

Plants: From Farm to Food and Biomedical Applications

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Historically, mankind has used plants and their derivatives as food and medicine for thousands of years. Currently, plants and natural products (NP) in general are extensively used as the main ingredients of culinary preparations or as spices all around the world, while, on the other hand, they are exploited as sources of bioactive compounds for the development of drugs and health-promoting products. Despite several drawbacks of NP having led pharmaceutical companies to reduce NP-based drug discovery programs in recent years [1], the use of “botanicals” (plant-derived ingredients and extracts from algae and fungi) as the main active ingredients of food supplements and nutraceuticals is increasing [2]. Recent studies focusing on the US market show that herbal dietary supplement sales surpassed USD 10 billion for the first time in 2020, with an increase of 17.3% from 2019 [3]. The use of NP in personal care products is also increasing, since consumers are becoming more concerned about the content and adverse effects of conventional personal care products, and keen to use natural ones as a safer alternative [4].

However, despite the commonly diffused conception that NP are usually safe and well-tolerated, several reports highlight the potential toxicity of NP already available on the food supplements market, pointing out the importance of a careful chemical and biological evaluation of these products prior to their distribution. As an example, the European Food Safety Authority (EFSA) recently provided a scientific opinion on the safety of hydroxyanthracene derivatives (HADs) [5] due to concerns about the possible harmful effects associated with long-term consumption of HAD-containing preparations. HADs are characteristic constituents of *Rheum*, *Cassia*, and *Aloe* species that are widely used in food supplements or nutraceuticals for their laxative effects. Four naturally occurring HADs, namely aloin A, aloin B, aloemodin, and emodin, have been listed as prohibited substances in food supplements by EFSA that, on the basis of epidemiological data, stated that they should be considered as genotoxic and carcinogenic unless there are specific data demonstrating to the contrary [5].

Overall, these data indicate that chemical studies of NP are important for several aspects: not only for the quest for novel therapeutic and health-promoting agents, but also for assessing the potential use of whole plants and extracts as foods or nutraceuticals, and for monitoring their toxicity. Starting from this consideration, the Special Issue (SI) of *Applied Sciences* entitled “Plants: From Farm to Food and Biomedical Applications” aimed at collecting original research works and reviews dealing with the chemical characterization of plants and vegetal material with potential uses as ingredients for human use, and the assessment of their bioactivity and toxicity. However, other correlated aspects were involved, such as ethnobotanical surveys and the synthesis and biological evaluation of nature-inspired compounds. The SI was launched in the beginning of 2021 and has collected nine contributions by the beginning of 2022 with a wide geographical distribution. In these contributions, several investigations on wild and cultivated plants from different regions of the world were reported, and different classes of chemical constituents were considered. The two articles by Al-Hmadi and coll. [6] and Smaili and coll. [7] focused on the characterization of essential oils from Tunisian *Pimpinella lutea* and Algerian *Daucus*



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reboudii, respectively, while the work by Poljšak and Kočevar Glavač [8] focused on the characterization of triglyceride fatty acids and unsaponifiable compounds in seed oil from *Tilia cordata* and *Tilia platyphyllos* collected in different sites of Slovenia. Baumgärtel and coll. focused on the metal content of eight plants with important nutritional value for the Angolan population [9], while Norazhar and coll. used a metabolomics approach for the untargeted characterization of the chemical profile of *Christia vespertilionis* leaves from Malaysia (used in traditional medicine), reporting several phenolic acids and flavonoids, together with other primary (e.g., fatty acids) and secondary metabolites [10].

Regarding the synthesis and biological evaluation of nature-inspired compounds, Kos and coll. reported the synthesis of several 3,4,5-trimethoxycinnamic acid (TMCA) derivatives, and, considering the anti-Alzheimer properties of TMCA, they tested the potential of these compounds to inhibit acetylcholinesterase (AChE) and butyrylcholinesterase (BChE) in vitro [11]. Results show that, among the 12 synthesized compounds, 2-chlorophenyl (2E)-3-(3,4,5-trimethoxyphenyl)-prop-2-enoate and (2E)-3-(3,4,5-trimethoxyphenyl)prop-2-enoate exerted the highest activity against both AChE ($IC_{50} = 46.18 \mu M$) and BChE ($IC_{50} = 32.46 \mu M$), respectively [11]. A similar topic was treated by Ribaud and coll. in their review article, where they discussed the huge volume of literature data regarding the anti-cholinesterase and anti-phosphodiesterase activity of several natural and nature-inspired compounds (e.g., alkaloids, flavonoids, phenolic acids, coumarins), and their potential pharmacological application to counteract neurodegeneration [12].

Apart from characterization of phytochemicals and nutrients in local medicinal and edible plants and studies on semi-synthetic derivatives, a couple of articles published within this SI deal with ethnobotany surveys and evaluation of therapeutic potential of formulated NP, namely curcumin. Specifically, Pranskuniene and coll. reported data about the ethnobotanical knowledge of 100 medicinal plants grown in the Tauragė District (Lithuania) home gardens, indicating their use by local people as homemade medicines and food–herbal preparations [13]. On the other hand, the data reported in the paper by Boarescu and coll. show the potential of NP formulation with polymeric nano-carriers to increase their therapeutic value. Specifically, a nano-formulation of curcumin was shown to exert significantly higher cardioprotective, hepatoprotective and nephroprotective effects in rats with type 1 diabetes mellitus compared to non-formulated curcumin [14].

Overall, all these interesting contributions highlight the high interest of researchers worldwide in exploring the chemistry, biological properties and potential applications as food or medicine of natural and nature-inspired compounds and natural extract. It also indicates that natural compounds still represent a source of new inspiration.

The Guest Editors are grateful to all the authors that actively contributed to the SI by submitting the results of their research activity in the field of natural and nature-inspired compound characterization. As a conclusive note, the Guest Editors would like to sincerely thank the reviewers and the Assistant Editors for their valuable support and for having made the realization of this SI possible.

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