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SADRŽAJ:

The influence of microbial inoculums on yield and yield components of rocket (*Eruca sativa* Mill.)

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Abstract

The use of microbial inoculums can improve growth and yield of plants without use of agrochemicals which can result in obtaining quality food. Rocket is widely grown for spice and salad in the areas of Mediterranean Sea. Having in mind the importance of rocket in human diet the research was carried out in rocket grown in unheated protected houses. The experiment included four variants as follows: variant 1 control – untreated variant; variant 2 – treated with application of inoculum from the product Uniker into the soil before the sowing of the rocket; variant 3 – treated with application of inoculum from two different products Uniker and Slavol S before sowing of the seeds, whereby Slavol S was applied by immersion of the seeds for five minutes before sowing, and Uniker was applied in the soil before the sowing of the rocket; variant 4 – treated with foliar application of live cells of bacteria *Azotobacter sp*. (10-6 cfu/ml) every fifteen days during vegetation. During the vegetation total yield (t/ha) and yield components were measured. The results showed that the highest average yield (22.30 t/ha) was achieved by variant 4. Also the highest average value for the weight of the whole plant (4.22 g), root weight (0.50 g), rosette weight (3.73 g) and leaves weight (2.50 g) was obtained by variant 4. The highest average value for the number of leaves was measured in variant 3 (6.13) while the root length was highest in control variant (116.70 mm).

Key words: rocket, microbial inoculums, yield, yield components.

Introduction

Rocket is used as salad and spice in human diet. Nutritional value of 100 g fresh rocket is as follows: water 91.7 g, fat 0.66 g, carbohydrates 3.7 g, proteins 2.6 g, fibers 1.6 g (Nyzinska-Wierdak, 2015). Having in mind the nutritional value of rocket nowadays there is a high interest in finding different technologies of production or adequate measures during production in order to increase yields and

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quality of the rocket. In conventional production on soil the average yields of rocket are 2 kg/m^2 (Lešić et al., 2004; Đurovka, 2008). Modern soilless technologies like floating hydroponics showed that the average yields of rocket reached 4.25 kg/m^2 (Geršak et al., 2012). Jakše et al. (2013) found that the best yield was obtained in vermiculite and perlite in the cells of volume 20 ml (2.13 and 1.89 kg/m^2). Microbial fertilizers represent an attractive replacement for chemical fertilizers that are polluting the environment and are used to increase the crop yield in an eco-friendly way while relying on sustainable agriculture principles (Najdenovska and Gjogjevikj, 2009; Najdenovska, 2012; Stamenković et al., 2018). Many authors have confirmed positive effect of inoculation of plants using different microorganisms on yields of different crops (Dobbelaere et al., 2001; Govedarica et al., 2002; Mrkovački et al., 2007; Yazdani et al., 2009; García de Salamone et al., 2012**;** Hajnal-Jafari et al., 2012; Marks et al., 2015). Thus the objective of the research was to determine the influence of microbial inoculums on yield and yield components of rocket.

Material and methods

The experiment was carried out in the village Lisice in Skopje. The rocket (*Eruca sativa* Mill.) was grown for autumn – winter production in unheated plastic tunnel. The rocket was sown on 19th of November in nests with more than 10 seeds per nest with black foil as mulch. The distance between rows was 25 cm and 20 cm between the nests in the row. All variants sprouted on 26th of November. During the vegetation rocket was irrigated without adding additional fertilizers and pesticides. The experiment included four variants, each variant in 3 repetitions in random block system. The variants of the experiment were:

- Variant 1 control – untreated variant;
- Variant 2 – treated with application of inoculum from the product Uniker into the soil before the sowing of the rocket;
- Variant 3 – treated with application of inoculum from two different products Uniker and Slavol S before sowing of the seeds, whereby Slavol S was applied by immersion of the seeds for five minutes before sowing, and Uniker was applied in the soil before the sowing of the rocket;
- Variant 4 – treated with foliar application of live cells of bacteria *Azotobacter sp*. (10^{-6} cfu/ml) every fifteen days during vegetation.

The product Uniker contains effective strains of proteolytic and cellulolytic bacteria that decompose the hardly-soluble compounds of carbon, nitrogen and phosphorus in the soil while the product Slavol S contains bacterial auxin (IAA or indole-3-acetic acid) and rhizobacteria.

The yield was measured after 90 days of sprouting using digital balance in the field. Randomly was selected 30 plants per variant and in the laboratory several yield components (biometrical parameters) were measured: weight of the whole plant (g), root length (mm), root weight (g), weight of the rosette (g), number of the leaves and leaves weight (g).

The results were statistically processed with analysis of variance (ANOVA) using SPSS.

Results and discussion

The yield is a significant indicator of the profitability and economic justification of the cultivation of each agricultural crop. The yield is directly dependent on the biological properties of the variety, the method of cultivation, the agro-ecological conditions as well as the applied agrotechnical measures including the foliar application of nutrients (Vural et al., 2000). The advantage of foliar nutrition is that the utilization of nutrients does not depend on the soil moisture content, the pH of the soil and other chemical and physical properties of the soil (Hanelt, 2001).

From the data in Table 1, the positive effects of the use of different types of microbial inoculums as well as the different ways of application in the production of the rocket can be established. Higher average yield compared to the control variant was achieved in variant 3 (21.80 t/ha) and variant 4 (22.30 t/ha). In variant 2, the achieved average yield of 20.60 t/ha was for 0.4 t/ha lower than control variant (21.70 t/ha). Differences in the obtained average yield also exist among the individual variants. The highest average yield was obtained in variant 4 (22.30 t/ha).

Table 1. Rocket yield t/ha (Ristikj, 2019)
Tablica 1. *Prinos rige t/ha (Ristikj, 2019)*

Repetition	Variant 1 Control	Variant 2 Uniker	Variant 3 Slavol S + Uniker	Variant 4 *Azotobacter* sp.
I	21.40	21.00	22.00	21.90
II	20.90	20.30	22.00	22.20
III	20.70	20.50	21.30	22.80
$\bar{x}$ ± SD	21.0^{a}± 0.36	20.6^{a} ± 0.36	21.8^{b} ± 0.43	22.3^{b} ± 0.45

[a, b] – the values marked with different letters have a statistically significant difference between the examined variants ($p<0.05$)

Higher yield in the treated variants is due to the activity of the used microbial inoculums that influence the intensified adoption of the nutrient elements of the soil, resulting in better nutrition of the plants which allows greater production of organic matter that eventually affects the increase in yield.

Statistically significant differences ($p < 0.05$) were found in variant 3 and variant 4 compared to the control variant. Variant 2 does not differ statistically from the control variant.

The application of bio-products leads to higher plant productivity and improvement of their quality. Bio-products are characterized by a wide range of effects, and their greatest efficacy is manifested in vegetable and fodder crops (Đukić et al., 2006).The highest yield obtained in variant 4 is due to the action of the applied microbial inoculum *Azotobacter chroococcum*. This is explained by the fact that this bacteria has the ability to synthesize many biologically active compounds – nicotine and pantothenic acid, pyridoxine, biotin, heteroauxin, *gibberellins* and a variety of other compounds. The complex of these substances influences the stimulation and acceleration of the growth and development of plants under favorable environmental conditions (Đukić et al., 2007). Mrkovački *et al.* (2007) found out that the application of *Azotobacter chroococcum* increase sugar beet yield by 7 % and crystal sugar yield by 6 %. Our findings are similar as in variant 4 foliar application of microbial inoculum *Azotobacter* (10^{-6} cfu/ml) gave 6 % higher yields than control variant. Dursun et al. (2008) examined the influence of various microbial inoculums on the chemical composition, yield, and biometric parameters of the rocket. The highest average yield of 4586.54 g/m^2 was determined in the variant with the use of microbial inoculum *Pseudomonas putidae* BA - 8.

Pimentel et al. (2010) examined the influence of different doses of farmyard manure on the yield of rocket. The highest yields (31.636 t/ha) were found in the variant using 160 N·ha^{-1} by using cow manure.

Barros Júnior et al. (2011) evaluated the effect of nitrogen fertilization on intercropping of lettuce and rocket. The maximum rocket yield (14435.78 kg/ha) was obtained with the combination of 195 kg·ha^{-1} of N for lettuce and 180 kg·ha^{-1} of N for rocket.

Pimpini and Enzo (1997) found that the average yield of rocket in protected areas in Veneto, Italy was 18 t×ha^{-1} while on the other hand Varga et al. (2009) pointed out that the yield of rocket under protected houses varied from 1.68 to 5.14 kg/m^2 at the second harvest 38 days after plant emerge.
The various types of microbial inoculums as well as the different ways of application have shown a positive influence on the yield components (biometric parameters) of the rocket. In most of the examined parameters, better results in treated variants compared to control were achieved (Table 2).
Variant 3 (3.78g) and variant 4 (4.22 g) showed better results for the weight of the whole plant compared to the control variant (3.72 g). The average weight of the whole plant in variant 2 (3.57 g) was lower than the control variant. The highest average weight of the whole plant was achieved in the variant 4.

In terms of the parameter length of the root highest average value (116.70 mm) was obtained in control variant. All treated variants showed lower average values in comparison to control variant. Among treated variants, the highest average value (101.10 mm) was determined in rocket plants of variant 4.

Higher average values of root weight were measured in plants of variant 3 (0.46 g) and in variant 4 (0.50 g) compared to the control variant (0.34 g). Lower average value of root weight (0.31 g) was obtained in variant 2 in comparison the control variant.

The highest average value for the weight of the rosette was determined in variant 4 (3.73 g). In variant 2, the obtained average value for weight of the rosette (3.26 g) was lower in relation to the control variant. Positive influence of microbial inoculum for the parameter number of the leaves was found in the plants of variants 3 and 4. The highest average value for the number of leaves was found in variant 3 (6.13). The number of leaves in variant 2 was lower compared to the control variant. The highest average value for the leaves weight was obtained in variant 4 (2.50 g) compared to the control variant. In variant 2, the average leaves weight of 1.87 g was lower than the control variant (1.95 g).

Table 2. Average values for yield components (biometrical parameters) of rocket plants (Ristikj, 2019)
Tablica 2. *Prosječne vrijednosti za prinosne komponente (biometrijski parametri) rige (Ristikj, 2019)*

Variant	Weight of the whole plant (g)	Root length (mm)	Root weight (g)	Weight of rosette (g)	Number of leaves	Weight of leaves (g)
	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD
Variant 1 Control	3.72^{ab} ± 1.58	116.70^{b}± 20.02	0.34^{a} ± 1.76	3.38^{a} ± 1.48	5.97^{ab} ± 1.31	1.95^{a} ± 0.85
Variant 2 Uniker	3.57^{a}± 0.39	88.30^{a}± 10.31	0.31^{a}± 0.09	3.26^{a}±0.49	5.10^{a} ± 0.51	1.87^{a} ± 0.34
Variant 3 Slavol S + Uniker	3.78^{b} ± 1.55	100.67^{b}± 23.45	0.46^{a} ± 1.90	3.53^{ab} ± 1.47	6.13^{b} ± 1.33	2.21^{b} ± 1.70
Variant 4 *Azotobacter sp.*	4.22^{c} ± 1.45	101.10^{ab}± 16.49	0.50^{a} ± 1.75	3.73^{b} ± 1.68	5.90^{b} ± 1.26	2.50^{b} ± 1.21

$^{a, b}$ – the values marked with different letters have a statistically significant difference between the examined variants ($p<0.05$)

Statistically significant difference ($p<0.05$) about the weight of the whole plant had variant 4 in comparison to control variant, variant 2 and variant 3. Also, variant 3 had statistically significant differences ($p<0.05$) in comparison to control, variant 2 and variant 4. In terms of root length, variant 2 statistically significant ($p <0.05$) differs from the control variant and variant 3. For the biometric parameter root weight, no statistically significant differences among the examined variants was found. Variants 3 and 4 statistically significant ($p <0.05$) differ from the control variant with respect to the

parameter weight of the rosette and number of leaves. As for the leaves weight, variants 3 and 4 differ significantly ($p < 0.05$) from the control variant, as well from variant 2.

Jakše et al. (2013) examined the influence of NPK fertilizers in combination with biostimulators on the yield and biometric parameters of the rocket, and found that the average height of the plant in the first harvest was 11,6 cm, while the second harvest was 13.7 cm and in the third harvest 11.3 cm. The weight of the leaves was 2.4 g in the first harvest, 2.3 g in the second harvest, and 1.7 g in the third harvest which is similar to our findings. Dursun et al. (2008) examined the influence of various microbial inoculums on the chemical composition, yield and biometric parameters of the rocket. The highest average weight of leaves (1.63 g), the length of the leaf (27.48 cm), the surface of the leaf (93.57 cm^2) and the root weight (0.60 g) were obtained from *Pseudomonas putidae* BA - 8. In a research of Cavarianni et al. (2008) tested rocket varieties "Selvatica", "Folhalarga" and "Cultivada" developed an average 8.83, 10.47 and 11.45 leaves which are higher in comparison to current findings.

Conclusion

According to the results of the research it can be concluded that the application of different types and ways of application of microbial inoculums can be applicable in the production of rocket. In practice for further use, can be recommended variant 4 (foliar application of living cell isolate from the *Azotobacter* (10^{-6} cfu/ml) every 15 days during vegetation).

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Urban Dendroflora of the Macedonia Park in the City of Skopje, North Macedonia

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Abstract

Subject of research in this article is the urban dendroflora of the Macedonia Park, situated on about 50,000 m^2 in the Macedonian capital city of Skopje, i.e., identification and presence of the recent woody plants. Thus, observed are morphological and ecological features of the woody plants and their current state in this urban environment. The investigation relates to a seven-year period (since the establishment of the Park in 2012 up to late 2019). After the field research and the inventorisation of the woody plants in the Park, 82 taxa were identified, represented in 1,318 individuals. Most represented tree species is the hybrid *Platanus* × *hispanica* Mill. ex Münchh. with 103 individuals (7.81% of the overall urban dendroflora). Most frequent tree including infraspecific taxa is *Fraxinus excelsior* L. (including *F. e.* 'Globosa', *F. e.* 'Jaspidea', and *F. e.* 'Pendula') with a total number of 146 individuals (11.08%). Concerning other growth form, the mini and small tree roses of hybrid *Rosa* Floribunda Group outnumber all ornamental woody species with 225 bushes (17.07%). Climbers are represented with 3 taxa (3.66% of identified taxa) in pergolas (*Wisteria sinensis* /Sims/ Sweet, *Parthenocissus quinquefolia* /L./ Planch.), and wire cage topiary (*Hedera helix* L.). Likewise, 87 individuals (6.60%) of 10 species (12.19%) occur as remnants of the greening in the past of which 3 species are used as a green core of a small sacral architecture: *Cupressus sempervirens* var. *horizontalis* (Mill.) Loudon (with 10 trees), *Platycladus orientalis* (L.) Franco (3), and *Pinus nigra* J.F.Arnold (1). In general, the urban dendroflora is properly selected and used for greening, although certain species and individuals are withering (e.g. *Betula pendula* 'Youngii', *Juniperus scopulorum* 'Skyrocket', *F. e.* 'Jaspidea') or unsuitably used for avenue and in small alpine-like garden.

Keywords: urban dendroflora, ornamental woody plants, Macedonia Park, Skopje.

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Introduction

The Macedonia Park is established in the municipality of Karposh in the Macedonian capital city of Skopje. This starts back in 2012 when first microlocation of the Park is designed (Figures 1,a and 2). To be more precise, the Park as a whole consists of three microlocations (parts). The first and the second part are territorial continuum divided by street (Figure 3), but the third microlocation is completely physically apart, and therefore it is not investigated.

Figure 1. Landscape plan of the Macedonia Park designed by PE Parks and Greenery.
Slika 1. *Krajobrazno planiranje parka "Makedonija", dizajn JP "Parkovi i zelenilo".*

The City of Skopje, the city Public Enterprise Parks and Greenery and the Municipality of Karposh worked together as public stakeholders to improve the landscape of previously established poplar plantation in 1960's (Shotaroska, 2018). These short-lived poplar trees with brittle branches and plate-root system (Džekov, 1988) became dangerous and risky in the park to drive by or walk in. Of course, the old poplar clone stands were far more aged at that moment and had already achieved the goal they were planted for in the past: fast-growing species for instant greenery and wood. Likewise, in the past century there was railway infrastructure for the narrow-gauge train passing through the Macedonia Park.

The Macedonia Park is designed by the PE Parks and Greenery mainly as landscape garden, but there are certain formal garden elements (Figure 1). In this regard, the first selection of the plant species was to combine these two types of garden compositions. However, during the years, various woody ornamentals are being incorporated in the landscape. Nowadays, this Park is one of the newly established multipurpose and multifunctional green city spaces on a satisfying area of about five

hectares, slowly but assuredly gaining its physiognomy to fulfil various needs of citizens of different age in an urban environment.

The first part established in 2012 has trim trails, fitness workouts (Figures 1,a and 2), pet parks, flowerbeds, leisurely squares and pergolas (Figure 7), small alpine-like garden (Figure 9) and trees in lines (Figure 5). In addition, children's velodrome has been made in 2016. This is the recreational part of the Park, and along its entire length white gravel trim trail in the form of the letter 'S' is made (Figure 1, a). Parallel to this is the asphalt trail that serves as a bike path, roller-skating or for family walk. For the plant care in this part of the Park on an area of about 25,000 m^2, an irrigation supply network with 220 sprinklers was installed.

The second part of the Park established in 2015 represents green belt of several parcels of regular and irregular shapes, mainly a grassy area with flower ornaments (Figure 1, b). It has white gravel walkways (Figure 4) and trim trails, and asphalt sidewalks (Figure 11, a) with trees in lines (Figure 11, b). Beside fitness workouts, there are many flowerbeds and couple of wooden gazebos for leisure and chess play (Figure 4). Children's playground is made of wood elements and form a castle. For the plant care in this part of the Park on an area of approximately 25,000 m^2, an irrigation supply network with 192 sprinklers was installed.

In addition, the Macedonia Park contains a third part established in 2017 that is not investigated in this research because it is physically separated from the rest. Roughly, it covers an area of 10,000 m^2, of which about 4,000 m^2 is children's playground, fountain and pedestrian pavements.

Since the establishment of this urban green space, Parks and Greenery as a public enterprise of the City of Skopje is responsible for the maintenance of the Park.

So far, the first (and unpublished) research made for the woody ornamentals in the Park is the bachelor thesis of Shotaroska (2018) defended at the Ss. Cyril and Methodius University in Skopje, Hans Em Faculty of Forest Sciences, Landscape Architecture and Environmental Engineering (the former Faculty of Forestry in Skopje). Now, this article deepens the scientific knowledge (especially in infraspecific taxa and cultivars), gives fresh information and up-to-date input about all woody plants in the Park. In fact, this scientific article is the first published data for the Park and represent the first official inventory of the urban dendroflora as a point from which may help elaborate future development plans for the Park. Furthermore, presented results for the abundance and the environmental characteristics of the species in this investigation will help the legal authorities (Parks and Greenery in particular) to properly maintain the existing woody plants and the plant collection in general (according to species' morphoecological features). With additional details, the results can be of use for the Green Cadastre project of the City of Skopje (2017-). Eventually, it will be the basis of

further research concerning the urban dendroflora of the Park (e.g. review after five or ten years, since the comparison line is now drawn).

Figure 2. View of the Macedonia Park, 2018.
Slika 2. *Pogled na park "Makedonija", 2018 g.*

Materials and Methods

Subject of research is the urban dendroflora, i.e., species identification with systematic affiliation and number of individuals of the recent woody plants in the Macedonia Park (urban dendroflora inventory). Therefore, observed are morphological and ecological features of the woody ornamentals, including their current state in this urban environment. The investigation relates to a seven-year period since the establishment of the first part of the Park in 2012 (until late 2019).

For the GPS location and aerial observation of the territory of the Park, application tools, geographic referenced data and orthophoto imagery of geospatial software application Google Earth Pro, version 7.3.2.5776 (Google LLC, 2019) are used.

For species' features and growth forms, certain recent and past literature for (urban) dendrology is used: Džekov (1988), Erhardt et al. (2002), Idžojtić (2013, 2009, 2005), Marinelli (ed., 2004), Royal Horticulture Society (RHS, 2002), Šilić (1990), Vidaković and Franjić (2004), and Vukićević (1982). For nomenclature and taxonomy of the woody species, the plant database of World Flora Online (WFO, 2019) is used (as an updated version of The Plant List /2013/, version 1.1), and for the lower (hort.) taxa and the English common names the online Internet database of the Royal Horticulture Society (RHS, 2019c). In addition, the Ninth Edition of the International Code of Nomenclature for Cultivated Plants (ISHS, 2016) is consulted.

Likewise, after the field investigation, to clarify identification of certain ornamental woody plants found in the Park, morphological analyses in the microscopy laboratory of Ss. Cyril and Methodius University in Skopje, Hans Em Faculty of Forest Sciences, Landscape Architecture and Environmental Engineering are made.

For the abiotic factors (climate and soil conditions) of the broader area of the city, data from the Study on Greening and Afforestation of the City of Skopje (Hadji Pecova et al., 2015) is used.

Investigation area

The investigation area covers a territory of about 50,000 m^2. In fact, the Macedonia Park consists of two almost equal parts of 25,000 m^2 (Figure 3), not taking into account the third physically divided microlocation.

Mitropolit Teodosij Gologanov Blvd. borders the whole Park on the north side. The first part of the Park is bordered partly by restaurants and the 100 Trees Park on the east side, Jurij Gagarin Str. on the south side (Figure 5), and Bradfordska Str. on the west side as borderline with the second part of the Park. In continuation to the west, the second part of the Park is bordered in the south by restaurant and individual housing, objects for collective housing and Jurij Gagarin / Mile Popjordanov Str., and westerly by individual houses.

Figure 3. Orthophoto imagery of the Macedonia Park investigation area (Google Earth Pro, 2019)[5].
Slika 3. *Ortofoto snimka istraživanog područja parka "Makedonija" (Google Earth Pro, 2019)*[5].

One of the most important abiotic factors that significantly affect the urban dendroflora on this location are processed. Certain climate conditions on site such as high summer temperatures, high insulation, and urban heat islands in summer and the effect of cold air lake in winter create unfavourable conditions (Study on Greening and Afforestation of the City of Skopje, 2015). Therefore, most important and critical climatic phenomena to be observed in relation to the growth and development of the ornamental woody plants in urban environment are insulation, temperature regime (with mean annual, mean month, and absolute maximum and minimum temperatures), precipitation (with humidity), and wind.

[5] Orthophoto imagery date: 16th September 2019. Retrieved with Google Earth Pro, version 7.3.2.5776. GPS: 41° 59' 48.98"N, 21° 24' 10.78"E. Maxar Technologies 2019.

According to the climate data from the Study on Greening and Afforestation of the City of Skopje (2015), the average annual amount of insulation is 2,114 hours at the Star Aerodrom climatological station and 2,083.9 hours at the Petrovec Airport. The sunniest are the summer months of July and August with 317.6 and 308.4 hours, respectively. In December and January there are 57 and 65 hours average monthly sunlight, respectively.

The mean annual air temperature in the Skopje Valley is 12.4 °C, with a very pronounced annual flow of the air temperature ranging from 0.0 °C in January to 23.6 °C in July. The mean maximum air temperature is between 4.2 °C in the coldest month - January, and 30.6 °C in the warmest month - August. Specific is the variation of the temperature regime and rapid changes in the air temperature in a short period. Summer months have high temperatures - the average monthly temperatures are 20.7 °C in July and 20.2 °C in August. The absolute annual maximum temperature is very high, reaching up to 40.6 °C and the differences with the absolute annual minimum temperature of -25.7 °C are very high. Important for the selection of plants is the occurrence of spring and autumn frosts. The average spring frost date in Skopje occurs between 8th and 13th April. The average date of the first autumn frost occurs between 22nd and 26th October. The average length of the ice period is between 165 and 173 days.

Figure 4. Allée with *Morus alba* and wooden gazebo for leisure and chess play, 2019.
Slika 4. *Aleja s Morus alba i drveni gazebo za odmor i igranje šaha, 2019 g.*

The entire Skopje valley is dominated by altered continental and maritime pluviometric regime with maximum rainfall during May or June, as well as in the autumn months (November). The annual amount of precipitation varies between 500 and 600 mm. But, certain places have rainfalls lower than 500 mm a year. Furthermore, the mean monthly rainfalls in May varies between 51 (Volkovo) and 70 mm (Gorno Vodno). In August, the mean monthly rainfalls vary from 21.5 to 38.8 mm, respectively. Drought and drought periods are one of the specific features of the climate in the city of Skopje, and most commonly occur in summer. Summer dry periods, accompanied by high air temperatures and low relative humidity, pose a risk on vegetation development. The longest period of no precipitation (dry season) of a total of 46 days was recorded in 1969. On average every fifth year in Skopje there is

heavy rain with intensity of 251.6 l/s/ha, and every 10 years the average intensity during 5 minutes is 408.0 l/s/ha. The average annual humidity in Skopje is 68-70 %.

Winds of different directions and different strength occur in the city. The most frequent direction of flow, in the western part of the city, is from the W and W-SW direction. In the eastern parts, the most frequent winds are from N-NE direction and S-SE direction. In the central parts of the city, there are prevailing winds from the NW and W quadrant with an average wind speed of 2.0 m/s. Strong cyclonic winds that occur in that part of the city increase the possibility to inflict damage on the vegetation, in particular to individual trees on open spaces in this relatively new established urban dendroflora of the Park (Figure 9). However, in the central city core, the winds have lowest values, i.e., 1.5 m/s as mean monthly (1.0 m/s in October, 2.1 m/s in April on average). In addition, anticyclone state of occurrence often affect negatively with extreme microclimate in Skopje as an urban environment – heat waves in summer and the effect of cold air lake in winter. Eventually, these phenomena lead to the atmospheric and ecologic occurrence of smog.

The Skopje Valley is well known of the occurrence of fog and temperature inversion, during which the air pollution has increased parameters. Although the Macedonia Park it is not close to, the foggiest days in Skopje occur in Star Aerodrom suburb with 81 day a year. Other climatological stations show smaller number of foggy days varying (Drachevo 18, Petrovec 29, Trubarevo 32). Foggiest months are December with 18 days in average, and January and November with 16 and 14, respectively. Beside radiation fog and the effect of cold air lake in winter, during summer the effect of urban heat island is pretty much present. Without aeration, the air pollution derived from the industry and the traffic causes tropical night phenomenon (air temperatures above 20 °C).

Most of the soils in the urban suburbs of Skopje have anthropogenic influence. The modern way of landscaping urban areas is based on the use of soil substrates that are favourable to the needs of a particular species. Therefore, ornamental species are planted in pre-prepared soils that contain natural macro- and microelements, have good aeration and permeability, adequate drainage and pH values. These features enable uninterrupted plant growth and good root development. In the area where the Macedonia Park is located, mostly are soils of river sediments (alluvial soils derived from neighboring Vodno Mountain and gravel) and urbisol. However, during this investigation, presence of coal beneath the surface of the soil on many places in the Park is found, due to the past railway infrastructure.

Figure 5. Single tree-lined avenue with *Platanus* × *hispanica* on Jurij Gagarin Str., 2018.
Slika 5. *Jednoredni drvored Platanus × hispanica u ulici "Jurija Gagarina", 2018 g.*

Figure 6. *Fraxinus excelsior* 'Globosa' with mini and tree roses of the Floribunda Group, 2018.
Slika 6. *Fraxinus excelsior 'Globosa' s patuljastim i ružama stablašicama hibridne grupe "Floribunda", 2018 g.*

Results

Inventory of the urban dendroflora

Along the Mitropolit Teodosij Gologanov Blvd. where the Macedonia Park is located was formerly poplar clone stand, which is now completely replaced by a number of different species in the improved park. The Canadian poplars as Italian female clones (*Populus* × *canadensis* Moench 'I214') that were planted in the 60's of the last century were cut because they posed a threat to the citizens. They had outgrown their physiological age, many of them were withering, their branches were broken by winds, and it was not uncommon for a whole tree to fall down or on a nearby-parked vehicle.

Nevertheless, in 2015 exotic tree species in line were planted – the subtropical palm trees *Trachycarpus fortunei* (Hook.) H.Wendl. In less than two years since the introduction, the Chusan palms were replaced with deciduous broadleaves (mainly *Acer* spp.), due to lack of adaptability of the

individuals to various biotic and abiotic influence that is not a specific subject of investigation in this research as non-existent urban dendroflora in the Park.

The research of the urban dendroflora in the Macedonia Park dates from the first part of the Park being established in 2012 and covers the time until the completion of this scientific article. However, some trees originate since the time of the poplar clones and the memorial trees around the monument dedicated to the WWII hero Kuzman Josifovski – Pitu, and some have been planted in the meantime by the citizens of the immediate surroundings or before the completion of the Park as a whole (Figure 3). The newest data is from 29th November 2019 when 15 trees of *Cupressus* × *leylandii* A.B.Jacks. & Dallim. and 30 individuals of *Thuja occidentalis* 'Brabant' were planted.

To this date, 82 taxa of recent woody plants were identified in the Park, represented in a total of 1,318 individuals. The list of the taxa and the number of individuals (where applicable) is presented in Table 1, ordered alphabetically by species' scientific name.

Table 1. Inventory of the urban dendroflora of the Macedonia Park in the city of Skopje.
Tablica 1. *Popis urbane dendroflore na istraživanom području parka "Makedonija" u Skoplju.*

Scientific name	**Number of individuals**
Acer platanoides 'Crimson King'	1
Acer platanoides L.	30
Acer pseudoplatanus 'Atropurpureum'	7
Acer pseudoplatanus L.	35
Aesculus hippocastanum L.	1
Albizia julibrissin Durazz.	8
Betula pendula Roth	4
Betula pendula 'Youngii'	20
Buxus microphylla Siebold & Zucc.	border hedges
Buxus sempervirens L.	border hedges
Catalpa bignonioides 'Nana'	4
Catalpa bignonioides Walter	7
Celtis australis L.	3
Chamaecyparis lawsoniana 'Alumii'	8 (small alpine-like garden)
Chamaecyparis lawsoniana 'Ellwoodii'	10 (small alpine-like garden)
Chamaecyparis pisifera 'Boulevard'	8 + border hedges
Cotoneaster horizontalis Decne.	small alpine-like garden
Cupressus × *leylandii* A.B.Jacks. & Dallim.	17
Cupressus sempervirens var. *horizontalis* (Mill.) Loudon[6]	10 (memorial)
Elaeagnus angustifolia L.	5
Euonymus alatus (Thunb.) Siebold	6 (small alpine-like garden)
Euonymus fortunei 'Emerald 'n' Gold' (v)	border hedges
Euonymus fortunei 'Emerald Gaiety' (v)	border hedges
Fraxinus americana L.	6
Fraxinus excelsior 'Globosa'	92
Fraxinus excelsior 'Jaspidea'	25
Fraxinus excelsior 'Pendula'	5
Fraxinus excelsior L.	24
Ginkgo biloba 'Globosa'	5

[6] RHS accepted name: https://www.rhs.org.uk/Plants/5080/i-Cupressus-sempervirens-i-var-i-horizontalis-i/Details (RHS, 2019a)

Scientific name	**Number of individuals**
Ginkgo biloba L.	18
Gleditsia triacanthos L.	1
Hedera helix L.	topiary wire cage
Hypericum calycinum L.	border hedges
Jasminum nudiflorum Lindl.	4 (small alpine-like garden)
Juglans regia L.	8
Juniperus communis 'Hibernica'	8 (small alpine-like garden)
Juniperus horizontalis Moench	small alpine-like garden
Juniperus scopulorum 'Skyrocket'	30
Koelreuteria paniculata Laxm.	22
Lavandula angustifolia Mill.	border hedges
Liquidambar styraciflua L.	28
Liriodendron tulipifera L.	77
Lonicera ligustrina var. *yunnanensis* Franch.	small alpine-like garden
Magnolia kobus × *stellata*	38
Metasequoia glyptostroboides Hu & W.C.Cheng	6
Morus alba L.	13 (chess gazebo)
Parthenocissus quinquefolia (L.) Planch.	18 (pergolas)
Photinia × *fraseri* 'Red Robin'	3
Picea glauca var. *albertiana* 'Conica'	2 (small alpine-like garden)
Picea pungens Engelm.	2
Pinus mugo Turra	2 (alpine-like garden)
Pinus nigra J.F.Arnold	3 (1 memorial + 1 small alpine-like garden)
Platanus × *hispanica* Mill. ex Münchh.	103
Platanus occidentalis L.	3
Platanus orientalis L.	2
Platycladus orientalis (L.) Franco	4 (3 memorial trees)
Platycladus orientalis 'Aurea Nana'	6 (small alpine-like garden)
Prunus 'Kanzan' (d)	69
Prunus cerasifera 'Nigra'	34
Prunus cerasifera 'Pissardii'	1
Quercus robur (Fastigiata Group) 'Koster'	4
Quercus rubra 'Aurea'	3
Quercus rubra L.	9
Robinia pseudoacacia L.	6
Rosa Floribunda Group	225 (157 mini + 68 small tree roses)
Salix alba 'Tristis' ambig.	6
Santolina rosmarinifolia subsp. *rosmarinifolia*[7]	small alpine-like garden
Sorbus aucuparia L.	38
Sorbus intermedia (Ehrh.) Pers.	7
Spiraea japonica 'Little princess'	border hedges
Taxus baccata 'Fastigiata' (f)	9
Thuja occidentalis 'Brabant'	30
Thuja occidentalis 'Globosa'	border hedges
Thuja occidentalis 'Rheingold'	border hedges
Thuja occidentalis 'Smaragd'	41
Tilia cordata Mill.	24
Tilia platyphyllos Scop.	4
Tilia tomentosa Moench	12
Ulmus glabra 'Exoniensis'	8
Ulmus glabra 'Pendula'	15
Ulmus minor Mill.	1
Wisteria sinensis (Sims) Sweet	27 (pergolas)
Total:	**1,318**

[7] RHS accepted name: https://www.rhs.org.uk/Plants/46527/Santolina-rosmarinifolia-subsp-rosmarinifolia/Details (RHS, 2019b)

Analysis of the urban dendroflora

After the field research and the determination of the woody plants in the Park, 82 taxa were identified, represented in 1,318 individuals. Most represented tree species is the hybrid *Platanus* × *hispanica* Mill. ex Münchh. (Figure 4) with 103 individuals (7.81 % of the overall urban dendroflora). Most frequent tree including infraspecific taxa is *Fraxinus excelsior* L. including *F. e.* 'Globosa' (Figure 5), *F. e.* 'Jaspidea', and *F. e.* 'Pendula' with a total number of 146 individuals (11.08 %).

Concerning other growth form, the mini shrubs and small tree roses of hybrid *Rosa* Floribunda Group (Figures 2 and 6) outnumber all ornamental woody species with 225 bushes (17.07 %).

Climbers are represented with 3 taxa (3.66 % of identified taxa) in pergolas with 27 vines of *Wisteria sinensis* (Sims) Sweet and 18 of *Parthenocissus quinquefolia* (L.) Planch. (Figure 7), and wire cage topiary (*Hedera helix* L.).

Likewise, 87 individuals (6.60 %) of 10 species (12.19 %) occur as line trees (Figure 5), solitary trees or in small groups as remnants of the greening in the past: *Platanus* × *hispanica* with 45 trees, *Morus alba* L. with 13 (Figure 4), *Juglans regia* L. (with 8), *Celtis australis* L. (3), *Aesculus hippocastanum* L. (1), *Gleditsia triacanthos* L. (1), *Pinus nigra* J.F.Arnold (1), and *Ulmus minor* Mill. (1), including 3 species used as a green core of a small sacral architecture: *Cupressus sempervirens* var. *horizontalis* (Mill.) Loudon (with 10 trees), *Platycladus orientalis* (L.) Franco (3), and *Pinus nigra* (1). It is interesting to note that the citizens of the immediate surroundings planted the white mulberry 'grove' near the wooden gazebo for chess play (Figure 4).

Figure 7. Square with *Wisteria sinensis* and *Parthenocissus quinquefolia* on pergolas, border hedges of *Thuja occidentalis* 'Globosa', and *Prunus cerasifera* 'Nigra' as focal point, 2018.

Slika 7. *Trg s Wisteria sinensis i Parthenocissus quinquefolia na pergoli, bordura od Thuja occidentalis 'Globosa' i Prunus cerasifera 'Nigra' kao fokusne točke, 2018 g.*

Discussion

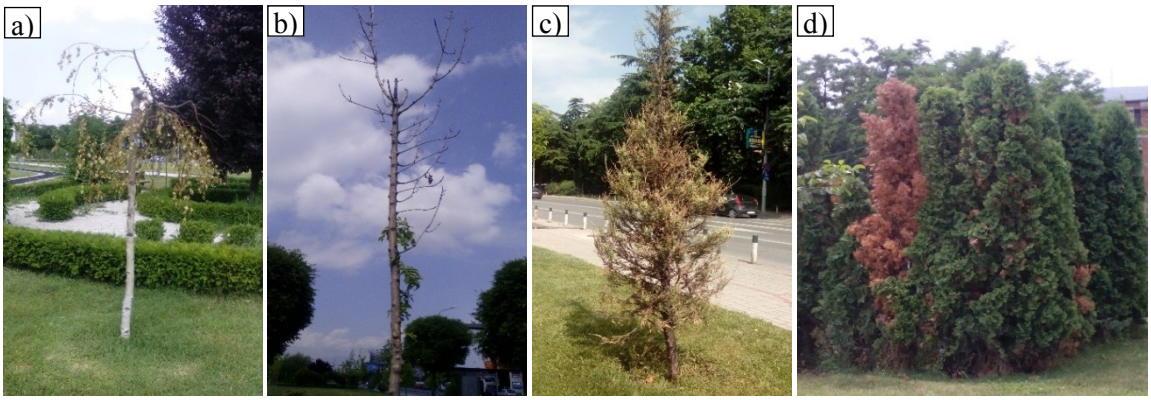
Although it has been a short period of investigation since the urban dendroflora was established to date, there are still some phenomena that can be discussed, of course, based on the abovementioned.

Public green spaces fulfil important aesthetic, social and environmental functions in urban areas (Hadji Pecova et al., 2015). Environmental ecosystem services provided by urban forests (including individual trees and shrubs, parks and forests) can be evaluated in three main categories: regulation of air, water, soil and climate, provisioning of habitat quality, and provisioning of other goods and services (Roeland et al., 2019). The Macedonia Park has various contents that are offered to the citizens. The synergy between the green and grassy areas, areas for active (Figure 2) and passive recreation (Figure 4), children's playgrounds and pet-friendly areas makes this urban environment a highly correlated socio-ecological green city core at this moment. The number of individuals (1,318) and (ornamental) woody taxa (82) used for landscaping (Table 1) are satisfying taking into account the total area of the Park (5 ha), and overall suitable for the location and the purpose they are planted for. As a justification, compared are some examples on this matter in the region, due to lack of existing data on domicile parks: the dendroflora of the Bihać City Park is represented in 80 taxa with 663 woody plants on an area of 3.1 ha (Delić et al., 2018), the park surrounding the Faculty of Forestry and the Faculty of Agriculture of the University of Zagreb with 112 woody taxa on 5.7 ha (Salantić, 1992), the park Univerzitetski Grad in the city of Banja Luka with 88 woody taxa and 1,553 specimens on 21 ha (Stupar, 2009).

Certain individual trees and small groups from the greening in the past have been left untouched, even incorporated or as much as it can in the newly established Park. It is important to emphasize the cooperation of the citizens and the responsible authorities for the improvement of the white mulberry trees and their promotion to allée (Figure 4).

Particularly interesting composition of the Park are the 4 round squares with pergolas and benches under the climbers' colourful 'canopy' of *Wisteria sinensis* and *Parthenocissus quinquefolia*, gravel paths with border hedges of *Thuja occidentalis* 'Globosa' and *Buxus* spp., and *Prunus cerasifera* 'Nigra' as a focal point in the center (Figure 7). Likewise, main aspects and functions of the plant design in parks and gardens (Sandeva et al., 2013) in urban environment are carefully met (Despot et al., 2013).

Unfortunately, like the other city green areas, in the Macedonia Park occasionally are noticeable certain issues that disturb the beautiful scenery and pleasant ambience. Such phenomena that can be remedied by humans should not be allowed to stand for long periods, since they interrupt the impression of the green space.



a) *Betula pendula* 'Youngii', b) *Fraxinus excelsior* 'Jaspidea', c) *Juniperus scopulorum* 'Skyrocket', d) *Thuja occidentalis* 'Smaragd'.

Figure 8. Withering of individuals, 2018.
Slika 8. *Sušenje stabala, 2018 g.*

Figure 9. Small alpine-like garden, 2018.
Slika 9. *Mali (alpski) vrt, 2018 g.*

Regarding the ecology of the recent species in the Park, for *Betula pendula* Roth species it is especially important to pay attention to the humidity, as the silver birch is sensitive to high temperatures and dry air (Džekov, 1988). This is very important for proper growth and development, and even for the survival of these trees, as birch is a light- and humidity-demanding species and thrives on full sun (Džekov, 1988). Several trees, during the data processing, were already withering (Figure 8, a). In addition, withering has been observed in some exemplars of ash, 'Jaspidea' in particular (Figure 8, b), and *Thuja* spp. (Figure 8, d).

Serious problem may be the presence of coal debris in the underground left over from the period when the narrow-gauge train was operating. It is for sure that the coal is a physical obstacle when planting various woody species in the Park.

In one section of the Park, the line of woody ornamentals along the Mitropolit Teodosij Gologanov Blvd. incite issues regarding the purpose of use and morphoecology of the species. *Magnolia kobus* × *stellata* is a shrub/small tree, and *Juniperus scopulorum* 'Skyrocket' is a narrowly columnar evergreen conifer shrub concerning the height, with an ultimate spread of 0.5 – 1 metres (RHS, 2019c). Therefore, using these two species one after another (alternately) as part of an avenue in this case, whose primary purpose is to prevent insulation during the summer along south-facing aspect for pedestrians and traffic is rather a pointless discussion. Moreover, the distance between the individuals is inadequate (too distant) for their habit and it is unlikely to create tree-lined avenue. In addition, many Rocky Mountain juniper 'Skyrocket' individuals are already withered (Figure 8, c).

a) *Salix alba* 'Tristis', b) *Quercus rubra*.

Figure 10. a) Trunk support with poles after windstorm, and b) bent tree caused by wind, 2018.
Slika 10. *a) Učvršćivanje stabla drvenim kolcima i b) iskrivljeno stablo zbog vjetra, 2018 g.*

Attention should be paid to *Tilia* spp. as they develop a strong root system, similar as *Platanus* spp., but with root suckers (Džekov, 1988), which can uplift the soil media and could damage paved surfaces - paths and pavements in an urban environment, in particular where they are too close to this type of infrastructure (certain sections in the Park). Occasionally, during the dry summer season, summer leaf fall or leaf drying is observed. In addition, the appearance of honeydew secretion from leaf insects is often manifested, similar to that of *Catalpa bignonioides* Walter (including 'Nana'). For this species, however, it is specific that its sharp, long, thin legume-like capsule fruit (Džekov, 1988; Idžojtić, 2013) can be dangerous for passersby when falling from the canopy.

Within the small garden (Figure 9), certain species are not suitable for the purpose of intended alpine-like space, are planted too close or cannot be maintained properly, or they are not characterized by prostrate/dwarf growth (RHS, 2002), for example these evergreen species: *Chamaecyparis lawsoniana* 'Alumii', *Cupressus* × *leylandii* A.B.Jacks. & Dallim., *Pinus nigra* J.F. Arnold. In addition, *Salix alba* 'Tristis' with its pendulous canopy completely covers or overshadows some of the light-demanding species (Figure 9).

As a relatively new raised green area on an open space, in the Park occasionally occur strong air flows, which may cause crown/trunk breaks or windthrows if they are not protected by physical support until the root system becomes sufficiently branched (RHS, 2002) to carry the load on the overhead part. In this regard, care should also be taken of the crown-root ratio of species with larger canopy like white willow 'Tristis' (Figure 10, a) and crown-trunk ratio as of *Sorbus aucuparia* L. and *Quercus rubra* L. (Figure 10, b), no matter of the fact that the first two are wind resistant species (RHS, 2002).

Robinia pseudoacacia L. (Figure 11, a) and *Koelreuteria paniculata* Laxm. (Figure 11, b), as species that can behive invasive in the Republic of North Macedonia (Simovski and Nikolov, 2019; Simovski et al., 2012; Trajanovski et al., 2018) are needed to be monitored for possible expansive territorial impact on other plants in the Park and the surrounding environment.

Eventually, it can be noted that only a small portion of the existing dendroflora in the investigated area, probably due to planting time, inadequate microclimate or quality of plant material, physiological weaken, and some species (may) decline. Thus, not only does the specimens lose its decorative value, but also it is necessary to constantly allocate resources for their proper care and maintenance (e.g. the Chusan palms lined trees of the past urban dendroflora) or to replace them again with the same species. Therefore, significant attention should be paid to the (future) proper selection of plants with suitable morphoecological characteristics with seasonal dynamics, and on adequate micro-locations (Simovski, 2011a,b,c,d).

Figure 11. Individual of a) *Robinia pseudoacacia* and lined trees of b) *Koelreuteria paniculata*, 2018.
Slika 11. *Pojedinačno stablo a) Robinia pseudoacacia i drvored s b) Koelreuteria paniculata, 2018 g.*

Taking into consideration all of the above, it should be point out that the Macedonia Park consecutively is gaining its projected physiognomy, successional emphasizing aesthetic, environmental and social features of the ornamental woody plants.

Conclusion

After field and laboratory observation during the period 2012-2019, an inventory with analysis of the existing urban dendroflora of the Macedonia Park in the city of Skopje is made: 82 taxa were identified, represented in 1,318 individuals. Beside the common use of trees and shrubs as typical park species, certain species are planted as lined trees, some small shrubs as border hedges, climbers for pergolas, form wire cage topiary, and for small alpine-like garden. Furthermore, there are species used as memorial trees of small sacral architecture in a previously established landscape design. The most represented tree species is the hybrid *Platanus* × *hispanica* Mill. ex Münchh. with 103 individuals, which is 7.81 % of the total urban dendroflora. The most frequent tree including infraspecific taxa is *Fraxinus excelsior* L. (including *F. e.* 'Globosa', *F. e.* 'Jaspidea', and *F. e.* 'Pendula') with a total number of 146 individuals (11.08 %). Concerning other growth forms, the mini and tree roses of hybrid *Rosa* Floribunda Group outnumber all ornamental woody species with 225 bushes (17.07 %). Climbers are represented with 3 taxa (3.66 % of identified taxa) in pergolas and wire cage topiary. Likewise, 87 individuals (6.60 %) of 10 species (12.19 %) occur as remnants of the previous greening of which 3 species are used as a green core of a small sacral architecture. After observation of morphological and ecological features of the woody species and their current state in this environment, the urban dendroflora is properly selected and used for greening, although certain species are withering or unsuitably used for avenue and in small alpine-like garden.

These results are the first published investigation for the woody plants of the Park. As such, they are a base for further scientific research concerning the urban dendroflora represented in the Park over time. The observed occurrence and the abundance of the species gives valuable up-to-date information for input in the Green Cadastre of the City of Skopje, and the morphoecological phenomena noted in the Park can practically guide the legal authorities (Parks and Greenery, the City of Skopje, and the Municipality of Karposh) to improve and properly maintain the existing woody ornamentals. In addition, the data may help elaborate future development plans for the Park.

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Stavovi i percepcije kninskih srednjoškolaca o uzgoju i primjeni sobnog bilja

Attitudes and perceptions of the Knin-based secondary school pupils concerning the growing and use of indoor plants

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Sažetak

Na osnovu njihovog habitusa, sobno bilje se dijeli na šest skupina: vrste koje izgledom podsjećaju na trave, biljke uspravnog rasta, penjačice i puzavice, rozetaste biljke i loptaste biljke. Unutar općeg dijela ovog rada obrađuju se ekološki i uzgojni zahtjevi sobnog bilja, kao i opća saznanja o njihovim različitim skupinama. Anketno istraživanje provedeno je tijekom mjeseca travnja i svibnja 2018. godine na uzorku od 60 ispitanika (učenika srednje škole) s područja grada Knina, njegove okolice i susjednih mjesta. Svrha navedenog istraživanja bila je istražiti stavove i percepcije kninskih srednjoškolaca o nabavi, uzgoju i primjeni sobnog bilja. Temeljem anketnog istraživanja ustanovljeno je da ispitanici (učenici kninskih srednjih škola) najviše nabavljaju sobno bilje u vrtnim centrima i supermarketima Knina. Najveći broj ispitanika godišnje izdvoji do 100 kn za nabavu i njegu sobnog bilja. Manji broj ispitanika se često bavi uzgojem lončanica aromatičnog bilja u interijeru. Najvažnija im je ukrasna karakteristika kod sobnog bilja cvijet. Mali broj ispitanika se bavi i uzgojem sobnog bilja. Najveći broj sobnog bilja im se nalazi u dnevnoj sobi. Za uzgoj i njegu sobnog bilja učenike su najviše zainteresirali njihovi roditelji i rodbina.

Ključne riječi: sobno bilje, opća saznanja, učenici, stavovi i percepcije, Knin.

Abstract

Based on their habitus, indoor plants are divided into six groups: types whose appearance reminds of grasses, plants that grow vertically, climbers and creepers, rosette-shaped and ball-shaped plants. Ecological and growth requirements of indoor plants have been addressed in the general part of this

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paper and general knowledge is provided about their different groups. A survey research was conducted in April and May 2018 on a sample of 60 respondents (secondary school pupils) from the area of the city of Knin, its outskirts and the neighbouring towns. The specific objective of the previously mentioned research was to analyse attitudes and perceptions of the Knin-based secondary school pupils in terms of supply, growing and use of indoor plants. According to the findings of the survey research, it was concluded that the respondents (the Knin-based secondary school pupils) most frequently purchase indoor plants in the Knin-based garden centres and supermarkets. The largest number of the respondents spend up to HRK100 at an annualised level for the purchase and care for indoor plants. A smaller number of the respondents are frequently involved in growing of potted aromatic herbs indoors. The decorative feature of indoor plants that they pointed out as the most important for them is the flower. A small number of the respondents are also involved in growing of indoor plants. The respondents normally place the largest number of indoor plants in the living room. The secondary school pupils' parents and relatives played the most important role in terms of arousing their interest in growing and care for indoor plants.

Key words: indoor plants, general knowledge, pupils, attitudes and perceptions, Knin.

Uvod

Ljudi su još davnina uzgajati različite sobne biljne vrste. Svojim rastom i razvojem u interijerima sobno bilje pruža lijep ugođaj ne samo izgledom već ponekad i mirisom (Courtier i Clarke, 1997).

Danas je urbanizirani način života doveo do toga da ljudi 80% ili više vremena provode u zatvorenim prostorima (Fjeld et al., 1998., prema Doxey et al., 2009.). Mnogi pojedinci i tvrtke oplemenjuju svoje domove ili urede sobnim biljem (Dravigne et al., 2008., prema Doxey et al., 2009).

Sobno bilje se na osnovu habitusa dijeli na šest skupina: vrste koje svojim izgledom podsjećaju na trave, biljke uspravnog rasta, penjačice i puzavice, rozetaste biljke i loptaste biljke. Sobne biljke koje izgledom podsjećaju na trave imaju busenast rast i duge uske listove. Biljke uspravna rasta često se koriste kao soliterne biljke. Ovoj skupini pripadaju neki kaktusi, stablašice i vrste kod kojih habitus ima oblik palme (Temim i Dorbić, 2017).

Prije početka uzgoja sobnog bilja potrebno je odabrati posude za njihov uzgoj. Posude za biljke mogu biti: glineni lonci, ukrasne posude, čaše, školjke, žardinijere, zdjele, vaze, košare itd. Odabirom oblika i veličine posude pospješuje se kvaliteta razvoja biljke te o njoj kao i o ishrani ovisi razvoj njezina korijena (Courtier i Clarke 1997).

Da bi biljci omogućili da razvije stabilan korijenov sustav, lonac mora biti odgovarajućih dimenzija, zatim mora sadržavati dovoljno komposta radi opskrbe hranjivih tvari i vode, i imati drenažne otvore kako bi se omogućilo otjecanje suvišne vode iz komposta (Courtier i Clarke, 1997).

Posude za uzgoj sobnog bilja mogu biti od različitih materijala kao što su: keramika, staklo, plastika, metal, glina, beton itd.

Začinske biljke zauzimaju posebno mjesto kao sobne biljke. Neke od njih su jednogodišnje, pa ih je potrebno svake godine ponovno sijati. Kao sobno začinsko bilje najviše se uzgajaju: krasuljica, vlasac, mažuran, bosiljak, peršin, majčina dušica, ružmarin i čubar (Squire, 1996).

Prilikom odabira bilja za interijer bitno je naglasiti da pojedine biljne vrste nisu uvijek u "modi" kao i da postoje različiti stavovi ljudske populacije o odabiru (Dorbić et al., 2018).

Interes za bilje, posebno za ukrasno imaju i djeca i stariji adolescenti. Osim vlastitih sklonosti koje pojedinac treba uglavnom pokazivati njegova okolina (u smislu društvene interakcije) također može pridonijeti u profiliranju i produbljenju interesa. Tako su npr. značajnu ulogu u organizaciji slobodnog vremena tijekom XIX. stoljeća u zadarskim učiteljskim preparandijama imali i školski vrtovi u kojima su učenici pomagali vrtlaru obrađivati vrt (Ströll, 1900). *Rad u vrtu trebao ih je odmaknuti od mehaničkog učenja u zatvorenoj prostoriji* (Vigato, 2008).

I u hrvatskoj nalazimo na slično, gdje se u projektu "Najljepši školski vrtovi" koji je započeo školske godine 1994./95., radilo na obnovi školskih vrtova, u kojima bi djeca baveći se vrtlarenjem lakše prebrodila ratne traume.

Neka su istraživanja u svijetu pokazala da sobno bilje pozitivno djeluje na umanjenje nedoličnog ponašanja i izostanke kod učenika osnovne škole ukoliko su s njim oplemenjene učionice (Ke-Tsung Han, 2008).

Sobno bilje može utjecati na čovjekovu psihu, poput smanjene napetosti (Ulrich et al., 1991., prema Doxey et al., 2009), te povećanu sposobnost koncentracije i pažnje (Taylor et al., 2001., prema Doxey et al., 2009).

Na osnovama navedenog provest će se anketno istraživanje gdje će se istražiti stavovi i percepcije kninskih srednjoškolaca o njihovoj nabavi, uzgoju i primjeni sobnog bilja.

Materijali i metode

Prilikom izrade ovog rada kao izvor podataka koristila se stručna i znanstvena literatura. Kao izvor primarnih podataka obavljeno je anketno istraživanje na području grada Knina.

Cilj provođenja anketnog ispitivanja na području grada Knina i njihove okolice bilo je istražiti stavove i percepcije kninskih srednjoškolaca, maturanata Srednje škole Lovre Montija o njihovoj nabavi, uzgoju i primjeni sobnog bilja.

Anketno istraživanje provedeno je tijekom mjeseca travnja i svibnja 2018. godine na uzorku od 60 ispitanika. U pogledu boravišta ispitanika s područja grada Knina je bilo 42 ispitanika, okolice Knina 16 ispitanika i ostalih mjesta 2 ispitanika. Među ispitanicima se nalazilo 38 žena i 22 muškarca. Starosna struktura uzorka bila je od 18 do 20 godina.

Statistička obrada podataka je izvršena u programu SPSS 14 za Windows sučelje.

Ekološki zahtjevi sobnog bilja

Temperatura

Većina sobnog bilja potječe iz tropskih krajeva. Temperatura je važan čimbenik u aktivaciji rasta biljke te mora biti u ravnoteži sa količinom i jačinom sunčeve svjetlosti (Squire, 1996).

U predsoblju, spavaćoj sobi i hodniku prevladavaju svježi uvjeti što pogoduje uspješniji rast većih biljaka. Stalna temperatura veća od 20 °C nepovoljno utječe na gotovo sve vrste sobnog bilja. Uz pravilno osvjetljenje tropske biljke podnose sobnu temperaturu od 35 °C, dok temperatura veća od 44 °C nepovoljno utječe na sve sobne biljke. Tijekom zime potrebe sobnog bilja za temperaturom su manje jer većina njih ulazi u fazu mirovanja (Herwig, 1975).

Kako bi biljka tijekom svog rasta i razvoja bila vitalna, svijetlost, temperatura i vlaga moraju biti u stalnoj ravnoteži (Squire, 1996).

Svjetlost

Svjetlost je značajan faktor za pravilan rast i razvoj sobnog bilja. Utjecaj i količina svjetla koja utječe na razvoj biljke ovisi o: veličini i položaju prozora, godišnjem dobu, vremenskim prilikama, o drveću ili zgradama te o zahtjevima svake pojedine biljke za svjetlošću (Courtier i Clarke, 1997).

Prema količini svjetla koja je potrebna različitim vrstama razlikuje se: puna sunčevu svjetlost, lagana sjenu, sjena i duboka sjena. Najpogodnije vrste za svijetle prozorske daske su kaktusi, kojima sunčeva svjetlost najviše odgovara prije i tijekom cvatnje. Tako npr. *Amarilis* (*Hipeastrum)* i neke druge vrste preferiraju svjetlo za vrijeme cvatnje: *Echinocereus pectinatus*, *Aporocactus flagelliformis, lithops salicola i Lithops pseudotrutancella* (Squire, 1996).

Afrička ljubica (*Saintpaulia ionantha*), *Euphorbia pulcherrima*, *Sanservieria trifasciata* i *Zebrina pendula* su vrste koje zahtijevaju izrazito sunčevo osvjetljenje, pa ih je najbolje smjestiti kod osvijetljenog prozora (Squire, 1996).

Voda i vlažnost zraka

Voda je sastavni dio svake biljke. Potrebe za vodom razlikuju se kod svake biljne vrste po na osob. Količina vode ovisi o godišnjem dobu i mikroklimatskim uvjetima unutar sobe u kojoj se biljka nalazi (Squire, 1996).

Najbolji pokazatelj dali biljka ima dovoljno vode je zemlja, koju je najbolje održavati podjednako vlažnom. Također venuće biljke ukazuje i na prekomjerni sadržaj vode pa korijen biljke često trune. Količina vode ovisi o veličini biljke i posude u kojoj se ona nalazi (Squire, 1996). Biljke se mogu zalijevati: kišnicom, odstajalom vodom te vodom iz gradskog vodovoda (Hessayon, 2002). Temperatura vode kojom zalijevamo biljke također je vrlo bitna, da ne dođe do stresa (Squire, 1996). Biljke tijekom zimskog mirovanja traže manje vode, dok su ljeti potrebe za vodom puno veće (Larousse, 2001).

Supstrat

Za supstrat se mogu koristiti različiti materijali prirodnog podrijetla kao što su: pijesak, treset, kućni kompost, kore od stabla i kokosova vlakna. Kao kompost može se koristiti i vrtna zemlja, ali ona sadrži dosta manje hranjiva. Zbog svoje prekompaktne strukture vrtna se zemlja miješa s raznim materijalima, te se kao takva koristi za sadnju velikih biljaka kao što su: palme, fikusi, agrumi, dracene itd. (Larousse, 2001).

Kompostu se najčešće dodaje riječni pijesak ili vrtlarski šljunak kako bi mu se poboljšala drenaža. Za razliku od pijeska, treset je lakši i čišći te dobro zadržava vlagu, ali mu je glavni nedostatak što sadrži malo hranjivih tvari (Bland i Davidson, 2002).

Većina biljnih vrsta ne preferira istu zemlju za uzgoj. Neke biljke vole kiselija tla koja su obogaćena humusom, dok druge više preferiraju vapnenasto-poroznu zemlju (Herwig, 1975).

Danas postoje specijalne mješavine i komposti tzv. sintetički jer u sebi sadržavaju materijale koji nisu organskog podrijetla. Najčešće se u tako kupljenim mješavinama nalaze materijali koji poboljšavaju zrak i drenažu (Larousse, 2001).

Najčešće korišteni sintetički materijali su perlit i vermikulit. Perlit se zbog svoje male težine koristi kao zamjena za pijesak, i njegova jedina uloga je zračenje. Vermikulit se radi od gline uz pomoć visoke temperature. Odličan je element za zračenje i drenažu jer ne zadržava vlagu.

Danas postoji kompost za lisnate biljke, kaktuse, agrume, orhideje i za bonsai (Larousse, 2001).

Mjere njege i održavanja sobnog bilja

Pod njegom sobnog bilja podrazumjeva se prihranjivanje, zalijevanje, presađivanje, privikavanje, podupiranje, skidanje ocvalih cvjetova.

Prihranjivanje

Kako bi uzgajane biljke imale dobar rast i razvoj potrebno im je osigurati dovoljno hranjivih tvari. Najjednostavniji način ishrane kućnih biljaka je dodavanje gnojiva u vodu. Kod jako neishranjenih biljaka koristi se i foliarna gnojidba (Matrin, 1986).

Hranjiva za kućne biljke dijele se na hranjiva za lisnate biljke (s visokim udjelom dušika) i na hranjiva za cvatuće biljke (s visokim udjelom kalija). Hranjiva se mogu nabaviti u raznim oblicima: u granulama, kao tekuće ili praškasto gnojivo, kao tablete i štapići hranjiva te kao folijarna hranjiva (Courtier i Clarke, 1998).

Presađivanje

Presađivanje biljaka se obavlja kada one istroše sva hranjiva i kada prerastu posudu u kojoj su prvotno rasle. Korijenje koje izlazi iz dna lonca znak je da ju treba presaditi. Biljka se presađuje u nešto veći lonac od prethodnog. Najbolje je da se presađivanje obavi početkom razdoblja aktivnog rasta. Neke kučne biljke je potrebno više puta godišnje presađivati (Matrin, 1986).

Adaptacija

Pod privikavanje spadaju uzgojni zahvati vezivanje biljaka uz potporanj, otkidanje i podrezivanje te otkidanje mrtvih osušenih glavica cvjetova.

Biljke kao što su penjačice zahtjevaju potporanj uz koji će se moći penjati, te neke od njih imaju zračno korijenje koje zahtjeva vlažnu površinu.

Mnogim kućnim biljkama prilikom uzgoja nije potrebno otkidanje ili podrezivanje, ali mnoge od njih treba orezivati kako bi im se sačuvao uzgojni oblik. Uklanjanjem vrha stabljike postiže se da biljka ne ide previše u visinu, te se postiže rast pupova u pazušcima listova.

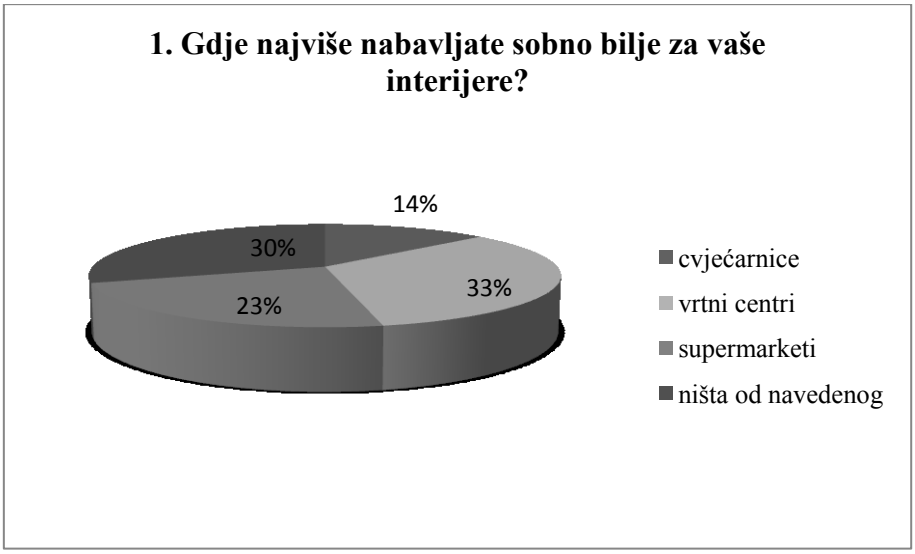
Nakon cvatnje vrlo je poželjno ukloniti stare ocvale cvjetove jer oni narušavaju izgled biljke. Ako ih se ne ukloni na vrijeme biljka gubi energiju stvarajući sjeme (Courtier i Clarke, 1998)

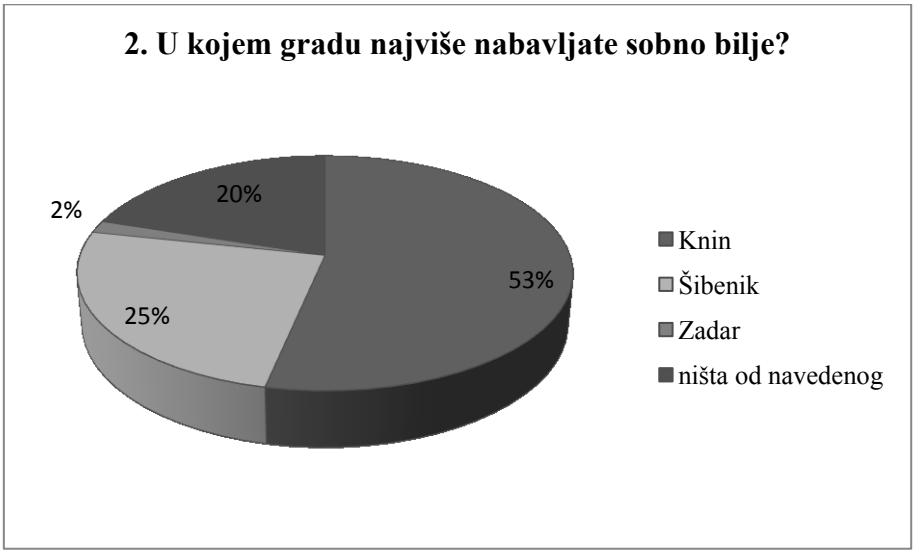
Rezultati i diskusija

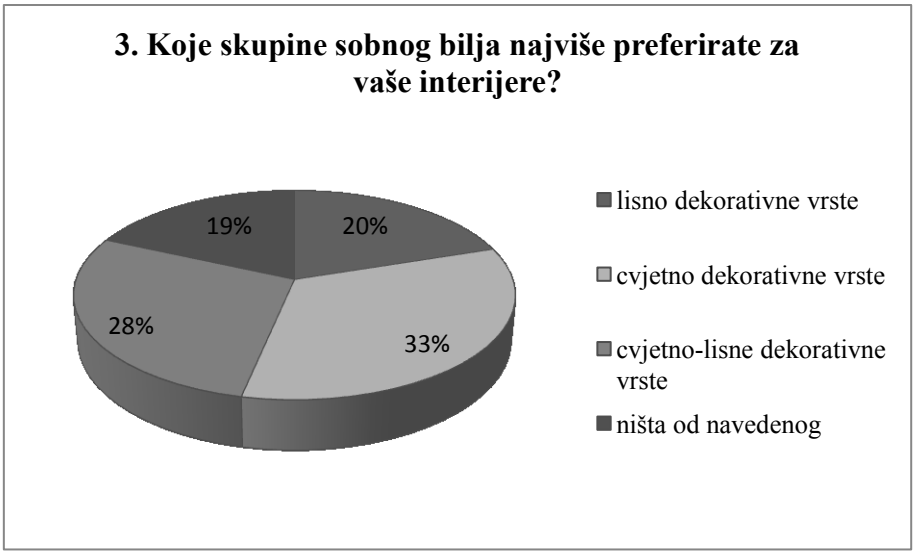
Svrha anketnog istraživanja bila je ispitati stavove i percepcije kninskih srednjoškolaca o nabavi, uzgoju i primjeni sobnog bilja (Slike 1. – 4., 5. – 15., 16. – 20.).

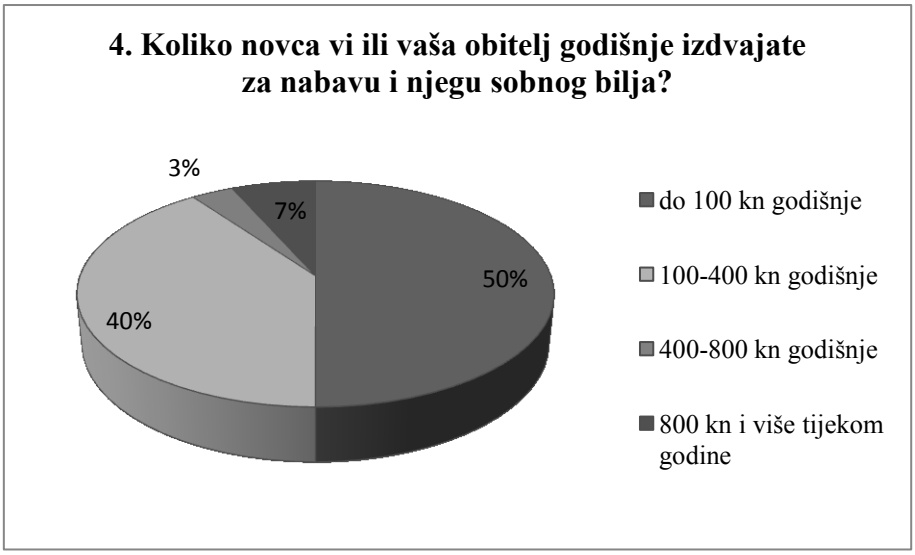
Slike 1. – 4. Istraživanje stavova i mišljenja kninskih srednjoškolaca o nabavi i izboru sobnog bilja (prema Zemunović, 2018)

Figures 1 – 4. Attitudes and perceptions of the Knin-based secondary school pupils concerning on the procurement and selection of houseplants *(according to Zemunović, 2018)*









Iz slika 1. – 4. je razvidno da ispitanici najviše nabavljaju sobno bilje u vrtnim centrima i supermarketima (33,3 % i 23,3 %). Njih 53,3 % nabavlja sobno bilje u gradu Kninu. Za sobne interijere najviše preferiraju cvjetno dekorativne i cvjetno-lisne dekorativne vrste (33,3 % i 28,3 %). 50,0 % ispitanika godišnje izdvoji do 100 kn za nabavu i njegu sobnog bilja, a njih 40,0 % od 100 do 400 kn godišnje.

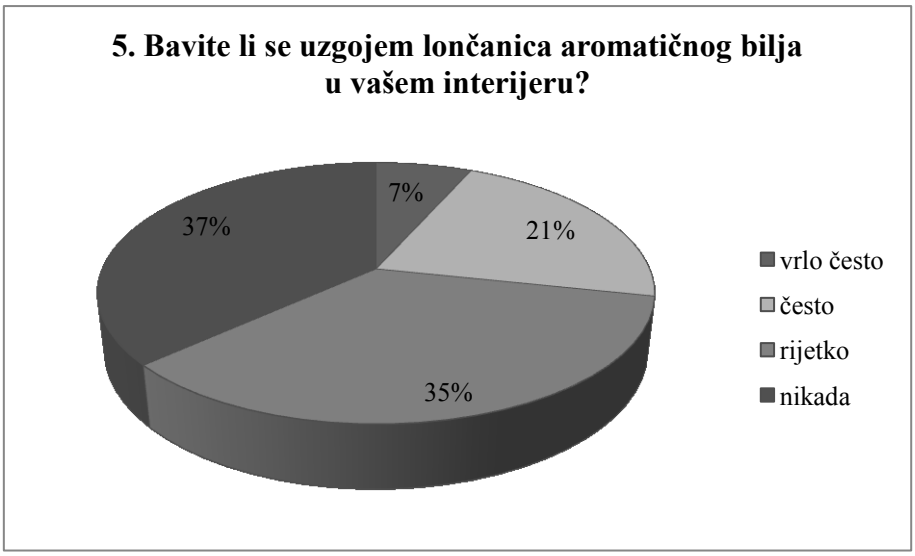
Slike 5. – 15. prikazuju stavove i mišljenja kninskih srednjoškolaca o uzgoju i vrstama sobnog bilja. Na pitanje bavite li se uzgojem lončanica aromatičnog bilja u vašem interijeru, (21,7%) ispitanika je odgovorilo da to radi često, a njih (36,7%) nikada (Slika 5.).

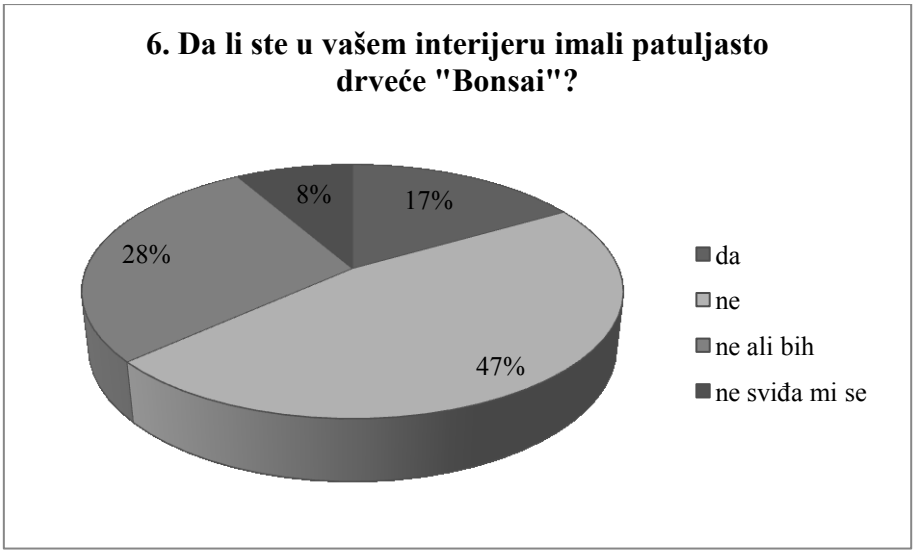
46,7 % ispitanika u inerijeru nije posjedovalo patuljasto drveće "Bonsai". Ispitanici su posjedovali kaktuse i sukulente (40,0 %). Veći broj ispitanika (68,3 %) nije posjedovao male terarije ili staklene vrtove (vrtovi u boci) sa sobnim biljem. Nešto više od polovine ispitanika (56,7%) nije posjedovao zatvoreni (ostakljeni) balkon u kojem je uzgajao sobno bilje. Na pitanje "Koja je po vama najvažnija

ukrasna karakteristika sobnog bilja?" 53,3 % ispitanika se odlučilo za cvjetove, a 26,7 % za listove. Ispitanici, njih 40 %, uzgajaju do 5 biljaka, a 28,3 % između 5 do 10 biljaka. Vezano za pitanje o pridržavanju ekoloških principa kod uzgoja i njege sobnog bilja, najveći broj ispitanika (43,3 %) je odgovorio da to radi osrednje. Keramičke (45,0 %) i plastične (31,7 %) dekorativne lonce ispitanici najviše koriste za sobno bilje. Uglavnom nikada (46,7 %) i rijetko se u slobodno vrijeme bave razmnožavanjem sobnog bilja. Mali broj ispitanika se bavi i uzgojem sobnog bilja, samo njih (23,3 %) to čini često, a (45,0 %) rijetko.

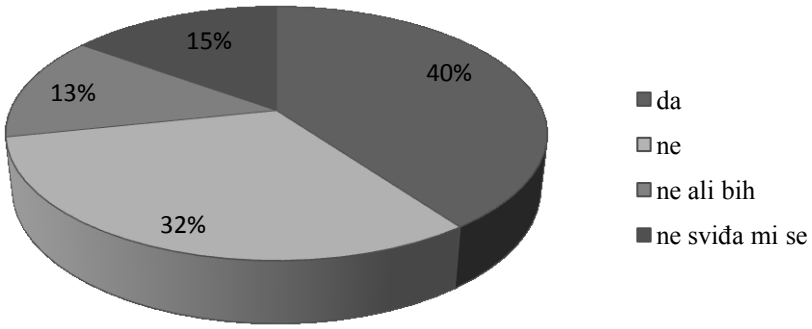
Slike 5. – 15. Istraživanje stavova i mišljenja kninskih srednjoškolaca o uzgoju i vrstama sobnog bilja (prema Zemunović, 2018)

Figures 5 – 15. *Attitudes and perceptions of the Knin-based secondary school pupils concerning the growing and species of indoor plants (according to Zemunović, 2018)*

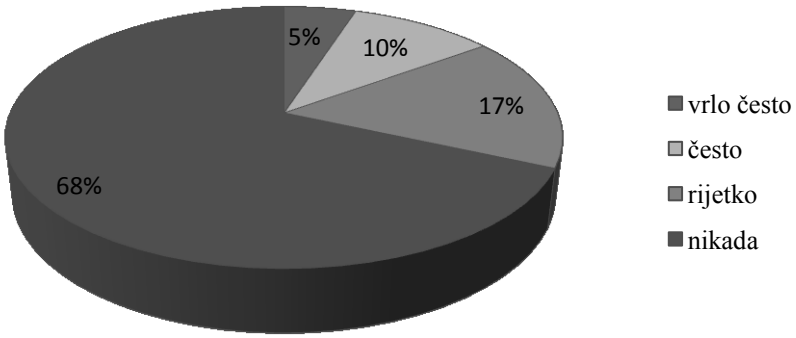




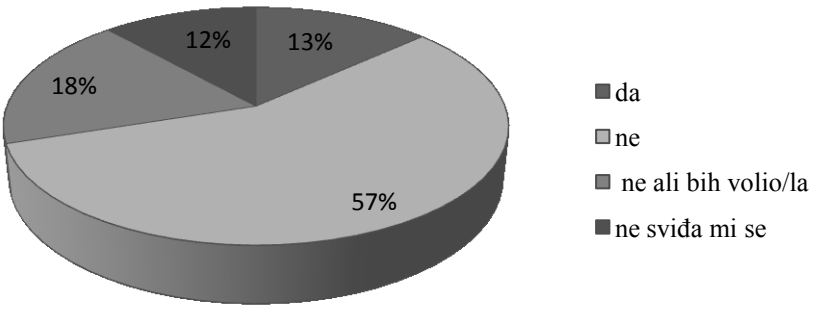
7. Da li ste u vašem interijeru posjedovali ili posjedujete kaktuse i sukulente?



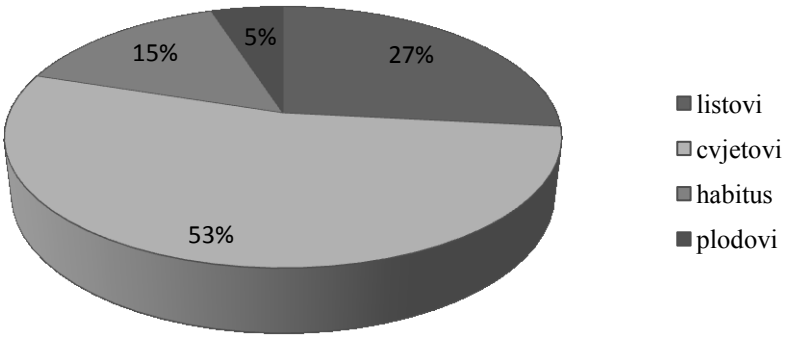
8. Da li ste u vašem interijeru imali male terarije ili staklene vrtove (vrtovi u boci) sa sobnim biljem ?



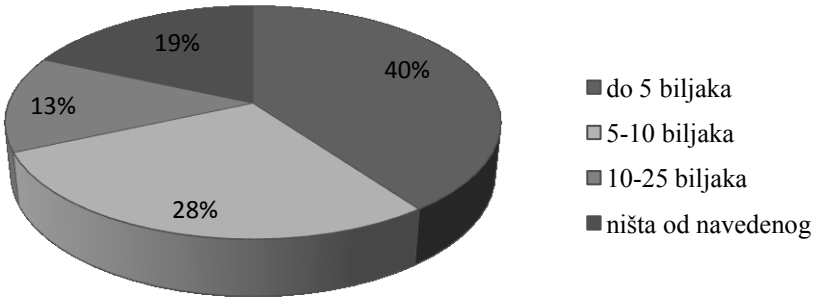
9. Da li posjedujete zatvoreni (ostakljeni) balkon u kojem uzgajate sobno bilje?



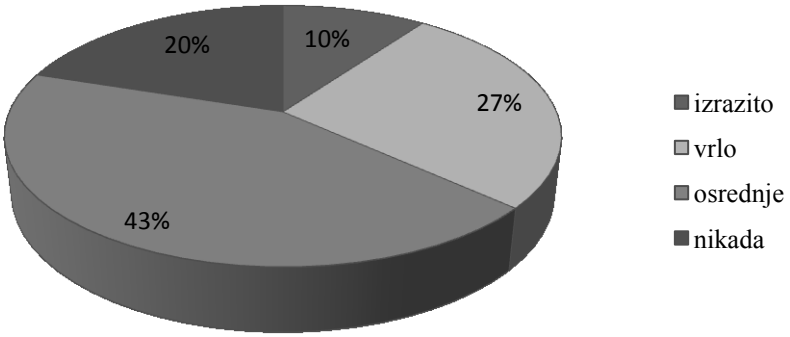
10. Koja je po vama najvažnija ukrasna karakteristika sobnog bilja?

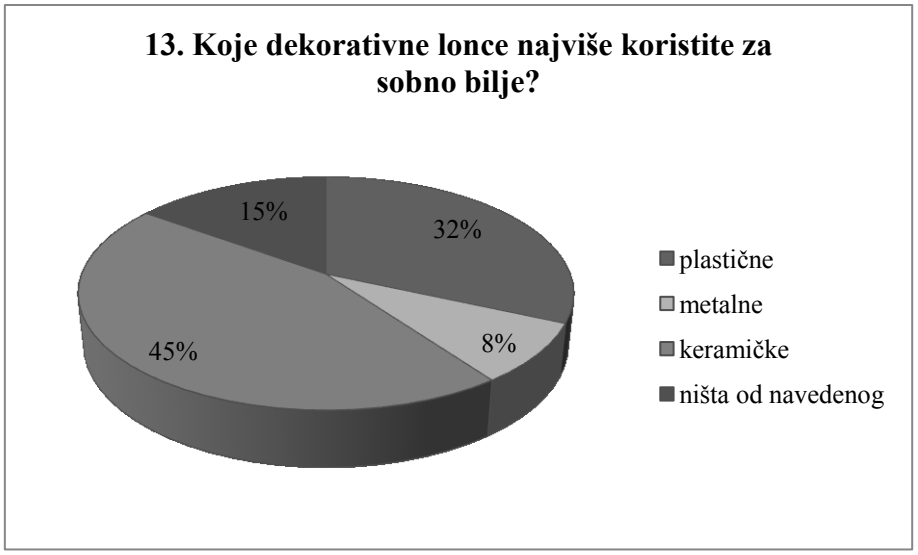


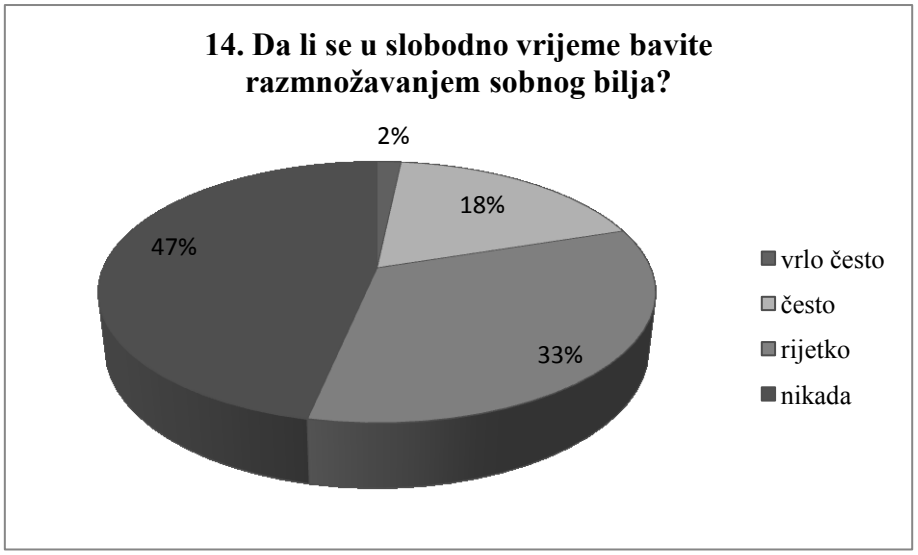
11. Koliko različitih ukrasnih vrsta (sobno bilje i ostale lončanice) uzgajate u vašem interijeru?

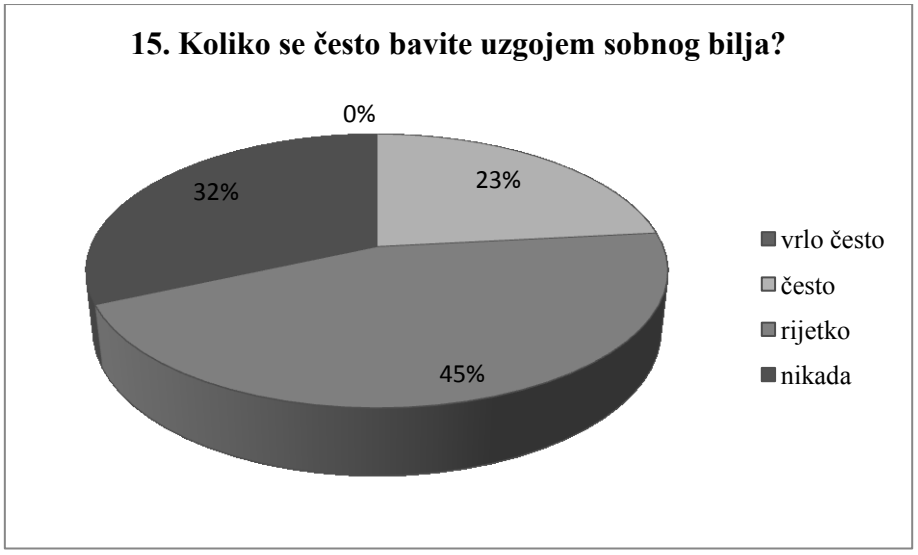


12. Da li se pridržavate ekoloških principa kod uzgoja i njege sobnog bilja?




13. Koje dekorativne lonce najviše koristite za sobno bilje?
15%
32%
8%
45%
plastične
metalne
keramičke
ništa od navedenog

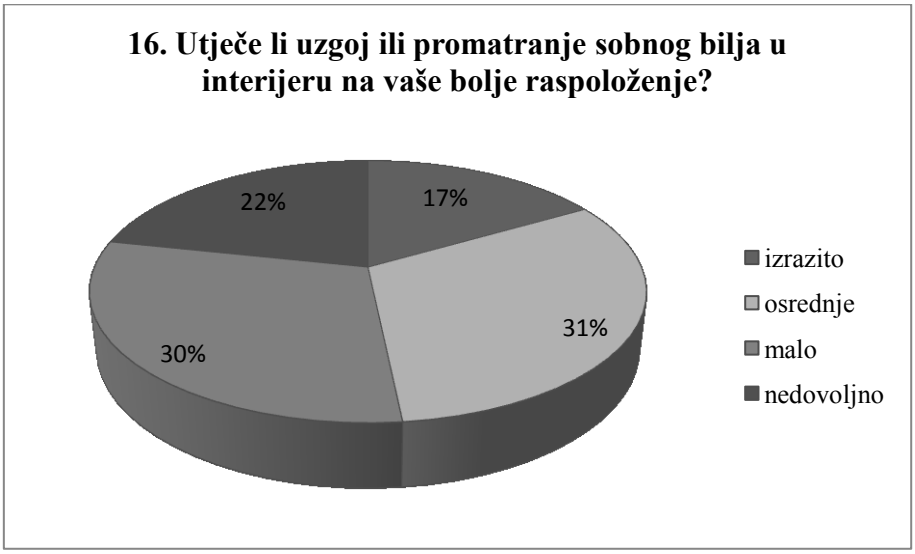

14. Da li se u slobodno vrijeme bavite razmnožavanjem sobnog bilja?
2%
18%
47%
33%
vrlo često
često
rijetko
nikada

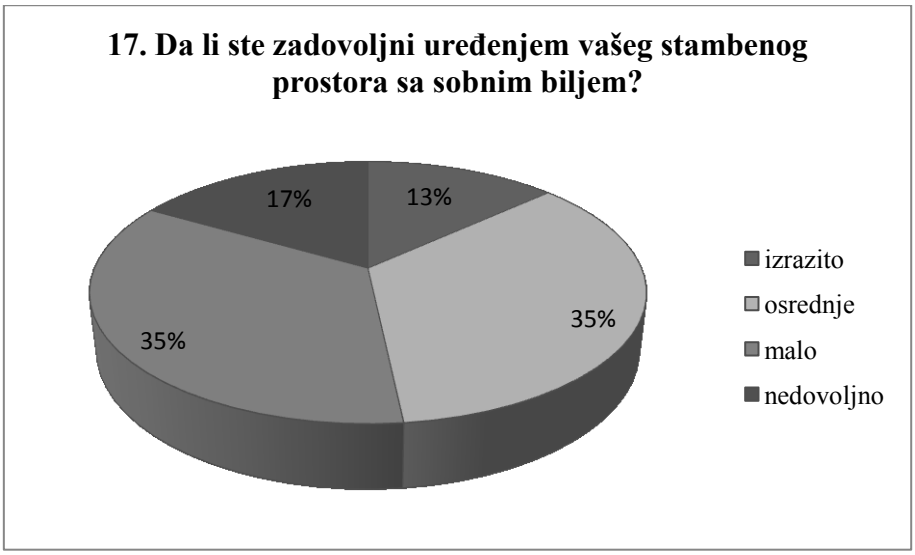

15. Koliko se često bavite uzgojem sobnog bilja?
0%
23%
32%
45%
vrlo često
često
rijetko
nikada

Iz slika 16. – 20. koje prikazuju stavove i mišljenja kninskih srednjoškolaca o primjeni i njezi sobnog bilja razvidno je da uzgoj ili promatranje sobnog bilja u interijeru tek osrednje (31,7 %) i malo (30,0 %) utječe na bolje raspoloženje ispitanika. Najveći broj ispitanika (35,0 %) je osrednje i malo zadovoljno s uređenjem stambenog prostora sa sobnim biljem. U pogledu mjera njege kod uzgoja najviše ih zanimaju zalijevanje i prihrana (46,7 %) i ostale mjere njege (23,3 %). Najveći broj sobnog bilja im se nalazi u dnevnoj sobi (66,7 %). Za uzgoj i njegu sobnog bilja su ih najviše zainteresirali roditelji i rodbina (55,0 %).

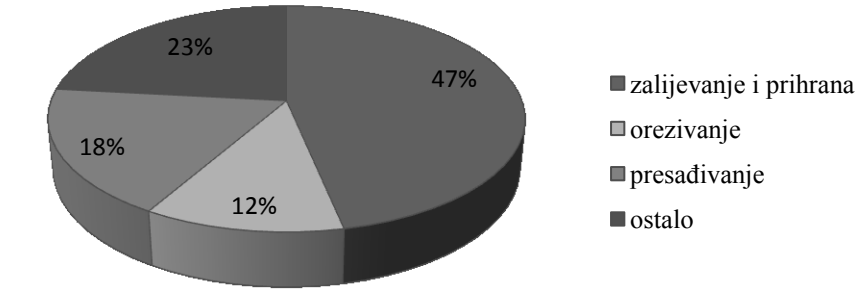
Slike 16. – 20. Istraživanje stavova i mišljenja kninskih srednjoškolaca o primjeni i njezi sobnog bilja (prema Zemunović, 2018)

Figures 16 – 20. *Attitudes and perceptions of the Knin-based secondary school pupils concerning the use and care species of indoor plants (according to Zemunović, 2018)*

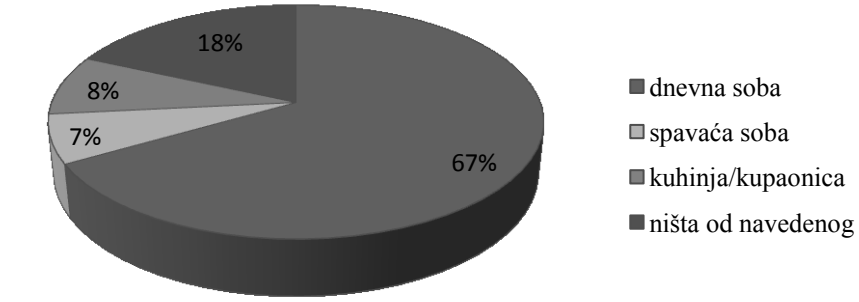




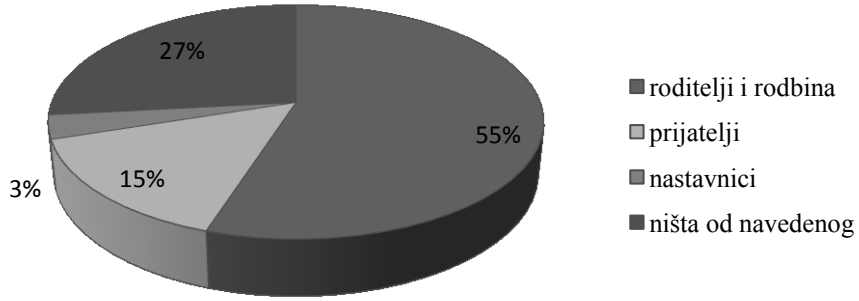
18. Koje mjere njege sobnog bilja vas najviše interesiraju kod uzgoja?



19. U kojoj prostoriji se najčešće nalazi najveći broj vašeg sobnog bilja?



20. Tko Vas je najviše zainteresirao za uzgoj i njegu sobnog bilja?



Zaključak

Temeljem anketnog istraživanja ustanovljeno je da ispitanici (učenici kninske srednje škole "Lovre Montija") najviše nabavljaju sobno bilje u vrtnim centrima i supermarketima u gradu Kninu. Za sobne interijere najviše preferiraju cvjetno dekorativne i cvjetno-lisne dekorativne vrste.

50 % ispitanika godišnje izdvoji do 100 kn godišnje za nabavu i njegu sobnog bilja što ne predstavlja značajan iznos, moglo bi se reći da je iznos vrlo mali.

Manji broj ispitanika se često bavi uzgojem lončanica aromatičnog bilja u interijeru. 40 % učenika je posjedovalo kaktuse i sukulente. Nešto više od polovine ispitanika (56,7 %) nije posjedovao zatvoreni (ostakljeni) balkon u kojem je uzgajao sobno bilje.

Ispitanici kao najvažniju ukrasnu karakteristiku kod sobnog bilja navode cvijet.

Najveći broj ispitanika uzgaja do pet biljaka i osrednje se pridržavaju ekoloških principa uzgoja i njege sobnog bilja. Gotovo nikada i rijetko se u slobodno vrijeme bave razmnožavanjem sobnog bilja. Mali broj ispitanika se bavi i uzgojem sobnog bilja.

Ustanovljeno je i da uzgoj ili promatranje sobnog bilja u interijeru tek osrednje i malo utječe na njihovo bolje raspoloženje. Najveći broj ispitanika je osrednje i malo zadovoljno s uređenjem stambenog prostora sa sobnim biljem. U pogledu mjera njege kod uzgoja ih najviše zanimaju zalijevanje i prihrana (46,7 %).

Najveći broj sobnog bilja ispitanici drže u dnevnoj sobi. Za uzgoj i njegu sobnog bilja su ih najviše zainteresirali roditelji i rodbina.

Zahvala

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Ljekovita i uzgojna saznanja o bademu i orahu

Medicinal and breeding knowledge of almond and walnut

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pregledni rad (scientific review)

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Sažetak

Iako je medicina napredovala, liječenje ljekovitim biljem i danas ima sve veću ulogu i značaj u životima ljudi. Proizvodnja lupinastog voća na malim ekstenzivnim voćnjacima i okućnicama dio je naše tradicije. U mediteranskom području uspješno se mogu uzgajati orah i badem. Orah i badem su izuzetno vrijedne ljekovite-biljke/voćke i mogu se koristiti na više načina. Prilikom izrade rada u svrhu primarnih podataka korišteno je anketno istraživanje koje je provedeno na području grada Knina, okolice i ostalih susjednih gradova. Za sekundarne podatke korištene su stručne i znanstvene publikacije i radovi. Cilj anketnog istraživanja bilo je istražiti percepcije i stavove ispitanika o ljekovitim i uzgojnim saznanjima o bademu i orahu. Anketno istraživanje je provedeno tijekom studenog 2018. godine. Rezultati su pokazali da više od polovine ispitanika ima saznanja o nekim uzgojnim i agro-ekološkim zahtjevima oraha. Ovisno o pitanju ispitanici uglavnom poznaju agro-ekološke zahtjeve badema. U većoj mjeri ispitanici poznaju i nutritivne vrijednosti ploda oraha i badema te njegovu ljekovitost. Dobiveni rezultati se mogu koristiti prilikom popularizacije uzgoja oraha i badema na dalmatinskom području ili Zagori kao i trendovima njihove uporabe u prehrani.

Ključne riječi: ljekovitost, uzgoj, saznanja, orah i badem.

Abstract

Although medicine has advanced, medicinal herbs still play an increasing role and importance in people's lives. Production of nuts in small extensive orchards and gardens is part of our tradition. Walnut and almond can be successfully grown in the Mediterranean area. Walnuts and almonds are extremely valuable medicinal plants / fruits and can be used in many ways. In compiling the paper,to obtain primary data, a survey was conducted that was carried out in the area of Knin, the surrounding area and other neighboring cities. For secondary data, professional and scientific publications and papers were used. The aim of the survey was to investigate respondents' perceptions and attitudes about the knowledge of using almond and walnut for the purposes of healing and breeding. The survey

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was conducted during November 2018. The results showed that more than half of the respondents had knowledge of some of the breeding and agro-ecological requirements of walnuts. Depending on the question, respondents generally know the agro-ecological requirements of almonds. To a greater extent, respondents are also aware of the nutritional value of walnut and almond fruit and its healing properties. The results obtained can be used to popularize the cultivation of walnuts and almonds in the Dalmatian area or the area of Zagora and as well as trends of their use in the diet.

Key words: medicinal, breeding, knowledge, walnut and almond.

Uvod

Ljekovito bilje ima dugu tradiciju upotrebe u prehrani i liječenju. Još od davnih vremena čovjek je u bilju otkrio, osim hranjivih i ljekovitih tvari, i aromatična, okrijepna te opojna sredstva koja su mu pomogla u rješavanju različitih tegoba. Premda je medicina napredovala, liječenje ljekovitim biljem danas ima sve veću ulogu i značaj u životima ljudi (Šolić, 2016).

Tradicija liječenja ljekovitim biljem sačuvala se kod mnogih naroda i danas. Različita znanja i iskustva su se prenosila generacijama s koljena na koljeno tako da danas postoje mnogi koji su zahvaljujući stečenom znanju svojih najbližih, postali uspješni korisnici i uzgajivači različitog ljekovitog bilja (Šolić, 2016).

U gore navedeno bilje spadaju i neke vrste uzgajanih voćaka. Proizvodnja različitog voća smatra se gospodarski prihvatljivom poljoprivrednom aktivnošću, posebice se to odnosi za područja u kojima je napuštanje poljoprivredne proizvodnje postalo intenzivno (Turk i Rozman, 2001). Proizvodnja voća na malim ekstenzivnim voćnjacima i okućnicama dio je naše tradicije. Intenzivno voćarstvo kod nas se javlja 60-ih godina 20. stoljeća. Na tadašnjim društvenim gospodarstvima podižu se suvremene plantaže voća. Takovo voćarstvo prouzrokovalo je postupno zapuštanje klasičnih voćnjaka i opadanje njihovog gospodarskog značenja. Danas veliki broj voćaka u modelu klasične (visoko stablašice) proizvodnje u principu izumire (Čmelik i sur., 2009).

U mediteranskom području i kod nas uspješno se mogu uzgajati (klasičnom sustavu) gotovo sve vrste kontinentalnih voćaka (jabuka, kruška, breskva, šljiva, trešnja, orah, jagodaste voćke, suptropske i južne voćke itd.) (Čmelik, 2010).

Među takvim biljem nalaze se orah i badem. Orah je izuzetno vrijedna ljekovita biljka, koju je moguće koristiti na više načina. Osim ploda, koriste se i ljuske ploda, kora, grane, listovi i deblo. Neki od pripravaka s orahom koji se mogu vrlo jednostavno pripraviti su: orasi u medu (za plodnost), mješavina oraha s medom i limunom protiv anemije, orahovo mlijeko protiv čira na želudcu, zeleni orasi (za štitnjaču), ruska tinktura protiv tumora, čaj od lišća (za čišćenje krvi) i dr. (Šoškić, 2006). U terapijskim dozama nisu uočene štetne nuspojave (Gelenčir i Gelenčir, 1991).

Orah je drvo visoko do 25 m, listovi su neparno perasti s 5-9 liski (Gelenčir i Gelenčir, 1991). Drvo mu je također cijenjeno. Plodovi oraha sadržavaju kvalitetne masnoće, bjelančevine, šećere, vitamine, B12, PP, C, E i dr., neke ugljikohidrate, mineralne i aromatske tvari (Miljković, 1991).

U Republici Hrvatskoj najviše orahovih stabala je samoniklog podrijetla. Ti orasi su dobro prilagođeni našim agroekološkim uvjetima, dok se sortni orasi odlikuju dobrim pomološkim svojstvima (Despetović, 2019). Kod nas je obični orah najviše raširen: *na brežuljkastim terenima Hrvatskog zagorja, oko Požege, Koprivnice, Bjelovara, Daruvara, Kutine, Siska, Jastrebarskog, Ozlja, u istočnoj Slavoniji oko Vukovara, Iloka i u Baranji, a u Dalmaciji oko Splita, Zadra i u Istri* (Littvay, 2011.). Uzgaja se kao visokostablašica. U pogledu izbora tla za plantažni i intenzivan uzgoj oraha treba odabrati duboka i propusna tla, slabo kisela, čija je pH vrijednost oko 6,5, premda orah tolerira i pH vrijednost oko 8 (Šoškić, 2007). Osjetljiv je na visoke ljetne i niske zimske temperature. Često nastrada od proljetnih mrazeva (Miljković, 1991). U posljednje vrijeme u nas u ekološkoj proizvodnji podignut je značajni broj višegodišnjih nasada među kojima se nalaze i nasadi oraha (Popović, 2018).

Na domaćem i inozemnom tržištu badem je u zadnjem desetljeću veoma tražen prehrambeni proizvod. Najviše se koristi kao sirovina u konditorskoj industriji, u proizvodnji čokolade, kolača, sladoleda, u farmaceutskoj industriji i kao svježe voće (Čagalj i Strikić). Badem se u velikoj mjeri uvozi. Stoga je ovu vrijednu kulturu potrebno ponovno uvesti u proizvodnju, radi zadovoljenja vlastitih potreba (Očić, 2017).

Od vitamina u bademu prevladavaju vitamini skupine E, B1, B2 i B6, nezasićene masne kiseline, visok sadržaj cisteina, arginina i glutaminske kiseline, šećeri (nereducirajući), polisaharidi, kalij, fosfor (Vrsaljko, 2002).

Badem također ima veliku primjenu u liječenju. Sjeme ili ulje u pučkoj medicini koristi se za liječenje različitih bolesti: raka mjehura, dojki, usta, slezene i maternice, astme, plućnih oboljenja, groznice, čira na dvanaestercu, kožnih erupcija, svrbeža, kašlja, srčanih anemija, grčeva itd. Od badema se proizvodi ulje, maslac i mlijeko i često se upotrebljava u kozmetici (https://www.centarzdravlja.hr/hrana-i-zdravlje/zdrava-prehrana/zasto-trebate-svaki-dan-jesti-badem/)

Badem se uzgaja na području Mediterana i u SAD-u. *Pored masline i vinove loze bajam je jedna od glavnih voćnih kultura u uzgoju u obalnom i otočnom prostoru Hrvatske*. *U uzgoju su zastupljene autohtone sorte* (Strikić i sur., 2018). Badem je voćna vrsta koja se tradicijski uzgaja i na širem Šibenskom području ali i južnije u Hercegovini (Dorbić i sur., 2012; Dorbić i sur., 2014; Hadžiabulić i sur., 2014). U novije vrijeme neki otporniji kultivari se sade i na kninskom području. Heliofitna je voćka, zahtjeva mnogo svjetla i topline u vrijeme dozrijevanja plodova. Cvjeta već u siječnju. Bademu odgovaraju duboko drenirana pjeskovito-ilovasta ili ilovasta tla, dobro opskrbljena humusom i mineralnim hranivima, koja imaju neutralnu-slabo kiselu ili slabo alkalnu reakciju (Miljković, 1991).

Bajam se u većini nasada uzgaja u uvjetima suhoga gospodarenja, bez navodnjavanja (Župić i Kožarić-Silov, 2017). Na bademima se javlja velik broj štetnika i bolesti no njihov intenzitet je veći ukoliko se radi o intenzivnijem uzgoju (Ciglar i Žužić, 1985; Maceljski i sur., Cvjetković, 2010)

Slika 1. Bademovo drvo u masliniku, Cipar (Foto: Anna Anichkova) (https://commons.wikimedia.org/wiki/File:Almond_tree_6241.jpg)

Figure 1. *Almond tree in an olive grove, Cyprus (Photo: Anna Anichkova) (https://commons.wikimedia.org/wiki/File:Almond_tree_6241.jpg)*

Slika 2. Orah (Foto: H. Zell) (https://commons.wikimedia.org/wiki/File:Juglans_regia_001.JPG)

Figure 2. *Walnut (Photo: H. Zell) (https://commons.wikimedia.org/wiki/File:Juglans_regia_001.JPG).*

Materijali i metode

Prilikom izrade rada kao izvor primarnih podataka korišteno je anketno istraživanje na području grada Knina, okolice i ostalih susjednih gradova. Za sekundarne podatke korištene su stručne i znanstvene publikacije i radovi. Cilj anketnog istraživanja bilo je istraživanje percepcija i stavova ispitanika o ljekovitim i uzgojnim saznanjima o bademu i orahu. Anketno istraživanje je provedeno tijekom studenog 2018. godine na uzorku od 40 ispitanika s područja grada Knina i okolice (15 muškarca i 25 žena). Starosna struktura uzorka bila je: do 20 godina (2), od 20 do 30 godina (21), od 30 do 40 godina (5), od 40 do 50 godina (7), od 50 do 60 godina (3) i više od 60 godina (2) ispitanika, a njihov izbor je bio slučajan. U pogledu stupnja obrazovanja struktura uzorka bila je sljedeća: NKV (1); srednja stručna sprema (26), viša stručna sprema (3), visoka stručna sprema (10) ispitanika. Obrađeni podatci izraženi su u postocima (%). Statistička obrada podataka je izvršena u programu SPSS 14 za Windows sučelje.

Rezultati

U dolje navedenim tablicama (1 i 2.) iz rezultata anketnog istraživanja daju se opća saznanja o bademu i orahu.

Tablica 1. Ispitivanje općih saznanja o orahu
Table 1*. Testing of the general knowledge of the walnut*

R. br	Pitanja	Odgovori	
		DA (%)	NE (%)
1.	Jeste li ste znali da orah potječe iz Male Azije i Dalekog Istoka?	40,00	60,00
2.	Jeste li ste znali da plodovi oraha snižavaju kolesterol, sprječavaju pojavu karcinoma, a dobri su za žile i mozak.	80,00	20,00
3.	Jeste li znali da su orasi bogati kalijem, magnezijem, fosforom, željezom, vitaminima B-kompleksa, vitaminom C?	72,50	27,50
4.	Jeste li znali da se čaj od listova oraha može primjenjivati kao sredstvo za čišćenje krvi?	27,50	72,50
5.	Jeste li znali da orah na submediteranu često strada od niskih temperatura?	62,50	37,50
6.	Jeste li znali da su najbolja tla za uzgoj oraha ona koja su duboka i plodna?	65,00	35,00
7.	Jeste li znali da se na submediteranu preporuča sadnja oraha u jesen?	57,50	42,50

Sukladno tablici 1. većina ispitanika (60 %) ne zna da orah potječe iz Male Azije i Dalekog Istoka. Veliki broj ispitanika (80 %) zna da plodovi oraha snižavaju kolesterol, sprječavaju pojavu karcinoma, a dobri su za žile i mozak. Više od dvije trećine ispitanih ima saznanja da su orasi bogati: kalijem, magnezijem, fosforom, željezom, vitaminima B-kompleksa i vitaminom C. Veći broj ispitanika (72,50 %) nije znalo da se čaj od listova oraha može primjenjivati kao sredstvo za čišćenje krvi. Nešto manje od dvije trećine ispitanih (62,50 %) znalo je da orah na submediteranu često strada od niskih temperatura i da su najbolja tla za uzgoj oraha ona koja su duboka i plodna. Malo više od polovine ispitanika je znalo da se na Submediteranu preporuča sadnja oraha u jesen.

Tablica 2. Ispitivanje općih saznanja o bademu
Table 2*. Testing of the general knowledge of the almond*

R. br	Pitanja	Odgovori	
		DA (%)	NE (%)
1.	Jeste li znali da su bademi dobar izvor vitamina E, kalcija, fosfora, željeza i magnezija?	77,50	22,50
2.	Jeste li znali da konzumacija badema ima anti oksidativni učinak za ljudski organizam?	80,00	20,00
3.	Jeste li znali da se od bademovih ljuski, suhih cvjetova i listova kuhanjem može dobiti ljekoviti napitak?	62,50	37,50
4.	Jeste li znali da konzumiranjem badema štitimo mozak od Alzheimerove bolesti?	45,00	55,00
5.	Jeste li znali da se badem isključivo uzgaja na području Mediterana i submediterana?	67,50	32,50
6.	Jeste li znali da su bademu za dozrijevanje plodova potrebne velike količine svjetlosti i topline?	77,50	22,50
7.	Jeste li znali da bademu najbolje odgovaraju pjeskovito-ilovasta tla?	42,50	57,50

Iz tablice 2. je vidljivo da veći broj ispitanika (77,50 %) ima saznanja da su bademi dobar izvor vitamina E, kalcija, fosfora, željeza i magnezija. (80 %) ispitanika je znalo da konzumacija badema ima anti oksidativni učinak za ljudski organizam. Nešto manje od dvije trećine ispitanih je znalo da se od bademovih ljuski, suhih cvjetova i listova kuhanjem može dobiti ljekoviti napitak. Polovina ispitanika nije znala da konzumiranjem badema štitimo mozak od Alzheimerove bolesti. Oko dvije trećine ispitanih je znalo da se badem isključivo uzgaja na području Mediterana i Submediterana. Veliki broj ispitanika (77,50 %) je znao da su bademu za dozrijevanje plodova potrebne velike količine svjetlosti i topline.

Više od polovine ispitanih nije znalo da bademu najbolje odgovaraju pjeskovito-ilovasta tla.

Zaključak

Tradicija liječenja ljekovitim biljem dio je tradicije mnogobrojnih naroda. Proizvodnja lupinastog voća (oraha i badema) na malim ekstenzivnim voćnjacima i okućnicama dio je hrvatske tradicije. U radu je metodom anketnog ispitivanja istraživana percepcija i stavovi ispitanika o ljekovitim i uzgojnim saznanjima oraha i badema. Više od polovine ispitanika s područja Knina, okolice i ostalih susjednih gradova ima saznanja o uzgojnim i agro-ekološkim zahtjevima oraha. U većoj mjeri ispitanici poznaju nutritivne vrijednosti ploda i njegovu ljekovitost. Uglavnom u većoj mjeri ispitanici poznaju nutritivne vrijednosti ploda badema i njegove ljekovite karakteristike. Ovisno o pitanju ispitanici uglavnom poznaju agro-ekološke zahtjeve badema. Dobiveni rezultati mogu biti iskorišteni kod popularizacije uzgoja oraha i badema na dalmatinskom području/zagori i trendovima uporabe u prehrani ljudi.

Zahvala

Rad je nastao u okviru izrade Referata: "Ljekovita i uzgojna saznanja o bademu i orahu" na Veleučilištu "Marko Marulić" u Kninu..

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Upute autorima

Stručno znanstveni časopis Futura objavljuje znanstvene i stručne radove iz biotehničkih znanosti (poljoprivrede, šumarstva, drvne tehnologije, prehrambene tehnologije, nutricionizma, biotehnologije i interdisciplinarne biotehničke znanosti) kao i društvene vijesti, bibliografije, zatim prikaze knjiga i radova, popularne znanstvene radove, polemike i dr. Objavljuju se samo radovi koji nisu drugdje predani za objavljivanje, niti objavljeni. Znanstveni radovi se kategoriziraju: – izvorni znanstveni rad (original scientific paper) – pregledni znanstveni rad (scientific review) – prethodno priopćenje (preliminary communication) – konferencijsko priopćenje (conference paper) – rad prethodno prezentiran na konferenciji. Radove recenziraju dva ili više znanstvenika iz odgovarajućeg područja. Rad ne smije imati više od 17 tipkanih stranica, veličina slova 11, font Times New Roman, prored 1,5, margine 2,5. Izuzetno, uz odobrenje uredništva, neki interdisciplinarni ili uredništvu interesantni radovi mogu sadržavati do 25 ili više tipkanih stranica. Rukopisi se predaju u elektroničkom obliku na hrvatskom ili engleskom jeziku (e-mail: urednistvo@gazette-future.eu).

Izvorni znanstveni rad treba sadržavati: puna imena i prezimena autora s nazivima institucija, adresom i e-poštom u bilješkama – font 10, naslov, sažetak, abstract, uvod, materijale i metode, rezultate istraživanja, diskusiju, zaključak i literaturu – font 12 podebljano za naslove. Radovi napisani na engleskom jeziku se predaju bez naslova na hrvatskom jeziku i hrvatskog sažetka.

Naslov rada treba biti što kraći, na hrvatskom i engleskom jeziku. Kategoriju rada predlažu autori, a potvrđuju recenzenti i glavni urednik.

Sažetak treba sadržati opći prikaz, metodologiju, rezultate istraživanja i zaključak. Rad je potrebno pisati u trećem licu s min. 3 do 5 ključnih riječi. Obim sažetka ne bi smio biti veći od 250 riječi. Abstract je prijevod sažetka s ključnim riječima.

Uvod treba sadržavati što je do sada istraživano i što se željelo postići danim istraživanjem. Materijale i metode istraživanja treba ukratko izložiti. U rezultatima i diskusiji (raspravi) potrebno je voditi računa da se ne ponavlja iznijeto. U zaključcima je potrebno izložiti samo ono što pruža kratku i jasnu predstavu istraživanja. Literaturu treba poredati prema abecednom redu autora i to: prezime i početno slovo imena autora ili Anonymous (nepoznat autor), godina izdanja u zagradama, naslov knjige ili članka, naziv časopisa te broj ili godište, kao i mjesto izdavanja i oznaku stranica od–do. Više od tri autora se u literaturi navodi kao npr. (Prezime et al., 2018). Fusnote u radu treba izbjegavati ili eventualno koristiti za neka pojašnjenja. Autori se u tekstu citiraju sukladno APA standardu npr. (Prezime, 2018); (Prezime1 i Prezime2, 2016); (Prezime et al., 2018) (više od dva autora). Citate prate navodnici ("n") i stranica preuzimanja citiranog teksta (Prezime, 2018, str. 44).

Tablice se numeriraju i navode iznad na hrvatskom i u kurzivu na engleskom jeziku.

Slike se numeriraju i navode ispod na hrvatskom i u kurzivu na engleskom jeziku.

Rezolucija slika (grafikon, fotografija, crtež, ilustracija, karta) treba iznositi najmanje 300 dpi.

Fotografija: Šibenik.

Autor: Boris Dorbić.