

Ecological Studies and Zoogeographic Affinities of the Amphibians and Reptiles Found in Chagai Desert, Balochistan, Pakistan

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Abstract.- Present study is based on more than two expeditions conducted from 1998 to 2000, to carry out ecological studies in the Chagai district, Balochistan, Pakistan. The studies were aimed to make an ecological assessment and document the herpetofauna of the area, for the reasons that the area was subjected to severe drought for the last several years. It was observed that drought very badly affected not only the composition of fauna and flora of the area but also forced the nomads to abandon their desert houses and migrate to the nearby cities and towns. Zoogeographic affinities with particular reference to reptiles have also been discussed.

Key Words: Herpetofauna, ecology, zoogeography, Chagai desert, Pakistan.

INTRODUCTION

The Chagai District lies in the northwestern side of the Balochistan and covers an area of 18,892 square miles. It comprises that belt of country, which lies immediately south of the Pak - Afghan boundary. The desert regions of Afghanistan bound the district on the north.

The climate of the district ranges from extreme hot in summer to severe cold in winter. The difference between day and night temperatures is considerable and the climatic conditions vary from area to area. Since the district falls outside the sphere of monsoon currents, the rainfall is irregular and scanty. The annual average rainfall in the district was 104 mm measured over the years 1993 - 1995 (Pakistan Meteorological Department, Karachi). Topsoil erosion by winds causes great damage to agriculture lands in the district. In Dalbandin particularly, the erosion increases as sandstorms ravage that area very frequently. Because of winds the roads get blocked and sometimes totally buried under sand.

Most soils in Chagai district have a homogenous porous structure conducive for plant growth. Some of the younger soils however have original lamination in the subsoil. All the soils are invariably calcareous. Their lime contents ranges between 5 and 30 percent. The lime is uniformly

distributed in most soils. If soils have high lime contents, they are hard when dry but soft and reliable when moist. The organic matter content is generally low, 0.3 to 0.5 percent (BOS, 1998). The best soil in Chagai district is a light loam called "Matt", which is found in the greater part of the oak plain and in the Baghak, Mal, and Chagai tracts. It requires less water, retains moisture longer and suits the great diversity of flora. Another soil is "Reki" or "Ragi", as the name implies, sand constitutes the predominant element; this type of soil is considered suitable for the production of Jowar and water melons. Other types of soils are the "Daddo" a hard stony soil and the "Sor", which is impregnated with salt, are all of inferior quality.

Minton (1966) and Mertens (1969) made significant contribution in the herpetological studies of Pakistan. Their studies were mainly related to the southern part of Pakistan and Balochistan was an important component of those studies. The other subsequent studies (Baig, 1988a,b, 1989, 1990, 1992, 1996, 1997, 1998a,c; Baig and Boehme, 1991, 1996, 1997; Dubois and Khan, 1979; Khan, 1980a,b, 1991, 1993a,b; Khan and Baig, 1998, 1992; Khan and Tasnim, 1990) were mainly carried out in other parts of Pakistan. However, Khan (1987) and Baig (1998b, 1999) made some contributions and described new taxa from Balochistan.

Our knowledge about the amphibian and reptiles of Chagai district is mainly based on the aforesaid studies. Khan (1987) while describing zoogeographic affinities of different amphibians and

reptiles of Balochistan, divided the Balochistan province into 6 regions on the basis of the presence of different species there. A very recent attempt to publish a translation of the book entitled "Gecko Fauna of the USSR and contiguous regions" (Szczerbak and Golubev, 1986) has certainly broadened our knowledge about the gecko fauna of the area.

MATERIALS AND METHODS

The area of the Chagai desert between Noshki and Hamun-i-Lora, Padag and Dalbandin were surveyed day and night to collect and document the herpetofauna and flora of the area. The diurnal species were photographed in the field while the nocturnal species were brought to the base camp and photographed on the subsequent day. Voucher specimens were preserved and then transported to PMNH laboratory to ascertain their identification. The identification of reptile species was based on the literature mentioned above while the plant species were identified with the help of literature mainly Stewart (1972) and consulting Quaid-i-Azam University Herbarium and National Herbarium, NARC, Islamabad. All the species were catalogued in PMNH for reference and subsequent documentation.

The senior author also had an opportunity to visit several other areas of Balochistan. The species collected from these areas, which are continuation of the habitat and lie adjacent to Chagai district have also been included and simultaneously marked in the Table I.

RESULTS AND DISCUSSION

Habitat types

Five different microhabitats have been identified in the study area that lies on the eastern side of the Chagai district. These microhabitats are representatives of the district and distinct in their characteristics and exhibit peculiar fauna and flora.

Some of the represented species of plants and reptiles have been mentioned with every microhabitat but the complete account of the amphibians and reptiles with the preferred habitat has been mentioned in Table I.

Watercatchment areas

Desert sinks into great depressions, the Hamuns (the salt lakes), which remain dry most of the year. The basin of these lakes is covered over by wide expanses of sun-cracked clay with oxidized pebbles and shifting reddish dunes. Generally, these lakes have nothing but salt incrustations with few marshy patches that in flood times are filled. The depressions are mostly surrounded by high sand dunes where variety of reptile species were found *i.e.* *Ophiomorus tridactylus*, *Phrynocephalus ornatus*, *Phrynocephalus clarkorum* and *Eristicophis macmahonii*. *Trapelus agilis* was observed in the bushes grown there.



Fig. 1. *Eristicophis macmahonii*

Zangi Navers and Hamun-i-Lora represent this habitat. Because of extreme draught conditions, which had been prevailing in the area, since long water reservoirs were completely depleted. But characteristics of the area were still intact and plant community comprising *Tamarix ramosissima*, *Arundo donax* and *Phragmites karka* was still surviving there in reasonably good number. It is very likely that by the time the draught would be over, the species from the neighbouring areas may invade and establish their population at Zangi Navers and other similar areas in Chagai.

Sand dunes

This habitat is characteristic of the Chagai and spreads over a large area. Sor Reg and Niam Reg represents this habitat. In addition to continuous stretches of sand dunes, it is also represented in

patches among other habitats like mountains, cultivated plains and Dak area.

Haloxylon salicornicum, *Calligonum polygonoides*, *Rhazya stricta*, *Peganum harmala*, *Alhagi camelorum*, *Salsola kali* and *Capparis spinosa* dominate the flora in this habitat, although several other plant species also grow there. The fauna of this area is very peculiar and represents significant component of endemism in Pakistan. It represents several species, which have great economic and scientific value. For example, *Eryx tataricus*, *Teratoscincus* spp., which in Pakistan are restricted to this part only, are exploited for pet trade. Saw-scaled Viper, *Echis carinatus* and Leaf-nosed Viper, *Eristicophis macmahonii*, are found in great numbers and could be an excellent source for venom extraction. Sand cat, *Felis margarita*, which is an endangered species, is also found in the area. Reg Mahi, *Opiomorus tridactylus*, is also unique and has not only great scientific value but 'Hakims' also used them for the preparation of several medicines.

The cultivated plains

Nok Jo, Sar Mal and Daidar lying between Noshki and Chagai represent this habitat. The soil in the plains is essentially brown silt loam or very fine sandy loam, well drained and highly calcareous, containing about 22% Calcium carbonate. Soil formed in red deposited loess are mainly silty-clay loam and silty-clays, homogenized to moderate depth and highly calcareous with 17% lime content.

In these areas where water is available (mainly through wells and tube-wells) the crops like maize, wheat, potato and onion are grown. The plants, *Tamarix aphylla*, *Populus euphratica*, *Morus nigra*, *Beta vulgaris*, *Ficus carica*, *Phragmites karka*, *Arundo donax*, *Eucalyptus calamedansis* and *Salix babylonica* are also grown in the area.

The reptile species which may be found here are mainly geckoes belonging to genera *Tenuidactylus*, *Tropiocolotes*; agamids belonging to genera *Trapelus*, *Phrynocephalus*; skinks belonging to genus *Eumeces*; desert lacerta belonging to genera *Eremias*, *Acanthodactylus* and Monitor lizard, *Varanus griseus caspius*. The snake species which include non-poisonous colubrids and

leptotyphlopids and poisonous vipers are also found in the area. *Bufo (viridis) zugmayeri* and *Euphlyctis cyanophlyctis*, which represent amphibians, have also been found in the fresh water pools made for the storage of water.

Rocky habitat

There are several mountain ranges e.g. Chagai Hills, Ras Koh, Pull Choto etc, which lie in and around Chagai district. The high altitude fauna and flora are therefore also represented in Chagai district. The plant species found in rock crevices are chasmophytes while on the rocks are lithophytes e.g. *Capparis spinosa*, *Boerhaavia diffusa*, *Artemisia scoparia*. The reptiles found here include *Laudakia* spp, *Trapelus agilis*, *Phrynocephalus scutellatus*, variety of geckoes belonging to genera *Tenuidactylus* and *Agamura*, Cliff Racer, *Coluber rhodorachis*. Pull Choto (29°22' N, 65° 07' E; elevation 4253 feet) is a single erected mountain among the sand dunes, rocky desert and some surrounding low lying sand-stone mountains. The mountainous, sub-mountainous and even desert species may be encountered there.

Dak area

It also represents a significant portion of the study area. It is flat stretch of land, hard in texture and saline in nature. It lies between 65° 30' – 65° 50' E longitude and 29°20' – 29° 35' N latitude.

The plants, which grow in the area are halophytes and are represented by *Haloxylon griffitti*, *Suaeda fruticosa* and *Fagonia cretica*. The reptile species found in the area are mainly ground agama, *Trapelus agilis*, desert lacerta belonging to *Eremias* and *Acanthodactylus*, geckoes and snakes.

Herpetofauna of Chagai District

Herpetofauna of Chagai is represented by 47 species, of which 2 are amphibian. Most of these species have been observed and collected from the study area. Eight of them have been collected from the adjacent areas while 11 of them whose presence is very likely but because of time constraints could not be observed collected during study period from Chagai have also been included in the potential herpetofauna of Chagai district (Table I).

Table I.- Amphibians and reptiles of Chagai desert.

	Common name	Scientific name	Family name	Preferred habitat
	Amphibia: Anura			
1.	Zugmayer's Green Toad	<i>Bufo (viridis) zugmayeri</i>	Bufoidae	CTP
2.	Skittering Frog	<i>Euphlyctis cyanophlyctis</i>	Ranidae	CTP
	Reptilia: Chelonia			
3.	Afghan Tortoise	<i>Testudo horsfieldi</i> *	Testudinidae	RCA
	Reptilia: Sauria			
4.	Tuberculated Rock Gecko	<i>Bunopus tuberculatus</i> **	Gekkonidae	RCA
5.	Fat-tailed Gecko	<i>Eublepharis macularius</i> **	Gekkonidae	RCA
6.	Lumsden's Fringe-toed Gecko	<i>Crossobamon evermanni lumsdeni</i> **	Gekkonidae	SDD
7.	Persian Dwarf Gecko	<i>Tropicolotes persicus</i> **	Gekkonidae	RCA
8.	Small-scaled Skink Gecko	<i>Teratoscincus microlepis</i>	Gekkonidae	SDD
9.	Keyserling's Skink Gecko	<i>Teratoscincus scincus keyzerlingi</i>	Gekkonidae	SDD
10.	Kharan Spider Gecko	<i>Agamura femoralis</i> **	Gekkonidae	RCA
11.	Persian Spider Gecko	<i>Agamura persica</i>	Gekkonidae	RCA
12.	Persian Gecko,	<i>Hemidactylus persicus</i> **	Gekkonidae	RCA
13.	Keeled Gecko	<i>Cyrtopodion scaber</i>	Gekkonidae	RCA
14.	Garden Lizard	<i>Calotes versicolor</i>	Agamidae	CTP, WCA
15.	Baloch Spiny- tailed lizard	<i>Uromastix asmussi</i> *	Agamidae	RCA
16.	Black Rock Agama	<i>Laudakia melanura</i> *	Agamidae	RCA
17.	Large-scaled Rock Gecko	<i>Laudakia nupta nupta</i>	Agamidae	RCA
18.	Caucasian Rock Agama	<i>Laudakia caucasia</i> *	Agamidae	RCA
19.	Brilliant Ground Agama	<i>Trapelus agilis</i>	Agamidae	WCA, CTP, DKA
20.	Gray Toad- headed Agama	<i>Phrynocephalus scutellatus</i>	Agamidae	RCA
21.	Yellow-speckled Toad-headed Agama	<i>Phrynocephalus leuteoguttatus</i>	Agamidae	SDD
22.	Black-tailed Toad- headed Agama	<i>Phrynocephalus maculates</i> **	Agamidae	DKA
23.	Clark's Toad- headed Agama	<i>Phrynocephalus clarkorum</i>	Agamidae	SDD
24.	Beautiful Toad - headed Agama	<i>Phrynocephalus euphilopus</i>	Agamidae	SDD
25.	Striped Toad- Headed Agama	<i>Phrynocephalus ornatus</i>	Agamidae	SDD
26.	Earless Dwarf Skink	<i>Ablepharus grayanus</i> *	Scincidae	RCA
27.	Yellow-bellied Mole Skink	<i>Eumeces taeniolatus</i>	Scincidae	CTP
28.	Orange-tailed Mole Skink	<i>Eumeces schneideri blythianus</i>	Scincidae	CTP
29.	Indian Three-toed Sand Swimmer	<i>Ophiomorus tridactylus</i>	Scincidae	SDD
30.	Indian Fringe-toed Sand Lizard	<i>Acanthodactylus cantor</i>	Lacertidae	SDD
31.	Small-scaled Fringe-toed Sand Lizard	<i>Acanthodactylus micropholis</i>	Lacertidae	SDD
32.	Reticulated Desert Lacerta	<i>Eremias acutirostris</i>	Lacertidae	SDD
33.	Caspian Desert Lacerta	<i>Eremias scripta</i>	Lacertidae	SDD
34.	Long-tailed Desert Lacerta	<i>Mesalina watsonana</i>	Lacertidae	DKA
35.	Transcasian Desert Monitor	<i>Varanus griseus caspius</i>	Varanidae	SDD
	Reptilia: Serpentes			
36.	Tartary Sand Boa	<i>Eryx tataricus speciosus</i>	Boidae	SDD
37.	Dark headed Gamma Snake	<i>Boiga trigonata melanocephalus</i> **	Colubridae	SDD, CTP
38.	Spotted:Desert Racer	<i>Coluber karelini karelini</i> *	Colubridae	CTP
39.	Cliff Racer	<i>Coluber rhodorachis</i>	Colubridae	RCA
40.	Royal Snake	<i>Spalerosophis atriceps</i> **	Colubridae	DKA
41.	Diadem snake	<i>Spalerosophis diadema</i> *	Colubridae	CTP
42.	Dark-headed Dwarf Snake	<i>Pseudocyclophis persica</i> **	Colubridae	RCA
43.	Maynard's Awl- headed Snake	<i>Lytorhynchus maynardi</i> ***	Colubridae	SDD
44.	Afro-Asain Sand Snake	<i>Psammophis schokari</i>	Colubridae	SDD
45.	McMahon's Viper	<i>Eristicophis macmahonii</i>	Viperidae	SDD
46.	Saw-scaled Viper	<i>Echis carinatus</i>	ViReridae	SDD
47.	Persian Horned Viper	<i>Pseudocerastes persicus</i> **	Viperidae	SDD,RCA

*Collected and observed in the surrounding areas of Chagai **Not collected but the presence is very likely

Abbreviations used: CTP, Cultivated plains; DKA, Dak areas; RKA, Rocky areas; SDD, Sand dunes; WCA, Waterchatchment areas.

Zoogeography

The present varied and interesting composition of the fauna in Pakistan is largely due to its role as a transitional zone between two of the world's six major zoogeographical regions, the Palaearctic and the Oriental, but the species have also come from as far as the Ethiopian region. The area lying east of River Indus represent Oriental component while rest of Pakistan is predominately Palaearctic.

Within Palaearctic region Wallace (1876) created Mediterranean sub-region whose transitional position was later on realized by Beaufort (1951) and Darlington (1957). Detailed subsequent studies (Nikolski, 1916; Darlington, 1957; Ali and Ripley, 1964; Minton, 1966; Has and Werner, 1969; Mertens, 1969) suggested further splitting of the Mediterranean sub-region into three distinct components *i.e.* Mediterranean (*sensu stricto*); Irano-Turanian (the study area of Balochistan lies in this component) and Saharo-Sindian (it includes coastal strip of Makran and lower Sind). Khan (1980a) made further splitting and created Seistan Division within Mediterranean sub-region. The whole Seistan Division falls within Chagai district and represent almost 80 % of this district.

All the herpetological studied carried out in Pakistan recognized extremely important zoogeographic position of Balochistan. It was observed that more than 60% herpetofauna of the area is Palaearctic and this element is mainly concentrated in NW Balochistan which represents the study area. Khan (1980a, 1987) observed that endemism in Balochistan is very marked. North-western Desert Basin of Balochistan appears to be an active centre of evolution of many of these endemic forms, representing high endemic component here *e.g.* Spotted Desert Racer, *Coluber karelini karelini*, Maynard's Awl-headed Snake *Lytorhynchus maynardi*, Farsian Spider Gecko *Agamura gastropholis*, Kharan Spider Gecko *Agamura femoralis*, Persian Spider Gecko *Agamura persica*, Tuberculated Gecko *Bunopus tuberculatus*, Lumsden's Fringe-toed Gecko, *Crossobamon evermanni lumsdeni*, Small - scaled Skink Gecko *Teratoscincus microlepis*, Keyserling's Skink Gecko, *Teratoscincus scincus* Keyserlingi, Banded Dwarf Gecko *Tropicolotes persicus.*, Dwarf Gecko

Tropicolotes depressus, *Phrynocephalus* spp.

Khan (1987) stated that psammophine forms are dominant in Seistan region (Chagai district) and it is the most species rich part of Balochistan with 47 taxa on record. Irano-Turanian and Seistanian elements dominate here, representing 15 and 13 taxa respectively. The endemic component representing 10 taxa is again highest among all the regions of Balochistan. As per Khan (1987) some southern part of Chagai falls in adjacent Kharan region, which again exhibit great diversity, representing 39 taxa, of which 9 are endemic. This again increases the importance of Chagai district.

There is considerable number of genera of Palaearctic origin which do not penetrate through Pakistan to reach the Indo-Oriental region; *e.g.* *Teratoscincus*, *Tropicolotes*, *Pseudocerastes*, *Phrynocephalus* etc.

CONCLUSIONS

The overall Chagai area is considered as desert Basin, comprised of different microhabitats. The climatic conditions are harsh and unfavourable for man as well as for other living organisms. Temperature fluctuation between day and night and summer and winter is very high. Prevailing draught has further deteriorated the chances of survival for all living organisms dependent on this fragile desert ecosystem. Desert people have abandoned their desert houses and have lost a significant component of their livestock. They have now been concentrated near towns where water is available.

The forests are lacking in Chagai and overall vegetation of the area is xerophytic, represented by *Tamarix* and *Calligonum* spp. The area where salt concentration in the soil is high *Haloxylon griffiti*, *Suaeda fruticosa* and other halophyte species are found.

Although the time available for the studies was not sufficient yet the collection of amphibians and reptiles shows that draught inflicted significant damage to this fragile desert ecosystem. This is apparent as only 60% of the total reptile species likely to be there could have been collected, about 15% were observed in the adjacent areas and 25% unfortunately remained unsighted. Secondly, the number of the specimens belonging to different

species was also not encouraging.

Because of unfriendly desert condition, scarcity of water, high day temperature and less vegetation diurnal species are less represented; these species are mainly Desert Larks, Desert Lacerta, and Agamids. The avifauna with the exception of night jays and owls is predominately diurnal. The major component of the desert otherwise, is nocturnal. Both the species of amphibian, more than 60% species of reptiles; with the exception of Gazelles, hare and Day Gird almost all mammalian species are nocturnal.

There are many species, which are found in Chagai and have very high price in the international as well as national market. They are being traded illegally to different parts of the world. A letter of the government of Germany, to the senior author, indicates the present state of affairs. About 3000 specimens, mainly those geckoes, which are found only in Kharan and Chagai district of Pakistan, had been exported within six-month time, only to Germany. The overall export component seems catastrophic for this fragile ecosystem.

Overexploitation of already limited natural resource e.g. excessive use of plant material for fuel and traditional hunting for food and fun; deficiencies in legislation and lack of will in its implementation; scarcity of water and absence of infrastructure for water resources development, operation and management to meet the requirement of the local people for agriculture and other use; exceptionally difficult and unfavourable working condition; absence of suitable incentives; tribal ownership system; lack of community participation; increasing cost of infrastructure development and financial constraints in government sector are some of the major hurdles blocking the sustainable development of the area.

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