild) 200 and 400 mg/kg/b. w for 21 days was given to rats then there was a decrease in cholesterol and triglyceride level. Cholesterol level (mg/dl) before treatment was  $130.9 \pm 7.51$ , after treatment with the extract at 200 and 400mg/kg/b. w level was  $102.0 \pm 1.80$ ,  $87.68 \pm 0.82$  respectively. Triglyceride level (mg/dl) before extract administration was  $143.8 \pm 2.12$ , when extract was given to rats at 200 and 400mg/kg/b.w level was  $27.60 \pm 0.72$ ,  $22.33 \pm 1.60$ , so, *Asparagus racemosus* has good



hypcholesteremia effect and can be used to treat problems related to hypercholesteremia [46]. The root extract of, *Asparagus racemosus* has been studied this effect. It has been evaluated that when extract (5 and 10g % dose levels for 4 weeks) was introduced in hypercholesteremic rats then dose-dependent drop in plasma and hepatic lipid profiles, augmented fecal excretion of cholesterol, neutral sterol and bile acid along with raise in hepatic HMG-CoA reductase activity and bile acid content was observed [47-48].

### Antifungal Activity

Hydroalcoholic and hexane extract of *Asparagus racemosus* has been screened for antifungal activity against *Aspergillus Niger* and *Candida albicans* by agar well diffusion method. Both fractions have antifungal potential *Aspergillus Niger* but hydro alcoholic showed greater effect but none of them showed activity against *Candida albicans*. Zone of inhibition values for *Aspergillus Niger* of hydroalcoholic and hexane fraction were 20 and 10 mm with MIC 0.5 and 0.7 mg/ml respectively [49]. *In vitro* antifungal activity against *Candida albicans*, *Candida tropicalis*, *Candida krusei*, *Candida guilliermondii*, *Candida parapsilosis*, and *Candida stellatoidea* of methanolic extract of *Asparagus racemosus* roots and tubers through disc diffusion method. It has been assessed that extract has potential against all strain with a zone of inhibition values for all these strains are 16, 16, 16, 16, 14, 13 and MIC (mg/ml) 0.312, 0.625, 0.625, 0.625, 0.625, 0.625 respectively. So, from these results it is indicated that root and tubers extract can be used for the treatment of vaginal candidiasis [50].

### Wound Healing Ability

*In vivo* wound healing ability of the root extract of *Asparagus racemosus* has been assessed by taking rats as a model having excision and incision at 200mg/kg and 400mg/kg orally for 10 to 22 days. It is found that an incision wound model, there was a dose-dependent increase in wound breaking strength that is 324.33±6.93gm, 360.83±5.83gm for 200 and 400 mg/kg respectively and these values are greater than the control group (241.03±18.73gm). In the excision wound, the model control group had time for epithelization was 22.66±0.2 days and in test groups at 200 and 400mg/kg period was 15.66±0.33 days and 15.33±0.4 days. Percentage of wound contraction transfer from 24.7±3.35 in control to 29.9±5.5. so, *Asparagus racemosus* has potent potential against any wound or ulcer [51].

### For Gynaecological Disorders

An ethnomedicinal study showed that root paste was used directly on the abdomen to assist delivery [52]. A survey has done on the use of *Asparagus racemosus* for typically female problems and it has been examined this plant justifies the name "A Versatile Female Tonic". It is used for no of problems such as leucorrhoea, menorrhagia, inflammatory conditions of sexual organs, miscarriages, dryness of sexual organs, as well as it boosts libido, augments ovulation and folliculogenesis, especially by acting as galactagogue, significant effect on hormones and normalize the uterus, known as a post-partum tonic and more effectively prepare the womb for conception [1].

### Antirolithiatic Activity

Ethanollic extract of *Asparagus racemosus* has been evaluated on the formation of solid non-metallic minerals in the urinary tract. From histopathological studies it was explored that extract, when administered at 200, 400, 800, and 1600 mg/kg, for 10 days in ethylene glycol (EG) 0.75% and ammonium chloride (AC) 2% induced urolithiatic rats, showed normal size tubules with single epithelial lining along the boundary rather than dilatation of the tubules and total deterioration of the epithelial lining with the permeation of the inflammatory cells into the interstitial space as in the positive control group. There was a dwindling of calcium, phosphorus, urea, and creatinine levels in serum as compared to the control group ( $P < 0.05$ ). So, it has been proved that *Asparagus racemosus* is a better option in urolithiatic patients than surgery [53].

### Traditional Uses

For kidney stones (a mixture of cow's bitter milk and root powder, use orally for 3-4 days) [54]. For skin problems (a mixture of tubers *Asparagus racemosus* and leaves of *Plumbago indica*) [55-56], for lactation (root powder along





with honey or milk increase milk amount), root decoction is used for Leucorrhoea [57]. It has been evaluated that its root extract is used for the management and treatment of diarrhea, dysentery and, general debility [58]. An ethnobotanical survey demonstrated the traditional use of the tuberous root of *Asparagus racemosus* for the management of epilepsy. For this purpose, half cup decoction with an equal volume of milk once a day for 90 days is exercised [59]. Root juice was used to augment sperm count and for impeding blood dysentery [43].

### Teratogenic Effect

It has been approved that *Asparagus racemosus* 100 mg/kg/day for 60 days given to the pregnant rats. In test groups augmentation in resorption of fetuses, gross malformations e.g. swelling in legs and small placental size with intrauterine growth impediment while live pup illustrated significant hindrance of various developmental factors, the decline in length and body weight [60].

### Miscellaneous Effects

This plant has minor diuretic effect (3200mg/kg), positive ionotropic and chronotropic effect, cause hypotension in cats showed congestion and complete stasis of blood flow in mesenteric vessels of mice, cause depression of respiration in cat, had a dilatory effect on bronchial musculature of guinea pigs [61-62].

### Conclusion

In this review article, all traditional and pharmacological uses as well as phytoconstituents responsible for its potential uses has been well described. It has been evaluated that *Asparagus racemosus* (asparagaceae) has valuable and versatile medicinal potential but very less work has been done for its utilization in humans. To attain maximum benefit from nature it should be necessary to research this plant in the future so that less expensive, multipurpose and handy package provided by nature can be exploited by a diseased person to cure disease as well as a healthy human being to maintain health

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