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Editorial

Wild Plant Species as Potential Horticultural Crops: An Opportunity for Farmers and Consumers

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By the year 2050, it is predicted that there will be 10 billion people on the planet, and along with this population growth, the need for food production will dramatically rise. Over the past few decades, modern agriculture has relied on intensive farming techniques in an effort to achieve high yields and meet the current food demand. However, future agricultural productivity improvements may not be sufficient to ensure such high demands. There are about 30,000 plant species that are considered edible; however, very few of them have been cultivated as food crops on a commercially significant scale. Wild edible species have the potential to lead food systems to be healthier, more sustainable, and resilient to the current climate change situation. Increased tolerance to several abiotic and biotic stresses, as well as high nutritional value and excellent nutraceutical properties, are common traits of wild plants, making them promising candidates as new horticultural crops.

This Special Issue covers research aspects regarding novel approaches for the outdoor/indoor cultivation of wild or underutilized species that can give new opportunities for growers to produce new food categories, particularly appealing to modern consumers. Cultivating wild species is also a way to preserve the ethnobotanical heritage and promote genetic diversity. Furthermore, the cultivation of food plants usually gathered in the wild could reduce the health-related risks associated with pollution and biological contamination.

The domestication of new plant species is an ongoing phenomenon in agriculture, which is of great importance nowadays. Sulaiman et al. [1] reported that only 250 plant species are fully domesticated, while many wild plants could meet the challenge of producing crops that are resistant to a series of biotic or/and abiotic stress factors, such as pests or climate change. These authors collected and presented data from five case studies from five Eurasian regions with different climate conditions and ecosystems, including 20 taxa of wild species with a high potential to become novel cultivated plants. The presented species are culturally significant since they are employed in traditional cuisine and have promising economic value. Many of them are leafy vegetables (e.g., *Malva sylvestris* L., *Allium ampeloprasum* L., *Chenopodium album* L., to name a few) that are a great source of minerals, vitamins, proteins, and fibers; on top of that, they can be consumed raw (fresh) or cooked (boiled), and different plant parts can be used (leaves, flowering bulbs, fruits, roots, etc.). The cultivation of these species may supply rural areas, farmers, and consumers, with more diverse and healthy food resources, as they are adapted to different climate conditions. Future studies should focus on the agronomical performance of these species, whose cultivation would also be a way of protecting native populations, as some of them are considered vulnerable/rare.

Wild edible leafy plants are a rich source of nutrients, antioxidants and have special organoleptic features that are highly appreciated by consumers. Baldi et al. [2] cultivated

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four wild edible leafy vegetables, namely dandelion, sorrel, wild chicory, and wild lettuce (*Taraxacum campylodes* G.E.Haglund, *Rumex acetosa* L., *Cichorium intybus* L., and *Lactuca serriola* L., respectively) in a floating hydroponic system, to evaluate their performance from an agronomical, chemical, nutritional, and sensory point of view. Plants were grown for 7 weeks and harvested at the baby leaf stage. The analysis that followed revealed promising prospects for using these species as baby salads. Features such as yield and mineral content were comparable to those of already cultivated leafy vegetables. Higher yields were obtained in sorrel (3.2 kg FW/m^2) and wild chicory (3.7 kg FW/m^2), while the mineral analysis of wild lettuce revealed that this was richer in phosphorus (P), calcium (Ca), and magnesium (Mg), compared to cultivated lettuce at the same growth stage. The four species did not show health risks in relation to heavy metal accumulation. The evaluation of their sensory attributes revealed a quite distinctive profile, which could promote their value as consumers' demand for new, tasty, and healthy food increases.

Areas such as the Mediterranean basin are full of unexplored plant species that are commonly used for traditional medicine or traditional food recipes. One such species is *Sanguisorba minor* Scop., a wild edible plant that is commonly harvested in the wild in dry and semi-dry grasslands throughout Europe. This species can be consumed boiled, in soups, or in salads and is a rich source of amino acids, minerals, vitamin E, and antioxidants. Ceccanti et al. [3] compared and revealed the differences between wild and domesticated *S. minor* in terms of their nutritional value (minerals, free sugars, organic acids, etc.). The results showed that after the plant's domestication, there was an increase in a series of features such as protein content (18.80 g/100 g for the wild plants, 23.10 g/100g for the domesticated plants) and total organic acids (5.82 g/100g and 20.43 g/100 g, respectively). The cultivated plants reported a higher content of polyunsaturated fatty acids (50.90%) than saturated (13.40%), while both wild and cultivated samples revealed a low ω6/ω3 ratio (0.31 and 0.36, respectively), demonstrating the species' significance in the protection of oxidative and inflammatory processes. The authors concluded that, because of its excellent nutritional characteristics, *S. minor* could be used as a functional food or ingredient in the human diet. Furthermore, fertilization and domestication management may be a method to maintain or improve its nutritional profile.

The applied cultivation practices affect a series of parameters for each plant species. New cultivation techniques, such as soilless cultivations, provide new insights into plants' performance and attributes. Toward this direction, Chrysargyris et al. [4] evaluated the performance of *Portulaca oleracea* L. in a soilless system, using residues from the extraction of essential oils from medicinal plants (*Origanum dubium* Boiss. and *Sideritis cypria* Post) as a component in the growing media mixture for partial peat substitution (0, 5, 10, 20, 40% *v*/*v*). High ratios (>10%) of these residues in the growing media reduced plant growth in terms of fresh weight (FW), leaf number, and plant height while also affecting the plant's mineral accumulation and physiological (stress) condition. This resulted in an increase in the antioxidant profiles of the plant that, in some cases, appeared more than doubled (up to 2.2 times). Additionally, when residues of *O. dubium* were used in the growing media (from 5% to 20%), the total phenolic compounds of purslane were increased up to 30.2%, in comparison to plants grown in 100% peat. This study concludes that tested residues can be used in a growth media at low ratios (up to 10%), given that, despite the growth inhibition, plants appeared to have improved nutritional profile and antioxidant status. In this study, the authors also promoted the sustainability of the cultivation/production of medicinal plants, as they demonstrated that all the materials produced by these crops (fresh and dry mass, essential oils, and residues) can be used. The waste, in fact, can be reused for other cultivation, even increasing the quality features of the produced plant, in this case, *P. oleraceae*.

The ability of plants to survive or to perform well under stress and abiotic conditions through increased electrical conductivity (in terms of salinity) or the deficit irrigation regimes have lately attracted research interests due to the scarcity or the low quality of water for agriculture. Alexopoulos et al. [5] cultivated *Hedypnois cretica* L. and *Urospermum*

picroides L. under three salinity levels (EC fixed at 2.0–2.2, 6.0–6.2, and 10.0–10.2 dS m^{-1}). These wild edible species of the Asteraceae family are commonly used in the Mediterranean area as food or medicines and have been referenced to be rich in bioactive compounds. The results of this study indicated the strong impact of salinity levels on the growth (leaf number, rosette diameter, plant fresh weight, etc.) and quality (mineral content, chlorophylls, total phenolic compounds, sugars, acidity, etc.) of both species while *U. picroides* appeared to be more tolerant to salinity compared to *H. cretica*. It is worth noting that the nitrate content decreased considerably even at moderate salinity levels, with a positive influence on the final quality of the edible leafy product. The water issue is also the work of Guarise et al. [6], who evaluated hedge mustard (*Sisymbrium officinale* (L.) Scop.) as a potential leafy vegetable for the fresh-cut salad industry production chain. For this aim, two populations of *S. officinale* (from Milan and Bergamo, Italy) were studied. Firstly, plants were grown for seed production, and then the produced seedlings were cultivated under 100% and 50% of the crop water requirement. The obtained results demonstrated that the species could be cultivated with a 50% of water reduction without decreasing the plant's yield (ranging from 22.3 to 40 g per plant). Interestingly, no effect was noticed for a series of quality parameters, such as the anthocyanin content (47 mg kg^{-1} FW) and total sugars (ranged from 7–10 mg kg^{-1} FW); however, as in the case of increased salinity mentioned earlier, total phenols were 25% higher in the leaves of plants grown under 50% of the water requirements in plants originating from both tested populations, as a response to the drought stress, which induced the production of secondary metabolites. This species may be appropriate for increasing vegetable output in geographical areas with limited water availability, or as an ideal crop for winter production when irrigation is limited to avoid the spread of fungal infections.

Abiotic or biotic stress conditions are not the main factors that affect plants' growth and quality. The fertilization plan is the first and one of the most important practices in commercial farming, and it greatly adds to crop yield and quality. In the study of Paschoalinotto et al. [7], *Scolymus hyspanicus* L., an edible wild Mediterranean species, was cultivated under different fertigation regimes in terms of different levels of nitrogen (N), phosphorus (P) and potassium (K), ranging from 100 to 300 ppm. Seven experimental treatments were used, including six fertigation regimes and the control treatment, where no fertilizers were added. The growth, nutritional, mineral profile, and chemical composition of *S. hispanicus* were evaluated at the end of the cultivation period. The results revealed that the moderate levels of K and P (200 ppm) resulted in a higher fresh mass yield (113.58 and 116.27 g, respectively), while the lowest value was recorded when the input of N, P, and K was at the highest tested levels of 300 ppm each. The applications of moderate K and P also produced plants with increased nutritional features, such as fiber and carbohydrate content. Nutrient solution management appears to be a very efficient strategy to increase the fresh yield of *S. hispanicus* without sacrificing the nutritional value. On top of that, low inputs of minerals such as K and P may improve the chemical composition of the species.

Fertigation management, the irrigation regime, and other cultivation strategies are species-specific, and in many cases, different management is required at different growth stages of a plant or different ripening stages of fruits. The study of Arena et al. [8] investigated the patterns of the accumulation of carbohydrates, organic acids, and minerals during different developmental stages of *Hexachlamys edulis* (O. Berg) Kausel and D. Legrand fruits, which is an underutilized native species from South America, is representative of the Myrtaceae family; the pleasantly tasty sweet and sour fruits of the plant are referenced for their high antioxidant activity and high carotenoid content. Additionally, the plant's leaf extracts are well known for their pharmacological properties, as they are used against bronchitis and coughs. For the first time, variations in carbohydrates, organic acids, and minerals in fruit's ripening stages were investigated. The rise in total sugars, together with the absence of changes in total organic acids with ripening, suggests a sweeter and less sour fruit meaning that this is a desirable product to be consumed. The results of this study pointed out that the optimal time for *H. edulis* fruit consumption, in order to reach the maximum flavor and

a good amount of nutrients, is the ripe or overripe stage, and suggested that the fruits are a promising source of compounds with high nutritional value. In the same context, Jia et al. [9] investigated changes in the physicochemical characteristics, antioxidant content, and nutritional composition of *S. obovatifoliola* subsp. *urophylla* (Hand.-Mazz.) H. N. Qin fruits at different maturity stages. This plant, endemic to China, produces large edible fruits with soft pulp and sweet taste, and the results of this study provide information for the proper maturity stage at harvest of fruits with better quality, longer shelf life, and better market acceptability.

Historically, gathering wild edible plants was the only way to survive amid famines and chronic poverty. These days, wild edible plants are more than a trend, and their introduction in cultivation schemes can provide not only important knowledge about the quality of the plants themselves but also allow the best cultivation mode to be found to make their production commercially significant. *Heracleum sphondylium* L., commonly known as hogweed, is an herbaceous plant of the Apiaceae family native to Europe and Asia. This wild edible plant grows in many different ecosystems and has been used in traditional medicine or as a food ingredient. Matarrese and Renna [10] reviewed the studies on this species, aiming to spread its knowledge and prospects as a new cash crop, which could be cultivated as both a horticultural and industrial crop. This review further indicates that ethnobotany may provide agricultural guidance, as hogweed and, more broadly, all wild edible plants have the potential to lead to healthier, more sustainable, and resilient food systems in the context of biodiversity enhancement.

This Special Issue collects a series of new approaches to the importance of the domestication of wild edible plants. The effect of cultivation practices, a series of abiotic stress factors such as salinity and deficit irrigation, were also evaluated during their introduction into cultivation schemes. Additionally, the effect of the ripening fruit stage on the nutritional features and the level of bioactive compounds of unexplored plants was also examined. According to the studies presented in this Special Issue, wild edible plants are promising candidates for both pharmaceutical and agri-food industries for the introduction of new agricultural crops and the achievement of functional products. Scientists from various disciplines (agronomists, chemists, pharmacists, biologists, etc.) need to combine forces and work toward the full domestication of wild edible plants in order to enrich food availability and diversity, while at the same time, protecting native populations.

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

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