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Asparagus racemosus (Shatawari), phytoconstituents and medicinal importance, future source of economy by cultivation in Uttrakhand: A review

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Abstract
Aromatic and medicinal plants have played key roles in the lives of tribal peoples living in the Himalaya by providing products for both food and medicine. *Asparagus racemosus* (Asparagaceae) is an important medicinal plant of tropical and subtropical India. Its medicinal usage has been reported in the Indian and British Pharmacopoeias and in traditional systems of medicine such as Ayurveda, Unani and Siddha. *Asparagus racemosus* has been described to use as antioxidant, immune stimulant, anti-dyspepsia and anti-tussive effects. It is also useful in treatment of epilepsy, kidney disorders, chronic fevers, excessive heat, stomach ulcers and liver cancer, increases milk secretion in nursing mothers and regulates sexual behaviors. The major active constituents of *Asparagus racemosus* are steroid saponins. Isoflavones, asparagamine, racemosol, polysaccharides, mucilage, vitamins A, B1, B2, C, E, Mg, P, Ca, Fe, and folic acid present in roots. Other primary chemical constituents of *Asparagus* are essential oils, asparagine, arginine, tyrosine, flavonoids (kaempferol, quercetin, and rutin), resin, and tannin. It is a well known Ayurvedic rasayana which prevent ageing, increase longevity, impart immunity, improve mental function, vigor and add vitality to the body. It is also used in nervous disorders, dyspepsia, tumors, inflammation, neuropathy and hepatopathy.

Keywords: *Asparagus racemosus*, medicinal plant, antioxidant, Ayurveda

1. Introduction

India in general and Himalayan region in particular is known for its biological richness and has always been a botanist's paradise. Uttarakhand state encompasses an area of 53,485 sq. Km., which accounts for nearly 15.5 per cent of the total geographical area of Western Himalayas. Most of the northern parts of the state are covered by the high Himalayan ranges and glaciers, while the lower reaches are densely forested. Presently, 95% raw materials required by pharmaceuticals and drug manufactures are collected from the wild and remote areas [1]. The pharmaceutical sector is using 280 medicinal plant species, out of which 175 are from the Indian Himalayan Region [2]. This region supports approximately 1748 plant species of known medicinal value [3]. The health care system of 80% population of the developing world is still dependent on their surrounding vegetation/ forests and pastures. They rely on medicinal plants because of their effectiveness, lack of modern healthcare alternatives and cultural preferences [4].

The Indian Himalayan Region (IHR) is also the habitat of major tribal communities like Bhotias, Boaxas, Tharus, Rajis, Jaunsaries, Shaukas, Kharvar and Mahigiri. From ancient period these communities mainly rely heavily and directly on the endemic vegetation for their daily needs such as food, fodder and medicines for their illness and various types of ailments. Lack of alternate income sources; push them to over-exploit natural resources of the region. No sustainable collection methods cause threat from harvesting and many valuable medicinal herbs are becoming rare due to their continuous utilization [5]. The genus *Asparagus* includes about 300 species around the world and, is common at low altitudes in shade and in tropical climates throughout India, Asia, Australia and Africa [6]. In Indian system of medicine *A. racemosus* is an important medicinal plant and its root paste or root juice has been used in various ailments and as health tonic [7, 8]. *A. racemosus* is used for prevent ageing, increase longevity, impart immunity, improve mental function, nervous disorders, dyspepsia, tumors, inflammation, neuropathy and hepatopathy [9]. Literature review showed that root extract of *A. racemosus* has antiulcer activity [10], antioxidant, anti-diarrhoeal, anti-diabetic and immune-modulatory activities [11]. A study of ancient classical Ayurvedic literature claimed several therapeutic attributes for the root of *A. racemosus* and has been specially recommended in

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cases of threatened abortion and as a galactagogue. Root of *A. racemosus* has been referred as bitter-sweet, emollient, cooling, nervine tonic, constipating, galactagogue, aphrodisiac, diuretic, rejuvenating, carminative, stomachic, antiseptic and as a tonic [12]. The plant is also known as Shatavari and is a part of most of the Ayurvedic rasayana preparation including Chyawanprash, an outstanding adaptogenic preparation [13-15]. Shatavari (*Asparagus racemosus*) is a climbing plant which grows in low forest areas throughout India. The name "Shatavari" translates to "a woman who possesses 100 husbands", referring to the Shatavari rejuvenation effect in female reproductive organs. Shatavari has been mentioned in Ayurvedic Shatavari is known for its phytoestrogenic properties and is extensively used in combating menopausal symptoms and increasing lactation [16-17].

2. Taxonomy: *A. racemosus* is plant with a woody stem and has needle like leaves with small white flowers [18]. Tuberous roots 30-100cm thick leaves reduced to minute chaffy scales & spines [19]. The plant is a climber growing to 1-2m in length found all over India [20].

3. Cultivation

3.1 Climate and Soil: Shatavari is native to the Indian subcontinent and can be found growing in surprisingly diverse environments from the humid tropical jungles of Sri Lanka to the foothills of the Himalayas. The plant is a climber; its thin branches and feathery leaves can often be found bursting out of shrubs and trees that it uses to support its growth and search for light. Although it is happy growing in humid jungles, shatavari can also thrive in extremely arid conditions. Its capacity to capture and store moisture in dry soils is reflected in its potential for replenishing fluids in the human body and bringing balance to a stressed system. In Uttrakhand climate wise divided in tropical, subtropical and hot climate, and it was find suitable by scientist's to grow in all. Usually this plant prefers to grow in light, medium and heavy soils. But black well drained and fertile soil is good for cultivation and temperature required 25-40 °C [21, 22].

3.2 Harvest: Month of May and June is suitable for plantations. Generally Shatavari crop does not affect with pest and diseases. Once harvesting 1.5-2 years after transplanting, this continues for 10-15 years [21, 22].

4. Chemical constituents

Asparagus racemosus is phytoestrogens rich plant species. Phytoestrogens are defined by the British working group on

phytoestrogens of the committee of toxicity of chemicals in food, consumer products and the environment of the food standards agency (FSA, 2003) as any plant substance or metabolite that induces biological responses in vertebrates and can mimic or modulate the actions of endogenous oestrogens usually binding to oestrogen receptors. The majority of phytoestrogens belong to a large group of substituted phenolic compounds known as flavonoids. Three classes of flavonoid, the isoflavones, coumestans and prenylated flavonoids are phytoestrogens that possess the most potent oestrogenic activity. The phytoestrogen classes mentioned above have a similar structure to oestradiol and are able to bind the estrogen receptor, preferably the ER although their binding affinity is lower than that of endogenous estradiol. All the structures of the phytoestrogens possess the phenolic (bottom, left) and hydroxyl (top, right) moieties of the oestradiol structure and the distances between the two groups in each compound are similar [23]. Previous studies and literature survey revealed that the major bioactive constituents of *Asparagus* are a group of steroid saponins. This plant also contains vitamins A, B₁, B₂, C, E, Mg, P, Ca, Fe, and folic acid. Other primary chemical constituents of *Asparagus* are essential oils, asparagine, arginine, tyrosine, flavonoids (kaempferol, quercetin, and rutin), resin, and tanninsteroidal glycosides (asparagosides), bitter glycosides, asparagines and flavonoids. Asparagine is a strong diuretic. In addition to these, contain diosgenin and other saponins such as shatavarins I and IV reported by Ravi Kumar *et al.*, in leaves and roots from *A. racemosus* [24] also Shatavarin V and Shatavarin VI-X were reported in roots of *A. racemosus* by Hayes *et al.* [25-26]. Racemofuran, (α, α-diphenyl-β-picrylhydrazyl) was reported from roots *A. racemosus* by Wiboonpun *et al.* [27]. Sekine *et al* also reported racemosol and asparagamine from roots of *A. racemosus* [28, 29]. Racemoside A, B, C steroid saponin was isolated from fruits by Mandal *et al.*, [30]. 8-methoxy-5, 6, 4'-trihydroxyisoflavone 7-o-β-D-glucopyranoside was reported from roots [31]. Quercitin, rutin, hyperoside flavonoids flower and fruits [32]. Sitosterol 4,6-dihydroxy-2-O(2-hydroxy benzaldehyde was isolated from roots by Singh [33]. Kaepfrol and sarsapogenin saponin was isolated from roots [34].

5. Biological activities: *Asparagus racemosus* (Shatavari) is used by ayurvedic doctors for the prevention and treatment of gastric ulcers, dyspepsia, galactogogue, nervous disorders, inflammation, liver diseases and many other purposes which are described in following table.

Biological activity of *A. racemosus* (Shatavari)

Bio-activity of <i>A. racemosus</i>	Procedure of action	References
Dyspepsia properties	Dried root powdered of <i>A. racemosus</i> The juice of fresh root of <i>A. racemosus</i>	[35-36]
Galactogogue properties	Root extract of <i>A. racemosus' Ricalex'</i> tablets (Aphali pharmaceutical Ltd. Ahmednagar) lactare (TTK Pharma, Chennai)	[37-38]
Antihepatotoxic potential	Alcoholic extract of root of <i>A. racemosus</i>	[39]
Uterus properties	Ethyl acetate Acetone extracts of the root of <i>A. racemosus</i>	[40]
antihepatotoxic potential	Alcoholic extract of root of <i>A. racemosus</i>	[39]
Cardiovascular activity	Alcoholic extract of the root of <i>A. racemosus</i>	[41]
Respiratory action	Higher doses of the alcoholic extract of root of <i>A. racemosus</i>	[41]
Immunomodulant activity	Polysaccharide fraction of <i>A. racemosus</i> is used	[42]
Antidepressant activity	Methanolic extract of roots of plant is used as	[43]
Adaptogen activity	<i>A. racemosus</i> extract has been found to have excellent adaptogenic properties	[44]
Anticarcinogen activity	Steroidal saponins of <i>A. racemosus</i> for apoptosis inducing study	[45]
In Neural Disorders activity	Investigated the potential of extract of <i>A. racemosus</i> against Kainic Acid (KA) - induced hippocampal and striatal neuronal damage	[46]

6. Discussion and conclusion

Asparagus racemosus is an important medicinal plant of Indian flora. As in this review we have seen that the plant is used for many purposes and show many biological activities in Ayurveda. Presently it is used in many ayurvedic medicines and as syrup especially for women as a tonic. Numerous applications of this plant in various formulations have raised the demand of the plant leading to its overexploitation. Due to this, alternative strategies for propagation and conservation are urgently required to prevent the species being threatened. This plant is suitable for growing in all over the climacteric conditions in Uttrakhand and will become as a source for earning money and providing employment of many young peoples. This review is prepared with the help of literature survey and some previously published articles [47-50].

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