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TRADITIONAL USES OF WILD BERRIES IN THE BUKOVINA REGION (ROMANIA)

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Abstract: *In recent years there has been given increased attention to the health-promoting dietary recommendations as regards the use of wild berries in human nutrition. This study analyzes the differences in the consumption of wild berries in the Bukovina area (in the northern part of Romania). Bilberries (Vaccinium myrtillus L.), sea-buckthorn (Hippophae rhamnoides L), rosehip (Rosa Canina L.) and hawthorn (Crataegus monogyna L.) are the plants harvested from spontaneous flora, with diverse uses, such as preparation of juices, tinctures and decoctions or tea beverages due to their medicinal and nutritional potential. Wild berries are also processed for production of beverages, jams, as functional food products, and, to some extent, they are consumed fresh as well. The consumers' preferences were established by the analysis of questionnaires of 101 respondents interviewed concerning different botanicals used in a particular geographical and cultural context. The results show that the selections of wild berries containing many biochemical compounds are mostly used as teas or decoctions due to their nutritional role and health benefits. The preference for sea-buckthorn (Hippophae rhamnoides L) was strongly associated with its dietary benefits for the immune system. The consumption of wild berries is considered important by the Romanians living in Bukovina in fresh form, as beverages or in the dried form.*

Key words: *Consumers' preferences, wild berries, Bukovina, Romania.*

1. Introduction

Bukovina has a population of over 630 thousand people, the majority living in the 97 villages spread throughout the mountainous area. The use of traditional medicines made from wild berries fruit to prevent diseases has been present in Bukovina since immemorial times and the villagers have made a craft of such practices. Thus, over the last decades, the interest in harvesting wild berries has increased considerably in many mountain regions of Romania.

Sea-buckthorn (*Hippophae rhamnoides L*), hawthorn (*Crataegus monogyna L.*) and rosehip (*Rosa Canina L.*), collected in the wild constitute a good source of natural antioxidant substances and the consumption of fruits plays an important role in the maintenance of health and in disease prevention [1]. Wild berries represent a rich natural resource in Bukovina, but their collection and capitalization have not been developed enough in the region.

Consumers' preferences (color, taste, flavor, aroma, texture) and information on health benefits may also be important in increasing the interest in wild berry picking as an activity.

The fruits of sea-buckthorn are the most favored fruits of edible wild plants, and probably the most frequently used ones

today. In Romania, local people used sea - buckthorn berry to treat urticaria, burns and other skin wounds, gastric and duodenal ulcers, liver diseases, anemia, atherosclerosis and cardiovascular disorders, fatigue and even stress. Sea buckthorn pulp oil treatment prevents atherosclerosis by lowering triglyceridemia, cholesterolemia and blood pressure (strong effects) and by reducing oxidative stress, inflammation and insulin resistance (weak effects) [2].

The fruit of sea buckthorn (*Hippophae rhamnoides L*) contains proteins, lipids, carbohydrates, vitamins (C and E), phenols, carotenoids, flavonoids, minerals, and volatile compounds and has various health benefits. The author of the study also reported that sea buckthorn berry cultivars (ssp. *carpatica*) exhibited higher oil content than other European or Asiatic sea buckthorn subspecies [3]. Moreover, the pulp/peel oils of ssp. *carpatica* were found to contain high levels of oleic acid and slightly lower amounts of linoleic and α-linolenic acids [3].

In another study, the authors evaluated the content of berries and leaves of six varieties of Carpathian sea buckthorn (*Hippophae rhamnoides L., ssp. Carpatica*) in terms of their carotenoid composition (free and esterified, (Pop et al. 2014). Total carotenoid content varied between 53 and 97 mg/100g dry weight in berries [4]. Volatile compounds of sea buckthorn are responsible for specific flavors and bacteriostatic action. In a study made by Socaci et al. 2013, the volatile compounds, in the headspace of sea buckthorn samples originating from the Carpathians, Romania, were separated. The most abundant derivatives were ethyl esters of 2-methylbutanoic acid, 3-methylbutanoic acid, hexanoic acid, octanoic acid and butanoic acid, as well as 3-methylbutyl 3-methylbutanoate, 3-methylbutyl 2-methylbutanoate and benzoic acid ethyl ester [5].

The fruit of blueberries *(Vaccinium myrtillus L.*) are eaten fresh, used in the preparation of tea, juice, as a remedy for gastric and duodenal ulcers, some types of cancer, being also recommended in the prevention of coronary diseases. Blueberry peels may be used in pharmaceutical products, due to their potential beneficial effects on human health; they have been reported to improve neuronal and cognitive brain functions and ocular health. On the other hand, recent studies indicated that the high contents of polyphenols and acid ascorbic in blueberries can play a remarkable role in the northern European diet, especially when redox homeostasis is imbalanced [6].

Blueberry low-sugar jams and juices are recommended for diabetics and people with specific health problems [7].

The fleshy part of the rosehip fruit is used in the pharmaceutical industry, as health supplements and for the preparation of herbal tea, due to its therapeutically properties: choleretic, diuretic, vitamin provider, antioxidant, astringent, anti-inflammatory and antidiabetic. It is also used in food industry in juices, as ingredients in pro-biotic drinks, yoghurt, jellies, jams and alcoholic beverages etc.

Various studies over the last decades have shown that the consumption of rose hip fruits may reduce the risk of many diseases, including, gastrointestinal, osteoarthritis, rheumatoid arthritis, inflammation, renal, gynecological, lung and nerve diseases [8, 9 and 10].

Clinical and experimental investigations show that hawthorn preparations can be safely used for the treatment of hypertension, it prevents ischemia and generally slows the heart rate, it also prevents chronic degenerative diseases especially atherosclerosis and cancer [11].

Nowadays, however, the consumption of wild berries is determined by the pleasure of gathering wild resources, recreating traditional practices and enjoying the

characteristic flavors [12]. Some authors studied the consumer perceptions of 3 formulations of frozen dessert bars made from both soy and wild blueberries [13]. The formulations tested in this study have got low acceptability, (chocolate and vanilla) flavor being mentioned as an essential reason when choosing frozen soy products [13].

Most studies on wild edible berries focus on nutrient contents in terms of macronutrients, minerals, and vitamins [1, 8, 9 and 10]. Size and texture are the ones of the most important quality parameters of wild berries strictly related to consumer perception [14].

Other studies have attempted to optimize pomegranate juice with blueberry, raspberry, or blackberry added in juices, to increase acceptance and consumption. Pomegranate/blueberry juice with 20% and 50% of blueberry juices have shown a higher acceptance for consumers, being the best option for the consumers interested in health benefits [15].

Documentation on the use of wild berries in treating some diseases is important for traditional medicinal practices and has contributed to the development of new dietary supplements.

Therefore, the objective of the present work is to provide information on the consumption and to study the use of traditional medicines made from the wild berries fruit registered in Bukovina (Romania). These data would be useful in rendering the wild berries' picking more important and providing nutritional, economic and cultural benefits.

2. Materials and methods

Methods

101 students were recruited from the Faculty of Food Engineering of the Suceava University, situated in Bukovina region (Fig. 1), located in the northeastern part of Romania.

Students were interviewed based on questionnaires about their consumption way and health benefits regarding wild berries used in traditional contexts. The respondents were explained the purpose of the questionnaire and they were asked to give their consent for collected data dissemination.

Fig. 1 - Geographical location of the study area

Wild berries preference checklists

Four wild berry fruits were taken into consideration in order to establish a preference checklist.

Statistical Analysis

Data sets were evaluated using descriptive statistics for average ± standard deviation. A principal component analysis (PCA) was performed with XLSTAT™ (Version 2017, by Addinsoft, U.S.A.).

Consumers test

Research was conducted in the Faculty of Food Engineering, Stefan cel Mare University of Suceava, Romania. A total of 101 of wild berries consumers recruited from the students who participated in the test (15^{th} – 25^{th} June 2018). The gender of participants being 78% female and 22% male, and their ages ranged from 19 to 24 years old. The mean age, sex and BMI (Body Mass Index) of respondents who answered the questionnaire are given in the Table 1.

Table 1.
The structure of respondents who answered the questionnaire

Category	Sex		Percent
	male	female	
Mean ± SD of age	20.32±1.52	21.15±3.86	
Mean ± SD of BMI	23.71±2.67	21.82±3.23	
Underweight (BMI<18.5)	-	9	8.91%
Normal Range (18.5≤ BMI<25)	18	58	75.25%
Overweight (25≤ BMI<30)	4	12	15.84%

3. Results and discussion

The comparison between the variations of cultures and factors involved in the wild berries choice may have important implications.

The answers to the 1^{st} question (*Are you consumer of any specific berries (cranberries, sea buckthorn, rosehip, hawthorn)? If yes, how often do you eat these wild berries?)* are shown in Fig. 2 .

From the analysis of Fig. 2, we can observe that cranberries are eaten by 47.53% of respondents in season (June - August) and occasionally (less than weekly) by 34.65% of respondents; sea buckthorn is not eaten by 52.47% of respondents and it is eaten occasionally by 31.68% of respondents; rosehip is not eaten by 63.36% of respondents and it is eaten occasionally by 29.7% of respondents; hawthorn is not eaten by 90.1% of respondents.

The Fig. 3 displays the answers to the 2^{nd} question (*What makes you choose a certain kind of wild berries? (with the variants: (a) because they are healthy; (b) I like the taste; (c) as treatment for various conditions; (d) something else, please specify).*

The respondents can mark more than one of the variants (a) to (d) for every wild berries. We can remark that the majority of respondents (50.49%) eat wild berries because they like taste and 37.62% eat them because they are healthy.

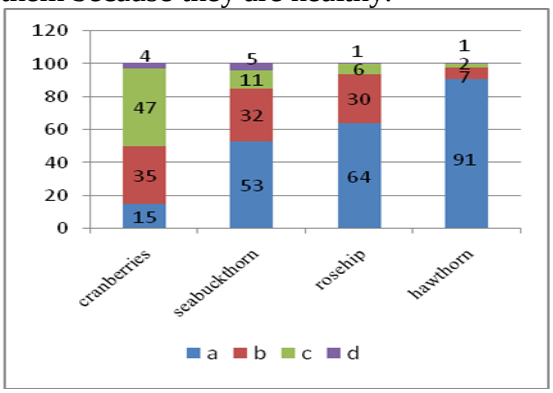

Fig. 2 - How often do you eat these specified berries (cranberries, sea-buckthorn, rosehip, hawthorn)?
a = I do not eat; b= occasionally (less than weekly); c = eat only in season (June - August); d = eat several times a week

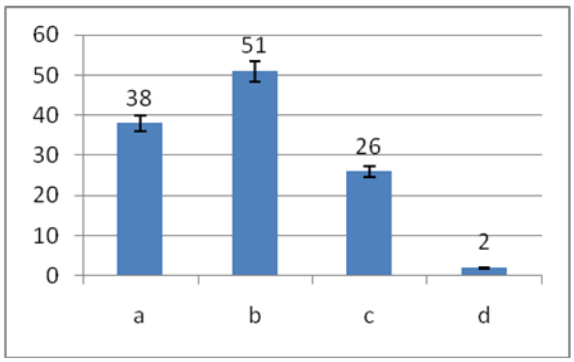

Fig. 3 - Motivation to eat a certain kind of wild berries (cranberries, sea buckthorn, rosehip and hawthorn) a = because they are healthy; b = I like the taste; c=as treatment for various conditions; d = other else, please specify

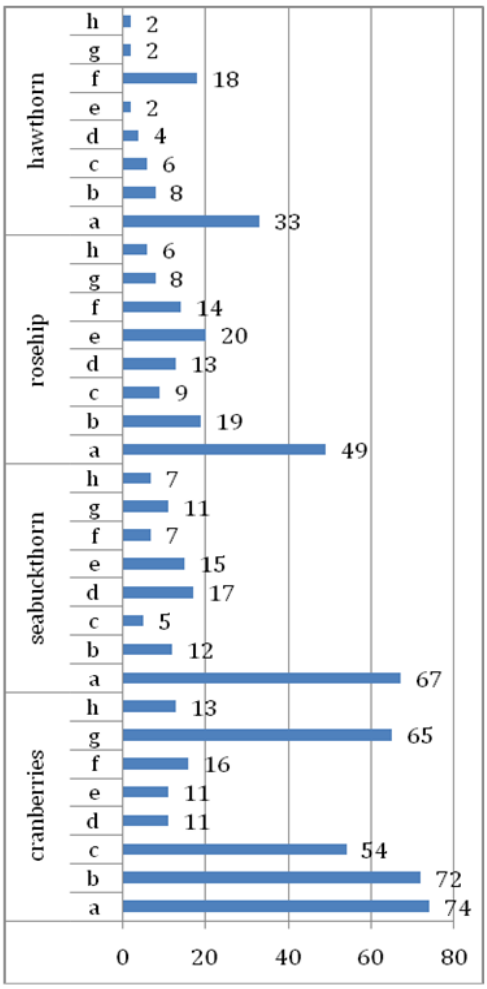

Fig. 4 - The appropriate quality of wild berries which is appreciated by respondents (a) healthy, (b) tasty, (c) sweet, (d) bitter, (e) sour, (f) sophisticated, (g) intense color

The answers to the 3rd question (*Please specify the quality which makes you eat this kind of wild berries*) can be viewed in the Fig. 4. The respondents can mark more than one of the variants (a) to (h) for every wild berry.

We can remark that wild berries would be eaten due to their healthy properties: 73.26% of respondents indicate cranberries, 66.33% sea buckthorn, 48.51% rosehip and 32.67% hawthorn. Also, cranberries would be eaten for taste (71.28%) and intense color (64.35%).

The answers to the 4th question indicate the acceptability of wild berries on a hedonic scale ranged from 1 to 5 points, where 1 corresponds to the response *I dislike it very much* and 5 corresponds to *I like it very much*.

The PCA (Principle Component Analysis) for scores of sensorial attributes (taste, odor, color and flavor) are shown in the Fig. 5.

The total variances are given by the first two principal components (F1 and F2) for wild berries (such as cranberries, sea buckthorn, rosehip and hawthorn, respectively).

Regarding the taste of wild berries (Fig. 5 (a)), the first principal component (F1) provides the greatest amount of information, about 49.7%, and the second one (F2) contributes by 22.55% of the data distribution.

For the odor of wild berries (Fig. 5 (b)), the first principal component (F1) provides the greatest amount of information, about 53.23%, and the second one (F2) contributes by 24.08% of the data distribution.

For the color of wild berries (Fig. 5 (c)), the first principal component (F1) provides the greatest amount of information, about 53.66%, and the second one (F2) contributes by 22.28% of the data distribution.

Regarding the flavor of wild berries (Fig. 5 (d)), the first principal component (F1) provides the greatest amount of information, about 50.52%, and the second (F2) contributes by 23.46% of the data distribution.

Moreover, we can remark that sea buckthorn and cranberries scores given for their color are very similar (having **0.525** correlation coefficient from the correlation matrix (Pearson (n)), different from 0, with a significance level α=0.05) and also, the taste of hawthorn and rosehip have similar scores (having **0.513** correlation coefficient from the correlation matrix (Pearson (n)), different from 0, with a significance level α=0.05).

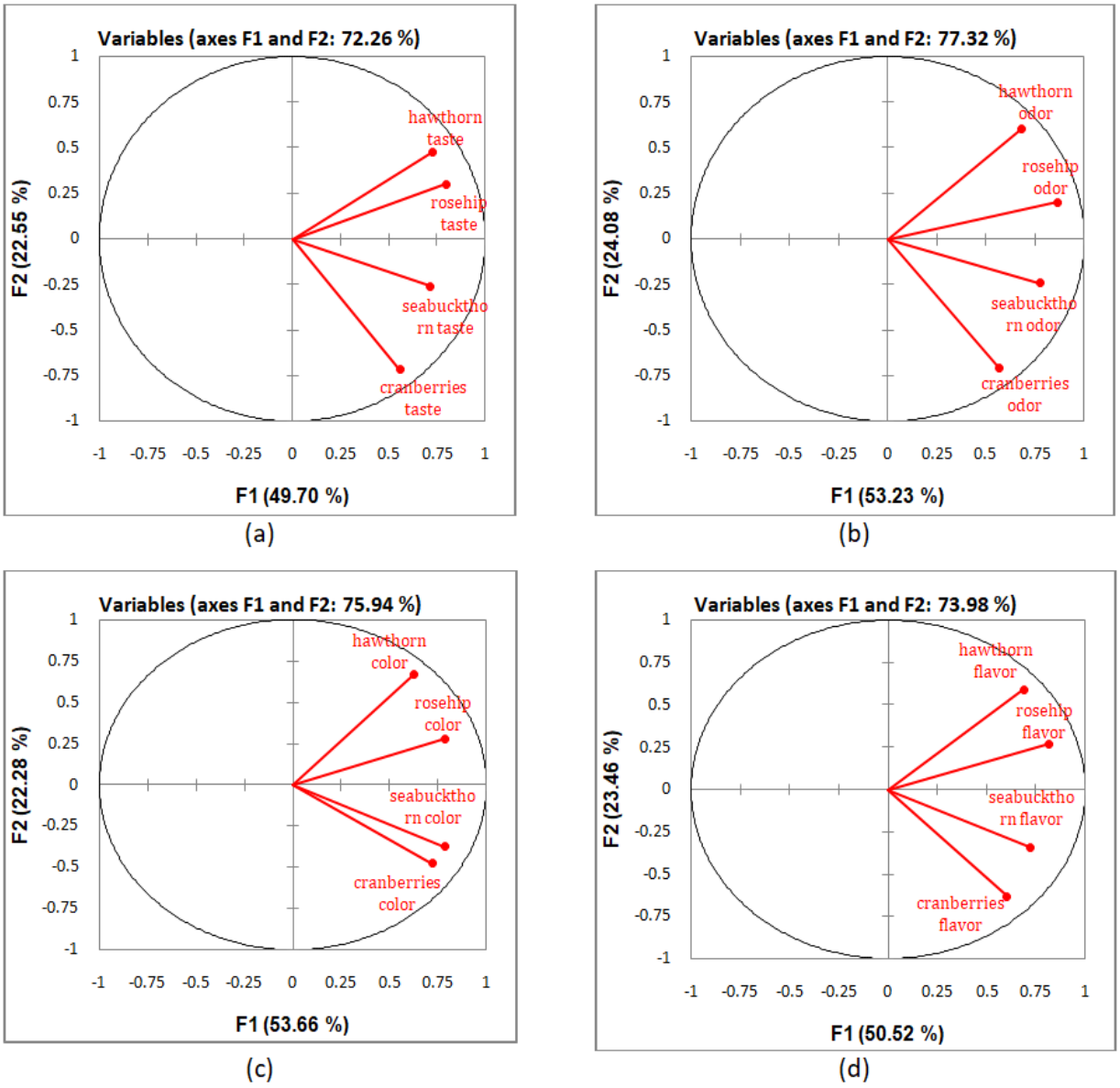

Fig. 5 - The PCA for scores of sensorial attributes: (a) taste, (b) odor, (c) color and (d) flavor

The answers to the 5th question (*Please fill in the table below, by ticking X in the cell corresponding to the quality of wild berries from your own point of view*)

indicate the way of consumption of wild berries (Fig. 6).
From Fig. 6 we remark that cranberries are consumed as fresh fruit by most respondents (73.26%) whereas sea buckthorn (40.59%), rosehip (40.59%) and hawthorn (27.72%) are consumed, in general, as tea.
Recently, the results of research data on the use of wild food plants used in Manyas region (Turkey) showed that the plants used are eaten raw [16].
Traditional wild fruit consumption can be enhanced by incorporating them into contemporary diets, being rich in soluble and insoluble fiber, ash, Na, Ca, and total vitamin C [17].

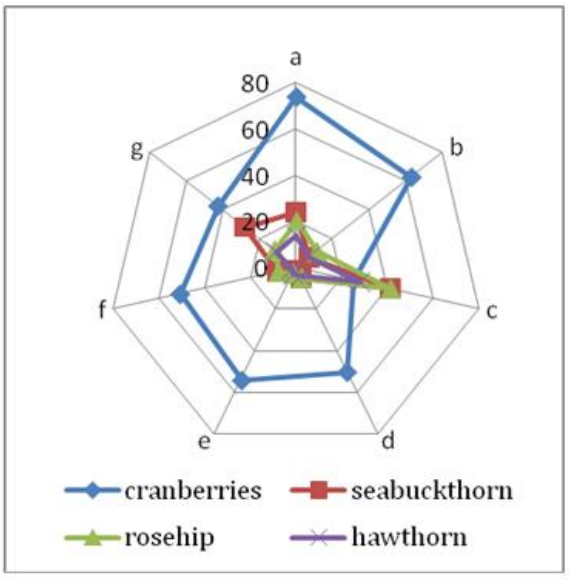

Fig. 6 - The way of consumption of wild berries: a = consumed as fresh fruit, b = consumed as jam, c = consumed as tea, d = added to yoghurt, e = added to ice cream, f = consumed as fruit juice, g = in other foods

4. Conclusion

In this paper we have studied some aspects concerning the use of wild berries (cranberries, sea- buckthorn, rosehip, and hawthorn) on the territory of Bukovina, emphasizing the significance of wild berries in the lives of local people in this region. We suggest that wild berries should be used as ingredients in new healthier diets because they are highly available and accessible.
These data are important in demonstrating differing reasons when it comes to berries' choices, still wild berries are not being consumed so frequently, this fact being explained by the low interest in or knowledge about their health benefits. This documentation makes Bukovina become an important area of exploitation of wild berries fruits and creates perspectives for further research on the use of wild berries in food and non-food applications (such as the pharmaceutical ones).

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