

CHAPTER

2

HERBAL KNOWLEDGE IN MODERN THERAPEUTICS AND CONSERVATION

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2.1 INTRODUCTION TO MEDICINAL PLANTS

Plants are widely recognized as an important component of the world's biodiversity. They play a pivotal role as an attractive source of new therapeutic agents due to the high structural diversity found in hundreds of thousands of species, including flowering plants, conifers, bryophytes and ferns. The current estimate of the total diversity of land plants is approximately 400,000 identified species, including 369,434 flowering plants, mostly of which are found in the tropical rainforest, the richest terrestrial ecosystem on the earth (Brummitt et al., 2021). This region is known as the home of many fascinating medicinal plant species.

Since ancient times, mankind has used natural products such as plants, animals, and microorganisms as sources of medicine and food. Medicinal plant applications have been recorded since early human history based on sophisticated traditional systems from great civilizations, such as Mesopotamia, Egypt, China, India, Greeks, and Romans. During these periods until the end of the 17th century, medicinal plants were applied on an empirical basis, without mechanistic knowledge of the pharmacological

activities of bioactive constituents. It was only in the 18th century that Anton von Störck, an Austrian physician who investigated poisonous plants such as Aconite and Colchicum, and William Withering, an English physician studied foxglove for the treatment of edema. Building on their investigations, a foundation is established for the rational clinical study of medicinal plants.

In Malaysia and Southeast Asia, medicinal plants play an important role in the cultural and healthcare traditions. The rich biodiversity of the region rainforest integrated with indigenous knowledge has developed natural herbal remedies for generations. Communities such as Malay, Chinese, Indian, and various minorities of indigenous groups, continue to rely on medicinal plants for treating common ailments, enhancing well-being, and supporting traditional health practices. Many of these plants have also attracted significant scientific interest for their bioactive compounds, which contribute to modern therapeutic potential. As global demand for natural products continues to grow rapidly, the conservation and sustainable use of Southeast Asian medicinal plants have become the key priority for future generations.

2.2 NATURAL PLANTS FOR DRUG DISCOVERY

Ethnobotany studies have played a key role in drug discovery, especially for the treatment of cancer, infectious diseases and other therapeutic applications, including cardiovascular diseases. Approximately, 10% of plant biodiversity has been assessed for its bioactive potential. Hence, there is still a considerable number of plant species available for investigation. In the past few decades, interest in medicine plants has increased considerably among scientists due to the diverse multidimensional nature of secondary metabolites ranging from simple structures to highly complex molecules with novel modes of action. The wide range of metabolites provides an attractive platform for pharmaceutical industry to discover new molecular entries with therapeutic applications.

Consequently, the discovery of modern drugs has increased significantly in recent years. Approximately, 49% of the total molecules

approved from 1981 to September 2019 are natural products or plant derived compounds. Impressively, 67% (809 of 1,205) of the new chemical entities (NCEs) registered were either natural or products derived from natural products. This number will continue to rise as numerous natural products are being extensively studied in the developmental stages of clinical investigation (Phases I–III). The trend indicates that natural products significantly influence the process and development of drug discovery. Therefore, tremendous global attention has focused on bioactive compounds derived from natural products (Newman & Cragg, 2020).

Plants have been a primary source of many pharmaceutical agents and cosmetic products throughout history. Often novel drug entities are developed from traditional medicinal plants, followed by synthetic modifications to improve bioavailability and minimize the side effects. For example, the isolation of the well-known anticancer drug paclitaxel (Taxol) from the bark of the Pacific yew tree, *Taxus brevifolia* (family Taxaceae) was reported in the 1960s. Paclitaxel which contains a tricyclic diterpenoid moiety, is the most well-known example of an important natural product with significant medicinal value. Quinine is the oldest antimalarial agent derived from the bark of *Cinchona officinalis*. It exhibits specific toxicity against *Plasmodium* and has fever-reducing activity. In the decades following its discoveries, another antimalarial drug, artemisinin was found from the plant *Artemisia annua*. Artemisinin possesses rapid action to swiftly reduce the amount of *Plasmodium* parasites in blood patients with malaria. There are many other significant drugs developed from traditional medicinal plants. Atropine is an artefact of the tropane alkaloid (–)-hyoscyamine, which racemizes from its original plant, *Atropa belladonna*, during the extraction process. Atropine is used as a mydriatic agent in ophthalmology and has other medicinal uses, including an antispasmodic and intravenous drug during anaesthesia. Other drugs used in clinical medicine are morphine and galantamine. Morphine is one of the oldest medications naturally derived from the poppy plant, *Papaver somniferum*, used to treat acute and severe chronic pain and is considered the gold standard of analgesics. At the same time, galantamine was discovered