

Apocynaceae Plants: Ethnobotany, Phytochemistry, Bioactivity and Biotechnological Advances – Book Review

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Book Review

A review of Maheshwari VL, Patil MP, Patil RH. 2023. Apocynaceae Plants: Ethnobotany, Phytochemistry, Bioactivity and Biotechnological Advances. Springer, Singapore. pp 263. EUR €117.69 (eBook), ISBN 978-981-99-5406-3 (eBook).

As revealed in *Apocynaceae* Plants: Ethnobotany, Phytochemistry, Bioactivity and Biotechnological Advances, edited by Ravindra H. Patil, Mohini P. Patil, and Vijay L. Maheshwari (2023), the book presents the latest research on the *Apocynaceae* plant family, with a specific focus on ethnobotanical uses, phytochemistry, and bioactive compounds. The application of the plants is significant, given that they have been used widely for medicinal purposes and have potential use as drugs. With the increasing demand for novel bioactive molecules, this book is a valuable resource for researchers in medicinal chemistry, pharmacology, and biotechnology.

The work synthesizes taxonomic, secondary metabolite profile, and biotechnological cutting-edge knowledge to provide a comprehensive view of the utilization of the *Apocynaceae* family in medicine and industry. The early chapters discuss morphology, ecological distribution, and traditional information regarding these plants and their cultural and historical importance. The other chapters detail the phytochemical constituents, including alkaloids, flavonoids, and terpenoids, for the pharmacological properties of the species. In addition, the book reveals novel extraction techniques, spectroscopic identification methods, and their applications in drug discovery. The book also discusses the biological activities of *Apocynaceae* family members, such as antioxidant, anti-inflammatory, and cytotoxic activities. The final sections discuss the agricultural and industrial uses of these plants, including their pesticidal activities, enzyme inhibitors, and application in nanotechnology. By connecting ethnobotanical information with contemporary scientific techniques, this book highlights the importance of *Apocynaceae* plants in medicine, agriculture, and biotechnology.

The authors highlight, in chapter one, the significance of the family *Apocynaceae* in ecosystems due to its wide distribution and abundant morphology that varies from shrubs and trees to herbaceous plants. Pioneering genera such as *Catharanthus*, *Rauvolfia*, and *Nerium* are renowned for their medicinal uses, particularly the presence of alkaloids and cardiac glycosides. However, most species are vulnerable to habitat loss, taxonomic classification, and conservation efforts. The authors stressed the need for a multidisciplinary approach integrating ethnobotany, phytochemistry, and pharmacology to fully exploit the potential of the *Apocynaceae* plants for medicine and industry. Using sustainable cultivation and collaborative research, species such as Catharanthus roseus are good prospects for pharmaceutical discoveries. The ecological, medicinal, and economic value of *Apocynaceae* species validates the need for further scientific research and conservation activities. To optimize their bioactive potential, conservation of habitat and protection of traditional knowledge are required. Chapter 2 explores the ethnomedicinal importance and traditional knowledge regarding *Apocynaceae* plants and explains their usage in Ayurveda, Siddha, and Unani medicine. The high contents of bioactive compounds, e.g., alkaloids and cardiac glycosides, of the plants make them valuable, with them being employed in traditional medication for controlling hypertension, gastrointestinal illness, and infection. Examples include *Rauvolfia serpentina* and *Catharanthus roseus*, which have immense utility by virtue of being medicinally significant. The chapter is directed towards the integration of indigenous knowledge and modern scientific studies to authenticate and enhance the medicinal potential of members of *Apocynaceae* for drug development and sustainable healthcare approaches.

Chapter 3 emphasizes the significance of planting secondary metabolites as a vital source for new drug development in the face of rising multidrug-resistant pathogens and non-communicable diseases. The chapter highlights the growing demand for bioactive phytochemicals, stressing their structural diversity and pharmaceutical potential. The chapter discusses various natural reservoirs, including soil, sea, and microbial populations, as sources of new metabolites. It also addresses the need for continued investigation of secondary metabolites in efforts to address global health issues such as tuberculosis, cancer, and cardiovascular disease.

Chapter 4 presents the isolation and extraction of secondary metabolites from *Apocynaceae* plants, along with explanations of some procedures for obtaining bioactive compounds. The chapter provides a summary of the processes involved in harvesting plant material, solvent extraction, and bioassay-guided fractionation in the isolation of active metabolites. The chapter also discusses the advantages of different methods of extraction, including Soxhlet extraction, maceration, and digestion, citing their efficiency in preserving the bioactivity of plant compounds. This section emphasizes the need for optimizing extraction processes to achieve maximum yield and quality of medicinally valuable secondary metabolites.

Chapter 5 discusses phytochemical screening and the chemical characterization of bioactive plant metabolites from the family *Apocynaceae*. It details preliminary and specific tests for the identification of primary and secondary metabolites, such as alkaloids, flavonoids, glycosides, steroids, and tannins, by chemical and chromatographic tests. Thin-layer chromatography (TLC), high-performance liquid chromatography (HPLC), gas chromatography (GC), and mass spectrometry (MS) are elaborated for the identification and estimation of these compounds. The chapter highlights the role of phytochemical screening in the identification of bioactive compounds of therapeutic significance.

Chapter 6 is concerned with the identification of bioactive secondary metabolites of plants from the *Apocynaceae* family using advanced analytical techniques. The chapter focuses on the application of ultraviolet-visible (UV-Vis) spectroscopy, Fourier transform infrared (FT-IR) spectroscopy, nuclear magnetic resonance (NMR) spectroscopy, and mass spectrometry (MS) for the structural elucidation of these metabolites. Additionally, the chapter explores the use of hyphenated techniques, such as gas chromatography-mass spectrometry (GC-MS), for the structural elucidation of plant metabolites. These methods are significant in establishing functional groups, molecular structure, and pharmacologically active components of the *Apocynaceae* family.

Chapter 7 examines the phytochemistry of members of the family *Apocynaceae* and their diverse secondary metabolites, including alkaloids, flavonoids, terpenes, glycosides, and sterols. These bioactive metabolites are significant for medicinal purposes, contributing to the pharmacological importance of the family. The chapter discusses various phytochemical screening procedures and the structural diversity of these metabolites, highlighting their significance in traditional medicine.

Chapter 8 emphasizes the biological and pharmacological effects of *Apocynaceae* species, including antioxidant, antiinflammatory, anticancer, cardioprotective, antidiabetic, and antimalarial properties. These biological activities are caused by the presence of potent phytochemicals, which are under investigation as potential therapeutic drugs. The chapter emphasizes the significance of further pharmacological studies of *Apocynaceae* species as a source for developing new effective therapies.

Chapter 9 examines the agricultural importance of *Apocynaceae* plants, particularly their insecticidal potency. The chapter deals with the impact of insect pests on agricultural production and the need for ecologically friendly approaches to controlling pest insects. The chapter concentrates on *Apocynaceae* biopesticides, such as *Calotropis procera*, that are highly insecticidal, larvicidal, and antiparasitic. The chapter emphasizes the role of secondary metabolites from plants in managing pests and advocates for the integration of botanical pesticides into modern agriculture.

Ethnobotany Research and Applications

Chapter 10 highlights plant tissue culture-based approaches towards the production of pharmaceutically valuable bioactive compounds from plants of the family *Apocynaceae*. The chapter discusses approaches such as callus and cell suspension cultures, which aid in the mass production of secondary metabolites with medicinal values. The chapter also introduces in vitro propagation and Agrobacterium-mediated transformation as means of enhancing metabolite yield. Through the utilization of biotechnological procedures, this approach offers an environmentally friendly solution to traditional plant extraction and the protection of medicinally important *Apocynaceae* species.

Chapter 11 discusses the presence of enzymes and enzyme inhibitors in plants of the family *Apocynaceae* and their industrial and biomedical importance. It elaborates on various enzymes like proteases, amylases, and lipases and their applications in digestion, metabolism, and biotechnology. It also discusses enzyme inhibitors, such as α -glucosidase inhibitors for the management of diabetes and α -amylase inhibitors for pest control. It also emphasizes the therapeutic applications of these bioactive molecules, particularly in drug development and disease management

Chapter 12 is solely for endophytes of *Apocynaceae* plants and describes how they are symbiotic with their host plants and can develop plant growth and stress resistance. It describes how endophytic fungi and bacteria contribute to plant health by phytohormone production, nutrient uptake, and pathogen defense. The chapter also describes the future potential of endophytes in biotechnology, particularly in the synthesis of antimicrobial, antioxidant, and anticancer metabolites

Chapter 13 discusses micropropagation-based conservation strategies of *Apocynaceae* plants, emphasizing the role of vitro propagation in the conservation of endangered species. It discusses the advantages of micropropagation, which include mass cultivation of plants, production of pathogen-free plants, and gene conservation. The chapter discusses different methodologies, including shoot tip culture, somatic embryogenesis, and meristem culture, for preserving genetic diversity and facilitating sustainable use of medicinally important *Apocynaceae* species

The lats chapter explains the various applications of *Apocynaceae* plants in nanotechnology, and in the biosynthesis of nanoparticles. It describes several processes of nanoparticle synthesis by physical, chemical, and biological methods, but with focus on plant-mediated synthesis. The chapter discusses the application of *Apocynaceae* nanoparticles in medicine, based on their antioxidant, anticancer, and antimicrobial activity, as well as their biosensing and catalytic potential

A thorough and reflective exploration of where traditional knowledge and modern science converge is outlined in this book. It discusses the ethnobotany, phytochemistry, and pharmacology of the *Apocynaceae* plants and addresses such significant issues as conservation issues and sustainable resource utilization. By highlighting the medicinal, ecological, and industrial applications of such plants, the book offers a wealth of information for scientists, students, and researchers in ethnobotany, biotechnology, and pharmacology. Conveying the importance of preserving biodiversity and synergizing traditional knowledge with modern-day scientific abilities, the book encourages sustainable strategies for medicine, agriculture, and biotechnological research.

Literature Cited

Maheshwari VL, Patil MP, Patil RH. 2023. Apocynaceae Plants: Ethnobotany, Phytochemistry, Bioactivity and Biotechnological Advances. Springer, Singapore.