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Editorial

Medicinal, Aromatic, and Spice Plants: Biodiversity, Phytochemistry, Bioactivity, and Their Processing Innovation

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1. Introduction

For centuries, drugs were entirely of natural origin, composed of herbs, animal products, and inorganic materials. Early remedies may have combined these ingredients with witchcraft, mysticism, astrology, or religion, but it is certain that those treatments that were effective were subsequently recorded and documented, leading to early herbal remedies. Many widely used pharmaceuticals are derived from plants and other natural sources or are based on traditional knowledge of herbal remedies.

Thanks to numerous scientific and professional meetings, the development of analytical and biological testing methods and related tools, along with the introduction of the large-scale cultivation, processing, and technological innovation of herbal plants, has gained great significance for the economy.

Today, several hundred plant species are used as medicinal, aromatic, and spice herbs. The key commercial species worldwide currently include chamomile, calendula, milk thistle, plantain, balm, mint, and yarrow, but there is potential for the cultivation of a wider range of species across larger areas. Significant opportunities exist for the production and processing of a wide range of herbs in many countries, serving both domestic and export markets.

Medicinal, aromatic, and spice plants are renewable raw materials, offering an alternative to the overproduction of traditional crops in agriculture. The food, pharmaceutical, and cosmetic industries produce important products using these plants. Products based on natural substances are gaining increasing value due to the presence of valuable components, primarily produced through the secondary metabolism of the plants. Many widely used pharmaceuticals are derived from plants and other natural sources or are based on traditional knowledge of herbal remedies. However, these plants can also be used for non-traditional purposes such as phytoremediation, which involves cleaning substrates contaminated by toxic metals using plants.

2. Special Issue Overview

The Special Issue of *Horticulturae* entitled *Medicinal, Aromatic, and Spice Plants: Biodiversity, Phytochemistry, Bioactivity, and their Processing Innovation* addresses a somewhat neglected area of biodiversity, including the ethnobotany and breeding of these plants to enhance their quality and productivity. The biosynthesis of natural plant substances and their qualitative–quantitative content plays a vital role in their biological properties, effects, new plant products, and innovative processing, which must be also emphasized in our contributions. Finally, it should be noted that medicinal, aromatic, and spice plants are natural biological resources with the potential to become a new generation of substances for human and animal nutrition and health. The recommended readership of this Special Issue is not only those engaged in research into and the processing of these special crops but also natural product chemists, pharmacogenetics, and users of these plants, given their increasing economic importance.

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However, issues related to intellectual and cultural property rights have emerged as significant factors in these research and development fields. A very important aspect of consolidating all original scientific work is the exchange of recent scientific information, results, and knowledge.

2.1. Diversity of Plants

Biodiversity is the degree of variation in life forms within a given species, ecosystem, biome, or an entire planet. Biodiversity is a measure of the health of ecosystems. It is estimated that some 10,000 plant species are used medicinally, most of which are used in traditional systems of medicine [1]. However, only a relatively small number of species are used in any significant volume.

Three papers cover wild-growing plant populations, which are heterogeneous both from the perspective of their morpho-phenological properties as well as from the chemical point of view. The original research presents, describes, and analyzes the anatomy of *Kopsia fruticose* Rob. (*Apocynaceae*) and correlates the anatomical features with the habitat and ecology of this plant [2]. Chemotaxonomic and ecological studies of secondary metabolites and their role in ecosystems regarding *Matricaria recutita* L. and *Juniperus communis* L. [3,4] are presented by authors from Albania and Slovakia, respectively. In the first case, chemical type B (/-/-α-bisabololoxide B >/-/-α-bisabololoxide A >/-/-α-bisabolol) was uniquely determined in wild Albanian chamomile populations. A dendrogram was constructed after a hierarchical cluster analysis based on essential oil substances from juniper, which showed four different chemotypes in Slovakia. The quality and chemotypes of juniper berries are very important for the Slovak national beverage "Borovicka" and the distillery industry on a whole in this country.

2.2. Phytochemistry and Bioactivity

Medicinal, aromatic, and spice plants continue to attract growing interest from both scientists and the public. Plants that consist of biologically active compounds, such as polyphenols, flavonoids, alkaloids, and polypeptides, have been found to possess many antimicrobial, antioxidant, anti-inflammatory, and antiseptic properties.

Ethnobotany is the study of the relationships that exist between people and plants. Ethnobotanists aim to document, describe, and explain complex relationships between cultures (and uses) of plants, focusing primarily on how plants are used, managed, and perceived across human societies. This includes their use as food, clothing, currency, medicine, and dye and in rituals, construction, cosmetics, and more.

Based on its traditional efficacy, researchers have conducted a series of studies and found that *Carissa macrocarpa* (Eckl.) A. DC. [5] leaf extract showed antioxidant activity with regard to a variety of phytochemicals, such as alkaloids, tannins, phenols, naphthoquinones, flavonoids, saponins, steroids, proteins, carbohydrates, mucilage, gum, and resin. Chemotypes of species of the *Thymus* L. genus [6] in the Carpathians region and their microbial activities were determined. Finally, an important study evaluated the larvicidal properties of the hexane extract of sweet basil (*Ocimum basilicum* L.; family: *Lamiaceae*) [7] leaves against the wild strain of Asian tiger mosquito (*Aedes albopictus*).

2.3. Herb Cultivation and Processing Innovation

Medicinal, aromatic, and spice plants are renewable raw materials. Their production is an alternative to the overproduction of the traditional crops in agriculture. Medicinal plants have increasing economic importance, and the food, pharmaceutical, and cosmetic industry produce important goods using these plants [8]. Products based on natural substances are enjoying increasing value. The presently rising consumption of these products is caused by changes in consumer behavior in industrialized countries [9].

Two original R&D papers covered the fields of the introduction of new hydrolats and hydrosols [10] of *Lavandula angustifolia* × *intermedia* and *Rosa hybrida* L., which are products created during the distillation of essential oils. These water-based products contain the fragrant and therapeutic components of the plant material, and they can be used in a variety of ways. These products can be used as natural fragrances, toners, and facial mists, and they can help soothe and hydrate the skin. Hydrosols and hydrolats are also generally gentle and safe for all skin types, making them a good choice for those with sensitive skin.

2.4. Non-Traditional Use of Medicinal Plants in Phytoremediation Technology

In recent years, the practical use of alternative medicine in healing processes has become increasingly popular. Several species of medicinal plants can be used as supplementary nutrition due to their ability to accumulate some essential nutrition elements (e.g., Se, Zn, and Fe) in the edible parts of these plants (so-called phytofortification). On the other hand, however, data related to toxic metal contents (e.g., Cd, Pb, Hg, and Cr) in pharmaceutically utilized parts of the medicinal plants are also considered from the perspective of "food safety " [11]. Considering all of the above-mentioned aspects, the cultivation and use of medicinal plants have to respect the potential hazard connected with environmental contamination, mainly with toxic heavy metals [12].

The influence of the immobilization of Pb in contaminated soils [13] was evaluated by applying organic amendments, in combination with diammonium phosphate (DAP), in a greenhouse experiment. Inorganic bone meal combined with DAP most effectively immobilized Pb in soil. These interesting results indicate that the bark of *Salix alba* contains significant amounts of phenolic compounds of Fe, Ni, and Mn.

3. Conclusions

In recent decades, the usage of medicinal, aromatic, and spice plants has been increasing worldwide, as evidenced by the growing number of products in the pharmaceutical, cosmetic, chemical, food, and related industries. Based on the above-mentioned findings, it can be clearly seen that natural products and their sources, such as medicinal, aromatic, and spice plants, continue to have great importance in the health-care of mankind. It is also clearly seen that natural resources, among them being herbs, are not adequately understood. Their chemical investigation should be intensified. Even plants that have already been studied can provide new biologically active ingredients because of their chemotaxonomic differences, new unknown chemical constituents, newly discovered biological effects, and because of the possibilities of the chemical and/or biological processing of plants and their ingredients to obtain favorable activity (Figure 1).

Due to the current trends of prescription drug costs and consumer desires for natural health-care products worldwide, pharmacies may offer product selection and educate staff in a way that supports conventional and alternative medicine systems, enabling the consumer and the medical practitioner to choose the best medicine, whether conventional or herbal, for the maintenance of health and for the treatment of a medical condition. The sustainable development in these fields lies in the following strategies:

- Developing new and improved varieties and species for soil-climatic conditions, their changes, and international markets;
- Providing agronomic systems for the efficient and sustainable production of high-quality plant raw materials, essential oils, and extracts;
- Devising harvest, post-harvest, extraction, and distillation technology to increase product yields and/or secure specified characteristics required by markets and controlled-registration authorities;
- Standardizing extracts for active natural substances and lyophilizates—their antiviral activity, immunological, and hormonal modulators;
- Standardizing extracts for active natural substances, essential oils, and lyophilizates and their antimicrobial effects on bacteria, yeasts, and microscopic fungi.

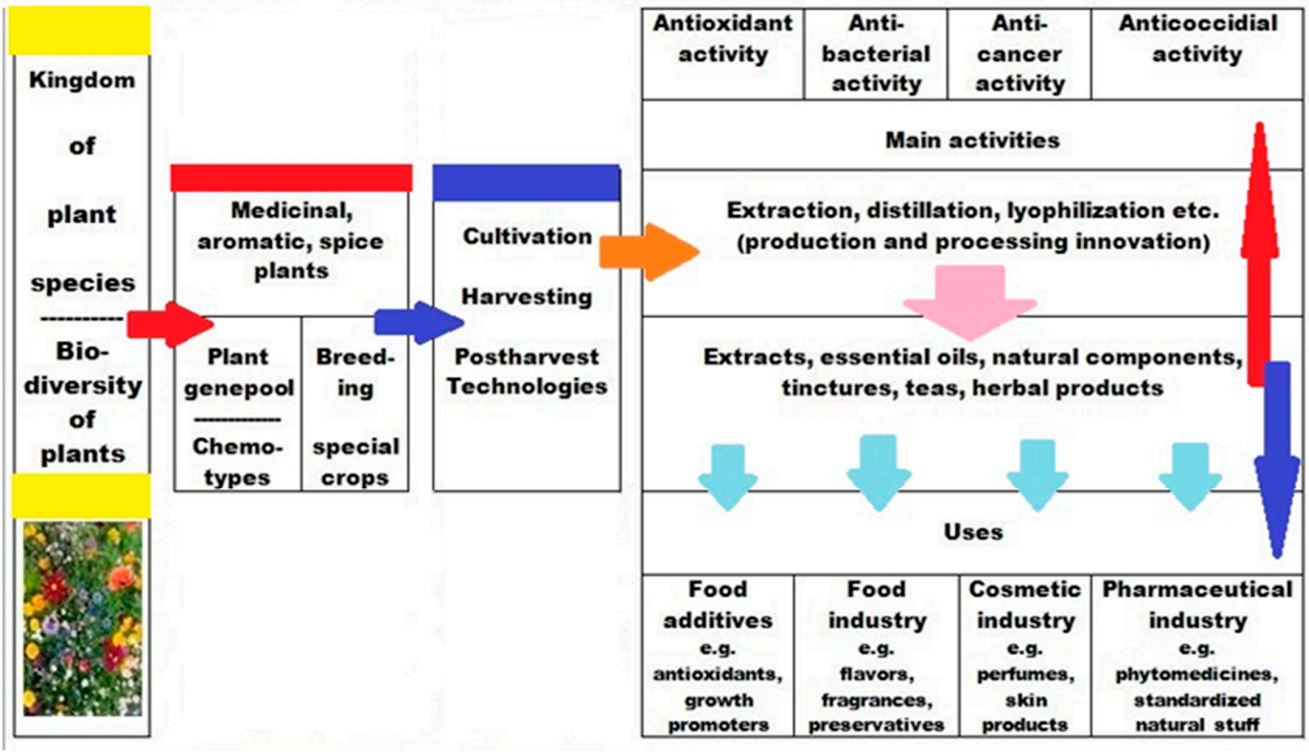

Figure 1. Scheme for introducing wild (autochthonous) plant species from their natural habitat into the cultivation, collection, post-harvest treatment, and technological processing of medicinal, aromatic, and spice plants.

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