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REVIEW ARTICLE

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Medicinal Plants in Modern Drug Discovery: A Review

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ABSTRACT

Today, research in drug discovery from medicinal plants involves combining phytochemistry, biological, and molecular techniques. Plant metabolite compounds have been an active source for the discovery of new drugs due to their chemical variations. Discovery of various drugs from medicinal plants continues to provide leads against various pharmacological targets, including cancer, HIV/AIDS, malaria, pain, diabetes, etc. In the present era, plant bioactive compounds remain a source for the discovery of new drugs.

Keywords: Medicinal plants, Natural products, Phytochemicals, Cancer, Malaria, Ethnopharmacology.

INTRODUCTION

Natural plant products have been utilized as medicine for thousands of years (Samuelsson, 2004). The World Health Organization has estimated that 80% of the inhabitants of the world rely mainly on traditional plants for their primary health care needs and it may be presumed that a major part of traditional healing involves the use of plant extracts or their active principles. Medicinal plants have been traditionally used for different kinds of infection diseases (Chitravadivu *et al.*, 2009). In more recent history, the use of plants as medicine involved isolation of active compound, beginning with the isolation of morphine from the opium in the early 19th century (Kinghorn, 2004; Samuelsson, 2004).

Drug discovery from medicinal plants has evolved to include the enquiry of bioactive compounds. Bioactive compound in plants defined as secondary metabolites eliciting pharmacological effects in man and human health (Nasim *et al.*, 2022). Today, secondary compounds are used in drug discovery due to their chemical diversity. Different secondary compounds have isolated from several medicinal plants, e.g. Alkaloids, Phenolics, Glycosides, Terpene etc. These compounds are having potent therapeutic applications against pathogen including virus, bacteria, fungus and protozoa (Singh *et al.*, 2025).

Molecular biology has become essential part of the drug discovery through identification of appropriate screening assays directed towards molecular targets. The American Society of Pharmacognosy refers to pharmacognosy as “the study of the physical, chemical, biochemical and biological properties of drugs, drug substances, or potential drugs or drug

substances of natural origin as well as the search for new drugs from natural sources". Pharmacognosy is an important broad area of drug discovery from medicinal plants. Pharmacognosy involves the broad study of natural products, including herbal remedies (Tyler, 1999). This article focused on a review on importance of medicinal plants in drug discovery.

Drug discovery from Medicinal Plants

Numerous methods have been utilized to acquire compounds for drug discovery includes isolation of bioactive compounds, synthetic chemistry, molecular modeling (Ley & Baxendale, 2002). Medicinal plants are huge source of new drugs, new drugs lead and new chemical entities (Newman *et al.*, 2000). Several medicinal plants derived drug have been introduced in the market.

Anti-malarial Drug

A number of medicinal plants have been introduced in the treatment of malaria. Antimalarial compound has been isolated from *Selaginella bryopteris* which have been reported for their anti- protozoal activity *in-vitro* against K1 strain of *Plasmodium falciferum* (Kunert *et al.*, 2008).

Arteether (trade name Artemotil®) is a potent anti-malarial drug and is isolated from *Artemisia annua*, a plant traditional used in Chinese medicine (Agtmael *et al.*, 1999).

Anti-diabetic Drug

Diabetes is most widespread metabolic diseases and those effects all over the world. Several remedies are used for the treatment of diabetes. Diabecon® (Trade name) is a drug and has been isolated from *Eugenia jambolena*, which is used as anti-diabetic drug. *Gymnema sylvestre* (gurmar), is another plant has been used for the diabetic treatment (Harvey, 2008).

Anti-HIV Drug

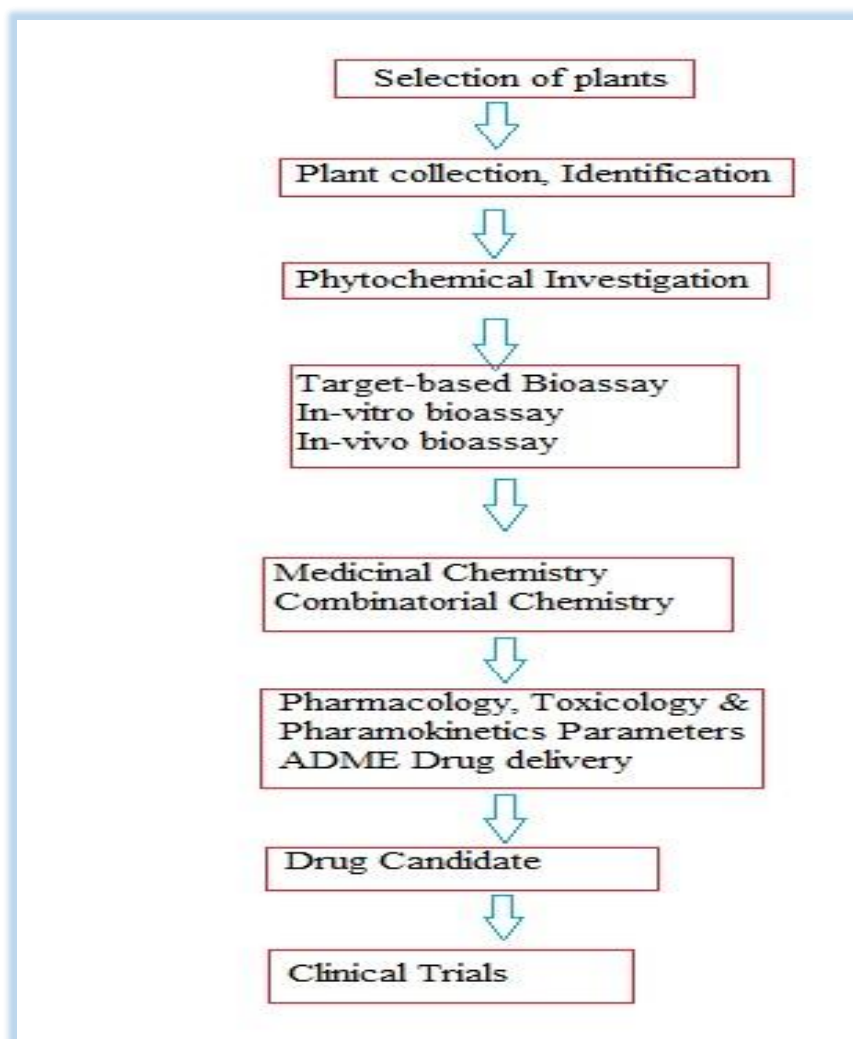
HIV is leading cause of death and the disease increases day by day. Several natural compounds particularly alkaloids, phenol, terpenoids has shown promising anti-HIV activity. Calanolide A is adipyranocoumarin natural products isolated from *Calophyllum lanigerum*. Calanolide is anti-HIV drug with a unique and specific mechanism of action as a non-nucleoside reverse transcriptase inhibitor (NNRTI) of type-1 HIV and effective against AZT resistant strains of HIV (Currens *et al.*, 1996, Buckheit *et al.*, 1999)

Anti-Cancerous Drug

Cancer is one of the leading causes of death. There are several medicines available in the market to treat various types of cancer but no drug is found to be fully effective and safe (Atanasov *et al.*, 2021) Many natural products and plant derived products have been identified with potent anti-cancer property. The first agents introduced in clinical use were vinca alkaloids, vinblastine and vincristine, isolated from the *Catharanthus roseus* G.Don. Scientists were noticed that plant extracts reduced significantly white blood cells count and also caused bone marrow depression in rats (Gueritte *et al.*, 2005). Taxol is another natural product isolated from *Taxus brevifolia* Nutt. Taxol is used as chemotherapeutic drug (Kingston *et al.*, 2005).

Achyranthes aspera linn. is a commonly found herb throughout India. The methanol extract of *Achyranthes aspera*, its alkaloids, non-alkaloids and saponin fraction has been exhibited

significant inhibitory effects on Epstein Barr Virus early antigen activation induced by the carcinogen 12-O-tetradecanoylphorbol-13-acetate in Raji cells (at a concentration of 100 μ g) [Bhoomika *et al.*, 2007].



Schematic of typical medicinal plant drug discovery and development (Wang *et al.*, 2024)

Anti-Inflammatory Drug

Inflammation is a complex vascular response of vascular tissue to harmful stimuli, irritants characterized by redness, swelling and pain. Inflammation is either acute or chronic inflammation. Cyclooxygenase (COX) is the key enzyme which involved in inflammation pain. Shaikh *et al.*, 2015 reported that the extracts of *Terminalia chebula* and *Terminalia bellarica* showed promising COX-2 inhibition activity by using carrageenan and phorbol myristate acetate induced mice edema animal model (Nasim *et al.*, 2022)

Steps in Drug discovery from Medicinal Plants

The process of drug discovery has been estimated to take an average of 10 years upwards (Reichert, 2003) and cost more than 800 million dollars (Dickson and Gagnon, 2004). Drug discovery from medicinal plants has traditionally been lengthier and more complex than other drug discovery methods. Medicinal plants identification is the first step of drug development process. Then optimization (involving medicinal & combinatorial chemistry),

development (including pharmacology, toxicology, pharmacokinetics, ADME [Absorption, Distribution, Metabolism and excretion and drug delivery, and clinical trials all take a considerable length of time (Wang et al., 2024).

CONCLUSION

A number of drugs have been discovered from medicinal plant. Natural bioactive compounds isolated from medicinal plants can be an effective source in the discovery of new drug. Today, researchers are finding different chemical compounds which may have potential to discovery of new drugs. There is also need to develop semi-synthetic modification to get better lead compounds from the natural products.

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