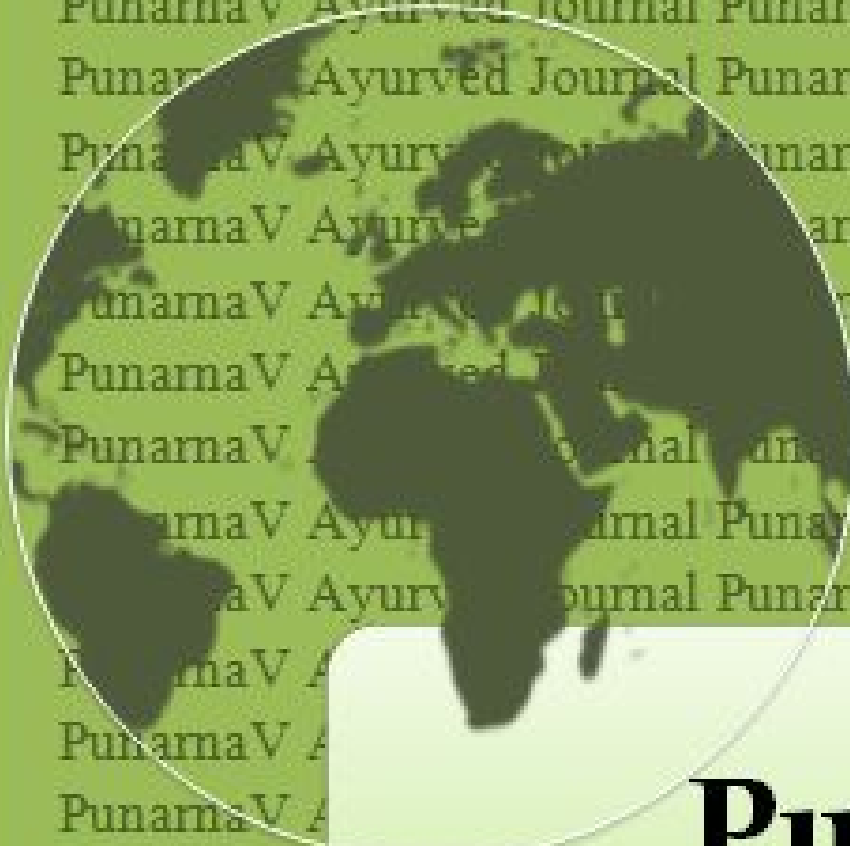


**MONTH: MAR: APR -2016**

**VOLUME: 4, ISSUE: 2**

**ISSN: 2348-1846**



# **Punarna V**

**TITLE**

**SCIENTIFIC BASIS FOR THE MEDICINAL USES OF ASPARAGUS RACEMOSUS  
(SHATAVARI): A REVIEW ARTICLE**

**SANTOSH KUMAR MITTAL<sup>1</sup>, NISHI JAIN<sup>2</sup>**

**AN INTERNATIONAL PEER REVIEWED AYURVED JOURNAL  
ON LINE BI-MONTHLY AYURVED JOURNAL**

**[www.punarnav.com](http://www.punarnav.com)**

**Email: [explore@punarnav.com](mailto:explore@punarnav.com), [punarnav.ayu@gmail.com](mailto:punarnav.ayu@gmail.com)**



## SCIENTIFIC BASIS FOR THE MEDICINAL USES OF ASPARAGUS RACEMOSUS (SHATAVARI): A REVIEW ARTICLE

SANTOSH KUMAR MITTAL 1, NISHI JAIN 2

<sup>1</sup> P. G. SCHOLARS, <sup>2</sup> Ph.D SCHOLAR DEPARTMENT OF SHARIR RACHANA, NATIONAL INSTITUTE OF AYURVEDA, JAIPUR, RAJASTHAN, INDIA.

### ABSTRACT:

*Asparagus racemosus (Shatavari) has been widely used in folk medicine and is today a highly commercially important target species. It is known as "hundred husbands" and "Queen of Herbs". Attention is being paid to research on the properties of it. It is known for its phytoestrogenic properties and used as a hormone modulator. A. racemosus are used in the treatment of diseases like nervous disorders, dyspepsia, diarrhoea, dysentery, tumors, inflammations, tuberculosis, epilepsy and fatigue and certain infectious diseases due to its antioxidant, adaptogenic, anti-stress, antiulcer, antidiarrhoeal, antibacterial, antitussive properties. The chemicals constituents present in it used for formulation and its future prospects for scientific evaluation are also discussed. Present article includes detailed exploration of pharmacological properties of A.racemosus.*

**KEYWORDS:** *Asparagus racemosus, hormone modulator, pharmacological and phytoestrogenic properties.*

## INTRODUCTION

**CORRESPONDENT:**  
**DR. SANTOSH KUMAR MITTAL**  
**MD SCHOLAR**  
**DEPARTMENT OF**  
**SHARIR RACHANA,**  
**NATIONAL INSTITUTE OF**  
**AYURVEDA, JAIPUR,**  
**RAJASTHAN, INDIA**

*Asparagus racemosus* (*Shatavari*) has been widely used in folk medicine and is today a highly commercially important target species. *Shatavari* (*A. racemosus*) is known as "hundred husbands" in Sanskrit for its beneficial effects in women and reproductive function. *Shatavari* may be translated as "100 spouses", implying its ability to increase fertility and vitality and "Queen of Herbs" because it promotes love and devotion. It is the main rejuvenative tonic for the female. *Charak* and *Ashtang* list it as part of the formulas to treat disorders affecting women's health<sup>1</sup>. Further, it is mentioned as *medhya*<sup>2</sup>, *rasayana*<sup>3</sup>, *balya*, *stanya*<sup>4</sup>, analgesic, *hridya*, *raktpitt shamak*, hypotensive, *sukrala*, diuretic, *chaksusya*, *jeevaniya*, emollient, galactagogue, nervine tonic, rejuvenating and stomachic properties<sup>5</sup> they are useful in treatment of

diseases like nervous disorders, dyspepsia, diarrhoea, dysentery, tumours, inflammations, tuberculosis, epilepsy and fatigue and certain infectious diseases<sup>6,7</sup>. Pharmacological studies with animals have documented the following properties of *A. racemosus* extract: antioxidant<sup>8,9</sup>, adaptogenic<sup>10,11</sup>, anti-stress<sup>12,13</sup>, antiulcer<sup>14,15</sup>, antidiarrhoeal<sup>16</sup>, antibacterial, antitussive and its use as a substrate for inulinase production<sup>17</sup>

*Rasa: madhur, tikta*

*Guna: guru, snigdha*

*Virya: seet*

*Vipaka: madhur*<sup>18</sup>

## SCIENTIFIC CLASSIFICATION<sup>19</sup>

<b>Kingdom</b>	Plantae
<b>Division</b>	Angiosperms
<b>Class</b>	Monocots
<b>Order</b>	Asparagales
<b>Family</b>	Asparagaceae
<b>Genus</b>	Asparagus
<b>Species</b>	Asparagus racemosus

## SYNONYMS

### VERNACULAR NAME<sup>20</sup>

Willd asparagus, *Satavar*, *Shatamuli*, *Ekalkanto*, *Satavari*, *Callagadda*, *Satavali*, *Narbodh*, *Satmooli*, *Satawar*, *Chhotaru*, *Mohajolo*, *Satavari*, *Callagad*. *Shatapadi*, *pivari*, *indivari*, *vari*, *bhiru*, *dipya*, *dvipishatru*, *amarkantika*, *sukshampatra*, *narayani*, *laghuparnika*, *vishwakhya*, *tejvalli*, *variya* etc.

**Plant parts used** Tuberous Roots, Leaves, flowers and fruits.<sup>21</sup>

### DESCRIPTION CHARACTERISTICS AND MORPHOLOGY<sup>22</sup>

*A. racemosus* is a medicinal plant native to tropical and subtropical India. Its medicinal use has been reported in the British and Indian pharmacopoeias as well as in the traditional Indian systems of medicine. The plant occurs on the piedmont plains up to 1300-1500 meters and in the forests. It prefers gravely and rocky soils. Its climber's reach from 1 to 3 m in height. Green, glossy leaves of *A. racemosus* are reminiscent of pine needles. The plant also has a root system characteristic for genus *Asparagus*. The rhizome with roots is an appropriate therapeutic material. Roots are cylindrical, fleshy tuberous straight or slightly curved, tapering towards the base & swollen in the middle; white buff colour, 5-15 cm in length 1-2 cm diameter<sup>23</sup>. Transverse section of the root is circular or elliptical; periderm is composed of 5-6 layers of compact cells, tangentially elongated thin walled phellem.<sup>24</sup>

### PHYTOCHEMICALS

*Shatavari* having more than 50 organic chemical compounds of different groups such as steroidal saponins, glycosides, alkaloids, polysaccharides, mucilage,

*racemosol* and *isoflavones* that possess wide range of medicinal properties (Thomsen, 2002).

Due to the type and number of rings comprising the aglycone, saponins are divided into: steroidal saponins with steroidal grouping as sapogenin and triterpenoid saponins having triterpen aglycone. In this subgroup there are only monodesmosides. Aglycone rarely has pentacyclic furastanol conformation. In addition to monodesmosides, bi- and tridesmosides may also occur in this subgroup<sup>25</sup>. Studies conducted by Hayes<sup>26</sup> on the roots of *A. racemosus* led to the isolation of ten saponins, five new and five already known ones. Due to structural similarities, they are divided into four types (I-IV). Asmari et al.<sup>27</sup> reported the presence of sarsasapogenin in natural plants of *A. racemosus* as well as in in vitro cultures. Other active compounds, such as quercetin, rutin (2.5% of dry basis) and hyperoside are isolated in the flowers and fruits of *A. racemosus*, while the presence of diosgenin and quercetin-3 glucuronide are found in the leaves of this plant<sup>28</sup>. Seeds of *A. racemosus* contain trace amounts of phytoecdysteroids<sup>29</sup>.

## FORMULATIONS AND PREPARATIONS

The drug *Shatavari* is used in nearly 67 Ayurvedic preparations like *Eranda paka*, *Puga khanda*, *Bhrilhachagaladya ghritha*, *Phalaghrita*, *Anuthaila*, *Brahma rasayana*, *Garbhachintamani rasa*, *Dhanwanthararishta*, *Mahathikthaka kashaya*, *Narayana thaila*, *Rasnadi*

*kashaya*, *Sahacharadi thaila*, *Saraswatharishta*, *Shatavari panaka*, *Shatavari ghritha*, *Shatamulyadi lehya*, *Vasishtha rasayana* and *Vidaryadi ghritha*.<sup>30</sup>

## PHARMACOLOGICAL ACTIVITY

### Adaptogenic properties

*A. racemosus* belongs to the 'rasayana' herbs i.e. medicinal plants improving general well-being by increasing viability and cellular immunity. The definition by Israel Brekham characterizes adaptogens as agents increasing resistance to hypoxia (low oxygen), supporting cardio-vascular system, eliminating fatigue, adjusting functions of the nervous system and a number of others. Adaptogens correct stress disorders caused by different medium by activating the body's defense system, the effect on the hypothalamic-pituitary axis and also on the adrenergic system. Rege et al.<sup>31</sup> administered orally the aqueous, standardized extract of *A. racemosus* to experimental animals and then exposed them to various biological, physical and chemical stimuli that cause stress. The results of this experiment found that the extract reversed some of side

effects of cisplatin such as gastric emptying and intestinal hypermotility.

### Cardioprotective Action

The increased concentration of serum lipids, especially cholesterol and the formation of reactive oxygen species are main causes for the development of coronary artery disease and atherosclerosis. Herbo-mineral formulation 'Abana' containing 10 mg of *A. racemosus* extract in each tablet showed a significant hypocholesterolaemic effect in rats, and thus has the potential of use in the cardiopreventive treatment<sup>32</sup>. The effect of *A. racemosus* on the lowering of cholesterol in hypercholesterolemia in rats was also studied by Visavadiya and Narasimhacharya<sup>33</sup>.

### Immunological activity

The immunoadjuvant potential of *A. racemosus* has been studied on

experimental animals immunized with diphtheria, tetanus and pertussis vaccine (DTP). A significant increase ( $p=0.005$ ) in antibody titers to *Bordetella pertussis* in animals has been shown when a daily aqueous root extract of *A. racemosus* was administered compared with animals which were not provided with this extract.<sup>34</sup> In another study, extracts and formulations prepared from *A. racemosus* showed immunopharmacological actions in cyclophosphamide (CP)-treated mouse ascetic sarcoma<sup>35</sup>. The supporting resistance action of *A. racemosus* has been repeatedly investigated<sup>36</sup>.

#### **Antibacterial properties**

The in vitro study<sup>37</sup> shows a very high antibacterial efficacy of methanol extracts of *A. racemosus* against *Escherichia coli*, *Shigella dysenteriae*, *Shigella sonnei*, *Shigella flexneri*, *Vibrio cholerae*, *Salmonella typhi*, *Salmonella typhimurium*, *Pseudomonas putida*, *Bacillus subtilis* and *Staphylococcus aureus*.

#### **Antineoplastic activity**

Chloroform/methanol (1:1) extract of fresh root of *A. racemosus* has been reported to reduce the tumor incidence in female rats treated with DMBA (7,12 dimethyl benz (a) anthracene).<sup>38</sup> This action is suggested to be mediated by virtue of mammatropic and/or lactogenic influence of *A.*

*racemosus* on normal as well as estrogen-primed animals, which renders the mammary epithelium refractory to the carcinogen.<sup>39</sup>

#### **Effect on respiratory system**

Higher doses of the alcoholic extract of root of *A. racemosus* are reported to cause dilatory effect on bronchial musculature of guineapigs but failed to antagonise the histamine induced bronchoconstriction. The extract has also been reported to produce depression of respiration in cat.<sup>40</sup>

#### **Effect on CNS**

Neither stimulant nor depressant action of lactare on central nervous system has been reported in albino mice.<sup>41</sup> *Shatavari* did not produce catalepsy in experimental rats even with massive oral doses suggesting that its action may be outside the blood brain barrier, similar to that of metoclopramide.<sup>42</sup>

#### **Antihepatotoxic activity**

Alcoholic extract of root of *A. racemosus* has been shown to significantly reduce the enhanced levels of alanine transaminase, aspartate transaminase and alkaline phosphatase in CC14-induced hepatic damage in rats,<sup>43</sup> indicating antihepatotoxic potential of *A. racemosus*.

#### **Gynaecological disorders**

It has been indicated as uterine tonic, thus it cleanses, nourishes, and strengthens the

female reproductive system and so is traditionally used for PMS and sexual debility (Frawley, 1989), Ammenorrhoea, Dysmenorrhoea, Dysfunctional Uterine Bleeding (Swarup and Umadevi, 1998; Chopra and Simon, 2000), menopause and pelvic inflammatory disease like endometriosis (Hemprabha et al. 2001; Prasad et al. 2002) and gonorrhoea (Thomsen, 2002).

### Effects on uterus

In spite of cholinergic activity of *A. racemosus* on guinea pig's ileum, ethyl acetate and acetone extracts of the root of *A. Racemosus* blocked spontaneous motility of the virgin rat's uterus.<sup>44</sup> It indicates the presence of some particular substance in the alcoholic extract which specifically blocks pitocin sensitive receptors though not other receptors in the uterus,<sup>44</sup> confirming that *Shatavari* can be used as uterine sedative. Further, a glycoside, Shatavarin I, isolated from the root of *A. racemosus* has been found to be responsible for the competitive block of oxytocin-induced contraction of rat, guinea pig and rabbit's uteri, in vitro as well as in vivo.<sup>45</sup>

This phytoestrogenic activity is due to the presence of steroidal saponins which exert hormone like actions in the body, and also due to the isoflavones which have mild

estrogenic activity that help to balance the estrogen levels.<sup>46</sup>

Ethyl acetate and acetone extracts of roots of *A. racemosus* block spontaneous motility of the virgin rat's uterus. These can also inhibit the spasmogenic effect of Ach, barium chloride and serotonin on the uterus,<sup>47</sup> The effectiveness in PMS is considered due to immunomodulator activity which boosts the immune status and imparts a feeling of well being<sup>48</sup>.

Saponin glycoside A4 produces specific and competitive blockade of pitocin induced contraction and spontaneous motility<sup>49</sup>.

It has been demonstrated that the AR containing preparations stimulate haemopoietic function and increase weight of accessory sex glands<sup>50</sup>. The plant is also beneficial in female infertility, as it enhances folliculogenesis and ovulation, prepares the womb for conception, and prevents miscarriages<sup>51</sup>. This study indicates that the phytoestrogen performs its function by binding directly to the estrogen receptor without enhancing the endogenous estrogen levels<sup>52</sup>

*Shatavari* may be very helpful with women who have stress related or immune-mediated fertility issues. Autoimmune fertility issues may be helped by proper immunological function supported by *Shatavari*.

*A. racemosus* being known source of phytoestrogens can be effective in reducing adverse menopausal symptoms (The chemical entities from plants which mimic hormones are called phytoestrogens). These are weaker than natural estrogens in action<sup>53</sup>. However they compete with estrogen for estrogen receptors. In the presence of excess of estrogens in the body phytoestrogens may have antiestrogenic effect by occupying some estrogen receptor<sup>54</sup>. Various formulas containing *A. racemosus* have shown their effectiveness in alleviating the symptoms in and postmenopausal period and in hysterectomised patients<sup>55</sup>.

The preparations based on *A. racemosus* roots (eg. *Shatavari sidh ghrit*) are recommended in cases of threatened abortions. This activity is due to Shatavarin-I<sup>56</sup> which blocks even oxytocin induced contractions in rat, guinea pig and rabbit uteri in vivo and in situ in a dose dependent manner. Its *rasayana* as well as antioxidant activity helps in modulating various immune processes and also prevents lipid peroxides at the placental level<sup>57</sup>. The polycyclic alkaloid asparagamine A is also reported to have an antioxytotic action, showing an antiabortifacient affect.

*Shatavari* possesses *Jeevaniya* (Erythropoetic) *Balya* (strength promotens), *Medhya* (Promoters of mental abilities) and *Rasayana* (agents for antiaging) and is one of the ingredients of modern formulations which are advocated for the pregnant women in programming a super baby. The incidence of pregnancy induced hypertension (PIH) is also decreased<sup>58</sup> PGI . 2 and NO are important vasodilators, *Rasayana* activity helps in modulating various immune processes at placental level. Anti ADH activity also helps in maintaining blood pressure and decreasing oedema of pregnancy by causing diuresis<sup>59</sup>.

*A. racemosus* also works as stimulant of Endometrium and Ovarian Tissues, regulating menstruation and ovulation, balance hormonal level (TSH, ESTROGEN, FSH, LH) and improved the Conception rate (64%vs28%) in women (Kumar et al. 2001). The alcoholic extract of *A. racemosus* did not show any anti fertility effect and all treated animals delivered normal litter in rat (Roy et al. 1971).

### Other properties

Saponins are an important class of secondary metabolites whose cytotoxic activity is tested against various cancerous cell lines. Apoptosis is the desired



endpoint of cancer therapy. The extracts from *A. racemosus* showed strong antioxidant effects in vitro against membrane damage induced by free radicals produced by gamma radiation in rat liver mitochondria<sup>60</sup>. *A. racemosus* is also used to treat dyspepsia, diarrhoea, neurodegenerative diseases and cough. The anti-diarrheal activity of *A. racemosus* extract is attributed to its ability to inhibit the prostaglandin biosynthesis which in turn results in the reduction of gastrointestinal motility and secretion<sup>61</sup>. The aqueous and ethanol extracts of *A.*

*racemosus* showed similar activity to loperamide. In an isolated study, methanol extracts of *A. racemosus* showed significant antitussive activity on a sulphur dioxide induced cough in mice<sup>62</sup>. Numerous studies carried out for further use of *A. racemosus* extracts in the treatment of neurodegenerative diseases such as Alzheimer's and Parkinson's diseases, in which excitotoxicity and oxidative stress are the major mechanisms of neuronal cell death, confirmed their antioxidant properties and ability to scavenge free radicals.<sup>63</sup>

### CONCLUSION

*A. racemosus* has been practiced for thousands of years with great success. Uses of *A. racemosus* are already well documented and support its therapeutic use as a multi-purpose medicinal agent. Utilization of this drug will not only promote reproductive health but also the general health of individual. Further research is imperative to probe into the

actual mode of action responsible for the medicinal effect because plant contain mixture of various phytochemical components and the effect of phytoestrogens as opposed to human estrogens is the further scope of research for this drug.

### REFERENCES

1. Sharma RK, Dash B. Charaka Samhita – Text with English Translation and Critical Exposition Based on Chakrapani Datta's Ayurveda Dipika. Chowkhamba; Varanasi, India; 2003. Garde GK. Sarth Vagbhat (Marathia Translation of Vagbhat's Astangahrdaya). Uttarstana, Aryabhushana Mudranalaya, pp.40-48; 1970.
2. Sharma PV. Sodashanghrdayam-Essential of Ayurveda. Motilal Banarsidass Publishers Private Limited; Delhi; 1993. 9.

3. Puri HS. 'Rasayana'- Ayurvedic herbs for longevity and rejuvenation. Taylor and Francis, London; 2003.
4. Gogte VM. Ayurvedic Pharmacology and Therapeutic uses of Medicinal Plants – Dravyagunavignyan. SPARC, Mumbai; 2000.
5. Goyal RK, Singh J, Lal H. Asparagus racemosus – an update. Indian J Med Sci 2003; 57:408-14.
6. Anupama K Sachan et al. Asparagus rasemosus: An overview. International journal of pharmaceutical and chemical sciences. ISSN: 2277-5005 Vol. 1 (3) Jul-Sep 2012. Pg 591.
7. Kamat JP, Bloor KK, Devasagayam TPA, Venkatachalam SR. Antioxidant properties of Asparagus racemosus against damage induced by  $\gamma$ -radiation in rat liver mitochondria. J Ethnopharmacol 2000; 71:425-35.
8. Bhattacharya SK, Bhattacharya A, Chakrabarti A. Adaptogenic activity of Siotone, a polyherbal formulation of Ayurvedic rasayanas. Indian J Experim Biol 2004; 38:119-28.
9. Rege NN, Thatte UM, Dahanukar SA. Adaptogenic properties of six rasayana herbs used in Ayurvedic medicine. Phytother Res 1999; 13:275-91.
10. Bhattacharya A, Murugandam AV, Kumar V, Bhattacharya SK. Effect of polyherbal formulation, EuMil, on nerochemical perturbations induced by chronic stress. Indian J Experim Biol 2002; 40:1161-3.
11. Murugandam AV, Kumar V, Bhattacharya SK. Effect of poly herbal formulation, EuMil, on chronic stress-induced homeostatic perturbations in rats. Indian Journal of Experimental Biology 2002; 40: 1151-60.
12. Anupama K Sachan et al. Asparagus rasemosus: An overview. International journal of pharmaceutical and chemical sciences. ISSN: 2277-5005 Vol. 1 (3) Jul-Sep 2012. Pg 591.
13. Datta GK, Sairam K, Priyambada S, Debnath PK, Goel RK. Antiulcerogenic activity of Satavari mandur – an ayurvedic herbo-mineral preparation. Indian Journal of Experimental Biology 2002; 40: 1173-77.
14. Anupama K Sachan et al. Asparagus rasemosus: An overview. International journal of pharmaceutical and chemical sciences. ISSN: 2277-5005 Vol. 1 (3) Jul-Sep 2012. Pg 591.
15. Singh RS, Rejesh Dhaliwal, Munish Puni. Production of inulinase from Kluyveromyces marxianus YS-1 using root extract of Asparagus racemosus. Process Biochemistry 2006; 41:1703-7.
16. Anupama K Sachan et al. Asparagus rasemosus: An overview. International journal of pharmaceutical and

- chemical sciences. ISSN: 2277-5005  
Vol. 1 (3) Jul-Sep 2012. Pg 591.
17. Anupama K Sachan et al. Asparagus racemosus: An overview. International journal of pharmaceutical and chemical sciences. ISSN: 2277-5005  
Vol. 1 (3) Jul-Sep 2012. Pg 591.
18. Anupama K Sachan et al. Asparagus racemosus: An overview. International journal of pharmaceutical and chemical sciences. ISSN: 2277-5005  
Vol. 1 (3) Jul-Sep 2012. Pg 591.
19. Magdalena. Pharmacological and therapeutic application of Asparagus racemosus Willd. Vol. 56 No. 2 2010.
20. Anupama K Sachan et al. Asparagus racemosus: An overview. International journal of pharmaceutical and chemical sciences. ISSN: 2277-5005  
Vol. 1 (3) Jul-Sep 2012. Pg 591.
21. Anupama K Sachan et al. Asparagus racemosus: An overview. International journal of pharmaceutical and chemical sciences. ISSN: 2277-5005  
Vol. 1 (3) Jul-Sep 2012. Pg 591.
22. Kohlmünzer S. Farmakognozja. Podręcznik dla studentów farmacji. Warszawa 1993:324-52.
23. Hayes PY, Jahidin AH, Lehmann R, Penman K, Kitching W, De Voss JJ. Steroidal saponins from the roots of Asparagus racemosus. Phytochemistry 2008; 69: 796-804.
24. Asmari S, Zafar R, Ahmad S. Production of sarsasapogenin from tissue culture of Asparagus racemosus and its quantification by HPTLC. Iranian J Pharmac Res, (Suppl. 2) 2004:66-7.
25. Thomsen M. Shatavari- Asparagus racemosus. 2002.  
<http://www.phytomedicine.com.au/files/articles/shatavari.pdf>
26. Dinan L, Savchenko T, Whiting P. Phytoecdysteroids in the genus Asparagus (Asparagaceae). Phytochemistry 2001, 56:569-76.
27. Sharma et al. 2000
28. Rege NN, Thatte UM, Dahanukar SA. Adaptogenic properties of six rasayana herbs used in Ayurvedic medicine. Phytother Res 1999; 13:275-91.
29. Khanna AK., Chander R, Kapoor NK. Hypolipidaemic activity of Abana in rats. Fitoterapia 1991; 62: 271-75.
30. Visavadiya NP, Narasimhacharya RL. Hypolipidemic and antioxidant activities in Asparagus racemosus in hypercholesteremic rats. Indian Journal of Pharmacology 2005; 37: 376-80.
31. Gautam M, Diwanay S, Gairola S, Shinde Y, Patki P, Patwardhan B. Immunoadjuvant potential of Asparagus racemosus aqueous extract in experimental system. Journal of Ethnopharmacology 2004; 91: 251-55.

## MEDICINAL USES OF ASPARAGUS RACEMOSUS (SHATAVARI)

32. Diwanay S, Chitre D, Patwardhan B. Immunoprotection by botanical drugs in cancer chemotherapy. *J Ethnopharmacol* 2004; 90:49-55.
33. Dhuley JN. Effect of some Indian herbs on macrophage functions in ochratoxin A treated mice. *Journal of Ethnopharmacology* 1997; 58: 15-20.
34. Mandal SC, Nandy A, Pal M, Saha BP. Evaluation of antibacterial activity of *Asparagus racemosus* Willd. root. *Phytother Res* 2000b; 14:118-19.
35. Sabins PB, Gaitonde BB, Jetmalani M. Effect of alcoholic extract of *Asparagus racemosus* on mammary glands of rats. *Indian J Exp Biol* 1968;6:55-7.
36. Rao AR. Inhibitory action of *Asparagus racemosus* on DMBA-induced mammary carcinogenesis in rats. *Int J Cancer* 1981;28:607-10.
37. Roy RN, Bhagwager S, Chavan SR, Dutta NK. Preliminary pharmacological studies on extracts of Root of *Asparagus racemosus* (Satavari), Willd, N.O. Liliaceae. *J Res Ind Med* 1971;6:132-8.
38. Narendranath KA, Mahalingam S, Anuradha V, Rao IS. Effect of herbal galactagogue (Lactare) a pharmacological and clinical observation. *Med Surg* 1986;26:19-22.
39. Dalvi SS, Nadkarni PM, Gupta KC. Effect of *Asparagus racemosus* (Shatavari) on gastric emptying time in normal healthy volunteers. *J Postgrad Med* 1990;36:91-4.
40. Muruganadan S, Garg H, Lal J, Chandra S, Kumar D. Studies on the immunostimulant and antihepatotoxic activities of *Asparagus racemosus* root extract. *J Med Arom PI Sci* 2000;22:49-52.
41. Jetmalani MH, Sabins PB, Gaitonde BB. A study on the pharmacology of various extracts of Shatavari- *Asparagus racemosus* (Willd). *J Res Ind Med* 1967;2:1-10.
42. Joshi J, Dev S. Chemistry of Ayurvedic crude drugs: Part VIIa-Shatavari-2: Structure elucidation of bioactive Shatavarin-I & other glycosides b,c. *Indian J Chem* 1988;27B:12-6.
43. Kalia V, Jadav AN, Bhuttani KK. In vivo effect of *Asparagus racemosus* on serum gonadotrophin levels in immature female wistar rats. 2<sup>nd</sup> world congress of Biotech. Dev. of Herbal Med. NBRI, Lukhnow, pp. 40. 2003.
44. Jetmalani MH, Sabins PB, Gaitonde BB. A study on the pharmacology of various extracts of Shatavari- *Asparagus racemosus* (Willd). *J Res Ind Med* 1967; 2:1-10.
45. Mitra SK, Sunitha A, Kumar VV, Pooranesan R, Vijaylakshmi M. U-3107 (EveCare) as a uterine tonic – Pilot Study. *The Ind. Pract.* 1998; 51: 4, 269-274.

46. Jetmalani MH, Sabins PB, Gaitonde BB. A study on the pharmacology of various extracts of Shatavari-Asparagus racemosus (Willd). J Res Ind Med 1967; 2:1-10.
47. Samanta SK. Modulation of male infertility by Ayurvedic drugs. International Seminar on Traditional Medicine, Calcutta. 1992.
48. Naik BJ. Management of pre-eclampsia by Ayurvedic drugs. Journal of National Integrated Medical Association 1988; 30(7): 7-12.
49. Gopumadhavan S, Venkataranganna MV, Rafiq M, Madhumathi BG, Mitra SK. Evaluation of the estrogenic effect of Menosan using the rat models of uterotrophic assay. Medicine Update 2005; 13,;37-41.
50. Molteni A, Brizio-Molteni L, Persky V. In vitro hormonal effects of soybean isoflavones. Nutr. 1995; 125(3 Suppl):751S-756S
51. Mills S, Bone K. Principles and Practice of Phytotherapy. Churchill Livingstone; London. 2001.
52. Singh SK, Kala SK. Evaluation of the efficacy and safety of Menosan in Post- menopausal symptoms: A short-term pilot study. Obs. and Gynae. Today 2002; VII 12: 727-730.
53. Khan SS, Chaghtai SA, Siddiqui MA, Khan SM. Indian medicinal plants, II: Asparagus racemosus Willd. Acta Clinica Scientia 1991; 1(2): 65-69.
54. Palep H. S. Beyond Safe Motherhood to Programing for a Super Baby - II Features Pharmacobiz; 17 april 2001.
55. Bhosale L, Padia D, Malhotra H, Thakkar D, Palep HS, Algotar KM. Capsule "Sujat" for comprehensive antenatal care and prevention of pregnancy induced hypertension. B.H. J. 2003; 42(1): 136- 140.
56. Bhosale L, Padia D, Malhotra H, Thakkar D, Palep HS, Algotar KM. Capsule "Sujat" for comprehensive antenatal care and prevention of pregnancy induced hypertension. B.H. J. 2003; 42(1): 136- 140.
57. Kamat JP, Bolor KK, Devasagayam TPA, Venkatachalam SR. Antioxidant properties of Asparagus racemosus against damage induced by  $\gamma$ -radiation in rat liver mitochondria. J Ethnopharmacol 2000; 71:425-35.
58. Venkatesan N, Thiyagarajan V, Narayanan S, Arul A, Raja S, Kumar SGV et al. Anti-diarrhoeal potential of Asparagus racemosus Willd root extracts in laboratory animals. J Pharmacol Pharmaceut Sci 2005; 8:39-45.
59. Mandal SC, Kumar CKA, Lakshmi M, Sinha S, Murugesan T, Saha BP, Pal M. Antitussive effect of Asparagus racemosus root against sulphur

## MEDICINAL USES OF ASPARAGUS RACEMOSUS (SHATAVARI)

dioxide-induced cough in mice.

Fitoterapia 2000a; 71: 686-9.

60. Parihar MS, Hemnani T. Experimental excitotoxicity provokes oxidative damage in mice brain and attenuation by extract of *Asparagus racemosus*. J Neural Transm 2004; 111:1-12.

