

**Резюмета на научните трудове
след защита на докторската дисертация**

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представени за участие в конкурс за „Доцент” по Научна специалност „Биохимия“;
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Труд № 5

Dinev T., Beev G., **Tzanova M.**, Denev S., Dermendzieva D., Stoyanova A., 2018, Antimicrobial activity of *Lactobacillus plantarum* against pathogenic and food spoilage microorganisms: a review, Bulgarian journal of veterinary medicine, 21(3): 253-268. DOI: 10.15547/bjvm.1084, eISSN 1313-3543 (SJR = **0.207, Q3**)

Резюме:

One of the most important properties of probiotic bacteria is their antimicrobial activity against many species of microorganisms which could be useful to prevent food spoilage caused by certain sensitive bacteria and fungi as well as to control the speed of propagation of potentially pathogenic bacteria by probiotic application. *Lactobacillus plantarum* is considered one of the probiotic bacteria with broadest spectrum of antibacterial activity which makes it useful in veterinary, human medicine and food industry. According to a number of studies *Lactobacillus plantarum* exerts inhibitory activity against many Gram-positive and Gram-negative bacteria – *Escherichia coli* (including *E. coli* 0157:H7), *Pseudomonas aeruginosa*, *Helicobacter pylori*, *Yersinia enterocolitica*, *Campylobacter jejuni*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Klebsiella*, *Salmonella*, *Shigella*, *Bacillus*, *Clostridium*, *Enterococcus*, *Lactobacillus* spp., etc. as well as a number of moulds and yeasts – *Aspergillus*, *Fusarium*, *Mucor*, *Candida* spp., etc. The main antibacterial compounds of *Lactobacillus plantarum* are the bacteriocins and organic acids whereas the antifungal compounds are the organic acids, hydroxy fatty acids and cyclic dipeptides. Because of the high antifungal activity of some *L. plantarum* strains against food spoilage microorganisms they can be used as effective biopreservatives in food industry. Also, some *L. plantarum* strains could be applied as supporting therapeutic agents in treatment of infections caused by the corresponding susceptible microorganisms

Труд № 6

Tzanova M.T., Grozeva N.H., Gerdzhikova M.A., Argirova M.D., Pavlov D.H. Terzieva S.R. 2018. Flavonoid content and antioxidant activity of *Betonica bulgarica* Degen et Neič, Bulgarian Chemical Communication, 50 (C) 90 – 97, ISSN: 0324-1130 (IF= **0.640, Q4**)

Резюме:

The Bulgarian endemic *Betonica bulgarica* Degen et Neič (syn. *Stachys bulgarica* Hayek) is a protected plant by the Biological Diversity Act and it is included in the Red Data Book of Bulgaria under the category “endangered“. The aim of this study was to determine the flavonoid content and antioxidant activity of different plant organs of this species (leaves, flowers, roots, stems and seeds), from four populations. Three flavonoids were found in significant amounts: rutin, quercetin and hispidulin. Rutin was in the largest quantity, followed by quercetin and hispidulin. The largest total flavonoid content was measured in leaves, followed by roots and flowers. The antioxidant activity of methanol extracts was tested by DPPH-method. The total polyphenol was also assayed. The correlation between flavonoid content and antioxidant activity of the studied plant organs was established.

Труд № 7:

Gerdzhikova M., Pavlov D., Grozeva N., **Tzanova M.**, Dimanov D., Terzieva S., Krastanov J. 2018. Chemical composition, mineral content, “in vitro” gas production and relative feed value of *Stevia rebaudiana* Bertoni. Bulgarian Journal of Agricultural Science, 24(1):40-46, eISSN 2534-983X (**SJR = 0.261, Q3**)

Резюме:

The aim of present study was to determine the chemical composition, digestibility, gas production, energy nutrition, relative feed value, and the use of *S. rebaudiana* as a forage crop. The chemical composition and mineral content of biomass from *Stevia rebaudiana* Bertoni were determined. The average crude protein content in the biomass was 86.33 g/kg of dry matter (DM); crude fat – 11.79 g/kg DM; crude fibre – 284.68 g/kg DM; ash – 96.56 g/kg DM and nitrogen free extracts (NFE) – 520.64 g/kg DM. The mineral content in the biomass of *S. rebaudiana* was similar to that of meadow grasses. Structural fibre components were on average for neutral detergent fibre (NDF) 35.52% and acid detergent fibre (ADF) 31.18% which are close to that of alfalfa and legume grasses. New data were obtained concerning in vitro gas production of *S. rebaudiana* biomass at 24 hour period – it was 225.83 dm/ml average, and at 48 hour period – 246.70 dm/ml (CO₂ and CH₄), which is close to the group of legume and cereal meadow grasses. The relative feed value (RFV) of *S. rebaudiana* biomass is close to that of perennial legumes. Regression equations were developed for advanced determination of: the quantity of metabolizable energy (ME), through the gas production at 24 hour period; and the relative feed value (RFV) and acid detergent fibre through the neutral detergent fibre.

Труд № 8:

Tzanova M. 2018, Quantification of Astaxanthin and Canthaxanthin in Muscle Tissues of Rainbow Trout *Oncorhynchus mykiss* and Brook Trout *Salvelinus fontinalis*, Turkish Journal of Fisheries and Aquatic Sciences, 18: 1053-1061. DOI: 10.4194/1303-2712-v18_9_05 (**IF = 0.738, Q3**)

Резюме:

This study reports the quantification of two main pigments in Salmonidae- astaxanthin and canthaxanthin, in different muscle tissues (skeletal and cardiac) of rainbow trout *Oncorhynchus mykiss* W. and brook trout *Salvelinus fontinalis* M. The fish were fed with conventional no

pigment supplemented feed. The xanthophyll quantities in flesh and heart were determined by high performance liquid chromatography and photodiode array detection after single-laboratory validation of the method. The target analysis of surrounding water showed concentrations under detection limit. This study demonstrates the ability of rainbow trout and brook trout to absorb two main xanthophylls, from environment containing them in concentrations under the detection limit. The total xanthophyll content in the cardio muscle is larger than those in the skeletal muscle in both fish species and higher in the skeletal muscle of *Salvelinus fontinalis* M. than those of *Oncorhynchus mykiss*.

Труд № 9

Tzanova M., Grozeva N, Gerdzhikova M, Atanasov V, Terzieva S, Prodanova R, 2018. Biochemical composition of essential oil of Corsican *Helichrysum italicum* (Roth) G. Don, introduced and cultivated in South Bulgaria, *Bulgarian Journal of Agricultural Sciences*, 24(6), 1071–1077 eISSN 2534-983X (**SJR = 0.261, Q3**)

Резюме:

This study provided GC-FID and GC-MS analysis of the volatile constituents of *Helichrysum italicum* (Roth) G. Don, introduced from Corsica (France), cultivated in South Bulgaria, harvested in different phenological stages – floral budding period and flowering period, and compared its quality to the quality of the species of native origin. Similarities in qualitative, but with differences in quantitative composition of their essential oils were indicated, because of the different environmental conditions. 41 components were identified, representing 89.25-95.63% of the total essential oil composition. In the essential oil of *H. italicum*, harvested in the floral budding period, the content of sesquiterpenes and oxygenated monoterpenes were higher. The essential oil had a good, balanced content of monoterpenes, sesquiterpenes and their oxidized derivatives, like α - and γ -curcumene, neryl acetate, α -pinene, α -copaene, limonene, cis- and trans- α -bergamotene, β -caryophyllene, eudesm-5-en-11-ol and selina-4,11-diene. Cultivating ability of these plant species opens up new opportunities for the food, pharmaceutical and cosmetic industries.

Труд № 10

Tzanova M.T., Gerdzhikova M. A., Grozeva N. H., Terzieva S. R. 2019. Antioxidant Activity and Total Phenolic Content of Five *Salvia* Species from Bulgaria, *Bulgarian Chemical Communication*, 51 (A), 90 - 94, ISSN: 0324-1130 (**IF= 0.640, Q4**)

Резюме:

A lot of species of the genus *Salvia* L. are used as herbal tea. They are also applied by the food flavouring, as well as in the cosmetic, perfumery and pharmaceutical industries. The most used as a medicinal plant and the best studied species of the genus is *Salvia officinalis* L. (garden sage). The aim of the present study was to determine the antioxidant activity and total phenol content of *Salvia amplexicaulis* Lam.; *Salvia pratensis* L.; *Salvia sclarea* L.; *Salvia verticillata* L. and *Salvia aethiopsis* L., collected from their natural populations in the Thracian Lowland, Bulgaria. The methanolic extracts from the dried leaves and flowers of each species were tested for their radical scavenging capacity by DPPH method and the total phenol content by using of

Folin-Ciocalteu reagent and gallic acid as a standard. The observed Pearson correlation between the measured quantities demonstrated a coefficient of 0.9565 at significance level $p \leq 0.01$. The tested species showed large total phenolic contents: from 906 ± 90 to 1795 ± 153 mmol GAE/kg DM and from 1746 ± 151 to 4555 ± 410 mmol GAE/kg DM of the methanolic extracts of leaves and flowers, respectively. The tested antioxidant capacities were found to be in the range from 21.8 ± 1.8 to 59.9 ± 5.0 mmol TE/kg DM and from 49.3 ± 4.5 to 89.0 ± 7.8 mmol TE/kg DM of the methanolic extracts of leaves and flowers, respectively. The results of the investigations showed that *Salvia verticillata* is the favorite *Salvia* species with the highest total phenol content and antioxidant activity

Труд № 11:

Beev G, Kolev T, Naydenova N, Dinev T, **Tzanova M**, Mihaylova G, 2019. Physicochemical, sanitary and safety indicators changes during the ripening of Bulgarian white brined cheese from local farms, Bulgarian Journal of Agricultural Sciences, 25 (Supp. 3): 109-115. eISSN 2534-983X (**SJR = 0.191, Q3**)

Резюме:

The present study aims to determine the physicochemical and microbiological changes of white-brined cheese from local farms during manufacturing and ripening. Milk pasteurization for white-brined cheese production leads to a severe reduction of microorganisms in milk. Thus, after pasteurization the total number of microorganisms decreases from 480 000 to 810 cfu/cm³, *Salmonella* spp. from 800 to 2 cfu/cm³ and *E. coli* from 4000 to 0 cfu/cm³. Ripening processes lead to a drastic reduction of cheese microflora with prevalence of specific lactic microflora (*Lactobacilli* and *Lactococci*) on the 45th day and complete annihilation of *E. coli* and *Salmonella* spp. These changes in the cheese microflora made the final product safe for consumption. On the other hand, the experimental data shows a strong multiplication of *Salmonella* spp. on the 7th day (10 cfu/cm³ at the 24th hour reached 0 cfu/cm³ on the 7th day) and insufficient decrease of the number of other microorganisms, making fresh white-brined cheese at its early ripening stages unsafe for consumption. Ripening of the cheese brings about an increase of the dry matter percentage (from 33.5% at 24th hour to 38.5% at 45th day), the fat content (from 13.3% to 16.4%), salt content (from 4.1% to 5.8%) and total protein content (from 13.7% to 16.7%) and reduction of moisture in non-fat substance (from 76.7% to 73.8%) of the final product. These changes are in accordance with the accepted standards for white-brined cheese production.

Труд № 12:

Yaneva Z., Ivanova D. Nikolova N., **Tzanova M**, 2020. The 21st century revival of chitosan in service to bio-organic chemistry. Biotechnology & Biotechnological Equipment, 34:1, 221-237, DOI: 10.1080/13102818.2020.1731333, eISSN: 1314-3530 (**IF = 1.186, Q3**)

Резюме:

The design and synthesis of biopolymer nano- and micro-formulations are a new trend with growing priority in scientific research and development in the fields of biomedicine,

bioorganic/medicinal chemistry, pharmaceuticals, agrochemistry and food industry. This incorporates a vast variety of improved and newly-developed analytical and physico-chemical techniques for green and efficient synthesis. The scope of the present review was to outline the recent advances in the methods for design of novel chitosan micro- and nano-carriers and transporters. Special emphasis is laid on their functionalities and capacity for encapsulation of natural bioactive compounds and controlled in vitro/in vivo release in various biological/physiological media. Expectations for the application of chitosan formulations and chitosan-based hybrid systems are progressively increasing as the knowledge regarding their physical, chemical and biological properties constantly expands. Thus, this review proposes insights on the objective assessment of the capacity, applicability and versatility of newly-designed chitosan-based hybrid systems. A detailed integrative approach, which incorporates the innovative scientific achievements based on complex novel, precise and reliable analytical procedures and methods for qualitative and quantitative morphological, structural, spectral, chemical and biochemical analyses of the bioprecursors and the designed chitosan-carrier micro/nano-hybrid systems, is applied. Sustainable knowledge on the mechanism and methods of natural bioactive substances encapsulation and in vitro/in vivo release is reviewed and discussed.

Труд № 13:

Tzanova M, Atanasov V, Yaneva Z, Ivanova D, Dinev T, 2020. Selectivity of Current Extraction Techniques for Flavonoids from Plant Materials. *Processes* 2020, 8(10), 1222. <http://dx.doi.org/10.3390/pr8101222>, ISSN 2227-9717 (**IF = 2.753, Q2**)

Резюме:

Flavonoids have a broad spectrum of established positive effects on human and animal health. They find an application in medicine for disease therapy and chemoprevention, whence the interest in flavonoids increases. In addition, they are used in food and cosmetic industries as pigments and biopreservatives. Plants are an inexhaustible source of flavonoids. The most important step of plant raw material processing is extraction and isolation of target compounds. The quality of an extract and efficiency of a procedure are influenced by several factors: Plant material and pre-extracting sample preparation, type of solvent, extraction technique, physicochemical conditions, etc. The present overview discusses the common problems and key challenges of the extraction procedures and the different mechanisms for selective extraction of flavonoids from different plant sources. In summary, there is no universal extraction method and each optimized procedure is individual for the respective plants. For an extraction technique to be selective, it must combine an optimal solvent or mixture of solvents with an appropriate technique. Last but not least, its optimization is important for a variety of applications. Moreover, when the selected method needs to be standardized, it must achieve acceptable degree of repeatability and reproducibility.

Труд № 14:

Grozeva NH, Gerdzhikova MA, **Tzanova MT**, 2020. Chemical composition, antioxidant activity and total phenol content of six vascular medicinal plants. Bulgarian Chemical Communications, 52 (D): 161-167. ISSN: 0324-1130 (**IF= 0.640, Q4**)

Резюме:

The Bulgarian flora is rich in medicinal plants, the annually collected and exported herbs are used on the Bulgarian and international markets as a raw material for a number of medicinal, cosmetic and other objectives. Despite the exceptional biodiversity and significant resources, the antioxidant potential of Bulgarian medicinal plants is still insufficiently explored. Data on the chemical composition of a number of medicinal wild plants are not complete. The aim of this study was to determine the chemical composition, antioxidant activity and total phenol content of the aerial parts of *Artemisia annua* L. (sweet wormwood), *Artemisia vulgaris* L. (common mugwort), *Prunus laurocerasus* L. (cherry laurel), *Tanacetum vulgare* L. (common tansy), *Urtica dioica* L. (common nettle) and *Verbascum densiflorum* Bertol. (denseflower mullein) from their populations in the Thracian Lowland. The Weende method was used to determine crude protein, crude fat, crude fiber, ash, and nitrogen free extracts (NFE). The antioxidant activity was tested by determining the radical scavenging capacity of the selected species by the DPPH method and the total phenol content - by using Folin-Ciocalteu reagent and gallic acid as a standard.

Труд № 15:

Gerdzhikova MA, Grozeva NH, **Tzanova MT**, Terzieva SR, 2020. Antioxidant activity, total phenol content and chemical composition of selected medicinal plants. Bulgarian Chemical Communications, 52 (D): 155-160. ISSN: 0324-1130 (**IF= 0.640, Q4**)

Резюме:

Interest in natural compounds with antioxidant activity as alternatives to commercial antioxidants has increased in recent years. Herbal extracts are well recognized sources of antioxidants. The phenols contained therein, including flavonoids, have been increasingly identified by many researchers as important dietary antioxidant factors. Studies have shown that there are differences in the content of bioactive substances in plants collected from different geographical regions. About 750 species in the Bulgarian flora are medicinal and have not yet been sufficiently studied. Because of this, in the present paper the total polyphenol content and antioxidant activity of some populations of *Equisetum arvense* L., *Equisetum telmateia* Ehrh., *Juniperus communis* L., *Lavandula angustifolia* Mill. and *Rosmarinus officinalis* L. were evaluated. In *Juniperus communis* the highest total phenol content of 946 mg GAE.kg⁻¹ DM and antioxidant activity of 58.5 mmol TE.kg⁻¹ DM were measured.

Труд № 16:

Roychev V, **Tzanova M**, Keranova N, Peeva P, 2020. Antioxidant content and antioxidant activity in raisins from seedless hybrid vine varieties with col-oured grape juice, Czech Journal of Food Sciences 38, 2020 (6): 410–416. eISSN 1805-9317 (**IF = 0.932, Q3**)

Резюме:

A study has been conducted on the antioxidant content and antioxidant activity in raisins from seedless hybrid varieties of vines with coloured grape juice. It has been found that the amounts of trans-resveratrol and quercetin as well as their antioxidant activity in raisins from the seedless coloured hybrid forms almost always mathematically exceed the levels of these indicators in the raisins of the Gamay Freaux, Black Corinth and Sangiovese grape varieties. It has been shown that 54% of the change in antioxidant activity is due to changes in the content of trans-resveratrol and 42% of quercetin. The applied mathematical models enable the theoretical study of the chemical composition of raisins of different grape varieties through the analytical forms of the proven relationships between them.

Труд № 17:

Dinev TG, Rusenova NV, **Tzanova MT**, Grozeva NH, Gerdzhikova MA, Stoyanov PS, Mladenova TR, Beev GG, 2020. Antimicrobial Potential of Methanolic Extracts from *Betonica bulgarica* Degen et Neič. (Lamiaceae). *Ecologia Balkanica*, 12(2): 165-174. eb.20153 eISSN: 1313-9940 (**SJR = 0.14, Q4**)

Резюме:

Betonica bulgarica Degen et Neič. (syn. *Stachys bulgarica* Hayek) is a Bulgarian endemic plant included in Red Data Book of Bulgaria under the category “endangered“. The aim of the present study is to provide data about the antimicrobial activity of *B. bulgarica* leaf, flower, seed, stem and root methanolic extracts against *Staphylococcus aureus* ATCC 25923, *Escherichia coli* ATCC 25922, *Bacillus cereus*, *Aspergillus ochraceus* 2002 IM-BAS, *Fusarium moniliforme* 394 FN-9, *Fusarium graminearum* 2294 IMI 155426 and *Penicillium verrucosum* 2003 NRRL F-143. Antimicrobial activity of the extracts was evaluated by agar well diffusion method. Root extracts of *B. bulgarica* exhibited the highest antibacterial activity against *S. aureus* and *B. cereus* with large zones of inhibition. All extracts demonstrated either low and statistically insignificant activity against *E. coli* or a lack thereof. As a whole, extracts of Ablanovo area (in Sinite kamani National Park) exerted the highest activity against *S. aureus*, *B. cereus* and *E. coli*. Leaf, flower, stem and root extracts of *B. Bulgarica* showed either a lack of antifungal activity or low and statistically insignificant one.

Труд № 18:

Grozeva N, Zhelyazkova M, Gerdzhikova M, **Tzanova M**, Pavlov D, Georgieva S, Georgiev D. 2020. Morphological and karyological variability of the Balkan endemics *Moehringia jankae* Griseb. ex Janka and *Moehringia grisebachii* Janka (Caryophyllaceae) from Eastern Balkan Range (Bulgaria). *Bulgarian Journal of Agricultural Sciences*, 26 (Suppl. 1), 30-47 eISSN 2534-983X (**SJR = 0.262, Q3**)

Резюме:

Seven populations of *Moehringia jankae* and eleven populations of *M. grisebachii* at Eastern Balkan Range – Sinite Kamani Natural Park were morphologically and karyologically tested. The chromosome numbers, the karyotype characteristics and the stomata type of *M. grisebachii* and *M. jankae* were described. Intrapopulation, interpopulation and interspecies variabilities

were established. The chromosome number $2n = 2x = 24$ have been found in all studied populations. The karyotypes of *M. jankae* and *M. grisebachii* consist of metacentric and submetacentric chromosomes, differences in morphology and size of chromosomes have been identified and in the studied populations of *M. grisebachii* were established one pair of chromosomes with satellites. The main source of phenotype variation was intrapopulation variability mainly due to characteristics of habitats of both species and their biological type. More variable in all populations of *M. jankae* and *M. grisebachii* were vegetative traits and the most variable was height of stem. The registered interpopulation variability was affected by the differences in the karyotype, the altitude, the exposure and the type of rock, number and area of population. Indumentum, dimensions of leaves and flowers and morphological features of pollen and seeds had taxonomic significance for distinguishing *M. jankae* from *M. grisebachii*.

Труд № 19:

Милена Танкова Цанова-Стоева, 2019. Биохимични аспекти на транс-ресвератрола и съдържанието му в грозде и вино, произвеждани в България, Монография. Кота, Стара Загора. ISBN 978-954-305-526-5

Резюме:

Транс-ресвератролът е един от най-обещаващите естествени съединения с голям терапевтичен потенциал. Много добри резултати са постигнати при използването му като добавка при изследване на неговите кардиопротективни, антиоксидантни, противовъзпалителни и невропротективни свойства. Най-популярният и достъпен източник на този стилбен в световен мащаб са гроздето и неговите продукти. Това ги превръща в храни с голям здравословен потенциал.

В настоящата монография е обобщена и анализирана натрупаната до този момент научна информация за биохимичните процеси, в които участва транс-ресвератрола. Систематизирани са данните за неговото съдържание в грозде и вино, произвеждани у нас, както и влиянието на различните фактори върху неговото съдържание.