Вх. № 1053/НО-05-06/ 18.11.2024 г.

REVIEW

from

Prof. Dr. Diana Peneva Zlatanova, Faculty of Biology, Department of Zoology and Anthropology/Sofia University "St. Kliment Ohridski"

of the materials submitted for the **competition for the academic position of Associate Professor** at the Institute of Biodiversity and Ecosystem Research (IBER), Bulgarian Academy of Sciences (BAS);

in a field of higher education 4. “Natural Sciences, Mathematics and Informatics”; Professional field 4.3. “Biological Sciences”, Scientific specialty: “Zoology”;

under the competition for "Associate Professor", announced in the State Gazette No. 66/06.08.2024, with the **only candidate Chief Assistant Professor Dr. Heliana Irji Dundarova**

1. General presentation of the materials received

By Order No. 64/04.10.2024 of the Director of the Institute of Biodiversity and Ecosystem Research, BAS I have been appointed as a member of the scientific jury of the competition for the academic position of **“Associate Professor”** at the Section "Community Ecology and Conservation Biology" of the Department "Ecosystem Research, Ecological Risk and Conservation Biology" of the IBER/BAS. In this regard, I received a set of documents on electronic media which are the subject of evaluation in this review. The set of electronic materials submitted by Dr. Dundarova in its entirety, as well as a reference to the minimum requirements under Article 24 of the Law for the Development of Academic Staff in the Republic of Bulgaria (LADAB) for the scientific field 4.3. Biological sciences show that the participant in the competition meets the conditions of the minimum national requirements for holding the relevant academic position of Associate Professor under the LADAB and Article 53 of its Implementing Rules. The minimum requirements of the Regulations on the Conditions and Procedure for the Acquisition of Scientific Degrees and for the Holding of Academic Positions at the Bulgarian Academy of Sciences and the Regulations on the Conditions and Procedure for the Acquisition of Scientific Degrees and for the Holding of Academic Positions at IBEI-BAS are also met.

2. General data on the applicant's career and thematic development

Chief Assistant Professor Dr. Heliana Irji Dundarova was born on 09.10.1984. From 2003 to 2007 she studied at the Faculty of Biology, Sofia University. She graduated as Bachelor of Biology. In 2008 he continued with a Master's degree at the Department of Zoology, Faculty of Natural Sciences, Charles University in Prague, Czech Republic. In 2011 she received her Master's degree with a thesis entitled: "Phylogeography of *Rousettus aegyptiacus* in the Mediterranean area". This shows that even as a Master's student Dr. Dundarova focused on the study of bats, which later became her main

research field. In 2013, she was enrolled as a PhD student at the IBER/BAS and in 2018 she defended her PhD thesis, again related to bats, on "Molecular phylogeny of the morpho-group: *Myotis mystacinus* (Chiroptera: Vespertilionidae) in the Balkan Peninsula". Since 02.04.2012 till now (with more than 11 years of work experience in the specialty) she has been working at the IBER/BAS, at first as a biologist in the section of Community Ecology and Conservation Biology/Conservation Biology Research Group, and after defending her PhD thesis - as a Chief assistant professor. The main activities of Dr. Dundarova's work in this scientific organization are related to the study of bat-associated species in the Palearctic using molecular methods.

Since her student years, Heliana Dundarova has participated in numerous national and international projects and expeditions. As a student during her Master's degree she participated in.) Winter monitoring of bats and control of *Pseudogymnoascus destructans* infestation levels by sampling cave walls and bat fur in the Bohemian Karst area, Czech Republic (2011) and 2). Radio-tracking *of M. mystacinus, M. alcathoe* and *M. brandtii* and determination of shelter parameters using heat sensitive transmitters (2011). Later after completion also participated in 1). Winter monitoring of bats in the Moran Mountains, Slovakia (2012); 2). Monitoring of bats and their habitats in Bulgaria under the project "Mapping and determination of the conservation status of habitats and species in Natura 2000" - Lot 5 (Bats) (2012); 3). Project BG051PO001-3.3.05-0001 "Science and Business" and grant for molecular analysis of tissue samples of bats belonging to the group of "Moustache noctuidae" at the Natural History Museum, Berlin, Germany - (2014 -2015). 4). Project "Enhancing sustainability in the conservation of bat fauna in the cross-border area Bulgaria - Greece", funded by INTERREG V-A "Greece-Bulgaria 2014-2020".

She has also been the project leader of several projects: 1). The 2018-2019 Rufford-funded project "Update of data on the status of summer and winter colonies in southwestern Kyrgyzstan"; 2). Project KP-06-H31/14 dated 11.12.2019 to "Scientific Research Fund" on "The role of cave-dwelling bat species in Bulgaria as vectors and reservoir of European rabies viruses"; 3). Project "Conservation of cave-dwelling bat species in Southern Kazakhstan" funded by Rufford in 2022-2023; 4). Ongoing project from 2023 to present "Study of lyssavirus load in cave-dwelling bat species in Vietnam and Bulgaria"; 5). Ongoing project from 2023 to present "Investigation of the role of *Miniopterus schreibersii* (Long- winged bat) as an "umbrella species" for establishing zoonotic potential in cave-dwelling bat species in Bulgaria" - KP-06-H71/5 dated 6.12.2023 of "Scientific Research Fund". Dr. Dundarova has participated as an expert on bats in a number of national and international speleological expeditions in Bulgaria, Albania, Kosovo, Iran, Laos and China, as well as organized scientific seminars and field work related to molecular methods in zoology, white-nose syndrome in bats, ecology and behavior of bats in hibernation, blood sampling of target bat species, etc.

All this shows that the candidate has a systematic and consistent development in scientific circles,

which leads to her logical growth.

Characteristics of the overall scientific activity of Asst. Heliana Dundarova

According to the attached files 5_Report of Compliance, 6_List of Scientific Papers and 9_Copies of Scientific Papers, the candidate presents a total of **27 scientific papers**, of which **six** on Indicator C with the equivalent of a habilitation thesis and **13** on Indicator D outside the habilitation thesis. Additionally, four scientific publications are presented in publications that are not refereed and indexed in world-known scientific databases and four on the basis of which a dissertation was defended. Of these, **22 papers (76%)** are in publications that have been refereed and indexed in world-renowned scientific databases (Web of Science and/or Scopus). In **14 publications (48%),** the candidate is the first (11) or second (3) author, which indicates Heliana's serious scientific involvement in the preparation of these scientific works.

Discrepancies are found in the part of Indicator D of the information submitted in files 5_Compliance Report and 6_List of Scientific Works. According to the 5_Report of compliance, a total of 13 papers were originally submitted in the table under Indicator D - five with Q1, two with Q2, two with Q3, two with Q4 and two with publication in a SJR publication without IF (in *Proceedings of the Zoological Society* and *Ecologica Montenegrina)*. In File 6_List of scientific papers *Proceedings of the Zoological Society* is listed as Q3 and *Ecologica Montenegrina* as a source without Q. When checked in Scopus, these *two sources* in the year of publication (2023) were Q3 - the first with 33 and the second with 44 percentile. Another work without Q with SJR but without Q is not listed in file 6_List of scientific works. A Scopus search of all submitted papers by journal in the years of publication did not find any papers without Q but with SJR. Additionally, the referenced *in press* publication "Cave- Dwelling Bats as a potential reservoir of European Lyssaviruses in Bulgaria" appeared in the June issue of this year's *Acta Zoologica Bulgarica*, implying that the submitted documentation lacks information on booklet, number and pages in the reference. If the scientific work is *in press,* it should not have been submitted for the competition, only published works can be judged. Additionally, not all papers are indicated according to which of the two sources (Web of Science or Scopus) Q and SJR is submitted (e.g., the first, eighth, 11 - 13 papers in indicator D). This makes it difficult to assess the final score for this indicator. One more error leads to confusion - in the file 5_Report of compliance, after the main table, publications without Q are mistakenly included in Indicator D, but with a numbering, from which onwards there is more confusion in the contribution report, as this numbering is probably used there.

Thus, the overall distribution of research papers by quartiles for indicators C and D is as follows: eight papers in Q1, four papers in Q2, four papers in Q3 and three papers in Q4. This shows that **most of the half of the candidate's scientific output** (63% of the submitted papers and 52% of the total papers) **is in high-ranking journals** (Q1 and Q2). The works submitted to the competition were

published in 15 different journals, with the highest number of publications in *Acta Zoologica Bulgarica* (3), *Acta Veterinaria Brno (*2) and *Animals* (2). According to Dr. Dundarova's profiles in Scopus and Web of Science**, she has an h-index of 5, with 86 (87 according to WoS) citations of her work to date**, which is more than the number listed in the attached documents.

In addition to excellent scientific production with a large number of publications in high-ranking journals, the candidate has demonstrated active participation in scientific forums (10 international forums and one national forum), numerous project activities and specialized training. This shows the overall accomplishment of Heliana Dundarova as a clearly visible scientist in the international space.

3. Main directions in the research work of the candidate and the most important scientific contributions in each of them

In his creative development, Chief assistant professor Heliana Dundarova has a narrow scientific profile related to the study of bats - their distribution, biology and ecology, complemented with molecular studies. A relatively small number of her other studies mentioned below are complementary to the molecular analyses she has used in the study of bats.

Dr. Dundarova's research on bats is in two directions: 1. Distribution, ecology, taxonomy and phylogeography of the main cave-dwelling species of bats; 2. Research on the health status of bats and their role as a reservoir for zoonoses. This close profiling has enabled the candidate to delve deeply into a very important and relevant topic, especially after the COVID-19 pandemic, namely the potential of bats as a vector of important viral and other pathogens of relevance including to humans. To this end, research has been conducted not only in Bulgaria but also in various other understudied areas such as central Asia, for example. In detail, Heliana's work in the habilitation thesis (Indicator C) and beyond (Indicator D) in can be summarized in the **following most important contributions in the** areas mentioned by the candidate:

I. Distribution, ecology, taxonomy and phylogeography of cave-dwelling bats:

- Taxonomic studies of bats in southern Kazakhstan and their ectoparasites

A specific ectoparasite of *Spinturnix otonycterisi* (Acari: Spinturnicidae) on the poorly studied and with unknown population trends Turkestan long-eared bat (*Otonycteris leucophaea*. (Indicator **C**, paper **3**) was collected and described for a first time.

- Underground habitats as a key conservation unit for vulnerable bat colonies in southwestern Kyrgyzstan.

The Cave Vulnerability Index was used to assess the role of subterranean habitats in the conservation of vulnerable bat colonies in southwestern Kyrgyzstan, with two caves containing some of the most abundant summer colonies of *Myotis blythii* in Eurasia (Indicator **C**, Article **5**). *I have **erroneously** referenced here Indicator D, **article 14, which** does not exist as a numbering in 6_List of scientific papers and copies of scientific papers.*

– Ecology and taxonomy of bats in the alpine zone of Pirin Mountain.

By recording ultrasound signals, the diversity of bats in the alpine zone of Pirin was analyzed, and 20 species were found. One of the studied caves turned out to be among the caves in Europe with the highest number of bat species at such a high altitude (indicator **C**, article **1**). As above, a *reference am **erroneously** given here is Indicator D, **Article 15,** which does not exist as a numbering in 6_List of scientific papers and copies of scientific papers.*

– Phylogeography of bat species-twins

An analysis for putative sympatry of two bat species - twins of the *Myotis mystacinus* morpho-group - *M. mystacinus* and *M. davidii* was conducted. They were found to have evolved into allopatry and secondary contact during their range expansion after the last glacial period. The role of native (*M. mystacinus*) and dispersal-influenced (*M. davidii)* populations has been established, resulting in mitochondrial replacement in the native species (Indicator **C**, paper **6**).

– Bats along the coast and Bulgarian Black Sea water area

An analysis of the presence and distribution of bats in the Bulgarian exclusive economic zone of the Black Sea has been made, with one species (*Pipistrellus nathusii*) found 100 km from the coast. An important result of the findings of this study is the identification of the need to organise long-term acoustic monitoring to determine the migratory movements of bats along the Bulgarian Black Sea coast and in the open sea using ships and platforms (Indicator **D**, Article **3**). *Here **again,** the reference in the Contributions Report **erroneously refers to Article 12** of Indicator D, which is devoted to a comparison of available cryoprotectors for sperm storage of wild deer species*

II. Studies on the health status of bats their role as a reservoir for zoonoses:

– Role of cave-dwelling bat species as vector and reservoir of European rabies viruses (lyssaviruses)

Here, **three papers** present different aspects of the role of cave-dwelling bats in the spread of lyssaviruses:

1). Interspecies transmission of pathogens between continents is examined in species of the families Rhinolophidae and Pteropodidae due to their close phylogenetic relationship and overlapping distribution in the southeastern Palearctic zone bordering the Ethiopian zoogeographic region (Indicator **C**, paper **2**);

2). The summer active season has been found to be better suited for more effective detection of lyssavirus load in bats due to a number of factors, such as increased immune functions during movement, variation in colony size in contact, species diversity and interspecific contacts of bats, and others that increase the chances of detecting seropositive animals in which lyssaviruses are circulating (Indicator **C**, paper **4**);

3). Antibodies to rabies have been detected in populations of cave-dwelling bat species in

Bulgaria, indicating that casual contact with bats in underground roosts should be considered a potential risk of rabies infection for tourists, bat researchers, wildlife rehabilitators and cavers (Indicator **D**, Article **11**).

– Analysis of the health status of bats using the abundance and diversity of their ectoparasites in Bulgaria and Southern Kazakhstan.

Ectoparasites (ticks, flies and fleas) in bats in Bulgaria were studied (Indicator **D**, Article **1**), and no significant difference in parasite load or diversity was found between the four most common bat species (*Rhinolophus ferrumequinum*, *Myotis myotis, M. blythii* and *Miniopterus schreibersii*). It was found that although caves in Bulgaria are used year-round by a number of bat species, parasite load and diversity remain low during hibernation and migration periods. In southern Kazakhstan, two new species of ectoparasites on bats have been identified for the country, due to still poor research (Indicator **D**, Article **8**).

– Pathogens

The possible impact of trypanosome parasites on the health status of *Myotis myotis* bats in Bulgaria, Poland and the Czech Republic was assessed by haematological and biochemical analyses, and two trypanosome species with a significantly higher prevalence in the Czech Republic compared to the other two countries were found (Indicator D, Article 4). To assess the geographic distribution of the white- nose syndrome caused by the fungus *Pseudogymnoascus destructans*, the distribution of temperature gradients in the Palearctic was analysed as a *proxy* of bat body temperature, which is most important for the development of the pathogenic agent on hibernating bats (Indicator **D**, paper **5**).

– 3. Cell cultures

A laboratory assay was performed under controlled conditions to simulate the functioning of macrophages extracted from *Myotis myotis* to reproduce the conditions of the organism in hibernation. It was found that although the overall performance of macrophages was suppressed at lower temperatures, these immune cells were still able to function normally (Indicator D, paper 2). Again under laboratory conditions, an experiment was performed with bat kidney cells, liver cells, peritoneal macrophages, and olfactory nerve cells to monitor the role of glycation as a cryoprotector for survival at freezing temperatures. Extrapolation of the results from the cell-based studies to the organism level shows that higher levels of glycose in important tissues can significantly improve survival during the period of hibernation at extremely cold temperatures (Indicator **D**, paper **9**).

III. Other studies

Other studies presented in the competition papers include molecular and phylogenetic analyses of:

– viruses on pollen in the Balkan region (indicator D, article 6);
– mitochondrial diversity, phylogenetic relationships and genetic diversity in the subpopulation

structure of Bulgarian mountain sheep breeds based on genotyping of microsatellite markers (Indicator **D**, papers **7 and 10**) and genetic differentiation and population structure of Bulgarian goat breeds (Indicator **D**, paper **13**). *Here again, I do not find article number 17 in Indicator D.* At the same time, in the list of scientific papers in Indicator D there is article 13, which corresponds to the analysis of the population structure of two Bulgarian goat breeds;

– Comparison of cryoprotectors for sperm storage of roe deer (*Capreolus capreolus*), red deer (*Cervus elaphus*) and fallow deer (*Dama dama*) in the Czech Republic and their high efficiency for storing the material (indicator **D**, article **12**, *erroneously listed as number 16 in the same indicator*).

I do not accept the mentioned contribution to biospeleological studies in three caves in Albania (erroneously mentioned in the list of contributions as indicator D, article 13), because although important from a fundamental and applied point of view, the results are published in a publication that is not referenced and indexed in world-renowned databases of scientific information (Web of Science and Scopus) and cannot be considered in this competition as a major contribution.

4. Significance of the obtained results, proven by citations, publications in prestigious journals, awards, membership in international and national scientific bodies, etc., in connection with the competition for the academic position of "Associate Professor".

According to the compliance report (file 5_Compliance report) in the competition for "Associate Professor" ch. asst. Dundarova participated with a **total of 19 publications**. *The four works* not indexed in Web of Science and/or Scopus are not included in the current competition due to their inapplicability (participation with 0 points). Indicator A is fulfilled (50 points) with the acquisition of the educational and scientific degree "Ph. The scientific papers for indicators C, D and E are distributed by quartiles and points as follows:

– **A total of six articles** were submitted for indicator C4: three articles in Q1, two articles in Q2 and one article in Q4, with a total of 127 points out of the required 100 points for the PhD.

– **A total of 13 papers** were submitted on indicator D7: According to the need for adjustment on this indicator, there are five papers with Q1, two with Q2, four with Q3, two with Q4, summing up to **249 points, not 239**. This is more than the required 200 points (220 according to the increased BAS minimum requirements) for the whole indicator D for a PhD.

– For the group of indicators E (E11), Heliana Dundarova presents 38 citations in refereed journals (43 in total), but as I mentioned above, many more are actually found in the scientometric databases. This makes a minimum of 76 points, which is more than the required 50 (60 points from the increased BAS criteria) points for Associate Professor. Of these, 13 are on the basis of which the dissertation was defended, and the rest are on publications outside the dissertation topic.

All the above-mentioned science metrics lead to two important conclusions: 1. The candidate Dr. Dundarova has a rich and fully satisfying scientific production covering the requirements for the

position of an Associate Professor 2. She is clearly a "visible" bat researcher at the national and international level, capable of working in international teams, as judged by the scientific output.

5. Evaluation of the candidate's scientific and scientific-applied activity and most significant scientific-applied achievements

Contributions of fundamental scientific value in the field of zoology

I. Distribution, ecology, taxonomy and phylogeography of cave-dwelling bats

– A new species-specific ectoparasite of the poorly studied and with unknown population trends Turkestan long-eared bat is described for the first time (paper B-3);

– By molecular methods, the evolution into allopatry and secondary contact of two species of twin bats of the *Myotis mystacinus* morpho-group has been established, with historical replacement populations (paper B-6);

– *Pipistrellus nathusii* was found to be present in winged waters 100 km offshore (paper D-3);

II. Research on the health status of bats their role as a reservoir for zoonoses

– Interspecies transmission of pathogens between continents has been found in species of the families Rhinolophidae and Pteropodidae from two different zoogeographic regions (Palearctic and Ethiopic);

– A comparative analysis of ectoparasites in bats in Bulgaria was made and no significant difference in parasite load or diversity was found in four of the most common species (paper D-1);

– Two new species of ectoparasites have been found on bats in southern Kazakhstan (paper D-8);

– The possible impact of trypanosome parasites on the health status of *Myotis myotis* in three countries - Bulgaria, Poland and the Czech Republic - was assessed by haematological and biochemical analyses (paper D-5);

– Macrophages extracted from *Myotis myotis* were found to continue to function normally under laboratory controlled conditions (Paper D-2);

– Glucose has been found to function as a cryoprotector of bat cells in the laboratory at the cellular level (Paper D-9);

Other research:

– The mitochondrial diversity, phylogenetic relationships and genetic diversity in the subpopulation structure of Bulgarian mountain sheep breeds were determined (paper D-7 and D-10);

– The genetic differentiation and population structure of two Bulgarian goat breeds is presented (paper D-13);

Contributions of scientific and applied value in the field of zoology

I. Distribution, ecology, taxonomy and phylogeography of cave-dwelling bats

– In two caves were found one of the most abundant summer colonies of *Myotis blythii* in Eurasia

(paper B-5);

– Recording and analysis of ultrasonic signals has been found to be most suitable for studying bats in high mountain areas. *Eptesicus nilssonii* was recorded, which is important for the distribution of the species in our country (paper C-1);

II. Research on the health status of bats their role as a reservoir for zoonoses:

– The appropriate sampling season for assessing lyssavirus load in bats has been established (Paper C-4);

– Antibodies to rabies have been detected in populations of cave-dwelling bat species in Bulgaria, alerting tourists, bat researchers, wildlife rehabilitators and cavers to the potential risk of rabies infection (paper D-11).

Other research:

– The effectiveness of different cryoprotectors for sperm storage has been established by representatives of Fam. Deer (paper D-12);

6. Demonstrated skills or aptitude for research leadership (project leadership, attracted external funding, etc.)

As an established scientist, Dr. Heliana Dundarova has a considerable experience working with an international team through her participation in a number of projects and expeditions mentioned above. Part of the funding for these projects has been foreign and part from the Research Fund, which is a testament to the quality of the project proposals, subsequently confirmed by publication in prestigious scientific journals.

7. ***Summary comment and personal impressions***

The overall analysis of the professional development of Asst. Dr. Heliana Dundarova show that he is a consistent and productive researcher at IBEI with a clear research profile and high qualifications, fully corresponding and coinciding with the topic of the announced competition for "Associate Professor". The evidence provided demonstrates that the publication and research activities meet and exceed in volume and quality the requirements for the post of Associate Professor at IBEI/BAS. In Bulgaria, Heliana is one of the leading scientists in the study of bats and especially in molecular research on them. The candidate's research is of particular relevance for the assessment of the role of bats in the formation of zoonoses. For this reason, I appreciate her work and her detailed insight into the research problems.

I would recommend to Dr. Heliana Dundarova in the future a more careful approach in structuring the documentation, given the large number of confused numbering. This of course does not lower my opinion of her scientific output.

CONCLUSION

The documents and materials presented by the chief asst. Dr. Heliana Dundarova comply with all

the requirements of the Law for the Development of Academic Staff in the Republic of Bulgaria, the Regulations for its Implementation and the relevant Regulations of IBEI/BAS. She has submitted for the competition scientific works exceeding the required minimum, with original fundamental scientific and applied contributions, which have received international recognition with their publication in high-ranking scientific journals. Additionally, the basic and applied contributions have important practical applications in bats and their relationship with humans.

On the basis of the materials and scientific works presented to me in the competition, the analysis of their significance and the scientific, scientific-applied and applied contributions contained in them, I give **a positive and high evaluation to the candidate** and recommend the Scientific Jury to prepare a report-proposal to the Scientific Council of IBEI/BAS for the election of the Chief assistant professor Dr. Heliana Irji Dundarova to the academic position of Associate Professor at the Section of Community Ecology and Conservation Biology of the Department of Ecosystem Research, Ecological Risk and Conservation Biology.

14.11.2024 г. Reviewer:.....

Gr. Sofia Prof. Dr. Diana Zlatanova