

BOOK OF PROCEEDINGS



*XIV International Scientific Agriculture Symposium
"Agrosym 2023"
Jahorina, October 05-08, 2023*



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**XIV International Scientific Agriculture Symposium
“AGROSYM 2023”**



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PREFACE

Dear colleagues,

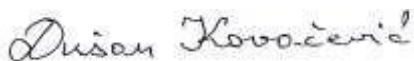
I am pleased to introduce the Book of Proceedings of the 14th International Scientific Agricultural Symposium “AGROSYM 2023”, which I hope you will find useful in your work. Almost 700 contributions have been accepted for the Book of Abstracts. The themes of AGROSYM 2023 cover all branches of agriculture and are divided into seven sessions: 1) Plant production, 2) Plant protection and food safety, 3) Organic agriculture, 4) Environmental protection and natural resources management, 5) Animal husbandry, 6) Rural development and agro-economy, and 7) Forestry and agroforestry.

Many scholars and practitioners argue that technology can increase production and feed more people while increasing supply stability and reducing the environmental impacts of agricultural production. Technology has been particularly important for improving production in annual crops such as maize, rice, soybean, wheat and cotton. Because trees have longer cycles, their breeding programs take longer. New plant breeding techniques can improve productivity, but there is a lively academic debate about their pros and cons.

While attention has been paid in the past mainly to the production side (cf. productivity, efficiency), more attention is nowadays paid to the consumption side as well as the intermediate stages (e.g. processing, distribution) of the food chain thus moving towards a ‘farm to fork’ approach. Globally, consumers are sending clearer signals about what they want on their tables i.e. higher quality as well as healthier, safer, and tastier products. Therefore, most agri-food companies have been exploring new, innovative ways to ensure more control over the production processes as well as final products quality and safety. Changes in investment strategy also have the potential to reduce the environmental and social costs of agriculture. It is now clear to most investors that companies paying more attention to sustainability and social responsibility, will have better returns on investments.

Agri-food systems have been central in the global debate on sustainable development and the achievement of the Sustainable Development Goals (SDGs) by 2030. Indeed, agri-food systems are at the center of various global challenges such as climate change, poverty, vulnerability, food insecurity, biodiversity loss, resource scarcity and ecosystem degradation. In this context, one of the goals of the sustainable agriculture movement is to develop farming systems that mitigate or eliminate environmental harms associated with industrial agriculture. It is also crucial to improve the resilience of food systems to crises, shocks and pandemics.

Many thanks to all the authors, reviewers and colleagues for their assistance in editing the Book of Abstracts. Special thanks go to all co-organizers and partners for their unselfish collaboration and comprehensive support.



East Sarajevo, 07 October 2023

Prof. Dušan Kovačević, PhD

Editor in Chief, President of the Scientific Committee of AGROSYM 2023

CONTENT

PLANT PRODUCTION	28
EFFECTS OF SOIL COVERAGE ON KIWIFRUIT (ACTINIDIA DELICIOSA CV. HAYWARD) PRODUCTION Peter A. ROUSSOS, Athanasios TSAFOUROS, Efstathios NTANOS, Nikoleta-Kleio DENAXA	29
EVALUATION OF THE TOLERANCE OF GRAPEVINE ROOTSTOCKS TO HIGH NACL SALT CONTENT IN THE SOIL, BASED ON THE CALCULATED VALUE OF THE TOLERANCE INDEX Fatbardha SHPATI	34
EFFECT OF THE COVID-19 PANDEMIC ON THE IMPORT AND EXPORT OF MINT (<i>MENTHA PIPERITA</i> L.) IN SERBIA Marija MARKOVIĆ, Milan UGRINOVIĆ	41
EFFECTS OF STRESS-ALLEVIATING PRODUCTS ON OLIVE PRODUCTIVITY AND OLIVE OIL QUALITY Peter A. ROUSSOS, Asimina-Georgia KARYDA, Vicky CHRISTOPOULOU	46
INFLUENCE OF BIOFERTILIZERS ON YIELD AND QUALITY OF LETTUCE GROWN IN THE OPEN FIELD Aleksandra GOVEDARICA-LUČIĆ, Dragana KNEŽEVIĆ, Dragica GAGOVIĆ, Milica GRUBAČIĆ, Milica STOJANOVIĆ.....	51
GROWTH PARAMETERS OF PEPPER TRANSPLANTS CULTIVATED BY THE FLOATING CONTAINERS TECHNOLOGY Elma SEFO, Zrinka KNEZOVIĆ, Lutvija KARIĆ	56
THE INFLUENCE OF VARIETY AND ENVIRONMENTAL CONDITIONS ON THE FORMATION OF PODS AND SEEDS AND YIELD OF FORAGE PEAS Igor ĐURĐIĆ, Vesna MILIĆ, Branka GOVEDARICA, Tanja JAKIŠIĆ, Nevena RISTIČEVIĆ, Jovana KOVAČEVIĆ, Slađana JANKOVIĆ	63
ORGANOLEPTIC, CHEMICAL AND MICROBIOLOGICAL PROPERTIES OF PEA SILAGE FROM THE JUGOVIĆ FARM Ivana BOŠKOVIĆ, Milan JUGOVIĆ, Tanja JAKIŠIĆ, Selena ČEVRIZ, Zoranka MALEŠEVIĆ	69
INFLUENCE OF CULTIVAR ON PHENOLOGICAL TRAITS, FRUIT CHARACTERISTICS AND YIELD OF PLUM Mirjana RADOVIC, Ivana MILETIC, Mirko KULINA, Dejan ZEJAK, Mihajlo LIZDEK	75
THE EFFECT OF SET SIZE AND PLANTING TIME ON THE ONION BULBS PRODUCTION Nikolina ĐEKIĆ, Milica BOSNIĆ, Vida TODOROVIĆ, Mirjana ŽABIĆ	82
THE INFLUENCE OF GENOTYPE AND AGRO-ECOLOGICAL CONDITIONS ON THE CONTENT OF STARCH IN TUBERS	

Branka GOVEDARICA, Vesna MILIC, Tanja JAKISIC, Selena CEVRIZ, Milan JUGOVIC	89
COMPARATIVE ANALYSIS OF GRAPE AND WINE QUALITY BETWEEN VRANAC AND CABERNET SAUVIGNON VARIETIES (<i>VITIS VINIFERA</i> L.)	
Tijana BANJANIN, Tatjana JOVANOVIĆ-CVETKOVIĆ, Zorica RANKOVIĆ-VASIĆ, Milenko BLESIC	94
ANALYSIS OF AGREEMENT OF RATERS DURING SENSORY ASSESSMENT OF WINES BABICA I CRLJENJAK KAŠTELANSKI	
Zrinka KNEZOVIĆ, Živko SKRAČIĆ, Danijela SKROZA, Mara BANOVIĆ	101
EFFECT OF THE COVID-19 PANDEMIC ON THE IMPORT AND EXPORT OF CHAMOMILE (<i>MATRICARIA CHAMOMILLA</i> L.) IN SERBIA	
Marija MARKOVIĆ, Milan UGRINOVIĆ	107
ARTA KIWIFRUIT: A CLONE OF HAYWARD WITH INTERESTING QUALITY CHARACTERISTICS	
Peter A. ROUSSOS, Anna KOSTA, Efthalia STATHI, Nikoleta-Kleio DENAXA, Athanasios TSAFOUROS, Efstathios NTANOS, Eleni TANI.....	112
COMPARATIVE EVALUATION OF SELECTION INDEXES FOR IDENTIFYING SUPERIOR WINTER BARLEY GENOTYPES	
Nikolay DYULGEROV, Boryana DYULGEROVA	118
THE IMPACT OF BIOSTIMULATOR ON WHEAT PROPERTIES: A CASE STUDY ON WELL-SUPPLIED SOIL IN THE 2021/2022 GROWING SEASON	
Dario ILJKIĆ, Marina MARINIĆ, Mirta RASTIJA, Ivana VARGA, Zvonko ZEKO, Josip STANIĆ, Luka DRENJANČEVIĆ	124
EFFECT OF DIFFERENT FERTILIZERS ON SEED GERMINATION AND DEVELOPMENT OF SEEDLINGS OF ANNUAL DAHLIA	
Marija MARKOVIĆ, Dragana SKOČAJIĆ, Danijela ĐUNISIJEVIĆ-BOJOVIĆ, Marija NEŠIĆ, Neda ORAŠANIN MILAKOVIĆ.....	130
EFFECT OF <i>AILANTHUS ALTISSIMA</i> ON PHOTOSYNTHETIC ACTIVITY, YIELD AND OLIVE OIL QUALITY CHARACTERISTICS UNDER TWO IRRIGATION REGIMES	
Asimina-Georgia KARYDA, Peter A. ROUSSOS	134
BIOSTIMULANTS EFFECT ON BALSAM CROP DURING ITS FIRST YEAR OF ESTABLISHMENT	
Athina TEGOU, Dimitrios BARTZIALIS, Ilias MICHALAKIS, Kyriakos D. GIANNOULIS, Nicholas G. DANALATOS, Eleni WOGIATZI.....	140
GROWTH AND FIBER YIELD OF HEMP UNDER DIFFERENT LEVELS OF IRRIGATION AND N-FERTILIZATION	
Ippolitos GINTSIODIS, Dimitrios BARTZIALIS, Andromachi ROUMELIOTI, Konstantina-Maria KOTSARINI, Natalia-Maria METAXA, Stylianos GIANNOULIS, Kyriakos D. GIANNOULIS, Nicholas G. DANALATOS.....	145
IRRIGATION AND FERTILIZATION EFFECT ON THE GROWTH OF A 2009 ESTABLISHED PERENNIAL CARDOON CROP	

Dimitrios BARTZIALIS, Ippolitos GINTSIODIS, Kyriakos D. GIANNOULIS, Nikolaos G. DANALATOS.....	150
EFFECT OF IRRIGATION AND FERTILIZATION ON GROWTH OF A BEYOND 10 YEARS OLD SWITCHGRASS CROP	
Kyriakos D. GIANNOULIS, Thalia BATRA, Dimitrios BARTZIALIS, Ippolitos GINTSIODIS, Nikolaos G. DANALATOS	157
OLIVE OIL QUALITY CHARACTERISTICS UNDER ORGANIC AND INTEGRATED MANAGEMENT IN MESSINIA COUNTY GREECE	
Peter A. ROUSSOS, Asimina-Georgia KARIDA, Vassilios KAIBALIS.....	165
INVOLVEMENT OF EXOGENOUS COMPOUNDS APPLICATION ON OLIVE CUTTINGS ADVENTITIOUS ROOT FORMATION	
Petros A. ROUSSOS, Nikoleta-Kleio DENAXA	172
GERMINATION OF SEEDS OF CALLISTEPHUS CHINENSIS, CELOSIA ARGENTEA AND ZINNIA ELEGANS AFTER TREATMENT WITH DIFFERENT FERTILIZERS	
Marija MARKOVIĆ, Dragana SKOČAJIĆ, Danijela ĐUNISIJEVIĆ-BOJOVIĆ, Marija NEŠIĆ, Neda ORAŠANIN MILAKOVIĆ.....	178
GRAPHIC ANALYSIS OF SEED YIELD AND AGRONOMIC TRAITS IN CHICKPEA	
Naser SABAGHNIA, Mohsen JANMOHAMMADI.....	182
OPTIMIZING GERMINATION OF NEGLECTED AND UNDERUTILIZED VOANDZOU (VIGNA SUBTERRANEA) SEEDS: A COMPARATIVE STUDY OF PRE-TREATMENT METHODS AND MORPHOTYPES	
Abdel Kader NAINO JIKA, Hamissou AMADOU MOUNKAILA, Abdourahamane AMADOU BOUBACAR , Mahaman Rabiou HACHIMOU SABO, Grace NELKAM KILABÉ DJIMADOUM, Alhassane Gousmane AHMED	187
CORRELATION, HERITABILITY AND PATH ANALYSIS OF GRAIN YIELD COMPONENTS IN SOME MAIZE GENOTYPES (<i>Zea Mays</i> L.)	
Aleksandar KOVAČEVIĆ, Jovan PAVLOV, Milan STEVANOVIĆ, Nenad DELIĆ, Marko MLADENOVIĆ, Sanja PERIĆ.....	195
THE INFLUENCE OF COVER CROPS AND MICROBIOLOGICAL FERTILIZER ON YIELD AND YIELD COMPONENTS OF SWEET MAIZE (<i>Zea Mays</i> L. <i>sacharata</i> Sturt)	
Zeljko DOLIJANOVIC, Biljana SEVIC, Milena SIMIC, Vesna DRAGICEVIC, Snezana DJORDJEVIC, Nenad DJURIC	203
EFFECT OF CALCIUM CHLORIDE AND DURATION OF STORAGE ON THE QUALITY OF THE APPLE CULTIVAR 'GLOSTER'	
Boris RILAK, Jelena TOMIĆ, Ivan GLIŠIĆ, Milan LUKIĆ, Žaklina KARAKLAJIĆ-STAJIĆ, Svetlana M. PAUNOVIĆ, Marijana PEŠAKOVIĆ	212
NEWLY CREATED ČAČAK'S SOUR CHERRY VARIETIES AS A RAW MATERIAL FOR SPIRIT PRODUCTION	
Branko POPOVIĆ, Sanja RADIČEVIĆ, Olga MITROVIĆ, Aleksandra KORICANAC, Ninoslav NIKIĆEVIĆ, Vele TEŠEVIĆ, Ivan UROŠEVIĆ	220

VARIABILITY OF SEED PROTEIN CONTENT AND SEDIMENTATION VOLUME IN WHEAT (*Triticum aestivum* L.)

Desimir KNEŽEVIĆ, Aleksandra Yu. NOVOSELSKAYA-DRAGOVICH, Alexander M. KUDRYAVTSEV, Mirela MATKOVIĆ STOJŠIN, Miodrag DIMITRIJEVIĆ, Sofija PETROVIĆ, Aleksandar PAUNOVIĆ, Danijela KONDIĆ, Veselinka ZEČEVIĆ 226

EVALUATION OF PEACH CULTIVARS OF EARLY AND MEDIUM-EARLY SEASON IN A HIGH DENSITY PLANTING

Dragan MILATOVIĆ, Đorđe BOŠKOV, Gordan ZEC, Aleksandar RADOVIĆ, Nemanja TEŠIĆ, Milana STOJANOSKI..... 234

NUTRITIONAL AND ECONOMIC BENEFITS OF TRITICALE CULTIVATION IN CURRENT GLOBAL CONDITIONS

Dragana LALEVIĆ, Milan BIBERDŽIĆ, Zoran S. ILIĆ, Lidija MILENKOVIĆ, Saša BARAĆ, Aleksandar VUKOVIĆ, Olivera ŠUŠA 240

PHENOTYPIC VARIABILITY AND SIMILARITY OF NUMBER OF SPIKELETS IN PRIMARY SPIKE IN WHEAT VARIETIES (*Triticum aestivum* L.)

Dušan UROŠEVIĆ, Desimir KNEŽEVIĆ, Mirela MATKOVIĆ STOJŠIN, Jelica ŽIVIĆ, Danica MIĆANOVIĆ, Adriana RADOSAVAC, Vesna KANDIĆ 247

THE EFFECTS OF EARLY AND LATE DEFOLIATION ON GRAPE YIELD AND GRAPE QUALITY OF PROKUPAC VARIETY

Dušica ĆIRKOVIĆ, Zoran BEŠLIĆ, Saša MATIJAŠEVIĆ, Bratislav ĆIRKOVIĆ, Dragana STANISAVLJEVIĆ, Zoran JOVANOVIĆ, Saša PETROVIĆ, Veroslava KOCIĆ 255

BIOLOGICAL PROPERTIES OF SWEET CHERRY CULTIVARS ON 'OBLAČINSKA' SOUR CHERRY ROOTSTOCK

Gordan ZEC, Dragan MILATOVIĆ, Ivana BAKIĆ, Đorđe BOŠKOV, Dejan ĐUROVIĆ, Boban ĐORĐEVIĆ, Milana STOJANOSKI..... 262

PREDICTING THE IMPACT OF CLIMATE CHANGE ON WATER AVAILABILITY FOR MAIZE CULTIVATION IN TOPLICA DISTRICT IN SERBIA

Dženita KOCA, Gordana MATOVIĆ, Enika GREGORIĆ, Vesna POČUČA, Mirjam VUJADINOVIĆ MANDIĆ 268

NUTRITIVE VALUE OF ITALIAN RYEGRASS-RED CLOVER MIXTURES DEPENDING ON THE SEEDING RATE IN THE MIXTURES

Jordan MARKOVIĆ, Tanja VASIĆ, Vladimir ZORNIĆ, Nedeljko RACIĆ, Filip BEKČIĆ, Marija STEPIĆ, Ivica KOSTIĆ 274

STATE OF EQUIPMENT WITH COMBINES IN AGRICULTURAL COOPERATIVE "AGROPROM"

Marija GAVRILOVIĆ, Miloš ZELIĆ, Biljana VELJKOVIĆ, Ranko KOPRIVICA 280

TRYPTOPHAN CONTENT INCREASE IN MAIZE INBRED LINES IMPROVED THROUGH MARKER ASSISTED BREEDING

Marija KOSTADINOVIĆ, Danijela RISTIĆ, Vesna PERIĆ, Dragana IGNJATOVIĆ-MIČIĆ, Jelena VANČETOVIĆ 287

INFLUENCE OF THE COVID-19 PANDEMIC ON THE IMPORT AND EXPORT OF CHRYSANTHEMUMS IN SERBIA

Marija MARKOVIĆ 294

CHARACTERISATION OF MUNG BEAN (*VIGNA RADIATA* L.) SEEDS USING FLUORESCENCE SPECTROSCOPY AND MULTIVARIATE ANALYSIS

Miloš PROKOPIJEVIĆ, Dragana BARTOLIĆ, Mira STANKOVIĆ, Ksenija RADOTIĆ 299

PROTEIN CONTENT IN SEED OF TRITICALE GROWN IN PURE CROP AND MIXTURE WITH PEAS

Milosav GRČAK, Dragan GRČAK, Desimir KNEŽEVIĆ, Radivoje JEVTIĆ, Vesna ŽUPANSKI, Dragan ŽIVANČEV, Vera RAJIČIĆ, Ivana JASNIĆ 304

EFFECTS OF IRRIGATION RATE AND PLANTING DENSITY ON MAIZE YIELD AND WATER USE EFFICIENCY IN THE TEMPERATE CLIMATE OF SERBIA

Miodrag TOLIMIR, Branka KRESOVIĆ, Željko KAITOVIĆ, Ljubomir ŽIVOTIĆ, Katarina GAJIĆ, Boško GAJIĆ 310

STRESS RESISTANCE INDICATORS AS THE TOOL FOR SELECTING DROUGHT-TOLERANT WHEAT GENOTYPES

Mirela MATKOVIĆ STOJŠIN, Veselinka ZEČEVIĆ, Dušan UROŠEVIĆ, Dragan BOŽOVIĆ, Jasmina BAČIĆ, Kamenko BRATKOVIĆ, Desimir KNEŽEVIĆ 318

ORGANIC FARMING: EXPLORING THE PROS AND CONS FOR SUSTAINABLE AGRICULTURE

Mirela TOMAŠ SIMIN, Marica PETROVIĆ, Bojana KOMAROMI 324

QUALITY OF OPERATION OF TECHNOLOGICAL-TECHNICAL SYSTEMS WITH DIFFERENT COMPRESSION CHAMBERS IN PREPARING ALFALFA HAY

Saša BARAĆ, Milan BIBERDŽIĆ, Aleksandar ĐIKIĆ, Dragana LALEVIĆ, Aleksandar VUKOVIĆ 333

EFFECT OF AZOTOBACTER SPP. ON INITIAL GROWTH OF GRASSES

Snežana ANĐELKOVIĆ, Dejan SOKOLOVIĆ, Zoran LUGIĆ, Goran JEVTIĆ, Jasmina RADOVIĆ, Jasmina MILENKOVIĆ, Snežana BABIĆ 340

GENETIC VARIABILITY AND HETEROSIS FOR MICRONUTRIENTS CONTENT IN MAIZE GENOTYPES

Snežana MLADENOVIĆ DRINIĆ, Danijela RISTIĆ, Milica NIKOLIĆ, Milomir FILIPOVIĆ, Željko KAITOVIĆ, Ana NIKOLIĆ, Violeta ANĐELKOVIĆ 346

PHYSICAL AND CHEMICAL CHARACTERISTICS OF SOUR CHERRY (*PRUNUS CERASUS* L.) CULTIVARS

Svetlana M. PAUNOVIĆ, Žaklina KARAKLAJIĆ-STAJIĆ, Jelena TOMIĆ, Boris RILAK 353

RESPONSE OF DIFFERENT WHEAT GENOTYPES TO DROUGHT IN SEMI-ARID CLIMATE CONDITIONS

Veselinka ZEČEVIĆ, Vojislav STOJŠIN, Desimir KNEŽEVIĆ, Mirela MATKOVIĆ STOJŠIN, Slađana SAVIĆ, Dušan UROŠEVIĆ, Danica MIĆANOVIĆ 359

EFFECTS OF THE USE OF DIFFERENT FERTILIZATION RATES AND MICROBIOLOGICAL PRODUCTS ON WHEAT YIELDS

Vojin CVIJANOVIĆ, Marija BAJAGIĆ, Mladen PETROVIĆ, Nenad ĐURIĆ, Igor ĐURĐIĆ, Miloš STANKOVIĆ 365

QUALITY CHARACTERIZATION OF BLACKBERRY FRUITS (*Rubus* subg. *Rubus Watson*) IN DIFFERENT MATURITY STAGES

Žaklina KARAKLAJIĆ-STAJIĆ, Jelena TOMIĆ, Marijana PEŠAKOVIĆ, Svetlana M. PAUNOVIĆ, Boris RILAK..... 371

THE EFFECT OF DIFFERENT MICROBIAL FERTILIZERS ON THE WEEDINESS OF SOYBEAN

Željko DOLIJANOVIĆ, Milena SIMIĆ, Snežana OLJAČA, Dobrivoj POŠTIĆ, Snežana ĐORĐEVIĆ, Srđan ŠEREMEŠIĆ 378

EVALUATING THE ROLE OF PHENOLIC COMPOUNDS IN OLIVE BUD DIFFERENTIATION

Peter A. ROUSSOS, Dimitrios ZARIFOPOULOS, Asimina-Georgia KARYDA..... 383

EVALUATION OF YIELD COMPONENTS OF LETTUCE (*Lactuca sativa* L.) GROWN IN NUTRIENT FILM TECHNIQUE

Dragan ŽNIDARČIĆ..... 390

A NEW PROMISING LATE MATURING CLEMENTINE MANDARIN 'MARTIATIKI'

Peter A. ROUSSOS, Nikoleta-Kleio DENAXA, Athanasios TSAFOUROS, Efstathios NTANOS 397

EFFECT OF DIFFERENT FERTILIZERS ON SEED GERMINATION AND EARLY SEEDLING DEVELOPMENT OF TAGETES PATULA L.

Marija MARKOVIĆ, Dragana SKOČAJIĆ, Danijela ĐUNISIJEVIĆ-BOJOVIĆ, Marija NEŠIĆ, Neda ORAŠANIN MILAKOVIĆ 403

COMPARED AGRICULTURAL MACHINE SIZE MEASUREMENT WITH A CAD AND AN IMAGE ANALYSIS SOFTWARE

Abdullah BEYAZ..... 408

THE ROLE OF ADDITIVE MANUFACTURING COMPOSITE SHEETS FOR MECHANICAL PROPERTIES IN AGRICULTURAL MACHINERY PRODUCTION

Abdullah BEYAZ, Metehan KAZANCI.....415

THE EFFICACY OF GLUTAMINE PRIMING ON GERMINATION AND SEEDLING DEVELOPMENT OF ROCKET IN SALT STRESS

Ayşe Gul NASIRCILAR Kamile ULUKAPI..... 423

PEAR BREEDING FOR THE FUTURE

Fatma Pınar ÖZTÜRK, Gökhan ÖZTÜRK, Emel KAÇAL, Dilek KARAMÜRSEL, Ayşegül SARISU, Melih AYDINLI, Ömer Faruk KARAMÜRSEL, İrfan NAZLI, Atakan GÜNEYLİ 430

CHARACTERIZATION OF HWM-GS AND EVALUATION OF QUALITY CHARACTERS IN ELITE SYNTHETIC WHEAT LINES

Ismet BAŞER, Feyza Tahan ÇAY, Damla Balaban GÖÇMEN, Alpay BALKAN, Oğuz BILGIN.....	436
THE EFFECT OF SOIL CONDITIONERS APPLIED TO SEED ON GRAIN YIELD AND YIELD TRAITS IN WHEAT	
Alpay BALKAN, Damla BALABAN GÖÇMEN, Oğuz BILGIN, İsmet BAŞER.....	444
GERMINATION AND EARLY SEEDLING DEVELOPMENT OF PURPLE CARROT TREATED WITH AMINO ACIDS	
Selin ŞİMŞEK, Oğulcan KARA, Ayse Gul NASIRCILAR, Kamile ULUKAPI.....	452
EFFECTS OF DIFFERENT ORGANIC MATERIALS ON PLANT WEIGHT AND DEHYDROGENASE ACTIVITY IN THE RHIZOSPHERE OF STRAWBERRY PLANTS	
Mohammed Gamal ABDELAZIZ ALI, Rıdvan KIZILKAYA.....	458
SEED PRIMING AGAINST TO DROUGHT STRESS	
Osman AYDENİZ, Sevinç BAŞAY.....	464
POSSIBILITY OF USING BANANA WASTE AS A SUBSTRATE FOR SUSTAINABLE AGRICULTURE UNDER SALT STRESS	
Ozlem SAHIN, Ayse Gul NASIRCILAR, Kamile ULUKAPI.....	470
INFLUENCE OF INTERCROPPING MAIZE WITH CLIMBING BEAN ON QUALITY AND YIELD OF FRESH FODDER	
Darko UHER, Zlatko SVEČNJAK, Martina KOVAČEVIĆ, Ivan HORVATIĆ.....	475
PhytoTester: PORTABLE INSTRUMENT FOR ASSESSMENT OF VITAL ACTIVITY OF THE VEGETABLE ORGANISMS	
Tamaz BICHIASHVILI, Shalva BICHIASHVILI.....	481
INFLUENCE OF MOWING HEIGHT AND PHENOLOGICAL STAGE OF MATURITY ON NUTRITIONAL VALUE OF ALFALFA HAY	
Aleksandar VUKOVIĆ, Dragana LALEVIĆ, Saša BARAĆ, Milan BIBERDŽIĆ, Rade STANISAVLJEVIĆ, Dragoslav ĐOKIĆ.....	487
IMPACT OF POLYETHYLENE MULCH AND LOW TUNNEL ON YIELD AND WATERMELON FRUIT CHARACTERISTICS	
Boris ADAMOVIĆ, Dušan PAROŠKI, Đorđe VOJNOVIĆ, Žarko ILIN.....	494
INDOOR SMART GARDEN: A NEW ERA IN PLANT PRODUCTION	
Branko MIHAILOVIĆ, Vesna POPOVIĆ, Katica RADOSAVLJEVIĆ.....	500
YIELDS OF NEW ONION CULTIVARS UNDER TWO SOWING METHODS	
Đorđe VOJNOVIĆ, Boris ADAMOVIĆ, Žarko ILIN.....	507
WEEDNESS AND FORAGE YIELD OF FIELD PEAS AND OATS MIXTURE CROP	
Vladeta STEVOVIĆ, Dalibor TOMIĆ, Miloš MARJANOVIĆ, Branka TRIFUNOVIĆ, Đorđe LAZAREVIĆ, Nenad PAVLOVIĆ, Milomirka MADIĆ.....	513
RESEARCH OF PHOSPHORUS (P) CONTENT IN AGRICULTURAL LAND	
Vladimir SABADOŠ, Danijela ŽUNIĆ.....	519

ANALYSIS OF PHYLOGENETIC VARIATION THE DOMINANT MICROORGANISMS GENUS OF <i>STENOTROPHOMONAS MALTOPHILIAREVEALED FROM MUSHROOM</i>	
Tetiana IVANOVA.....	528
PLOIDY STUDY OF FESTUCA TAXA IN CARPATHIAN BASIN	
Dániel BALOGH, Attila FÚRÉSZ, Károly PENKSZA, Antal SZÓKE, Csaba LANTOS	536
CONTROLLED-ENVIRONMENT VERTICAL FARMING IN ORNAMENTAL PLANT PRODUCTION AND APPLICATION OF A DECISION SUPPORT SYSTEM: THE EXAMPLE OF HYBRID AFRICAN VIOLET	
Hamid Asım ÇÖKREN, Baran KAYNAK, Bahadır ŞİN, Numan ÇELEBİ.....	542
PLANT PROTECTION AND FOOD SAFETY	549
<i>SCLEROTINIA MINOR</i> AS A NEW PATHOGEN OF LETTUCE IN SERBIA	
Milica MIHAJLOVIĆ, Maja ŽIVANOVIĆ, Jovana HRUSTIĆ, Brankica PEŠIĆ.....	550
INSECTICIDES FLONICAMID AND PYRIPROXYFEN IN THE CONTROL OF GREENHOUSE WHITEFLY IN TOMATOES	
Sanja LAZIĆ, Dragana ŠUNJKA, Slavica VUKOVIĆ, Jelena EĆIMOVIĆ, Dragana BOŠKOVIĆ, Aleksandra ŠUŠNJAR, Antonije ŽUNIĆ	556
INFLUENCE OF INSECTICIDES APPLICATION ON CHANNEL LENGTH IN STEM OF MAIZE PLANTS CAUSED BY FEEDING OF LARVAE OF EUROPEAN CORN BORER (<i>Ostrinia nubilalis</i> Hbn.)	
Dragan GRČAK , Milosav GRČAK , Snežana GOŠIĆ-DONDO, Željko D. POPOVIĆ, Vanja TATIĆ, Iva UZELAC, Danijela KONDIĆ, Desimir KNEŽEVIĆ	563
EFFECTS OF PLANTS ESSENTIAL OIL AND PLANT POWDER ON THE MORTALITY OF SITOPHILUS GRANARIUS L.	
Jana RAMMAL, Abdel KADER EL HAJJ.....	570
GLYPHOSATE RESIDUES IN GROUNDWATER IN SLOVAKIA	
Erika REMEŠICOVÁ, Lucia MIŠUROVÁ, Adriana KUŠNIER PALUGOVÁ, Suzana TREŠNJIĆ IVANOVIĆ	576
SUSTAINABILITY IN OLIVE OIL PACKAGING	
Turkan MUTLU KECELI	582
MICROBIOLOGICAL PURITY IN PRODUCTION, PROCESSING AND FOOD DISTRIBUTION	
Bojan GOLIC, Biljana PEĆANAC, Dragan KNEŽEVIĆ.....	586
VARIABILITY OF TWO-YEAR-OLD SEEDLINGS OF <i>GINKGO BILOBA</i> L. GROWN FROM SEED COLLECTED IN THE CITY AREA OF BELGRADE (SERBIA)	
Filip JOVANOVIĆ, Sonja BRAUNOVIĆ, Natalija MOMIROVIĆ, Ljubinko RAKONJAC, Ivana ŽIVANOVIĆ.....	594
OVERVIEW OF THE FACTORS THAT INFLUENCE FEED SAFETY AND QUALITY	

Aleksandra ANGELESKA, Radmila CRCEVA NIKOLOVSKA, Elizabeta DIMITRIESKA STOJKOVIK, Sandra MOJSOVA, Igor ESMEROV, Ljupco ANGELOVSKI	600
ANTIFUNGAL ACTIVITY OF RHIZOBIA AGAINST RED CLOVER PATHOGENS FROM GENUS FUSARIUM	
Filip BEKČIĆ, Nataša DUDUK, Zoran LUGIĆ, Jasmina RADOVIĆ, Snežana BABIĆ, Marija STEPIĆ, Snežana ANDJELKOVIĆ.....	607
ENTOMOFAUNA ON WHEAT AND BARLEY IN BIJELJINA AREA (BOSNIA AND HERZEGOVINA)	
Dejana STANIĆ, Slađan TRIŠIĆ	613
A SAMPLE PREPARATION METHODOLOGY USING DIFFERENT d-SPE SORBENT FOR AMITRAZ ANALYSIS IN HONEY	
Aleksandra TASIĆ, Ivan PAVLOVIĆ, Tanja BIJELIĆ.....	622
CONTROL OF <i>CYDIA POMONELLA</i> L. IN APPLE ORCHARDS USING A MIXTURE OF INSECTICIDES	
Slavica VUKOVIĆ, Dragana ŠUNJKA, Sanja LAZIĆ, Antonije ŽUNIĆ, Aleksandra ŠUŠNJAR, Miloš PETROVIĆ, Dragana BOŠKOVIĆ	630
SURVEY OF THE POSSIBLE PRESENCE OF <i>Xylella fastidiosa</i>, THE CAUSAL AGENT OF PIERCE'S DISEASE OF GRAPEVINE AND OTHER PLANT DISEASES IN REPUBLIC OF SRPSKA	
Vojislav TRKULJA, Gordana BABIĆ, Bojana VUKOVIĆ, Bojana ĆURKOVIĆ, Jovana PRIJIĆ, Bogdan NEDIĆ.....	635
DETERMINATION OF CONTENT AND COMPOSITION OF ESSENTIAL OIL OF <i>ORIGANUM VULGARE</i> L. FROM THE REGION OF HERZEGOVINA	
Zoranka MALEŠEVIĆ, Selena ČEVRIZ, Đorđe ILIĆ, Mirjana JOVOVIĆ, Dragana VUKOVIĆ, Aleksandra GOVEDARICA-LUČIĆ.....	642
ANTIFUNGAL ACTIVITY OF THREE CHEMOTYPES OF <i>SATUREJA MONTANA</i> ESSENTIAL OIL AGAINST <i>ALTERNARIA ALTERNATA</i>	
Sara MIKIĆ, Tatjana STEVIĆ, Snežana MRĐAN, Željana PRIJIĆ, Stefan GORDANIĆ, Vladimir FILIPOVIĆ, Ana DRAGUMILO, Tatjana MARKOVIĆ.....	648
THE IMPACT OF <i>BOTRYTIS CINEREA</i> ON INDIVIDUAL PHENOLIC COMPOUNDS IN CABERNET SAUVIGNON WINE	
Nikolina ŽIVKOVIĆ, Danka MITROVIĆ, Ivana PLAVŠIĆ JANJATOVIĆ, Aleksandar PETROVIĆ.....	653
THE SITE AND TEMPERATURE EFFECT ON <i>IN VITRO</i> POLLEN PERFORMANCE OF SOME CHERRY CULTIVARS	
Slavica ČOLIĆ, Vera RAKONJAC, Radosav CERKOVIĆ, Milena ĐORĐEVIĆ, Ivana GLIŠIĆ, Sanja RADIČEVIĆ.....	657
MELISSOPALYNOLOGICAL ANALYSIS OF HONEY SAMPLES FROM BOSNIA AND HERZEGOVINA	
Danijela PETROVIĆ, Helena BREKALO, Antonela MUSA, Sandra MEDIĆ	666

DIVERSITY OF SOIL-DWELLING INSECTS THAT ATTACK MAIZE AND SUNFLOWER CROPS FROM SOUTH AND SOUTHEASTERN ROMANIA Maria IAMANDEI, Andrei CHIRILOAIE-PALADE, Raluca GEORGESCU, Mădălina RĂDULEA, Ionuț-Cristian POPA	672
SUSTAINABILITY IN OLIVE LEAVES FOR FUNCTIONAL FOOD INGREDIENTS PRODUCTION Turkan MUTLU KECELI	678
FOOD SAFETY FOR OLIVE OIL Turkan MUTLU KECELI	682
COMBINING OF TWO PREDATOR, <i>ORIOUS LAEVIGATUS</i> (FIEBER) (HEMIPTERA: ANTHOCORIDAE) AND <i>SERANGIUM PARCESETOSUM</i> SICARD (COLEOPTERA: COCCINELLIDAE) IN PROTECTED EGGPLANT GROWING Mehmet KEÇEÇİ, Ali ÖZTOP	686
INVESTIGATION OF THE COMBINED HARMFUL EFFECTS OF CHLORPYRIPHOS AND CYPRODINIL ON PHEASANT EMBRYOS Rita SZABÓ, László MAJOR, József LEHEL, Bence BALÁZS, Nadhirah Binti SAIDON, Péter BUDAI	697
TROPHIC INTERACTIONS AND DYNAMICS OF <i>APHIS SPIRAECOLA</i> PATCH ON CITRUS TREES IN PROXIMATE PLOTS, MOSTAGANEM, ALGERIA Zine Eddine LABDAOUI, Abd El Basset BOUKHOUNA, Mohamed MAHMOUDI, Yamina GUENAOUI	704
FIRST FINDING IN EUROPE OF <i>COLLETOTRICHUM SCOVILLEI</i>, A NEW AGENT OF PEPPER ANTHRACNOSE AND ASSESSMENT OF POTENTIAL BACTERIAL BIOCONTROL AGENTS Bekri XHEMALI, Marina CORTIELLO, Gazmend GJINOVCI, Betim BRESILLA, Francesco MODICA, Emilio STEFANI, Davide GIOVANARDI	712
FUMONISIN LEVELS IN CORN AND CORN PRODUCTS IN SERBIA IN 2022 Anja VUKSAN, Danka MITROVIĆ, Marko JAUKOVIĆ	718
BASIC CHARACTERISTICS, APPLICATION AND SAFETY OF STEVIA REBAUDIANA BERTONI – A LOW-CALORIE NATURAL SWEETENER IN FOOD Višnja SIKIMIĆ, Slavica ČABRILO, Milica ALEKSIĆ, Jovanka POPOV – RALJIĆ	722
FIELD DIGITIZATION AND DECISION SUPPORT SYSTEM (DSS) IN PEACH CULTIVATION TO MANAGE THE MEDITERRANEAN FRUITFLY, <i>CERATITIS CAPITATA</i> IN TUNISIA Mohamed BRAHAM, Hassib BEN KHEDHER, Ahmed MOUSSA	730
ORGANIC AGRICULTURE.....	739
ANTIOXIDANT PROPERTIES OF BLACK CURRANT BERRIES (<i>Ribes nigrum</i> `Titania`) Ladislav VASILIŠIN, Goran VUČIĆ, Srdjan LJUBOJEVIĆ, Ana VELEMIR	740

ATTITUDES OF PRODUCERS' TOWARDS DISTRIBUTION CHANNELS OF ORGANIC PRODUCTS IN THE REPUBLIC OF CROATIA

Irena PUGELNIK 746

CO-CULTIVATION AS A PLANTING STRATEGY FOR QUALITATIVE AND QUANTITATIVE PLANT GROWTH AND ENVIRONMENTAL PROTECTION

Kristina Ilektra MAKNEA, Violeta Alexandra ION, Adrian ASANICA 752

ENVIRONMENT PROTECTION AND NATURAL RESOURCES MANAGEMENT 760

RELATIONSHIPS BETWEEN WILD FLORA, CROPS, APHIDS (HEMIPTERA, APHIDIDAE) AND THEIR NATURAL ENEMIES IN CITRUS ORCHARDS

Samir ALI-AROUS, Malika MEZIANE, Khaled DJELOUAH 761

SOIL WETNESS AND VEGETATION TYPES OF SEMBERIJA REGION (BOSNIA AND HERZEGOVINA) ACCORDING TO COPERNICUS DATABASE

Branislav DRAŠKOVIĆ Goran SRDIJA, Zoran SRDIJA 769

POLLINATION AND SEASONAL DYNAMICS OF ANEMOPHILIC FLORA IN THE AREA OF THE CITY OF MOSTAR IN BOSNIA AND HERZEGOVINA

Danijela PETROVIĆ, Toni GALIĆ, Mate BOBAN, Helena BREKALO 774

STATE OF VASCULAR FLORA IN THE ENVIRONMENT OF BORAČKO LAKE IN BOSNIA AND HERZEGOVINA AND SUSTAINABLE DEVELOPMENT

Emina ADEMOVIĆ, Ana KNEŽEVIĆ 780

ADVANCEMENTS IN ROBOTICS, SMART FARMING, AND COMPUTER VISION: REVOLUTIONIZING AGRICULTURE

Vesna RADOJČIĆ, Aleksandar Sandro CVETKOVIĆ 787

THE CALCULATION OF GHG EMISSIONS OF CULTIVATED CROPS AND USAGE OF THESE CROPS IN FEED MIXTURES IN ANIMAL NUTRITION

Pavel ČERMÁK, Eva WEISBAUEROVÁ, Martin DĚDINA, Petr JEVIČ, Tomáš LOŠÁK 795

IMPROVING LANDSCAPE RESILIENCE IN THE MEDITERRANEAN AGAINST CLIMATE CHANGE THREATS: THE "RESALLIANCE" PROJECT

Gavriil XANTHOPOULOS, Eduard MAURI, Eduard PLANA, Evangelia AVRAMIDOU 800

"ON EITHER SIDE OF THE ELECTRIC FENCE" (A BOTANICAL STUDY OF THE AUTUMNAL ASPECT OF THE DRAINED LAKE BED OF A DOMESTIC WATER BUFFALO PASTURE IN THE ZÁMOLYI BASIN)

Dániel BALOGH, Károly PENKSZA, Levente VISZLÓ, Gabriella KEMÉNY, Attila FÜRÉSZ 807

EFFECT OF DIFFERENT SHRUB SPECIES ON SOIL: SEED BANKS CHEMICAL AND BIOLOGICAL PROPERTIES

Reza ERFANZADEH, Shadi HAZHIR, Alireza MOHEBALI 813

THE COLLECTION OF *HOSTA* Tratt FROM "AL. CIUBOTARU" NATIONAL BOTANICAL GARDEN (INSTITUTE)

Irina SFECLA.....	820
REMOVAL OF THE WATER FROM FENAMIPHOS PESTICIDE IN THE SOIL USING MORINGA OLEIFERA	
Ashraf KABAR, Iman IBRAHIM, Zaainaldeen NASSAR, Nasser Abu GALWA, Fawzi KODIH	827
PURIFICATION OF WATER FROM CHLORPYRIFOS IN THE SOIL BY USING MORINGA OLEIFERA	
Ashraf KABAR , Iman IBRAHIM, Nasser Abu GHALWA, Fawzi KODIH.....	836
SEASONAL VARIATIONS OF FLOWERING OF <i>Amorpha fruticosa</i> L. AS AN INDICATOR OF GLOBAL WARMING IN BLUE-GREEN INFRASTRUCTURE	
Mirjana OCOKOLJIĆ, Đurđa PETROV, Dragan VUJIČIĆ, Nevenka GALEČIĆ.....	846
EFFECTS OF CLIMATE PARAMETERS ON BLACKTHORN IN AGROFORESTRY ECOTONES AS GREEN ROAD INFRASTRUCTURE ELEMENTS	
Mirjana OCOKOLJIĆ, Đurđa PETROV, Dragan VUJIČIĆ, Nevenka GALEČIĆ	853
PHYSICAL, CHEMICAL AND MICROBIOLOGICAL ANALYSIS OF DRINKING WATER ON THE TERRITORY OF PROKUPLJE (SERBIA)	
Svetlana BOGDANOVIĆ, Moma DENIĆ, Ivana ZLATKOVIĆ, Dobrila RANĐELOVIĆ, Dragana STANISAVLJEVIĆ.....	859
CHARACTERIZATION OF DIFFUSE PHOTOSYNTHETICALLY ACTIVE RADIATION IN BURGOS (SPAIN)	
Ana GARCIA-RODRIGUEZ, Sol. GARCIA-RODRIGUEZ, Elena GARRACHON-GOMEZ, Diego. GRANADOS-LOPEZ, Cristian TERRADOS-LOPEZ.....	864
CHARACTERIZATION OF ERYTHEMAL ULTRAVIOLET RADIATION IN BURGOS, SPAIN	
Sol GARCIA-RODRIGUEZ, Ana GARCIA-RODRIGUEZ, Elena GARRACHON-GOMEZ, Ignacio GARCIA, David GONZALEZ-PEÑA.....	869
INFLUENCE OF COVER CROPS ON SOIL BIOLOGICAL QUALITY	
Mário DUARTE, Elsa VALÉRIO, Rosa Santos COELHO, Maria GODINHO	876
STATUS OF RADIONUCLIDES IN THE SOILS FROM VOJVODINA PROVINCE, NORTHERN SERBIA	
Željko MIHALJEV, Milica ŽIVKOV BALOŠ, Sandra JAKŠIĆ, Marija MIHALJEV, Nenad POPOV.....	883
SHEEP FARMERS' PERCEPTION OF CLIMATE CHANGE: CASE OF KONYA PROVINCE, TÜRKİYE	
Cennet OĞUZ, Aykut ÖRS, Aysun YENER ÖĞÜR, Yusuf ÇELİK.....	888
RESEARCH ON RECREATIONAL VALUE OF FOREST PARKS BASED ON CHOICE EXPERIMENT METHOD: A CASE STUDY OF WUYI MOUNTAIN IN CHINA	
Yimeng ZHANG, Yuanyuan YI.....	894
PREDICTIVE CLASSIFICATION OF AQUACULTURE FISH MORTALITY USING DATA MINING CLASSIFIERS	

Dimitris C. GKIKAS, Marios C. GKIKAS, John A. THEODOROU	900
A MONTHLY STUDY OF INTERCEPTED PHOTOSYNTHETICALLY ACTIVE RADIATION (IPAR) FOR VINEYARDS IN CASTILLA Y LEÓN	
Elena GARRACHÓN-GÓMEZ , Ana GARCÍA-RODRÍGUEZ, Sol GARCÍA-RODRÍGUEZ, Manuel GARCÍA-FUENTE	908
ANIMAL HUSBANDRY	914
CHARACTERIZATION AND IDENTIFICATION OF POTENTIAL PROBIOTIC LACTIC ACID BACTERIA ISOLATED FROM EGYPTIAN TRADITIONAL FERMENTED DAIRY PRODUCTS	
Nesreen M. NASR, Walaa M. BAHNAS, Khaled A. ABBAS	915
HIPPOTHERAPY IN THE CONTEXT OF MODERN METHODS OF REHABILITATION	
Igor V. GONCHARENKO	926
EFFECT OF DIFFERENT STOCKING DENSITIES IN THE OUTDOOR AREA ON BROILER PERFORMANCE CHARACTERISTICS	
Omer EREN, Ali AYGUN, Dogan NARINC	931
COMPARISON OF THREE DIFFERENT LAYER GENOTYPES RAISED IN A FREE-RANGE SYSTEM FOR EGG QUALITY	
Ali AYGUN, Dogan NARINC, Hasan ARISOY	936
MICROBIOLOGICAL STATUS AND MOLD CONTENT IN MILK AND FEED MIXTURES WITH THE ADDITION OF ADDITIVES	
Aleksandra JEVTIĆ, Saša PEŠEV, Nikola STOLIĆ, Bratislav PEŠIĆ, Nebojša ZLATKOVIĆ	941
REFERENCE INTERVALS OF HEAVY METALS IN THE MUSCLE TISSUE OF CATTLE CONSIDERING PARATYPIC FACTORS	
Kirill NAROZHNYKH	948
STUDY ABOUT THE MODE OF IMPLEMENTATION OF THE BREEDING PROGRAM ON ABERDEEN ANGUS BREED IN ROMANIA	
Dragoş Florin MANEA, Vasile MACIUC	955
ASSESSMENT OF THE ECONOMIC VIABILITY OF SUCKLER COW BREEDING MODEL	
Luis SANTA MARIA	962
SENSORS DATA IN AUTOMATIC MILKING SYSTEM AND MASTITIS	
Katarina PANDŽIĆ, Zrinko MIKIĆ, Zdenko IVKIĆ, Drago BEŠLO, Pero MIJIĆ, Tina BOBIĆ	968
TOP-DOWN AND BOTTOM-UP REGULATIONS AT THE ALGERIAN COASTS (1°W – 8°E): MODELING OF COPEPODA - MEDUSOZOA RELATIONSHIPS	
Lilia MELLAK, Aldjia KHERCHOUCHE, Selman CHABANI, Aziz HAFFERSSAS ..	976
THE HUMAN ANIMAL RELATIONSHIP IN DAIRY FARMING	
Nassima BOUHROUM, Belmehel BENS AHLI	984
PERIPHERAL INDICATORS OF ACIDOSIS IN DAIRY COWS	

Nassima BOUHROUM, Belmehel BENSALHI	988
EVOLUTION OF BIOCHEMICAL PARAMETERS IN POST PARTUM COWS AFFECTED WITH BRUCELLA	
Nassima BOUHROUM, Belmehel BENSALHI, Abdellatif NIAR	993
INFLUENCE OF ULTRASONIC TREATMENT ON THE FERMENTATION OF GOAT'S MILK SUPPLEMENTED WITH MILK PROTEIN ISOLATES	
Tanja VUCIC, Snezana JOVANOVIC, Marija MILETIC GLISIC	999
TWO GENETIC VARIANTS IN <i>EBF1</i> GENE EFFECT ON LIVE WEIGHT IN SHEEP	
Varvara SHEVTSOVA, Lyubov GETMANTSEVA, Yuri KOLOSOV, Alexander USATOV	1006
<i>IN OVO</i> α-TOCOPHEROL MODIFIES SERUM LIPID PROFILE BY GENDER OF BROILER CHICKS AT 72TH-HOUR OF POST-HATCHING STAGE	
Elif BABACANOĞLU ÇAKIR, Mehmet Reşit KARAGEÇİLİ	1010
CURRENT SITUATION OF CATTLE HUSBANDRY AND BREEDING POSSIBILITIES IN BİNGÖL PROVINCE OF TÜRKİYE	
Turgut AYGÜN	1015
OCCUPATIONAL AND ZONOTIC DISEASES IN LIVESTOCK SECTOR	
Turgut AYGÜN	1021
USE OF SERUM LEVELS OF FSH AND LH AS INDIRECT SELECTION CRITERION IN GENETIC IMPROVEMENT OF REPRODUCTION IN SHEEP	
Turgut AYGÜN	1027
THE INFLUENCE OF THE NUTRITIONAL STATUS OF DAIRY COWS ON THEIR WELL-BEING	
Zrinko MIKIĆ , Katarina PANDŽIĆ, Zdenko IVKIĆ, Drago BEŠLO, Pero MIJIĆ, Tina BOBIĆ	1033
EVALUATION OF BIRTH WEIGHT BY BANDED MEASURE IN SELECTED BREEDING HERD OF SLOVAK SPOTTED BREED	
Jozef BUJKO, Juraj CANDRÁK, Peter STRAPÁK, Cyril HRNČÁR, Mariusz BOGUCKI, Dariusz KOKOSZYŃSKI	1039
TICK FAUNA OF SHEEP IN EAST SERBIA	
Ivan PAVLOVIĆ, Jovan BOJKOVSKI, Violeta CARAO PETROVIĆ, Milan P.PETROVIĆ, Aleksandra TASIĆ, Marija PAVLOVIĆ, Dragica VOJINOVIĆ	1045
PHENOTYPE EVALUATION OF GATACKO CATTLE FROM THE TERRITORY OF GACKO MUNICIPALITY IN BOSNIA AND HERZEGOVINA	
Jelena NIKITOVIC, Dusan ANDRIJASEVIC, Tatjana KRAJISNIK, Zoran MALETIC, Milan PUZIGACA	1051
THE EFFECT OF POTASSIUM HUMATE ON THE PRODUCTIVITY, HAEMATOLOGICAL AND BIOCHEMICAL BLOOD PARAMETERS OF DAIRY COWS	
Aiga NOLBERGA-TRŪPA, Aija MĀLNIECE, Aivars POĻAKOVŠ	1057
THE IMPACT OF BREEDING HONEYBEES IN DIFFERENT REGIONS OF	

SERBIA AND BOSNIA AND HERZEGOVINA ON THEIR MORPHOMETRIC PARAMETERS	
Aleksandar IGNJATOVIĆ, Nebojša NEDIĆ, Goran MIRJANIĆ, Predrag PERIŠIĆ, Goran JEVTIĆ.....	1065
POPULATION STRUCTURE OF THE ENDEMIC MAKAL DACE (SQUALIUS MICROLEPIS HECKEL, 1843) FROM THE MATICA RIVER	
Predrag IVANKOVIĆ, Leona PULJIĆ, Zrinka KNEZOVIĆ.....	1071
STATUS OF THE MIGRATORY BEEKEEPING IN LATVIA	
Aleksejs ZACEPINS, Valters BRUSBARDIS, Oļvija KOMASILOVA, Armands KVIESIS, Vitalijs KOMASILOVS.....	1076
ASSESSMENT OF THE MICROBIOLOGICAL STATUS OF DRINKING WATER ON ANIMAL FARMS	
Bojan GOLIC, Dragan KNEŽEVIĆ, Biljana PEĆANAC.....	1086
NUTRITIONAL VALUES OF DOMINANT FESTUCA SPECIES IN SANDY GRASSLANDS ALONG THE DANUBE BASED ON A SYSTEMATIC SAMPLING	
Attila FÜRÉSZ, László SIPOS, Ferenc PAJOR, Péter PENKSZA, Károly PENKSZA.....	1094
THE INFLUENCE OF AGE ON REPRODUCTIVE CHARACTERISTIC IN SIMMENTAL COWS	
Jelena NIKITOVIC, Tatjana KRAJISNIK, Stevan RAJIC.....	1102
THE INFLUENCE OF ALTITUDE ON THE QUALITY OF HONEY IN CENTRAL SERBIA	
Goran JEVTIĆ, Snežana BABIĆ, Snežana ANĐELKOVIĆ, Đorđe LAZAREVIĆ, Mirjana PETROVIĆ, Kazimir MATOVIĆ, Nebojša NEDIĆ.....	1109
EFFECTS OF BREEDER AGE ON EGG QUALITY TRAITS IN JAPANESE QUAILS	
Medine KAYA, Ali AYGÜN, Doğan NARİNÇ.....	1115
HOLSTEIN BREED LIVESTOCK IN GEORGIA	
Tamar QACHASHVILI, Amrosi CHKUASELI, Giorgi KHATIASHVILI, Jemal KHATIASHVILI.....	1120
AN OVERVIEW OF THE CURRENT STATE OF GRASSLANDS IN THE PODRINJE REGION AS A SOURCE OF HEALTHY ANIMAL FEED	
Mirjana PETROVIĆ, Vladimir ZORNIĆ, Jasmina RADOVIĆ, Nedeljko RACIĆ, Dejan SOKOLOVIĆ, Svetlana JERINIĆ, Zoran LUGIĆ.....	1127
IMPROVING POSSIBILITIES OF INDIGENOUS HAIR GOAT BREEDING IN BİNGÖL PROVINCE IN TÜRKIYE	
Emre ALARSLAN, Turgut AYGÜN.....	1132
BREEDING TECHNOLOGIES FOR HIGH LAMB CARCASS QUALITY	
Angela CIVIDINI.....	1139
RURAL DEVELOPMENT AND AGRO-ECONOMY.....	1145

DIVERSIFICATION OF AGRICULTURAL VALUE CHAINS AND RURAL DEVELOPMENT IN MALI: CASE OF KITA CERCLE

Innocent MUMARARUNGU, Bisetsa ERICKSON, Gisaro Ca- Madeberi Ya BITITI, Philippe BURNY 1146

THE ECONOMIC IMPORTANCE OF AGRICULTURE AND TOURISM FOR THE ECONOMIC DEVELOPMENT OF BOSNIA AND HERZEGOVINA

Adriana RADOSAVAC, Ružica ĐERVIDA, Gordana PETROVIĆ, Tatjana IVANOVIĆ, Desimir KNEŽEVIĆ 1154

AGRICROWDFUNDING AS AN INNOVATIVE AGRI-FINANCING MODEL

Zorica GOLJIĆ, Nedeljka ELEZ 1163

REGIONAL SOCIO-ECONOMIC IMBALANCES IN BULGARIA

Angel SAROV 1172

EFFECT OF THE TRANSITION TOWARDS CIRCULAR ECONOMY

Monika SABEVA 1180

YOUNG CONSUMERS AND ETHICAL MEAT CONSUMPTION

Martina SALOVA, Zbynek ULCAK 1186

VITALITY OF EDUCATION ORGANIZATIONS IN QALIUBIYA RURAL AREAS (CASE STUDY IN SHEBIN DISTRICT IN EGYPT)

Mazen MOHAMED BARAKAT 1193

APPLYING CATEGORICAL REGRESSION FOR EXPLORING VETERINARY STUDENTS' ATTITUDES TOWARDS CAREER PERSPECTIVES

Athanasios BATZIOS, Vagis SAMATHRAKIS, Alexandros THEODORIDIS, Georgia KOUTOUZIDOU, Alexandros KAKOURIS 1200

A SOCIAL NETWORK ANALYSIS ON THE COLLABORATIVE CONSERVATION OF RANGELANDS IN LOCAL COMMUNITIES OF IRAN

Fatemeh BORNA, Iman ISLAMI, Hossein AZADI 1207

MODELING THE TIME SERIES OF RASPBERRY YIELDS IN THE REPUBLIC OF SERBIA USING THE ARIMA MODEL

Angelina PETKOVIĆ, Sveltana JANKOVIĆ-ŠOJA 1213

IMPORTANT PARTNERS OF SERBIA IN THE FOREIGN TRADE EXCHANGE OF FOOD

Biljana VELJKOVIĆ, Ranko KOPRIVICA, Marija GAVRILOVIĆ, Milun D. PETROVIĆ, Simeon RAKONJAC 1218

FORECAST OF AND TRENDS IN THE SERBIAN RASPBERRY PRODUCTION

Mirjana LUKAČ BULATOVIĆ, Katarina ĐURIĆ 1225

THE INFLUENCE OF CORN AND FATTENING PIGS PRICE FROM CURRENT YEAR ON THE NUMBER OF FATTENING PIGS IN FOLLOWING YEAR

Nebojša NOVKOVIĆ, Ljiljana DRINIĆ, Nataša VUKELIĆ, Veljko ŠARAC 1232

DISTRIBUTION AND EFFICIENCY OF ECONOMIC SUBSIDIES FOR SOIL CONSERVATION ALONG TWO DECADES IN SPAIN

Mistral VAN OUDENHOVE, Pedro PÉREZ CUTILLAS, Carolina BOIX FAYOS 1238

GREEN BONDS AS A FINANCIAL TOOL TO SUPPORT AGRICULTURAL SECTOR – OPPORTUNITIES AND CHALLENGES Zorica GOLIC, Saša LALIC	1245
EXPANSION AND DECLINE OF NATURAL RUBBER EXPORTATIONS IN THE BRAZILIAN AMAZON REGION José de Jesus Sousa LEMOS	1255
THE INFLUENCE OF INTERNATIONAL MARKETS ON BARLEY PRICES IN THE REPUBLIC OF NORTH MACEDONIA Lazo DIMITROV, Marija GJOSHEVA KOVACHEVIKJ, Despina POPOVSKA STOJANOV, Sreten ANDONOV, Sasho KJOSEV, Bodan ANDONOV	1265
THE LAND CONSOLIDATION INFLUENCE ON DEMOGRAPHY: CASE STUDY ON VOJVODINA IN SERBIA Goran MARINKOVIĆ, Žarko NESTOROVIĆ, Zoran ILIĆ, Marko BOŽIĆ.....	1272
FORESTRY AND AGRO-FORESTRY	1277
STRUCTURAL AND FUNCTIONAL RESPONSES OF <i>ALNUS GLUTINOSA</i> [L.] GAERTN. TREES ON DIFFERENT SITE TYPES IN CENTRAL BOSNIA Mirsada STARČEVIĆ, Azra ČABARAVDIĆ	1278
SEASONAL CHANGES OF FUNCTIONAL RESPONSES ON <i>ALNUS GLUTINOSA</i> (L.) GAERTN. SITES Mirsada STARČEVIĆ, Azra ČABARAVDIĆ	1285
POSSIBILITIES AND DIFFICULTIES OF MEASURING CARBON SEQUESTRATION IN AGROFORESTRY SYSTEMS IN HUNGARY Orsolya SZABÓ, Tamás MOLNÁR, Éva Ilona KIRÁLY, Attila BOROVIKS, Zsolt KESERŰ.....	1292
MACHINE LEARNING METHODS FOR LAND COVER AND TREE SPECIES CLASSIFICATION USING GOOGLE EARTH ENGINE Tamás MOLNÁR, Géza KIRÁLY	1299
TAXONOMY AND PHYTOGEOGRAPHY ANALYSIS OF MEDICINAL PLANTS AT THE AREA OF NATURE MONUMENT "ŠUMA KOŠUTNJAK" Dušan JOKANOVIĆ, Vesna NIKOLIĆ JOKANOVIĆ, Kristina ŽIVANOVIĆ, Ivan DESIMIROVIĆ, Jovana DEVETAKOVIĆ, Marina NONIĆ	1305
PREVIEW OF MEDICINAL PLANTS WITHIN LOWLAND PEDUNCULATE OAK FORESTS AND THEIR USEFUL PROPERTIES Dušan JOKANOVIĆ, Vesna NIKOLIĆ JOKANOVIĆ, Kristina ŽIVANOVIĆ, Ivan DESIMIROVIĆ, Radoslav LOZJANIN, Tihomir ŠOŠKIĆ.....	1311
SEASONAL DYNAMICS OF INSECT COMMUNITIES AND THREE MAJOR PESTS IN FRUŠKA GORA NATIONAL PARK (SERBIA) Dušanka VUJANOVIĆ, Jelena JOVIĆ, Maja AROK, Marija MILIČIĆ, Andrijana ANDRIĆ.....	1317
FLORISTIC AND ECOLOGICAL ANALYSIS OF BLACK PINE FORESTS (<i>Pinus nigra</i> Arn.) ON WESTERN BALKAN SERPENTINITES	

Marijana NOVAKOVIĆ-VUKOVIĆ	1324
SYSTEM MONITORING OF THE CROWN CONDITION ON ICP FORESTS SAMPLE PLOTS LEVEL I IN SERBIA WITH A SPECIAL VIEW OF BIOTIC DAMAGE ON PLOTS WITH OAK AS THE EDIFIER	
Miroslava MARKOVIĆ, Renata GAGIĆ-SERDAR, Goran ČEŠLJAR, Snežana STAJIĆ, Natalija MOMIROVIĆ	1333
EDAPHIC CHARACTERISTICS OF THE PARK IN THE ŠARENGRAD AREA IN NOVI SAD IN SERBIA	
Saša PEKEČ, Miroslav MARKOVIĆ , Predrag PAP, Saša KOSTIĆ, Marina MILOVIĆ, Andrej PILIPOVIĆ, Milutin ĐILAS	1339
DEMOGRAPHIC OF EMPLOYEES IN PUBLIC FOREST ENTERPRISES AS FACTOR FOR IMPROVEMENT OF FOREST PRODUCT AND SERVICES	
Zoran PODUŠKA, Snežana STAJIĆ, Branka PAVLOVIĆ, Vlado ČOKEŠA	1344
CHARACTERISTICS OF LOWER NON-AGRICULTURAL SOILS IN THE NORTH BANAT REGION, MUNICIPALITY OF KIKINDA AND POSSIBILITIES FOR THEIR AFFORESTATION	
Miodrag RADOVANOVIĆ, Zoran GALIĆ, Velisav KARAKLIĆ, Milutin ĐILAS	1351
BACTERIAL TREATMENT IMPACT ON ONE-YEAR-OLD SESSILE OAK (<i>QUERCUS PETRAEA</i> (MATT.) LIEBL) SEEDLINGS OF THREE SERBIAN PROVENANCES	
Sanja JOVANOVIĆ, Vladan POPOVIĆ, Aleksandar LUČIĆ, Ljubinko RAKONJAC	1357
AWARENESS AND ADOPTION OF SCIENTIFIC AGRICULTURAL PRACTICES IN AGROFORESTRY HOME GARDENS WITH SPECIAL REFERENCE TO WELIGAMA, SRI LANKA	
Malghaha Gamage Dilshani ABEYSINGHE, Ganganee Chandima SAMARAWEERA, Mangala DE ZOYSA.....	1362
AUTHOR INDEX.....	1372

TAXONOMY AND PHYTOGEOGRAPHY ANALYSIS OF MEDICINAL PLANTS AT THE AREA OF NATURE MONUMENT “ŠUMA KOŠUTNJAK”

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Abstract

The study was carried out during two consecutive growing seasons (2020-2021) with the aim to record medicinal plants at the area of protected nature monument “Šuma Košutnjak”. Based on field research, together with numerous references, there was established presence of total of 147 medicinal plants at the whole researched locality. After the plants were determined, taxonomy and phytogeography analyses of collected material were performed. As for taxonomy, the most distributed families are *Rosaceae* (10.88 %) and *Lamiaceae* (9.52 %), while *Fabaceae* (5.44%) and *Asteraceae* (5.44%) are a bit less present. In the phytogeography analysis participation of different life forms and floral elements was determined. Among life forms the most common are hemicryptophytes (40.14%), then phanerophytes (24.49%) and therophytes (11.56%). The most dominant floral elements are Eurasian (20.41%), submediterranean (17.69%), mideuropean (12.24%) and submediterranean (11.56%). It should be noted that some species, according to destructive human effect, are very endangered due to low rate of their natural regeneration. Therefore it is needed to conduct protective measures in order to conserve gene pool of these species. If we want to obtain reliable information about the number and presence of medicinal plants at this area, it is necessary to perform detailed monitoring which would include several consecutive growing seasons.

Key words: NM “Šuma Košutnjak”, medicinal plants, taxonomy, phytogeography.

Introduction

The nature monument “Šuma Košutnjak” was declared (Decision on the declaration of the protected area Šuma Košutnjak, decision number 501-2419/14-C-20) as protected due to the significant spatial functions and bioecological value of the complex under the forest vegetation, as well as to preserve the habitat of numerous representatives of mammals, birds, insects and amphibians. This protected area is classified into the third category and two protection regimes have been established within it: the second level protection regime on part of the protected area which includes the pedunculate oak and hornbeam forests near Hajdučka česma with an area of 3.48 ha (1.31%) and the third level protection regime on the remaining part of the protected locality on an area of about 262 ha (98.69%).

Medicinal plants play a crucial role in nutrition and treatment, and the essential oils derived from certain medicinal species are widely utilized in the cosmetic industry (Kišgeci & Adamović, 1994; Tucakov, 2014; Vilotić, 2018; Vilotić, 2021). In terms of the wealth of biodiversity, Serbia is a country that has enormous potential in terms of the number of representatives of flora and fauna, and also applies the international standards contained in the IUCN categorization of protected areas in order to further protect and preserve certain areas (Šijačić-Nikolić & Milovanović, 2010). Floristic research conducted in the area of “Košutnjak Forest” (Šarčević-Todosijević et al., 2018) found out numerous representatives

from the *Rosaceae*, *Lamiaceae* and *Asteraceae* families that have pronounced medicinal properties. Some earlier research (Ilić et al., 1972) emphasizes the great influence of the anthropogenic factor in this area, which caused a certain succession of vegetation. The above mentioned authors established the presence of a relict shrub species – *Ruscus aculeatus* L., which once grew on the coast of the Pannonian Sea and survived the glacial epoch.

The scope of the paper is, based on taxonomy and phytogeography analysis of the protected area “Šuma Košutnjak”, to investigate which families have the most representatives, and to establish the most distributed life forms and floral elements, as well. In addition to this, one of the goals of the research is to draw attention to the state of the gene pool of certain medicinal taxa that are threatened to some extent by anthropogenic influence, as well as to implement adequate conservation measures for their protection.

Material and methods

Floristic research at the whole area of NM “Šuma Košutnjak” was carried out during two consecutive growing seasons (2020-2021). Medicinal plants were determined based on numerous references (Kojić & Vilotić, 2006; Igić et al., 2010; Tucakov, 2014; Vilotić, 2018; Vilotić, 2021; Jokanović, 2021). As for endangered species, they were recorded due to low rate of its' natural regeneration and fragmentary presence just in some parts of the studied area. Life forms classification was conducted due to Raunkier system (1934) which was extended by Mueller-Dombois et. Ellenberg (1974), while Stevanović (1992) did it for taxa in Serbia. Floral elements were determined based on overview of flora species from Serbia with plant-geographic characteristics (Gajić, 1980). Taxonomy features were identified based on many references related to medicinal plants in Serbia (Sarić, 1989; Randelović et al., 2002; Tucakov, 2014; Vilotić, 2018).

Results and discussion

An overall monitoring was conducted in the entire area of NM “Šuma Kosutnjak”, which established the presence of 147 medicinal plants (Table 1). The analysis of proportion of some families by medicinal plants at Kukavica mountain in southeastern Serbia (Jovanović, 2016) showed domination of *Lamiaceae*, *Asteraceae* and *Rosaceae* families which coincides a lot to our results. Great similarity was found by conducted phytogeography analysis (Jovanović, 2016), as well – the most distributed life form at Kukavica mountain are hemicryptophytes, phanerophytes and therophytes, while among floral elements the greatest proportion was recorded by Eurasian elements which is the same as in our research. Došić (2016) monitored medicinal plants at Besna Kobila mountain and there is complete similarity with our results in terms of the most distributed families and life forms, however, unlike the area of NM “Šuma Košutnjak”, where Eurasian floral element is the most dominant, it is mideuropean floral element on Besna Kobila. Jokanović et al. (2022) investigated medicinal plants at the area of Gornji Srem in the belt of lowland pedunculate oak forests and established that hemicryptophytes are the most represented as life form, while the most numerous floral element is Eurasian, which is completely the same as in our research. As for taxonomy analysis of medicinal plants in the area of Gornji Srem (Jokanović et al., 2022), apart from 4 families which are the most distributed as in our paper, as well (*Fabaceae*, *Rosaceae*, *Lamiaceae* and *Asteraceae*), there is another family (*Poaceae*) with almost 10% proportion.

Table 1: Display of taxonomy and phytogeography plant characteristics (P - phanerophytes; H - hemicryptophytes; G - geophytes; T/H - therophytes/hamephytes; Ch - hamephytes; T - therophytes; S - scandetophytes; H/T - hamephytes/therophytes; DC - woody hamephytes)

Latin name	Family	Life form	Floral element
<i>Acer platanoides</i> L.	Aceraceae	P	Mideuropean
<i>Achillea millefolium</i> L.	Asteraceae	H	Eurasian
<i>Aesculus hippocastanum</i> L.	Sapindaceae	P	Mediterranean-submediterranean
<i>Agrimonia eupatoria</i> L.	Rosaceae	H	Eurasian
<i>Agropyrum repens</i> (L.) Beauv.	Poaceae	G	Cosmopolit
<i>Ajuga reptans</i> L.	Lamiaceae	H	Submideuropean
<i>Allium scorodoprasum</i> L.	Alliaceae	G	Mideuropean
<i>Allium ursinum</i> L.	Alliaceae	G	Boreal
<i>Anemone ranunculoides</i> (L.) Holub	Ranunculaceae	G	Submideuropean
<i>Arctium lappa</i> L.	Asteraceae	T/H	Eurasian
<i>Artemisia vulgaris</i> L.	Asteraceae	H	Circumpolar
<i>Asarum europaeum</i> L.	Aristolochiaceae	G	Eurasian
<i>Asperula odorata</i> L.	Rubiaceae	Ch	Subpontic-submediterranean
<i>Ballota nigra</i> L.	Lamiaceae	H	Subpontic
<i>Bellis perennis</i> L.	Asteraceae	H	Submideuropean
<i>Betula pendula</i> Roth.	Betulaceae	P	Sub-south-siberian
<i>Brassica alba</i> L.	Brassicaceae	T	East-submediterranean
<i>Brassica nigra</i> L.	Brassicaceae	T	East-submediterranean
<i>Bromus mollis</i> L.	Poaceae	T	Submediterranean
<i>Campanula glomerata</i> L.	Campanulaceae	H	Eurasian
<i>Campanula persicifolia</i> L.	Campanulaceae	H	Eurasian
<i>Capsela bursa-pastoris</i> (L.) Med.	Brassicaceae	T	Cosmopolit
<i>Cardamine bulbifera</i> L.	Brassicaceae	T	Subcircumpolar
<i>Carpinus betulus</i> L.	Betulaceae	P	Mideuropean
<i>Chelidonium majus</i> L.	Papaveraceae	H	Eurasian
<i>Cichorium intybus</i> L.	Asteraceae	H	Subeurasian
<i>Cirsium arvense</i> (L.) Scop.	Asteraceae	G	Subeurasian
<i>Clematis vitalba</i> L.	Ranunculaceae	S	Subpontic-submediterranean
<i>Conium maculatum</i> L.	Apiaceae	H	Mideuropean
<i>Convallaria majalis</i> L.	Asparagaceae	G	Circumpolar
<i>Convolvulus arvensis</i> L.	Convolvulaceae	S	Cosmopolit
<i>Convolvulus cantabrica</i> L.	Convolvulaceae	Ch	Submediterranean
<i>Cornus mas</i> L.	Cornaceae	P	Pontic-submediterranean
<i>Cornus sanguinea</i> L.	Cornaceae	P	Submideuropean
<i>Coronilla varia</i> L.	Fabaceae	H	Subpontic
<i>Corylus avellana</i> L.	Betulaceae	P	Submideuropean
<i>Corylus colurna</i> L.	Betulaceae	P	Iranian
<i>Crataegus monogyna</i> Jacq.	Rosaceae	P	Mideuropean
<i>Dactylis glomerata</i> L.	Poaceae	H	Subeurasian
<i>Daucus carota</i> L.	Apiaceae	H/T	Eurasian
<i>Dryopteris filix-mas</i> (L.) Schott.	Dryopteridaceae	H	Cosmopolit
<i>Epilobium parviflorum</i> Schreb.	Oenotheraceae	H	Mideuropean
<i>Euphorbia amygdaloides</i> L.	Euphorbiaceae	T	Subatlantic-submediterranean
<i>Euphorbia cyparissias</i> L.	Euphorbiaceae	H	Eurasian
<i>Evonymus europaeus</i> L.	Celastraceae	P	Submideuropean
<i>Festuca glauca</i> Vill.	Poaceae	H	Eurasian
<i>Festuca ovina</i> L.	Poaceae	H	Subeurasian
<i>Ficaria verna</i> L.	Ranunculaceae	G	Submideuropean
<i>Fragaria indica</i> L.	Rosaceae	H	Eurasian
<i>Fragaria vesca</i> L.	Rosaceae	H	Eurasian
<i>Fraxinus excelsior</i> L.	Oleaceae	P	Submideuropean
<i>Fraxinus ornus</i> L.	Oleaceae	P	Submediterranean
<i>Fumaria officinalis</i> L.	Papaveraceae	T	Submideuropean
<i>Galium aparine</i> L.	Rubiaceae	T	Eurasian
<i>Galium sylvaticum</i> L.	Rubiaceae	G	Mideuropean
<i>Galium verum</i> L.	Rubiaceae	H	Eurasian
<i>Geranium dissectum</i> L.	Geraniaceae	T	Eurasian
<i>Geranium robertianum</i> L.	Geraniaceae	T	Subcircumpolar
<i>Geum urbanum</i> L.	Rosaceae	H	Eurasian
<i>Glechoma hirsuta</i> Waldst. et Kit.	Lamiaceae	H	Pontic-east-submediterranean
<i>Hedera helix</i> L.	Araliaceae	S	Subatlantic-submediterranean
<i>Helleborus odorus</i> (L.) W.K.	Ranunculaceae	G	Mideuropean
<i>Hordeum murinum</i> L.	Poaceae	T	Submediterranean
<i>Hypericum hirsutum</i> L.	Hypericaceae	H	Subeurasian
<i>Hypericum perforatum</i> L.	Hypericaceae	H	Mideuropean
<i>Hyssopus officinalis</i> L.	Lamiaceae	H	Submediterranean
<i>Iris variegata</i> L.	Iridaceae	G	Pontic-submediterranean
<i>Juglans regia</i> L.	Juglandaceae	P	Mideuropean
<i>Lamium galeobdolon</i> (L.) Crantz	Lamiaceae	Ch	Submideuropean
<i>Lamium maculatum</i> L.	Lamiaceae	H	Submideuropean
<i>Lamium purpureum</i> L.	Lamiaceae	T	Submideuropean
<i>Lapsana communis</i> L.	Asteraceae	T	Submideuropean
<i>Leonorus cardiaca</i> L.	Lamiaceae	H	Eurasian
<i>Ligustrum vulgare</i> L.	Oleaceae	P	Mideuropean

<i>Lolium perene</i> L.	Poaceae	H	Submediterranean
<i>Lonicera caprifolium</i> L.	Caprifoliaceae	P	Mediterranean
<i>Lysimachia vulgaris</i> L.	Primulaceae	H	Eurasian
<i>Malva sylvestris</i> L.	Malvaceae	H	Submediterranean
<i>Medicago sativa</i> L.	Fabaceae	H	Subpontic
<i>Mentha longifolia</i> (L.) Huds.	Lamiaceae	H	Submediterranean
<i>Oxalis acetosella</i> L.	Oxalidaceae	H	Circumpolar
<i>Oxalis europea</i> L.	Oxalidaceae	G	Circumpolar
<i>Paeonia officinalis</i> L.	Paeoniaceae	G	Eurasian
<i>Papaver rhoeas</i> L.	Papaveraceae	T	Mediterranean
<i>Plantago lanceolata</i> L.	Plantaginaceae	H	Eurasian
<i>Plantago major</i> L.	Plantaginaceae	H/T	Eurasian
<i>Plantago media</i> L.	Plantaginaceae	H	Eurasian
<i>Polygonum aviculare</i> L.	Polygonaceae	T	Cosmopolit
<i>Potentilla erecta</i> (L.) Rausch.	Rosaceae	H	Eurasian
<i>Potentilla micrantha</i> Ramond ex DC	Rosaceae	H	Submediterranean
<i>Primula vulgaris</i> Huds.	Primulaceae	H	Subeurasian
<i>Prunella vulgaris</i> L.	Lamiaceae	H	Subeurasian
<i>Prunus avium</i> L.	Rosaceae	P	European-westasian
<i>Prunus cerasifera</i> Ehrh.	Rosaceae	P	Sub-southsiberian
<i>Prunus padus</i> L.	Rosaceae	P	Eurasian
<i>Prunus spinosa</i> L.	Rosaceae	P	Sub-south-siberian
<i>Pteridium aquilinum</i> (L.) Kuhn	Pteridaceae	G	Cosmopolit
<i>Pulmonaria officinalis</i> L.	Boraginaceae	H	Submediterranean
<i>Pyrus piraster</i> L.	Rosaceae	P	Mediterranean
<i>Quercus cerris</i> L.	Fagaceae	P	East-submediterranean
<i>Quercus farnetto</i> Ten.	Fagaceae	P	Submediterranean
<i>Quercus petraea</i> (Matt.) Liebl	Fagaceae	P	Mediterranean
<i>Quercus pubescens</i> Wild.	Fagaceae	P	Submediterranean
<i>Quercus robur</i> L.	Fagaceae	P	Submediterranean
<i>Quercus rubra</i> L.	Fagaceae	P	Submediterranean
<i>Ranunculus repens</i> L.	Ranunculaceae	H	Pontic-submediterranean
<i>Robinia pseudoacacia</i> L.	Fabaceae	P	Adventive
<i>Rosa arvensis</i> Huds	Rosaceae	P	Submediterranean
<i>Rosa canina</i> L.	Rosaceae	P	Eurasian
<i>Rubus hirtus</i> L.	Rosaceae	P	Mediterranean
<i>Rumex acetosella</i> L.	Polygonaceae	H	Subcircumpolar
<i>Rumex obtusatum</i> L.	Polygonaceae	H	Submediterranean
<i>Ruscus aculeatus</i> L.	Asparagaceae	G	Eurasian
<i>Ruscus hypoglossum</i> L.	Asparagaceae	G	Submediterranean
<i>Salvia pratensis</i> L.	Lamiaceae	H	Submediterranean
<i>Salvia viridis</i> L.	Lamiaceae	H	Submediterranean
<i>Sambucus ebulus</i> L.	Adoxaceae	G	Submediterranean
<i>Sambucus nigra</i> L.	Adoxaceae	P	Submediterranean
<i>Scilla bifolia</i> L.	Asparagaceae	G	Submediterranean
<i>Sedum album</i> L.	Crassulaceae	Ch	Submediterranean
<i>Silene vulgaris</i> (Moench.) Garcke	Caryophyllaceae	H	Subeurasian
<i>Solanum dulcamara</i> L.	Solanaceae	T	Subeurasian
<i>Sorbus torminalis</i> (L.) Crantz.	Rosaceae	P	Submediterranean
<i>Stachys sylvatica</i> L.	Lamiaceae	H	Submediterranean
<i>Stellaria holostea</i> (L.) Scop.	Caryophyllaceae	H	Submediterranean
<i>Stellaria media</i> (L.) Scop.	Caryophyllaceae	H	Cosmopolit
<i>Symphytum officinale</i> L.	Boraginaceae	T/H	Submediterranean-pontic
<i>Tamus communis</i> L.	Dioscoreaceae	S	Mediterranean-submediterranean
<i>Taraxacum officinale</i> Web.	Asteraceae	H	Eurasian
<i>Teucrium chamaedrys</i> L.	Lamiaceae	Ch	Mediterranean
<i>Tilia platyphyllos</i> Scop.	Tiliaceae	P	Mediterranean
<i>Trifolium alpestre</i> L.	Fabaceae	H	Subpontic
<i>Trifolium campestre</i> Schreber.	Fabaceae	T	Submediterranean
<i>Trifolium pratense</i> L.	Fabaceae	H	Subeurasian
<i>Trifolium repens</i> L.	Fabaceae	H	Subeurasian
<i>Ulmus minor</i> Mill.	Ulmaceae	P	Pontic-european
<i>Urtica dioica</i> L.	Urticaceae	T/H	Eurasian
<i>Verbascum phlomoides</i> L.	Scrophulariaceae	H	Continental-mediterranean
<i>Verbena officinalis</i> L.	Verbenaceae	H	Eurasian
<i>Veronica chamaedrys</i> L.	Scrophulariaceae	H	Submediterranean
<i>Veronica persica</i> Poir.	Scrophulariaceae	Ch	Subboreal-circumpolar
<i>Viburnum lantana</i> L.	Adoxaceae	P	Submediterranean
<i>Vicia cracca</i> L.	Fabaceae	H	Subeurasian
<i>Viola alba</i> L.	Violaceae	H	Submediterranean
<i>Viola tricolor</i> L.	Violaceae	T/H	Eurasian
<i>Vinca minor</i> L.	Apocynaceae	DC	Submediterranean
<i>Vitis vinifera</i> L.	Vitaceae	P	Subeurasian

Conclusions

Based on the field study during two consecutive growing seasons (2020-2021) at the complete area of NM "Šuma Košutnjak" 147 medicinal plants were found. The taxonomy analysis results showed that families *Rosaceae* (10.88%) and *Lamiaceae* (9.52%) are most presented, then *Fabaceae* and *Asteraceae* should be mentioned with the same distribution (5.44%), and finally *Poaceae* (4.76%) and *Fagaceae* (4.08%) that also have a bit more significant participation. As for life forms, the most dominant are hemicryptophytes (40.14%), then phanerophytes (24.49%), therophytes (11.56%) and geophytes (8.16%). Among floral elements the most distributed are Eurasian (20.41%) and submideuropean (17.69%), then mideuropean (12.24%) and submediterranean (11.56%). Almost 80% from all recorded medicinal plants are herbaceous, while the other belong to shrubs and trees. Some individuals such as *Campanula persicifolia* L., *Hypericum hirsutum* L., *Paeonia officinalis* L. and *Ruscus hypoglossum* L. are due to anthropogenic factor very endangered, because the possibility of their natural regeneration is pretty reduced and, as a result, they are located on very small areas. For that reason is very important, not only to conduct conservation measures and protection of mentioned taxa, but also to explain visitors how they should behave in the urban forest ecosystem like this.

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