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EDITED AND REVIEWED BY
Stefano Colazza,
University of Palermo, Italy

*CORRESPONDENCE
Srećko Ćurčić
srecko@bio.bg.ac.rs

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Editorial: Chemical ecology of arthropods, plants, and fungi: bioactivity and importance of natural products

Srećko Ćurčić[1]*, Ljubodrag Vujisić[2], Milica Ljaljević Grbić[1] and Antoaneta Trendafilova[3]

[1]University of Belgrade - Faculty of Biology, Belgrade, Serbia, [2]University of Belgrade - Faculty of Chemistry, Belgrade, Serbia, [3]Institute of Organic Chemistry with Centre of Phytochemistry, Bulgarian Academy of Sciences, Sofia, Bulgaria

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Editorial on the Research Topic
Chemical ecology of arthropods, plants, and fungi: bioactivity and importance of natural products

Chemical ecology is the study of the role of chemical interactions between organisms and the environment and the effects of these interactions on the behavior and evolution of organisms (Bagnères and Hossaert-McKey, 2016). The ability of organisms to recognize and transmit information through chemical substances is one of the extraordinary aspects of nature. It can be said that chemical communication is the unspoken language of nature. Chemical communication is found in almost all biological interactions (Meinwald, 2003). It is particularly pronounced in arthropods, plants, and fungi (Blum, 1981; Mallik and Inderjit, 2002; Spiteller, 2015). The study of chemical ecology provides insights into various biological processes, which opens up numerous applications in different fields (e.g., biomedicine, agriculture, and manufacturing) (Atanasov et al., 2021; Tewari et al., 2021). For example, chemical signals can be used to suppress the spread of certain human diseases, defend a crop from disease, and protect food from pests. This shows that chemical ecology is an extremely important area of research for many basic and applied sciences.

The chemoecological studies conducted so far show that there are an infinite number of natural products produced by arthropods, plants, and fungi (Seabrooks and Hu, 2017). The chemical composition of natural products of different groups of these organisms can indicate their specific relationship, from which certain inferences about evolution and phylogeny can be drawn, which is the task of chemotaxonomy (Singh, 2016; Adamek et al., 2019).

The Research Topic titled "*Chemical Ecology of Arthropods, Plants, and Fungi: Bioactivity and Importance of Natural Products*" was intended to be a collection of contributions covering various aspects of chemical ecology and other disciplines (chemotaxonomy, ecology, chemistry, biomedicine, morphology, etc.), focusing on both the biological activity (antimicrobial, antiparasitic, anti-adhesive, anti-invasive, etc.) and the ecological role and importance of natural products of selected organisms (arthropods, plants, and fungi). The topic editors had the pleasure of receiving excellent manuscripts from 36 authors from several countries. A total of four papers were published in the form of original research in 2022 and 2023 as part of this Research Topic.

In this series of papers, Raspotnig et al. analyzed the scent gland secretions of *Nelima* harvestmen (Opiliones) from two continents. The authors paid particular attention to the study of the so-called "sclerosomatid compounds", which are considered a key group in the chemosystematics of these harvestmen. The chemical composition of these compounds differed significantly between North American and European *Nelima* species. In addition, the authors reported the first case of polymorphism between juvenile and adult individuals in the secretions of *Nelima* harvestmen and constructed a scheme showing how these secretions are regenerated.

In their study in this Research Topic, Bautista-Sopelana et al. investigated the bioactivity of the extracts and essential oils of two plants (*Papaver rhoeas* and *Echium plantagineum*) eaten by the great bustard (*Otis tarda*) against selected parasites and other pathogens. The extracts of the aerial parts of the two studied plant species (especially the extracts of flowers, leaves, and capsules) showed activity against the nematodes and protozoans tested. The foraging behavior of the stressed birds could be explained by the biological activity of the eaten plants against parasites.

Vesović et al. presented a comprehensive study that focused on the chemical composition of pygidial gland secretions and the structure of the glands in five ground beetle (Carabidae) species of the tribe Carabini. In addition, the same research team analyzed the antibacterial activity of pygidial gland secretions from two Carabini species against 11 bacterial strains. A total of 11 chemical compounds were detected in the pygidial gland extracts of the studied ground beetles. The secretions of *Carabus ulrichii* and *C. gigas* showed pronounced antibacterial activity against the selected strains.

The study of the biological activity of the pygidial gland secretion and some of its chemicals of the troglophilic and guanophilic ground beetle *Laemostenus punctatus* was the subject of the publication by Nenadić et al. Significant antimicrobial potential of the secretion and the standards of its certain chemicals (formic and oleic acids) against resistant and non-resistant bacteria and *Candida* species (laboratory and guano isolates) was demonstrated. The anti-adhesive and anti-invasive effects of the secretion and formic acid were also determined. Moreover, the secretion and formic acid were found to be non-toxic to HaCaT cells *in vitro*.

In conclusion, the results published in this Research Topic clearly show that there is a great variety of natural products with a wide range of roles, functions, applications, and effects on the environment. It is very important to explore the structure and function of organs producing natural products as they may have great potential for biomimetics (Rajabi et al., 2021). To better understand the role of these chemicals in ecosystems and their importance to humans, especially in terms of health, more comprehensive knowledge of the synthetic pathways and ecological roles of natural products, as well as the structure of the organs that produce them, is needed. We hope that our Research Topic will be of great interest to both the general public and the scientific community.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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