

REVIEW

regarding the competition for "Docent" in professional direction 4. 3. Biological sciences, scientific speciality "Zoology", announced in SG no. 66/06.08.24

Candidate: Ch. Assistant Professor Dr Heliana Irzhi Dundarova of the "Community Ecology and Conservation Ecology" section, "Ecosystem Research, Ecological Risk, and Conservation Ecology" department, at IBER - BAS

Reviewer: Prof. Dr. Vasil Valkov Popov, professional direction 4. 3. Biological sciences, scientific speciality "Zoology", appointed according to Order No. 64/04.10.2024 of the Director of IBER-BAS as a member of the scientific jury

General data on the candidate's career and thematic development

In 2007 H. Dundarova, acquired the educational and qualification degree of Bachelor at Sofia University "St. Kliment Ohridski", Faculty of Biology. In 2011, she graduated as a Master of Zoology at the Department of Zoology at Charles University, Faculty of Natural Sciences in Prague, Czech Republic. Major specialities are molecular ecology, genetic methods in zoology, mammalogy, ornithology, batrachology and herpetology, ichthyology, comparative anatomy of vertebrates, evolutionary biology. All exams are taken with high marks. The topic of the thesis is "Phylogeography of *Rousettus aegyptiacus* in the Mediterranean area". It marked the beginning of the successful scientific development of H. Dundarova in the field of molecular genetics and phylogeography of bats in the Palearctic and neighbouring territories. From 2012 until now, H. Dundarova has worked at IBER - BAS and has a total of 11 years of work experience in the speciality. In 2018, she defended her doctoral dissertation in the same direction as her master thesis, namely "Molecular phylogeny of the morpho-group: *Myotis mystacinus* (Chiroptera: Vespertilionidae) on the Balkan Peninsula". The research was carried out at IBER - BAS and at the Natural History Museum, Berlin, Germany (after winning a fellowship, 2014 – 2015), where she advanced her qualification in molecular genetics and statistical analyses.

Review of submitted documents

The submitted documents for the competition are a resume; copies of diplomas for "master" and "doctor" degrees; certificate of internship in the speciality; certificate of compliance of the applicant with the minimum state requirements, the requirements of the BAS and the criteria of the Scientific Council of IBER - BAS; a list of scientific works; list of citations; statement of contributions; copies of scientific works. The submitted documents meet the requirements of the Regulations on the terms and conditions for acquiring scientific degrees and holding academic positions at IBER - BAS, adopted by the Scientific Council on July 22, 2014, amended and supplemented by the Scientific Council of IBER - BAS with decisions of April 28 2015, May 12, 2015, November 20, 2018, May 8, 2020, July 9, 2021, and November 25, 2022.

Main directions in the candidate's research work and most important scientific contributions

Publications outside the doctoral thesis are 23 (including SJR without IF). According to the requirements, they are divided into two groups, "Habilitation work" and "Scientific publications outside the habilitation work". The first group includes 6 publications that mark the candidate's main areas of work related to the study of bats in the Palearctic and neighbouring areas. They are written in English. These articles are distributed by quartiles as follows: Q1 – 3 pcs., Q2 – 2 pcs., Q4 – 1 pc. All of them are in impact factor journals. In 4 of them, Ch. Assistant Professor Dr. H. Dundarova, is the first author. The total number of points that the publications in this group carry is 127. The second group includes 17 publications - 16 pcs. in English and 1 pc. in Russian. In 5 of them, Ch. Assistant Professor Dr. H. Dundarova is the first author. In this group, 6 pieces have SJR but no IF. The rest (JCR-IF) are distributed by quartiles as follows: Q1 – 5 pcs., Q2 - 2 pcs., Q3 – 2 pcs., Q4 – 2 pcs. Papers in this group carry 239 points. The scientific production with which Ch. Assistant Professor Dr. H. Dundarova participated in the competition is in accordance with the minimum national requirements for occupying the academic position of "Docent", exceeding the requirements by groups of indicators.

I accept the reference made for the scientific contributions of Ch. Assistant Professor Dr. H. Dundarova. It is prepared on the basis of the submitted list of scientific works that do not repeat publications submitted for the acquisition of the educational and scientific degree "doctor". I will

highlight the most important contributions that give insight into the applicant's scientific achievements in the main line of work, research on bats.

Phylogeography

- Using a multilocus phylogeographic approach, the role of interspecific interactions in shaping the modern distribution of closely related bat species (*M. mystacinus* and *M. davidii*) has been elucidated. *M. mystacinus* and *M. davidii* were found to have evolved in allopatry and came into secondary contact during their range expansion after the last ice age. An uneven population distribution in secondary contact zones was established by mitochondrial and nuclear markers. It is likely that the "native" populations of *M. mystacinus* hybridised with the expanding populations of *M. davidii* , resulting in mitochondrial replacement in the former species. Nuclear and mitochondrial genotypes of *M. mystacinus* were identified at relatively few sites, suggesting that native populations may have been largely replaced by the invading *M. davidii*. The likely cause of this replacement is the change in environmental conditions combined with ecological competition. This is one possible example of historical population replacement that is “captured” in phylogeographic models. The results and analyses presented are in favor of the view of restoring the species name *aurascens* for the western populations of *Myotis* ‘*davidii*’ (Article B-6).

Faunistics, species diversity, and conservation

- For the first time outside the tropics, bat abundance, species diversity, and conservation priority have been assessed using the Cave Vulnerability Index (BCVI) in Kyrgyzstan. Two underground sites were found to be highly endangered and in need of protection. Significant summer colonies of *Rhinolophus ferrumequinum*, *R. lepidus*, *Myotis blythii*, and *M. emarginatus* were confirmed in five caves. Some of the most numerous summer colonies of *M. blythii* in Eurasia were found in only two of these caves. A breeding colony of *Rhinolophus lepidus* has been established for the first time in Kyrgyzstan, due to its long-standing misidentification as *R. hipposideros*. The results indicate that the IUCN conservation status of *R. hipposideros* should be reviewed and changed from “Near Threatened” to “Vulnerable” for Central Asia (Articles C - 5; D - 14).

- *Pipistrellus nathusii* was recorded for the first time in the Black Sea 100 km from the coast. Six more species have been identified along the Bulgarian Black Sea coast and some islands, demonstrating the need to organise long-term acoustic monitoring to determine bat migratory movements of bats along the Bulgarian Black Sea coast and in the open sea (Articles **D-3, D-12**).
- The karst landscape in the highest parts of Pirin is established to provide suitable summer and winter shelters, as well as places for communication and reproduction of cave and forest species of bats, despite the harsh climatic conditions, 20 species of bats have been identified, more than half of the Bulgarian bat fauna. The recording and analysis of ultrasound signals is proven to be the best way to establish the local diversity of bats. The presence of *E. nilssonii* in Bulgaria has been confirmed. Cave No. 30, located at 2,600 m, turned out to have the most species and the highest altitude in Europe, as well as the main swarming place of forest bat species (Articles **C – 1, D - 15**).

Pathogens, Cell Cultures

- A hypothesis for the spread of phylogroup II lyssaviruses in Europe has been proposed through the contact zone between the Palearctic and Ethiopian realms, where the ranges of two species of the Rhinolophidae and Pteropodidae overlap, in the context of their close phylo-genetic relationship within the suborder Yinpterochiroptera (Article **B-2**).
- Estimation of the lyssavirus load in bats is more efficient when sampling during the active summer season, when colony size, species diversity, and interspecies contacts provide greater chances for pathogen transmission between individuals and the immune system is more responsive to antigenic stimulation, which increases antibody production and the chances of detecting seropositive animals (Article **B-4**).
- Anti-rabies antibodies were detected in cave-dwelling bat species in Bulgaria using two ELISA kits. Evidence suggests that casual contact with bats should be considered a possible risk of rabies in underground roosts (Article **D-11**).
- The prevalence of trypanosome pathogenicity in bats in Bulgaria, Poland, and the Czech Republic was identified and evaluated. The total prevalence of the two discovered species

(*T. dionisii* and *T. vespertilionis*) is 27%, and their prevalence in the Czech Republic is significantly higher than in the other countries studied. No influence was found on blood hematologic and biochemical parameters in trypanosome-positive *Myotis myotis* (Article **D-4**).

- Quantitative data were obtained for analysis and modelling of the geographical distribution of *Pseudogymnoascus destructans* mould. The development of the pathogen in hibernating bats is the result of an interaction of environmental and biological factors. Temperature has been found to be a suitable environmental indicator of infection status and intensity (Article **D - 5**).
- *In vitro* experimental data obtained on a macrophage cell line from *Myotis myotis* show that although macrophage overall function is suppressed at lower culture temperatures, these immune cells are still able to function normally under a wide range of temperature conditions. Therefore, the controlled conditions used in cell cultures appear to provide a suitable surrogate model for studying morphological and functional cellular phenomena and simulating body temperature-dependent changes in heterothermic organisms (Articles **D - 2**).
- Through an *in vitro* study, bat cells can survive at negative temperatures, especially with the help of glucose. This supports the theory that higher glucose levels in important tissues can significantly improve survival during hibernation at extremely low temperatures (Article **D-9**).

Ectoparasites

- The female, male and protonymph of *Spinturnix otonycterisi* Dundarova & Orlova sp. nov. (Acari: Spinturnicidae) are described for the first time from specimens collected from the Turkestan long-eared bat (*Otonycteris leucophaea*) (Severcov, 1873) in southern Kazakhstan. The morphological specificity of this ectoparasite corresponds to the phylogenetic and geographical specificity of the host. A key has also been developed to determine the species of the genus *Spinturnix* from Kazakhstan (Article B-3).
- Two new species of ectoparasites (*Spinturnix emarginata* and *S. nobleti*) have been identified for the territory of South Kazakhstan (Article **D - 8**).

- In Bulgarian caves inhabited by bats during periods of hibernation and migration, ectoparasite loads and their diversity were found to remain low, but mixed colonies allow for interspecies transmission of species-specific ectoparasites. The highest diversity of ticks, flies, and fleas is found in *Rhinolophus ferrumequinum* and *Miniopterus schreibersii*, and *Spinturnix myoti* is a dominant ectoparasite, collected in almost all places and in all species of bats (Article **D - 1**).

The contributions are original and can be characterised, for the most part, as the accumulation of new empirical data in poorly known scientific areas. Some of them provide a basis for solving practical questions or proposing new hypotheses.

Significance of the Results Obtained

I believe that the results of the research are significant, as they have resonated in the world scientific community. A report on the citations is presented: 9 publications were cited 43 times, of which 38 were in journals referenced in Scopus or WoS, which carry 76 points and exceed the requirements for a "Docent" competition. This shows the knowledge of Ch. Assistant Professor Dr. H. Dundarova from the Bulgarian and foreign specialists as an established scientist in the main areas of her research activity.

Demonstrated skills or aptitude for conducting research

Ch. Assistant Professor Dr. H. Dundarova has also gained considerable experience in the implementation, administration, and scientific management of scientific projects. In the period 2011 – 2023, she led or participated in 10 international and national projects aimed at studying and monitoring various aspects of ecology and biology of bats. Part of the research, the results of which are presented in the materials for the current competition, were carried out within the framework of six speleological expeditions in our country and abroad - China, Laos, Iran, Kosovo, Albania.

A motivated answer to the question of to what extent the candidate has a clearly defined profile of research work

Based on the review, analysis, and evaluation of the competition materials presented above, I can state that Ch. Assistant Professor Dr. H. Dundarova has a clearly defined profile in her research work. Her scientific research is mainly on various aspects of the biology and ecology of

bats, namely, phylogeography, fauna, species diversity, conservation, pathogens, cell cultures, ectoparasites, and corresponds to the scientific speciality of the competition.

Role of the Candidate for the training of young scientific personnel

In 2010, a Bulgarian-Czech seminar on "Molecular methods in zoology" was organised at the Faculty of Biology of Sofia University, with the active participation of H. Dundarova.

Personal impressions and opinion of the reviewer

I know H. Dundarova since her joining IBER. I was a reviewer for her Ph.D. thesis and a supervisor for the Young Scientists and Postdoctoral Fellows programme. Together, we worked on the materials she collected on the biodiversity of bats in the high parts of Pirin Mt. On this basis, I can say that her scientific achievements are the result of her persistence, organisation, incessant curiosity and ability to work in a team. She is responsive, well-intentioned, and correct. She is organised and has a high level of responsibility. Works with modern equipment in the laboratories of IBER - BAS and other scientific institutions. Possesses high computer competence.

Conclusion

Based on the analysis of the candidate's scientific and scientific-applied activity, I believe that Ch. Assistant Professor Dr. H. Dundarova meets the requirements of the Law on the Development of the Academic Staff in Bulgaria, as well as the criteria of the Scientific Council of IBER - BAS for occupying the academic position "Docent". This gives me the reason to give a **positive assessment** on the choice of Ch. Assistant Professor Dr. H. Dundarova for "Docent". I propose to the honorable Scientific Jury to vote on a proposal to the Scientific Council of IBER to **choose** Ch. Assistant Professor Dr. H. Dundarova for "**Docent**" in professional direction 4. 3. Biological sciences, scientific speciality "Zoology" for the needs of the section "Ecology of communities and conservation ecology", Department "Ecosystem studies, ecological risk and conservation ecology" at IBER - BAS.

Prof. Dr. Vasil Popov, 17 November 2024