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A Review on Hibiscus Pippali Arjuna Sarpagandha Aswagandha Concepts Aspects

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Abstract

The medicinal plants Hibiscus, Pippali, Arjuna, Sarpagandha, and Ashwagandha are collected from different plant parts, including flowers, fruits, stem bark, and roots. Each species belongs to a separate botanical family and is an important source of crude drugs. Due to their pharmacological properties, these plants are extensively used in pharmacognosy, Ayurveda, and various herbal medicinal preparations.

Keywords: Hibiscus Pippali Arjuna Sarpagandha Aswagandha Pharmacognosy

Introduction

Phytopharmaceuticals are medicinal preparations obtained from natural sources, mainly plants, that contain biologically active substances with therapeutic potential. These products are developed through a scientific process involving the identification of medicinal resources, extraction of active constituents, quality standardization, safety evaluation, and preparation into suitable pharmaceutical forms.

India has a wide range of medicinal plant resources because of its diverse geographical conditions, rich biodiversity, and traditional healthcare systems such as Ayurveda, Siddha, Unani, and folk medicine. The Indian phytopharmaceutical sector utilizes plants, algae, fungi, and other natural materials for producing medicines, dietary supplements, nutraceuticals, and healthcare products.

Examples of Important Phytopharmaceutical Compounds

- Curcumin obtained from turmeric (*Curcuma longa*)
- Withaferin A obtained from Ashwagandha (*Withania somnifera*)
- Azadirachtin obtained from Neem (*Azadirachta indica*)
- Sennosides obtained from Senna (*Senna alexandrina*)

- Vinpocetine-related bioactive compounds obtained from plant sources

1. Natural Resources Used for Phytopharmaceutical Production

Phytopharmaceutical production mainly depends on various natural resources, especially medicinal plants and their biologically active components.

A. Medicinal Plants

Different parts of plants are used depending on the location and concentration of active compounds.

Leaves

Examples:

- Neem
- Tulasi
- Aloe vera

Roots and Rhizomes

Examples:

- Ashwagandha roots
- Turmeric rhizomes
- Ginger rhizomes

Bark

Examples:

- Cinnamon
- Arjuna

Flowers

Examples:

- Clove flower buds
- Saffron

Seeds and Fruits

Examples:

- Amla fruits
- Fenugreek seeds
- Castor seeds

B. Other Natural Sources

Apart from higher plants, phytopharmaceutical research also involves:

- Marine plants and algae
- Medicinal fungi
- Microorganisms
- Traditional natural resources used in indigenous medicine

2. Step-by-Step Processing of Phytopharmaceuticals

Step 1: Selection and Authentication of Medicinal Raw Materials

The first stage involves choosing appropriate medicinal species with known therapeutic value.

Main Activities:

- Selection of plants with medicinal importance
- Botanical identification of species
- Scientific authentication by experts
- Preparation of reference specimens
- Recording traditional medicinal information

Importance:

Proper identification helps to prevent:

- Use of incorrect plant species
- Adulteration of raw materials
- Differences in medicinal activity

Step 2: Cultivation and Sustainable Production

Medicinal plants used for pharmaceutical production may be obtained through:

- Agricultural cultivation
- Controlled farming systems
- Organic cultivation methods
- Sustainable collection from natural habitats

Cultivation Practices

Land Preparation

Includes:

- Soil quality analysis
- Field preparation
- Addition of organic nutrients

Selection of Planting Materials

Important factors include:

- High-quality seeds
- Healthy seedlings
- Disease-free plant material

Crop Management

Includes:

- Irrigation management
- Weed removal
- Pest and disease control

Harvesting

The harvesting period is carefully selected because the amount of active compounds depends on:

- Plant maturity
- Climatic conditions
- Season
- Growth stage

Step 3: Collection and Harvesting of Plant Materials

Different plant parts are collected at suitable stages to obtain maximum medicinal value.

Examples:

- Leaves are collected during active vegetative growth.
- Roots are harvested after sufficient maturity.
- Flowers are collected before complete blooming.
- Fruits are collected at the appropriate ripening stage.

Proper harvesting ensures:

- Higher concentration of active compounds
- Better medicinal quality
- Improved storage life

Step 4: Post-Harvest Processing

Freshly collected plant materials require processing before extraction.

A. Cleaning

Cleaning removes:

- Soil particles

- Unwanted plant materials
- Insects
- External contaminants

B. Washing

Washing is carried out when required to eliminate surface impurities.

C. Drying

Drying reduces moisture content and prevents microbial deterioration.

Drying Methods

Sun Drying

- Traditional and economical method
- Suitable for stable plant materials

Shade Drying

- Used for compounds sensitive to heat and sunlight

Mechanical Drying

- Provides controlled temperature conditions

Freeze Drying

- Maintains the quality of heat-sensitive components

D. Size Reduction

Plant materials are processed by:

- Cutting
- Grinding
- Powder preparation

Reducing particle size improves the efficiency of extraction.

Step 5: Extraction of Bioactive Compounds

Extraction involves separating medicinally important compounds from plant materials using suitable techniques.

Common Extraction Techniques

1. Solvent Extraction

Plant materials are treated with solvents such as:

- Water
- Ethanol

- Methanol
- Hydroalcoholic solvents

This method is used for obtaining:

- Alkaloids
- Flavonoids
- Phenolic compounds
- Glycosides

2. Maceration

In this method:

- Plant material is soaked in a suitable solvent.
- Active compounds dissolve into the solvent.
- The extract is filtered and collected.

Advantages:

- Simple procedure
- Suitable for compounds affected by heat

3. Percolation

In percolation:

- Solvent passes continuously through powdered plant material.
- Active compounds are gradually extracted.

It is commonly used for commercial-scale production.

4. Soxhlet Extraction

This method involves repeated circulation of heated solvent through plant material.

Benefits:

- Efficient extraction
- Improved recovery of compounds

5. Supercritical Fluid Extraction

This technique uses substances such as carbon dioxide under high pressure.

Advantages:

- Produces high-quality extracts

- Environment-friendly process
- Suitable for sensitive compounds

6. Ultrasound-Assisted Extraction

Ultrasonic energy is applied to improve extraction efficiency.

Benefits:

- Reduced extraction time
- Lower solvent requirement

Step 6: Concentration and Purification

Extracted materials contain multiple compounds and require further processing.

Concentration

Excess solvent is removed using:

- Evaporation
- Vacuum concentration
- Rotary evaporators

Purification Techniques

Used for separating desired compounds:

- Column chromatography
- High-performance liquid chromatography (HPLC)
- Filtration
- Crystallization
- Membrane separation techniques

Step 7: Identification and Analysis of Active Compounds

Scientific methods are used to identify and measure bioactive constituents.

Analytical Techniques

HPLC

Used for:

- Separation of compounds
- Quantitative analysis

GC-MS

Used for:

- Volatile compounds

- Essential oil analysis

LC-MS

Used for:

- Complex molecular identification

NMR Spectroscopy

Used for:

- Determining chemical structures

Spectrophotometry

Used for:

- Measuring chemical properties

Step 8: Standardization of Plant Extracts

Standardization ensures that every batch has consistent quality and medicinal activity.

It involves:

- Identification of marker compounds
- Measurement of active constituents
- Purity assessment
- Detection of contaminants

Quality parameters include:

- Moisture content
- Ash value
- Microbial limits
- Heavy metal contamination
- Pesticide residue analysis

Step 9: Preclinical Evaluation

Before clinical use, phytopharmaceutical products undergo laboratory investigations.

Pharmacological Studies

Evaluate:

- Biological activity
- Therapeutic effects
- Mechanism of action

Toxicological Studies

Determine:

- Short-term toxicity
- Long-term safety
- Acceptable dosage levels

Animal Studies

Used to evaluate:

- Effectiveness
- Safety
- Biological responses

Step 10: Clinical Evaluation

Clinical trials are conducted to confirm safety and effectiveness in humans.

Phase I

- Determines safety
- Establishes suitable dosage

Phase II

- Evaluates therapeutic effectiveness
- Determines optimum dose

Phase III

- Confirms safety and efficacy in larger populations

Phase IV

- Monitors long-term effects after marketing

Step 11: Formulation Development

Extracted compounds are converted into pharmaceutical products.

Common dosage forms include:

- Tablets
- Capsules
- Syrups
- Creams and gels
- Herbal oils
- Advanced pharmaceutical preparations

Each formulation is developed to improve:

- Stability
- Patient convenience

- Therapeutic effectiveness

Step 12: Quality Control and Regulatory Approval in India

Phytopharmaceutical products must comply with quality and safety regulations.

Important Regulatory Organizations

Ministry of AYUSH

Functions include:

- Promotion of traditional medicine
- Development of quality standards
- Support for research activities

Central Drugs Standard Control Organization (CDSCO)

Responsible for:

- Drug regulation
- Approval processes
- Safety evaluation

Indian Pharmacopoeia Commission (IPC)

Provides:

- Official standards for medicines

Quality testing includes:

- Identity verification
- Purity analysis
- Stability studies
- Safety assessment

Step 13: Manufacturing and Packaging

Industrial production involves:

1. Preparation of standardized extracts
2. Mixing with suitable formulation ingredients
3. Processing and filling
4. Quality testing
5. Packaging

Packaging protects products from:

- Moisture
- Light exposure

- Contamination
- Chemical degradation

Step 14: Storage and Distribution

Proper storage maintains product quality and shelf life.

Required conditions include:

- Controlled temperature
- Reduced humidity
- Protection from direct sunlight

Distribution occurs through:

- Pharmacies
- Hospitals
- Online platforms
- International export markets

3. Major Phytopharmaceutical Industries in India

Ayurvedic Pharmaceutical Sector

Produces:

- Herbal medicines
- Traditional formulations
- Plant extract-based products

Herbal Extract Industry

Produces:

- Standardized botanical extracts
- Purified active ingredients

Nutraceutical Industry

Produces:

- Dietary supplements
- Functional foods
- Wellness products

Cosmetic Industry

Uses plant extracts such as:

- Aloe vera
- Neem

- Amla
- Turmeric

4. Challenges in Phytopharmaceutical Production in India

Raw Material Challenges

- Seasonal variations
- Incorrect plant identification
- Differences in quality of raw materials

Processing Challenges

- Limited advanced extraction facilities
- Difficulty in maintaining standardization

Scientific Challenges

- Need for more clinical research
- Complexity of plant-based chemical mixtures

Market Challenges

- Competition among products
- Increasing regulatory requirements

5. Future Scope of Phytopharmaceuticals in India

The future development of phytopharmaceuticals can be improved through:

- Advanced extraction and purification technologies
- Organic cultivation of medicinal plants
- Biotechnology-based production methods
- Development of scientifically validated herbal medicines
- Export of high-quality standardized extracts
- Integration of traditional knowledge with modern pharmaceutical research

Pharmacognosy of Hibiscus, Pippali, Arjuna, Sarpagandha, and Ashwagandha

1. Hibiscus (Hibiscus rosa-sinensis)

Biological Source:

Hibiscus is obtained from the fresh or dried flowers of Hibiscus rosa-sinensis L.

Family: Malvaceae

Geographical Distribution:

It is commonly grown in India, China, tropical Asian countries, and other regions with warm climates.

Macroscopic Characters:

- Flowers are large, attractive, and usually red in colour.
- Petals are soft and arranged in a funnel-like form.
- The calyx consists of five sepals.
- Flowers have a characteristic floral odour.
- Taste is slightly mucilaginous.

Microscopic Characters:

- Petals contain an epidermal layer with papillary projections.
- Pigmented parenchymatous cells are present.
- Calcium oxalate crystals may occur.
- Both glandular and non-glandular trichomes can be observed.

Chemical Constituents:

- Anthocyanins
- Flavonoids
- Tannins
- Mucilage
- Polyphenolic compounds
- Vitamins

Uses:

- Used for its antioxidant activity.
- Incorporated in hair care preparations.
- Supports wound healing.
- Used in herbal formulations for soothing and cooling effects.
- Exhibits antimicrobial properties.

2. Pippali (Long Pepper) (*Piper longum*)

Biological Source:

Pippali is obtained from the dried immature fruit spikes of *Piper longum* L.

Family: Piperaceae

Geographical Distribution:

It is found in India, Nepal, Sri Lanka, Bangladesh, and other tropical parts of Asia.

Macroscopic Characters:

- Fruits are arranged in cylindrical spikes.
- Surface is rough due to closely packed small fruits.
- Colour varies from greenish to dark brown.
- Odour is aromatic.
- Taste is strongly pungent.

Microscopic Characters:

- Fruit contains a well-developed pericarp.
- Oil cells and stone cells are present.
- Parenchymatous tissue contains starch grains.
- Vascular bundles are visible.

Chemical Constituents:

- Piperine
- Piplartine
- Volatile oil
- Alkaloids
- Resin

Uses:

- Used as a digestive stimulant.
- Acts as a carminative agent.
- Used in traditional remedies for respiratory conditions.
- Improves the absorption of certain drugs.
- Used as a spice and flavouring material.

3. Arjuna (Terminalia arjuna)

Biological Source:

Arjuna consists of the dried stem bark of Terminalia arjuna (Roxb.) Wight & Arn.

Family: Combretaceae

Geographical Distribution:

It is mainly found in India, Sri Lanka, and Myanmar, especially near river banks.

Macroscopic Characters:

- Bark occurs in curved or flat pieces.
- Outer surface is smooth or slightly rough.
- Colour ranges from greyish-green to reddish-brown.
- Inner surface appears fibrous.
- Taste is strongly astringent.

Microscopic Characters:

- Cork tissue is present externally.
- Cortex contains stone cells and tannin-containing cells.
- Secondary phloem contains fibres.
- Calcium oxalate crystals may be present.

Chemical Constituents:

- Triterpenoids
- Tannins
- Flavonoids
- Saponins
- Arjunolic acid
- Arjunic acid

Uses:

- Used as a cardiac tonic.
- Supports cardiovascular health.
- Traditionally used in blood pressure management.
- Possesses antioxidant activity.
- Used in Ayurvedic heart-related preparations.

4. Sarpagandha (*Rauvolfia serpentina*)

Biological Source:

Sarpagandha is obtained from the dried roots of *Rauvolfia serpentina* (L.) Benth. ex Kurz.

Family: Apocynaceae

Geographical Distribution:

It occurs in India, Sri Lanka, Myanmar, Bangladesh, and various Southeast Asian regions.

Macroscopic Characters:

- Roots are cylindrical and slightly curved.
- Outer surface is brownish-yellow.
- Fracture is short and irregular.
- Odour is faint.
- Taste is bitter.

Microscopic Characters:

- Outer cork layer is present.
- Cortex consists of parenchymatous cells.
- Large amounts of starch grains are present.
- Laticiferous tissues may occur.
- Xylem vessels are well developed.

Chemical Constituents:

- Reserpine
- Rescinnamine
- Ajmaline
- Serpentine
- Indole alkaloids

Uses:

- Used as an antihypertensive drug.
- Possesses sedative and tranquillizing effects.
- Used in certain nervous disorders.
- Helps reduce anxiety and restlessness.
- Important source of medicinal alkaloids.

5. Ashwagandha (Withania somnifera)

Biological Source:

Ashwagandha is obtained from the dried roots of *Withania somnifera* (L.) Dunal.

Family: Solanaceae

Geographical Distribution:

Cultivated mainly in India (Rajasthan, Madhya Pradesh, Punjab), Pakistan, and other dry regions.

Macroscopic Characters:

- Roots are cylindrical, branched, and tapering.
- Surface colour ranges from yellowish-white to light brown.
- Has a characteristic odour.
- Taste is bitter with a slightly acrid sensation.

Microscopic Characters:

- Root contains an outer cork layer.
- Cortex consists of parenchymatous cells containing starch grains.
- Xylem contains vessels and fibres.
- Calcium oxalate crystals may be present.

Chemical Constituents:

- Withanolides
- Withaferin A
- Alkaloids
- Steroidal lactones
- Flavonoids

Uses:

- Used as an adaptogenic herb and general tonic.
- Helps in managing stress and fatigue.
- Supports immune function.
- Shows antioxidant and anti-inflammatory effects.
- Used in Ayurvedic preparations for improving strength and vitality.

Conclusion

1. Hibiscus

Botanical name: Hibiscus rosa-sinensis

Family: Malvaceae

Common names: Hibiscus, China rose, Gudhal, Japa

Description

Hibiscus is a commonly grown ornamental and medicinal flowering shrub belonging to the Malvaceae family. It is widely cultivated in warm climates, including tropical and subtropical regions. The plant develops a bushy structure with shiny green leaves having toothed margins and produces large, attractive flowers in various shades such as red, pink, yellow, and white.

Different parts of the plant, especially flowers and leaves, are traditionally used in herbal preparations and cosmetic products. The bright flower colors are mainly due to anthocyanin pigments, while mucilage content contributes to its soothing properties in traditional applications.

Major Phytochemical Constituents

- Anthocyanins
- Flavonoids
- Phenolic compounds
- Organic acids
- Tannins
- Mucilage
- Vitamin C and antioxidant compounds

Uses and Benefits

- Antioxidant activity: Natural polyphenols and anthocyanins help protect cells from oxidative stress.
- Cardiovascular wellness: Traditionally used to support healthy blood pressure and overall heart function.
- Hair and skin applications: Flower extracts are widely used in herbal hair oils, shampoos, and cosmetic products.
- Digestive support: Hibiscus beverages are traditionally consumed to support digestion and hydration.
- Refreshing properties: Commonly used as a cooling herbal drink in warm regions.
- Common Applications
- Herbal tea preparations
- Hair oils and shampoos
- Cosmetic formulations
- Herbal extracts
- Traditional herbal remedies

Precaution

Individuals using medicines for blood pressure or blood sugar control should consult a healthcare professional before taking concentrated hibiscus products.

2. Pippali (Long Pepper)

Botanical name: *Piper longum*

Family: Piperaceae

Common names: Pippali, Long pepper, Indian long pepper

Description

Pippali is a perennial climbing herb cultivated mainly in India and other tropical Asian regions. It has broad, heart-shaped leaves and produces long cylindrical fruit spikes containing numerous tiny fruits. The dried fruits are used as a spice and as an ingredient in traditional medicinal preparations.

The characteristic sharp taste and aroma of Pippali are mainly attributed to bioactive alkaloids such as piperine along with volatile oils. It holds an important position in Ayurvedic herbal formulations.

Major Phytochemical Constituents

- Piperine
- Piperlongumine
- Essential oils
- Alkaloids
- Flavonoids
- Phenolic compounds

Uses and Benefits

- Digestive support: Traditionally used to stimulate appetite and improve digestive function.
- Respiratory wellness: Commonly included in traditional preparations for cough, cold, and respiratory comfort.
- Improved absorption: Piperine may enhance the availability of certain nutrients and herbal compounds.
- Antioxidant effects: Contains compounds that help reduce oxidative stress.
- Metabolic support: Traditionally used to support healthy metabolic activity.

Common Applications

- Ayurvedic formulations
- Herbal powders
- Spice preparations
- Respiratory herbal products

Precaution

Excessive use may cause digestive discomfort. Individuals with sensitive stomachs should use concentrated Pippali preparations carefully.

3. Arjuna

Botanical name: Terminalia arjuna

Family: Combretaceae

Common names: Arjuna, Arjun tree

Description

Arjuna is a large medicinal tree found throughout the Indian subcontinent. It has a strong trunk covered with smooth grey bark, elongated leaves, small flowers, and woody fruits with characteristic wing-like structures. The bark is the main part used in traditional medicine.

In Ayurveda, Arjuna bark is especially valued for cardiovascular applications. Its therapeutic properties are associated with several bioactive compounds, including triterpenoids, tannins, and flavonoids.

Major Phytochemical Constituents

- Arjunolic acid
- Arjunic acid
- Triterpenoids
- Flavonoids
- Tannins
- Glycosides
- Polyphenols
- Saponins

Uses and Benefits

- Cardiovascular support: Traditionally used to maintain heart health and proper circulation.
- Antioxidant activity: Helps protect tissues from oxidative damage through plant-derived compounds.
- Cholesterol support: Studied for its possible effects on lipid metabolism.
- Anti-inflammatory potential: Contains compounds that may help regulate inflammatory responses.
- General wellness: Used in traditional rejuvenating formulations.

Common Applications

- Bark powder
- Herbal decoctions
- Capsules and tablets
- Ayurvedic medicines

Precaution

People taking cardiovascular medicines should consult a healthcare professional before using Arjuna supplements.

4. Sarpagandha (Indian Snakeroot)

Botanical name: Rauvolfia serpentina

Family: Apocynaceae

Common names: Sarpagandha, Indian snakeroot, Rauwolfia

Description

Sarpagandha is a medicinal shrub native to India and parts of Southeast Asia. It is a small evergreen plant with dark green leaves, delicate flowers, and long twisted roots. The roots contain several important alkaloids and are the primary medicinal part of the plant.

This herb has been traditionally used in Ayurvedic medicine. The alkaloid compounds present in the roots, particularly reserpine, have been extensively studied for their effects on the nervous and cardiovascular systems.

Major Phytochemical Constituents

- Reserpine
- Rescinamine
- Ajmaline
- Yohimbine
- Indole alkaloids

Uses and Benefits

- Blood pressure support: Historically used in traditional medicine for maintaining healthy blood pressure.
- Nervous system activity: Alkaloids present in the plant have been studied for their effects on nerve function.
- Relaxation support: Traditionally used in preparations associated with calmness and sleep.
- Cardiovascular research: Certain compounds have been studied for their influence on heart rhythm and circulation.

Common Applications

- Root extracts
- Ayurvedic medicines
- Herbal formulations

Precaution

Sarpagandha contains potent alkaloids and should be used only under professional supervision. It may interact with medicines related to blood pressure, mood, and nervous system function.

5. Ashwagandha

Botanical name: Withania somnifera

Family: Solanaceae

Common names: Ashwagandha, Indian ginseng, Winter cherry

Description

Ashwagandha is a medicinal shrub widely used in Ayurvedic traditions. It has small greenish flowers, orange-red berries, and thick roots that are mainly used for herbal preparations.

Traditionally considered a rejuvenating herb, Ashwagandha is associated with strength, vitality, stress adaptation, and overall wellness. Its biological activity is mainly linked to withanolides and other steroidal compounds.

Major Phytochemical Constituents

- Withanolides
- Alkaloids
- Flavonoids
- Steroidal lactones
- Phenolic compounds

Uses and Benefits

- Stress support: Traditionally used to promote relaxation and improve stress response.
- Energy and vitality: Used to support physical strength, endurance, and overall fitness.
- Cognitive support: Studied for its possible effects on memory, focus, and mental performance.
- Antioxidant activity: Contains compounds that help protect cells from oxidative damage.
- Physical performance: Traditionally used to support muscle strength and stamina.

Common Applications

- Root powder
- Herbal capsules
- Herbal tonics
- Ayurvedic formulations

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