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Food plant diversity in cultural ecosystem services perspective: edible plants as a driver for improving the offer of gastro-tourism

Диверзитет јестивог биља у перцепцији културних услуга екосистема: јестиво биље као покретач унапређења понуде гастро-туризма

Milica Luković[1], Danijela Pantović[2], Marija Kostić[3], Sonja Veljović[4], Jovan Bugarćić[5]*

[1,2,3,4,5]University of Kragujevac, Faculty of Hotel Management and Tourism in Vrnjačka Banja, Vojvodjanska 5a, Vrnjačka Banja, Serbia /
Univerzitet u Kragujevcu, Fakultet za hotelijerstvo i turizam u Vrnjačkoj Banji, Vojvođanska 5a, Vrnjačka Banja, Srbija

* Corresponding author / Autor za prepisku

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Abstract: Recent studies indicate a decennial decline in wild edible plant resources consumption and use in traditional cuisine, while Covid-19 reversed this situation in the last two years into increased demands for well-rooted traditional products. By using the literary potential of wild edible plants in gastronomy and semi-structured interviews (n-29) in affirmed rural tourist households, research investigate 1) the diversity of wild edible plants proven in gastronomy, 2) the diversity of plants that are currently used in the preparation of traditional dishes and 3) an experimental tourism model was conducted to evaluate the relationship between wild edible plants and tourism-related cultural ecosystem services.The results show limited plant diversity patterns used as traditional food components compared to natural resource potentials. In the range of cultural ecosystem services, results indicate the variety of categories in which wild edible plants represent the catalyst of local eco-gastro tourism improvements through the authentic sense of gastronomy, herbal tours, rare species, etc.

Keywords: wild edible plants, cultural ecosystem services, gastro-tourism.

Сажетак: Недавне студије указују на десетогодишњи пад потрошње и употребе самониклог јестивог биља у традиционалној кухињи, док је Covid-19 преокренуо ову ситуацију због повећане потражње добро укорењених традиционалних производа. Коришћењем литерарно познатих потенцијала дивљих јестивих биљака у гастрономији и полуструктурираних интервјуа (n-29) у афирмисаним сеоским туристичким домаћинствима извршено је истраживање 1) разноликости дивљих јестивих биљака доказаних у гастрономији, 2) разноликости биљака које се тренутно користе у припреми традиционалних јела и 3) спроведен је експериментални туристички модел за процену односа између дивљих јестивих биљака и услуга културног екосистема у вези са туризмом. Резултати показују ограничену шему употребе јестивог биља које се користе као део традиционалне компоненте хране у поређењу са потенцијалима природних ресурса. У спектру културних екосистемских услуга, резултати указују на разноврсност категорија у којима самоникле јестиве биљке представљају катализатор унапређења локалног еко-гастро туризма кроз аутентични израз гастрономије, биљне туре, ретке врсте итд.

Кључне речи: самоникло јестиво биље, културне екосистемске услуге, гастро-туризам.

[1]*orcid.org/0000-0002-7102-0178, e-mail: milica.petrovic@kg.ac.rs*
[2]*orcid.org/0000-0001-8605-8614, e-mail: danijela.durkalic@kg.ac.rs*
[3]*orcid.org/0000-0001-8105-8033, e-mail: marija.kostic@kg.ac.rs*
[4]*orcid.org/0000-0001-6408-9153, e-mail: pecic84@hotmail.com*
[5]*orcid.org/0000-0002-6104-2939, e-mail: bugarcicjovan@gmail.com*

INTRODUCTION

According to the definition (Hummer, 2013; Reyes-García et al., 2015; Schulp et al., 2014), wild edible plants are plants species that are grown spontaneously in their natural habitat and collected from nature providing direct and indirect resources for human nutrition in diverse forms (e.g. food, beverages). Under the global trends in homogenisation and energy-boosted food enriched with refined carbohydrates and "bed" fats, added and artificial sugars, and an increase in animal-sourced products, wild edible plants are almost neglected (Schunko et al., 2022). Millenium ecosystem assessment (MA, 2005) reported a globally decreasing trend in the gathering and consumption of wild edible plants, even though they are still representing additional economic benefits for rural communities. The source of income based on wild plants is achievable through plants collected from wild and trade markets, practical use in gastronomy, tourism, herbal tours, natural products, etc. Wild edible plants are important from the aspects of local food security, nutrition patterns and biodiversity conservation. In the last two years, enforced by Covid-19, the situation with wild herbs gathering, consumption and use has changed. The world trade report on medicinal plants indicates increased demands for natural immune-boosting species under the Covid-19 circumstances (Timoshyna et al., 2020; Gajić et al., 2022). As well as, a number of papers (e.g. Luković et al., 2023) reported a rise in wild edible plants consumption and demand for natural-based products in tourism areas. These reports indicate potential open space for "big-return" plants from the wild in local businesses strengthening gastro tourism products' authenticity and maximization of cultural ecosystem services utilization.

Ecosystem services represent a range of goods and services from nature (MA, 2005). They include four main categories (supporting ES, provisioning ES, regulating ES and cultural ES) with direct and indirect ecological, economic and social benefits to humans (de Groot et al., 2002). Wild edible plants are incorporated in almost all ecosystem categories, especially perceived and evaluated in provisioning and cultural context (Reyes-García et al., 2015). Cultural ecosystem services as a non-material range of services include categories related to aesthetic and sense of place, biological and intangible cultural heritage, tourism and recreation-related activities, with educational and spiritual functions. Primarily, wild plants are an integral part of provisioning ecosystem services as direct benefits to humans and the local community through collection and utilization. In a cultural context they could be considered as a source of authenticity and experience incorporated in local gastronomy, part of ecotourism offer (herbal tours, plant watching/safari), including traditional practices, skills and knowledge. Current global trends such as rural areas depopulation, traditional practices and knowledge erosion, migrations, agro biodiversity business decrease, habitat alternation, etc., had an impact on wild edible plants consumption and representation in rural tourism gastronomy offer (Abbet et al., 2014). New tourism waves, encouraged by Covid-19, could spontaneously force wild edible plants to gather, rebuild traditional roots, reinforce plant consumption in traditional or innovative dishes and reconnect or fortify the relationship with cultural ecosystem services.

Ethno botanical studies conducted in the Republic of Serbia mostly considered wild plants as a source of phytochemical components or traditional medicinal use (e.g. Janaćković et al., 2018; Jarić et al., 2015; Šavikin et al., 2013; Šoštarić et al., 2023). A very small number of studies perceive the diversity and utilization of wild edible plants as a part of nutrition and local gastronomy. Dajić Stevanović et al., 2014 reported the importance of ethno botanical knowledge and practices for sustainable rural development including autochthon fruit, vegetable and wheat species, as well as wild edible plants as a part of the centuries-long tradition. Natural resources and gastronomic culture united in cultural ecosystem services represent an indivisible part of the cultural heritage of each country (Luković et al., 2023). Following trends, eco-friendly environment and well-being, local plant richness and diversity contributed to tourism needs and attractiveness through, plant-based dishes and products, traditional culinary festivals, and cultural and other social events (Pamungkas et al., 2013). According to Sujarwo & Caneva (2016) wild plants used as traditional nutrition is necessary for fostering and making strong relations between biodiversity, and cultural ecosystem services for sustainable tourism development.

In the context of the perceived importance of food plants for gastro-tourism improvement, ultimately rural development based on tourism, this study aims to overview cultural ecosystem services related to food plant potentials from proven sources and their utilization in the real frame of the current gastronomic offer in rural tourism households.

1. MATERIALS AND METHODS

Study area and data collection

The research was conducted in the territory of the Republic of Serbia (Figure 1) with focus on registered touristic households, geographically distr-

ibuted on the north, west and east, following potentially prominent areas with considerable diversity of edible plants. Taking into account affirmed rural-tourism households, 29 representatives mainly from western Serbia were selected for focus group discussion. The research included 3 parts: identification of key elements of cultural ecosystem services, resource utilization in gastronomy and tourists experience. Together with focus group, semi-structured interviews related experience with local food were conducted between tourists. In addition, they valuated sub-categories of cultural ecosystem services. The research was designed using concept of tourism experience according to Pine & Gilmore's (1999) which considers four cultural ecosystem services sub-categories. Obtained results are statistically analyzed, compared and graphically presented. The most frequently mentioned plant species were counted using Relative frequency citation index RFC=FC/N (FC is frequency of citation and N is a total number of respondents, 0-1) and the values grouped 0-0.2=1; 0.3-0.5=2; 0.6-0.8=3; 0.7-0.85=4; 0.86-1=5).

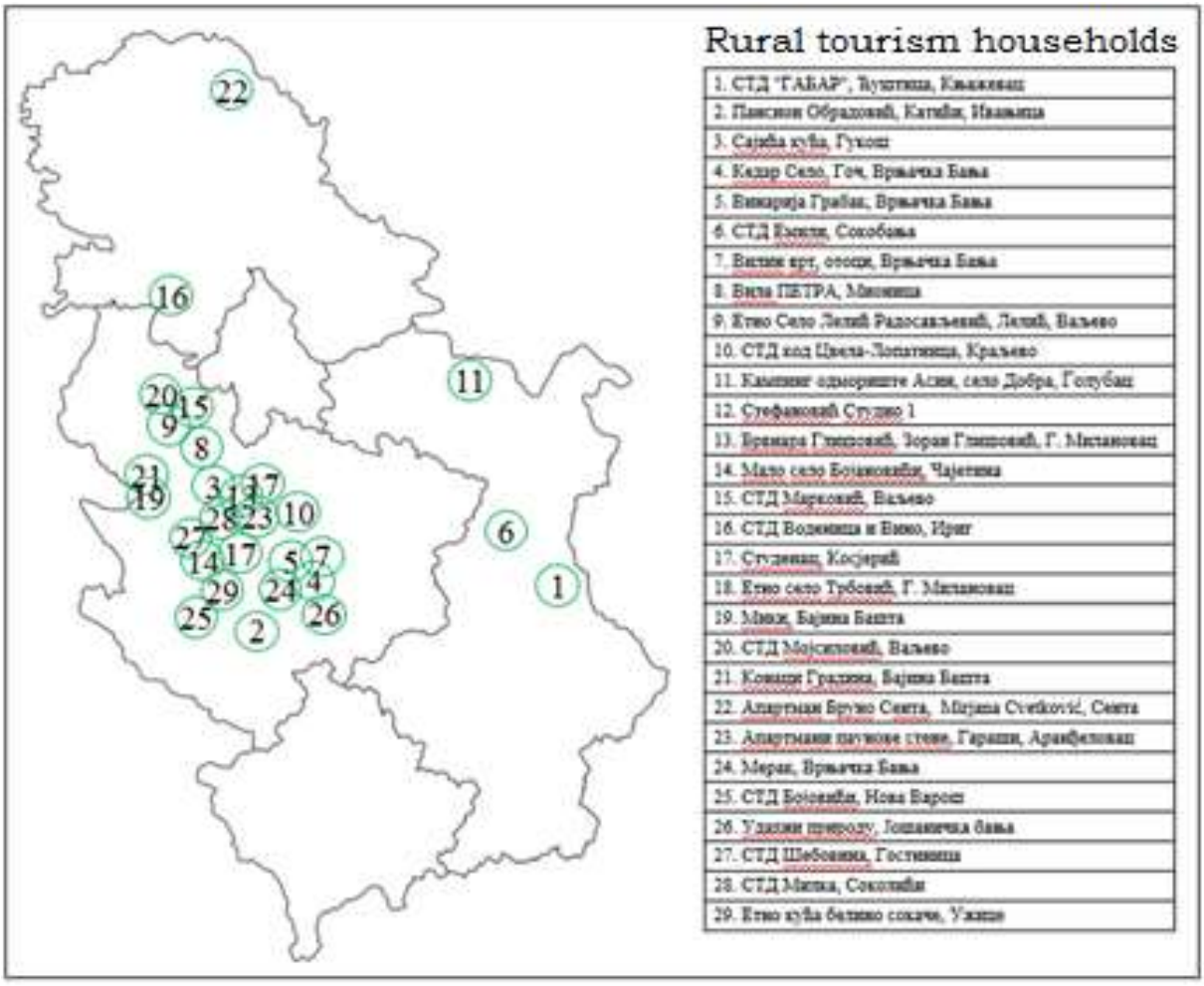

Figure 1. Map of the researched area

2. RESULTS AND DISCUSSION

Representatives of rural tourism households mentioned about 120 plant species that they use in local gastronomy and medicine. According to the frequency of participants' statements for consumption purposes, 30 plant and mushroom species with the highest RFC score (Table 1) were presented in Table 1. The wider distribution of a few mentioned plants influence that they are common for all geographical regions e.g. *Urtica dioica, Rumex* spp., *Taraxacum officinale, Mentha spicata*.

Table 1. The most frequently used plants/mushrooms regionally

	Plant species	Local name	RFC_W	RFC_E	RFC_N	Plant part use	Purpose of usability
AU	*Allium ursinum*	Wild garlic	5	4	1	L	Pie, fresh-salads, fermented
MC	*Matricaria chamomilla*	Chamomile	3	4	5	H	Tea
MS	*Mentha spicata*	Spearmint	4	5	3	L, H	Tea, juice, spice
MO	*Mellisa officinalis*	Lemon balm	3	4	5	L	Tea, spice
OV	*Origanum vulgare*	Oregano	5	5	2	L, H	Tea, spice
SM	*Satureja montana*	Winter savory	1	5	1	H	Tea, spice
TO	*Taraxacum officinale*	Dandelion	4	5	3	L, F	Fresh-salads, juice, honey
TV	*Thymus vulgaris*	Common thyme	4	5	2	H	Tea, spice
UD	*Urtica dioica*	Stinging nettle	4	4	3	L, S	Soup, pie, juice
CM	*Cornus mas*	Cornelian cherry	4	3	1	Fr	Juice, jam, “compot”
FV	*Fragaria vesca*	Wild strawberry	5	5	3	Fr	Juice, “slatko”, jam
PS	*Prunus spinosa*	*Blackthorn*	5	4	4	Fr	Juice, jam, tea
JR	*Juglans regia*	Walnut	4	3	2	Fr	Fresh, rakia
JC	*Juniperus communis*	Juniper	4	3	1	Fr	Rakia, tea, spice
RC	*Rosa canina*	Dog rose	5	4	2	Fr	Jam, tea
RV	*Rubus vulgaris*	Blackberry	5	4	1	Fr	Juice, jam, “slatko”, Confectionery
R	*Rumex* spp.	Greens	5	4	3	L	Pie, soup, sarma
SN	*Sambucus nigra*	Elder	4	4	2	F	Juice
VM	*Vaccinium myrtillus*	Bilberry	5	4	1	Fr	Juice, jam, “slatko”, Confectionery
FE	*Fagopyrum esculentum*	Common buckwheat	5	3	1	S	Bread and pastry
AO	*Asparagus officinalis*	Sparrow grass	2	2	4	L	Salads, dish
AG	*Anethum graveolens*	Dill	2	2	4	L	Spice
ME	*Morchella esculenta*	Common morel	4	2	1	Fr	Cooked, fermented
CS	*Cantharellus cibarius*	Chanterelles	5	4	1	Fr	Dried, cooked, fermented
AC	*Agaricus campestris-*	Field mushroom	4	3	1	Fr	Dried, cooked, fermented
LP	*Lactarius piperatus*	Pepper milkcap	5	4	2	Fr	Cooked
B	*Boletus* spp.	Porcini mushrooms	5	5	2	Fr	Dried, cooked, pickled, spice
MP	*Macrolepiota procera*	Parasol mushroom	4	3	1	Fr	Cooked, fermeted

Abbreviations: RFC – relative frequency of citation (W-west, E-east, N-north), H – herb, Fr – fruits, L – leaves, F – flowers, S-seed, R – root

Opposite, plant species (e.g., *Allium urisnum*) is specific to the west and east mountain regions of Serbia, with limited distribution on the southern border of Vojvodina, Fruška Gora mountain. Mostly berries, including *Fragaria vesca, Prunus spinosa, Juniperus communis, Rosa canina, Rubus vulgaris*, are dominant in western cuisine with the highest RFC scores (4 or 5). Aromatic plants used as a spice (e.g. *Origanum vulgare, Satureja montana, Thymus vulgaris*, etc.) are characteristic for east and west regions (Figure 2), except *Matricaria chamomilla* which was mentioned by households from the north. Mushrooms are expressed with high RFC scores (5 and 4) in western Serbia gastronomy, with mostly RFC (2-4) in the eastern region and the last RFC (1-2) in northern Serbian cuisine. Despite the proven diversity of nature in our country (especially forest ecosistem), the utilization of wild plants has great unused potential. Vračarić et al. (1986) reported that approximately 20 percent of Serbia's flora has edible value and can be used as vegetable plants and salads, teas, herbs rich in starch, spices etc.

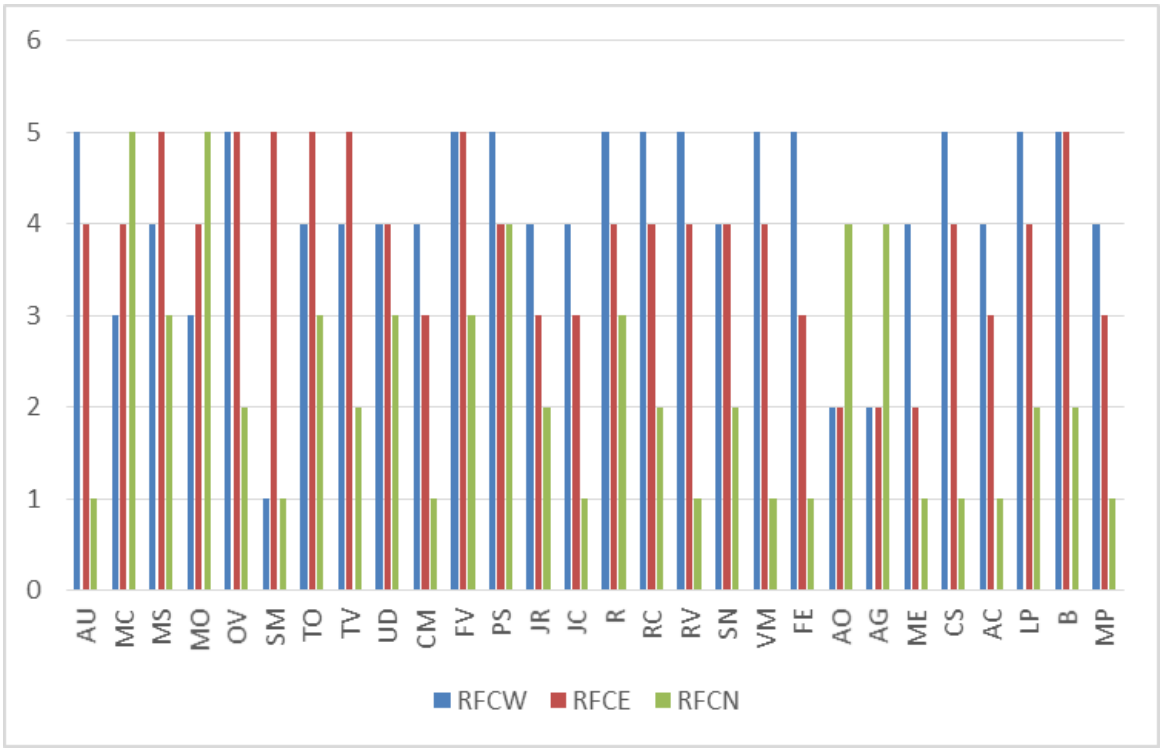

Figure 2. Regional usage of food plants according to transformed RFC score (1-5)

Obtained data showed that the majority of mentioned plant species (about 20%) are utilized as raw material for beverage preparation (juice, tea or rakia). Wild species (e.g. *Fragaria vesca, Rubus vulgaris, Sambucus nigra*) are commonly used for juice preparation, while *Taraxacum officinale* and *Prunus spinosa* used less frequently (Fig. 3). Species *Urtica diorica* and *Rumex* are used for pies and soup preparation in almost all included regions. Besides fresh mushrooms used in culinary, they can be preserved by different technology methods and used as dry, or fermeted. Interestingly, mushroom species (e.g. *Fistulina hepatica*) are used as material for jam preparation.

In previous scientific research, the well-rooted use of wild edible plants is proven on the territory of the seleced areas (Filipović & Tasić, 2012). Our data showed that a variety of plants used in Neolithic nutrition such as *Triticum durum, Sambucus nigra, Rubus fruticosus, Pyrus* sp., *Cornus mas*, etc., have still remained in the diet today.

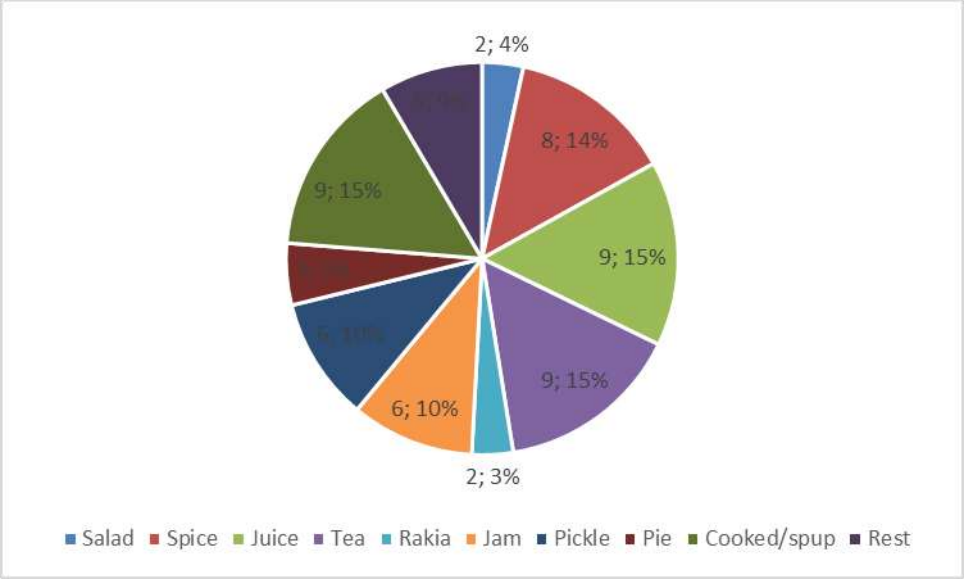

Figure 3. Percentage of food plants in different gastronomic products

The resource-use model proposed by Sommit & Boonpaisarnsatit (2020) was applied to evaluate experience related to food plant knowledge and utilization. An experimental test was applied to 37 students with experience in rural tourism households. Before travel, interest and awareness of food plant species, their utilization in local cuisine was highly evaluated (average 4.12). During the travel, expectations were incompatible with the site situation, which was evaluated at 3.47. In post-travel, tourists expect a greater level of involvement of wild plants in gastronomic offers. The expectations are expressed with an average score 4.52 related to raising awareness, more diversity of wild plants in food products and enriched gastro-tourism offers.

Table 2. Evaluation of pre/during/post travel experience related to food plant knowledge and utilization

	Evaluation aspects	Score/mean
Pre-travel knowledge and experience	- Interest in local food plants	4.47
	- Awareness of food plants benefits	4.30
	- Knowledge on food plants utilization and tradition	3.61
During travel knowledge and experience	- Food plants as part of current gastronomic offer	3.80
	- Diversity of wild plants in gastronomic products	3.41
	- Education on local food plants	3.21
Post-travel knowledge and experience	- Raise awareness about food plants	4.12
	- Level of experience on food with wild plants	4.54
	- Potentials to enrich gastronomic offer	4.81
	- Applicability of knowledge and practices	4.62

The consumption of wild food plants has often been ignored and marginalized by modern agricultural production systems (Baldi et al., 2022). Data presented and discussed in this paper provide information on the use of wild food plants in Serbian gastronomic tradition, and show that these biological resources can play an important role even today.

At a gastronomic point of view, wild plants are a specialty in Serbia, they are sufficiently varied and diverse, and rich and interesting in taste and aroma with potential nutritive value. There are sources that indicate that wild plants have always been used on Serbian soil as an addition to other food, but the data about the utilization of mushroom in the diet no exist until 19th century (Mandić et al., 2018). Based on the available literature, many wild plants were used as part of a home pharmacy in the past (Vulić, 2021; Carvalho & Barata, 2017; Popović et al., 2020). Both medicinal plants and foods are considered to have healthful properties, preventing disease by strengthening the body's defense system (Baldi et al., 2022). Although that wild plants cannot be used as independent dishes (salads and deserts) in most case, they are an excellent addition or spice that brightens the plate and adds a great deal of aromas, flavors and wonderful colors (Carvalho & Barata, 2017; Božić & Milošević, 2021). As an added value, the dishes are also inspired by stories about wild plants, which are closely connected with the Serbian cultural and culinary heritage.

Wild plants of Serbia can be discussed in terms of diversity, nutritional value and usability. An important fact is that forests occupy about one third of the territory of the Republic of Serbia (Smailagić et al., 2019), while these territories contain a large number of wild plants with notable potential for utilization in daily diet. Our ancestors developed cultivated plants from wild plants, as they were consequently easier to grow and, above all, met the mass need for plant crops (Filipović and Tasić, 2012). With the development of plant cultivation, crossbreeding and thus the creation of new species that are more friendly to agriculture, man has lost the need for gathering (Vulić, 2021), which has been significantly changed in the last three years by the COVID-19 pandemic. A detailed ethnobiological view of one complex cultural food showed the importance of this approach in future research. Some of the species would be interesting to study for their nutritional content and pharmacological properties, especially wild fruit in Serbia (Popović et al., 2020). These figures, as well as the versatility observed in the use of many species in terms of both utilized plant parts and recipes they are intended for, demonstrate the richness of traditional Serbian ethnobotany. Such biocultural heritage, on one hand, needs to be safeguarded from the risks of progressive depletion related to the ongoing disappearance of rural society; on the other hand, it can be a “source of inspiration”, in the light of current scientific and technical knowledge, for different fields of human activity, including agriculture.

Finally, it should also be recalled that the use of wild plants is closely linked to the environment and its preservation. In this regard, knowing and passing on the local traditions is a way to maintain that specific link existing between the communities and the surrounding environment, where traditional knowledge has been formed and experienced.

CONCLUSION

The present study revealed a complex relationship between a human food culture and the biodiversity of the surrounding environment. Based on the obtained data, we found that wild plants can be included in the gastronomic choices offered in Serbia. Obtained data showed that all analyzed regions have notable plant species that wider utilized in local gastronomy as sources of valuable nutrients as well as the aroma. Evaluation of pre/during/post travel experience related to food plant knowledge and utilization showed that the tourist experience has a notable difference. The plant diversity in the Republic of Serbia has great potential in local gastronomy. Analysed available literature sources indicate historically rooted traditions in food plant utilization, as well as the great number of plants which could be used to improve the local gastronomic offer. Enrichment of gastro-tourism offers with local food plants makes the new experience and travel motives.

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