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Species diversity of reptiles in the landscapes of the Lesser Caucasus within Azerbaijan

S.G. Jafarova[1], S.N. Bunyatova[2*]

[1]Bioecology Department, Baku State University, 23 Academician Z.Khalilov Str., Baku AZ 1148, Azerbaijan
[2]Institute of Zoology, Azerbaijan National Academy of Sciences, A.Abbaszade Str., 504 Block, 1128 Pass., Baku AZ1004, Azerbaijan
***For correspondence**: s_bunyatova@mail.ru*

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Every landscape zone of the Lesser Caucasus is distinguished by its own reptile species complex. Significant territories of the Lesser Caucasus within Azerbaijan are lowlands. More than 25 species and subspecies of reptiles (54.7% of local reptile fauna) are encountered in this zone. The majority of species inhabiting this landscape zone are xerobionts. All reptile species registered in the semi-desert have also been observed on the foothills. The middle mountainous zone is characterized by the presence of species such as *Anguis fragilis, Ablepharus bivittatus, Lacerta media, Darevskia raddei, D.armeniaca, Zamenis hohenackeri, Coronella austriaca, Montivipera raddei*. The representatives of the neighboring foothills do also exist here. In total, 20 species and subspecies have been registered in this zone, consisting of 47.6% of reptile fauna in the study area. The high-mountain zone owns less rich herpetofauna, the core of which is mainly composed of the Caucasian autochthons. Paralaudakia caucasia species enters this area from its surroundings. In total 6 species or 13.9% of the Lesser Caucasus's reptile fauna has been recorded here.

Keywords: *Lesser Caucasus, reptiles, herpetofauna, biodiversity, landscapes*

INTRODUCTION

The relief (landscape) forms of the Lesser Caucasus, including its Azerbaijan part, are split into - mountain ranges and massifs, on the one hand, and plains, on the other. Each of these landscapes is being characterized by its own reptile fauna, and therefore we will deep dive into their peculiarities in more detail.

The mountain system of the Lesser Caucasus in Azerbaijan is represented by ridges (ranges) towards the southeastern direction. These ridges form the Shahdag, Karabakh and Konguro-Alanghez mountain ranges (Geography of Azerbaijan Republic, 2014).

Ground volcanism has played a leading role in the formation of the present landscapes in particular parts of the Lesser Caucasus (southeastern) at the beginning of the manifestation of which is noted in the Late Sarmatian. Many areas of the Lesser Caucasus have more or less preserved volcanic relief of lava sheets and slopes of large volcanoes.

The high-mountain zone of the Lesser Caucasus range does not have continuous distribution as it is on the Great Caucasus. Relatively small areas of the high mountains are interspersed among mid-mountain areas. The Lesser Caucasus is predominantly a mid-mountainous territory (Geography of Azerbaijan Republic, 2014).

Several vegetation types (landscapes) are distinguished in the territory of the Lesser Caucasus: semi-desert, desert, foothill, steppes and upland xerophytes, arid woodlands, alpine meadows and meadow-steppes, forest vegetation (Prilipko, 1970).

The above-described various landscape patterns determine a significantly uneven distribution

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and a pronounced "lace of areas" peculiarity of a significant part of the animal species including reptiles inhabiting here.

In 1947, A.M.Alekperov studied the fauna of Nakhichevan AR (Nakhichevan, Kakhab, Zeynaddin, Julfa, Daridag); in 1948, he made a collection on amphibians and reptiles of Zangelan. He transferred his herpetological collections to the Zoological Institute of ANAS.

In 1950, A.M.Alekperov again conducted investigations in the Nakhichevan AR and surveyed all districts of the Republic via the transect methods. Based on the materials of this study as well as previous expeditions, he published the paper "Reptiles of the Nakhichevan ASSR". In his next article called "Materials on studying of amphibian and reptile fauna of the Nakhichevan ASSR" (1954) beside the personal materials of the collection of the Nakhichevan State Pedagogical Institute were also used (Alekperov, 1954).

In 1955-1960, I.S. Darevsky worked in the Nakhichevan AR, who for the first time revealed *Psammophis lineolatus* (Darevsky, 1967).

In 1955, A.M.Alekperov organized an expedition for comprehensive studying the amphibian and reptile fauna of Azerbaijan. The survey was conducted on the Eastern slopes of the Lesser Caucasus (Khanlar region, Adjikend, Chaikend, Lake Gek-gel) and Garabagh. Huge efforts were invested by A.M.Alekperov into the study of the batracho-herpetofauna of Azerbaijan resulted in the publication of his monography - "Amphibians and Reptiles of Azerbaijan" (1978).

Studies of T.A.Aliev (1974) are devoted to the ecology and distribution of venomous snakes of the Nakhichevan AR. S.B.Akhmedov (1981) studied skinks of the Lesser Caucasus. S.G.Jafarova studied ecology, distribution and conservation of the reptiles of the Lesser Caucasus (Alekperov and Jafarova, 1979; Jafarova, 1979; 1980). Due to the occupation of the territories of the Lesser Caucasus (Nagorno Garabagh and surrounding five districts) by the Armenian invaders, field surveys stopped since the 1980s.

S.N.Bunyatova surveyed the eastern slopes of the Lesser Caucasus in 2015-2020 years (Bunyatova, 2020).

MATERIALS AND METHODS

This research is based on materials collected by S.G.Jafarova over the period of 1974-1980 and by S.N.Bunyatova in 2015-2020 years. S.G.Jafarova worked in the Upper Garabagh, Garabagh volcanic plateau and Hakari physical-geographical regions, as well as S.N.Bunyatova surveyed Ganja physical-geographical region and Nakhichevan AR.

All available herpetological literature and collection of reptiles in the repositories of the Department of Vertebrate Zoology at the Baku State University and herpetological collection at the Institute of Zoology of ANAS were used as well.

Collecting of materials in the field and their laboratory processing were conducted by application of generally accepted methodologies (Bannikov et al., 1977).

Counting on tape samples (along transects) was carried out according to the methodology of L.G. Dinesman and M.L. Kaletskaya (1952), with some modifications. The counts were carried out visually along path (walking) routes and at stationary sites, mainly during the period of maximum activity of reptiles in the spring and summer seasons.

All collected materials are preserved in the collection fund of the Department of Vertebrate Zoology at the Baku State University.

RESULTS AND DISCUSSION

The modern landscape of the Lesser Caucasus has been generated a long way of complex geological development. In its structure, along with folded ridges, chains of volcanic peaks and extensive subsidences, which have the patterns of either high plateaus formed by flows of solidified lava and upland basins, or representing vast plains lowlands, are involved.

Concerning the history of the formation of the mammal fauna of the Caucasus, N.K. Vereshagin (1959) indicated that it was inextricably linked with the history of the development of the Caucasian land, its flora of landscapes, with the development of the life forms and ranges of certain animal species. The formation of landscapes was influenced by the impact of transgressions and regressions of the seas, mountain-building processes and glaciations. According to I.S. Darevsky (1967),

"….one can only speculate about the species composition of the primary nucleus of the Caucasian herpetofauna, but the picture of the distribution of this fauna should be considered as a consequence of changes in the primary habitats as a result of intense mountain-forming processes and under the influence of glaciers."

At the present, each landscape zone of the Lesser Caucasus is being characterized by its own reptile species complex, formed as a result of long-term historical processes of these areas formation.

On the territory of the country, large areas are occupied by low-lying semi-deserts, which are characterized by wormwood-saltwort and saltwort semi-shrub communities. More than 25 species and subspecies of reptiles are inhabiting here. These are *Testudo graeca, Trapelus ruderatus, Paralaudakia caucasia, Phrynocephalus horvatii, Trachylepis septemtaeniata, Eumeces schneiderii, Eremias strauchi, Lacerta strigata, Xerotyphlops vermicularis, Eryx jaculus, Platyceps najadum, Dolichophis schmidti, Hemmerrhois ravergieri, Eirenis collaris, E.modestus, E.punctatolineatus, Rhynchocalamus melanocephalus, Telescopus fallax, Psammophis lineolatus, Malpolon insignitus, Vipera lebetina.*

A significant number of species of the analyzed landscape zone belong to xerobionts. *Trapelus ruderatus, Trachylepis septemtaeniata, Xerotyphlops vermicularis, Rhynchocalamus melanocephalus, Psammophis lineolatus* and to the lesser extent, *Ophisops elegans* and *Eryx jaculus* are characterized by linkage to untouched virgin habitats. The rest of the species have been adapted to a wide range of biotopes in both natural and anthropogenic complexes. Xerophytization of landscapes is largely occurring due to human economic activity, enabling some of these species to reclaim new habitats, settling within the area. For example, *Eremias strauchi* inhabiting on dry clay-gravelly slopes of mountains with shrubby xerophytic vegetation rises up to 1400-2000 m, *Eumeces schneiderii* – up to 1000 m and *Paralaudakia caucasia* by intrazonal habitats – up to 2000-2500 m above sea level.

In addition to this zone, the following landscape zones are distinguished in the Lesser Caucasus: *lower* – foothills, *middle* – middle mountains and *high* – high mountains. The foothills consist of landscapes, which are similar to the underlying plains. Landscape-forming grouping of plants is wormwood formations, rising to an altitude of 400-500 m, and in the Nakhichevan Autonomous Republic up to 1200-1400 m above sea level; arid woodlands, which include *Rhamnus pallasii, Paliurus spina-cristi, Berberis* sp., *Juniperis* sp., etc.

All reptile species inhabiting the foothills have been recorded by us in the lowland semi-desert. Particular attention was drawn to the mutual penetration (transition) of certain reptile species into the neighboring landscape zones. River valleys and canals of irrigation systems, as well as a dense road network, have an important role in reptile settlements. Thus, *Mauremys caspica, Eumeces schneiderii, Eryx jaculus* and *Macrovipera lebetina* penetrate into the mountain-steppe zone along the river valleys flowing into the Araz River. *Lacerta strigata* settles along the roadsides and fields into the semi-deserts, where it forms settlements of the "oasis" type. *Testudo graeca* and *Pseudopus apodus* from the deforested xerophytic slopes of the mountains ascend to the middle mountains zone.

The middle mountain zone is characterized by the presence of species such as *Anguis fragilis, Ablepharus bivittatus, Lacerta media, Darevskia raddei, D.armeniaca, Zamenis hohenackeri, Coronella austriaca, Montivipera raddei*. There are also representatives of the neighboring foothill zone: *Testudo graeca, Paralaudakia caucasia, Pseudopus apodus, Natrix tessellata, N.natrix, Platyceps najadum, Dolichophis schmidti, Telescopus fallax*. In total, 20 reptile species and subspecies have been registered in the middle mountain zone, and it consists of 47.6% of the overall reptile fauna of the study area. *Ablepharus bivittatus, Darevskia armeniaca, Zamenis hohenackeri, Coronella austriaca* adhere to the mountain zone and adjacent territories of gorges and ravines, rocky areas on the mountain slopes covered by bushes. *Darevskia portschinskii* and *D.rostombekovi* adhere to rock outcrops and its foothills with xerophilous vegetation. *Montivipera raddei* stays mainly on the edges of oak forests.

The alpine zone is more monotonous. It is composed of the uppermost parts of the forest belt, the belt of subalpine shrubs, subalpine and alpine mountain-meadow plant groups.

Table 1. Vertical distribution of reptile species of the Lesser Caucasus within Azerbaijan

N	Species and subspecies	Population number	Plains and foothills 200-600 (850) m	Middle mountains 1000-1500 (2000) m	High mountains 2000-2300 (2500) m
1	*Mauremys c.caspica*	common	+	+	-
2	*Emys orbicularis*	common	+	+	-
3	*Testudo g.ibera*	common	+	+	+
4	*Trapelus r.ruderata*	rare	+	+	-
5	*Paralaudakia c.caucasica*	common	+	+	+
6	*Phrynocephalus horvatii*	rare	+	+	-
7	*Pseudopus apodus*	numerous	+	+	-
8	*Angius f.fragilis*	common	-	+	-
9	*Trachylepis septemtaeniata*	rare	+	-	-
10	*Eumeces schneiderii*	common	+	+	-
11	*Ablepharus bivittatus*	rare	-	+	-
12	*Eremias s.strauchi*	common	+	+	-
13	*Eremias pleskei*	rare	+	+	-
14	*Lacerta strigata*	numerous	+	+	-
15	*L. media*	common	+	+	-
16	*Darevskia r.raddei*	numerous	-	+	+
17	*D. portschinskii*	rare	-	+	-
18	*D. valentini*	rare	-	-	+
19	*D. armeniaca*	abundance	-	+	+
20	*D rostombekovi*	common	-	+	+
21	*Ophisops e.elegans*	numerous	+	+	-
22	*Xerotyphlops vermicularis*	common	+	+	-
23	*Eryx j.familiaris*	common	+	+	+
24	*Natrix n.natrix*	common	+	+	-
25	*N. n.perca*	common	+	+	-
26	*N. tessellata*	common	+	+	-
27	*Platyceps n.najadum*	common	+	+	-
28	*Dolichopis schmidti*	common	+	+	-
29	*Hemerrhois r.ravergieri*	common	+	+	-
30	*H. chernovi*	rare	+	+	-
31	*Zamenis h.hohenackeri*	rare	-	+	+
32	*Elaphe urartica*	common	+	+	-
33	*E. dione*	common	+	-	-
34	*Eirenis collaris*	common	+	-	-
35	*E.p.punctatolineatus*	common	+	-	-
36	*E.modestus*	common	-	+	-
37	*Coronella austriaca*	common	-	+	-
38	*Rhynchocalamus m.satunini*	rare	+	-	-
39	*Telescopus fallax*	common	+	+	-
40	*Psammophis lineolatum*	rare	+	-	-
41	*Malpolon insignitus*	common	+	+	-
42	*Vipera eriwanensis*	rare	-	+	+
43	*Vipera l.obtusa*	common	+	+	-
44	*Montivipera raddei*	rare	-	+	+

The core of the herpetofauna of the high-mountain belt is mainly built on the Caucasian autochthons – *Darevskia armeniaca, D. raddei, D.valentini* and *Vipera eriwanensis*, which are numerous or common here. Some locations here is being also reached by *Paralaudakia caucasia*. In total, six species were recorded here, or 13.9 % of inhabiting the study area of the Lesser Caucasus. The distribution of the reptile species along the vertical landscape belts is presented in Table 1.

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Kiçik Qafqazın Azərbaycan hissəsində yayılan sürünənlərin landşaftlar üzrə növ müxtəlifliyi

S.Q. Cəfərova[1], S.N. Bünyatova[2]

[1]Bakı Dövlət Universitetinin Bioekologiya kafedrası, Bakı, Azərbaycan
[2]AMEA-nın Zoologiya İnstitutu, Bakı, Azərbaycan

Müasir dövrdə Kiçik Qafqazın hər bir landşaft zonası özünəməxsus sürünən növlərinin müxtəlifliyi ilə fərqləndirilir. Məlum olduğu kimi, ölkə daxilidə Kiçik Qafqaz ərazinin əhəmiyyətli hissəsi yarımsəhralarla örtülmüşdür. Sürünənlərin 25-dən çox növ və yarımnövü burada qeydə alınır (54,7%). Bu landşaftda yayılan növlərin əksəriyyəti kserobiontlara aiddir. Yarımsəhralarda qeydə alınan növlərin hamısı dağətəyi ərazilərdə də müşahidə olunmuşdur. Orta dağlıq *Anguis fragilis, Ablepharus bivittatus, Lacerta media, Darevskia raddei, D.armeniaca, Zamenis hohenackeri, Coronella austriaca, Montivipera raddei* kimi növlərlə xarakterizə olunur. Burada həmçinin dağətəyi zonanın növləri də qeydə alınır. Ümumilikdə orta dağlıqda 20 növ və yarımnöv sürünənə rast gəliniur ki, bu da tədqiqat zonasında yayılan növlərin 47,6%-ni təşkil edir. Yüksək dağlıq ərazilərin faunası nisbətən kasaddır. Bu qurşağın sürünənlər faunasının əsasını Qafqaz avtoxtonları təşkil edir. Bəzi yerlərdən buraya *Paralaudakia caucasia* növü də daxil olur. Burada cəmi 6 növ qeydə alınmışdır ki, bu da Kiçik Qafqazda yayılan növlərin 13,9%-ni təşkil edirlər.

***Açar sözlər**: Kiçik Qafqaz, sürünənlər, herpetofauna, biomüxtəliflik, landşaftlar*

Видовое разнообразие рептилий в ландшафтах Малого Кавказа в пределах Азербайджана

С.К. Джафарова[1], С.Н. Бунятова[2]

[1]Кафедра биоэкологии Бакинского государственного университета, Баку, Азербайджан
[2]Институт зоологии НАН Азербайджана, Баку, Азербайджан

В настоящее время каждая ландшафтная зона Малого Кавказа характеризуется своим комплексом видов пресмыкающихся. Значительные территории Малого Кавказа в пределах республики заняты низменными полупустынями. Здесь сконцентрировано 25 видов и подвидов пресмыкающихся (54,7 % от общего количества в рассматриваемом регионе республики). Значительное число видов этой ландшафтной зоны относится к ксеробионтам. В предгорьях обитают все виды, отмеченные нами для равнинных полупустынь. Среднегорья характеризуются присутствием таких видов, как *Ablepharus bivittatus, Lacerta media, Darevskia raddei, D.armeniaca, Zamenis hohenackeri, Coronella austriaca, Montivipera raddei*. Здесь же встречаются и виды соседней предгорной зоны. Всего в зоне среднегорий зарегистрированы 20 видов и подвидов, что составляет 47,6% от всего их количества в рассматриваемом регионе. Высокогорный ярус более однообразен. Ядро герпетофауны высокогорного пояса слагается в основном из кавказских автохтонов. Поднимается сюда местами и *Paralaudakia caucasia*. Всего здесь зарегистрировано 6 видов, или 13,9%, населяющих исследуемую территорию Малого Кавказа.

***Ключевые слова**: Малый Кавказ, рептилии, герпетофауна, биоразнообразие, ландшафты*