


Phytoecdysteroids

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Phytoecdysteroids

Properties, Biological Activity
and Applications

 Springer

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Preface

Ecdysteroids are one of the most widespread steroid compounds in nature. They were found in more than 90% of the world's animal species, named after arthropods, the species number of which reaches 1 million, as well as in some other invertebrates. In 1966, K. Nakanishi and his colleagues discovered ecdysteroids for the first time in the plant *Podocarpus nakaii*, which is very popular in oriental medicine. The presence of ecdysteroids was later discovered in many types of plants, including flowering ones.

The role of these compounds in organisms of lower animals, where as hormones they regulate a number of extremely important vital processes, is well known. For assessing the role of ecdysteroids in the vital activity of plants, one should bear in mind the close ecological interconnection and interdependence between the world of plants and insects. Unlike plants, most invertebrates do not have an enzyme apparatus for the complete synthesis of steroids. Plants supply a necessary material for building cell membranes and insect hormones in the form of sterols.

Ecdysteroids secreted from plants (phytoecdysteroids) being in most cases hormones for arthropods, they are not for warm-blooded ones. However, they were able to regulate many physiological processes in their bodies. In this case, phytoecdysteroids do not have toxic or any other side effects. It was found that beneficial shifts occurring under the influence of phytoecdysteroids in the mammalian organisms are accompanied by a noticeable improvement in their functional status, which is manifested by activation of the central nervous system, followed by increased efficiency, and increased adaptive capabilities of the body to environmental stressors.

Ecdysteroids in both animal and plants world play an extremely important role in the regulation of vital processes in their organisms, despite the fact that they are far from each other in evolutionary terms. This circumstance led to a significant interest in scientific research and important results were obtained that have both fundamental theoretical and practical significance.

In recent years, in the field of chemistry and pharmacology of plant steroids, most of the work is devoted specifically to phytoecdysteroids, as the most original and promising group of compounds with metabolic activity. Many research

institutions are conducting active research in this direction. The largest number of works in the field of ecdysteroid chemistry is devoted to their study both in terms of establishing the structures of newly isolated compounds and in terms of identifying promising plants producing ecdysteroids for use in medicine, cosmetology, the food industry, and agriculture (Scientists—V. V. Volodin, Institute of Biology, Komi Scientific Center of the Ural Branch of the Russian Academy of Sciences, Syktyvkar; B. I. Tuleuov—International Phytochemistry Scientific and Production Holding, Karaganda, Republic of Kazakhstan). Of great interest are the works on the synthesis of ecdysteroids and their derivatives, leading to the production of new substances with more prolonged action (works of Prof. V.N. Odínokov—Institute of Petrochemistry and Catalysis of the Russian Academy of Sciences, Ufa; and Prof. I. V. Zavarzin—Institute of Organic Chemistry named after Acad. N. D. Zelinsky Russian Academy of Sciences, Moscow).

Numerous studies have established that phytoecdysteroids are quite common secondary metabolites of plants, more than 500 compounds of this series have already been identified. Based on them, more than 300 ecdysteroid-containing substances have been created on the basis of which biologically active additives and preparations are developed for use in various fields of human activity.

For many years at the Institute of the Chemistry of Plant Substances named after Academician S. Yu. The Yunusov, Academy of Sciences of the Republic of Uzbekistan, also conducts multifaceted comprehensive studies of compounds of this class, isolated from plants of Uzbekistan and neighboring countries. This monograph is devoted to the analysis and generalization of the data obtained.

The authors are grateful to the initiators of these works at the Institute, carried out both in the chemical-pharmacological and technological aspects, to Profs. N. K. Abubakirov, Z. Saatov, A. G. Kurmukov, T. T. Shakirov, N. D. Abdullaev A. U. Mamatkhanov, as well as all employees of the laboratory of glycoside chemistry, pharmacological and experimental-technological laboratories involved in the implementation of these studies.

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About the Authors

Ugilyo Yusufvna Yusupova has been working in the Glycoside Chemistry Laboratory of the Institute of Plant Chemistry since 2013. Her group distinguishes natural compounds in plant composition, especially ecysteroids and iridoids. She studies the biological activity of natural individual compounds as well as substances obtained by synthetic methods. Moreover, she and her group have developed new technological methods for the isolation of phytoecdysteroids. To date, several species of plants belonging to genera including *Silene*, *Ajuga*, *Rhaponticum*, and *Dianthus* have been studied.

Nurmurod Sheralievich Ramazonov began his research with ecdysteroids in 1990 as a Ph.D. student at the Institute of Plant Chemistry. His thesis focused on the relationship between the isolation of ecdysteroids from the plant genera *Silene*, *Ajuga*, and *Rhaponticum*. After receiving his Ph.D. in 1998, he expanded his research into ecdysteroids, especially in the area of ecdysteroid metabolites and their perspectives. In 2007, he defended his doctoral work with the aim of developing a drug and dietary supplement based on ecdysteroids.

Vladimir Nikolaevich Syrov began his academic studies in 1972 under the guidance of Doctor of Medical Sciences A. G. Kurmukov. He successfully defended his Ph.D. in 1979 and his doctoral dissertation in the field of ecdysteroids and their pharmacological activity in 1997. Since 2005, he has been a professor of pharmacology. He studies the influence of ecdysteroids on the course of basic metabolic reactions of the body, molecular mechanisms, and the relationship between structure and biological activity. Biologically active additives developed by Dr. Syrov have been based on the phytoecdysteroids Ecdysten Plus, eksumid, and jistenin. He is an expert member of the Pharmacological Committee of the Ministry of Health of the Republic of Uzbekistan.

Shomansur Shosaidovich Sagdullaev research areas are phytochemistry and natural product chemistry. He has held the post of editor of the journal, *Chemistry of Natural Compounds*. He has won the Science and Technology Innovation Award and the Outstanding Contribution Award of the Republic of Uzbekistan. He was also given the China Tianshan Award by the Xinjiang Uygur Autonomous Region People's Government in 2016 as well as the Chinese Government Friendship Award in 2018. He has been the director of the Institute of the Chemistry of Plant Substances, Academy of Sciences, Republic of Uzbekistan (ICPS) from 2006 to present.