

Traditional knowledge on the medicinal use of plants from genus *Gentiana* in the Pirot County (Serbia)

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The paper provides an insight into the traditional use of medicinal plant species from the genus *Gentiana* in the Pirot County in Southeastern Serbia. The ethnopharmacological study was conducted in the form of interviews among the population in four municipalities: Pirot, Babušnica, Bela Palanka, and Dimitrovgrad. Among the population of Pirot County, it was noticed the use of two species from the genus *Gentiana*: *G. cruciata* and *G. lutea*. It was recorded that cross gentian (*G. cruciata*) has great popularity and versatile aspects on traditional usage, that was mentioned by 53 respondents, and that includes the treatment of cancer diseases, improving the immune system, diabetes, blood purification, for appetite, gastric and duodenal ulcer, for high blood pressure, inflammation, lung diseases. cold, cough, disease prevention, diseases of internal organs, high cholesterol, and leaking breast. The usage of the root of yellow gentian (*G. lutea*) was mentioned by 30 respondents, and that includes improving the immune system, appetite, for the stomach, blood purification, circulation, as an aphrodisiac, against cancer diseases, diabetes, and gastric and duodenal ulcer. It is important to note that yellow gentian, recorded in the study area, is the first species on the list of illegally collected species in Serbia.

Key words: *Gentiana*; Pirot County; traditional medicine

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1. INTRODUCTION

The efficacy of herbal medicinal products has been confirmed by many years of experience in traditional medicine. The use of medicinal plants became a growing tendency due to accessibility, wide range of therapeutic applications, safety, and low cost (Janačković et al., 2019). According to the same authors, there is not much ethnobotanical evidence for East Serbia. Therefore, we conducted an ethnopharmacological study in Pirot County (Southeastern Serbia), situated on the border between Serbia and Bulgaria, which is a typical traditional and underdeveloped region of Serbia. This study was organized to increase the knowledge of medicinal flora on the Balkan Peninsula, as one of the most important centers of plant diversity in Europe (Zlatković et al., 2014).

The pharmacognosy map data of the Pirot's environment is known according to Mihajlov and Milojević (1985). Furthermore,

Milojević and Mihajlov (1985) have noticed 208 species of medicinal plants and 788 native folk names, whereby most of them are characterized by the characteristics of the language of this region. A list of 326 medicinal herbs was compiled in the Pirot County by Marković et al. (2010), of which 60 were aromatic plants (Marković et al., 2009). Medicinal plants of the *Gentiana* genus which are part of Serbian medicinal flora, and which were also noticed in the Pirot County, according to Marković et al. (2020), are *Gentiana asclepiadea* L., *Gentiana cruciata* L., *Gentiana lutea* L., and *Gentiana punctata* L..

A great abundance of medicinal plant resources in Pirot County creates opportunities for its rational use but also implies the need for its protection from overexploitation, and pressure on wild populations (Marković et al., 2010). *G. lutea* has been observed by the same authors at a few sites in very poor and fragile populations of the Stara Planina Mts. However, the high

demand for raw material of yellow gentian root (*Gentianae radix*) and uncontrolled exploitation led to the devastation of natural populations and the inclusion of *G. lutea* in the ranks of strictly protected plant species worldwide (Marković et al., 2010; 2020). Collection, use, and market sales of plant species *G. asclepiadea*, *G. cruciata* and *G. lutea* are regulated by special legislation and can be considered as protected species, according to Serbian National legislative (OGRS, 2016).

Gentiana asclepiadea, the willow gentian, occurs in open pasture or forest slopes on Stara Planina Mts. and Vlaška Mt. in the Pirot County (Marković et al., 2020). There is several traditional indications *G. asclepiadea* can be used for, which are described in the literature. Pančić mentioned that the underground parts of this plant, yellow as wax, are known among the people of Serbia as a remedy against jaundice (Sarić, 1989). Additionally, Tasić et al. (2001) reported that is used especially after jaundice. The underground parts of the *G. asclepiadea* are used for the same indications as the underground parts of the *G. lutea* (Sarić, 1989; Tasić et al., 2001). According to Randjelović et al. (1998), *G. asclepiadea* is used as a prophylactic agent, against digestive disorders, to improve appetite, against anemia, and for general strengthening of the immune system. Moreover, Tasić (2012) mentioned the use of roots of *G. asclepiadea* for loss of appetite, as a stomachic, gall, and liver disease.

Gentiana cruciata, commonly called cross gentian, is a herbaceous perennial native to grasslands, and dry meadows in Pirot County. The above-ground part of the species *G. cruciata* is used to stimulate appetite as described by Tucakov (Sarić, 1989). The same author noted that it is not toxic, although it is very bitter. Tasić et al. (2001) mentioned that *G. cruciata* is used as hologog and amarum. According to the mentioned authors, *G. cruciata* is considered a perspective species, which can be a quality substitution for the root of *G. lutea*. Tasić (2012) mentioned the use of aerial parts for loss of appetite, as a stomachic, as well as a component in homemade preparations showing beneficial effects in gall and liver diseases.

Gentiana lutea, the yellow gentian, grows in grassy alpine and sub-alpine pastures only on Stara Planina Mts. (Midžor, Belež, Kopren) in the Pirot County (Marković et al., 2020). In accordance with the European Medicines Agency monograph of *G. radix*, the underground part of *G. lutea*, is used as traditional herbal medicine for temporary loss of appetite and mild dyspeptic/gastrointestinal disorders. Gostuški and Tucakov (according to Sarić, 1989) mention the usage of the root of *G. lutea* to stimulate appetite and in case of difficult digestion, help the secretion of glands in the mouth and stomach, against anemia, and after serious illnesses. The same authors mentioned that it has been used to improve digestion, against circulatory disorders, and as a mild sedative. Tasić (2012) mentioned the use of root for loss of appetite, as a stomachic as well as a component in homemade preparations showing beneficial effects in gall and liver diseases. The largest amount of gentian root is consumed in the industry of alcoholic drinks for the production of bitter brandies and liqueurs (Sarić, 1989).

Gentiana punctata was also recorded in the flora of Stara Planina Mts. (Tasić, 2012). It is an official replacement or substitute for the root of *G. lutea*. The study aimed to collect, analyze and evaluate traditional knowledge of two gentian species (*G. cruciata* and *G. lutea*) which were mentioned by respondents in the Pirot County, open possibilities for their rational exploitation in accordance with principles of protected species in Serbia, regulated by national legislation, and promote their cultivation near to their natural habitats, and therefore accelerate economic

progress of this rural and underdeveloped region of Serbia.

2. MATERIALS AND METHODS

2.1. Study area

Investigated area of Pirot County is situated in the Balkan Peninsula, on the border between Serbia and Bulgaria, at altitudes 239 to 2169 m. It includes four municipalities Pirot, Babušnica, Bela Palanka and Dimitrovgrad. The mountain ranges in the Pirot municipality are: the Stara Planina Mts, part of Vidlič, Belava, Sedlar, Vlaška Mts, in Bela Palanka municipality: Šljivovička Mt and Svrliške Mts, in Babušnica municipality Suva Planina Mts and Ruj Mt, and in Dimitrovgrad municipality the Greben Mt and part of Vidlič Mt. The mentioned mountains are rich in medicinal plant species (Marković et al., 2010; 2009; 2019b; Zlatković and Bogosavljević, 2014). Stara Planina Mts dominates the relief of Pirot County. It represents the richest mountain in terms of medicinal plants (Marković et al., 2010).

2.2. Data collection

Research about the knowledge and application of medicinal plants in the Pirot County was conducted by interviewing the population of four municipalities of this county: Pirot, Babušnica, Bela Palanka, and Dimitrovgrad. The survey was conducted using a semi-structured questionnaire. The questions were about general information about mentioned species, the knowledge, and the way of application of medicinal herbs. The population of 144 villages of Pirot County was included, with 631 persons, of which 337 were male and 294 were female (Marković et al., 2019b; Stankov-Jovanović et al., 2018).

Plant vouchers that were collected in the study area were authenticated according to Josifović (1970-1986), Jordanov (1963-1979) and Tutin et al. (1964-1980). The nomenclature of the taxa was compiled from databases: The EURO+MED PlantBase – the information resource for Euro-Mediterranean plant diversity (<https://ww2.bgbm.org/EuroPlusMed/query.asp>) and GPC – Global Plant Checklist managed by IOPI – International Organization for Plant Information (<http://www1.biologie.uni-hamburg.de/b-online/ibc99/iopi/query.htm>). The species collected were labeled and deposited in the herbarium collection at the Department of Biology and Ecology, Faculty of Sciences and Mathematics, the University of Niš “Herbarium Moesiacum Niš” (HMN). The voucher numbers for species mentioned during research are 14132 for *G. cruciata*, and 14133 for *G. lutea*. Original questionnaire data are also deposited in the HMN herbarium.

2.3. Data analysis

The results of interviews are presented in alphabetical order of villages in four municipalities (Table 1 and 2). The data were entered in the columns: municipality, village or the name of the place of residence, gender, nationality, age, form in which the medicinal plant has application, medicinal use, and therapeutic group. A comparison with the results of previous studies was performed by analyzing the ethnopharmacological applications of gentian species in neighboring regions of the Balkan Peninsula.

3. RESULTS AND DISCUSSION

3.1. Quantitative analysis

During the investigation, we recorded 3754 use reports of medicinal plants concerned human medicine, of which 83 reports refer to applications of plants from genus *Gentiana* (2.21 %).

Table 1. Overview of the survey results in the Pirot County population about the application of cross gentian (*Gentiana cruciata*)

Municipality	Village	Gender	Nationality	Age	Form	Use	Group ^a
Pirot	Barje Čiflik	M	Serbian	74	extract	Inflammation	En
Pirot	Bela	M	Serbian	57	extract	Gastric and duodenal ulcer	Dg
Pirot	Blato	M	Serbian	34	extract	Gastric and duodenal ulcer	Dg
Pirot	Velika Lukanja	M	Serbian	63	extract	For appetite	Dg
Pirot	Velika Lukanja	M	Serbian	62	water macerate	Cancer diseases	Ca
Pirot	Velika Lukanja	F	Serbian	58	water macerate	Cancer diseases	Ca
Pirot	Visočka Ržana	M	Serbian	66	extract	High blood pressure	Cd
Pirot	Vlasi	F	Serbian	42	extract	Cold	Rs
Pirot	Gnjilan	F	Serbian	65	extract	Diabetes	En
Pirot	Gostuša	F	Serbian	65	extract	Diabetes	En
Pirot	Gostuša	M	Serbian	52	water macerate	Cancer diseases	Ca
Pirot	Gostuša	M	Serbian	66	water macerate	Cancer diseases	Ca
Pirot	Gostuša	M	Serbian	59	extract	Blood purification	Dp
Pirot	Dojkinci	F	Serbian	56	extract	Improving the immune system	Pr
Pirot	Dojkinci	F	Serbian	46	extract	Uniknown use	Vr
Pirot	Zaskovci	M	Serbian	79	water macerate	Cancer diseases	Ca
Pirot	Izvor	M	Serbian	67	water macerate	Cancer diseases	Ca
Pirot	Izvor	F	Serbian	57	extract	High cholesterol	Cd
Pirot	Izvor	F	Serbian	64	extract	Improving the immune system	Pr
Pirot	Jelovica	M	Serbian	53	extract	Cough	Rs
Pirot	Jelovica	F	Serbian	56	extract	Blood purification	Dp
Pirot	Krupac	M	Serbian	59	extract	Inflammation	If
Pirot	Oreovica	F	Serbian	58	water macerate	Cancer diseases	Ca
Pirot	Oreovica	F	Serbian	37	water macerate	Cancer diseases	Ca
Pirot	Pakleštica	M	Serbian	73	extract	Improving the immune system	Pr
Pirot	Pakleštica	M	Serbian	33	extract	Diabetes	En
Pirot	Pokrevenik	M	Serbian	64	extract	Diabetes	En
Pirot	Pokrevenik	F	Serbian	47	extract	Diabetes	En
Pirot	Ponor	M	Serbian	77	extract	Diabetes	En
Pirot	Slavinja	M	Bulgarian	60	extract	Uniknown use	Vr
Pirot	Sopot	F	Serbian	73	water macerate	Cancer diseases	Ca
Pirot	Topli Do	M	Serbian	62	extract	Diabetes	En
Pirot	Topli Do	M	Serbian	62	extract	For appetite	Dg
Pirot	Topli Do	M	Serbian	62	extract	Improving the immune system	Pr
Pirot	Crnoklište	F	Serbian	52	extract	Disease prevention, instead of coffee	Pr
Babušnica	Dol	F	Serbian	72	water macerate	Cancer diseases	Ca
Babušnica	Radinjinice	F	Serbian	62	extract	Leaking breast	Rp
Babušnica	Crvena Jabuka	M	Serbian	67	extract	Uniknown use	Vr
Bela Palanka	Klisura	F	Serbian	59	water macerate	Cancer diseases	Ca
Bela Palanka	Novo Selo	M	Serbian	75	extract	Improving the immune system	Pr
Dimitrovgrad	Vlkovija	F	Bulgarian	61	water macerate	Cancer diseases	Ca
Dimitrovgrad	Gornji Krivodol	F	Bulgarian	60	water macerate	Cancer diseases	Ca
Dimitrovgrad	Dragovita	M	Bulgarian	57	extract	Improving the immune system	Pr
Dimitrovgrad	Dragovita	M	Bulgarian	72	extract	High blood pressure	Cd
Dimitrovgrad	Izatovci	M	Serbian	52	extract	Improving the immune system	Pr
Dimitrovgrad	Petraš	M	Bulgarian	37	extract	Improving the immune system	Pr
Dimitrovgrad	Radejna	M	Bulgarian	61	extract	For appetite	Dg
Dimitrovgrad	Radejna	M	Bulgarian	61	extract	Blood purification	Dp
Dimitrovgrad	Radejna	F	Bulgarian	51	extract	Blood purification	Dp
Dimitrovgrad	Smilovci	F	Bulgarian	50	extract	Blood purification	Dp
Dimitrovgrad	Smilovci	F	Bulgarian	50	extract	Lung diseases	Rs
Dimitrovgrad	Trnski Odorovci	M	Bulgarian	57	extract	Lung diseases	Rs
Dimitrovgrad	Trnski Odorovci	M	Bulgarian	27	extract	Diseases of internal organs	Vr

^a Group abbreviations, Ca – Cancerous, Cd – Cardiovascular, Dg – Digestive, Dp – Depurative, En – Endocrinology, If – Infectious, Pr – Preventive, Rp – Reproductive, Rs – Respiratory, Vr – Various.

Table 2. Overview of the survey results in the Pirot County population about the application of yellow gentian (*Gentiana lutea*)

Municipality	Village	Gender	Nationality	Age	Form	Use	Group ^a
Pirot	Veliki Jovanovac	M	Serbian	42	extract	Improving the immune system	Pr
Pirot	Veliko Selo	F	Serbian	43	extract	Improving the immune system	Pr
Pirot	Gnjilan	M	Serbian	41	extract	Improving the immune system	Pr
Pirot	Gostuša	M	Serbian	53	water macerate	Improving the immune system	Pr
Pirot	Dojkinci	M	Serbian	67	extract	For stomach	Dg
Pirot	Dojkinci	F	Serbian	46	water macerate	Improving the immune system	Pr
Pirot	Izvor	F	Serbian	63	extract	Improving the immune system	Pr
Pirot	Jelovica	M	Serbian	85	extract	For circulation	Cd
Pirot	Jelovica	M	Serbian	85	extract	For stomach	Dg
Pirot	Jelovica	M	Serbian	85	extract	Aphrodisiac	Rp
Pirot	Jelovica	F	Serbian	56	water macerate	For stomach	Dg
Pirot	Miljkovac	M	Serbian	66	extract	Improving the immune system	Pr
Pirot	Oreovica	M	Serbian	42	extract	Improving the immune system	Pr
Pirot	Oreovica	F	Serbian	58	extract	Improving the immune system	Pr
Pirot	Pakleštica	M	Serbian	72	extract	Improving the immune system	Pr
Pirot	Pokrevenik	M	Serbian	64	extract	Diabetes	En
Pirot	Pokrevenik	M	Serbian	64	extract	Gastric and duodenal ulcer	Dg
Pirot	Pokrevenik	M	Serbian	64	extract	Blood purification	Dp
Pirot	Sukovo	M	Serbian	63	water macerate	For appetite	Dg
Pirot	Topli Do	M	Serbian	76	water macerate	Blood purification	Dp
Pirot	Topli Do	M	Serbian	76	water macerate	Cancer diseases	Ca
Pirot	Topli Do	M	Serbian	62	water macerate	For appetite	Dg
Pirot	Topli Do	M	Serbian	62	water macerate	Blood purification	Dp
Babušnica	Dol	M	Serbian	62	extract	For appetite	Dg
Babušnica	Zavidince	F	Serbian	44	water macerate	Improving the immune system	Pr
Bela Palanka	Divljana	M	Serbian	61	extract	For appetite	Dg
Bela Palanka	Divljana	M	Serbian	61	extract	For circulation	Cd
Bela Palanka	Leskovik	M	Serbian	45	extract	Improving the immune system	Pr
Dimitrovgrad	Gornji Krivodol	M	Bulgarian	75	water macerate	For stomach	Dg
Dimitrovgrad	Kusa Vrana	M	Bulgarian	39	extract	For appetite	Dg

^a Group abbreviations, Ca – Cancerous, Cd – Cardiovascular, Dg – Digestive, Dp – Depurative, En – Endocrinology, Pr – Preventive, Rp – Reproductive.

Among the local population of Pirot County, two species of the *Gentianaceae* family were the subject matter of questions *G. cruciata* and *G. lutea*. Of the total number of the interviewed population about two species of genus *Gentiana*, 83 persons knew about them, of which 68 of them were Serbian nationality and 15 were Bulgarian nationality. Among respondents, a total of 55 were male, and 28 were female. In Pirot municipality, species of *Gentianaceae* family were known to 58 respondents, in municipality Babušnica 5, in municipality Bela Palanka 5, and municipality Dimitrovgrad 15 interviewed people.

3.2. Application of *Gentiana lutea* in Pirot County

Yellow gentian (*G. lutea*) is also known as „lincura“ to the local population of Pirot County. A total of 30 interviewed persons mentioned the yellow gentian and its medicinal usage (Table 2) in the form of macerate in homemade traditional fruit brandy, called "Rakija" (20 respondents) or in the form of macerate prepared with cold water (10 respondents). Rakija is collective term for fruit spirits (or fruit brandy) popular in the Balkans, where the alcohol content is normally 40 % (v/v) and sometimes up to 50 % (v/v). The majority of interviewed persons mentioned the use of the yellow gentian (*G. lutea*) for improving the immune system (12 respondents). The usage for appetite was mentioned by five respondents. The usage for stomach was mentioned by four interviewed person and the usage for blood purification by three respondents. The usage of yellow gentian for circulation was known to 2 respondents. One interviewed person mentioned the usage of yellow gentian root as an aphrodisiac, against cancer diseases, diabetes, and gastric and duodenal ulcer.

3.3. Therapeutic groups and comparison of applications with other studies in neighboring regions on Balkan Peninsula

3.3.1. Therapeutic groups

We summarized the applications of gentian species used in Pirot County in ten therapeutic groups (Table 3). The most common uses of the aboveground part of *G. cruciata* are against cancer diseases, for preventive treatments, in digestive troubles and endocrinology therapeutic group, and the most common form of application is as macerate in traditional fruit brandy. Macerate can be prepared and used, with the above-ground part of *G. cruciata* or the underground part of *G. lutea* for internal use for most of the mentioned diseases, especially to increase the appetite and help in digestive problems, and decreasing cholesterol in the blood.

3.3.2. Comparison of applications of *Gentiana cruciata* with other studies in neighboring regions on the Balkan Peninsula

Ethnopharmacological studies were obtained also in neighboring countries on the Balkan Peninsula. Menković et al. (2011) studied the traditional usage of wild medicinal plants in the Prokletije Mountains (Montenegro). They mentioned the use of *G. cruciata* against loss of appetite, as a stomachic and component in preparations showing beneficial effects in gall and liver diseases. Zlatković and Bogosavljević (2014) studied the taxonomic and pharmacological valorization of medicinal plants of the Svrljiški Timok gorge in eastern Serbia. They emphasize the following effects of *G. cruciata*: stomachic, cholagogue, tonic, for appetite. They note that *G. cruciata* is one of the very popular plants in the folk medicine of this area, but not included in any of cited sources in lists of monographs on medicinal plants of World Health Organization (WHO).

Jarić et al. (2015) mentioned that *G. cruciata* is the plant with the most phytotherapeutic uses on Suva Planina Mts. against cholesterol, diabetes, stomach ailments (stomach ulcers), improving appetite and the immune system, which is in line with our results. On the other hand, indications such as women's illness, to improve digestion, liver and gall bladder complaints, diseases related to the treatment of esophagus and chest diseases, blood detoxification, and anti-anemic were different in comparison to our study.

3.3.3. Comparison of applications of *Gentiana lutea* with other studies in neighboring regions on the Balkan Peninsula

Similar to our results for the application of *G. lutea* were obtained in Serbia in general by Jarić et al. (2014), who did an ethnobotanical study about Serbian medieval medicine. They mentioned the following effects of yellow gentian: antidote in case of poisoning (snake or insect poison), antihelminthic, antihypertensive, blood detoxification, poor circulation, cold, carminative, diabetes, febrile conditions, gall bladder diseases, gastrointestinal tract disorders (diarrhea, regulating digestion, not specified gastrointestinal tract disorders, gastric ulcers, increasing appetite), liver disease, rheumatism, respiratory tract diseases (bronchitis, influenza), a stimulant.

Dajić Stevanović et al. (2014) also did an ethnobotanical study of the application of medicinal plants in Serbia in general. They state that the population of Serbia uses *G. lutea* for loss of appetite, as a stomachic, as well as a component in homemade preparations showing beneficial effects in gall and liver disease. Pieroni et al. (2005) were mentioned a completely different use of *G. lutea* in Lëpushë, Northern Albanian Alps, as prevention against heart disease, macerated in cold water wild plum distillate for 1-2 days.

Menković et al. (2011) mentioned the same applications of *G. lutea* as the uses of *G. cruciata* against loss of appetite and as a stomachic, which was the same as our findings showed, and as a component in preparation showing beneficial effect in gall and liver diseases, which was different in comparison to our results. Pieroni et al. (2011) have provided similar data in the study of the different applications of *G. lutea* growing in Western Serbia, Pešter plateau. They emphasize that *G. lutea* shows the following effects with the internal application: digestive troubles, stomachache, stomach ulcer, diarrhea, treatment of cold and cough, and against rheumatism with the external form of application. The uses against digestive troubles were similar to our study, while the other uses were different.

Šavikin et al. (2013) mentioned the usage of *G. lutea* in Western Serbia, Zlatibor district, for treatments of digestive problems, which was similar to our study, and loss of appetite, which was different in comparison to our investigation.

Pieroni et al. (2013, 2014) in Western Macedonia and Eastern Albania also were mentioned *G. lutea*. They were noted that the yellow gentian was dried and sold, and also largely gathered and traded in the past, but the use is unknown in those two regions. Among Albanians and Aromanians living in the Rraicë and Mokra areas of Eastern Albania, *G. lutea* is known as cardiogenic, which is similar to the results of Pieroni et al. (2005), but it is different with presented data of our study.

Rexhepi et al. (2013) evaluated traditional medicinal plant knowledge among Albanians, Macedonians, and Gorani in the Sharr Mountains (Montenegro). They mentioned the different uses of *G. lutea* in comparison to our study – to regulate temperature, and for respiratory system problems (influenza and cough).

Table 3. Therapeutic groups with the frequency of reported indications of application for the traditional use of two gentian species in Pirot County

Therapeutic group	Indication	Number of reports	
		<i>G. cruciata</i>	<i>G. lutea</i>
Cancer diseases	Cancer	13	1
Preventive	Improving the immune system	8	12
	Disease prevention	1	-
Endocrinology	Diabetes	7	1
Digestive	For appetite	3	5
	For stomach	-	4
	Gastric and duodenal ulcer	2	1
Depurative	Blood purification	5	3
Cardiovascular	High blood pressure	2	-
	For circulation	-	2
	High cholesterol	1	-
Reproductive	Leaking breast	1	-
	Aphrodisiac	-	1
Infectious	Inflammation	2	-
Respiratory	Lung diseases	2	-
	Cold	1	-
	Cough	1	-
Various	Unknown use	3	-
	Diseases of internal organs	1	-
Form of application	Macerate in Rakija ^a	40	20
	Water macerate	13	10

^a Rakija, traditional fruit brandy (alcohol by volume 40 % (v/v)).

Mustafa et al. (2015) studied a cross-cultural comparison of folk plant uses among Albanians, Bosniaks, Gorani, and Turks living in Kosovo. They mentioned the similar uses of *G. lutea* with our study against digestive disorders and as a flavor additive for an alcoholic beverage. Jarić et al. (2015) studied traditionally used plants on Suva Planina Mountains (Southeastern Serbia). They found that *G. lutea* can be used against abdominal pains, digestive, and strengthening the immune system, which was partially similar applications with the results of our investigations in the Pirot County.

In Eastern Albania, according to Pieroni et al. (2015), *G. lutea* was used as cardiogenic, which was a different use in comparison to our investigation in Pirot County. According to Šarić-Kundalić et al. (2010), yellow gentian was used against loss of appetite, and for strengthening of the organism, which was the identical uses, as well as against stomach ailments, for sedation, anemia, fever, and liver ailments, which was different use to that in the Pirot County.

Živković et al. (2020) were noted the uses of *G. lutea* against vein complaints and digestive problems, which were different, as well as against the loss of appetite, which was the same use as in the Pirot County.

In South Kosovo, according to (Mustafa et al., 2020), yellow gen-

tian was traditionally used for blood, and ulcer of the stomach, which were the same uses in comparison with the results of our survey, and against heart diseases, and for better digestion which was the different uses as in our study.

CONCLUSION

This study provided a detailed review of the ethnopharmacological application of two medicinal plant species from the genus *Gentiana* which were noticed as medicinal plants among the population in the Pirot County, *G. cruciata*, and *G. lutea*. It includes great popularity and versatile aspects on traditional usage of *G. cruciata* and *G. lutea*, which make Pirot County interesting from the ethnobotanical point of view. Based on the results of interviews of the local population in Pirot County done in this study, it can be concluded that cross gentian (*G. cruciata*) is very popular and well known to people living in the rural area and that is frequently used for the treatment of various medical indications, especially for cancer diseases, improving the immune system, digestive disorders, and diabetes. Yellow gentian (*G. lutea*) is also popular among the population of Pirot County, especially for improving the immune system, appetite, and stomach in the form of macerate in traditional fruit brandy.

Our results might be built-in in the commercial use of available

plant species from the genus *Gentiana* in the study area. Only exploitation in accordance with national legislative of protected species, conducted by experts, who have attended appropriate training, and possess collecting permits, can protect their natural habitats and sparse populations in nature. For the rural community, living in the mountain region of this economically poor region, promotion of traditional knowledge and practice, about plants from genus *Gentiana*, such as good natural conditions and possibility for their cultivation, close to their natural habitats, can provide an opportunity for economic development and higher standard of living in this area.

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