

ПРЕДВАРИТЕЛЬНЫЕ ДАННЫЕ О МОЛЕКУЛЯРНО-ГЕНЕТИЧЕСКОЙ СТРУКТУРЕ

- Plötner J. 2005. Die westpaläarktischen Wasserfrösche – Von Märtyrern der Wissenschaft zur biologischen Sensation. Bielefeld : Laurenti Verlag. 160 s.
- Plötner J., Uzzell T., Beerli P., Spolsky C., Ohst T., Litvinchuk S. N., Guex G.-D., Reyer H.-U., Hotz H. 2008. Widespread unidirectional transfer of mitochondrial DNA : a case in western Palaearctic water frogs // *J. of Evolutionary Biology*. Vol. 21, iss. 3. P. 668 – 681.
- Plötner J., Uzzell T., Beerli P., Akin C., Bilgin C. C., Haefeli C., Ohst T., Köhler F., Schreiber R., Gaston-Denis G., Litvinchuk S. N., Westaway R., Heinz-Ulrich R., Pruvost N., Hotz H. 2010. Genetic divergence and evolution of reproductive isolation in Eastern Mediterranean water frogs // *Evolution in Action* / ed. M. Glaubrecht. Berlin ; Heidelberg : Springer-Verlag. P. 373 – 403.
- Plötner J., Baier F., Akin C., Mazepa G., Schreiber R., Beerli P., Litvinchuk S. N., Bilgin C. C., Borkin L., Uzzell T. 2012. Genetic data reveal that water frogs of Cyprus (genus *Pelophylax*) are an endemic species of Messinian origin // *Zoosystematics and Evolution*. Vol. 88, № 2. P. 261 – 283.
- Yanina T. A. 2014. The Ponto-Caspian region : Environmental consequences of climate change during the Late Pleistocene // *Quaternary International*. Vol. 345. P. 88 – 99.

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PRELIMINARY DATA ON THE MOLECULAR GENETIC STRUCTURE OF *PELOPHYLAX RIDIBUNDUS* (AMPHIBIA: ANURA: RANIDAE) FROM THE SOUTHERN PART OF THE CRIMEAN PENINSULA, BASED ON MITOCHONDRIAL AND NUCLEAR DNA ANALYSIS

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Molecular genetic analysis of 28 marsh frogs *Pelophylax ridibundus* complex from 12 localities of the Crimean peninsula was conducted by two molecular markers, namely, *COI*, the gene of the first subunit of cytochromeoxydase mtDNA, and *SAI-1*, the first intron of the serum albumin gene nDNA. It has been found that the mtDNA type specific for the “eastern” form (the Anatolian *P. cf. bedriagae*) prevails for the Crimean marsh frogs, while the mtDNA type of the “western” form (the Central-European *P. ridibundus*) has been observed in a single case in the Chernaya River basin (the southwestern Crimea). At the same time, our nuclear marker analysis has revealed the presence of the “western” form alleles within the studied area which occurs there more rarely than the “eastern” one (in a 2:5 frequency ratio). The alleles of the “western” form were identified in contrasting landscape zones and various altitude-climatic belts of the peninsula which might give evidence of the occurrence of multidirectional colonization waves of *P. ridibundus* in the Pleistocene-Holocene epoch.

Key words: *Pelophylax ridibundus*, *Pelophylax cf. bedriagae*, cytochromeoxydase, serum albumin, Chernaya River basin, Crimea.

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REFERENCES

- Atlas. Autonomous Republic of the Crimea.* Eds. M. V. Bagrov, L. G. Rudenko. Simferopol; Kyiv, 2003. 80 p. (in Ukrainian).
- Andreev V. M. Issue of Pontida and Valleys of Ancient Rivers in the Black Sea. *Geology and Mineral Resources of World Ocean*, 2010, no. 2, pp. 47–50 (in Russian).
- Borkin L. Ya., Litvinchuk S. N., Rozanov Yu. M., Skorinov D. V. On Cryptic Species (from the example of Amphibians). *Zoologicheskiy zhurnal*, 2004, vol. 83, no. 8, pp. 936–960 (in Russian).
- Evsyukov Y. D. Geomorphological characteristic and history of development of mainland edge of Taman' Peninsula. *Geology and Mineral Resources of World Ocean*, 2007, no. 2, pp. 86–97 (in Russian).
- Ermakov O. A., Zaks M. M., Titov S. V. Diagnostics and distribution of «western» and «eastern» forms of marsh frog *Pelophylax ridibundus* s. l. in Penza Province (on data of analysis of mtDNA cytochrome oxidase gene). *Tambov University Reports. Series Natural and Technical Sciences*, 2013, vol. 18, iss. 6, pp. 2999–3002 (in Russian).
- Ermakov O. A., Fayzulin A. I., Zaks M. M., Kaybeleva E. I., Zaripova F. F. Distribution «Western» and «Eastern» Forms of Marsh Frog *Pelophylax ridibundus* s. l. in the Samara and Saratov Region (on data of analysis of mtDNA and nDNA). *Proceedings of the Samara Scientific Center of the Russian Academy of Sciences*, 2014, vol. 16, no. 5-1, pp. 409–412 (in Russian).
- Ermakov O. A., Simonov E. P., Ivanov A. Ju., Zamaletdinov R. I., Fayzulin A. I. Genetic Characteristics of Marsh Frog (*Pelophylax ridibundus* complex) from the Western Caucasus Based on Mitochondrial and Nuclear DNA data. *Transactions of I.D. Papanin Institute for Biology of Inland Waters RAS “Molecular genetics of aquatic organisms”*, 2016 a, iss. 73 (76), pp. 70 – 76 (in Russian).
- Ermakov O. A., Fayzulin A. I., Askenderov A. D., Ivanov A. Ju. Molecular-genetic Characteristics of Marsh Frog from the Republic of Dagestan (based on mitochondrial and nuclear DNA data). *Proceedings of the Samara Scientific Center of the Russian Academy of Sciences*, 2016 b, vol. 18, no. 5-1, pp. 94–97 (in Russian).
- Zaks M. M., Bystrakova N. V., Ermakov O. A., Titov S. V. Molecular Genetic and Morphological Characteristics of Marsh Frogs (*Pelophylax ridibundus*) from the Penza Region. *Modern Herpetology: Problems and Ways of Their Solutions. Collection of Papers of the First International Conference of the Young Herpetologists of Russia and Neighboring Countries*. Saint Petersburg, Zoological institute of RAS Publ., 2013, pp. 86–89 (in Russian).
- Zamaletdinov R. I., Pavlov A. V., Zaks M. M., Ivanov A. Y., Ermakov O. A. Molecular-genetic characteristic of *Pelophylax esculentus* complex from the eastern range of distribution (Volga region, Tatarstan Repub- lic). *Tomsk State University J. of Biology*, 2015, no. 3 (31), pp. 54–66 (in Russian).
- Kotenko T. I. Vliyanie irrigatsii na gerpetokompleksy v Krymskom Prisivash'e [Impact of Irrigation on Herpetological Assemblages in the Crimean Sivash Region]. *Materialy III Mizhnar. nauk. konf. “Bioriznomanit-tia ta rol' zootsenozu v prirodnikh i antropogenikh ekosistemakh”* [Proc. III Intern. Scientific Conf. “Biodiversity and Function of Zoocenosis in Nature and Anthropogenic Ecosystems”]. Dnipropetrovsk, Dnipropetrovsk National University Press, 2005. pp. 392 – 394 (in Russian).
- Kukushkin O. V. Genezis gerpetofauny Kryma: novoe videnie problemy [Genesis of the Crimean Herpetofauna: a New Vision of the Problem]. In: *Materialy nauch. konf. “Iubileinye zoologicheskie chteniia”* [Proc. of the Intern. Scientific Conference Devoted to 100th anniversary of S. L. Delyamure and 90th anniversary of S. A. Skryabin “Commemorative Zoological Readings”]. Simferopol, 2013. pp. 22 – 25 (in Russian).
- Litvinchuk S. N., Rosanov J. M., Borkin L. J., Skorinov D. V. Molecular, Biochemical and Cytogenetic Aspects of Microevolution in Anurans of Russia and Adjacent Countries. *Proc. of the 3 th Meeting of the Nikolsky Herpetological Society “The Problems of Herpetology”*. Saint-Petersburg, 2008, pp. 247–257 (in Russian).
- Manilo V. V. Mixoploidy in *Rana ridibunda ridibunda* and *Rana esculenta* (Anura, Ranidae) from Zhitomir Region of Ukraine. *Proc. of the 1th Conference of the Ukrainian Herpetological Societ*. Kyiv, 2005, pp. 99–104 (in Russian).
- Miroshnichenko A. I. Parazitofauna ryb basseina reki Chernoi [Parasitofauna of the Fisch from the Chernaya River Basin]. *Materialy VI Mezhdunar. nauch.-prakt. konf. “Zapovedniki Kryma. Bioraznoobrazie i okhrana prirody v Azovo-Chernomorskem regione”* [Proc. of VI Intern. Scientific-practical Conf. “Reserves of the Crimea. Biodiversity and Protection of Nature in Azov – Black Sea Region”]. Simferopol, Taurida National University Press, 2011, pp. 310–322 (in Russian).
- Paleogeography of Europe During the Last one Hundred Thousand Years*. Moscow, Nauka, 1982. 175 p. (in Russian).
- Pasynkova L. A. 2013. Canyons of the Continental Slope of the Black Sea. *Scientific notes of V. I. Vernadsky Taurida National University. Ser. Geography*, 2013, vol. 26 (65), no. 3, pp. 260–266 (in Russian).
- Pysanets E., Kukushkin O. *Amphibians of the Crimea*. Kyiv, National Museum of Natural History, 2016. 320 p.
- Pozachen'yuk K. A. Floristic Relations of Crimea in Terms of Positional Relationship. *Optimization and Protection of Ecosystems*, 2012, iss. 7, pp. 11–21 (in Russian).
- Pozachen'yuk E. A. Landscape Diversity of the Crimea. *Scientific notes of V. I. Vernadsky Crimean Federal University*, 2015, vol. 1 (67), no. 3, pp. 37–50 (in Russian).

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- Svinin A. O., Ivanov A. Yu., Zaks M. M., Litvinchuk S. N., Borkin L. J., Rosanov J. M., Ermakov O. A. Distribution of the «eastern» and «western» forms of the Marsh Frog, *Pelophylax ridibundus*, and Their Participation in the Origin of Hemiclonal Hybrids, *P. esculentus* in Mari El Republic. *Current Studies in Herpetology*, 2015, vol. 15, iss. 3–4, pp. 120–129.
- Sludsky A. F. Ancient Valleys of Salgir River. *Bull. of the Crimean Branch of Geographical Society of the USSR*, 1953, iss. 2, pp. 31–38 (in Russian).
- Suryadnaya N. N. Characteristic of Morphological Variability of the Marsh Frog (*Rana ridibunda* Pall., 1771) from the Crimean Territory. *Visnyk of Zaporizhzhya National University. Biological Sciences*, 2002, no. 2, pp. 148–153 (in Russian).
- Suryadna N. N. The Data on Caryology of Green Frogs (*Rana ridibunda*, *R. lessonae*, *R. esculenta*) from Ukraine. *Vestnik Zoologii*, 2003, vol. 37, no. 1, pp. 33–40 (in Russian).
- Szczerbak N. N. *Zemnovodnye i presmykaiushchesia Kryma (=Herpetologia Taurica)* [Amphibians and Reptiles of the Crimea (=Herpetologia Taurica)]. Kiev, Naukova dumka, 1966. 240 p. (in Russian).
- Szczerbak N. N. 1984. Zemnovodnye i presmykaiushchesia. Izuchenie fauny i chislennosti nazemnykh pozvonochnykh Karadaga (1981 – 1982) (zakluchitel'nyi otchet) [Amphibians and Reptiles. The study of Terrestrial Vertebrates Fauna and Abundance at Karadag (1981 – 1982) (final report)]. *Letopis' prirody Karadagского gosudarstvennogo zapovednika AN USSR* [Annals of Nature of Karadag State Reserve of Academy of Sciences of Ukrainian SSR], 1984, vol. 1, book 1, part 5, pp. 4–32 (in Russian, unpublished).
- Akin C., Bilgin C. C., Beerli P., Westaway R., Ohst T., Litvinchuk S. N., Uzzell T., Bilgin M., Hotz H., Guex G.-D., Plötner J. Phylogeographic Patterns of Genetic Diversity in Eastern Mediterranean Water Frogs Have Been Determined by Geological Processes and Climate Change in the Late Cenozoic. *J. Biogeography*, 2010, vol. 37, iss. 11, pp. 2111–2124.
- Akin C. P., Bilgin C. C., Beerli P., Westaway R., Schreiber R., Mazepa G., Uzzell T., Plötner J. Do Discordant Mitochondrial and Nuclear Distribution Patterns Indicate Introgression Following Secondary Contact Between Anatolian Water Frog Lineages (*Pelophylax cf. bedriagae*) and European Water Frog Lineage (*Pelophylax ridibundus*) in Anatolia? *Book of Abstracts of Ecology and Evolutionary Biology Symposium*. Istanbul, 2014. Available at: http://www.eebst2014.boun.edu.tr/EEB_ST-2014/Home_files/BookofAbstracts_EEBST2014.pdf (accessed 15 January 2017).
- Aljanabi S. M., Martinez I. Universal and Rapid Salt-extraction of High Genomic DNA for PCR-based Techniques. *Nucleic Acids Research*, 1997, vol. 25, pp. 4692–4693.
- Hoffmann A., Plötner J., Pruvost N. B., Christiansen D. G., Rothlisberger S., Choleva L., Mikulicek P., Cogalniceanu D., Sas-Kovacs I., Shabanov D., Morozov-Leonov S., Reyer H.-U. Genetic Diversity and Distribution Patterns of Diploid and Polyploid Hybrid Water Frog Populations (*Pelophylax esculentus* complex) Across Europe. *Molecular Ecology*, 2015, vol. 24, iss. 17, pp. 4371–4391.
- Plötner J. *Die westpaläarktischen Wasserfrösche – Von Märtyrern der Wissenschaft zur biologischen Sensation*. Bielefeld, Laurenti Verlag, 2005. 160 S.
- Plötner J., Uzzell T., Beerli P., Spolsky C., Ohst T., Litvinchuk S. N., Guex G.-D., Reyer H.-U., Hotz H. Wiidespread Unidirectional Transfer of Mitochondrial DNA: a case in Western Palaearctic Water Frogs. *J. of Evolutionary Biology*, 2008, vol. 21, iss. 3, pp. 668–681.
- Plötner J., Uzzell T., Beerli P., Akin C., Bilgin C. C., Haefeli C., Ohst T., Köhler F., Schreiber R., Gaston-Denis G., Litvinchuk S. N., Westaway R., Heinz-Ulrich R., Pruvost N., Hotz H. 2010. Genetic Divergence and Evolution of Reproductive Isolation in Eastern Mediterranean Water Frogs. In: *Evolution in Action*. Ed. M. Glaubrecht. Berlin; Heidelberg, Springer-Verlag, 2010, pp. 373–403.
- Plötner J., Baier F., Akin C., Mazepa G., Schreiber R., Beerli P., Litvinchuk S. N., Bilgin C. C., Borkin L., Uzzell T. Genetic Data Reveal that Water Frogs of Cyprus (genus *Pelophylax*) are an Endemic Species of Messinian Origin. *Zoosystematics and Evolution*, 2012, vol. 88, no. 2, pp. 261–283.
- Yanina T. A. The Ponto-Caspian Region: Environmental Consequences of Climate Change During the Late Pleistocene. *Quaternary International*, 2014, vol. 345, pp. 88–99.

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