



جامعة الأنبار - مركز دراسات الصحراء



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History and Impotence of Medicinal Plants	عنوان المحاضرة باللغة الانجليزية
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محتوى المحاضرة

Introduction

Medicinal plants have been an indispensable resource for the treatment of human ailments since the dawn of civilization. Their use in various traditional systems of medicine laid the foundation for modern pharmacology. Today, medicinal plants are not only essential for traditional healthcare but also serve as key resources in drug discovery, biotechnology, and phytopharmaceutical industries.

The World Health Organization (WHO) estimates that nearly 80% of the global population relies on plant-based medicines for primary healthcare needs, particularly in developing countries. Additionally, more than 25% of prescription drugs in developed countries contain active principles derived from higher plants or their synthetic analogs. The continuous exploration of plant biodiversity has led to the discovery of novel therapeutic agents, making medicinal plants a cornerstone in modern medicinal and pharmaceutical research.

1.2 Historical Background

1.2.1 Prehistoric and Ancient Uses

Archaeological and ethnobotanical evidence suggests that early humans used medicinal plants for healing purposes. Traces of herbal use have been found in prehistoric burial sites such as the Shanidar Cave in Iraq (~60,000 BCE), where pollen from medicinal plants like yarrow (*Achillea*) and ephedra (*Ephedra sinica*) was discovered.

1.2.2 Contributions of Ancient Civilizations

Mesopotamia

- One of the earliest recorded civilizations to document medicinal plant use.



- Cuneiform tablets from 2600 BCE list hundreds of plant-based remedies, including those made from myrrh, licorice (*Glycyrrhiza glabra*), and thyme.

Ancient Egypt

- The *Ebers Papyrus* (ca. 1550 BCE) documents over 700 plant-based formulas.
- Commonly used herbs included garlic (*Allium sativum*), aloe (*Aloe vera*), and castor oil plant (*Ricinus communis*).

India

- Ayurveda, an ancient Indian system of medicine, was formalized around 1500 BCE.
- Ayurvedic texts like *Charaka Samhita* and *Sushruta Samhita* describe over 1,000 medicinal plants.
- Notable plants: *Withania somnifera* (Ashwagandha), *Curcuma longa* (Turmeric), *Ocimum sanctum* (Tulsi).

China

- Traditional Chinese Medicine (TCM) has a history of over 2,000 years.
- The *Shennong Bencao Jing* lists 365 medicinal substances, mostly plant-based.
- Key plants: *Panax ginseng*, *Camellia sinensis* (green tea), *Artemisia annua* (Qinghao).

Greece and Rome

- Theophrastus, known as the “Father of Botany,” wrote *Enquiry into Plants*.
- Dioscorides compiled *De Materia Medica*, a five-volume encyclopedia on herbal medicine, used for over 1,500 years.

1.3 Importance in Modern Medicine

1.3.1 Source of Pharmaceutical Compounds

Medicinal plants are rich in **secondary metabolites** such as alkaloids, flavonoids, tannins, glycosides, terpenoids, and phenolics, many of which exhibit potent pharmacological activities.

Examples of plant-derived drugs:

Drug Name	Source Plant	Therapeutic Use
Morphine	<i>Papaver somniferum</i> (opium poppy)	Pain relief
Quinine	<i>Cinchona officinalis</i>	Antimalarial
Artemisinin	<i>Artemisia annua</i>	Antimalarial
Taxol (Paclitaxel)	<i>Taxus brevifolia</i>	Anticancer
Vincristine	<i>Catharanthus roseus</i>	Anticancer

1.3.2 Role in Traditional and Complementary Medicine

Medicinal plants continue to play a crucial role in traditional systems:

- **Ayurveda:** Uses plant combinations for holistic healing.
- **Traditional Chinese Medicine:** Utilizes herbal decoctions and complex mixtures.
- **Unani:** Originated in Greece and developed in Islamic culture; emphasizes plant-based regimens.
- **African traditional medicine:** Employs thousands of native species for ethnomedical practices.



1.3.3 Socio-Economic and Cultural Significance

- Medicinal plant harvesting, processing, and trade offer income sources to rural communities.
- Cultural rituals and knowledge associated with plant use reinforce indigenous identities.
- The global trade in herbal products is growing rapidly, with a market value expected to exceed **USD 150 billion by 2025**.

1.4 Challenges in Medicinal Plant Utilization

1.4.1 Overexploitation and Habitat Destruction

- Many medicinal plants are collected from the wild, leading to population declines.
- Examples: *Podophyllum hexandrum*, *Nardostachys jatamansi*, *Saussurea costus*.
- Threats include deforestation, climate change, and land-use conversion.

1.4.2 Adulteration and Quality Issues

- Substitution of authentic species with look-alikes.
- Presence of contaminants such as heavy metals, pesticides, and microbes.

1.4.3 Conservation Measures

- **In situ:** Establishing protected areas and sacred groves.
- **Ex situ:** Gene banks, seed storage, botanical gardens, and **tissue culture**.
- **Policy support:** Convention on Biological Diversity (CBD), Nagoya Protocol.

1.5 The Role of Biotechnology

Biotechnology has emerged as a key tool for enhancing the utility, conservation, and production of medicinal plants.

1.5.1 Micropropagation and Tissue Culture

- Rapid, clonal propagation of elite and endangered medicinal plant species.
- Suitable for producing disease-free planting material.

Example species:

- *Aloe vera*, *Rauwolfia serpentina*, *Withania somnifera*

1.5.2 Genetic Engineering

- Enhancing production of secondary metabolites via overexpression of biosynthetic genes.
- Development of transgenic plants resistant to diseases or pests.

1.5.3 Hairy Root Culture and Bioreactors

- *Agrobacterium rhizogenes* induces hairy roots for high-yield metabolite production.
- Bioreactors allow for mass production under controlled conditions.

1.5.4 Omics Technologies

- Genomics, transcriptomics, proteomics, and metabolomics help:
 - Discover biosynthetic genes
 - Understand metabolic pathways
 - Identify marker genes for selection and breeding



1.5.5 DNA Barcoding

- Molecular technique for plant authentication and quality control.
- Commonly used regions: **rbcL**, **matK**, **ITS**.

1.6 Summary

Medicinal plants have an enduring legacy, serving as essential components of traditional healing systems and providing critical leads for modern drug development. Their importance transcends medicine—touching agriculture, industry, culture, and the environment. While their growing demand highlights their value, it also raises concerns regarding conservation and sustainable utilization. Biotechnology offers innovative solutions to these challenges, ensuring that medicinal plants continue to contribute to global health and biodiversity in the 21st century and beyond.

Key Terms

- **Phytotherapy:** The use of plant-derived medications in the treatment and prevention of diseases.
- **Secondary metabolites:** Organic compounds not directly involved in growth or reproduction but crucial for plant defense and human pharmacology.
- **Bioprospecting:** Systematic search for genes, compounds, and organisms with potential use in biotechnology and pharmaceuticals.
- **Hairy root culture:** Technique using *Agrobacterium rhizogenes* to induce fast-growing roots rich in secondary metabolites.

Review Questions

1. Discuss the contribution of ancient civilizations to the development of medicinal plant knowledge.
2. Describe at least five important medicinal plants and the drugs derived from them.
3. What are the major challenges facing the conservation of medicinal plants?
4. Explain how tissue culture can be used in conserving endangered medicinal species.
5. Define secondary metabolites and explain their significance in pharmacology.

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