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ZOOGEOGRAPHIC ANALYSIS OF THE HERPETOFAUNA OF SOUTH-WESTERN TURKMENISTAN

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This article gives a complete overview about the reptiles of western Turkmenistan and their zoogeographical relation. The data were obtained by several expeditions during the last years and completed by compilation of the specific herpetological literature about this area. Ten general landscape units are described along a profile from the Central Karakum desert throughout the Malyi Balkhan chains, the Kyurendag Corridor, the Western Kopetdagh to the state border of Iran. The mountain and plain reptile fauna is analyzed. After discussing the faunal element composition of various landscapes, the Western Kopetdagh was included into the South-West Asian province while the Turanian plain and the Malyi Balkhan were included into the Turanian province of the Palearctic.

Key words: Herpetofauna, South-Western Turkmenistan, Biogeography.

INTRODUCTION

Due to a long period of investigation the herpetofauna of western Turkmenistan is quite well known. The first data were published at the end of the 19th century by O. Boettger (1888) and N. Zarudnoy (1889 – 1890). Nikolsky (1915, 1916) presented material after collection and examination. Chernov (1934) published the first general survey on the reptiles of Turkmenistan. Later investigations were added in a fundamental monograph by Bogdanov (1962). A number of articles about reptiles of the Malyi Balkhan and other western marginal mountain ridges of Turkmenistan were published by Shammakov (1964a, 1966, 1969). In 1968 a vast publication of Anderson described the lizard fauna of Iran and the area adjacent to Turkmenistan. In the early nineties two monographs were published: Shammakov (1981) wrote about the lowland reptile fauna and Atayev (1985) about the mountainous reptiles. The monographs of Shcherbak (1974), Shcherbak and Golubev (1986) and Eremchenko and Shcherbak (1986) provide additional taxonomical and ecological data about species distributed in Turkmenistan. Some recent articles are devoted specifically to the herpetofauna of the Western Kopetdagh (Skalon 1982; Atayev 1987; Atayev et al. 1991).

During the last 40 years some new reptile taxa from western Turkmenistan have been described:

Euphlebaris turcmenicus Darevsky 1978 from the Monjukly ridge;

Eremias strauchi kopetdaghica Shcherbak 1972 from the southern slope of the Western Kopetdagh;

Coluber atayevi Tuniyev and Shammakov 1993 from the Sayvan-Nokhur plateau of the Western Kopetdagh.

The following new findings were recorded:

1951: *Lacerta strigata* in the Atrek river valley, western Turkmenistan (Bogdanov 1956);

1964: *Cyrtopodion spinicauda* in the Central Kopetdagh, 1968 in the Western Kopetdagh and 1985 in the Malyi Balkhan (Atayev et al. 1968; Rustamov and Atayev 1976; Shammakov and Atayev 1987);

Coluber schmidtii was found in the early sixties in the Western Kopetdagh (Shammakov 1964b);

1970: *Elaphe dione* in the Atrek river valley (Bogdanov 1970) and *Phrynocephalus maculatus* at the Bami railway station (Bogdanov et al. 1974).

Despite the extremely various and changeable natural conditions of Western Turkmenistan, nobody investigated and compared the herpetofauna along a profile crossing Western Turkmenistan from the sand desert Karakum southward to the ridge Monjukly which borders Iran. Therefore, the zoogeographical

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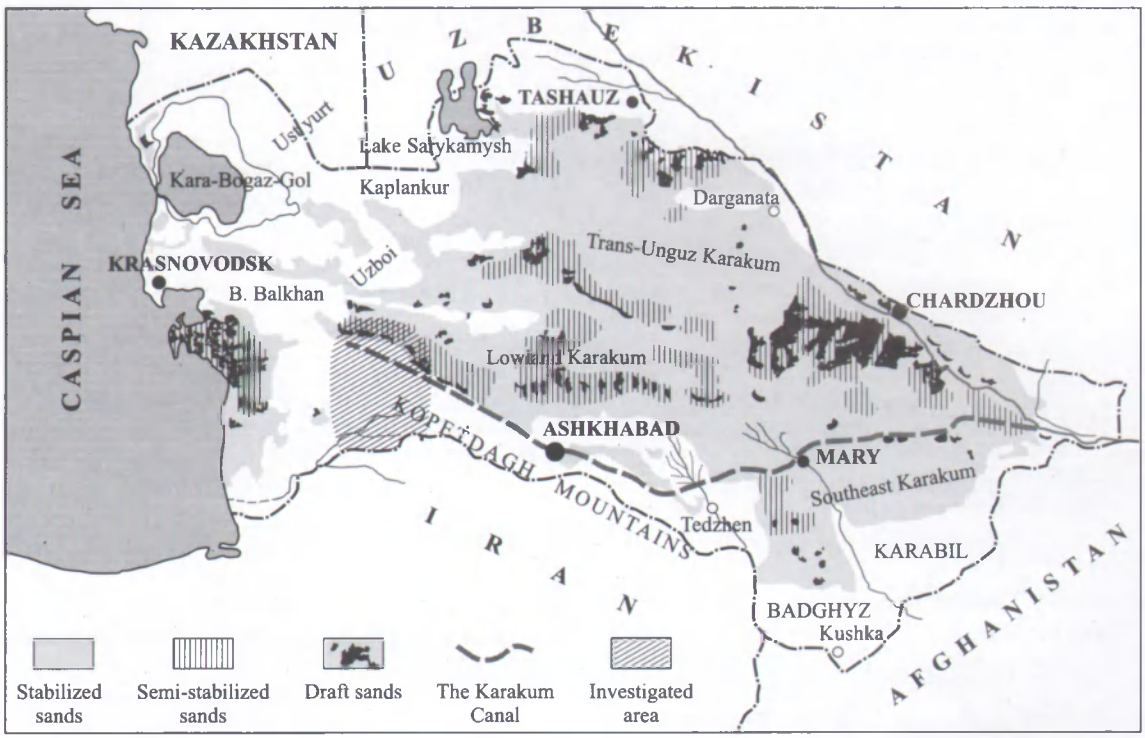


Fig. 1. A schematic map of Turkmenistan (from Babaev, 1994).

status of this region as a whole and of each of its distinct landscapes has not been studied yet.

MATERIAL AND METHODS

Comparison of the ten landscape units bases of several expeditions in this area during the last 5 years by the first author and a joint Swiss-Swedish-Russian-Turkmenian expedition from April to May 1994, which has covered the main areas of the western Turanian lowland and the Turkmeno-Khorasan mountains (Fig. 1).

Examination sites were chosen according to altitudinal and ecological principles and were described by vegetation typology: the whole region after Korovin (1934), the Western Kopetdagh after Fet and Kamahina (1982) and Neshatayeva (1985), the Karakum desert after Kalenov and Muhamedov (1992). (We made corrections for local conditions in each vegetation type in all plots). Plants were defined after the guide of Nikitin and Geldikhanov (1988).

The reptile species were divided into ecological-geographical (faunal) groups according to modern chorology (which one) and ecological characteristics. We compared the zoogeographical areas of the herpetofauna of Western Turkmenistan according to the different representation of these groups in the studied areas.

PHYSIOGRAPHY AND DESCRIPTION OF THE STUDIED AREA

According to the climatic peculiarities and vegetation the arid regions of Turkmenistan were divided into northern deserts of the Central Asian type and into southern deserts of the Mediterranean type (Gvozdezky and Mihaylov, 1987). Our study covers the southern zone of the Turanian lowland as well as the higher area of the Western Kopetdagh mountains and Malyi Balkhan.

The Western Kopetdagh is situated in the northwestern part of the Turkmeno-Khorasan mountains, westward of the village Nokhur (Babayev and Durdyev, 1982). It differs from the Central and Eastern Kopetdagh in a relief and landscape of comparatively young origin and in complex geological and geomorphological structures. Small mountains and broad longitudinal valleys (Hodjakala, Sumbar, Chandyr)

cover the area westwards to the highest peak (Uchkui, 1900 m) of the eastern part of Western Kopetdagh. The Peredovoy range is steep on its northern side and has a broad plateau-like crest on the southern slope (Sayvan-Nokhur plateau). The range Monjukly with an altitude of about 1000 m lies behind the Sumbar river valley and near the borders of Iran. High belts of vegetation are observed in the Western Kopetdagh (from wormwood deserts in the foothills up to a mountain-steppe on the upper limits of the ridges).

According to its geological peculiarities, the Malyi Balkhan must be directly included in the mountain system of the Kopetdagh like its marginal northwestern link (Gvozdezky and Mihaylov, 1987). The Malyi Balkhan reaches 779 m of altitude and is covered by wormwood-salwort deserts of the southern type.

Between the northern slope of the Malyi Balkhan and the dried-out river-bed of the Uzboy (the ancient river-bed of the Amu Darya) lies the western part of the Central Karakum, the biggest sand desert of Middle Asia. This desert was formed by alluvium of the ancient river Amu Darya. Its aridization increased about 70,000 years ago, when the Amu Darya turned northward to the Aral sea (Babayev and Zonn, 1992). Various versions of ephemera and ephemera-desert-bushes present the modern vegetation of the Karakum desert (Kalenov and Muhamedov, 1992).

Southwards, the Kyurendag Corridor separates the Malyi Balkhan from the Western Kopetdagh. This is a clay plain which continues further to the east along the whole Kopetdagh. The major part of the clay lowland is characterized by wormwood-salwort and wormwood-ephemera desert. The central lowest part of the Kyurendag Corridor consists of so called takyrs — bare clay spots almost without vegetation.

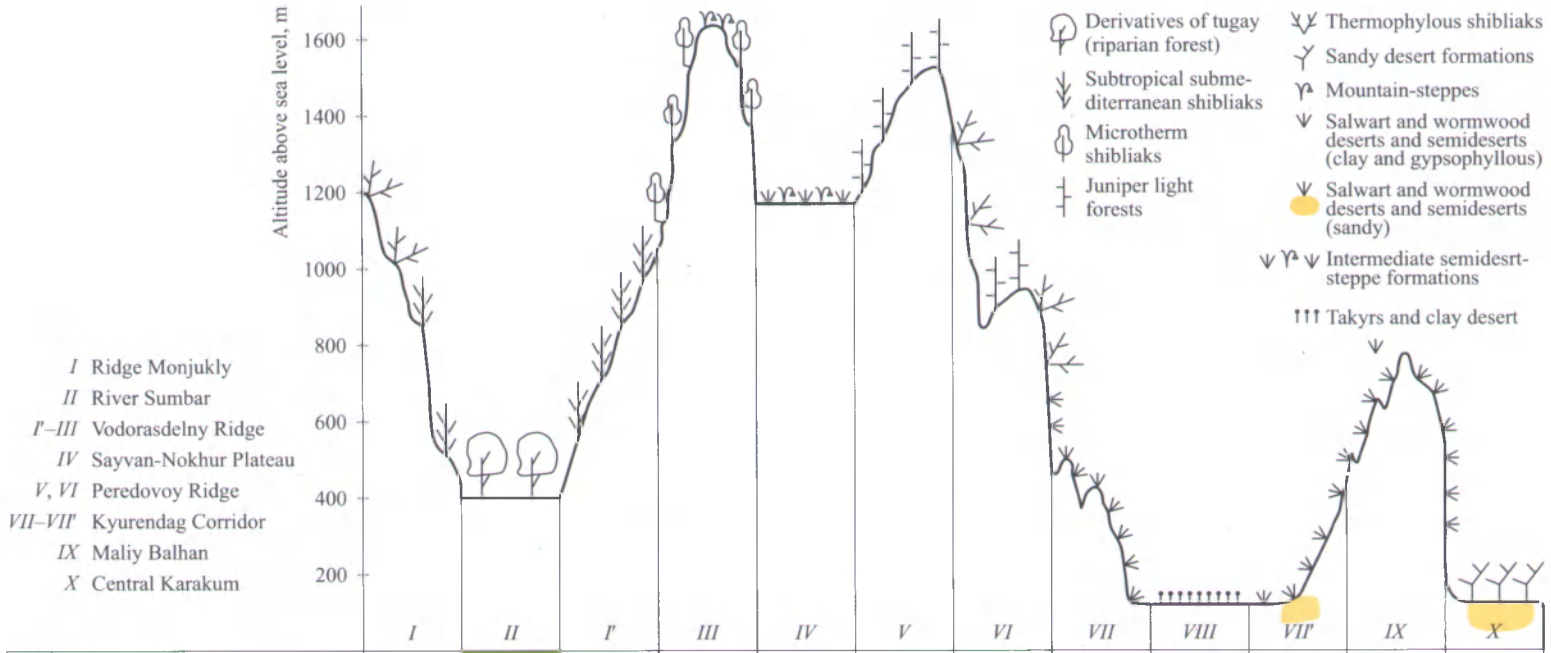
Along the main part of the profile the climate is of a sharply continental dry type, only in the valley of the Sumbar river it is subtropical. The mean annual temperature is 15.9°C in the north and 16.2°C in the south. The prevailing monthly mean temperatures in June to August are 30°C in the Turanian lowland and 26 – 30°C in the Sumbar river valley. The ground surface temperature can reach 50°C. Winter is often mild and snowless in the lowland and at the foot of the hills, the mountains are snow-covered. The isotherms of January are about 0°C in the north and +5°C in the valley of the river Sumbar, although the temperature can fall to –29°C in the whole study area. The volume of precipitation increases southward from 148 mm near the Malyi Balkhan up to 328 mm in the Sumbar river valley (Babayev and Durdyev, 1982; Orlovsky, 1992).

The studied area was divided into 10 landscape units (Fig. 2) which are described below:

Unit I and I*. The northern slope of the range Monjukly is up to 1200 m and the southern slope of the Vodorazdelny ridge up to 800 m. The vegetation consists of subtropical Submediterranean shibliaks which are formed by *Paliurus spina-christi*, *Punica granatum*, *Celtis caucasica*, and partly of *Zyzyphus jujuba*, *Ficus carica*, *Jasminum fruticans*. This is a quite well watered area with several springs and small creeks. Near the watercourses a dense vegetation exists consisting of *Prunus divaricata*, *Crataegus sp. var.*, *Rubus anatolicus*, and *Vitis sylverstris*. The woodless space is covered with xerophylous shrubs.

Unit II. The Sumbar river bed, in 350 – 400 m altitude. Derivates of the so-called tugay (riparian or gallery-forest) are found here. A formation of *Populus euphratica* with *Elaeagnus orientalis*, *Ulmus carpinifolius* and grass floor of *Lolium rigidum* develops on the first terrace. On the second terrace grow *Tamarix meyeri* formations with partly *Tamarix laxa*, *T. florida*, *Phragmites australis* and *Arundo donax*. On the third terrace are units of semideserts consisting of distributed sand and clay. They have an anthropogenic origin and are represented by *Haloxylon aphyllum* and *Aellenia subaphyla*.

Unit III. The upper belts of the Vodorazdelny ridge (1200 – 1600 m). The crest of the Vodorazdelny ridge is covered with mountain-steppe vegetation. Dominating species are *Festuca vallessiaca*, *Stipa crassiculmis*, *S. capillata*, *S. lessingiana*, *Elytrigia trichophora*, *Eremurus subalbiflorus*, and *Bongardia chrysogonum*. Both slopes of the Vodorazdelny ridge have microtherm shibliaks with *Acer turcomanicum* as prevalent species and several subdominant species such as *Celtis caucasica*, *Crataegus sp. var.*, *Cotoneaster nummularius*, *Lonicera floribunda*, *Colutea buhsei*, and *Rhamnus coriacea*. On the grass level *Cousinia umbrosa*, *Allium paradoxum*, and others were found. Woodless slopes are covered with tragacanthic formations of phrygana and units of tomillares consisting, e.g., of *Acantholimon* sp. var., *Thymus afghanicus*, and *Onosma dichroantha*. This whole area is well watered by numerous springs and brooks near which single specimens of *Juglans regia*, *Platanus orienatalis*, and *Elaeagnus orientalis* are preserved.



		I	II	I'	III	IV	V	VI	VII	VIII	VII'	IX	X
1.	*Emys orbicularis*		■										
2.	*Mauremys caspica*		■										
3.	*Agrionemys horsfieldi*	■	■	■	■	■	■	■	■		■	■	■
4.	*Phrynocephalus helioscopus*									■	■		
5.	*Ph. interscapularis*												■
6.	*Ph. mystaceus*												■
7.	*Laudakia caucasia*	■	■	■	■	■	■	■				■	
8.	*Trapelus sanguinolentus*	■	■	■	■	■	■	■	■		■	■	■
9.	*Pseudopus apodus*	■	■	■	■	■	■	■					
10.	*Alsophylax laevis*									■			
11.	*Crossobamon eversmanni*										■		■
12.	*Cyrtopodion caspius*	■	■	■	■	■	■	■	■		■	■	■
13.	*C. russowi*		■										■
14.	*C. spinicauda*	▒		▒				▒	▒			▒	
15.	*Eublepharis turcmenicus*	▒	▒	▒				▒	▒				
16.	*Teratoscincus scincus*												■

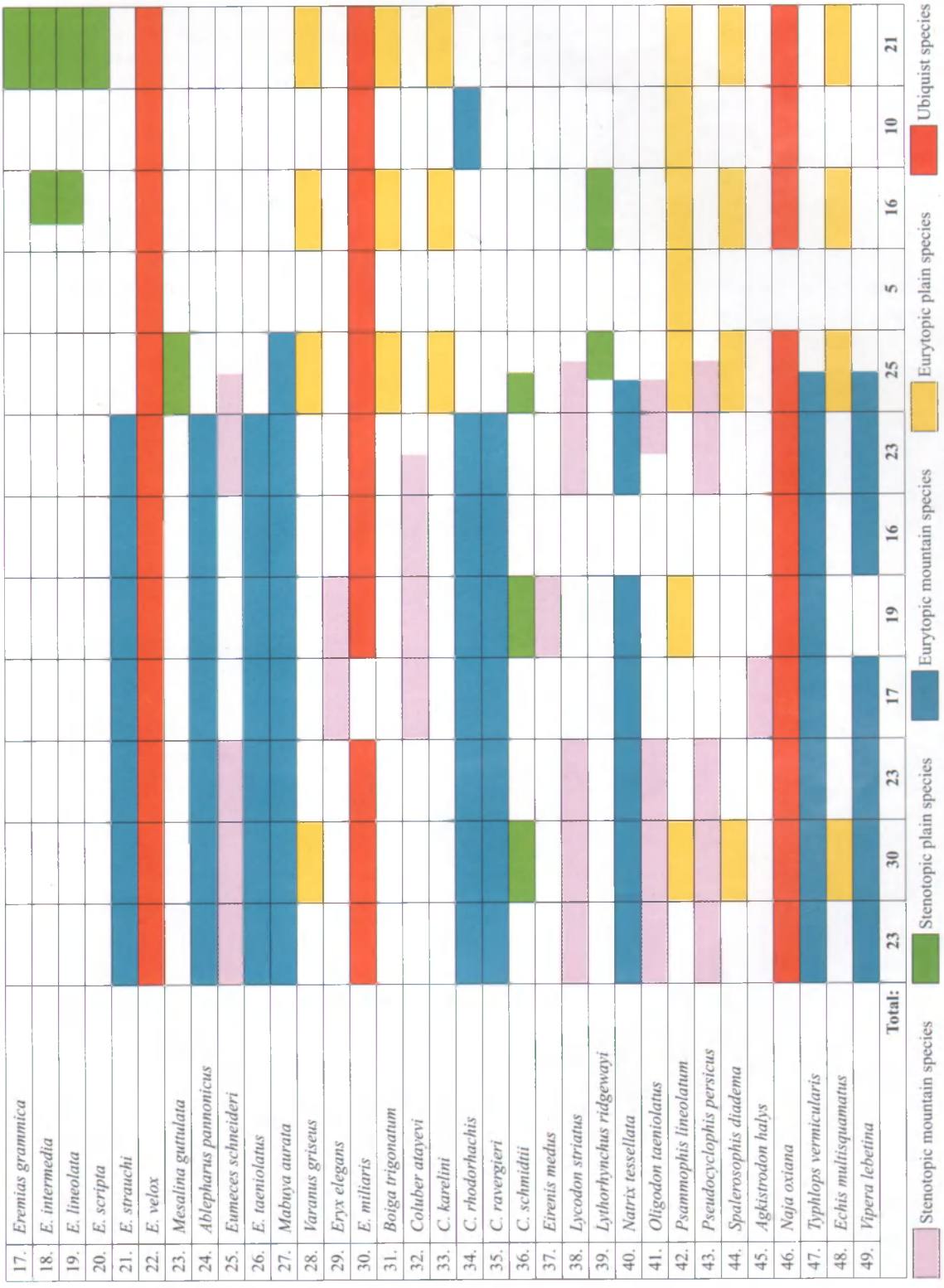


Fig. 2. Landscape distribution of reptiles along the profile across western Turkmenistan.

Unit IV. The Sayvan-Nokhur plateau (1000 – 1200 m). This is a district of cultivation and pasture. A big area is covered with crops. The primary vegetation is preserved island-like on the slopes of small hills and shows intermediate formations between semideserts and mountain-steppes. The corresponding species are *Artemisia oliveriana*, *Onosma dichroantha*, *Iris ewbankiana*, *Bothriochloa ischaemum*, and *Hypecoum parviflorum*. There is one creek on the plateau which dries out during the summer period.

Unit V. The southern slope of the Peredovoy ridge (1200 – 1500 m). The main vegetation type, *Junipereta turcomanica*, consists of light juniper forests and units of mountain-steppe. This district is very steep, dry and without springs.

Unit VI. Gorges of the northern macroslope of the Western Kopetdagh (600 – 1000 m). Rocky gorges with steep slopes and big stony-broken areas. The main vegetation type is thermophyllous shibliak with *Celtis caucasica*, *Acer turcomania*, and *Swida meyeri* prevailing on the slopes and *Cercis griffithii* and *Berberis densiflora* in the steep places. Quite big associations are formed by *Hymenocrater bituminosus* and *Ephedra* sp. The corresponding grasses are *Fritillaria raddeana* and *Hyacintus litwinowi*. A few springs are present in this area.

Unit VII. Submountaneous inclined clay and gravel plain of the Kopetdagh (up to 400 m). The covering of vegetation is very thin consisting of scattered annual ephemeras, under-shrubs and low shrubs with the main component *Artemisia*. Its center is formed by specialized gypsophyts of different families. The short vegetation period is determined by a spring rain and by summer dryness.

Unit VII*. Clay plain near the southern foothills of the Malyi Balkhan (Kyuren Dag Corridor). Clay lowland with single small ravines and sandy spots with grass (up to 100 m). The desert vegetation is formed mainly of *Artemisia badhysi* and *Salsola richteri* mixed with *Arnebia linearifolia*, *Koelpinia macrantha*, *Zygophylum macrophyllum*, *Gagea graminifolia*, *Hypecoum trilobum*, etc. The vegetation on the clay consists of fragments of psammophylous associations.

Unit VIII. Takyrs (clay spots) of the Kyuren Dag Corridor. Central part of the Kyuren Dag Corridor which has bare areas, so-called takyrs with primitive communities of *Salsola gemmascens-Salsola rigida*.

Unit IX. Malyi Balkhan. Parallel located chains (400 – 700 m). The outer ridges are covered with semidesert vegetation whereas the inner ridges are mainly badlands completely without vegetation. Along the dried river bed *Ferula oopoda*, *Leontice ewersmannii*, *Rheum turkestanicum*, *Amberboa amberboi*, *Glaucium elegans*, and *Asparagus persicus* are found.

Unit X. Western end of the Central Karakum. Sand desert with moving dunes, sandy hills and grass covered valleys. The grass vegetation is formed mainly of perennial, annual and monocarpical ephemeras (*Poa bulbosa*, *Carex physodes*, *Eremopyrum bonapartis*, *Arnebia decumbens*, *Silene nana*, *Strigosella grandiflora*, and *Nonea caspica*). Specialized trees and bushy psammophyts are represented by *Haloxylon persicum*, *Ammodendron* sp., *Aellenia subaphylla*, *Salsola richteri*, *Calligonum microcarpum*, *C. caput-medusae*, and *C. leucocladum*.

FAUNISTIC NOTES

Class REPTILIA
Order Chelonia
Family Emydidae

1. ***Emys orbicularis*** (Linnaeus 1758) was only recorded along the river Sumbar, where in some places it was common but not numerous.

2. ***Mauremys caspica*** (Gmelin 1774) inhabits like the former species only the valley of the Sumbar, however in a much bigger population density than *E. orbicularis*.

Family Testudinidae

3. ***Agrionemys horsfieldi*** (Gray 1844). Specimens were observed along the whole investigated profile except of the bare takyrs of the Kyuren Dag Corridor. This species is abundant on the Monjukly range, in the Sumbar river valley, on the southern macroslope of the Western Kopetdagh and on its crest zone (units I – III). It is quite common on the Malyi Balkhan (unit IX) and comparatively rare in all other units.

Order Squamata
Suborder Sauria
Family Agamidae

4. ***Phrynocephalus helioscopus*** (Pallas 1771) was found in the clay plain of the Kyuren Dag Corridor (unit VIII), where it occurs on takyr and poorly-grassed places of the clay desert. It penetrates into the first chain of hills of the Malyi Balkhan along the

broad dried out valleys but habitually it occurs on the open plain clay unit.

5. ***Phrynocephalus interscapularis*** Lichtenstein 1856, was only observed along the profile in the Karakum sand desert near the village Ahchakuyma (Unit X).

6. ***Phrynocephalus mystaceus*** (Pallas 1776) was found in the Karakum sand desert near the village Ahchakuyma. It is common on the slopes of bigger sand dunes.

7. ***Laudakia caucasia*** (Eichwald 1831) is found along the whole Western Kopetdagh and Malyi Balkhan a widely distributed species. The population on the Malyi Balkhan is much smaller than that on the Kopetdagh. Animals were observed in rocky gorges as well as along the slopes and plateau-like grounds with big stones or blocks.

8. ***Trapelus sanguinolentus aralensis*** Lichtenstein 1823. These agamas were observed along the whole profile with the exception of the takyrs in the central part of the Kyuren Dag Corridor. They were most abundant in the clay and sand lowlands around the Malyi Balkhan. The population density decreased up to the mountains and increased again in the valley of the river Sumbar.

Family Anguidae

9. ***Pseudopus apodus*** (Pallas 1775) was only found in the Western Kopetdagh where it was comparatively rare on the northern macroslope (units VI – VII) and quite abundant in the upper belts of the mountains and on the southern macroslope. As a xero-mesophylous species it prefers shibliaks and bushes or the vicinity of springs, but it also occurs in the units of the mountain-steppe and semideserts.

Family Gekkonidae

10. ***Alsophylax laevis*** Nikolsky 1907, lives in the central part of the clay plain in the Kyuren Dag Corridor. It prefers the termitariums among poor semishrubs of *Artemisia* and *Salsola*.

11. ***Crossobamon eversmanni*** (Wiegmann 1834) is a sand-loving gecko of the plains, very common in the sand desert near the village Ahchakuyma. Above that it was found on the small sandy spots near the foothills of the Malyi Balkhan.

12. ***Cyrtopodion caspius*** (Eichwald 1831) is a species widely distributed throughout the profile, with the exception of the takyrs (unit VIII). In the mountains it lives in various rocky and stony habitats. In the hills and plains (including sand plains) it prefers the burrows of rodent colonies, mainly of *Rhombomys opimus* and *Meriones erythrourus*.

13. ***Cyrtopodion russowi*** (Strauch 1887) lives on big bushes and desert-trees like *Ammodendron*, *Haloxylon*, and *Calligonum* of the sand deserts, which grow rarely in too dense soils. We found *C. russowi* near the village Ahchakuyma (unit X). It is also known to live in the valley of the river Sumbar (Shammakov, 1981; Skalon, 1982; Atayev, 1987).

14. ***Cyrtopodion spinicauda*** (Strauch 1887) is a sporadically distributed species of the small-detritus gray shale badlands of the foothills of the Kopetdagh. It is rarely found in the upper mountain belts of the Kopetdagh. We observed it on the Malyi Balkhan and up to 900 m on both macroslopes of the Western Kopetdagh.

15. ***Eublepharis turcmenicus*** Darevsky 1977, is known on the low belts of both macroslopes of the Western Kopetdagh. Normally, it occurs in places with detritus and big blocks and shrubs not far away from springs.

16. ***Teratoscincus scincus*** (Schlegel 1858) was seen in the Karakum sand desert near the village Ahchakuyma, where it was quite common in open sand patches.

Family Lacertidae

17. ***Eremias grammica*** (Lichtenstein 1823) is the biggest-sized desert lacertide observed by us. This species was common on the big sand dunes near the village Ahchakuyma.

18. ***Eremias intermedia*** (Strauch 1876) was the most prevalent reptile species on the clay plain near the southern foothills of the Malyi Balkhan. The animals were also comparatively common on sandy patches with grass near the northern edge of the Malyi Balkhan (units VIII, X).

19. ***Eremias lineolata*** (Nikolsky 1896) occurs on open sand plains with few shrubs. We observed it as well in the sand desert near Ahchakuyma as on the small sandy spots inside the clay plain near the southern foothills of the Malyi Balkhan (units VII*, X).

20. ***Eremias scripta*** (Strauch 1867) is a typical sand-loving species. It inhabits the crests of high aeolian sand dunes, mainly near the sand grass *Stipagrostis* sp. We did not find this species but, according to Bogdanov (1962) and Shcherbak (1974), it is known from Ahchakuyma.

21. ***Eremias strauchi kopetdaghica*** Szczerbak 1971, is a common species in the Western Kopetdagh. It is dominant in the upper mountain belts

(units III – V) but relatively few specimens are found in the lower belts of the northern macroslope.

22. ***Eremias velox*** (Pallas 1771) spreads along the whole profile from the sand deserts and takyrs round the Malyi Balkhan southward to the ridge Monjukly. The biggest population density is found in the foothills of the Kopetdagh and in the Malyi Balkhan whereas it is smaller in the sand deserts and the high mountain belts.

23. ***Mesalina guttulata watsonana*** Stoliczka 1872, was only found on the profile on the inclined lowland of the northern foothills of the Kopetdagh. It is quite common but not numerous in the gravel (gypsophylous) wormwood semidesert.

Family Scincidae

24. ***Ablepharus pannonicus*** (Lichtenstein 1823) is a common species in the Western Kopetdagh. Skinks were only abundant among *Phryganas* from the foothills up to the crest of the Kopetdagh. Apparently, it is possible to find this species also in the upper parts of the Malyi Balkhan. It is known from the more northerly located ridge of the Bol'shoi Balkhan. Unfortunate weather conditions during our work on the main crest of the Malyi Balkhan were characterized by storm winds resulting in the absence of reptile surface activity (except for single specimens of *Laudakia caucasia* in the cracks of rocks).

25. ***Eumeces schneideri princeps*** Eichwald 1839, is a common species of the foothills and low-mountain belts on both slopes of the Western Kopetdagh. It prefers grassy soft grounds with big flat stones.

26. ***Eumeces taeniolatus*** Blyth 1854, is a widely distributed skink along the whole Western Kopetdagh from the foothills to the highest limits. Most specimens were observed in stony and rocky gorges with steep slopes covered with bushes and shibliak vegetation.

27. ***Mabuya aurata*** (Linnaeus 1758) is as frequent in the Western Kopetdagh as the former species. It reaches down to the inclined plain near the Kopetdagh foothills but it does not form populations of high density as all other skinks of the Kopetdagh.

Family Varanidae

28. ***Varanus griseus caspius*** Eichwald 1831, populates the plain and reaches the foothills. We found it in the clay lowland of the Kyuren Dag Corridor. Traces of it were seen in the sand near Ahchakuyma. In the literature these monitor lizards were recorded from the valley of the river Sumbar (Atayev, 1985) and from the inclined plain of the Western Kopetdagh (Shammakov, 1981).

Suborder Serpentes
Family Boidae

29. ***Eryx elegans*** (Gray 1849) was found on the profile on the Sayvan-Nokhur plateau (unit IV) and on the crest of the Vodorazdelny ridge (unit III) with corresponding mountain-steppe vegetation and intermediate semidesert-steppe vegetation. Normally it prefers rodent colonies and places with big flat stones.

30. ***Eryx miliaris*** (Pallas 1773) is a widely distributed species with the highest population density in the sand deserts. On the profile, many specimens were seen in the Karakum sand desert near Ahchakuyma, only occasionally in other places and none on the crest of the Kopetdagh (unit III). This snake can even live on takyrs where it finds refuge under the crest of the clay's crust.

Family Colubridae

31. ***Boiga trigonatum melanocephala*** Annandale 1904. A species of the plains which is spread over sand and clay deserts round the Malyi Balkhan and near the northern foothills of the Western Kopetdagh.

32. ***Coluber atayevi*** Tuniyev and Shammakov, 1993, was earlier included in *C. najadum*. It was known as one of the rarest snakes of the Kopetdagh (Nikolsky, 1916; Chernov, 1934; Bogdanov, 1962; Atayev and Shammakov, 1990) and accordingly it was included in the Red Data Book of Turkmenistan (1985). Actually this snake is locally common in the upper belts of the mountains, up from 750 – 800 m above sea level. It is a dominant species at 1000 – 1200 m which is, in comparison with other snakes, frequently found.

33. ***Coluber ravergieri*** Menetries 1832, was found along the whole Western Kopetdagh. This snake prefers humid shady places not far away from springs and creeks. The largest density was observed in the small gorges of the Vodorazdelny ridge of the Kopetdagh (unit III).

34. ***Coluber karelini*** Brandt 1838, is a species of the plains. It is more common in sand deserts but can also live on the clay units. We observed it around the Malyi Balkhan and near the northern foothills of the Kopetdagh.

35. ***Coluber rhodorhachis*** (Jan 1865) (= *C. ladacensis* [Anderson 1871]). This species is not common in the mountains of the Western Kopetdagh and

the Malyi Balkhan. It inhabits stony and rocky biotopes of gorges and occurs also on slopes near the burrows of rodent colonies.

36. ***Coluber schmidtii*** Nikolsky 1909, is common in the Sumbar river valley. It is found southward from the village Bami on the northern foothills of the Western Kopetdagh (Atayev et al., 1991). We found it on the Sayvan-Nokhur plateau, where it prefers rodent colonies in *Artemisia* bushes along the plain places near watercourses.

37. ***Eirenis medus*** (Chernov 1949) was only caught on the Sayvan-Nokhur plateau (unit IV), where the species was locally common under the stones in semidesert-steppe areas on the slopes of small hills.

38. ***Lycodon striatus bicolor*** Nikolsky 1903 is a thermophyllous species which inhabits semidesert and shibliak biotopes of the Western Kopetdagh. The few findings are due to the nocturnal life-style of this species.

39. ***Lythorhynchus ridgewayi*** Boulenger 1887 was only seen on the clay plain between the Western Kopetdagh and the Malyi Balkhan, except the central takyrs. It is a comparatively rare, but in suitable habitats and at optimal activity seasons locally common snake. It was also observed near the southern foothills of the Malyi Balkhan in 1992.

40. ***Natrix tessellata*** (Laurenti 1768) is sporadically distributed along the whole Western Kopetdagh, except for light Juniper forests. It lives in habitats near constant watercourses (springs, creeks, rivers), but it might be found in hibernation places quite far away from the water.

41. ***Oligodon taeniolatus*** (Jordan 1853) was not encountered by us during our expedition but it is known from the studied area, according to other authors (Scherback, 1979; Atayev et al., 1991; Atayev, 1985, 1987). It exists in the Western Kopetdagh syntopically with *Lycodon striatus*.

42. ***Psammophis lineolatum*** (Brandt 1838) is a widely distributed species on the plains. Beside the Kyuren Dag and the Balkhan Corridors it lives on the Malyi Balkhan, in the valley of the river Sumbar and on the Sayvan-Nokhur plateau.

43. ***Pseudocyclophis persicus*** (Anderson 1872) is a common but not numerous species of low belts on both slopes of the Western Kopetdagh. In the north it can also live on the inclined lowland not far from hills.

44. *Spalerosophis diadema schiraziana* Jan 1865, is a species of the plains which was observed both in sand and in clay deserts (except for takyrs). It does not occur on real mountains but is found in the valley of the river Sumbar (Atayev, 1985).

Family Elapidae

45. ***Naja oxiana*** (Eichwald 1831) is a widely distributed species along the whole profile, except for takyrs (unit VIII). The number of findings increases in the Sumbar river valley and on the slopes of the range Monjukly and of the Kopetdagh which are exposed towards that valley.

Family Typhlopidae

46. ***Typhlops vermicularis*** Merrem 1820, is common and locally numerous on the submountain inclined plain on the north of the Kopetdagh southward to the ridge Monjukly (in all mountain belts of the Western Kopetdagh).

Family Viperidae

47. ***Echis multisquamatus*** Cherlin 1981 lives in the plains. It was recorded round the Malyi Balkhan and near the foothills of the Kopetdagh. It is also found in the Sumbar river valley (Skalon, 1982; Atayev, 1985).

48. ***Vipera lebetina*** (Linnaeus 1758) is common on both macroslopes of the Western Kopetdagh, where it mainly occurs on stony and rocky gorges with big blocks and steep slopes among the shibliaks. Since if is not caught for serpentariums in the gorges of the northern macroslope it occurs there in big numbers. The taxonomic status of this population is not clearly defined but we believe it to be closer to *V. lebetina obtusa* (although somewhat smaller) than to the form "*cernovi*" described from the eastern Kopetdagh (Chikin and Shcherbak, 1992).

Family Crotalidae

49. ***Agkistrodon intermedius caucasicus*** Nikolsky, 1916 inhabits the Western Kopetdagh only on the highest part of the ridge up from 1200 m. Snakes were found on the steep slopes of gorges covered with microtherm shibliaks and with big colonies of *Microtus afghanus*.

DISCUSSION

We found 49 reptile species which account for 62% of the known list of reptiles of Turkmenistan in spite of the comparatively small area. This is due to the various landscapesour of profile: from the far west end of the Central Karakum desert, across some parts of the Turkmeno-Khorasan mountains, to the

subtropical districts on the border of Iran. The chosen units correspond to different landscapes of the profile. They are non-equivalent in species numbers. The richest fauna was found in the valley of the river Sumbar (30 species) and the poorest reptile list was found in the takyrs of the Kyuren Dag Corridor (5 species). If only the number of original (corresponding) species is considered, both the Sumbar valley and the takyrs of the Kyuren Dag Corridor have but 2 original species correspondingly. Therefore, *Emys orbicularis* and *Mauremys caspica* are only present on the profile in the Sumbar valley because they need comparatively large constant water courses. The takyrs on the other hand are the unique biotop of *Phrynocephalus helioscopus* and *Alsophilax laevis*.

The species composition for each landscape unit depends on the differences in the ecological tolerance of the reptiles. We have distinguished several ecological groups of reptiles in western Turkmenistan according to their character of distribution and altitude range.

1. Stenotopic plain species.

This group consists of 3 subgroups. 1a — stenotopic species of sand deserts (*Phrynocephalus interscapularis*, *Ph. mystaceus*, *Crossobamon eversmanni*, *Cyrtopodion russowi*, *Teratoscincus scincus*, *Eremias grammica*, *E. lineolata*, and *E. scripta*); 1b — stenotopic species of clay deserts (*Phrynocephalus helioscopus*, *Alsophylax laevis*, *Mesalina guttulata*, and *Lythorhynchus ridgewayi*); 1c — stenotopic hydrophylous and mesophylous species (*Emys orbicularis*, *Mauremys caspica*, and *Coluber schmidtii*).

2. Eurytopic plain species.

These reptiles occur both in sand and clay deserts and are as a rule only absent in large takyrs (*Eremias intermedia*, *Varanus griseus*, *Boiga trigonatum*, *Coluber karelini*, *Psammophis lineolatum*, *Spalerosophis diadema*, and *Echis multisquamatus*).

3. Steno- and oligotopic mountain species.

This group includes animals, which occur in certain mountain belts. We distinguish two subgroups. 3a — species of foothills and lower belts of mountains (*Cyrtopodion spinicauda*, *Eublepharis turcmenicus*, *Eumeces schneideri*, *Lycodon striatus*, *Oligodon taeniolatus*, and *Pseudocyclophis persicus*); 3b — species of middle- and high-mountain belts (*Eryx elegans*, *Coluber atayevi*, *Agkistrodon intermedius*, and *Eirenis medus*).

4. Eurytopic mountain species.

These are widely distributed reptiles in all or almost all mountain belts (*Laudakia caucasia*, *Pseudopus apodus*, *Eremias strauchi*, *Ablepharus pannonicus*, *Mabuja aurata*, *Eumeces taeniolatus*, *Coluber ravergieri*, *C. rhodorhachis*, *Natrix tessellata*, *Typhlops vermicularis*, and *Vipera lebetina*).

5. Ubiquist species.

Representatives of this group might be typical in some landscapes but live as well in lowlands as in mountains at all or almost all ecological altitude-belts. (*Agrionemys horsfieldi*, *Trapelus sanguinolentus*, *Cyrtopodion caspius*, *Eremias velox*, *Eryx miliaris*, and *Naja oxiana*).

It can be seen in Fig. 2 that several of the plain species are also present in the Sayvan-Nokhur plateau higher than 1000 m. Firstly these are *Psammophis lineolatum* and *Coluber schmidtii*. This is explained by the distribution of the two species through wide weakly inclined valleys from the south-west up to the Sayvan-Nokhur plateau. Many springs and creeks in combination with semidesert plain units provide favorable conditions for mesophylous species like *Coluber schmidtii* and desert inhabitants like *Psammophis lineolatum* and *Eryx miliaris*. In the same way, several desert animals like *Cyrtopodion russowi*, *Varanus griseus*, *Psammophis lineolatum*, *Spalerosophis diadema*, and *Echis multisquamatus* have reached the Sumbar river valley from the near Caspian deserts. All these species are confined to the small units of corresponding habitats (i.e. sand or badlands) which was well illustrated by Bogdanov (1962) and Atayev (1987). All these species are not encountered in the tugay-forests and in the humid biotopes of the Sumbar valley.

Another interesting aspect arises from comparison of the number of species for mountains and lowlands in general and for each subdivision particularly. We noted 22 species for plains, 21 for mountains, and 6 ubiquists. The number of species of the plains is slightly more than that for mountain species even if we include several local findings of other reptiles near our profile like *Lacerta strigata* from the rivers Chandyr and Atrek on the south (Atayev, 1985) or *Phrynocephalus maculatus* near the village Bami, *Ph. raddei* from the northern foothills of the Kopetdagh (Shammakov, 1985), and *Telescopus rhynopoma* from the station Iskander (Rustamov and Atayev, 1976).

A comparison of the herpetofauna from the Western Kopetdagh and the Malyi Balkhan shows a poor list of mountain elements from the latter. On the Malyi Balkhan we observed *Cyrtopodion spinicauda*, *Laudakia caucasia*, and *Coluber rhodorhachis*. Apparently these species entered the Malyi Balkhan in the past more humid periods, when gorge-like water courses ran into the Kyuren Dag Corridor from both sides (i.e., from the Kopetdagh and the Malyi Balkhan) and formed suitable conditions for the entrance of mountain reptiles. It is difficult to estimate now, if these were the only species who could reach the Malyi Balkhan or if the rigorous modern climatic conditions, mainly cruel winds (for about 200 days per year), have preserved only a small part of the former mountain inhabitants while the rest became extinct. This might be true for our finding of *Mabuja aurata* and *Ablepharus pannonicus* which are known in more northerly areas like the Bol'shoi Balkhan, the Uzboy valley and the Caspian shore.

At the Kopetdagh the most various fauna was observed at the lower belts of both macroslopes (23 species). The species composition was more or less identical, thus we could not pick out corresponding elements for the described landscape units (I, I*, VI). But generally, the number of original reptiles is still large at the foothills of both slopes of the Kopetdagh (*Eumeces schneideri*, *Eublepharis turcmenicus*, *Lycodon striatus*, *Oligodon taeniolatus*, and *Pseudocyclophis persicus*).

The herpetofauna of the upper belts in the Kopetdagh is poor but has its own corresponding species. Thus 17 species were found in the mountain-steppe belt (including the microtherm shibliak) and two of them live only there (*Eryx elegans* and *Agkistrodon intermedius*). The reptile list of the Sayvan-Nokhur plateau is a little bigger (19 species) due to the above mentioned causes of invasion of some species of plain landscapes. The original reptile of this plateau is *Eirenis medus*. The smallest number of high mountain reptile species occurs in the light juniper forests with very dry microclimatic characteristics.

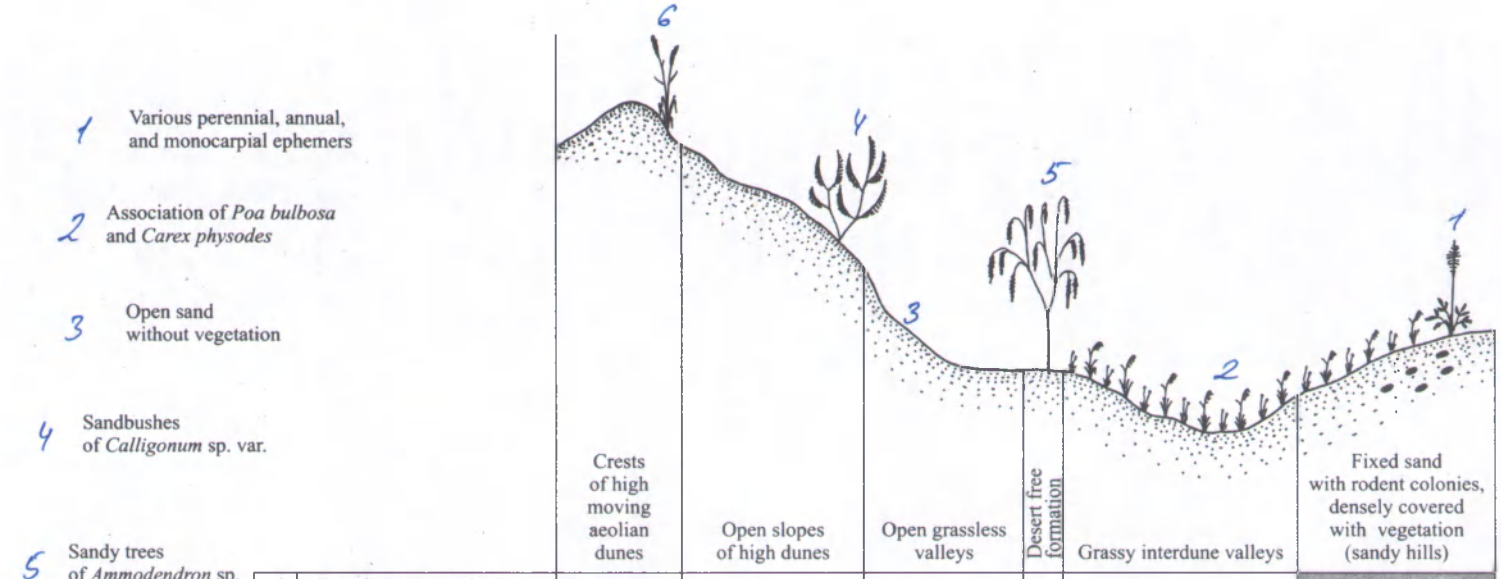
Comparison of the fauna of different desert types shows that the sand desert is richer and more distinctive than the clay desert. This is at first sight a paradox, which can be explained by a broader variation of the microbiotopes (microstations) in the sand than in the clay plain. Botanists connect the increasing speciation process of plants in the Karakum with the mobility of the sand (Kolenov and Muhamedov, 1992). This rule is the same for all biota.

Besides the daily niche segregation between diurnal and nocturnal species, there exists a strong microhabital preference (Fig. 3) which is evolutionary fixed. It was well described by Ananjeva (1976) by the example of the genus *Eremias*.

Now we come to a more detailed discussion of the microhabital occurrence of sand desert reptiles. High moving sand dunes along crests with sand-grass (*Stipagrostis* sp.) are the habitat of *Eremias scripta*. Open grassless slopes of high dunes are populated by *Phrynocephalus mystaceus*. On the same dunes in the units with a few shrubs (*Calligonum* sp.) *Eremias grammica* and *Teratoscincus scincus* can be observed. Along the open grassless valleys between high dunes two species are common: *Phrynocephalus interscapularis* and *Eremias lineolata*. In more grassy interdune valleys and on sandy hills live *Crossobamon eversmanni* and *Eremias intermedia*. The main spectrum of moving and semifixed sands form the habitats of *Eryx miliaris*, *Boiga trigonatum*, and *Echis multisquamatus*. Species like *Agrionemys horsfieldi*, *Eremias velox*, and *Trapelus sanguinolentus* appear on sands with the most vegetation covering. *Cyrtopodion caspius*, *Psammophis lineolatum*, *Coluber karelini*, and *Spalerosophis diadema* live near the burrows of rodent colonies. All types of microstations in the sand desert are under the control of *Varanus griseus* and *Naja oxiana*. On the desert trees and big shrubs like *Haloxylon*, *Ammodendron*, and *Calligonum* lives the gecko *Cyrtopodion russowi*.

The clay desert between the Malyi Balkhan and the Kopetdagh has been separated into two units by the takyrs. Near the Kopetdagh on the inclined plain a row of mountain species get more abundant towards the foothills. Moreover, *Mesalina guttulata* is a corresponding species of this part of the gypseous gravely clay desert, which is not found near the Malyi Balkhan. At the same time the small sand spots in the clay desert near the Malyi Balkhan are populated by some sand preferring species (*Eremias intermedia*, *E. lineolata*, and *Crossobamon eversmanni*) which are not encountered near the Kopetdagh.

One of the most debatable aspects is the zoogeographical status of the investigated area. Perhaps the main cause of the traditional uniting of the heterogeneous fauna of the plains and mountains of Middle Asia has been the study of this region according to the political boundaries, ignoring the natural geographical units. But the majority of authors have recognized the originality of the sand desert and of the mountain fauna.



1.	*Trapelus sanguinolentus*						■
2.	*Eremias scripta*	■					
3.	*E. grammica*		■				
4.	*E. lineolata*			■			
5.	*E. intermedia*					■	■
6.	*E. velox*						■
7.	*Phrynocephalus mystaceus*		■				
8.	*Ph. interscapularis*			■			
9.	*Teratoscincus scincus*		■				
10.	*Crossobamon eversmanni*			■		■	
11.	*Cyrtopodion russowi*				■		
12.	*C. caspius*						■
13.	*Agrionemys horsfieldi*						■
14.	*Varanus griseus*	■	■	■	■	■	■
15.	*Psammophis lineolatum*						■
16.	*Spalerosophis diadema*						■
17.	*Boiga trigonatum*				■	■	■
18.	*Echis multisquamatus*			■	■	■	■
19.	*Eryx miliaris*	■	■	■	■	■	■
20.	*Coluber karelini*						■
21.	*Naja oxiana*	■	■	■	■	■	■
	Total:	4	6	7	6	7	13

Fig. 3. Microhabital distribution of reptiles in sand desert.

One of the first conceptions was advanced by Nikolsky (1916). According to him, the Middle Asian fauna is young and was formed during the postglacial period by migrants, mainly from Central Asian deserts. This opinion was refuted by Chernov (1949) who pointed out the existence of special speciation centers of sand desert, clay, gravel and foothill desert fauna in Middle Asia. According to Chernov, the last three faunas had connections with the south-west Asian (Middle East) fauna, but they are not identical. Among the mountain speciation centers in Middle Asia Chernov noted only the Pamirs-Alay and Tien Shan mountain systems. It is necessary to point out that Chernov (1935) reported earlier also special lizard forms corresponding to the Turanian plain, such as *Teratoscincus scincus*, *Gymnodactylus russowi* (= *Cyrtopodion russowi*), *Agama aralensis* (= *Trapelus sanguinolentus*), *Eremias scripta*, *E. lineolata*, *E. grammica*, *Phrynocephalus mystaceus*, and *Ph. interscapularis*. Later in the zoogeographical chapter Terentyev and Chernov (1949) separated the plains of Middle Asia from the Kopetdagh and the Pamirs-Tien Shan into subdivisions. But this symbolic separation has not been analyzed and explaned and has no ranks to the biochores. This subdivision had a rather physiographic character. At the same time, the authors discussed the origin of several Middle Asian reptiles. Besides the lizards mentioned above, Terentyev and Chernov (1949) classified *Eremias intermedia*, *Crossobamon eversmanni*, and *Eryx miliaris* as Middle Asian authochtons; *Eremias strauchi*, *Varanus griseus*, *Coluber najadum* (= *C. atayevi*), and *Lythorhynchus ridgewayi* as Middle East (South-west Asian) species; *Eublepharis macularius* (= *E. turcmenicus*), *Oligodon taeniolatus*, *Lycodon striatus*, and *Naja naja* (= *Naja oxiana*) were included in the Indian faunistic elements. *Testudo horsfieldi* (*Agrionemys horsfieldi*) was called a product of tropical Africa.

Anderson (1968) reports in his zoogeographical analysis of the lizard fauna of Iran about the originality of the Iranian plateau and suggests that even in the Iranian part of the Turkmen steppe (low plain near the Kopetdagh) "only 43.5% of the lizard fauna are forms which can be considered truly Aralo-Caspian, the remainder being species from the Iranian plateau and species confined primarily to mountain slopes..." (p. 319). And right in the Iranian plateau the number of Aralo-Caspian species forms only 8.3%. According to Anderson the following species belong to the Aralo-Caspian faunal elements (which be called "Turanian"): *Phrynocephalus helioscopus*, *Ph interscapularis*, *Ph. mystaceus*, *Crossobamon eversmanni*, *Cyrtodactylus* (*Cyrtopodion*) *russowi*, *Eremias grammica*, *E. intermedia*, *E. lineolata*, *E. scripta*, and *E. velox*. Species like *Clemmys* (*Mauremys*) *caspica*, *Emys orbicularis*, and *Ophisaurus* (*Pseudopus*) *apodus* are called Mediterranean. *Agama agilis* (= *Trapelus sanguinolentus*), *Eumeces schneideri*, *Mabuya aurata*, and *Varanus griseus* were called Iranian/Saharo-Sindian faunal elements. And finally, the so called "Iranian" (Anderson 1968) faunal elements consist of *Testudo* (*Agrionemys*) *horsfieldi*, *Agama caucasica* (*Laudakia caucasia*), *Alsophylax* (*Cyrtopodion*) *spinicauda*, *Cyrtodactilus* (*Cyrtopodion*) *caspius*, *Teratoscincus scincus*, *Eremias* (*Mesalina*) *guttulata watsonana*, *Eremias velox strauchi* (= *E. strauchi*), *Ablepharus pannonicus*, and *Eumeces taeniolatus*.

The examination of the zoogeographical connections between reptiles from Middle Asia and the Caucasus allowed Rustamov (1981) to relate *Gymnodactylus* (*Cyrtopodion*) *caspius*, *G. russowi*, *Phrynocephalus helioscopus*, *Ph. mystaceus*, *Ablepharus pannonicus*, *Agama* (*Trapelus*) *sanguinolenta*, *Eremias velox*, *Elaphe dione*, *Psammophis lineolatum*, *Agkistrodon halys*, and *Eryx miliaris* to the Turanian species. According to Rustamov, these species have their origin in the center of reptile speciation in the Turanian desert. Other species were segregated by Rustamov into the following faunal groups: Mediterranean: (*Mauremys caspica*, *Pseudopus apodus*, *Natrix tessellata*), European: (*Emys orbicularis*, *Coluber schmidtii*), Irano-Afghanian: (*Laudakia caucasia*, *Mabuya aurata*, *Eumeces schneideri*, *Eremias strauchi*, *Typhlops vermicularis*, *Coluber najadum* (= *C. atayevi*), *C. ravergieri*); Saharo-Sindian: (*Vipera lebetina*); Minor Asian or Caucasian-Minor Asian: (*Lacerta strigata*).

Shcherbak (1982) has separated a special arid Mediterranean-Asian subregion ("Aridisches Mediterranian-Asiatisches Untergebiet") in the Palearctic subdivision. Later he gave additional evidence for it (Shcherbak, 1984). According to his map (p. 229), the Turkmenian part of the Kopetdagh is together with the sand deserts in the Karakum sand district of "Karakum-Bezirk" of the Turanian desert province. Situated northward from the Kopetdagh, the Karakum takyr district belongs to the same province (Shcherbak, 1982).

Finally, one of the recent zoogeographical analysis of the mountain herpetofauna of Turkmenistan

was conducted by Atayev (1985). The reptiles of the Western Kopetdagh belonged to the following faunal elements: Frontal Asian (Middle East): (*Mauremys caspica*, *Eumeces taeniolatus*, *Ablepharus pannonicus*, *Eremias strauchi*, *Typhlops vermicularis*, *Eryx elegans*, *Coluber rhodorhachis*, *C. ravergieri*, *Eirenis meda* (*E. medus*), *E.* (*Pseudocyclophis*) *persicus*, *Oligodon taeniolatus*, *Telescopus rhynopoma*); European-Mediterranean: (*Emys orbicularis*, *Ophisaurus* (*Pseudopus*) *apodus*, *Natrix tessellata*, *Coluber jugularis* (= *C. schmidtii*)); Endemic for Middle Asia and Eastern Iran: (*Agrionemys horsfieldi*, *Eublepharis turcmenicus*, *Gymnodactylus* (*Cyrtopodion*) *caspius*, *G.* (*C.*) *spinicauda*, *Naja oxiana*); Sub-endemic for Middle Asia and Eastern Iran: (*Agama* (*Trapelus*) *sanguinolenta*, *Eremias velox*, *Psammophis lineolatum*); Saharo-Sindian: (*Mabuya aurata*, *Eumeces schneideri*, *Spalerosophis diadema*, *Vipera lebetina*); Indian: (*Lycodon striatus*) and Caucaso-Minor Asian: (*Agama* (*Laudakia*) *caucasia*, *Lacerta strigata*).

Thus, we can see the absence of a common approach to the zoogeographical subdivision of the Turkmenistan area and it is even impossible to unite opinions about which faunal elements the various species belong to. In addition, these points of view are often diametrically opposite to each other.

On the basis of recent chorology and ecological tolerance (generally on habitat preferences), we picked out 5 main ecological-geographical groups of reptiles from the investigated area. These are the Turanian, South-West Asian, Mediterranean, Oriental, and Saharo-Sindian groups.

The Turanian group includes species with origin and modern distribution in the sand and clay deserts of the Turanian plain with insignificant irradiation towards the neighboring areas of Eastern Iran, Southern Kazakhstan and the Fergana valley. All these species (see Table 1) are animals of the plains and their findings in elevated districts are determined by the presence of suitable habitats (big plain surface with sand or clay deserts). In our opinion, a more detailed subdivision of the Turanian group (based on edaphic factors) is not necessary at least not in this article because the whole Turanian plain consists more or less of a mosaic of sand and clay units.

The South-West Asian group is of a complex composition. It was divided into 3 subgroups according to the species distribution patterns and altitude range: Iranian, Turkmeno-Khorasanian, and Irano-Afghanian. The Iranian elements have their origin in the elevated regions of South-West Asia and their recent distribution largely spreads from Eastern Anatolia and the Armenian Highland towards the Iranian plateau with irradiation into arid and semiarid districts of the Near East and Eastern Transcaucasia northward up to Daghestan. The species of the Turkmeno-Khorasan subgroup are endemics of these ridges and they can penetrate along the continuums of this mountain system westward to Alburz and eastward to the Hindu Kush. The Irano-Afghanian subgroup consists mainly of species from the intermediate foothill and low mountain zone of the eastern part of the Iranian plateau and the mountain system of the Hindu Kush with insignificant irradiation to the inner districts of Middle Asia.

Mediterranean species (including European-Mediterranean) have their origins from areas which are located around the modern Mediterranean sea. They have often a disjunct distribution in that area and more eastwards along the regions connected with the ancient Tethys.

The Oriental group includes Paleotropical species of Southern and South-Eastern Asia with recent distribution from Sri Lanka and the Hindustan peninsula up to eastern Hindu Kush. It has an insignificant irradiation northward to the foothills of Gissaro-Darvaz and the Kopetdagh mountains.

The Saharo-Sindian group includes reptiles which are separated from the ancient Mediterranean group due to the conditions of aridization on the southern border of the Palearctic. These are mainly inhabitants of arid and extra-arid plains of northern Africa eastwards to the deserts of India, part of which has penetrated to the deserts of the Turanian plain.

The zoogeographical analysis of the herpetofauna of the Western Kopetdagh, the Malyi Balkhan and the Turanian plain (Fig. 4) shows the progressive decreasing number of South-West Asian species and the increasing number of Turanian representatives from elevated areas towards the plain.

The Western Kopetdagh has only 19.3% Turanian elements whereas the number of South-West Asian species is 54.8%. The Mediterranean fauna which is not found on the Malyi Balkhan and the Turanian plain is present only on the Kopetdagh (19.4%). The South-West Asian and the Mediterranean species form more than 74% of the herpetofauna of the Western Kopetdagh. Among the South-West Asian group of reptiles in the Western Kopetdagh are 36.7% of Iranian elements, 16.7% endemics of the Turkmeno-Khorasan mountains, and only

TABLE 1. The Distribution of Reptiles of Western Turkmenistan within the Main Physiography Subdivisions

Species	Faunal group	Western Kopetdagh	Malyi Balkhan	Turanian plain
Emys orbicularis	E/M	+	–	–
Mauremys caspica	M	+	–	–
Agrionemys horsfieldi	T	+	+	+
Phrynocephalus helioscopus	T	–	+	+
Ph. interscapularis	T	–	–	+
Ph. mystaceus	T	–	–	+
Laudakia caucasia	I	+	+	–
Trapelus sanguinolentus	T	+	+	+
Pseudopus apodus	M	+	–	–
Alsophylax laevis	T	–	–	+
Crossobamon eversmanni	T	–	+	+
Cyrtopodion caspius	T	+	+	+
C. russowi	T	–	–	+
C. spinicauda	KH	+	+	–
Eublepharis turcmenicus	KH	+	+	–
Teratoscincus scincus	T	–	–	+
Eremias grammica	T	–	–	+
E. intermedia	T	–	+	+
E. lineolata	T	–	–	+
E. scripta	T	–	–	+
E. strauchi	I	+	–	–
E. velox	T	+	+	+
Mesalina guttulata	SS	–	–	+
Ablepharus pannonicus	I	+	?	–
Eumeces schneideri	I	+	–	–
E. taeniolatus	I	+	–	–
Mabuya aurata	I	+	–	–
Varanus griseus	T	+	+	+
Eryx elegans	KH	+	–	–
E. miliaris	T	+	+	+
Boiga trigonatum	O	–	+	+
Coluber atayevi	KH	+	–	–
C. karelini	T	–	+	+
C. rhodorhachis	I	+	+	–
C. ravergieri	I	+	–	–
C. schmidtii	I	+	–	–
Eirenis medus	KH	+	–	–
Lythorhynchus ridgewayi	AF	–	+	+
Lycodon striatus	O	+	–	–
Natrix tessellata	M	+	–	–
Oligodon taeniolatus	O	+	–	–
Psammophis lineolatum	T	+	+	+
Pseudocyclophis persicus	I	+	–	–
Spalerosophis diadema	SS	–	+	+
Agkistrodon intermedius	KH	+	–	–
Naja oxiana	AF	+	+	+
Typhlops vermicularis	M	+	–	–
Echis multisquamatus	T	–	–	+
Vipera lebetina	M	+	–	–

Note. +) known presence; M) Mediterranean faunal element; I) Iranian faunal element; E) European faunal element; KH) Turkmeno-Khorasanian faunal element; AF) Irano-Afghanian faunal element; SS) Saharo-Sindian faunal element; O) Oriental faunal element; T) Turanian faunal element.

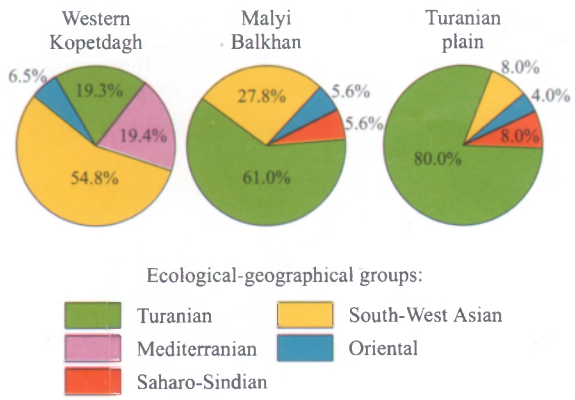


Fig. 4. Pie diagrams representing the chorotype composition of herpetofauna of western Turkmenistan.

3.3% of Irano-Afghanian species. Quite a high level of local endemism, described earlier by Darevsky (1981), and the presence of Mediterranean species place the Western Kopetdagh closer to the Alburz and Talysh than to the Eastern Kopetdagh which has an interconnection with the Hindu Kush through Badhyz. The only endemic species in the Eastern Kopetdagh are *C. spinicauda* and *E. turcmenicus*. At the same time there are Irano-Afghanian species like *Cyrtopodion longipes* and *Laudakia erythrogastra* and Saharo-Sindian elements like *Psammophis schokari*.

More than half of the species list of the fauna of the Malyi Balkhan consists of the Turanian group (61.0%). The number of South-West Asian species is still high (but less than 28%), whereas the endemics of the Turkmeno-Khorasan mountains are only represented by *C. spinicauda*. The numbers of Iranian and Irano-Afghanian species reach 11.8% each. There is 1 representative of the Saharo-Sindian and 1 of the Oriental group (each 5.6%).

The majority of the Turanian plain species are from the Turanian ecological-geographical group (80.0%). The South-West Asian group represents a minority here (8%), moreover it consists totally of Irano-Afghanian species. The Saharo-Sindian (8%) and Oriental (8.3%) faunal elements are slightly increasing.

Thus we can suggest significant differences between the herpetofauna of the Western Kopetdagh and the Turanian plain. These differences are associated with the unequal age of genesis of these areas and with the generally modern landscape-ecological isolation of the Kopetdagh from the desert of the Turanian plain. The Peredovoy ridge as well as the foothills are often an insurmountable barrier for penetration of the Turanian plain species towards the Kopetdagh. On the other hand, the plain conditions of sand and clay deserts have not been suitable habitats for mountain South-West Asian and Mediterranean reptiles.

Regarding this, it is necessary to include the Western Kopetdagh into the South-West Asian province and the Turanian plain into the Turanian province. The border between these two provinces lies between the northern foothills of the Kopetdagh and its inclined plain. Apparently, the Malyi Balkhan should be united with the Turanian province as a separate district.

Finally, it is necessary to mention that zoogeographists which based their examples on other classes of vertebrate animals in their zoogeographical subdivisions of Turkmenistan came to the same conclusions (Zykov, 1991; Reshetnikov and Shakirova, 1993).

As mentioned above, the zoogeographical borders prove to be correct according to us, due to the species composition of the inclined lowland. Turanian (37.5%) and Saharo-Sindian (8.3%) elements which form the backbone of the plain desert fauna, totally represent about half of the reptiles of this spot. The other half consists of South-West Asian (25%), Mediterranean (16.0%) and Oriental (12.5%) faunal elements.

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