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BUXORO VILOYAT EKOLOGIY, ATROF MUHITNI MUHOFAZA
QILISH VA IQLIM O‘ZGARISHI BOSHQARMASI
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UI GREENMETRIC – XALQARO REYTING AGENTLIGI

IQLIM O‘ZGARISHI SHAROITIDA CHO‘L – VOHA
EKOSISTEMASI: MUAMMOLAR VA YECHIMLAR
MAVZUSIDAGI XALQARO SIMPOZIUM

MATERIALLARI



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**“IQLIM O‘ZGARISHI SHAROITIDA CHO‘L – VOHA EKOSISTEMASI:
MUAMMOLAR VA YECHIMLAR” MAVZUSIDAGI XALQARO SIMPOZIUMNING**

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AMPHIBIANS FROM ARID ECOSYSTEMS OF TAJIKISTAN: HISTORICAL AND NEW RECORDS OF DESERT SURVIVORS

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The high-mountain ecosystems are biodiversity hotspots in Central Asia [1]. Tajikistan has a unique location due to more than 90% of the territory occupied by mountain landscapes [1, 2]. Mountains are also playing a special role in isolation of intermontane ecosystem components (including deserts) with long-term cases of allopatric speciation. Desert landscapes occupy a relatively small area in the north (Sughd Region) and southwest (Khatlon Region) parts of Tajikistan, and are of great interest for the study of biodiversity due to its unique mountain isolation.

In comparison with reptiles [2], the amphibian fauna of Tajikistan has not been sufficiently studied yet and, due to the taxonomic revision of some amphibian groups [3, 4, 5], requires recent clarification. The batrachofauna of Tajikistan consists of two genera of tailless amphibians (*Pelophylax* Fitzinger, 1843 and *Bufo* Rafinesque, 1815) and these genera pose the main taxonomical problems in recent batrachological studies.

The Palearctic green toads of the genus *Bufo* are widespread group of amphibians native to Europe, Western and Central Asia, and Northern Africa. It consists of at least 15 species of amphibians, seven species of which inhabited Central Asia [3]. The Palearctic green toads from this region are characterized by different ploidy levels: there are three diploid species (*Bufo sitibundus*, *B. perrini*, and *B. turanensis*), two tetraploid species (*B. oblongus* and *B. pewzowi*) and one triploid (*B. baturae*) [3]. Despite differences in ploidy levels, morphological characters for many species of green toads are vague and their reliable determination is often possible using methods of molecular analysis [6].

Another group of amphibians found in Tajikistan is water frogs of the genus *Pelophylax*. Water frogs are highly distributed amphibians in Palearctic Realm that occur in a large part of Europe, Asia, and Northern Africa. There are also some introduced populations in Saudi Arabia, the Altai Mountains, the Southern Ural, the Western Siberia, the Russian Far East, the United Kingdom, and some other localities [7]. Hybridization, hemiclinal reproduction, and polyploidization are well-known features of water frogs of the genus *Pelophylax* consisted of about 25 species and three kleptons [8]. Kleptons are special taxonomical units (species rank form) characterized by hemiclinal reproduction (known as hybridogenesis) during which one

genome is eliminated from pre-gamete cells, while the second one goes under endoreduplication process and transmits without true recombination [9, 10].

In reports on the herpetofauna of Tajikistan, from two to six species of amphibians were noted, which is currently a pressing issue for further research on distribution, biological features, as well as determining strategies for the protection and establishing of conservation status. Here, we provide some historical and recent data on taxonomical status and our new records of amphibians in Tajikistan inhabited waterbodies in the arid and mountain landscapes.

Amphibians were collected and determined in arid and mountain areas of four Tajikistan regions (Varzob, Panj, Levakant and Rudaki Districts) in July 2023. Three localities in the Varzob River (Varzob River 1: 38.7163 N, 68.8147 E; Varzob River 2: 38.7203 N, 68.8168 E; Chorbed mountain: 38.7025 N, 68.8126 E), one locality near the Panj River (37.2134 N, 68.5916 E), one locality in the Vakhsh River valley (37.8834 N, 68.9486 E), and one near Danghara (38.0509 N, 69.2591 E) were examined.

During the expedition in Tajikistan of 2023, we found new records of two amphibian species in arid ecosystems: *Bufotes turanensis* and *Pelophylax persicus* (fig. 1). Adult *B. turanensis* were found in two localities in the Varzob River, one locality near the Panj, one locality in the Vakhsh River valley, and one near Danghara. Tadpoles of *B. turanensis* were found in Varzob Ravine and the Vakhsh River valley. Adult individuals and tadpoles of *Pelophylax persicus* were observed in the Vakhsh River valley and a small river near Danghara.

The first studies on green toad biology contained information on the entire *Bufotes viridis* complex. Thus, the green toad ("*Bufo viridis*") was observed by S.A. Chernov in 1945 in the Gissar valley and on the southern slope of the Gissar Ridge [11]. S.A. Said-Aliev in the field seasons of 1954 – 1973 observed green toads in the northern (recent Sughd Province), central (recent Districts under Central Government Jurisdiction) and southwestern parts of Tajikistan (Khatlon Region), as well as in the south of modern Badakhshan Mountainous Autonomous Region (recent Shughnon, Roshtqal'a, and Ishkoshim Districts) [11]. The marsh frog (previously "*Rana ridibunda*") has been found in many water bodies of the Zeravshan, the Vakhsh, the Panj and the Syr Darya Rivers drainages in the northern, central and southwestern parts of Tajikistan [11]. *Pelophylax* species was not found in the south of modern Badakhshan Mountainous Autonomous Region.

The arid territories of Tajikistan were often typical for the description of new taxa and were under the focus of researchers close attention. In 1978, H. Hemmer, J.F. Schmidler and W. Böhme described a new subspecies of *Bufo viridis* near the City of Dushanbe (*B. v. turanensis*) [12]. In the same year, E.M. Pisanets described tetraploid species *B. danatensis* from the southern Turkmenia [13]. After his work, in the 1980s and 1990s, Central Asian tetraploids (*B. oblongus*, *B. pewzowi*) were mostly called "*B. danatensis*", a recent younger synonym of *B. oblongus*.

In 1996, diploid toads from the Beshkent sands (south-western Tajikistan) were described as *Bufo shaartusiensis* according to allozyme analysis [14]; however it has been recently synonymized with *B. turanensis* [3].

One of the most important discoveries in amphibian cytogenetics was the identification of a bisexual triploid species ("*Bufo pseudoraddei baturae*", recently *Bufotes baturae*) characterized by genome elimination and endoreduplication processes in the germ line cells [15]. It was found that the southernmost parts of Pamirs in Tajikistan inhabited by these triploids [16]. Batura toad was reliably found in the Badakhshan Mountainous Autonomous Region: Ishkoshim (Ishkoshim District), Lyangar and Bulunkul (Murghob District) [14]. In the vicinity of Bulunkul, the Batura toad is known from Yashilkul Lake with geothermal streams in the Sasyk-Bulak and Issyk-Bulak [14, 17].

According to allozyme data, S.V. Mezhzherin described *Rana terentievi* [18] and further molecular analysis confirmed the validity of this species, which is distributed south of the Vakhsh River valley. Modern molecular genetic studies have shown that the marsh frog is a

complex of closely related cryptic species [19]. Three species were found to inhabit the East European Plain: *P. ridibundus*, *P. kurtmuelleri*, and *P. cf. bedriagae*. While the first two taxa have few genetic differences and are often considered within a single species, while the *P. ridibundus* and *P. cf. bedriagae* are widespread species with the widest hybrid zone among amphibians. Genes of the Anatolian water frog, *P. cf. bedriagae*, were found in the southern Kazakhstan populations, including localities close to the borders of Tajikistan (in the Syr Darya River drainage, near Khujand) [20].

Thus, according to the above-mentioned studies, the following five reliably identified anuran amphibian species are found in Tajikistan:

1. Terentjev's Frog – *Pelophylax persicus* (Schneider, 1799).
2. Turan Toad – *Bufotes turanensis* (Hemmer, Schmidtler et Boehme, 1978).
3. Pewzow's Toad – *Bufotes pewzowi* (Bedriaga, 1898).
4. Perrin's Green Toad – *Bufotes perrini* Mazepa, Litvinchuk, Jablonski et Dufresnes, 2019.
5. Batura Toad – *Bufotes baturae* (Stoeck, Schmid, Steinlein et Grosse, 1999).

Possibly, “Syrdarya” species of the marsh frog [20] occurs on some northern territories of Tajikistan. Further molecular analysis will shed light on the relationships within this complex of water frogs from Tajikistan.

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ЭКСТЕРНАЛИИ ПУСТЫННЫХ ТЕРРИТОРИАЛЬНО-ПРОИЗВОДСТВЕННЫХ КОМПЛЕКСОВ

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Введение

В протекающей фазе индустриального развития территориально-производственного комплекса (ТПК), требуется обеспечение экологической безопасности не только в его собственных интересах, но и всей страны. Способ достижения этой цели основывается на экологизации ТПК. При этом смысл экологизации заключается в переходе производительных сил ТПК на более высокий уровень, техника, технология и производственные отношения которого максимально минимизировали бы или вовсе исключили бы негативные воздействия на экосистемы и обеспечили бы сохранение природно-ресурсного потенциала и здоровых условий для протекания естественного отбора всего разнообразия их растительного и животного населения на отдалённую перспективу.

Опустынивание ТПК – имеет место не столько из-за аридизации – глобального феномена, а в большей мере – из-за технологических погрешностей и нарушений пастбищеоборота и правил выпаса животных, а также других производств.