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RELEVANCE OF PLANT INVESTIGATORY METHODS

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ABSTRACT

Plants are indispensible to man for his life. Nature has provided a complete store house of remedies to cure all ailments of mankind. One of the major problems faced by user industry is non availability of quality control profiles for herbal raw materials and their formulations leading to adulterant and substitutes. With the advent of new analytical tools and sophisticated instrumental technology, it is possible to suggest a practical quality control profiles for a crude drug. The crude medicinal plant can be identified and standardized on the basis of their morphological, histological, physico-chemical and biological parameters. This review paper highlights the plant investigatory methods and their applicability in *Ayurvedic* drugs.

Keywords: Ayurveda, *plant investigatory methods, analytical, histological, pharmacognosy*

INTRODUCTION

In the past, almost all medicines were obtained from the plants, the plant being man's only chemist for ages. Today, a vast store of knowledge concerning therapeutic properties of different plants has accumulated.[1] Chemistry of the plant is as divergent as the great variety of forms in which plant occur. The quality control of herbal crude drugs and their bioconstituents is of paramount importance in justifying acceptability in modern system of medicine.[2] considering the employ and export of *Ayurvedic* drugs, the Government of India has specified the rules and regulation related to standardization of drugs. In the year 2000, Government has issued good manufacturing practices (GMP) specifying authentic, contamination-free genuine raw materials and manufacturing process to ensure the product with desired quality standards[3]. Increased demand and lack of availability of potent drugs, exploration of new drug substitutes, detection of adulterants, analyzing influence of climatic and regional variation and even drug processing and storage methods have compelled to use the modern investigative methods. By using advanced separation techniques and sophisticated instrumental analysis, both qualitative and quantitative physico-chemical evaluation could be done.[4]

ANCIENT PLANT INVESTIGATORY METHODS

In ancient period, people had their own drug testing protocol for both identification as well as for testing the efficacy of the drug, they are as follows, first and foremost is, *prakruti*[5] *(*nature) it refers to plant morphology like *chakralakshnika* is the specific diagnostic feature of *Guduchi* (*Tinospora cordifolia* Willd. Miers).[6], *guna*[7] (quality) of the drug for example *Sheetamula* is the synonym of *usheera (Vetiveria zizanoides*

Linn. Nash) [8], here *sheeta* means *sheeta* quality of the drug, *prabhava* (special action) like *kushtagn (cures skin disease)* action of *Kadhira (Acacia catechu* Linn.f. Willd)[9], *deshajata* (place of collection) of plants[10], *Charaka* in *paraaparadi guna* context, explained plant collected from *jangala pradesh (desert)* will be more potent compared to *anupa desha (marshy)*[11], *ruthau jata and gruhita* (time of collection) of plant materials[12], for example *flower and fruit* should be collected in their particular *ruthu* (season), root should be collected during *shishira (*janu- mar*) and grishma (*may-july*) ruthu*[13], after assessing the plant material with these investigative methods and if given in proper *maatra* (dose) in priorly examined patient, it does dosha *apakarshana (*elimination*) and upashamana (*pacifies*).* This shows that these ancient methods not only help in identification but also assess the efficacy of plant material[14].

In olden days *Vaidya* (physician) himself used to collect the drug for treating his patient hence quality and efficacy was ensured. But now the scenario has completely changed because most physicians are dependent on pharmaceutical company, here question arises about its quality, purity and efficacy. Hence there is a need for investigatory methods like morphological, histological, physico-chemical and biological parameters which can be utilized for identification and standardization of medicinal plants.

MORPHOLOGICAL AND ORGANOLEPTIC EVALUATION

It is a technique of qualitative evaluation based on the study of morphological features and sensory profile of the whole drugs.[15] For example *Lodra (symplocas racemosa* Roxb) *and Kutaja (Holarrhena antidysentrica* Roth) bark should be identified with the following morphological features, *Lodra (symplocas racemosa* Roxb) bark has channeled or curved pieces thickness up to 1cm, outer surface is uneven and rough, grayish brown to grey externally, pale to whitish brown internally. *Kutaja (Holarrhena antidysentrica* Roth) bark has Small recurved pieces of varying sizes and thickness, outer surface buff to brownish and longitudinally wrinkled bearing horizontal lenticels. Inner surface brownish and rough.[16]

Shatavari (Asparagus racemosus Willd.*)* has following organoleptic characteristics, root silvery white or ash coloured externally and white internally, odour nothing specific, starchy, slightly bitter followed by sweet taste, spindle shape. They help in identification and standardization of crude drugs. Similarly such specific morphological and organoleptic features can be utilized for differentiating adulterents.[17]

MICROSCOPIC EVALUATION

It is detailed examination of the drug by their known histological characteristics. Histological studies are made from very thin sections of drugs. The characteristics of cell walls, cell contents, starch grains, calcium oxalate crystals, trichomes, fibers, vessels, etc. can be studied in detail, e.g. lignified trichomes in nux-vomica, warty trichomes in senna. The powdered cloves do not contain sclereids or calcium oxalate crystals, but both of them are present in powdered clove stalks. Presence of non-lignified vessels in ginger powder indicates adulteration. The diameter of starch grain in *Cinnamomum cassia* is 10 microns and hence, useful for detecting adulterants.[18]

PHYSICAL EVALUATION

Physical evaluation are as follows moisture content, viscosity, melting point, solubility, refractive index, ash values and extractives, volatile oil content and foreign organic matter. Detection of moisture content helps to prevent decomposition of crude drugs either due to chemical change or microbial contamination. Viscosity is a means for standardizing the liquid drugs like *Ghritha* (ghee), *Taila*(oil), *Madhu* (honey) and is constant at a given temperature and index of its composition. Melting point is a parameter to judge the purity of crude drugs. For pure phytochemicals it is accurate and constant and for crude drugs is given in a range. Solubility identifies the presence of adulterant in a drug. Refractive index is a standard parameter for oils and solvents and is a means for identification and purity of a substance. Ash values represents inorganic salts, naturally occurring in drug or adhering to it or deliberately added to it as a form of adulteration, it's a criterion to judge the identity and purity of the crude drugs. Acid insoluble ash determines adhering dirt and sand. Water soluble extractive determines the water soluble active constituents of crude drugs such as tannins, sugar, glycosides etc. Alcohol soluble extractive determines the alcohol soluble active constituents of crude drugs like resins etc. Volatile content is a means to standardize aromatic drug. Foreign organic matter, if it exceeds the limit, deterioration in the quality of drug takes place. Chromatographic technique helps for identification of the crude drugs and detection of adulterants and substitutes, separation of complex mixtures of phytoconstitutents, for quantitative analysis of drugs. Spectrophometric are used for , detection of drug components in a compound drug, standardization of herbal drugs and compound drugs, the quantitative analysis of alkaloids, quinine and strychnine etc, the identification of the drugs and raw materials used in pharmaceutical industry, determination of impurities and minor components in the mixture.[19]

CHEMICAL EVALUATION

Qualitative tests for the identification of various active constituents using various chemical reagents which are specific to active principles are namely, detection of alkaloids, carbohydrates and glycosides, phytosterols, fixed oils and fats, saponins, phenolic compounds and tannins, proteins and free amino acid, gums and mucilage and volatile oils.[20]

Ex. Presence of standard amount of volatile oil in *Lavanga (Syzygium aromaticum* Linn M&P*)* (not less than 15.0 %w/w) shows its quality and purity, if less volatile oil, the sample may be adulterated with exhausted cloves.[21] Similarly *Asoka (Saraca indica* Linn) must contain 6% tannins[22], 5-9% alkaloid piperin and 1-2.5% volatile oil in *Maricha (Piper nigrum* Linn) [23] and 0.04-1 % Punarnavine alkaloid in *Punarnava (Boerhaavia diffusa* Linn).[24]

It gives chemical profile of a crude drugs and also helps in identification of crude drugs and detection of adulteration through evaluation of active principle.[25]

BIOLOGICAL EVALUATION

Estimation of potency of crude drugs on living organisms like animal tissue or entire animal is known as *bioassay*. It is carried out, when the standardization is not adequately done by physical and chemical means. It confirms the therapeutic activity of raw material and finished product. Some of the activities analyzed are, hepatoprotective

activity, hypoglycemic activity, antipyretic testing, anti-inflammatory activity, neuropharmacological activity.[26]

DISCUSSION

Various investigatory methods carry their own importance in analyzing the identity, quality and purity of crude drugs, differentiating the adulterant and substitutes from genuine sample, for standardization of the known and new medicinal plant and for exploring new substitute for endangered species.

In one of the study, pharmacognostic and phytochemical analysis of different market samples of *Asoka (Saraca indica* Linn*)* were analyzed to screen the genuinity of the samples by subjecting to pharmacognostic and phytochemical and found that None of the market samples were derived from the Genuine *Ashoka (Saraca indica* Linn*)* and this shows that *Ashoka (Saraca indica* Linn*)* has been adulterated or substituted with other similar botanical sources.[27]

In another study, pharmacognostic standardization; physico-and phytochemical evaluation of the roots of *Amaranthus spinosus* Linn. Root was carried out, to determine its macro-and microscopical characters of root and root powder, physic-chemical evaluations, preliminary phytochemical screening and thin layer chromatography (TLC). These findings were useful to supplement information with regard to its identification parameters, and acceptability of herbal drugs, in the present scenario, which lacks regulatory laws to control the quality of herbal drugs.[28]

Pharmacognostical evaluation of *Barringtonia acutangula* Gaertn. leaf was carried out to investigate the physico-chemical, morphological, histological and high performance-thin layer chromatographic (HPTLC) profile; such studies help to propose the parameter to establish authenticity of *B.acutangula* Gaertn and even differentiate the drug from its other species and will assist in standardization viz., quality, purity and sample identification.[29]

Pharmacognostic evaluation of leaves of certain Phyllanthus species used as a botanical sources of *Bhumyamalaki (Phyllanthus niruri* Sensu Hook. f.*)* in *Ayurveda*, different species of Phyllanthus were subjected to simple microscopic observations. Such simple micro techniques identified accurately the different species of Phyllanthus.[30]

Various investigatory methods carry their own importance in analyzing the crude drug; still they are seen overpowering the other. Like morphological evaluation does identification of crude drug, where as microscopic evaluation is more specific compared to the morphological evaluation because it confirms of drug through histological characters. Compared to the above investigation, physico-chemical evaluation is more advanced since it gives both identification and quantification of active principle in a single and compound formulations and the biological evaluation confirms the therapeutic activity which is of clinical importance.

Plant materials are used throughout developed and developing countries for various purposes, which represent a substantial proportion of the global drug market. This resulted in increased demand, decreased availability, which compelled the manufacturers to add adulterants. It is therefore essential to establish internationally recognized guidelines for assessing their quality. The World Health Assembly - in resolutions

WHA31.33 (1978), WHA40.33 (1987) and WHA42.43 (1989) has emphasized the need to ensure the quality of medicinal plant products by using modern control techniques and applying suitable standards.[31] hence appropriately adopting the modern evaluation techniques in Ayurveda will ensure genuinity, purity of crude drugs and formulations. This will in better therapeutic effect.

CONCLUSION

Over the years the nature and degree of crude drug evaluation has undergone a systematic change. The crude drug can be identified and standardized on the basis of their morphological, histological, physico-chemical and biological studies. To ensure identity and purity of both natural as well as market samples to be used in therapeutics, adopting these modern techniques of drug evaluation is indeed essential.

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