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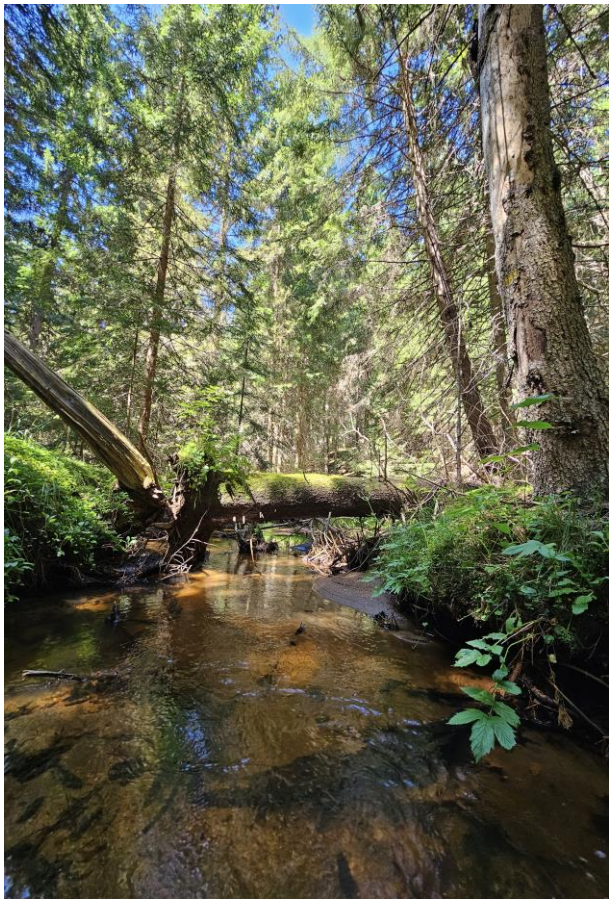

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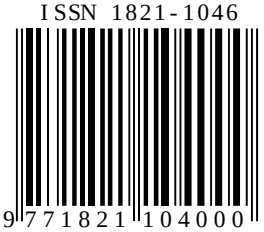

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Original scientific paper

TRADITIONAL MEDICINAL USE OF PLANTS FROM THE GENUS *CRATAEGUS* IN THE PIROT DISTRICT (SERBIA)

Marija S. MARKOVIĆ[1], Biljana M. NIKOLIĆ[1], Dejan S. PLJEVLJAKUŠIĆ[2], Ljubinko B. RAKONJAC[1], Sonja Z. BRAUNOVIĆ[1], Filip A. JOVANOVIĆ[1], Vesna P. STANKOV JOVANOVIĆ[3]*

Abstract: *The informants in the rural areas of the Pirot District were surveyed on the knowledge and use of medicinal plants. The plants from the genus* Crataegus *were mentioned by 119 respondents.* C. laevigata *was mentioned against high blood pressure.* C. monogyna *was mentioned for the following applications: against high blood pressure, for the heart, improving heart rate, for circulation, and against sclerosis.* C. pentagyna *was mentioned against high blood pressure, for the heart, improving heart rate, strengthening the heart, against cardiac diseases, for circulation, immune system improvement, against the common cold, cough, and diabetes, for disease prevention (coffee replacement), as hot drink, and against kidney and bladder diseases. The medicinal uses, considered novelties in our research, were noted and stressed because they were not mentioned in previously published ethnobotanical papers on the Balkans.*

Keywords: *Crataegus laevigata*, *Crataegus monogyna*, *Crataegus pentagyna*, medicinal use, Pirot District.

TRADICIONALNA LEKOVITA UPOTREBA BILJAKA IZ RODA *CRATAEGUS* U PIROTSKOM OKRUGU (SRBIJA)

Apstrakt: *Ruralno stanovništvo Pirotskog okruga anketirano je o poznavanju i korišćenju lekovitih biljaka.. Vrste iz roda* Crataegus *su pomenute od strane 119 ispitanika.* C. laevigata *je pomenuta protiv visokog krvnog pritiska.* C. monogyna *je pomenuta za sledeće primene: protiv visokog krvnog pritiska, za srce, za regulaciju otkucaja srca, za cirkulaciju i protiv skleroze.* C. pentagyna *je pomenuta protiv visokog krvnog pritiska, za srce, poboljšanje rada srca, jačanje srca, protiv srčanih bolesti, za cirkulaciju, poboljšanje imuniteta, protiv prehlade, kašlja, dijabetesa, za prevenciju bolesti (zamena za kafu), kao topli napitak, i protiv bolesti bubrega i bešike. Zabeležene su lekovite upotrebe, koje se mogu smatrati novinama u našem istraživanju, jer nisu pominjane u ranije objavljenim etnobotaničkim radovima o Balkanu.*

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Ključne reči: *Crataegus laevigata*, *Crataegus monogyna*, *Crataegus pentagyna*, lekovita upotreba, Pirotski okrug.

1. INTRODUCTION

The plants from the genus *Crataegus*, commonly known as hawthorns, are trees and shrubs from the family Rosaceae, subfamily Maloideae. Approximately 280 species worldwide are distributed throughout the temperate regions in the northern hemisphere, including North America, Europe, and Asia (Kumar et al., 2012). Most of the species are shrubby. They are common in hedgerows and forest edges, while in open woodlands, they occupy the bushes' floor. The widespread presence of *Crataegus* species in forests can be attributed to their adaptability, effective seed dispersal, and ability to thrive in forest environments.

In Europe, the most common species from the genus *Crataegus* are *Crataegus monogyna* (common hawthorn) and *Crataegus laevigata* (midland hawthorn), which are found across a wide range, from the British Isles to the Mediterranean and Eastern Europe (Gosler, 1990).In the Pirot District (southeastern Serbia), three shrubby species from the genus *Crataegus* with medicinal properties were noted: *C. monogyna* Jacq., *C. laevigata* (Poiret) DC. (syn. *C. oxyacantha* L.), and *C. pentagyna* Waldst. & Kit. ex Willd. (Marković et al., 2020). *C. laevigata* inhabits thickets and forests, while *C. monogyna* and *C. pentagyna* have been noted in oak and beech forests, according to the same authors.

The species from the genus *Crataegus* contain significant amounts of cyanogenetic heterosides and flavonoids (Sarić, 1989; Marković et al., 2010, 2020). Oligomeric procyanidins, flavonoids, triterpenes, polysaccharides, and catecholamines have been identified in the genus, and many of these have been evaluated for biological activities (Kumar et al., 2012).

Gostuški (1973) mentioned the use of *C. laevigata* flowers in Serbia for the treatment of gout, stone-inflammation of female genital organs, kidney stones, heart diseases, and inflammation of female genital organs, kidney stones, heart diseases, and stone-inflammation of female genital organs, kidney stones, heart diseases, and blood pressure regulation. Tucakov (1990) and Tasić et al. (2001) mentioned the use of *C. laevigata* as a cardiac sedative, for blood pressure regulation, and sedation.

According to Sarić (1989), Tasić et al. (2001) and Marković et al. (2020), *C. laevigata* and *C. monogyna* flowers were used as spasmolytic, cardiac, geriatric, and against sore throat. The same authors state that the flowers and leaves were used against heart diseases as well as for blood pressure regulation, while the fruits were used against diarrhoea.

C. monogyna, *C. laevigata*, and *C. pentagyna* can only be harvested with appropriate permits, as they are the protected plant species in Serbia under national legislation (Službeni glasnik Republike Srbije, 2010).

This study aimed to collect and investigate traditional knowledge about the medicinal use of plant species from the genus *Crataegus* in the Pirot District. The research also aimed to find traditional forms of medicinal use of plants from the genus *Crataegus* that have not been recorded in previous ethnobotanical studies on the Balkans.

2. MATERIAL AND METHODS

Research on the traditional knowledge and use of medicinal plants was conducted in the form of a population survey. The questionnaires included residents of 144 villages in municipalities of the Pirot District: Pirot, Babušnica, Bela Palanka, and Dimitrovgrad. A total of 631 respondents were surveyed on knowledge and use of medicinal plants, of which 337 were men and 294 were women. The results of a study on the traditional use of plants from the genus *Crataegus* for medicinal purposes were compared with previous ethnobotanical studies on the use of the mentioned plant species in the Balkans.

3. RESULTS

Out of a total of 4817 reports collected in the Pirot District, 119 reports were about the medicinal use of plants from the genus *Crataegus* (2.47%), of which one report about use of *C. laevigata*, 33 reports about *C. monogyna*, and 85 reports about *C. pentagyna.* A total of 99 respondents (66 men, 33 women) mentioned the plants from genus *Crataegus* for medicinal purposes, of which one respondent (man) mentioned *C. laevigata*, 28 respondents (20 men, 8 women) mentioned *C. monogyna*, and 70 respondents (45 men, 25 women) mentioned *C. pentagyna*. The age of the respondents who mentioned the medicinal use of plants from the genus *Crataegus* was 34 to 83 years.

Regarding national structure, 83 respondents were of Serbian nationality, 15 were of Bulgarian nationality, and one was of Roma nationality. A respondent of Serbian nationality was mentioned *C. laevigata*. *C. monogyna* was mentioned by 23 respondents of Serbian nationality and 5 respondents of Bulgarian nationality. *C. pentagyna* was mentioned by 83 respondents of Serbian nationality, 15 respondents of Bulgarian nationality, and one respondent of Roma nationality.

In the municipality of Pirot, 77 reports on the medicinal use of plants from the genus *Crataegus* were given, of which one report was about the use of *C. laevigata*, 22 reports about the use of the *C. monogyna*, and 54 reports about the use of *C. pentagyna.* In the municipality of Babušnica, 16 reports on the medicinal use of plants from the genus *Crataegu*s were given, of which 5 reports about the use of *C. monogyna* and 11 reports about *C. pentagyna*. In the municipality of Bela Palanka, 15 reports on the medicinal use of plants from the genus *Crataegus* were given, of which 2 reports were about the use of *C. monogyna* and 13 reports were about *C. pentagyna*. In the municipality of Dimitrovgrad, 11 reports on the medicinal use of plants from the genus *Crataegus* were given, of which 4 reports about the use of *C. monogyna* and 11 reports about *C. pentagyna*.

One respondent mentioned the fruit of the plant species C. laevigata, with the local name “crveni glog”, for treating high blood pressure (Table 1).

Table 1. *Overview of the survey results on the use of* C. laevigata *in the population of the Pirot District.*

Municipality	Village	Nationality	Gender	Age	Plant part	Form	Medicinal use	Group
Pirot	Gostuša	Srb.	M	66	fruit	Decoction	High blood pressure	Cd

Note: Group of diseases: Cd – cardiovascular.

The plant species *C. monogyna* was mentioned by the local names "beli glog" and "glog". The flower of plant species *C. monogyna* was mentioned in the form of an infusion for the heart (anti-arrhythmic) (6 reports), for the treatment of high blood pressure (5 reports), for circulation (1 report), improving heart rate (1 report), and against sclerosis (1 report). The leaf of *C. monogyna* was mentioned as an infusion for improving heart rate (1 report). The fruit of *C. monogyna* was mentioned against high blood pressure (12 reports), for the heart (3 reports), improving heart rate (1 report), for circulation (1 report), and (Table 2). One respondent mentioned using *C. monogyna* fruit but did not know how to use it (Table 2).

Table 2. *Overview of the survey results on the use of* C. monogyna *in the population of the Pirot District.*

Municipality	Village	Nationality	Gender	Age	Plant part	Form	Medicinal use	Group
Pirot	Berilovac	Ser.	M	66	fruit	Decoction	For the heart	Cd
Pirot	Blato	Ser.	M	64	fruit	Decoction	High blood pressure	Cd
Pirot	Brlog	Ser.	M	79	leaf	Infusion	Improving heart rate	Cd
Pirot	Brlog	Ser.	M	46	flower	Infusion	Improving heart rate	Cd
Pirot	Brlog	Ser.	M	64	fruit	Decoction	Improving heart rate	Cd
Pirot	Gostuša	Ser.	M	56	flower	Infusion	Circulation	Cd
Pirot	Gostuša	Ser.	M	66	fruit	Decoction	High blood pressure	Cd
Pirot	Gostuša	Ser.	M	53	fruit	Decoction	High blood pressure	Cd
Pirot	Gostuša	Ser.	M	59	flower	Decoction	For the heart	Cd
Pirot	Gostuša	Ser.	M	59	flower	Infusion	High blood pressure	Cd
Pirot	Jelovica	Ser.	F	56	fruit	Infusion	High blood pressure	Cd
Pirot	Orlja	Ser.	M	65	fruit	Decoction	For the heart	Cd
Pirot	Orlja	Ser.	M	65	fruit	Decoction	High blood pressure	Cd
Pirot	Pokrevenik	Ser.	F	65	fruit	Decoction	Circulation	Cd
Pirot	Pokrevenik	Ser.	F	34	flower	Infusion	High blood pressure	Cd
Pirot	Poljska Ržana	Ser.	M	68	flower	Infusion	High blood pressure	Cd
Pirot	Ponor	Ser.	M	77	flower	Infusion	Sclerosis	Nr
Pirot	Rasnica	Ser.	F	38	fruit	Decoction	High blood pressure	Cd
Pirot	Srećkovac	Ser.	F	53	flower	Infusion	For the heart	Cd
Pirot	Sukovo	Ser.	M	63	fruit	Decoction	Uniknown use	Vr
Pirot	Cerova	Ser.	M	65	flower	Infusion	High blood pressure	Cd
Pirot	Crvenčevo	Ser.	F	74	flower	Infusion	For the heart	Cd

Babušnica	Rakita	Bul.	F	56	fruit	Decoction	For the heart	Cd
Babušnica	Resnik	Ser.	M	40	fruit	Decoction	High blood pressure	Cd
Babušnica	Studena	Ser.	M	59	flower	Infusion	For the heart	Cd
Babušnica	Studena	Ser.	M	59	flower	Infusion	High blood pressure	Cd
Babušnica	Crvena Jabuka	Ser.	M	67	fruit	Extract in alcohol	High blood pressure	Cd
Bela Palanka	Vrgudinac	Ser.	M	82	fruit	Decoction	High blood pressure	Cd
Bela Palanka	Ljubatovica	Ser.	F	62	fruit	Decoction	High blood pressure	Cd
Dimitrovgrad	Željuša	Bul.	M	43	flower	Infusion	For the heart	Cd
Dimitrovgrad	Kamenica	Bul.	F	36	flower	Infusion	For the heart	Cd
Dimitrovgrad	Poganovo	Bul.	M	74	fruit	Decoction	High blood pressure	Cd
Dimitrovgrad	Slivnica	Bul.	M	68	fruit	Decoction	High blood pressure	Cd

Note: Nationality: Ser. – serbian. Bul. – Bulgarian; Gender: M – male, F – female; Group of diseases: Cd – cardiovascular, Nr – nervous system diseases, Vr – various.

The plant species *C. pentagyna* was mentioned by local names "crni glog" and "gloginja". The flower of plant species *C. pentagyna* was mentioned in the form of an infusion for the treatment of high blood pressure (13 reports), for the heart (3 reports), for circulation (1 report), improving heart rate (1 report), strengthening the heart (1 report). The leaf of *C. pentagyna* was mentioned as an infusion to improve heart rate (1 report) and prevent high blood pressure (1 report). The fruit of *C. pentagyna* was mentioned in the form of decoction against high blood pressure (53 reports), for the heart (13 reports), strengthening the heart (2 reports), immune system improvement (2 reports), against cardiac diseases (1 report), common cold (1 report), cough (1 report), diabetes (1 report), disease prevention (coffee replacement) (1 report), for circulation (1 report), as hot drink (1 report), improving heart rate (1 report), against kidney and bladder diseases (1 report) (Table 3).

Table 3. *Overview of the survey results on the use of* C. pentagyna *in the population of the Pirot District.*

Municipality	Village	Nationality	Gender	Age	Plant part	Form	Medicinal use	Group
Pirot	Berilovac	Ser.	M	83	fruit	Decoction	Disease prevention (coffee replacement)	Cd
Pirot	Berilovac	Ser.	M	76	fruit	Decoction	High blood pressure	Cd
Pirot	Blato	Ser.	M	59	fruit	Decoction	High blood pressure	Cd
Pirot	Blato	Ser.	F	58	flower	Infusion	High blood pressure	Cd
Pirot	Blato	Ser.	F	58	fruit	Decoction	High blood pressure	Cd
Pirot	Brlog	Ser.	M	64	leaf	Infusion	Improving heart rate	Cd
Pirot	Brlog	Ser.	M	64	flower	Infusion	Improving heart rate	Cd
Pirot	Brlog	Ser.	M	64	fruit	Decoction	High blood pressure	Cd
Pirot	Velika Lukanja	Ser.	M	62	flower	Infusion	Common cold	Rs
Pirot	Velika Lukanja	Ser.	M	62	fruit	Decoction	High blood pressure	Cd
Pirot	Velika Lukanja	Ser.	M	80	fruit	Decoction	High blood pressure	Cd
Pirot	Velika Lukanja	Ser.	F	74	flower	Infusion	High blood pressure	Cd

Pirot	Veliki Jovanovac	Ser.	F	55	flower	Infusion	High blood pressure	Cd
Pirot	Veliki Jovanovac	Ser.	F	55	fruit	Decoction	Immune system improvement	Pr
Pirot	Gostuša	Ser.	M	56	flower	Infusion	Circulation	Cd
Pirot	Gostuša	Ser.	M	59	fruit	Decoction	Hot drink	Vr
Pirot	Gostuša	Ser.	M	66	fruit	Decoction	High blood pressure	Cd
Pirot	Gostuša	Ser.	M	53	fruit	Decoction	High blood pressure	Cd
Pirot	Dojkinci	Ser.	F	46	fruit	Decoction	Unknown use	Vr
Pirot	Držina	Ser.	F	67	fruit	Decoction	High blood pressure	Cd
Pirot	Držina	Ser.	F	67	fruit	Decoction	Cough	Rs
Pirot	Držina	Ser.	M	77	fruit	Decoction	For the heart	Cd
Pirot	Zaskovci	Ser.	M	79	fruit	Decoction	High blood pressure	Cd
Pirot	Jelovica	Ser.	F	56	flower	Infusion	High blood pressure	Cd
Pirot	Krupac	Ser.	F	65	flower	Infusion	High blood pressure	Cd
Pirot	Kumanovo	Ser.	F	63	flower	Infusion	High blood pressure	Cd
Pirot	Kumanovo	Ser.	F	63	fruit	Decoction	High blood pressure	Cd
Pirot	Mali Jovanovac	Ser.	F	49	flower	Decoction	High blood pressure	Cd
Pirot	Mali Suvodol	Ser.	F	61	fruit	Decoction	Diabetes	En
Pirot	Nišor	Ser.	M	58	fruit	Infusion	For the heart	Cd
Pirot	Nišor	Ser.	M	58	fruit	Infusion	High blood pressure	Cd
Pirot	Novi Zavoj	Ser.	F	67	fruit	Decoction	For the heart	Cd
Pirot	Oreovica	Ser.	F	60	flower	Decoction	High blood pressure	Cd
Pirot	Oreovica	Ser.	F	56	fruit	Decoction	High blood pressure	Cd
Pirot	Orlja	Ser.	M	65	fruit	Decoction	For the heart	Cd
Pirot	Orlja	Ser.	M	65	fruit	Decoction	High blood pressure	Cd
Pirot	Osmakova	Ser.	F	65	fruit	Decoction	High blood pressure	Cd
Pirot	Pakleštica	Ser.	M	72	fruit	Decoction	High blood pressure	Cd
Pirot	Planinica	Ser.	F	50	fruit	Decoction	For the heart	Cd
Pirot	Planinica	Ser.	F	50	fruit	Decoction	High blood pressure	Cd
Pirot	Prisijan	Rom.	M	60	fruit	Decoction	Strengthening the heart	Cd
Pirot	Prisijan	Ser.	M	47	fruit	Decoction	High blood pressure	Cd
Pirot	Rasnica	Ser.	F	38	fruit	Decoction	High blood pressure	Cd
Pirot	Rudinje	Ser.	M	78	fruit	Decoction	Immune system improvement	Pr
Pirot	Sopot	Ser.	M	64	fruit	Decoction	Kidney and bladder diseases	Ur
Pirot	Sopot	Ser.	F	59	fruit	Decoction	High blood pressure	Cd
Pirot	Staničenje	Ser.	M	59	fruit	Decoction	Uniknown use	Vr
Pirot	Sukovo	Ser.	F	59	fruit	Decoction	High blood pressure	Cd
Pirot	Sukovo	Ser.	M	63	fruit	Decoction	Uniknown use	Vr
Pirot	Topli Do	Ser.	M	76	fruit	Decoction	Cardiac diseases	Cd
Pirot	Topli Do	Ser.	M	62	fruit	Decoction	High blood pressure	Cd

Pirot	Crvenčevo	Ser.	M	74	flower	Infusion	For the heart	Cd
Pirot	Crnoklište	Ser.	M	46	fruit	Decoction	High blood pressure	Cd
Pirot	Crnoklište	Ser.	F	52	fruit	Decoction	High blood pressure	Cd
Babušnica	Vučidel	Bul.	M	59	fruit	Decoction	For the heart	Cd
Babušnica	Dol	Ser.	M	62	flower	Infusion	High blood pressure	Cd
Babušnica	Zavidince	Ser.	F	44	fruit	Decoction	High blood pressure	Cd
Babušnica	Zvonce	Bul.	F	52	fruit	Decoction	For the heart	Cd
Babušnica	Zvonce	Bul.	F	72	fruit	Decoction	High blood pressure	Cd
Babušnica	Kaluđerevo	Ser.	F	72	fruit	Decoction	High blood pressure	Cd
Babušnica	Kaluđerevo	Ser.	M	76	fruit	Decoction	High blood pressure	Cd
Babušnica	Kambelevec	Ser.	M	67	fruit	Decoction	High blood pressure	Cd
Babušnica	Našuškovica	Bul.	M	70	fruit	Decoction	High blood pressure	Cd
Babušnica	Radoševac	Ser.	M	53	flower	Infusion	High blood pressure	Cd
Babušnica	Crvena Jabuka	Ser.	M	67	fruit	Extract in alcohol	High blood pressure	Cd
Bela Palanka	Vrgudinac	Ser.	M	68	fruit	Decoction	High blood pressure	Cd
Bela Palanka	Vrgudinac	Ser.	M	82	fruit	Decoction	High blood pressure	Cd
Bela Palanka	Donja Koritnica	Ser.	M	54	flower	Infusion	High blood pressure	Cd
Bela Palanka	Donja Koritnica	Ser.	M	54	leaf	Infusion	High blood pressure	Cd
Bela Palanka	Moklište	Ser.	M	60	fruit	Decoction	High blood pressure	Cd
Bela Palanka	Moklište	Ser.	F	68	fruit	Decoction	For the heart	Cd
Bela Palanka	Moklište	Ser.	F	68	fruit	Decoction	High blood pressure	Cd
Bela Palanka	Moklište	Ser.	M	50	flower	Infusion	For the heart	Cd
Bela Palanka	Moklište	Ser.	M	50	fruit	Decoction	For the heart	Cd
Bela Palanka	Mokra	Ser.	M	75	fruit	Decoction	Strengthening the heart	Cd
Bela Palanka	Mokra	Ser.	M	75	flower	Infusion	Strengthening the heart	Cd
Bela Palanka	Novo Selo	Ser.	F	46	fruit	Decoction	High blood pressure	Cd
Bela Palanka	Crvena Reka	Ser.	M	65	fruit	Decoction	High blood pressure	Cd
Dimitrovgrad	Gojin Dol	Bul.	M	60	flower	Infusion	High blood pressure	Cd
Dimitrovgrad	Donja Nevlja	Bul.	M	65	flower	Infusion	For the heart	Cd
Dimitrovgrad	Dragovita	Bul.	M	50	fruit	Decoction	High blood pressure	Cd
Dimitrovgrad	Kusa Vrana	Bul.	M	39	fruit	Decoction	High blood pressure	Cd
Dimitrovgrad	Radejna	Bul.	M	61	fruit	Decoction	For the heart	Cd
Dimitrovgrad	Slivnica	Bul.	M	68	fruit	Decoction	High blood pressure	Cd
Dimitrovgrad	Trnski Odorovci	Bul.	F	63	fruit	Decoction	High blood pressure	Cd

Note: Nationality: Ser. – serbian. Bul. – Bulgarian, Rom – Roma; Gender: M – male, F – female; Group of diseases: Cd – cardiovascular, Pr – preventive, Rs – respiratory, Ur – urinary diseases, Vr – various.

Fruits of plants from genus *Crataegus* were most often used in the form of a decoction (83 reports), of which 64 reports were about the use of *C. pentagyna*, 18 reports about the use of *C. monogyna*, one report was about the use of *C. laevigata*. Less often, the respondents have mentioned using flowers as an infusion (33 reports),

of which 19 reports were about *C. pentagyna* and 14 reports about *C. monogyna.* The leaves in the form of infusion were mentioned the least (3 reports), of which *C. pentagyna* with 2 reports, and *C. monogyna* with 1 report.

Table 4. *Respondents mentioned medicinal uses of plants from the genus Crataegus and parts of plants and forms used.*

Medicinal use (Group of diseases)	Species	Number of reports	Part of the plant	Form
High blood pressure (Cd)	*C. pentagyna*	38	fruit	decoction
High blood pressure (Cd)	*C. pentagyna*	13	flower	infusion
For the heart (Cd)	*C. pentagyna*	19	fruit	decoction
High blood pressure (Cd)	*C. monogyna*	11	fruit	decoction
For the heart (Cd)	*C. monogyna*	6	flower	infusion
High blood pressure (Cd)	*C. monogyna*	5	flower	infusion
For the heart (Cd)	*C. pentagyna*	3	flower	infusion
Unknown use (Vr)	*C. pentagyna*	3	fruit	decoction
Immune system improvement (Pr)	*C. pentagyna*	2	fruit	decoction
Strengthening the heart (Cd)	*C. pentagyna*	2	fruit	decoction
Circulation (Cd)	*C. monogyna*	1	fruit	decoction
Circulation (Cd)	*C. monogyna*	1	flower	infusion
High blood pressure (Cd)	*C. laevigata*	1	fruit	decoction
High blood pressure (Cd)	*C. pentagyna*	1	fruit	extract in alcohol
High blood pressure (Cd)	*C. monogyna*	1	fruit	extract in alcohol
High blood pressure (Cd)	*C. pentagyna*	1	leaf	decoction
Cardiac diseases (Cd)	*C. pentagyna*	1	fruit	decoction
Common cold (Rs)	*C. pentagyna*	1	fruit	decoction
Cough (Rs)	*C. pentagyna*	1	fruit	decoction
Diabetes (En)	*C. pentagyna*	1	fruit	decoction
Disease prevention (Pr)	*C. pentagyna*	1	fruit	decoction
Circulation (Cd)	*C. pentagyna*	1	flower	infusion
Hot drink (Vr)	*C. pentagyna*	1	fruit	decoction
Improving heart rate (Cd)	*C. monogyna*	1	flower	infusion
Improving heart rate (Cd)	*C. monogyna*	1	fruit	decoction
Improving heart rate (Cd)	*C. monogyna*	1	leaf	infusion
Improving heart rate (Cd)	*C. pentagyna*	1	flower	infusion
Improving heart rate (Cd)	*C. pentagyna*	1	fruit	decoction
Improving heart rate (Cd)	*C. pentagyna*	1	leaf	infusion
Kidney and bladder disease (Ur)	*C. pentagyna*	1	fruit	decoction
Sclerosis (Nr)	*C. monogyna*	1	flower	infusion
Strengthening the heart (Cd)	*C. pentagyna*	1	flower	infusion
Unknown use (Vr)	*C. monogyna*	1	fruit	decoction

*Groups of diseases: Cd – cardiovascular, En – endocrinology, Nr – neurology, Pr – prevention, Rs – respiratory, Ur – urology, Vr – various.

The most significant number of respondents mentioned using plants from the genus *Crataegus* against high blood pressure (71 reports) in the form of a decoction (50 reports), infusion (19 reports), or alcoholic extract (2 reports) and for the heart (22 reports) in the form of decoction (13 reports) or infusion (9 reports). The twice-mentioned medicinal uses of fruits in the form of decoction were for strengthening the heart and immune system improvement (Table 4).

4. DISCUSSION

The results of our study are compared with previous ethnobotanical research on the traditional medicinal use of plant species from the genus *Crataegus* in the Balkan Peninsula.

Crataegus laevigata

Jarić et al. (2007) mentioned at Kopaonik Mt the use of *C. laevigata* for hypertensive properties, which had the same medicinal uses compared to our study. The same authors mentioned using *C. laevigata* as a cardiotonic, circulatory stimulant to strengthen the heart and regulate its rate, which were different medicinal uses compared to our study.

Jarić et al. (2015) recorded at Suva Mt. the use of *C. laevigata* as an antihypertensive agent, which was the same medicinal use as in our study.

Janaćković et al. (2019) in Negotin Krajina mentioned using *C. laevigata* to strengthen the heart muscles and blood vessels, which was a different use than our study.

Crataegus monogyna

Šarić-Kundalić et al. (2010) mentioned using *C. monogyna* in Bosnia to treat heart ailments, similar to our study's medicinal use. The same authors mentioned the use of powder for sedation, which was similar to medicinal use compared to our study.

Menković et al. (2011) recorded the use of *C. monogyna* against hypertension, senile heart, ischemia of the heart, mild forms of bradycardia arrhythmias, and cardiotonic, which were similar medicinal uses as in our study, and as sedative, which was different medicinal use, compared to our study.

Pieroni et al. (2011) reported at Pešter Plateau the use of *C. monogyna* against hypertension and for the heart, similar to medicinal uses as in our study. The same authors mentioned using *C. monogyna* against sore throat and as a diuretic, which were of different medicinal use compared to our investigation.

Popović et al. (2012) found that the population from Deliblato Sands used species *C. monogyna* as a cardiac, which is the same medicinal use as in our study, and as a relaxant and sedative, which are different medicinal uses compared to our research.

Kozuharova et al. (2013) noted that using *C. monogyna* for calming effects in Bulgaria was similar to our research.

Šavikin et al. (2013) mentioned the use of *C. monogyna* against heart failure in the Zlatibor District, which was the same use compared to our study.

Zlatković et al. (2014) found that the population at Rtanj Mt. used species *C. monogyna* as a cardiotonic and antihypertensive agent, which were similar uses compared to our study.

Koleva et al. (2015) found that the population of Bulgaria used *C. monogyna* for the treatment of heart disorders, which was the same as in our study. The same authors mentioned *C. monogyna* for prophylaxis and nervous disorders, which were used differently than our research.

Mustafa et al. (2015) mentioned the use of *C. monogyna* as an anti-hypertensive agent in Kosovo and Metohija, which had identical medicinal use compared to our research. The same authors mentioned the medicinal use for improving blood circulation as neuro relaxant, antidiabetic, and anti-cholesterolemia agent, which are different medicinal uses compared to our study.

Pieroni et al. (2015) noted that in the population of Rraicë and Mokra areas in Eastern Albania, the fruits of *C. monogyna* are consumed raw as a snack, which is a different use than our research.

In ethnobotanical research on Konjuh Mt. in Bosnia, Saric-Kundalic et al. (2016) noted that *C. monogyna* was used to decrease high blood pressure and arrhythmia, which are similar applications to our research. The same authors mentioned the applications for decreasing blood fats, strengthening the heart muscle, sedation, and against renal stones, which differed from our research.

Tsioutsiou et al. (2019) noted that in Central Macedonia (Greece), the use of *C. monogyna* to prevent cardiovascular diseases differed from our research.

Matejić et al. (2020) mentioned for the Svrljig and Timok regions the use of *C. monogyna* against cardiac insufficiency, which was similar to our research. The same authors mentioned using *C. monogyna* for immunity, for the treatment of cough, and against diarrhoea, which were different applications compared to our research.

Mustafa et al. (2020) mentioned using *C. monogyna* to treat hypertension in Štrpce in the southern part of Kosovo and Metohija, which the respondents in our research also mentioned. The same authors noted the use for blood circulation, influenza, warts, headaches, lungs, and in the treatment of respiratory complaints, which were different applications compared to our research.

Živković et al. (2020) in the Pčinja District mentioned using *C. monogyna* to treat heart failure, similar to our study. The same authors mentioned the use against respiratory complaints and as a source of vitamin C, which were different uses compared to our research.

Łuczaj et al. (2021) on the Adriatic Islands noted that flowers of *C. monogyna* in the form of infusion are suitable for the heart, which was the same use as in our research.

Crataegus pentagyna

Šarić Kundalić et al. (2010) mentioned using *C. pentagyna* in Bosnia against heart ailments, similar to our study's medicinal use. The same authors mentioned using powder for sedation, which was a different application than our research.

Pieroni et al. (2011) noted at Pešter Plateau the use of *C. pentagyna* for the treatment of hypertension and for the heart, which were identical medicinal uses as in our study. The same authors mentioned using *C. monogyna* against sore throat and as a diuretic, which were of different medicinal use compared to our investigation.

Zlatković et al. (2014) noted that the population at Rtanj Mt used species *C. pentagyna* as an antihypertensive agent, which was the same use compared to our research.

In the study on Konjuh Mt in Bosnia, Saric-Kundalic et al. (2016) found that *C. pentagyna* was used to decrease high blood pressure, strengthen the heart muscle,

treat arrhythmia, and prevent renal stones, which are similar applications to our study. The same authors mentioned sedation use, which differed from our study.

Matejić et al. (2020) mentioned for the Svrljig regions the use of *C. pentagyna* for the treatment of hypertension, which was identical in comparison with our investigation. The same authors mentioned using *C. pentagyna* against stomach pain and hepatitis, different uses from our study.

The novelties of our research

The medicinal uses of *C. monogyna* flowers for circulation and *C. monogyna* flowers and fruits against sclerosis, as well as the use of *C. pentagyna* flowers for circulation, and *C. pentagyna* fruits against diabetes, for disease prevention (coffee replacement), immune system improvement, against the common cold, cough, kidney and bladder diseases, and as hot drink were not mentioned in previous ethnobotanical research on the Balkan Peninsula, so the mentioned uses can be considered the novelties of our research.

The protection

The protection of the populations of *C. laevigata, C. monogyna*, and *C. pentagyna* in the Pirot District should be considered because these species are on the list of protected species in Serbia (Službeni glasnik Republike Srbije, 2010).

5. CONCLUSION

Based on the presented data, it can be concluded that three species from the genus *Crataegus* (*C. laevigata, C. monogyna* and *C. pentagyna*) were usually used in the rural areas of the Pirot District. The most common uses were noted for the cardiovascular group of diseases (high blood pressure, for the heart, improving heart rate, strengthening the heart, against cardiac diseases, and for circulation. The less common uses were noted for the following groups: prevention (immune system improvement, disease prevention), respiratory (common cold, cough), endocrinology (diabetes), neurology (sclerosis), urology (kidney and bladder disease), and various (hot drink).

Respondents in the Pirot District mentioned different and new uses, which were compared with previous research on the Balkan Peninsula, including the use of *C. monogyna* for circulation and the treatment of sclerosis and the use of *C. pentagyna* for circulation, the treatment of diabetes, disease prevention (coffee replacement), immune system improvement, against common colds, coughs, kidney and bladder diseases, and as a hot drink.

Further chemical and pharmacological studies are necessary to make the mentioned plant species from the genus *Crataegus*, the possible candidates for the new pharmacological products.

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TRADITIONAL MEDICINAL USE OF PLANTS FROM GENUS *CRATAEGUS* IN THE PIROT DISTRICT (SERBIA)

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Summary

This paper investigated the traditional use of plants from the genus *Crataegus* for medicinal purposes in the Pirot District. The research was conducted through surveys among the rural population in four municipalities: Pirot, Babušnica, Bela Palanka, and Dimitrovgrad. The results were compared with previous ethnopharmacological studies on the medicinal use of this plant species in the Balkans.

The species *Crataegus laevigata* was mentioned for the treatment of high blood pressure (1 report). The species *Crataegus monogyna* was mentioned for the following applications: against high blood pressure (17 reports), for the heart (9 reports), improving heart rate (3 reports), for circulation (2 reports), and against sclerosis (1 report). The species *C. pentagyna* was mentioned against high blood pressure (53 reports), for the heart (13 reports), improving heart rate (3 reports), strengthening the heart (3 reports), against cardiac diseases (1 report), for circulation (1 report), immune system improvement (2 reports), against common cold (1 report), cough (1 report), diabetes (1 report), for disease prevention (coffee replacement) (1 report), as hot drink (1 report), and against kidney and bladder diseases (1 report).

The uses of species *C. monogyna* for circulation and the treatment of sclerosis, and the use of species *C. pentagyna* for circulation, the treatment of diabetes, disease prevention

(coffee replacement), immune system improvement, against the common cold, cough, kidney and bladder diseases, and as hot drink were not mentioned in previously published ethnobotanical papers on the Balkan Peninsula, so the mentioned applications can be considered the novelties of this study.

TRADICIONALNA LEKOVITA UPOTREBA BILJAKA IZ RODA *CRATAEGUS* U PIROTSKOM OKRUGU (SRBIJA)

Marija S. MARKOVIĆ, Biljana M. NIKOLIĆ, Dejan S. PLJEVLJAKUŠIĆ, Ljubinko B. RAKONJAC, Sonja Z. BRAUNOVIĆ, Filip A. JOVANOVIĆ, Vesna P. STANKOV JOVANOVIĆ

Rezime

Predmet ovog rada bilo je proučavanje tradicionalne upotrebe biljaka iz roda *Crataegus* za lekovite svrhe u Pirotskom okrugu (Jugoistočna Srbija). Istraživanje je sprovedeno u vidu ankete među ruralnim stanovništvom u četiri opštine: Pirot, Babušnica, Bela Palanka i Dimitrovgrad. Rezultati su upoređeni sa prethodnim etnofarmakološkim istraživanjima o lekovitoj upotrebi ove biljne vrste na Balkanu.

Vrsta *Crataegus laevigata* je pomenuta za lečenje visokog krvnog pritiska (1 izjava). Vrsta *Crataegus monogyna* je pomenuta za sledeće primene: protiv visokog krvnog pritiska (17 izjava), za srce (9 izjava), za poboljšanje srčane frekvencije (3 izjava), za cirkulaciju (2 izjave) i protiv skleroze (1 izjava). Vrsta *C. pentagina* je pomenuta protiv visokog krvnog pritiska (53 izjave), za srce (13 izjava), za poboljšanje rada srca (3 izjave), za jačanje srca (3 izjave), protiv srčanih bolesti (1 izjava), za cirkulaciju (1 izjava), poboljšanje imuniteta (2 izjave), protiv prehlade (1 izjave), kašlja (1 izjave), dijabetesa (1 izjave), za prevenciju bolesti (zamena kafe) (1 izjava), kao topli napitak (1 izjava) i protiv bolesti bubrega i bešike (1 izjava).

Upotrebe vrste *C. monogyna* za cirkulaciju i za lečenje skleroze, a vrste *C. pentagyna* za cirkulaciju, lečenje dijabetesa, za prevenciju bolesti (zamena za kafu), poboljšanje imuniteta, protiv prehlade, kašlja, bolesti bubrega i mokraćne bešike i kao topli napitak nisu pominjane u ranije objavljenim etnobotaničkim radovima na Balkanskom poluostrvu, pa se pomenute primene mogu smatrati novinama ove studije.

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