



## ESSENCE OF SCIENTIFIC VALIDATION AND AUTHENTICATION OF ANCIENT INDIAN MEDICINAL PLANTS

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Plants are multicellular living beings that manufacture their own organic matter through photosynthesis, which is why they are said to be autotrophic beings, that is, they do not need to eat other living things to obtain food, since they are capable of manufacturing them same. through photosynthesis Each plant is a chemical factory that has many metabolites. Medicinal plants have been used for thousands of years to flavor and preserve food, as a treatment against different microorganisms that cause many health disorders, such as bacteria, fungi, parasites and yeasts, and as disease prevention. Currently in India, more than 70% of the population uses herbal medicines for their health. There is ample evidence based on the experience of many of these medications; it is for this reason that proper authentication and standardization are needed, as previous steps to consider the source materials for herbal formulation in any medicine system, WHO continuously emphasizes ensuring quality control of medicinal plant products using modern techniques and the application of appropriate standards. The objective of this research is to review the current status of medicinal plants at large in India and role of standardization and validation of Indian medicinal plants. The overview depicts the outlay about the essence and necessarily of standardization using different markers to identify the correct characterization of Indian Medicinal Plants. These markers can so simple and specific to a plant so that the plant can possess correct and perfect identification in terms of validation.

**Key words:** Indian Medicinal plants, Standardization and Validation and Markers.

### Introduction

Plants are multicellular living beings that manufacture your own organic matter through photosynthesis, reason by which it is said that they are autotrophic beings, that is, they do not need to eat other living beings to obtain food, since they are capable of manufacturing it themselves through

photosynthesis. This process is carried out in the chloroplasts of plant cells, where there is a substance, chlorophyll, which captures solar energy. Together with water, mineral salts and carbon dioxide, this energy is used to produce organic matter. In photosynthesis, oxygen is released<sup>1</sup>. The term of medicinal plants includes a various

type of plants used in herbalism and some of these plants have a medicinal activity. There are more than 3,300 million people in less developed countries that use medicinal plants on a regular basis, which is why they are considered the backbone of traditional medicine. Medicinal plants have been used for thousands of years to flavor and preserve food, as a treatment against different microorganisms that cause many health disorders, such as bacteria, fungi, parasites and yeasts, and as disease prevention. These healing properties have been transmitted throughout the centuries within and among human populations. During the secondary metabolism active compounds are produced, which are generally responsible for the biological properties of the different plant species used for various purposes, for example, the treatment of infectious and inflammatory diseases. Currently, studies on the antimicrobial capacity of various plants, which were considered empirical, have been scientifically confirmed, with the development of reports on infectious microorganisms resistant to antimicrobials. Products derived from plants may potentially control microbial growth in diverse situations and in the specific case of disease treatment<sup>2</sup>

Currently in India more than 70% of the population use herbal drugs for their health. There is ample evidence based on the experience for many of these medications. There are also several institutes / universities in India that conduct similar research on herbal medicines or medicinal plants. Thus, several Institutes carry out basic and clinical research on the possible health benefits of herbal medicines. These Indian herbal medicines also contain beneficial health compounds, as they include antioxidants and components that can be used in functional foods. Newer approaches utilizing

collaborative research and modern technology in combination with established traditional health principles will yield rich dividends soon in improving health, especially among people who do not have access to the use of costlier western systems of medicine<sup>3</sup>.

This article has as its main objective to review scientific validation and a computational compilation of ancient Indian medicinal plants.

### **Medicinal Plants**

Plants are made up of cells, so they are considered living things. They need air, water, land and sunlight to live. They cannot move from one place to another, but their leaves move to sunbathe, and their roots move towards the water. Its seeds can be transported by animals or dragged by the wind. We get food from all different parts of plants: flowers, fruits, vegetables, seeds, nuts, stems and leaves. Some plants provide us with medicines, and trees are used to make paper and furniture. More than 270,000 plant species have been identified and classified, but scientists believe there are millions more waiting to be discovered<sup>4</sup>. The term medicinal plants include several types of plants used in herbalism and some of these plants have medicinal activities. Medicinal plants are the "backbone" of traditional medicine, which means that more than 3.3 billion people in less developed countries use medicinal plants on a regular basis. These medicinal plants are considered resources rich in ingredients that can be used in the development and synthesis of drugs. In addition to these plants play a critical role in the development of human cultures throughout the world<sup>2</sup>.

### **Uses of medicinal plants:**

Table 1 lists the medicinal plants frequently used as raw materials for the extraction of active ingredients that are used in the

S. No.	Drug	Botanical Name	Therapeutic Uses
1.	Artemisinin	<i>Artemisia annua</i> L.	Antimalarial drug
2.	Galantamine	<i>Galanthus woronowii</i> Losinsk	Anti-Alzheimer's Drug
3.	Taxol	<i>Taxus brevifolia</i>	Anticancer drug
4.	Opium alkaloids	<i>Papaver somniferum</i>	Analgesic, Antitussive
5.	Vinca alkaloids	<i>Catharanthus roseus</i>	Anticancer drug
6.	Reserpine	<i>Rauwolfia serpentina</i>	Antihypertensive
7.	Quinine, Quinidine	<i>Cinchona</i> spp.	Antimalarial drug
8.	<i>Digitalis</i> glycosides	<i>Digitalis purpurea</i> , <i>Digitalis lantana</i>	Cardiotonic glycosides
9.	Sennosides A and B	<i>Cassia angustifolia</i>	Laxative
10.	Pervilleine A	<i>Erythroxylum pervillei</i>	Anticancer
11.	Sylvestrol	<i>Aglaia foveolata</i>	Cytotoxic
12.	Resveratrol	<i>Cassia angustifolia</i>	COX-1 enzyme inhibitor

**Table 1.** List of medicinal products derived from plants with medical importance<sup>10</sup> (Courtesy Muhammad and Muhammad, 2016)

synthesis of different drugs, such as laxatives, anticoagulants, antibiotics and antimalarial drugs, among others, are currently used for the treatment of various pathologies. In addition, the active components of Taxol, Vincristine and Morphine isolated from Foxglove, Periwinkle, Yew and Opium Poppy, respectively. Medicine, in several developing countries, which uses local traditions and beliefs, remains the pillar of medical care. According to WHO, "health is a state in which you must be in complete physical, mental and social well-being, and not just the absence of disease". Medicinal plants can make an important contribution to the objective of WHO to ensure that all peoples, throughout the world, lead a socioeconomically sustainable productive life<sup>2</sup>.

Traditional medicine has been known for many centuries in many parts of the world for the treatment of various human diseases. The use of antibiotics has revolutionized the treatment of various bacterial infections. However, its indiscriminate use has led to an alarming increase in the resistance of microorganisms to antibiotics, which requires the need to

develop new antimicrobials. The last few years have witnessed a renewed interest in exploring natural resources to develop such compounds. Medicinal plants occupy 80% of the world's population, and in India the use of plants as therapeutic agents remains an important component of the traditional medicinal system. Several plants have been documented for their biological and antimicrobial properties, including: *Anethum graveolens* (Dill), *Foeniculum vulgare* (Fennel), *Trachyspermum ammi* (Omum) and *Elettaria cardamomum* (Cardamom), which have been commonly used to treat the treatment of disorders gastrointestinal; *Acalypha indica* (Hit grass) and *Aerva Lanata* (Chaya) have shown high efficacy against bacteria such as *Staphylococcus aureus* and *Escherichia coli*, *Viola odorata* (Common or garden violet) has been used to treat respiratory diseases and as an anti-inflammatory agent, while *Syzygium aromaticum* (Clove) is used for toothache due to its local anesthetic activity. Also, the biological and antimicrobial activities of the essential / volatile oils of these plants have been reported<sup>5,6</sup>.

It has been shown that the methanol leaf extracts of *Tinospora cordifolia*,

*Ziziphus mauritiana*, *Sida cordifolia*, *Acacia nilotica*, *Withania somnifer* have shown a potent antibacterial activity against *Bacillus subtilis*, *E. coli*, *Pseudomonas fluorescens*, *Staphalococcus aureus* and *Xanthomonas axonopoun* activity against *Aspergillus flavus*, *Dreschlera turcica* and *Fusarium verticillioides*. *Withania somnifer* is recognized as a strong antibacterial, the methanol extract of *Withania somnifer* is effective against *Candida albicans*. The organic extracts of *Cassia fistula* and the aroma of *Acacia* show potent antibacterial and antifungal activities against various gram-positive bacteria<sup>7,8</sup>. The efficacy of several species of the genus *Euphorbia* (*Euphorbiaceae*) as antiviral and antitumor agents has been evaluated, in part based on information on plants that have traditionally been used as medicines to treat various human diseases. In fact, pronounced antiviral activity has been reported in several species of the genus *Euphorbia*, against polio, coxsackie and rhinovirus. In addition, antitumor activity against sarcoma, leukemia in mice and cytotoxic activity against certain cancer cell lines has also been observed<sup>9</sup>. On the other hand, medicinal plants, their derivatives and their characterized secondary metabolites are widely used medicinally and are becoming popular worldwide as a natural alternative to synthetic chemicals in both the traditional and allopathic medicine system. The beneficial effect of herbal medicine is usually the result of the combination of secondary metabolites produced in herbs, uch as: glycosides, alkaloids, flavonoids, tannins, etc.<sup>11</sup>.

There are many industrial uses with medicinal plants, for example in traditional medicines, herbal teas and healthy foods, as well as nutritional, galenic, phytopharmaceutical and industrially

produced pharmaceutical products. In addition, medicinal plants constitute a source of economic income for most developing countries, as they are a ready source of medicines such as quinine and reserpine; of galenics such as tinctures and intermediate products (for example, diosgenin from *Discorea sp.*) in the production of semi-synthetic drugs<sup>2</sup>.

#### **Role of Indian Medicinal Plants:**

For most developing countries, the main problem of public health remains the acute need for basic medical care, which unfortunately is needed even at the most elementary level. This is true both in fast-growing cities and in rural areas. WHO indicates that more than half of the world's population does not have access to adequate health care services. This is because poor people do not have access and cannot afford current health care services. Therefore, innovative alternative approaches are needed to address this issue. Medicinal plants offer alternative remedies with enormous opportunities. They not only provide access and affordable medicines to people with limited resources; They can also generate income, employment and foreign exchange for developing countries. It has been shown that many traditional healing herbs and parts of plants have medicinal value, especially in rural areas and that they can be used to prevent, relieve or cure various human diseases. WHO estimates that more than 80% of the world's population depends solely or primarily on traditional health care remedies. Rural communities continue to rely on locally produced, plant-based remedies, some from family gardens, but many from forests, alpine pastures and other multi-use habitats. Women and the elderly are the main harvesters and traders of these types of plants. Recently, interest in many countries has been aroused by the

commercial extraction of active ingredients from plants that contribute to the cure of important diseases such as cancer and AIDS, for example, those mentioned in the study conducted by Salehi<sup>12</sup> such as: *Andrographis paniculata*, *Xylopi frutescens*, *Apium graveoles*, among others, which attack the virus causing AIDS; Likewise, Desai and co-workers mentions in their research that the *Podophyllum peltatum* plant has properties to attack testicular cancer in humans. WHO estimates that a minimum of 20,000 plant taxa have registered medicinal uses<sup>13</sup>. It is estimated that up to 70,000 plant species are used in folk medicine and most of these species are found in the Asia-Pacific region<sup>14</sup>.

Ayurveda in India is considered an ethnomedicine and, also, a complete medical system that cares about the physical and psychological well-being of people, as well as ensuring the philosophical, ethical and spiritual. It is very important to live in harmony with the Universe and the harmony of nature and science. This universal and holistic approach makes it a unique and different medical system. This system emphasizes the importance of maintaining an adequate lifestyle to maintain a positive health. This concept was in practice for two millennia and practitioners of modern medicine have now considered the importance of this aspect<sup>15</sup>.

Approximately 90% of Ayurvedic preparations are of plant origin. Ayurvedic plants have a stronger action on the body than food or spices. These actions allow the plant to reverse the pathophysiological processes and stabilize the *doshas*. For this reason, such plants should be used with caution. Classic Ayurvedic preparations, made of such plants, are known as "yoga" in Sanskrit. Yogas have developed years of practical experience combining plants to

obtain the optimal effect. Polyherbal combinations have also proven to be more durable and effective than particular herbs. In ayurveda, mostly preparations are polyherbal as per the classical literature, with a combination of number of plants involved. These components are combined very much precisely, so that the formula is balanced and can be reproduced. One or two plants in these combinations are active, and the others are playing a supporting role. Support herbs also have different actions, they may act as catalysts to help absorption, transport or reducing toxicity. The result can be excellent only if ideal combination is delivered but these results are based on a thorough knowledge of the plant<sup>16</sup>.

#### **Current status of medicinal plants:**

Ayurveda, traditional Indian medicine (TIM) remains the oldest but living tradition in Asia. This is the "greatest tradition" with a solid philosophical and experimental basis. The increase in side effects, the lack of curative treatment for several chronic diseases, the high cost of new drugs, microbial resistance and emerging diseases are some of the reasons for the renewed public interest in complementary and alternative medicines. It was evidenced that in 2010 at least two thirds of the population of the United States used one or more of the alternative therapeutic approaches. The use of indigenous medicines of natural origin forms an important part of such therapies; More than 1500 herbs are sold as dietary supplements or traditional ethnic medicines. Pharmaceutical companies have renewed their strategies in favor of the development and discovery of natural products drugs. For example, in Europe, *AnalytiCon Discovery* has emphasized drug discovery based on the chemistry of natural products. In the Asia-Pacific region, *MerLion Pharmaceuticals* in Singapore has the necessary structures and capabilities for the discovery of drugs based

on natural products. China has successfully promoted its own therapies worldwide with a science-based approach. However, the increasing use of traditional therapies requires scientifically stronger evidence of the principles behind therapies and the effectiveness of medications. Recent advances in analytical and biological sciences, together with innovations in genomics and proteomics, can play an important role in the validation of these therapies. The Western scientific community primarily considers traditional medicines with caution and underlines concerns related to research, development and quality<sup>17</sup>.

Also, herbal medicine has been used in India for thousands of years and is increasingly used worldwide in recent decades, as evidenced by the rapid growth of global and national markets for herbal medicines. The world pharmaceutical market was worth USD \$ 550 billion in 2004 and USD \$ 900 billion in 2009. According to WHO estimates, the demand in 2009 for medicinal plants was approximately USD \$ 14 billion and for the year 2050 is expected to be USD \$ 5 billion. Due to the high prices and harmful side effects of synthetic drugs, people rely more on medicinal herbs and this trend is growing, not only in developing countries but also in developed countries<sup>18</sup>. In addition, according to WHO, between 65% and 80% of populations in developing countries currently use medicinal plants as remedies. The development of new natural resource products is also encouraged because it is estimated that of the 300,000 species of plants that exist in the world, only 15% have been evaluated to determine their pharmacological potential<sup>19</sup>.

#### **Conservation methods:**

The conservation of plant genetic resources involves two basic strategies, *in situ* and *ex situ*:

***In situ conservation:*** It is the preservation of different species of plants within their own ecosystem. This strategy has the potential to conserve wild species of the same family of plants, their traditional crops and allows the natural forces of evolution to play their part in generating greater variability for natural selection. It allows genetic changes largely resulting in new plants. Literally “in place”, for example, conservation in natural habitat, biosphere reserves, national parks, farm conservation, home gardens, among other methods<sup>20,21</sup>.

***Ex situ conservation:*** Refers to when the conservation of the plant is attempted outside or far from its natural habitat, such as seed storage in gene banks, cryogenic preservation (in liquid nitrogen from -165°C to -196°C) of seeds, pollen, bud tips, etc., tissue culture, DNA conservation at -20°C, Botanical garden, gene bank<sup>20,21</sup>.

#### **Standardization of Medicinal plants:**

The use of herbal medicines continues to expand rapidly throughout the world. Authentication and standardization are previous steps when considering source materials for herbal formulation in any medicine system. In traditional medical systems, medications are mainly dispensed as decoction of water or ethanol extract. Fresh parts of the plant, juice or raw powders are a rarity rather than a rule. Therefore, parts of medicinal plants must be authentic and free of harmful materials such as pesticides, heavy metals, microbial or radioactive contamination, etc. It is very important that a standardization system be established for each plant medicine on the market because the possibility of variation in different batches of medicine are huge. WHO continuously emphasizes ensuring quality control of medicinal plant products using the modern techniques and application of appropriate standards. The increasing use

of botanical products by the public is forcing measures to evaluate the health claims of these agents and develop quality and manufacturing standards. Several systems of traditional medicine, especially the Indian medicine system attracted worldwide attention due to its long historical clinical use and its reliable therapeutic efficacy.<sup>22</sup>

Most herbal products in today's market have not undergone a drug approval process to prove their safety and effectiveness. Some of them contain mercury, lead, arsenic and corticosteroids and poisonous organic substances in harmful amounts. Liver failure and even death have been reported after ingestion of medicinal herbs. Most of the ayurvedic formulations available in the market are spurious, adulterated or mislabelled. Therefore, it is essential to establish quality standards for use as medicines and as a raw material for the preparation of other pharmaceutical products. Without quality control, there is no guarantee that the herb contained in the bottle will be the same as indicated on the outside. Quality standards for some plants are available in several herbal and Ayurvedic pharmacopoeias, but due to the diversity and the large number of plant species, numerous plants have not been included in the pharmacopoeia, which lacks appropriate methodologies for standardization. Therefore, the standardization of a raw drug is an integral part of establishing its correct identity. The standardization of herbal medicines is gaining momentum in India and, as a result, it is also proposed to include safety parameters according to international standards. The standardization of medicinal plants means the approval of the quality and identity of that medicinal plant that does not contain adulteration or contamination that

can reduce the efficiency of its medicinal abilities<sup>23</sup>.

WHO has also provided guidelines for clinical research of traditional medicines that consider both efficacy and safety and is performed for Good Clinical Practices:

- Quality control of medication material, in this case, vegetables and finished products.
- Stability assessment and shelf life.
- Evaluation of medication safety through toxicological studies.
- Evaluation of effectiveness through evaluations of ethnomedical information and biological activity. The bioactive extract should be standardized based on active ingredients or main compounds together with the chromatographic fingerprints (TLC, HPTLC, HPLC and GC)<sup>23</sup>.

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