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Editorial

Chemical Diversity, Yield, and Quality of Aromatic Plants

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Abstract: Natural products, i.e., food, drugs, cosmetics, flavors, dyes, and preservatives, have recently become a subject of great interest. There is no doubt that the primary condition for the suitability and use of these products is a solid scientific basis, especially in terms of biological activity. Medicinal aromatic plants (MAPs) play a valuable and vital role in the economic, social, cultural, and ecological aspects of local communities worldwide. MAPs, commonly known as herbs or spices, are distinguished by their original aroma and valuable healing effects. They are common in folk medicine and have modern proven healing effects. These plants are characterized by great diversity both morphologically and chemically, as well as in terms of biological activity. Their properties are modified by various factors of variation: genetic, ontogenetic, environmental, and post-harvest. This review presents the results of the latest research on the use of wild and cultivated aromatic plants in the pharmaceutical, cosmetic, and food production sectors. In addition, the relationship between the quantity and quality of MAP yield and the genetic, environmental, and agrotechnical factors involved was discussed.

Keywords: cultivated and wild plants; biodiversity; secondary metabolites; essential oils; biological activity

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1. Introduction

Medicinal aromatic plants (MAPs) are a diverse group of plants characterized by their ability to synthesize a specific type of aroma; the concentration, type, and biological activity of this aroma tend to be unusual and variable. The aroma concentration in the different parts of the plant depends on the plant's age, the environmental conditions in which it grows, and its genetic composition. Aromatic plants are a source of fragrance and are valuable for treating various diseases [1]. The essential oils (EOs) synthesized by numerous plant species from different botanical families vary considerably in their chemical composition and biological activity. Therapy based on the action of EOs, called aromatherapy, is as old as human civilization. Due to their antidepressant, stimulating, detoxifying, antimicrobial, antiviral, and calming properties, they have recently gained popularity as natural, safe, and inexpensive therapies for many health problems. Microbial resistance, caused by the overuse or inappropriate use of antibiotics, is a global crisis, increasing the risk of treatment failure and healthcare costs. EOs consist of hydrophobic metabolites with antimicrobial activity. More than one hundred metabolites have been identified, mainly from the sesqui- and monoterpene groups. The hydrophobicity and variable degree of reactivity of EOs make them interesting therapeutic products for use against pathogenic microorganisms, either alone or in combination with traditional antibiotics. However, much of the chemical diversity of plants remains unexplored, as most studies have focused on domesticated species [2,3].

The demand for MAPs is growing worldwide, mostly coming from natural sites. In recent years, the total European imports of MAPs have amounted to 194,000 tons, representing a value of EUR 694 million [4]. Areas rich in endemic MAPs are known to be vulnerable to climate change, yet significant in biodiversity and biological value [5]. Recently, attention has been drawn to the issue of medicinal plant biodiversity loss, pointing to environmental factors as the primary cause. Rainfall, deforestation, the siltation of water bodies, and a lack of pollinators are some of the most important causes of biodiversity change [6]. Considering the need to regenerate plants and protect soils from erosion, it is essential to use a proper harvesting strategy. A rational harvest is recommended, leaving 50% of the plant biomass in the field to avoid soil degradation. Furthermore, a rational harvesting strategy encourages the sustainable cultivation of MAPs without significant changes in essential oil yields while guaranteeing the preservation of environmental biodiversity [4]. The introduction of wild *Origanum grosii* Pau & Font Quer genotypes into cultivation resulted in changes in the chemical profile of the essential oil, where γ-terpinene and carvacrol were found to increase in favor of a decrease in p-cymene [7]. Furthermore, the domestication of this species favored biomass and oil production. This variability can be attributed to irrigation and soil chemistry in the experimental field.

This Special Issue brings together 17 articles presenting the current research on the morphological, chemical, and biological characteristics of MAPs, and the diversity of aromatic substances and their effects; it also discusses the modern methods of cultivating MAPs, systems for extracting secondary metabolites, and how they can be used for human and environmental benefit.

2. Chemical Diversity of Aromatic Plants

The variation in the chemical composition of aromatic plants applies to both wild and cultivated species and determines their medicinal value. Aćimović et al. [8] presented a detailed characterization of *Angelica archangelica* L. (syn. *A. officinalis* Hoff.), an aromatic spice and medicinal plant from the Apiaceae family. A systematic description of the biology, phytochemistry, and chemotaxonomy of *A. archangelica* is presented concerning the composition of the essential oil (EO) and the biological activity associated with the presence of this substance. This paper focuses on a cross-analysis of the taxonomy of *A. archangelica* and its distribution in different regions and presentsits chemical composition. *A. archangelica* is one of the plants introduced to broader areas of central, eastern, and southern Europe; as a medicinal plant, it forms a significant part of the medicinal flora of many areas. The authors demonstrated the chemical diversity of the EO from the root/seed between subspecies and areas of *A. archangelica*, as well as a more significant number of chemotypes in some parts of Europe where subspecies distributions partially overlap, or where the species has been introduced into cultivation. Furthermore, it has been noted that there is a correlation between habitat preference and fruit morphology. *A. archangelica* has a complex chemical composition. In addition to the EO and coumarins that contribute to the plant's biological activity, it contains glycosides, carbohydrates, phytosterols, saponins, phenols, and fats that affect its nutritional potential. The EO of *A. archangelica* root shows good bacterial activity against *Aspergillus niger*, *Candida albicans*, *Cladosporium cladosporioides*, *Clostridium difficile*, *C. perfringens*, *Enterococcus faecalis*, *Escherichia coli*, *Eubacterium limosum*, *Penicillium venetum*, *Peptostreptoccocus anaerobius*, and *Staphylococcus aureus*, as well as against *Alternaria solani*, *Botrytis cinerea*, and *Fusarium* spp. For these reasons, EO from the root of *A. archangelica* can be used as a natural preservative and antibiotic to treat infectious diseases caused by these pathogens, as well as a biological plant protection agent. EO from the fruit of *A. archangelica* showed cytotoxic effects against human pancreatic cancer lines (PANC-1) and Crl mouse breast cancer cells, while EO from the root at high doses (from 219.9 μg/mL) induced significant apoptosis and necrosis in human histiocytic lymphoma cells (U937). In addition, low doses of EO from *A. archangelica* root showed anti-inflammatory effects. It provides an essential basis for developing adjuvant formulations for drug therapies and new food products or dietary supplements. Based on the area of occurrence and morphological and chemical characteristics (analysis of volatile substances), the authors showed that four subspecies could be defined within the species: *A. archangelica* subsp. *archangelica*, *A. archangelica* subsp. *litoralis* (Fr.) Thell, *A. archangelica* subsp. *decurrens* (Ledeb.) B. Fedtsch., and *A. archangelica* subsp. *himalaika* (C.B. Clarke) by G. Singh & G.M. Oza. It was also hypothesized that *A. archangelica* originated in the northern temperate regions of Europe and that there were two subspecies, subsp. *archangelica* and subsp. *litoralis*. According to this theory, subsp. *himalaica* may be an ecologically distinct species.

Genetic factors, among others, cause changes in the chemical composition of MAPs; consequently, different biological activities may result. A study by Walasek-Janusz et al. [9] evaluated the antimicrobial activity of EOs obtained from the flowers of four lavender cultivars: *Lavandula angustifolia* 'Hidcote Blue Strain', 'Hidcote Blue', and *L.* × *intermedia* 'Phenomenal' and 'Grosso'. The concentration of EOs (20, 10, 5, 2.5, 1.25, 0.6, 0.3, 0.16, 0.08, and 0.04 mg/mL) was tested to determine the minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), or minimum fungicidal concentration (MFC) against ten strains of Gram-positive bacteria, five Gram-negative bacteria, and eight yeasts in in vitro cultures. The EOs tested showed antimicrobial activity against all microorganisms analyzed. Yeast showed greater sensitivity to lavender oil than bacteria, while Gram-positive bacteria were more sensitive than Gram-negative bacteria. The most resistant EOs analyzed were *E. faecalis* ATCC 29212 and *P. aeruginosa* ATCC 27853. The lowest MIC values for bacteria and fungi were obtained for 'Grosso' oil, which showed the highest fungicidal activity, while the highest bactericidal activity was found for 'Hidcote Blue' and 'Grosso' oil. Using *Staphylococcus aureus* as anexample, it was shown that the antimicrobial activity of lavender oil depends on the chemical composition and type of bacteria. *S. aureus* ATCC 6538P was the most sensitive, while *S. aureus* ATCC 0 was more resistant and required relatively high oil doses to achieve MIC and MBC effects. The plants tested were characterized by a high EO content (3.1–8.1%), with *L.* × *intermedia* cultivars, especially 'Phenomenal', containing more EO than the others. Linalyl acetate and linalool were the main constituents of the EOs of all cultivars (18.6–34.3% and 15.1–29.6%, respectively). 'Grosso' oil also had a high content of terpinene-4-ol (18.08%). The authors indicate that most likely linalool and terpinene-4-ol are the compounds responsible for antimicrobial activity.

Research on the common tansy (*Tanacetum vulgare* L.) has shown that wild populations are a valuable and diverse source of bioactive substances [10]. Environmental and genetic factors have been implicated as the causes of variability in the chemical composition of tansy, the use of which is limited by the presence of the toxic thujone. The EOs obtained from the inflorescences of plants growing on the ruderal site contained the most toxic trans-thujone, although the concentration of the compound did not exceed 10%. The highest amount of EO (1.05 mL$\cdot-$kg^{-1}) was found in the raw material taken from the reclaimed area. Forty-seven compounds were identified in the oil of tansy, among which camphor (31.21–1.27%) and trans-chrysanthenyl acetate (76.09–0.09%) predominated, while the concentration of trans-thujone varied (0–9.95%). The oil from plants in the reclaimed site and the roadside ditch contained no trans-thujone; the highest levels of trans-dihydrocarvone (20.62%) and trans-thujone (9.95%) were found in the inflorescence oil of plants from the ruderal site. The tested tansy plants represented four chemotypes: (1) camphor/1,8-cineol, (2) trans-chrysanthenyl acetate/camphor, (3) trans- and hydrocarvone/camphor/trans-thujone, and (4) trans-chrysanthenyl acetate. Of particular interest was the thujone-free chemotype, rich in 1,8-cineol and camphor, and the equally interesting trans-chrysanthenyl acetate chemotype, also without thujone. The highest amount of flavonoids (0.52%) was found in the raw material taken from the ruderal and reclaimed sites, while the highest amount of phenolic acids (2.42%) was found in the raw material from the ruderal site. Extracts from the inflorescences of tansy showed a high antioxidant potential (88.41%).

In turn, Dziwak et al. [11] presented a comprehensive overview of bryophytes as a potential source of compounds with diverse applications. Bryophytes, a heterogeneous group of plants, are common in almost all ecosystems. They have no developed physical barriers but are rarely attacked by herbivores or pathogens. These plants have acquired the ability to produce various secondary metabolites with different functions, such as phytotoxic, antimicrobial, antifungal, insecticidal, and molluskicidal activities. Secondary metabolites may also be involved in stress tolerance, i.e., UV absorption, drought, and freezing resistance. Due to these properties, bryophytes have been used for centuries to combat health problems in many cultures across continents. Currently, scientists are discovering new and unique compounds in bryophytes with the potential for practical applications, which in an era of drug resistance may be of considerable importance. Biologically active compounds that can be obtained from bryophytes include antioxidants, compounds that are toxic to specific groups of organisms (potential plant protection agents), inhibitors of some enzymes, anticancer and anti-HIV-1 compounds, neurotrophic compounds, and compounds that relax muscles and strengthen the heart. They are also associated with numerous aromas (carrot, cedar, mushroom), astringency, and bitterness. The authors presented bryophytes as a potential source of compounds with various possible applications, with a particular focus on volatile compounds and antimicrobial, antifungal, and cytotoxic potential, and as a source of materials for further promising research. Sources of odor include volatile mono- and sesquiterpenes, terpenoids, and low-molecular-weight derivatives of fatty acids or phenylpropanoids. The odors of bryophytes depend not only on the content of volatile secondary metabolites but also on the habitat conditions of the plants. In summary, knowledge of bryophytes has advanced considerably over the past 40 years. Scientists are now discovering new, unique compounds with the potential for practical application, which may be of considerable importance in the era of drug resistance. Further research can determine the actual therapeutic value of these metabolites.

The search for plants with medicinal uses has led to some ethnobotanical studies documenting traditional medicinal plant species, preparation, and use by local communities. Hassanpouraghdam et al. [12] reported that *Mentha aquatica* L. (Lamiaceae), found in different parts of Iran, is a source of valuable oil and preparations to regulate biliary function, and is used as a gastric tonic and disinfectant. The authors proved the morphological and biochemical diversity of wild populations of *M. aquatica* from the Hyrcanian hotspot of Iran. Plants from Gilan, Golestan, and Mazandaran provinces in the Caspian region were sampled for analysis. Differences between the sampled plants regarding morphological traits were demonstrated, identifying significant positive correlations between selected traits. In addition, EO concentration ranged from 1.13% for the Behshahr-Mazandaran sample to 0.27% for the Abbas abad-Mazandaran sample. The main constituents of the EO of *M. aquatica* were menthofuran (13.21–52.46%), 1,8-cineole (12.42–25.55%), (E)-caryophyllene (3.18–15.43%), viridiflorol (1.04–11.16%), germacrene D (1.70–8.29%), caryophyllene oxide (0.51–4.96%), neryl acetate (1.11–4.95%), p-cymene (1.55–4.77%), and β-pinene (1.7–3.45%). Finally, the authors concluded that the populations from Rahimabad-Gilan and Behshahr-Mazandaran would be reliable choices for the food and pharmaceutical industries due to their higher oil yields and contents of α-pinene, 1,8-cineole, menthofuran, viridiflorol, and β-caryophyllene. This finding urges the further evaluation of populations from different habitats to guide future breeding programs.

The Lamiaceae family includes many valuable species of MAPs with applications in medicine, pharmacy, cosmetology, and other productions. The subject of a subsequent study [13] was the assessment of genetic and ontogenetic variation in the chemical composition of the basil (*Ocimum* spp.) herb. The raw materials of *O. basilicum*, *O. basilicum* var. *purpurescens*, *O. basilicum* × *citrodorum*, *O. basilicum* 'Cinnamon', *O. basilicum* 'Siam Queen', and *O. basilicum* var. *minimum* 'Minette' harvested at the vegetative stage, early flowering, full flowering, and late flowering were analyzed. Basil plants accumulated the least EO, flavonoids, and tannins in the vegetative phase (average: EO—0.86%, flavonoids—0.60%, tannins—0.41%). The highest content of the tested substances was found for *O. basilicum* var. *minimum* 'Minette'. The object of another study [14] was a species commonly used in Iranian medicine, *Stachys lavandulifolia* Vahal (Lamiaceae). The morphological and biochemical diversity of populations from the western and northwestern parts of Iran was assessed. The most comprehensive ranges of variation were recorded for the auxiliary shoot length, the leaf length in the main branch, and the number of flowers in the inflorescences. Furthermore, using cluster analysis, the 13 populations were divided into 4distinct groups. The following were identified as the leading oil constituents: α-pinene (1.07–34.87%), (E)-caryophyllene (0.45–25.99%), germacrene D (3.36–20.61%), δ-cadinene (2.82–19.90%), bicyclogermacrene (1.72–12.08%), α-terpineol (0–11.86%), α-muurolol (0.31–11.50%), p-cymene (0.67–9.67%), β-elemene (0.63–9.31%), and sabinene (0.32–6.29%). The authors demonstrated that natural habitats and associated climatic and soil factors influenced the oil's morphological characteristics and chemical composition variation. The populations studied could aid in the development of breeding material interventions related to the highlighted components of EOs required by the pharmaceutical industry and others.They could also be used for the domestication and cultivation of this valuable species.

Sage (*Salvia* spp.) is one of the largest genera of the Lamiaceae family and is used for medicinal, food, and cosmetic purposes. In most European countries, *S. officinalis* is cultivated in herb plantations; many other sage species are harvested in their natural habitats, some of which are endangered and vulnerable. Esmaeili et al. [15] reported that 61 sage species have been identified in the 'Flora of Iran', of which 17 (28%) are endemic to Iran. The authors evaluated the domestication process and adapted eight native Iranian sage species for cultivation: *S. atropatana*, *S. macrosiphon*, *S. sclarea*, *S. officinalis*, *S. nemorosa*, *S. syriaca*, *S. virgata*, and *S. frigida*. The root architecture was closely correlated with the climatic conditions of the origin of the species. The contents of dry matter, flavonoids, and phenolic acids in the leaves, flowers, and roots varied considerably between species. Rosmarinic acid, the critical phenolic substance of sage, was present at 0.24–0.47 mg/g dry weight. The EO content ranged from 0.35% (*S. atropatana*) to 1.45% (*w*/*w*) (*S. officinalis*). The main EO components varied in the different sage species,: α-thujone (39.34%), camphor (17.18%), and β-thujone (15.51%) in *S. officinalis*; aromadendrene (47.5%) and tetramethylbutane (18.12%) in *S. nemorosa*; linalool (26.20%) and linalyl acetate (20.50%) in *S. sclarea*; linalool (27.20%) and caryophyllene oxide (14.63%) in *S. macrosiphon*; caryophyllene oxide (24.30%) and α-cubebene (11.40%) in *S. atropatana*; β-caryophyllene (28.75%) in *S. frigida*, valeranone (26.09%) and δ-cadinene (23.32%) in *S. virgate*; and bornyl acetate (30.83%), isobornylformate (18.4%), camphor (15.12%), and cis-verbenol (13.55%) in *S. syriaca*. Oxidized monoterpenes were the predominant compounds in the oil of *S. officinalis* (78.64%), *S. syriaca* (88.06%), *S. sclarea* (52.65%), and *S. macrosiphon* (32.83%). The highest level of oxidized sesquiterpenes was found in *S. atropatana* oil (31.67%). The most potent antioxidant activity (IC_{50}) was found in the roots of *S. macrosiphon* (10.9 μg/mL) and *S. sclarea* (14.9 μg/mL), the stem of *S. nemorosa* (14.3 μg/mL), and the leaves of *S. atropatana* (14.0 μg/mL). Cluster analysis based on EO data revealed the most similarities between *S. sclarea* and *S. macrosiphon* and a clear separation of *S. virgata*, *S. syriaca*, and *S. officinalis* from other species. The authors concluded that *Salvia* spp. plants contain a wide range of interesting bioactive compounds, especially *S. sclarea*, the species with the highest potential for producing phenolic compounds, flavonoids, and EO. *S. officinalis*, *S. nemorosa*, and *S. sclarea* were the best species for the production ofmedicinal raw materials.

The properties and actions of natural compounds are crucial in maintaining human health and protecting the environment. Given their broad biological activity and relevance in perfume, cosmetic, and pharmaceutical applications, EOs interest researchers, manufacturers, and consumers. Oulebsir et al. [16] reported that the leaf oil of *Citrus aurantium* grown in Algeria consists mainly of linalool, linalyl acetate, and α-terpineol, and has a low phenolic content and low EO antioxidant activity (3.48 ± 0.10 mg/g gallic acid equivalent and $IC_{50} > 10{,}000\ mg \cdot L^{-1}$, respectively). In contrast, elastase and collagenase activity inhibition was very high following oil application. This represents the first report of anti-elastase and anti-collagenase activity recorded for this oil and requires confirmation in further studies. It is emphasized that the inhibition of collagenase and elastase may be due to the inhibition of proinflammatory mediator production. Overall, their results reflected the plant's strong antiaging effects. A confirmation of its anti-elastase and anti-collagenase activities may increase the use of *C. aurantium* oil in pharmaceutical and cosmetic production in the future.

3. Yield and Quality of Aromatic Plant

In modern plant cultivation, biostimulants are an element of agrotechnology that can positively influence yield quantity and quality by reducing the adverse effects of stress factors on plants. Biostimulants are classified as humic substances, complex organic materials, components of mineral origin, inorganic salts, seaweed extracts, chitin, chitosan derivatives, antitranspirants, free amino acids, other nitrogenous compounds, and microbial inoculants [17]. Proline is an amino acid that increases plant tolerance to abiotic and biotic stresses, and positive effects of proline have been observed even in plants not exposed to stress factors [18]. A study by Gruszecki et al. [19] aimed to determine the effect of the timing of proline application on the size and structure of the yield of parsley (*Petroselinum crispum* (Mill.) Nyman ex A.W. Hill; cv. Halblange and Sonata) under field conditions. This study hypothesized that the growth stage of parsley plants and the number of treatments could affect the size and quality of root and leaf yield and the content and composition of EO. The timing and number of proline applications affected the leaf weight, and the total and marketable yield. Amino acid spraying increased the average number of 'Halblange' plants at harvest but decreased the number of 'Sonata' plants in all applications. Two to three applications of proline decreased the total EO content of Halblange cultivar plants and modified their composition. However, the application of this amino acid did not affect the total and marketable root yield and leaf weight of parsley compared to the control. The study showed that the timing of proline application may be more important than the number of applications and that the results may depend on the cultivar. The timing of application may affect the efficacy of proline and be more critical than the number of applications. Proline sprays adequately timed to the plant's developmental stage can increase the crop's quantity and quality, improve the uniformity of the marketable yield, and reduce the susceptibility of roots to cracking and pest damage. However, it should be noted that using proline may reduce the EO content and alter its composition. In the case of root parsley, the most beneficial effect was obtained when proline was applied at two stages, BBCH 41 (roots begin to expand, diameter > 0.5 cm) and BBCH 42–43 (roots are 20–30% of typical diameter). A single spray of parsley plants with proline did not change the EO content of the roots, while two or three applications significantly reduced it. Spraying with proline increased the proportion of apiol, β-pinene, and β-phellandrene as the number of applications increased. An inverse relationship was found for myristicin. A single application of proline had little effect on the content of elemycin and z-ligustilide, while two or three applications decreased the contents of these compounds.

In spice production, attention is given to high-yielding varieties and those characterized by aroma stability. Gruszecki and Walasek-Janusz [20] evaluated the yield, content, and chemical composition of EOs of 15 turnip-rooted parsley [*Petroselinum crispum* (Mill.) Nym. var. *tuberosum*] cultivars. A wide variation in the content of EOs in the leaves and roots of the cultivars tested was shown. The oil content in the roots ranged from 0.013 to 0.045 mL·100 g^{-1} fresh weight (FM), while, in the leaves, it was in the range of 0.041–0.121 mL·100 g^{-1} FM. The yield of oil obtained from the leaves was higher than that from the roots, indicating that parsley leaves can be a valuable spice and should not be treated as a waste product when the roots are harvested. The study found that the content of EOs varied with weather conditions, although some cultivars (Kinga, Eagle, and Berlin PNE) had a constant EO content. The dominant component of EOs obtained from the roots of all cultivars was apiol. In contrast, in the case of EOs obtained from leaves, myristicin, β-pinene, Z-falcarinol, and β-phellandrene were the main constituents, and their content varied considerably based on the weather conditions. The study presented here also shows that parsley varieties differ in the chemical composition of EOs, which varies throughout the year. The roots of *P. crispum* as storage organs, accumulating, in autumn, the spare materials needed by the plant to resume growth in spring and release generative organs, enabling it to survive in unfavorable weather conditions (winter period). Apiol was the main component of the EOs of the roots of each parsley variety. According to the authors, this may indicate that the composition of the root oil depends on the place of cultivation, and that the climatic conditions of central and eastern Europe favor the accumulation of this component in the roots. In the assimilatory organs, the composition of the oils was more varied, indicating a more active and individual adaptation of the plants to changing conditions during the different growing seasons. Root parsley is mainly cultivated for its aromatic roots; the above studies [20] show that its leaves are a full-flavored spice and contain many EOs. Furthermore, the varied response of varieties, depending on weather conditions, regardingthe content of EOs may indicate the possibility of selecting varieties suitable for crop weather conditions. The varying composition of EOs extracted from roots and leaves may demonstrate that the plant can modify volatile components depending on organ specificity and stress. The variability in EOs beyond the influence of weather conditions may also be due to the variability in the populations, as they are not hybrid varieties.

Chemical crop protection products are subject to discussion and concern due to their adverse environmental and public health effects. Research has focused on natural alternatives to avoid the dangers of synthetic herbicides. Kordali et al. [21] conducted a study to evaluate the allelopathic effect of EOs extracted from *Origanum syriacum*, *O. onites*, and *O. majorana*. In *O. syriacum* oil, the main constituents were carvacrol (88.49%), p-cymene (5.71%), γ-terpinene (1.63%), β-caryophyllene (1.48%), and terpinene-4-ol (0.65%). In *O. onites*, carvacrol (58.65%), thymol (30.97%), linalool (4.17%), p-cymene (1.94%), and β-caryophyllene (0.98%) were identified as the main constituents. In *O. majorana* oil, carvacrol (40.57%), α-terpineol (29.28%), p-cymene (9.02%), γ-terpinene (5.80%), and carvacrol methyl ether (3.46%%) predominated, whereas in *O. majorana* oil, carvacrol (40.57%), α-terpineol (29.28%), p-cymene (9.02%), and γ-terpinene (5.80%) predominated. EOs and plant extracts were tested at concentrations of 5, 10, and 20 L/Petri against the seed germination and seedling growth of four weed species (*Thlaspi arvense*, *Amaranthus retroflexus*, *Rumex cripus*, and *Lactuca serriola*). EO concentrations were set at 5, 10, and 20 μL/Petri dish for seed germination. In the greenhouse experiment, the final concentration of the solutions was set at 20 μL, the solutions were sprayed directly onto the surface of the weeds, and mortality was recorded after 24 and 48 h of application. It was observed that increasing the application reduced seed germination. Phytotoxic effects on seedling germination were observed in the greenhouse, resulting in a mortality rate of 48.76–94%. Ultimately, *Origanum* EOs can be considered as alternative bioherbicides for the weeds tested in different crops. In the next study [22], the allelopathic activity of 123 MAPs from 31 families was analyzed using the dish-pack method on a lettuce seed model. Their allelopathic interaction effects were examined after selecting the most potent inhibitory compounds. Two methods were used to assess allelopathic interaction effects: the calculation of fractional inhibitory concentration (FIC) and the plotting of isobologram diagrams. Lettuce hypocotyl length, root length, percentage, and germination rate were investigated. *Pelargonium graveolens* leaf extract had the most significant inhibitory effect on lettuce root growth (EC50 = 5.31 mg/well), while *Echinophora platyloba* stem had the most significant inhibitory effect on hypocotyl growth (EC50 = 7.91 mg/well). Furthermore, the lowest percentage of lettuce germination was observed for *Lavandula officinalis* (flower) and *Nepeta binaloudensis* (leaf) (23.61 and 22.85%, respectively). The highest inhibitory effect, considering lettuce germination rate, was found for *Salvia ceratophylla* (leaf) (12.86 seed/day), and the lowest was found for *Nepeta binaloudensis* (leaf) and *Lavandula officinalis* (flower) (3.60 and 3.32 seed/day, respectively). Certain phenolic compounds, such as thymol, carvacrol, p-cymene, and 1,8-cineole, were the primary components of the plants tested and thus are probably the main factors responsible for the inhibitory effect. According to FIC and isobologram calculations, two types of interactions occurred, including synergistic (*Nepeta binaloudensis* (leaf) with *Trachyspermum ammi* (fruit) and *Nepeta binaloudensis* (leaf) with *Lavandula officinalis* (flower) and antagonistic (*Pelargonium graveolens* (leaf) with *Lavandula officinalis* (flower) interactions. These interactions can be used to prepare more effective natural biopreparations and reduce herbicide use.

The growing trend in agriculture to reduce the use of pesticides is linked to the difficulty of protecting crops from pathogenic and toxic fungi. Faced with the withdrawal of chemical plant protection products, alternatives are being sought [23]. Hydrolates are an alternative method to chemical treatment and are safe for the environment, human health, and life. Rosinska's [24] study aimed to determine the effect of treatment with oregano and coconut hydrolysates on onion seed quality. The seed germination, vigor, and seed health of two onion seed samples were investigated. Seed germination was assessed according to ISTA principles, seed healthiness by an agar test, and vigor by germination rate and uniformity. Seeds were treated with hydrolysate solutions at concentrations of 10, 20, 50, and 100%; untreated seeds and seeds soaked in water and treated with a fungicide were used as the controls. Applying hydrolates improved germination; additionally, fewer diseased seedlings were also observed after treatment with hydrolate solutions. Higher concentrations of hydrolysates effectively reduced the fungi *Alternaria alternata*, *Cladosporium* spp., and *Fusarium* spp. by eliminating or reducing their presence on seeds. The study showed positive effects on seed health, especially at higher concentrations of coconut and oregano hydrolysates. Due to their beneficial effects on seed germination and seed health, hydrolysates can be recommended as effective and safe seed treatment formulations. Zabka [25], who searched among 69 species of safe antifungal plant substances as components of botanical pesticides, selected 13 species as being potentially interesting. *Krameria lappacea* (Dombey) Burdet & B.B. Simpson proved very intriguing, with an extraction efficiency of 17.6% and minimum inhibitory concentrations (MIC50) of 0.11–1.24 mg·mL^{-1}. A remarkable efficacy against dangerous filamentous fungi was demonstrated, comparable to expensive EOs or active phenolic compounds. In the most effective fraction of the extract by GC–MS and LC–MS analysis, two significant substances from the neolignan group, analogs of kramerixin, were detected, and their molecular structure was determined. The merits of *K. lappacea* are discussed based on the mode of action and chemical properties of the detected neolignans. It seems that *K. lappacea* may be a suitable source of environmentally friendly preparations due to its high efficiency of a simple extraction, excellent antifungal activity, broad antifungal spectrum, harmlessness, and assumed lower volatility of active compounds.

The interesting problem of the metabolic engineering of MAPs was discussed by Shelepova et al. [26], emphasizing that there is a need to overcome insufficient productivity through this route. Plant breeding is a traditional, labor-intensive, and limited method to improve the ability of aromatic plants to produce secondary metabolites. Modern biotechnology methods, including genetic engineering and genome editing, can be helpful and cost-effective in improving aromatic plants, as they can increase the efficiency of obtaining high-productivity plants and creating resistant forms and breeding lines. The genetic engineering of MAPs has developed over the last decade regarding the biotransformation of secondary metabolic pathways in general and individual terpene pathways. One of the most significant achievements of the last decade is the possibility of modifying the enzymatic pathway for metabolite conversion, thus improving the quality of EOs, and neutralizing undesirable chemical composition properties. Significant progress has also been made in obtaining more resistant forms and lines of MAPs through different approaches to genetic modification, which can reduce losses and increase productivity while exploiting the capacity inherent in plant systems to create protective mechanisms. For example, transgenic *Citrus sinensis* lines overexpressing the linalool synthase gene (CuSTS3-1), and with the highest linalool content, showed strong resistance to the citrus canker *Xanthomonas citri* subsp. *citri*. In contrast, gene expression in *Matricaria recutita* led to an increased release of (E)-β-farnesene, which helps the plant to attract natural enemies of aphids. Another aim of engineering natural bioactive compounds is to modify MAPs to increase their yield and EO content. Creating plants with a predominance of one or more components in the EOs expands the production range and increases the market potential of MAPs. More recently, obtaining EO compounds in the cell culture of particularly valuable and endangered plants, such as *Ajuga bracteosa* Wall ex. Benth., *Nepenthes khasiana* Hook f., *Zataria multiflora* Boiss, has become possible.

Moreover, Sommano et al. [27] presented novel perspectives on cultivating medicinal mushrooms. The fruiting bodies, mycelium, or spores in the form of extracts or powders of various medicinal mushrooms are used to prevent or treat many ailments and to balance a healthy diet. Among the active substances of mushrooms are triterpenes, lectins, steroids, phenols, polyphenols, lactones, statins, alkaloids, and antibiotics. *Taxomyces andreanae* species, cultured in a semisynthetic liquid medium, produced taxol and related compounds that are able to reduce breast cancer size. Recent clinical studies argue that even hallucinogenic mushrooms can potentially treat addiction, depression, anxiety, and other mental health problems. Psilocybin and psilocin are indole alkaloids found in many mushroom species, mainly *Psilocybe*. These compounds help to treat diseases of the human central nervous system. The use of psilocybin is considered relatively safe due to its minimal physiological toxicity and limited potential for misuse. It increases the demand for natural products derived from mushrooms. This study analyzed the types and varieties of therapeutic mushrooms, particularly those belonging to Psilocybe. It also evaluated approaches to cultivating and producing secondary metabolites, providing guidance to farmers and companies involved in cultivating and producing functional foods. Medicinal mushrooms can be cultivated conventionally or viathe novel technique of solid-substrate periodic fermentation using a polypropylene bag (bioreactor). Fungal bioactive substances such as psilocybin and psilocin can be obtained by culture in liquid medium or culture medium. Psilocybin produced at high de novo levels was biosynthesized from 4-hydroxylated substrates in *Saccharomyces cerevisiae* by implementing a biosynthetic pathway from *P. cubensis*, with the expression of a novel cytochrome P450 reductase.

4. Conclusions

The articles collected in this Special Issue clarify several topics concerning the morphological and chemical diversity of aromatic plants and the factors of their variability. Additionally, they point to directions for future research on this interesting group of plants. The variability in MAPs in terms of morphology, functional traits, chemical composition, and biological activity provides an opportunity for research to elucidate the specific physiological mechanisms and consequent changes in the content of bioactive substances. Research has demonstrated the antimicrobial and antioxidant potential of EOs and other bioactive compounds and their potential for applications in medicine, pharmaceuticals, cosmetics, and food production. The progressive decline of wild plant reservoirs in some areas of the world makes it necessary to take measures to protect the biosystem, which is supported, among other things, by attempts to acclimatize and cultivate wild plants. Introducing MAPs species into cultivation is considered a good practice to obtain a high yield of good-quality raw material with stable and reproducible characteristics while avoiding the potential extinction of the native population. Ideally, future research on topics such as the biodiversity of MAPs, their biological activity, the modification of their chemical composition, and the extraction and purification of medicinal compounds can be an effective means of obtaining safe pharmaceutical products.

Conflicts of Interest: The authors declare no conflict of interest.

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