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PRELIMINARY AND PHYTOCHEMICAL SCREENING OF ASPARAGUS RACEMOSUS ROOT

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Abstract:
Asparagus racemosus Willd, commonly known as Shatavari, is an important medicinal plant widely used in the Ayurvedic system of medicine for its galactagogue, adaptogenic, immunomodulatory, antioxidant and anti-ulcer properties. The present study was undertaken to carry out preliminary and phytochemical screening of Asparagus racemosus root extracts using different solvents in order to identify the presence of bioactive phytoconstituents and to scientifically validate its traditional medicinal uses. The roots of Asparagus racemosus were collected, authenticated, shade dried, powdered and subjected to extraction using solvents of increasing polarity such as petroleum ether, chloroform, ethanol, methanol and distilled water. The obtained extracts were subjected to qualitative phytochemical analysis using standard procedures to detect the presence of alkaloids, flavonoids, saponins, tannins, steroids, glycosides, carbohydrates, proteins and phenolic compounds. The preliminary phytochemical screening revealed that ethanolic and methanolic extracts showed the presence of maximum number of phytoconstituents, whereas petroleum ether extract showed limited phytochemical presence. The presence of saponins, flavonoids and phenolic compounds supports the traditional use of Asparagus racemosus as a rejuvenating and adaptogenic herb. The results of the study confirm that Asparagus racemosus root is a rich source of medicinally important phytochemicals and can serve as a potential candidate for further pharmacological and phytochemical investigations.

KEYWORDS: *Asparagus racemosus, Shatavari, Galactagogue, Adaptogenic, Immunomodulatory*

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INTRODUCTION:

Medicinal plants have been used since ancient times as a primary source of healthcare across the world. According to the World Health Organization (WHO), nearly 80% of the world's population relies on traditional medicine for primary healthcare needs[1]. The growing interest in herbal medicine is mainly due to its natural origin, fewer side effects, affordability, and long history of traditional use. Phytochemicals present in medicinal plants are responsible for their therapeutic activities and form the basis for many modern pharmaceutical drugs[2].

Among various medicinal plants, *Asparagus racemosus* Willd, commonly known as Shatavari, occupies a significant position in the Ayurvedic system of medicine. The plant belongs to the family Asparagaceae and is widely distributed throughout tropical and subtropical regions of India. The roots of *Asparagus racemosus* are the most important medicinal part and have been extensively used in Ayurvedic formulations for centuries[3]. Traditionally, *Asparagus racemosus* roots are used as a galactagogue, adaptogen, immunomodulator, anti-ulcer agent, antioxidant, anti-inflammatory agent, andreproductive tonic, particularly in female health disorders[4]. In Ayurveda, Shatavari is regarded as a "Rasayana" drug, which means it promotes longevity, vitality, and resistance against diseases. The therapeutic efficacy of the plant is mainly attributed to the presence of diverse bioactive compounds[5]. Phytochemicals are naturally occurring chemical constituents present in plants that contribute to their medicinal properties[6]. These include alkaloids, flavonoids, tannins, saponins, steroids,glycosides, phenolic compounds, carbohydrates, proteins, and terpenoids. Preliminary phytochemical screening is an essential step in herbal drug research as it helps to identify the major groups of phytoconstituents present in a plant extract[7]. This initial screening provides scientific validation for traditional claims and helps in selecting suitable extracts for further pharmacological and quantitative studies[8].

Several studies have reported that *Asparagus racemosus* roots are rich in steroidal saponins (Shatavarins I–IV), which are considered the primary active constituents. These saponins are responsible for adaptogenic and galactagogue activities[9]. In addition, the presence of flavonoids and phenolic compounds contributes to antioxidant properties, while alkaloids and glycosides may play a role in immunomodulatory and therapeutic actions. The extraction of phytochemicals from plant material depends largely on the polarity of the solvent used[10]. Non-polar solvents such as petroleum ether extract lipophilic compounds like steroids and fixed oils, whereas polar solvents such as methanol, ethanol, and water are more efficient in extracting flavonoids, phenolic compounds, glycosides, and saponins[11].

Therefore, the present study is designed to carry out preliminary and phytochemical screening of *Asparagus racemosus* root extracts using various solvents. The study aims to identify major phytochemical constituents and provide scientific evidence supporting its traditional medicinal use. The findings of this investigation may serve as a foundation for further quantitative analysis, pharmacological evaluation, and development of standardized herbal formulations.

MATERIALS AND METHOD:

Macroscopic of *Asparagus racemosus* root: *Asparagus racemosus* root macroscopical characters were studied based on organoleptic and morphological features such as color, odor, taste, shape, size, and surface characteristics.

Microscopic study of *Asparagus racemosus* root: The transverse section of Asparagus racemosus root shows a typical monocot root structure consisting of well-defined tissues such as epidermis, cortex, endodermis, pericycle and vascular bundles.

Determination of Moisture Content (Loss on Drying): Moisture content is defined as the amount of water and volatile matterpresent in acrude drug, which is determined by drying the sample at a specified temperature until a constant weight is obtained. To determine the moisture content of *Asparagus racemosus* root powder by Loss on drying method.

A clean and dry evaporating dish was taken and weighed (W_1). About 2 g of powdered drug was accurately placed in the dish and weighed (W_2). The sample was dried in a hot air oven at 105°C for 3–4 hours. The dish was removed, cooled in a desiccator and weighed again (W_3). Drying was continued until a constant weight was obtained.

Determination of Ash Value: Ash value is defined as the total amount of inorganic residue remaining aftercomplete incineration of a crude drug. It represents the presence of inorganic salts, minerals, and possible contaminants such as soil and sand. Ash value represents the inorganic residue remaining after incineration of crude drug. It helps in determining the purity and presence of adulterants such as sand and soil.

A clean, dry silica crucible was taken and weighed (W_1). About 2 g of powdered drug was accurately

placed in the crucible and weighed (W_2). The sample was first charred on a low flame to remove smoke. The crucible was then placed in a muffle furnace at 450–600°C for about 3–4 hours until white ash was obtained. The crucible was cooled in a desiccator and weighed (W_3). The process was repeated until constant weight was obtained.

Extraction of *Asparagus racemosus* roots: The extraction of *Asparagus racemosus* roots is carried out to isolate bioactive constituents such as alkaloids, flavonoids, saponins, tannins, and phenolic compounds, which are responsible for its medicinal properties (anti-inflammatory, antioxidant, immunomodulatory, etc.).

Soxhlet extraction method: Soxhlet extraction is a continuous extraction technique used to extract phytoconstituents from plant material using a suitable solvent. The dried and powdered drug (about 20–30 g) of *Asparagus racemosus* was placed in a thimble. The thimble was inserted into the Soxhlet apparatus. A suitable solvent (e.g., ethanol/methanol) was added to the round bottom flask. The apparatus was assembled and heated using a heating mantle. The solvent evaporated, condensed in the condenser, and percolated through the sample. The extraction cycle was repeated for 6–8 hours until the solvent in siphon tube became colorless. The extract was collected and concentrated using a rotary evaporator. The dried extract was stored in an airtight container.

Decoction method: The decoction method is a traditional extraction technique used to extract water-soluble constituents from plant materials by boiling in water. It is especially useful for extracting heat- stable compounds such as tannins, glycosides, and some alkaloids. Take dried powdered roots of *Asparagus racemosus.* Add the powder to a suitable quantity of distilled water. Boil the mixture gently for 15–30 minutes. Allow it to cool at room temperature. Filter the extract using muslin cloth or Whatman filter paper. Collect the filtrate for further phytochemical analysis.

Phytochemical Screening: In order to identify the presence of different secondary metabolites responsible for pharmacological activities of *Asparagus racemosus*, a preliminary phytochemical screening of the powdered root was carried out. Alkaloids, flavonoids, tannins and saponins were tested using standard qualitative methods.

Test for Alkaloids: Natural nitrogen-containing compounds called alkaloids are known for various biological activities.

- **Mayer's Test:** A few drops of Mayer's reagent were added to 2 ml of plant extract. Alkaloids were present as a cream-colored precipitate was formed.
- **Wagner's Test:** A few drops of Wagner's reagent were added to 2 ml of plant extract. Alkaloids were present when a reddish-brown precipitate formed.
- **Dragendorff's Test:** About 10 ml of 1% hydrochloric acid was added to the powdered drug and boiled for 2 minutes. After filtration, Dragendorff's reagent was added to the filtrate. The presence of alkaloids was confirmed by the formation of an orange or reddish-brown precipitate.
- **Hager's Test:** A few drops of Hager's reagent were added to the extract. Formation of a yellow precipitate indicated the presence of alkaloids.

Test for Flavonoids: Flavonoids are known for their antioxidant, antimicrobial and anti-inflammatory properties.

- **Alkaline Reagent Test:** A few drops of 10% sodium hydroxide solution were added to 2 ml of plant extract. A yellow color developed which disappeared on addition of dilute hydrochloric acid, confirming flavonoids.
- **Shinoda Test:** Magnesium ribbon and concentrated hydrochloric acid were added to the extract. A pink or red color indicated the presence of flavonoids.
- **Lead Acetate Test:** Addition of lead acetate solution to the extract produced a yellow precipitate, confirming flavonoids.
- **Ferric Chloride Test:** Addition of ferric chloride solution produced a greenish-black color, indicating flavonoids.

Test for Tannins: Tannins are polyphenolic compounds known for antibacterial and astringent properties.

- **Ferric Chloride Test:** Addition of ferric chloride produced a blue-black or green color, indicating tannins.
- **Gelatin Test:** Addition of gelatin solution produced a white precipitate, confirming tannins.
- **Lead Acetate Test:** A white precipitate was formed indicating tannins.
- **Potassium Dichromate Test:** Formation of a yellow precipitate indicated the presence of tannins.

Test for Saponins: Saponins are known for their foaming and surface-active properties.

- **Foam Test:** The extract was shaken vigorously with water. Formation of persistent foam indicated saponins.
- **Froth Test:** Stable froth formation confirmed saponins.

- **Emulsion Test:** Formation of a stable emulsion indicated presence of saponins.
- **Haemolysis Test:** Lysis of red blood cells confirmed saponins.

Test for Flavonoids: Flavonoids are a group of polyphenolic compounds widely distributed in plants and are known for their antioxidant, antimicrobial and anti-inflammatory properties. They play an important role in protecting the plant and also contribute to various pharmacological activities.

- **Alkaline Reagent Test:** A few drops of 10% sodium hydroxide solution were added to 2 ml of plant extract. A yellow color was developed which disappeared on addition of dilute hydrochloric acid, indicating the presence of flavonoids.
- **Shinoda Test:** A small piece of magnesium ribbon and a few drops of concentrated hydrochloric acid were added to the extract. The formation of a pink or red color confirmed the presence of flavonoids.
- **Lead Acetate Test:** A few drops of lead acetate solution were added to the extract. The formation of a yellow precipitate indicated the presence of flavonoids.
- **Ferric Chloride Test:** A few drops of ferric chloride solution were added to the extract. The appearance of a greenish-black color indicated the presence of flavonoids.

RESULTS AND DISCUSSION:

Macroscopic Characteristics:

- **Color:** Creamy white to light brown
- **Odor:** Slightly aromatic
- **Taste:** Sweet and slightly bitter
- **Shape:** Cylindrical, tapering at one end
- **Size:** Approximately 5–20 cm in length and 1–2 cm in diameter
- **Surface:** Smooth or slightly wrinkled with longitudinal striations
- **Texture:** Fleshy when fresh, becoming hard and brittle on drying
- **Fracture:** Short and fibrous
- **Arrangement:** Occurs in clusters of tuberous roots

The roots are thick, succulent, and tuberous in nature. They appear fasciculate and arise in clusters from the base of the plant. When dried, the roots become slightly wrinkled and show longitudinal ridges. These macroscopic characteristics are important for identification and authentication of the crude drug.

Microscopic of Root of *Asparagus racemosus*

Transverse Section (T.S.) of Root: The transverse section of *Asparagus racemosus* root shows a typical monocot root structure consisting of well-defined tissues such as epidermis, cortex, endodermis, pericycle and vascular bundles.

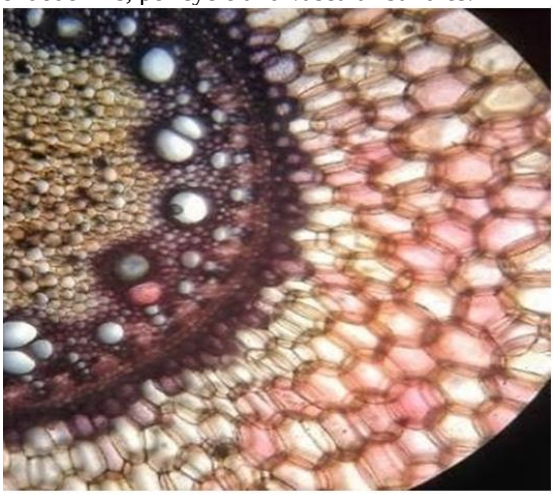

Figure 1: Transverse section of *Asparagus racemosus* root

- **Epidermis:** The outermost layer is the epidermis, composed of a single layer of thin-walled cells. These cells are compactly arranged and act as a protective covering.
- **Cortex:** Below the epidermis lies a wide cortex, made up of parenchymatous cells. Cells are thin-walled, Intercellular spaces present Starch grains may be present.
- **Endodermis:** The innermost layer of cortex is the endodermis, which is made up of barrel-shaped cells. Casparian strips present, Regulates movement of water and nutrients.
- **Pericycle:** Just below the endodermis lies the pericycle, consisting of a single layer of cells. It plays role in lateral root formation.
- **Vascular System:** The vascular tissues are arranged radially.
- **Xylem:** Well-developed and entrally locate

Moisture content:

Table No. 1: Observation of moisture content

S. No.	Description	Weight (g)
1	Weight of empty dish (W_1)	3.140
2	Weight of dish + sample before drying (W_2)	5.920
3	Weight of dish + sample after drying (W_3)	5.860

Calculation of percentage (%) moisture content:

$$\textbf{Moisture content } \% = \frac{W2 - W3}{W2 - W1} X\ 100$$

Results= (%) moisture content (2.158 %)

Ash value:

Table No. 2: Observation of ash value

S. No.	Description	Weight (g)
1	Weight of empty crucible (W_1)	35.93
2	Weight of crucible + drug (W_2)	37.93
3	Weight of crucible + ash (W_3)	36.08

Calculation of percentage (%) ash value:

$$\textbf{Ash value } \% = \frac{W3 - W1}{W2 - W1} X\ 100$$

Results = (%) moisture content (7.5 %)

Preliminary Phytochemical Screening: The preliminary phytochemical screening of *Asparagus racemosus* root extracts was carried out to identify the presence of various bioactive phytoconstituents. The extracts were prepared using different solvents of increasing polarity, namely petroleum ether, chloroform, ethanol, methanol, and distilled water. The qualitative analysis revealed the presence of several important phytochemicals responsible for the medicinal properties of the plant.

Table No. 3: Preliminary Phytochemical Screening of *A. racemosus* Root Extracts

Phytoconstituents	Petroleum Ether	Ethanol	Methanol	Aqueous
Alkaloids	–	+	+	–
Flavonoids	–	+	+	+
Saponins	–	+	+	+
Tannins	–	+	+	+
Steroids	+	+	+	–
Glycosides	–	+	+	+
Carbohydrates	–	+	+	+
Proteins	–	–	+	+
Phenolic Compounds	–	+	+	+

(+ Present, – Absent)

DISCUSSION:

The preliminary phytochemical screening of *Asparagus racemosus* root extracts revealed the presence of various biologically active compounds. The results indicate that the phytochemical composition of the plant varies significantly depending on the solvent used for extraction. Petroleum ether extract showed the presence of steroids, indicating that non-polar solvents are effective in extracting lipophilic compounds. However, most polar phytochemicals were absent in petroleum ether extract, suggesting its limited extraction efficiency for polar constituents. Chloroform extract showed the presence of alkaloids, tannins, steroids, and phenolic compounds. This indicates that moderately polar solvents are capable of extracting certain bioactive compounds, but their efficiency is lower compared to polar solvents. Ethanolic and methanolic extracts exhibited the presence of maximum phytochemical constituents, including alkaloids, flavonoids, saponins, tannins, glycosides, carbohydrates, steroids, proteins, and phenolic compounds. Among all the solvents used, methanol extractshowed the richest phytochemical profile, which may be attributed to its high polarity and better penetration ability into plant tissues. These findings are in agreement with earlier reports stating that methanol is one of the most effective solvents for phytochemical extraction. Aqueous extract also showed the presence of several phytochemicals such as flavonoids, saponins, tannins, glycosides, carbohydrates, proteins, and phenolic compounds. This supports the traditional use of *Asparagus racemosus* in aqueous preparations like decoctions and herbal formulations. The presence of saponins in alcoholic and aqueous extracts supports the traditional use of *Asparagus racemosus* as a galactagogue and adaptogenic herb. Flavonoids and phenoliccompounds contribute to antioxidant and anti-inflammatory activities, while alkaloids andglycosides may be responsible for immunomodulatory and therapeutic effects. The

detection of tannins suggests potential anti-ulcer and antimicrobial properties. Overall, the results of the present study confirm that *Asparagus racemosus* root is a rich source of phytochemicals with significant medicinal potential. The variation in phytochemical presence among different solvent extracts highlights the importance of solvent selection in phytochemical studies.

CONCLUSION:

The present study was carried out on *Asparagus racemosus* root to evaluate its phytochemical constituents and standardization parameters. The plant material was collected, authenticated, shade dried and powdered for further analysis. Extraction of the powdered drug was performed using different methods such as Soxhlet extraction, maceration and decoction method with suitable solvents. The obtained extracts were subjected to preliminary phytochemical screening to detect the presence of various bioactive compounds. The phytochemical screening revealed the presence of alkaloids, flavonoids, tannins, saponins, glycosides and phenolic compounds in the extracts. These constituents are responsible for the medicinal properties of the plant. Physicochemical parameters such as ash value and moisture content (loss on drying) were also determined to ensure the quality and purity of the crude drug. The results obtained were withinacceptable limits, indicating good quality of the plant material. From the present study, it can be concluded that the root of *Asparagus racemosus* contains significant phytochemical constituents which justify its traditional medicinal use. The extraction methods used were effective in isolating bioactive compounds, and the phytochemical screening confirmed the presence of important secondary metabolites. The physicochemical evaluation further supported the standardization and quality of the crude drug. Thus, *Asparagus racemosus* root can be considered a valuable natural source of therapeutic agents and may be used for further pharmacological and formulation studies.

CONFLICT OF INTERESTS

There are no any conflicts of interests

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