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REVIEW

on the materials submitted for participation in the competition for occupying the academic position of “Professor” in professional field 4.3. Biological Sciences, scientific specialty “Ecology and Ecosystem Protection”, announced by the Forest Research Institute – Bulgarian Academy of Sciences in the State Gazette, Issue No. 18/17.02.2026.

Candidate for participation in the competition: Assoc. Prof. Dr. Ina Yosifova Aneva, FRI – BAS

Reviewer: Prof. Dr. Mariyana Ivanova Lyubenova, Sofia University “St. Kliment Ohridski”, professional field 4.3. Biological Sciences, scientific specialty “Ecology and Ecosystem Protection” – retired.

1. Brief biographical data.

Dr. Ina Aneva was born on 04.06.1985. She completed her secondary education at the Natural Sciences and Mathematics High School – town of Blagoevgrad, receiving two certificates of merit – for excellent academic achievement and for participation in the National Olympiad in Biology and Health Education (2004). She completed her higher education at Sofia University: Bachelor’s degree in Molecular Biology (2008) and Master’s degree in Botany (Higher Plants), receiving a gold badge for excellent academic achievement in 2010. She defended her doctoral dissertation in 2016 on the topic “Biological and phytochemical in situ and ex situ study of *Sideritis* species with conservation status in Bulgaria”. She has held the following positions: laboratory assistant (2007–2009) at the Institute of Molecular Biology – BAS, Neurogenetics Section; biologist (2011–2012), assistant professor (2016–2017), chief assistant professor (2017–2019), and currently associate professor (since 2019) at IBER and FRI, BAS. At present, she is Scientific Secretary of the “Biodiversity, Bio resources and Ecology” Division at BAS. According to the certificate issued, her total professional experience in the specialty is 13 years and 6 months.

The candidate has proficiency in English at level C1 and holds a category B driving license. She is the author (producer, screenwriter, director, camera operator, and editor) of the feature-documentary film “155 Years of BAS: The Living Spirit of the Founders”, which premiered in the “Prof. Marin Drinov” Hall of BAS (2024) and was broadcast on BNT2 and BNT4. The film was presented at the Ethnografilm Festival, Paris (2025). Dr. Aneva has received 12 scientific awards – 8 national and 3 international, including the “Pythagoras 2020” Grand Prize for Young Scientist, the Honorary Badge “For Merit to BAS” 2024, and UNESCO’s Man and the Biosphere (MAB) Young Scientists Award.

2. Compliance of the submitted documents and materials of the candidate with the minimum requirements pursuant to the Regulations on the Acquisition of Scientific Degrees and the Occupation of Academic Positions at the Forest Research Institute – BAS.

The set of documents submitted by Dr. Aneva for the competition fully complies with the Regulations for the Development of the Academic Staff of FRI–BAS. The candidate has held the academic position of “Associate Professor” for more than 5 years.

3. General description of the submitted materials by type, importance, place of publication, language of publication, number of co-authors, etc.

Dr. Ina Aneva is the author and co-author of 148 scientific publications, 102 of them are refereed and indexed in Web of Science and Scopus. A total impact factor is 223, as well as book of chapters in international editions, including Springer and Taylor & Francis, and conference proceedings. She has presented 174 reports, in the form of poster or oral presentations.

In the present competition, the candidate has submitted 56 publications – 16 under the group of indicators „B“ and 40 under the group of indicators „G“. The publications under the **group B** were published in the period 2020–2026, with the exception of one, which was published in 2019. Of the 16 submitted publications, No. 5 was not found in Web of Science and Scopus, while Nos. 13, 15, and 16 are not indexed. The analysis in this section will be based on 12 publications; the remaining 4 will be considered in the contributions. The publications are distributed by quartiles as follows: 6 are in Q1, 2 are in Q2, 1 is in Q3, and 2 are in Q4. The total IF is 28.169, and the total SJR is 6.284. For publications Nos. 6 and 7, the quartiles, IF, and SJR are taken for 2025. The works are in English and were published in 12 prestigious journals, 4 of which are published in Bulgaria: *Plants* – 3 publications; *Diversity*; *Heritage*; *Life*; *Horticulturae*; *Plant Biosystems*; *Chemistry and Biodiversity*; *Biotechnology & Biotechnological Equipment*; *Forestry Ideas*; *Ecologia Balkanica*; *Phytologia Balcanica* – by 2 publications; and a book section published by Springer. **In-group G**, the submitted publications cover the period 2020–2025. They are distributed by quartiles as follows: Q1 – 18 publications; Q2 – 4 publications; Q3 – 12 publications; and Q4 – 6 publications. The total IF is 120.493, and the total SJR is 24.526. The publications in-group G were published in English in 30 different prestigious journals, such as *Biological Conservation*, *Frontiers in Pharmacology*, *Phytochemical Analysis*, *Food Research International*, *Phytomedicine*, *Phytotherapy Research*, *Plants* – by 2 to 4 publications and many others. Three of the publications were published in Bulgaria – *Comptes rendus de l'Académie bulgare des Sciences*, *Bulgarian Chemical Communications*, and *BioRisk*.

Assoc. Prof. Aneva has presented a list of 130 participations in international forums for the period 2009–2025. The participations relevant to the competition are those from 2020–2025, totaling 45. These participations include 7 congresses, conferences, symposia, sessions, and meetings at which oral or online reports and lectures, including plenary lectures, were delivered in Bulgaria – Sofia and Varna; Serbia – Belgrade, Niš, and Pirot; North Macedonia – Ohrid; Turkey – Antalya; Greece – Thessaloniki and Athens; Italy – Erice, Rimini, and Pisa; Slovenia – Ljubljana; Ireland – Dublin; China – Hangzhou; and Chile.

A list of 44 participations in national forums for the period 2009–2025 has also been presented. For the period 2020–2025, the participations are 12, mainly in conferences, seminars, and PhD forums in Sofia, Plovdiv, Stara Zagora, and Sandanski.

The form of participation is not specified; one plenary presentation is indicated.

Summary: The publications submitted for the competition cover the period 2019–2026. Publications in quartiles Q1 – 24 publications – and Q3 – 13 publications – predominate. The remaining publications are in Q2 – 6 publications – and Q4 – 8 publications. The publications from the two groups have a total IF of 148.662 and a total SJR of 30.810. No declarations of contribution have been signed among the co-authors. The works were published in 39 international journals, 6 of which are published in Bulgaria. The largest number of publications is in *Plants* – 7 publications. Two publications each were published in the journals *Diversity*, *Chemistry & Biodiversity*, *Biochemical Systematics and Ecology*, *Frontiers in Pharmacology*, *Phytomedicine*, and *Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromaticas*, while in the remaining journals there is one publication each.

The total number of points under indicators A (50), B (229), and G (782) accumulated by the candidate is 1061, which exceeds by more than 2.7 times the requirements of the law and the regulations (390) for these indicators. The wide variety of prestigious international editions shows that Dr. Aneva is an established specialist with a clearly defined profile and an affinity for the interdisciplinary approach in research. The use of different approaches in the study of a given object – ecological, molecular, ethnobotanical, etc. – usually produces high-quality and valuable results.

For the participations in national and international forums for 2020–2025, she receives 102 points.

Dr. Aneva is a member of 9 editorial boards, with 2 of the journals being indexed, which give her 45 points.

4. Main areas of the candidate's research work and the most important scientific contributions.

Dr. Aneva's research work includes elucidation of spatial patterns of biodiversity; the influence of anthropogenic factors on populations and ecosystems, agroecology, etc., but her works are focused *mainly on the study of medicinal plants* through the application of an interdisciplinary approach combining ecological, molecular, and phytochemical methods. Her research is highly relevant, as it considering the increased interest in medicinal plants due to the growing demand for nature-friendly approaches to human treatment. It matters also the scientifically proven broad-spectrum biological potential of these objects, and the increase in the average age of the human population on a global scale, which is associated with the increasingly frequent presence of a complex of diseases in patients. The richness of the Bulgarian flora, combined with long-standing traditions in its use, creates a prerequisite for conducting research with high-applied value. As the candidate points out, medicinal plants represent a unity of ecological, genetic, and chemical characteristics, connecting different levels of organization. The approaches used in these studies are ecological — distribution, ecological requirements, biodiversity, conservation significance, sustainable use and conservation; molecular — for taxonomically complex groups; phytochemical, ethnobotanical, and others.

Because of her professionalism, interdisciplinary approach, and teamwork, Dr. Aneva has achieved substantial contributions in her research works, 56 in total, generally relating to the Applied Ecology:

A. Group of contributions, related to the clarification of spatial patterns of biodiversity; the influence of anthropogenic factors on populations and ecosystems; distribution, cultivation, and conservation significance of medicinal plants — 17 publications: 1, 3, 4, 7, 8, 11, 12, 13, 14, 15, 16, 17, 25, 30, 32, 46, and 47;

B. Group of contributions, related to the study of biochemical and genetic diversity of medicinal plants as an element of biological diversity — 15 publications: 7, 9, 10, 19, 20, 28, 29, 36, 40, 41, 42, 44, 49, 52, and 56;

C. Group of contributions, related to the assessment of the functional and ecologically determined potential of medicinal plants and their secondary metabolites — 16 publications: 5, 6, 18, 21, 23, 24, 27, 31, 33, 34, 38, 43, 48, 50, 51, and 54;

D. Group of contributions, related to the study of the toxicological and ecological effects of natural and synthetic compounds on biological systems — 8 publications: 22, 26, 35, 37, 39, 45, 53, and 55.

The contributions may conditionally be divided into the following categories: scientific-applied contributions, A + B, or 32 contributions, and applied contributions, C + D, or 24 contributions — Annex 1.

5. Reflection of the candidate's scientific publications in the literature (citation rate).

Assoc. Prof. Dr. Aneva has submitted a list of 803 citations and a folder containing files of 649 citing publications. The information shows that 55.40% of her scientific output has been cited. The largest number of publications were cited in 2019 and 2020 – 15 and 14 publications, respectively, followed by 2021 and 2022 – 12 and 11 publications, while for 2023, 2024, and 2025 the numbers are 6, 3, and 1 publication, respectively.

The most cited publications are Nos. 34, 23, 40, 41, 47, 3, 66, 33, 10, 80, 7, 53, 37, 38, 42, 14, and 29, with 84, 44, 44, 43, 41, 40, 38, 37, 35, 30, 28, 24, 22, 18, 17 and two with 16 citations, respectively. Eight publications have between 15 and 10 citations; 23 publications have between 3 and 8 citations; and the remaining publications have 1 to 2 citations.

The scientific output has been cited by approximately 400 reputable journals, most of which are refereed and indexed in world-renowned databases. The journals with the highest number of citations are *Molecules*, *Plants*, *Frontiers in Pharmacology*, *International Journal of Molecular Sciences*, *Pharmaceuticals*, *Antioxidants*, *Chemistry & Biodiversity*, *Marine Drugs*, and *Journal of Ethnopharmacology*, with 39, 35, 16, 16, 13, 12, 11, 11, and 10 citations, respectively. Ten journals have between 8 and 6 citations, including *Agronomy*, *Sustainability*, *Biochemical Systematics and Ecology*, *Land, Life*, and others. Thirty-two journals have between 5 and 3 citations, including *Agriculture*, *Ecosystems & Environment*, *Applied Science*, *Biology*, *Food Bioscience*, *Biological Conservation*, *Environmental Science and Pollution Research*, and others. The remaining journals have 1 to 2 citations.

The citation analysis demonstrates that Dr. Aneva has established a scientific profile and authority within the international scientific community. Under indicator group D, the candidate has presented 1600 points from citations, which exceeds the required minimum of 120 points.

6. Participation in scientific and applied projects.

Assoc. Prof. Dr. Aneva has indicated her participation in a total of 48 projects, serving as leader of 14 and participant in 34.

For the competition, she has submitted participation in 15 *national scientific or educational projects*, of which 7 are for the period 2020–2025. As a whole, these projects refer to: a Management Plan (2015); a project under EMEPA (2013); a project under the “Natura Bulgaria Consortium” (2012); 4 projects under the National Scientific Programs: “Environmental Protection and Reduction of the Risk of Adverse Events and Natural Disasters” (2018/2023), “Healthy Foods for a Strong Bio economy and Quality of Life” (2018/2023), “Education with Science” (2019/2020), and “European Scientific Networks” (2023/2024), funded by the Ministry of Education and Science; and 6 projects under the National Science Fund: four projects for 2016/2019 and for 2017/2021, 2018/2022, and 2024/2028.

Dr. Aneva has been the *leader of 7 national scientific or educational projects, as 3 of them for the period 2020–2025*. As a whole, these projects refer to: a project under the National Science Fund (2017/2021), an environmental assessment (2021/2022), a project under the Recovery and Resilience Plan (2025/2026), a project under the National Scientific Program “Young Scientists” (2018), 2 projects under the “Program for Supporting Young Scientists” (2016 and 2017), and a

project under the “Science and Business scheme” (2013), funded by the Ministry of Education and Science. *All projects have been completed, with the exception of two, one of which she has led.*

The candidate *has participated* in 6 international scientific or educational projects, 5 of them for the period 2020–2025, under: Horizon Europe Framework Program (2012/2026), CA19128 (2020/2024), the National Science Fund (2016/2017 and 2023/2025), International Cooperation (2019/2021), and BG03 – Ministry of Environment and Water (2016/2017).

Dr. Aneva *is the leader of 3 international projects*: 3 under the Horizon Europe program (2022/2025, 2024/2026, and 2025/2026). *Some of the international projects have been completed, with the exception of 5, in 3 of which she is the leader. All the listed projects are applied.*

The total number of points from participation in and leadership of projects that she has indicated are 560, with a total of BGN 989,731 attracted from the projects in which she is the leader, corresponding to 198 points. *For 2020–2025, the total number of points for participation in and leadership of projects are 380, with attracted funding amounting to BGN 953,331, corresponding to 190.7 points.*

7. Teaching activity (supervisor/consultant of doctoral students, student training, etc.)

Assoc. Prof. Aneva has indicated that she has conducted 242 hours of practical classes at the University of Forestry, 150 hours of lectures at New Bulgarian University, and 8 hours of lectures at Aristotle University of Thessaloniki.

For the evaluated period, her teaching activity includes 6 practical courses at the University of Forestry, 5 lecture courses at New Bulgarian University, and 4 lectures at Aristotle University of Thessaloniki, amounting to a total of 63 points. She has been co-supervisor of 2 doctoral students, which gives her 50 points.

8. Assessment of the candidate’s personal contribution.

Most of the works in groups B and G are collective publications. In-group B, they have between 2 and 7 co-authors: 3 and 4 publications have between 2 and 5 co-authors; 2 publications each have 3 and 4 co-authors; and 1 publication each has 6 and 7 co-authors. The candidate is in first position in 7 publications; in second, third, and fifth position in 1 publication each, and in fourth position in 2 publications.

In group G, the publications have between 3 and 11 co-authors, and one publication has 35 co-authors: 8 publications have 4 co-authors; 6 publications have 7 co-authors; 5 publications each have 5 and 8 co-authors; 4 publications have 6 co-authors; 3 publications each have 3, 10, and 11 co-authors; and 2 publications have 9 co-authors. *Overall, the candidate is in first, second, or third position in 40.4% of her works. In 10 publications, Dr. Aneva is a leading author, being in first or second position.*

Assoc. Prof. Aneva’s personal IF is 22.141, and her personal SJR is 4.596.

In 26 of the international and 5 of the national participations in forums, she is in first or second position, corresponding to 57.8% and 41.7% of her personal participation, respectively.

9. Critical remarks and recommendations.

Technical remarks: 1. The publications are not arranged by year in the list, but by quartiles and years, and in some places the sequence is disrupted. A publication from 2019 is included in-group C. Did it participate in the competition for Associate Professor? 2. In the list of international forums, the venue of No. 88 is not indicated. The type of participation in the forums is not specified. Are all of them reports and lectures? 3. Some citing sources are not indicated correctly; for example, in citation No. 464, the source is not specified. It would be advisable to indicate the

indexing of the citing journals in order to provide a more complete assessment of the citation rate; 4. Projects from before the period 2020–2025 are included in the evaluation. The projects are not indicated correctly; in some places, years and funding organizations are missing. For project No. 14, supporting evidence is missing.

Recommendations: At the present stage of the science development, the interdisciplinary approach in research, as well as teamwork and publishing in co-authorship, is not only inevitable but also advisable and prestigious, and is a guarantee of quality. Nevertheless, I recommend that Dr. Aneva to publish an independent work in which to summarize some of the results obtained and presents her views on the development of these research areas.

10. Personal impressions - I have known Dr. Aneva from the Faculty of Biology, from her participation in the Seminar of Ecology at IBER–BAS, and from her participation in committees for career development.

11. Overall assessment

Dr. Aneva's points by indicators are as follows: A – 50, B – 229, G – 782, D – 1600, E – 620.7, and Additional Indicators of the Forest Research Institute – 210 points. The total number of points is 3491.7.

Under indicators B, G, D, and E, she exceeds the minimum requirements by 2.3, 3.3, 13.3, and 4.1 times, respectively.

12. Conclusion

In view of the analysis of the scientific output and activities, as well as the assessments made, I propose that Assoc. Prof. Dr. Ina Yosifova Aneva be elected to the academic position of "Professor" in professional field 4.3. Biological Sciences, scientific specialty "Ecology and Ecosystem Protection".

Date: 15.06.2026

Reviewer:

Annex 1.

Summary of the Contributions of Assoc. Prof. Dr. Ina Yosifova Aneva

Scientific-applied contributions

A. Group of contributions related to: the clarification of spatial patterns of biodiversity; the impact of anthropogenic factors on populations and ecosystems; distribution, cultivation and conservation significance of medicinal plants – 17 publications: 1, 3, 4, 7, 8, 11, 12, 13, 14, 15, 16, 17, 25, 30, 32, 46, and 47

1. The effectiveness of elements of green and blue infrastructure as a tool for maintaining biodiversity in agricultural ecosystems was studied through an analysis of 115 sample plots in different agricultural landscapes across Europe (No. 17).
2. Through a study of the biodiversity of agroecosystems in two contrasting regions, it was established that it depends on land-use type, as well as climatic and ecological factors, with the leading factors differing between the two regions (No. 1).
3. Analyses of grassland communities in different parts of the country, covering 36 sample plots and different habitat affiliations (8), demonstrated that species richness is closely related to soil characteristics and geological substrate. The highest biodiversity values were found in sub-Mediterranean and sub-Pannonian steppe grassland communities, associated with limestone substrate and specific soil conditions, while the lowest values were found on chernozems developed on loess (No. 8).
4. The studies on changes in land use and land cover conducted in Kurram Valley, northwestern Pakistan, in Khyber Pakhtunkhwa Province, revealed clearly expressed dynamics in the landscape structure over a 27-year period (No. 47). **Perspective:** the role of land use in the state of ecosystems and the need to apply sustainable management practices for the conservation of biodiversity and ecosystem services.
5. A comparative analysis was made of the practices for control and quality assessment of forest reproductive material in 23 European countries, highlighting the need to harmonize methods for the sustainable management of forest ecosystems (No. 32).
6. A quantitative ethnobotanical study was conducted on the use of medicinal plants, covering 85 species documented through data from 115 informants. Indices such as use value, up to 0.47, and relative frequency of citation, up to 47.82, were applied to assess the significance of the species (No. 46). This is important for the conservation of plant diversity and for guiding future pharmacological studies.
7. Conclusions were drawn regarding the contemporary use of medicinal plants, based on data from 92 informants and 29 settlements. The study documents the use of 114 plant species from 52 families in relation to their conservation and reproduction (No. 4).
8. Review studies were conducted on the genus *Tilia* L. in Bulgaria, concerning genetic resources, distribution, and status, based on information from forest management plans (No. 11).
9. Studies were carried out on the role of pollinators and the reproduction of medicinal plant resources (No. 14).
10. A comprehensive assessment of the reproductive potential of *Primula veris* L. was performed through embryological, population, and genetic analyses (No. 25).
11. A resource assessment of *Adonis vernalis* L., Ranunculaceae, was carried out through an analysis of natural localities in the Western Stara Planina Mountains (No. 16).
12. A relationship was established between the traditional use of species of the genus *Gentiana* L., their biological activity, and declining populations. Proposed solution: cultivation and micropropagation (No. 30).

13. A contribution was made to the cultivation of representatives of the genus *Thymus* L., taxa with an established phytochemical profile, through an approach linking taxonomy, phytochemistry, and sustainable standardized use (No. 7).
14. Studies were conducted on the population status and conservation status of *Rhodiola rosea* L., Crassulaceae, from six localities in Rila (No. 12).
15. A new natural locality of the endangered species *Inula spiraefolia* L., Asteraceae, was established, and its habitat was characterized (No. 13).
16. *Malus florentina* (Zuccagni) C.K. Schneid., Rosaceae, was established as a new species for the flora of the country, and its habitat was characterized. Its communities were assigned to the alliance *Quercetalia pubescentis*. In the Red Data Book, the species is listed as extinct. It is considered that its occurrence is the result of a natural process of eastward range expansion on the Balkan Peninsula (No. 15).
17. *Sideritis elica* Aneva, Zhelev and Bonchev, Lamiaceae, was described as a species new to science in Bulgaria through morphological and morphometric analysis, cluster and principal component analysis, and molecular-genetic studies. The species is a narrow endemic. Its habitat was also characterized (No. 3).

B. Group of contributions related to: the study of the biochemical and genetic diversity of medicinal plants as an element of biological diversity – 15 publications: 7, 9, 10, 19, 20, 28, 29, 36, 40, 41, 42, 44, 49, 52, and 56.

1. A combined NMR–HPLC analytical platform was developed for phytochemical profiling and differentiation of species of the genus *Rhodiola* L., through which the species-specific marker crenulatin, characteristic of *R. crenulata* (Hook.f. & Thomson) H. Ohba, was identified and shown to be applicable for detecting admixtures in products from *R. rosea* L. (No. 19).
2. New data were presented on the chemical composition of essential oils and extracts from Bulgarian and Balkan taxa of the genus *Thymus* L., Lamiaceae. New chemotypes were described for *T. atticus*, *T. leucotrichus*, and *T. striatus*. The chemical composition of the essential oil of the Balkan endemic *T. perinicus* Jalas, 1974, was described for the first time, and two groups were identified according to chemical composition (Nos. 7 and 9).
3. An analysis was carried out of the genetic diversity and composition of volatile compounds from the flowers of two spatially separated populations of *Hyssopus officinalis* L., Lamiaceae. The results demonstrated a high level of polymorphism and a low degree of genetic differentiation between the populations, as well as the presence of clearly distinguishable chemotypes dominated by different biochemical components, i.e. the presence of significant chemical differentiation in genetically similar populations (No. 10).
4. Significant interspecific differences were established in the metabolic profile and biological activity of *Asphodelus albus* Mill. and *A. aestivus* Mill., Asphodelaceae. Using UHPLC/Orbitrap MS, flavonoids, anthraquinones, and phenolic acids were identified, as well as the compounds aloin A, aloin B, and aloesin, reported for the genus for the first time. The extracts showed pronounced antioxidant and enzyme-inhibitory activity (No. 20).
5. A relationship was demonstrated between evolutionary differentiation in species of the genus *Hypericum* L. and their ability to produce hypericin. It was established that the more evolutionarily differentiated taxa exhibit higher metabolic activity associated with changes in endogenous phytohormones (No. 28).
6. Spatial variability was demonstrated in the metabolic profiles and alkanin content of populations of *Alkanna tinctoria* (L.) Tausch., combined with low genetic diversification, $He = 0.220–0.298$,

- and a stable genome size. This highlights the vulnerability of the species and its importance as a genetic resource (No. 29).
7. Chlorogenic acid and isomeric dicaffeoylquinic acids were identified and quantified in six species of the genus *Inula* L., and significant interspecific variability was established in the composition and ratio of the individual compounds (No. 36). The obtained results expand the knowledge of the phytochemical diversity of the genus and emphasize the importance of secondary metabolites as a functional component of biological diversity.
 8. The composition of volatile compounds in four species of the genus *Inula* L. was analyzed by GC-FID/MS, with 141 components identified and clearly expressed interspecific variability in the chemical profiles established (No. 40). The obtained results contribute to the clarification of chemotaxonomic relationships and confirm the high degree of phytochemical diversity within the genus.
 9. Metabolic profiling of natural populations of *Nectaroscordum siculum* ssp. *bulgaricum* (Janka) Stearn. was performed using GC-MS analysis, identifying 52 primary and secondary metabolites, including amino acids, carbohydrates, organic acids, and phenolic acids (No. 41). The obtained results demonstrate the importance of metabolic variability as an indicator of adaptation and as a basis for assessing the genetic resources of the species.
 10. A new ent-kaurane diterpene was isolated and structurally characterized from the aerial parts of *Inula bifrons* (L.) L., together with a number of known compounds reported for the species for the first time (No. 42), thereby expanding knowledge of the chemical profile of the genus.
 11. The composition of terpene compounds in four species of the genus *Inula* L. was studied, with 33 terpenoids identified, including triterpenoids, diterpenoids, and sesquiterpene lactones (No. 44). Significant differences were established between the species, related to the presence or absence of certain groups of compounds, some of which were described for the first time for the respective taxa. A relationship between the chemical profile and taxonomic affiliation was demonstrated, emphasizing the importance of terpene compounds as chemotaxonomic markers.
 12. The variability in the content of phenolic compounds and the antioxidant activity of *Inula britannica* L., Asteraceae, from 11 natural localities in Bulgaria was studied, and significant spatial differentiation associated with habitat conditions was established (No. 52). It was demonstrated that the main components in the extracts are chlorogenic acid and various isomers of dicaffeoylquinic acid. The grouping of populations according to their chemical profile was also demonstrated.
 13. The phytochemical composition of three species of the genus *Carlina* L., Asteraceae — *C. vulgaris*, *C. acanthifolia*, and *C. corymbosa* — was studied, revealing the presence of diverse groups of secondary metabolites, including phenolic acids, flavonoids, triterpenes, and specific compounds such as carlina oxide, as well as a significant content of fructans and inulin (No. 49). The highest concentrations of biologically active compounds were recorded in the roots, emphasizing their role as the main reservoir of metabolic diversity. A relationship between polyphenol content and antioxidant activity was demonstrated.
 14. The phytochemical profile of natural populations of *Arctostaphylos uva-ursi* (L.) Spreng. from different mountain regions in Bulgaria was studied, with GC-MS analysis identifying major groups of bioactive compounds, including phenolic acids, flavonoids, and triterpenes (No. 56). Quantitative differences were established in the content of key components such as arbutin, gallic acid, and catechin among the individual populations, with the highest values recorded in high-mountain localities.

Applied contributions

C. Group of contributions related to: the assessment of functional and ecologically determined potential of medicinal plants and their secondary metabolites – 16 publications: 5, 6, 18, 21, 23, 24, 27, 31, 33, 34, 38, 43, 48, 50, 51, and 54

1. Analyses based on ethnobotanical indices were carried out regarding the application of plants for various diseases, most commonly those affecting the nervous, respiratory, digestive, and cardiovascular systems (No. 5).
2. Ethnopharmacological data on the genus *Thymus* L., Lamiaceae, were synthesized for a period of more than a century, including 533 documented records of use, showing similarities in therapeutic applications across different Balkan countries. Certain taxonomic inconsistencies were identified. The information is important for guiding future research (No. 6).
3. The main groups of medicinal plants and phytochemical compounds affecting pulmonary hypertension were identified through six key mechanisms: antioxidant, anti-inflammatory, vasodilatory, antiproliferative, antiremodelling, and proapoptotic. Their potential for more effective influence on the disease compared with conventional therapies was substantiated (No. 18).
4. Through a systematic review and meta-analysis of randomized clinical trials, the effect of *Cynara scolymus* L., Asteraceae, on major anthropometric indicators was assessed. A moderate and statistically limited effect on body weight and body mass index was established, with a more pronounced influence in specific patient groups (No. 21), relevant to the prevention of metabolic disorders.
5. A randomized clinical trial showed that the combined application of an extract from the leaves of *Cynara scolymus* L. with conventional therapy, metformin and vitamin E, leads to significant improvement of liver function and reduction of fatty infiltration in patients with non-alcoholic fatty liver disease (No. 24).
6. Data on the effects of *Tribulus terrestris* L., Zygophyllaceae, on the female reproductive system were systematized. Its secondary metabolites, mainly steroidal saponins, including protodioscin, modulate hormonal balance, improve ovarian function, and show potential in polycystic ovary syndrome, menopausal syndrome, and hormone-dependent neoplasia (No. 23).
7. It was demonstrated that the intake of *Punica granatum* L., Lythraceae, leads to a statistically significant increase in antioxidant enzymes, GPX and TAC, and a reduction in lipid peroxidation, TBARS, which substantiates its role in the regulation of oxidative stress (No. 27).
8. The biological potential of essential oils and exudates from *Artemisia santonicum* L. and *A. lerchiana* Web. was assessed, and strong phytotoxic activity, over 90% inhibition of germination, as well as substantial acetylcholinesterase inhibition were established. This substantiates their role as natural protective compounds with potential application as biopesticides (No. 31).
9. Data on the therapeutic potential of phytochemical compounds in allergic asthma were systematized, showing that they suppress inflammatory processes through inhibition of key cytokines, IL-4, IL-5, and IL-13, reduction of IgE, and modulation of the immune response (No. 33). The main molecular mechanisms were analyzed, including the involvement of signalling pathways such as NF- κ B, MAPK, and JAK/STAT, as well as the role of antioxidant protection through ROS regulation. The multitarget effect of phytochemicals on the pathogenesis of the disease was substantiated, emphasizing their importance as a complementary therapeutic resource.
10. The mechanisms of action of phytochemical compounds in allergic rhinitis were summarized, including suppression of inflammatory mediators and key signalling pathways, MAPK/NF- κ B, TLR4/MyD88, and JAK/STAT, as well as reduction of oxidative stress, which substantiates their multitarget therapeutic potential (No. 34).
11. Ethnopharmacological and phytochemical data on species of the genus *Gentiana* L. were systematized, and through in silico analysis the potential of flavonoid glycosides to interact with receptors associated with visceral pain, P2X3 and TRPV1, was identified (No. 38). A relationship

- between traditional use and molecular mechanisms of action was demonstrated, substantiating the analgesic potential of the compounds.
12. Through a systematic review and meta-analysis, the therapeutic potential of resveratrol in respiratory diseases was assessed, demonstrating its anti-inflammatory and antioxidant action through modulation of key mediators such as TNF- α and NF- κ B (No. 43). It was established that the compound may suppress inflammatory processes and the cytokine response, including in conditions associated with viral infections and acute respiratory distress syndrome.
 13. A comprehensive study was conducted on the chemical composition and biological activity of the endemic Balkan species *Angelica pancicii* Vandas, Apiaceae, in which GC-FID/MS and HPLC analyses revealed substantial differences in the metabolic profile of the different plant organs (No. 48). Major groups of compounds were identified, including mono- and sesquiterpenoids and furanocoumarins, some of which were quantified and linked to the observed biological effects. It was demonstrated that the extracts and essential oils exhibit significant antioxidant activity and an inhibitory effect on acetylcholinesterase, up to over 80%, as well as weaker but measurable α -amylase inhibition, substantiating the potential of the species as a source of bioactive compounds with possible application in metabolic and neurodegenerative disorders.
 14. The therapeutic potential of a hydromethanolic extract of *Fraxinus excelsior* L., Oleaceae, was studied in an experimental model of rheumatoid arthritis, in which a significant reduction of inflammation, oxidative stress, and tissue damage was established (No. 50). It was demonstrated that the extract affects key biochemical indicators, including reduction of malondialdehyde, MDA, increase of glutathione, GSH, and suppression of the activity of metalloproteinases, MMP-2 and MMP-9, which is associated with protection of articular cartilage and reduction of the inflammatory process. Histological and behavioural analyses confirmed these results, showing significant improvement in tissue structure and reduction of pain sensitivity.
 15. The alkaloid profile of three species of the genus *Corydalis* DC., Papaveraceae, was studied, and thirteen isoquinoline alkaloids belonging to different structural groups, including protopines, aporphines, and protoberberines, were identified by GC-MS analysis (No. 51). It was established that extracts from the aerial parts exhibit significant acetylcholinesterase inhibitory activity; IC₅₀ around 0.36 mg/mL, comparable to that of the reference compound galantamine.
 16. The role of the mTOR signalling pathway in viral infections, including COVID-19, was systematized, with analysis of its importance for the regulation of cell growth, immune response, and inflammatory processes (No. 54). It was shown that inhibition of mTOR may affect viral replication and the cytokine response through modulation of key inflammatory mediators and immune cells, revealing potential for therapeutic application. The possibility of using mTOR inhibitors as a complementary strategy in the treatment of viral infections associated with a pronounced inflammatory response was substantiated.

D. Group of contributions related to the study of toxicological and ecological effects of natural and synthetic compounds on biological systems – 8 publications: 22, 26, 35, 37, 39, 45, 53, and 55

1. Data on the mechanism of action of natural compounds and RNK interference in coronavirus infections were systematized, showing that they can inhibit key viral genes and proteins, including 3CLpro, PLpro, and the spike protein, as well as modulate the host immune response (No. 22).
2. The mechanisms of action and toxicity of avermectins were summarized, demonstrating their complex impact on the physiological systems of animals and on ecosystems through bioaccumulation, ecotoxicity, and the risk of resistance development (No. 26).
3. The phytotoxic activity of extracts, exudates, and essential oils from 13 plant species was assessed through a bioassay for inhibition of germination in model weed species. It was established that essential oils exhibited the strongest inhibitory effect (No. 35). Complete or almost complete suppression of germination was demonstrated in species such as *Lolium perenne* L. following the application of oils from *Origanum vulgare* subsp. *hirtum* (Link) A. Terracc and *Thymus moesiacus*

Velen., associated with the presence of bioactive compounds such as carvacrol, citral, and α -terpinyl acetate. The obtained results substantiate the role of secondary metabolites as an ecological factor in allelopathic interactions and as a potential source of natural herbicides.

4. The herbicidal potential of essential oils from representatives of the families Lamiaceae and Asteraceae was assessed through in vitro and in vivo experiments, establishing strong inhibition of germination with IC_{50} values in the range of 0.52–3.0 $\mu\text{L}/\text{mL}$ (No. 37). It was demonstrated that oils rich in carvacrol cause complete suppression of germination and, under field conditions, lead to a 77% reduction in plant biomass. The possibility of prolonging the effect through the use of a superabsorbent was shown, emphasizing the applicability of plant metabolites as environmentally safe bioherbicides.
5. Data on the toxicity of medicinal plants and related cases of poisoning in humans were systematized, and a classification of toxic effects by organs and mechanisms of action was performed (No. 39). It was shown that a number of plant compounds can cause hepatotoxicity, nephrotoxicity, cardiotoxicity, and neurotoxicity, including through interactions with physiological and biochemical processes. The need for control and scientifically grounded use of medicinal plants was emphasized as a condition for their safe and sustainable application.
6. The risks of combined application of natural products and medicinal products in COVID-19 were analyzed, showing that a number of phytochemical compounds can induce QT-interval prolongation through interaction with hERG channels (No. 45). Data on the cardiotoxic effects of plant extracts and secondary metabolites were systematized, including the potential for arrhythmias during combined therapy. The need for critical assessment of safety and drug interactions when using natural products as complementary agents was emphasized.
7. The biocidal activity of essential oil from *Origanum vulgare* subsp. *hirtum* (Link) A. Terracc. was assessed, establishing a strongly pronounced phytotoxic and insecticidal effect on target plant species and pests (No. 53). Complete inhibition of seed germination at concentrations of 2 $\mu\text{L}/\text{mL}$ was demonstrated, as well as high mortality of aphids (*Myzus persicae*) at 3 $\mu\text{L}/\text{mL}$, correlating with the high carvacrol content, over 80%, in the composition of the oil. The obtained results show that the secondary metabolites of the species play an essential role in interspecific interactions and represent a promising resource for the development of environmentally safe biopesticides.
8. Data on the acetylcholinesterase-inhibitory activity of plant extracts and essential oils as a mechanism of insecticidal action were systematized, establishing that a number of species from the families Lamiaceae, Asteraceae, and Amaryllidaceae exhibit high biological activity (No. 55). It was shown that compounds such as carvacrol and galantamine are among the main active components determining the inhibitory effect on the enzyme and, respectively, toxicity toward insects. The obtained results substantiate the potential of plant secondary metabolites as an alternative to synthetic insecticides and emphasize their role in ecologically oriented pest control strategies.