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Affinities and Zoogeography of Herpetiles of Pakistan

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Abstract : Important aspects of geography of Pakistan are discussed. Status of 195 herpetelian taxa, hetherto recorded from Pakistan, is determined. The province-wise distribution of herpetiles and its bearing on the zoogeographical divisions of Pakistan is mentioned. Faunal analysis, comparison of Pakistani herpetofauna with the herpetofauna of the adjascent countries is made and its implications discussed. Zoogeographical position in relation to the geographical background of Palearctie and Oriental Regions discussed. Further division of Irano-Turanian sub-region into "Siestanian" sub-region is proposed. On the basis of endamism center of evolution of various herpetelian taxa within Pakistan are pointed out. Invision routs and corridors for Palearctic and Oriental taxa are determined.

INTRODUCTION

The peculiar situation of Pakistan in South-east Asia is interesting both geographically and zoologically. The North-western and the Western parts of Pakistan are the eastern most part of the Iranian Plateau, thus having a preponderance of Palearctic elements, while the North-eastern and the eastern part of Pakistan is continous with the great Indo-Gangetic Plain with the preponderance of the Oriental elements. The presence of the ethiopial elements cannot be overlooked. The transitional type of herpetofauna and the peculiar topography, when studied togather reveal many interesting facts and figures. In the present study an attempt is made to expose these hidden corners of the herpetology of Pakistan.

In essaying a description of the geographic pattern obtained in Pakistan, while studying herpetiles, one problem present itself. It concerns the scale. Some parts of the region are examined, somewhat in considerable detail (Beluchistan and Sind), while other areas remain largely *terra incognita* (Punjab and North West Frontier Province).

However, by a laborious consultation of scattered information in literature, sufficient material has been accumulated to allow to make some generalizations to shape the present paper. It is hoped in due course of time, much more area of Pakistan will be probed into so to add many more forms to the herpetofauna of Pakistan. However, it will not change the main conclusions drawn in this paper, but will add more evidence to support them.

Recently attempts have been made to study the zoogeography of Pakistan, Ali and Ripley (1968) have studied the avifauna, Akhtar (1974) termites, Mirza (1975) fishes and Roberts (1977) mammals. Smith (1931) have commented on the zoogeographical position of the North-western part of the Indian Sub-Region, now Pakistan. Minton (1966) and Mertens (1969) have analysed the nature of the Pakistani herpetofauna.

The regional studies of the herpetofauna of Pakistan has contributed much to understand the nature and distribution of the herpetiles, Mirza and Ali (1972) have studied the chelonians and amphibians of Lahore, while Khan (1968) amphibians, (1972) lizards and (1977) snakes of Jhang District. Herpetiles of Las Bela have been the subject of Minton (1962).

Herpetiles of Pakistan by the safe reconing of Mertens (1974) are represented by 184 authenticated species, this number was 178 in 1969. In the present study are included all the species mentioned in literature to be occuring in the environs of Pakistan, thus the number of the taxa is raised to 195. It is hoped in due course of time, this number will be confirmed and more species will be added to it.

During the present study an attempt has been made to bring the details of geography of Pakistan and to correlate the present distribution of herpetiles to the eco-geographical environs of Pakistan. Comparison of Pakistani herpetofauna with that of the surrounding countries is made, invision routs and center of evolution within Pakistan determined. To the best knowlegde of the present author no such study has ever been undertaken in the past.

RELIEF OF PAKISTAN

Various aspects of the geography of Pakistan are still incompletely understood. There is pausity of literature on relief, climate, vegetation, soil and hydrology of Pakistan. Kureshy (1977) do not take up these aspects in detail. For the zoogeographical study of a group of animals in

a certain area all these aspects must be known exhaustively, for the complete understanding. However, present author has dug out the following outlines of the relief of Pakistan, from the issues of Punjab Geographical Review, Pakistan Geographical Review, Bulletin of the Karachi Geographical Society, Pakistan Journal of Forestry, Spate's "India and Pakistan" (1963) and Stamp's "Asia, a regional and economic geography"(1967).

The relief of Pakistan can be divided into three major units (Fig I) :

1. The huge complex of mountains and plateaus lying in the North-west and West.
2. Potwar Plateau and Salt Range at the foot-hills of the Himalayas.
3. The Plains of Indus and its tributaries, in the east and South-west.

Zoogeographically these units are important and meaningful, thus necessitating a detailed study :

1. The North, north-west and western mountain complex is a vast, complex and intricate system of mountains and valleys, which can further be divided into :

(*i*) The northern mountains,

(*ii*) The north-western mountains, and

(*iii*) The western mountainous ranges.

(*i*) **The Northern mountains,** consist of western most strike of the Himalayas, which is broken in many ranges, *the central or Great Himalayas* having an altitude of 20,000 feet (5714 Meter). The *inner Himalayas or Ladakh Range* and *the Trans Himalayan or Karakoram Range*. These ranges stem from Pamir Knot and mainly lie in occupied Kashmir. They have shaped the land and climatology of Pakistan, but have no direct effect on the present distribution of the herpetiles of Pakistan, since they have high altitude and form permanent snow and cold deserts.

The vegetation is xerophytic in character. Only the high mountain species of amphibians and reptiles are rarely represented, howerver the eastern Himalayan species have used the shallow valleys between these ranges to invade the northern Pakistan.

Lesser Himalayas occur in the northern Hazara and Murree, where Dunga Gali attains a height of over 15,000 feet (4286 Meter). These

mountains receive much rainfall throughout the year and are covered with snow in the winter. The soil being residual as well as transported in nature. The narrow valleys formed by the torrents have a deposition of alluvial infill and are cultivated. Pine forests grow along the slops. The valleys and the slops with the humid climatology form an ideal habitat for various amphibians, agamids, geckos and colubrid snakes.

The sub-Himalayas or Siwaliks are low lying mountains having average height of 2,000 to 3,000 feet (571-857 Meters). They extend over southern Hazara and Murree, including Rawalpindi and Pabbi Hills. These rocks are much faulted and built from unconsolidated material. Climate is sub-tropical continental highlands, rain-fall occurs throughout the year (Kureshy, 1977). Generally the vagetation in Rawalpindi and Pabbi Hills is mainly shrubs with sparce grass. The mountain slops support mountain temperate forests. The Siwaliks form ideal habitat for agamid lizards, Mabuya, colubrid and natricine snakes, elapids and vipers are also represented.

Between the mountains, torrents have cut deep gullies, with permanent water recesses to support many kinds of amphibias. In the valleys the torrents cut a more or less plain course, where pools and ravines are formed, creating ideal habitat for different amphibian species. The wide raging south-east Asian toad *Bufo melanostictus* has recently been demonstrated to be present in this region (Khan, 1972 and 1976). A further investigation of these mountains may reveal many new forms.

(*ii*) **The North-western mountains.** Having branched off from the Pamir Knot, Hindu Kush, with north, South-western strike, extends in Afghanistan. While in Pakistan, it give three minor ranges, southward in Chitral, Swat and Dir valleys, which are drained by Chitral-Kunar, Panjkora and Swat rivers. The slops of these ranges are generally steep to precipitous except in the southern part where moderate to gentle slope occurs. The valleys especially in the higher altitude are extremly narrow and are U-or V-shaped. The only small flat strip of land lies in the southern parts of Dir and Swat. There is great boi-climatic diversity, from tropical to arctic, bearing a large variety of vegetational types and rich flora (Beg and Bakhsh, 1974).

Hindu Kush remains snow covered throughout the year, while Chitral, Swat and Dir valleys have cold snowy winters, with general winter and spring rains. These outspurs of Hindu Kush are forming ideal habitat for

mountain agamids, geckos, colubrids, elapids and lacertids, however varanids are also reported from these mountains.

Lying at the southern end of the outspurs of Hindu Kush is the *Koh-i-Sofed Range*, with an east-west strike almost continuing across the Indus with the *Kala Chitta Range* and the *Salt Range*, deep inside. The general height of *Koh-i-Sofed* is 12,000 feet (3428 Meters). It merges with the low lying *Waziristan Hills* along its southern side. *Waziristan Hills* have the same east-west alignment. The valleys of these hills are traversed by the Kurram and Tochi Rivers, while the Gomal river passes at their southern most edge. The valleys of these rivers are green, and the hills support steppic forests. Mostly the bare hill sides and tops are covered with bushes and xerophytic grasses. The rainfall decreases towards the lower outer hills as well as towards the south.

Herpetologically, these hills are least known. *Koh-i-Sofed* and *Waziristan Hills* have been very effective corridor for the faunal exchanges between Palearctic and Oriental Regions. The taxa originating in the Siestan have taken this route to spread in Pakistan. Similarly the Oriental elements have reached Afghanistan through this passage.

(*iii*) **Western Mountains or the plateau of Baluchistan.** South of Gomal River lies the Baluchistan plateau—a complex of arid basins and hills, running allover, with an average height of 1000 to 3000 feet (286-857 Meters). It is the eastern most end of the Great Iranian plateau. The Baluchistan plateau slops gently to the south-west and merges into the desert of Iran. To the south, across the low ranges of hills, it meets the Arabian Sea. Along east it is sharply demarcated from Indus Plains by *Sulaiman Pak* and *Kirthar Ranges*.

The mountain skeleton of Baluchistan consists of two great virgations meeting togather at *Quetta Node*. In the northern Baluchistan, along the west, lies *Toba kakar Range* with south-west trend. It forms a border with the nighbouring Afghanistan. A great series of echelonned ridges, runs along the east of the northern Balochistan, is known as *Sulaiman Range*. It has a general height of 6000 to 7000 feet (1714-2000 Meters), with an initial north-south, then east-west strike. These ranges consist of folds of Cretaceous and Eocene limestone and sandstone, and have produced an extraordinary landscape of innumerable scarps, small plateaus, littered with boulders, set in the arid hills, with a few greener patches in small alluvial or detrital basins. Main basins enclosed by these ranges are of Loralai

and Zahob. The general climate being sub-humid and semi-arid (Ahmed, 1951). The vegetation is steppic forests in southern latitude (Roberts, 1977). In the north-west, Quetta region, the climate being dry, the rainfall being low, about 5 to 10 inches. Having a low humidity. The climatic conditions are favourable for fruit gardening. Winter has snowfall, while the summers are somewhat hot. Thunder-storms and dust-storms are more frequent. The mountainous nature of the country, effects the direction and the force of the wind, which generally assumes the character of draughts traversing the funnel like valleys.

The eastern border of southern Baluchistan have *Kirthar*, *Pab* and *Hala Ranges*, all stemming from *Central Bruhui Range*, which meets in turn the Quetta Node. All these ranges have north-south trend, which in the southern Baluchistan becomes east-west to become continuous with strike of the Iranian Plateau, and form a parallel with the Arabian Sea. The southern Baluchistan Ranges are *Siahan*, *Central Makran* and *Makran Coast Ranges*. Broadly speaking the southern Baluchistan comprises of extensive tract of level mud-flats, occuring as coastal plains or as enclosed synclinal plains hemmed by the bounding sandstones ridges or as erided cores of anticlines. These ridges run parallel to the east-west direction of the coast. The outstanding lines of Ridges that constitute dominating feature of landscape are harder stones outcropping on the flanks of folds. They essentially consists of calcarious mudstones with thick series of sandstone bands occuring in between, which are soft and prone to weathering. They have played an important role in shaping the physiography of this region (Ullah, 1954). The intervening space between these ridges give rise to the formation of valleys of varying width and extent. Sporadic and torrential rain water finds its way down the mountain slops, consequently a trellis type drainage pattern results. The water erodes mudstones into maize of gullies and produces a characteristic badland topography.

Most dominant climatic element in the region is the steady inflow of sea-breeze throughout summer. Humidity is high, annual and diurnal ranges of temperature are low. Hot winds descending from interior occasionally raise the temperature. Mild but dry winter and xerophytic vegetation are the characters of Makran coast.

The Makran Coastal strip has been used as a passage by the Saharo-Sindian and Ethiopial elements to penetrate into the Oriental Region, similarly most of the Oriental taxa have taken it to colonize the west.

The north-western Baluchistan has a general terrain formed of a series of plateau, some of which are separated from one another by mountaneous ranges. The *Ras Koh* in the center with a north-east south-west strike, the *Chagi Hills* in the north-west lying at the border with Afghanistan, with a east-west strike, and *Siahan Range* at the southern border of the desert, with almost an east-west strike, lying in the middle of the western Baluchistan. These Ranges enclose a desert basin called the Chagi Desert. It is a true desert, with 2-5 inches of annual rain fall, most of which comes in late winter and early spring. It has sand dunes and xerophytic vegetation. Daily minimum temperatures are often below freezing during winter, while summer is intensely hot and dry, with frequent dust storms. Desert sink into the great depressions, called the Hamuns-the salt lakes, which remain dry most of the year. The basin of these lakes is covered overe by wide expances of sun-cracked clay, with oxidized pebbles (*dasht*) and shifting reddish dunes. Generally these lakes have nothing but salt incrustations with few marshy patches. In flood time they are filled. They have patches of reed and tamarick growing along the wetter patches of Hamuns.

Herpetologically, Chagi Desert is most charcateristic, as it has large number of typical forms, which have differentiated in its environs.

2. **The Potwar Plateau and the Salt Range.** The whole-undulating region lying between the Indus and the Jhelum rivers, in the sub-mountain region, stretching from the Salt Range to the foot-hills of Himalayas is called the Potwar Plateau (Bhatti, 1949). It is bordered by Indus and Jhelum rivers at west and the east respectively. On the north are the *Kala Chitta Range* and *Margala Hills*, on the south is the *Salt Range*. This plateau has an average height of 1500 to 2000 feet (428-571 Meters), Erosional and depositional processes have played a leading role in shaping its relief. Within this compact region, there is a wide variety of orographical features, an interesting climate, a very close inter-relationship between land forms and the biological responces.

The Potwar Plateau has three natural units; *the northern ranges* formed by *Kala* (Sandstone originally purple, almost black due to exposure to wind and water) *Chitta* (White nummulitic limestone) height 1500 to 3000 feet (428-857 Meters), *Margala Hills*, height 2,400 feet (685 Meters), and the mountain systems of the Rawalpindi district (*Utrina ridge, Patriata spur*, and *Jhelum Bank Ridge*). These hills support tropical deciduous forests. It is of great ecological value and interest, as it has deciduous species of Indo-Malayan origin as well as some truely Oriental mammal and bird

species. Early summer and spring is hot and dry but there is much rain in late summer (Roberts, 1977). Herpetologically this region is least known. A thorough survey of this area might reveal interesting facts about herpetiles.

(*ii*) **The Soan basin** : South of the northern bordering ranges and ridges, extending right up to the northern slopes of the Salt Range, lies an undulating strip rock consisting of vertical walls, rough, jagged and narrow, with one moral ridge, the *Khire-Murat* (1,500 feet or 428 Meters), It is steep, dreary, impassable barrier, dying away in a series of small spurs along the banks of the Soan River. The descent from the mountaneous portion in the north is accomplished through a hilly and sub-mountain tract, not homogenous in character. It has stretches of more or less level fertile country, called the Soan valley. The general terrain is pebbly alluvial, south of Soan pabbly ridges are less frequent. The vast extents of the Soan valley, which consist of ravines in most parts, cut by torrents and divided into fantastic shapes, with the fertile tracts in between. General aspect of the terrain is bleak dry and stony, with thorny bushes and long grass.

(*iii*) **The Salt Range** : It forms the southern boundry of Potwar. Topographically it is very interesting. Rising abruptly from the low plains on the south it forms the precipitous escarpment, 2,500 to 3,500 feet (614-1000 Meters) heigh, over looking the "Thal". Its eastern part has south-west strike while southern part north-west. Salt Range starts in two almost parallel series of hills, the northern *Bakrala Ridge* and the southern *Tilla Hills*, enclosing the Jhelum Tehsil. The surface of the whole tract is broken, and distorted in a way which is hardly to realize without seeing it. The Salt Range has the remarkable property of absorbing the heat during the day and radiating it at night (Lamba, 1947). The general climate is sub-humid, submountain north (Ahmed, 1951), with summer and winter pronounced rains. On account of the broken nature of the country, there are many local variations. Some hills are rainnear than other. The rain fall seems to follow the river valleys in a curious manner. The vegetation is degraded and heavily over-grazed.

Unfortunately, the Potwar Plateau and the Salt Range are least known herpetologically. Almost no collection is made from this part, except the studies on the amphibians found in the brankish water of the Salt Range (Pruthi, 1933). The varient orography and the nature of the soil suggests, that a thorough study of this region might reveal many new records and froms. *Gymnodactylus montiumsalsorum* is only known from Salt Range.

and Ravi rivers. There are bed-Rock hills near Chiniot and Rabwah, Sangla and Shah Kot. *Bari Doab*, between Ravi and Beas rivers. The Doabs have over all semi-arid climate, summer heat is intense while winters are severe. The water of the rivers have been utalized by the construction of ingenous system of canals. The once bare, hard, almost impervious to water, powdery with saltpetre soil, growing some grass after a shower, dotted with small hardy trees or shrubs, ; has now been converted into an irrigated green fields, and are the main source of food grain for the country. Due to the influence of man many changes has taken place in the herpetofauna. The original habitat of agamids, varanids, colubrids and lacertids have been changed. On the other hand, the habitat of lizards like *Mabuya, Ophisops*, and snakes like elapids and colubrids is enhanced. The irrigation has extended the ranges of most of the Indo-Oriental amphibians, like *Rana tigerina, R. cyanophlyctis, R. shadrensis* and *Microhyla ornata*. The patches of land still remain to be reclaimed, might still have the relects of the species which have vanished from the reclaimed areas.

(*b*) **Bhawalpur Plain.** It is almost a southern extension of the doabs. The north-eastern part is a cover and meander flood plain, while the central part is the sand hill plain which is largely levelled and irrigated. The south-western part is the cover flood plain of Dera Nawab, a reclaimed area of Thar Desert known as Cholistan. General climate is arid, summer temperature is high, and winters cool to cold. In summer diurnal ranges of temperature are well pronounced. Dust-storms are more frequent (Ahmed, 1951). The Bhawalpur Plain has predominant sandy and desolate soil, and is the north-western extension of the Indian Desert, thus its herpetofauna has greater affinities with the Indian sub-region. A thorough survey has not yet been made of this area.

(*c*) **The Derajat or Sulaiman Piedmont.** Derajat consists of the trans-Indus territory. It is divided into two distinct parts, *Pachand* : high rainless tract running along the eastern side of the Sulaiman Range. It is seamed by the hill torrents. The other *Sindh* : including all the land under the influence of the Indus River; so it is capable of irrigation, either by canals, wells or by inundations, direct from Indus. An arid and desolate strip of highland *Danda Tract* lies between these two parts. The general climate of Derajat is arid, rain water runs off the slops, eroding deep gullies and is of no use for the area. Natural vegetation is poor consists of mainly thorny bushes grasses. On its south Derajat becomes continous with the Sibi Desert. Minton (1966) puts this area as transitional

zone since there is no information available pertaining to the herpetofauna of this region.

(*ii*) **Lower Indus Plain.** The sediments of the Indus have played a key role in shaping this plain. It is flat, sloping to the south. It can conveniently be divided into four physical parts :

(*i*) North-western highlands,

(*ii*) Thar Desert,

(*iii*) Sind Plain, and

(*iv*) Indus Delta.

(*i*) **North-western highlands.** It includes the Kachhi-Sibi Plains, bounded on the north by *Marri-Bughti*, and on the west by the *Kalat Ranges*. It is barred desolate area in which the heat and acridity combined with uniformly textured soil create ideal conditions for mirage, and called *Pat desert*. Its southern edge is incontact with the Indus alluvium which is formed by Sulaiman and Kirthar Ranges and is known as Kohistan. It is driest and consists of the sun-mountain strip along the west of the Indus River. The high slops support some grass, herbs and stunted shrubs. However the beds of the torrents and the valleys between the ranges have larger trees and are much greener. Deserticolous lacertids and sand burrowing snakes are quite abundant here. This area is also more or less least known herpetologically.

(*ii*) **Thar Desert** : The Great Indian Desert extends in its south-western extent in the eastern Sind and is known as Thar Desert. It consists of, largely, the sand hills, which vary from small dunes to hills 300 to 400 feet high, overlying the Indus alluvium, some times permanent rock. They are separated by valleys of varying breadths. Natural vegetation consists of herbs, shrubs, grasses, stunted bushes. However the vegetation reaching to the standard of a forest is confined to the areas around the shallow ponds or where parent alluvium is visible. Both the annual and diurnal ranges of temperatures are great. In summer dust storms are the main feature. Indo-Oriental forms have been recorded from Thar Desert. They have used it as a corridor to penetrate deep into the Sibi and Thal Deserts.

(*iii*) **The Sind Plain** : It is the main part of the lower Indus Plain. It is divided by the Indus bed in *right bank alluvium*: which is older in formation ; and the *left bank alluvium* which is of recent formation, and is

broad and stretches towards the desert. It is traversed by old river beds and lakes. It has been reclaimed. Sind plain is always liable to be flooded in vast stretches. Forests of longer trees are being planted. Certain scattered patches of land have been declared as reserve forests. (Munshey, 1951). Its northern part is much waterlogged and saline. Lake Manchhar lies in this plain. The central part has uniform landscape, however *Rohri Cuesta,* a ridge of nummulitic limestone breaks the monotony of landscape. The lower Sind plain is predominantly a cover flood plain. *Ganjo Takkar ridge* lies in the south. This region has greater range of temperature, less humidity, dusty winds in summer and freezing winds in winter.

(*iv*) **The Indus Delta :** It is higher than the adjacent lands. So that the distributaries of Indus, in this region, have their beds and levels higher than adjacent lands, which are filled with seeped water, thus resulting in the formation of the marshes. Many of the channels perform duel function of distributaries and estuaries. The coast is low and flat, formed by the tidal delta. It has swamps and tamarisk groves in its western section. The eastern section is the *Rann of Kutch,* a saline marshy land. The coastal strip along Karachi, has thin mantle of soil over weathered bedrock. A few low hills rise to 50 feet. Sea breeze is a very important and pleasant feature, in summer. While in winter land breeze increase the temperature. There is a general high humidity.

Generally, the Indus Plain have alluvial soil. Due to reclamation, it is covered with green crops. Thus have increased the habitat of mostly the mesic forms of Indo-Oriental Region. They are *Mabuya, Riopa, Calotes, Spalerosophis, Ptyas, Coluber, Natrix, Argyrogena, Oligodon, Lycodon* etc., the sand burrowing forms like *Acanthodactylus, Ptyodactylus, Agamura,* and *Lytorhynchus* are some of the Palearctic genera found here.

Main features of the Geography of Pakistan

To conclude the salient features of the geography of Pakistan, two main features become clear.

(I) North, north-western and western mountainous rampart and its Plateaus.

The *north* part which consists of lofty mountains, which remain covered by snow, most of the year. While the *north-western mountains,* become dry as they descend the Himalayan heights and loose their characteristic Himalayan vegetation, becomming barren and desolate. The *western*

mountains are much broken, dry and barren, with here and there green valleys. All these mountain except for the northern mountains, form the eastern leg of the mountains of the Great Iranian Plateau (Fig. I).

(2) The desert plains.

The Great Indian Desert extends deep in Pakistan as the Plains of Punjab and Sind. Its north-western most extension is the Thal Desert, continuing with Sibi Desert through Dejart desert. While its south-western extension reaches to the south-western costal strip. On the other hand The Chagi Desert in the north-western Baluchistan, is continous with the Iranian Desert, as its eastern most extension. Most of the desert plain has been reclaimed by artificial irrigation, changing the physical nature of the soil, but there is no great change in the climate, which remains semi arid or arid (Fig. II).

Both the lofty and low mountains and reclaimed and non-reclaimed desert plains form effective barriers for various texa of herpetiles, it forms mainly the subject matter of the present work.

Analysis of the herpetofauna

Herpetiles of Pakistan are represented by 24 families, 79 genera and 195 texa (Table 1) derived from various sources (Table III). A brief statistical analysis is hereby undertaken to understand the composition, and the representation of various families and genera.

Amphibians

Amphibians are represented by 3 families (12.08% of the total), and 3 genera (3.79% of the total) and 18 species (10% of the total).

Family Bufonidae : is represented by single cosmopolitan genus *Bufo*, with 7 species (33 %). The taxa consist of 3 Palearctic, 3 Indo-Oriental and one endemic, (Table I and IV).

Family Microhylidae : represented by single south-east Asian genus *Microhyla* with one taxon (5.55%) *M. ornata*, Oriental in distribution.

Family Ranidae : is represented by single Indo-Oriental *Rana* with 10 species (55.55%). Two of these taxa are Paleactic, while 6 Oriental and two endemic.

Chelonians

Chelonians are represented by 5 families (20.83%) with 15 taxa, falling within 12 genera. Oriental elements are dominant.

Family Emydidae : is represented by 3 genera (25%), with 4 species (26.66%). All are Indo-Oriental in distribution.

Family Testudinidae : has one representative genus *Testduo*, with 2 taxa (13.33%), one Palearctic and the other Oriental.

Family Cheloniidae : 4 genera (33.33%), with 4 species (26.66%). All Indo-Oriental in their affinities.

Family Dermochelyidae : is represented by single genus *Dermochelys*, with single taxon, circum-tropical in distribution.

Family Trionychidae : is represented by 3 genera (25%) and 4 taxa (26.66%). All with Indo-Oriental affinities.

Crocodelians

The crocodiles are represented by two families, Crocodylidae and Gavialidae, each with single representative genus, *Crocodylus* and *Gavialis*, each with single texon. Both having the Indo-Oriental affinities.

Lizards

The lizards are represented by 5 families (20.90%) with 88 taxa (45.12%), 43 Palearctic, 20 Oriental and 25 endemic taxa.

Family Gekkonidae : This family is represented by 11 genera (39 28%) and 33 species (33.50%). This number includes 10 Palearctic and 7 Indo-Oriental taxa, while 16 taxa are more or less endemic of Pakistan. These lizards are widely distributed in Pakistan.

Family Agamidae : is represented by 5 genera (17.85%) and 23 species (26.13%). Considerable endemism is shown by these lizards, about 7 taxa fall in this category. Palearctic elements amount to 11, while Indo-Oriental genera are 5 in number. The agamids are most widely distributed lizards of Pakistan.

Family Chamaeleonidae : This is an Ethiopial family, represented by a Palearctic genus *Chamaeleo*, which is represented by an Indian species.

The presence of which in the south-eastern part of Sind has recently been demonstrated, (Minton, 1966).

Family Lacertidae : This family is represented by 3 genera (10.71%) and 12 taxa (13.63%). They consist mainly the Palearctic elements 10, while oriental 1, with 1 endemic form.

Family Scincidae : 7 genera (25%), and 15 taxa (17.04%). They show preponderance of the Palearctic elements 9, while 5 Indo-Oriental and one endemic.

Family Varanidae : is represented by single Ethiopio-Oriental genus *Varanus*, with 4 taxa (4.54%). Three of these are Palearctic while one Indo-Oriental.

Ophidia

Snakes are represented by 8 families (33.33%) falling in 72 taxa (36.92%). Palearctic elements come to 19, while Indo-Oriental are dominant 43 with 10 endemics (Table I).

Family Typhlopidae : is represented by single cosmopolitan genus *Typhlopus*, which is represented by two Indo-Oriental taxa.

Family Leptotyphlopidae : is also represented by single cosmopolitan genus *Leptotyphlops*, with one Palearctic and the other endemic taxon.

Family Boidae : is represented by two genera, with 4 species (5.55%). One of these taxa is Palearctic, while 3 are Indo-Oriental.

Family Colubridae : is the largest family of the snakes of Pakistan, contributing 16 genera (47.05%) and 39 species (54.16%). This family is widely represented in Pakistan. Predominantly Indo-Oriental 20, and 12 Palearctic elements. About 6 taxa are endemics of Pakistan.

Family Elapidae : is represented by two genera of deadly poisonous snakes, represented by three species. Two being Indo-Oriental while one is Palearctic in distribution.

Family Hydrophiidae : is the second largest family with 7 genera (20.58%) and 14 species, all Indo-Oriental in distribution, and well represented in the Pakistani coastal waters.

Family Viperidae : It is represented by 4 genera (11.76%(and 7 species. Like elapids they are deadly poisonous snakes. Vipers are mostly Palearctic in affinities.

Family Crotalidae: is also a family of poisonous pit-vipers, represented by monotypic Holarctic genus *Agkistrodon*. Of all the 27 terresteial snakes genera, 7 genera belong to the poisonous snakes, represented by 10 taxa (9.72%) out of total 58 ophidian taxa. These snakes are widely distributed throughout Pakistan, causing harm to human and animal life.

To summarize, the amphibians are represented by 3 genera, 18 species ; while Chelonians with 12 genera, 15 species ; Crocodelians 2 genera, two species. The lizards form the main bulk, with 28 genera and 88 species. The snakes are the second largest group with 34 genera and 72 species. Amphibians are represented by 5 Palearctic species, 10 Indo-Oriental and 3 endemics ; Chelonian 1 Palearctic, 1 circum-tropical and 13 Indo-Oriental texa. Crocodelians are represented by 2 Indo-Oriental species ; lizards with 40 species of Palearctic lizards, 19 of Indo-Oriental and 25 endemics. The snakes have 19 Palearctic and 43 Indo-Oriental, with 10 endemics. Thus the herpetiles of Pakistan have 68 Palearctic, 88 Indo-Oriental and 38 endemic taxa. (Table II, III, IV).

TABLE 1

THE COMPOSITION OF THE HERPETOFAUNA OF PAKISTAN

	genera		species	
AMPHIBIANS	Number	Percentage of total=3	Number	Percentage of total=18
Bufonidae	1	33·33	7	38·88
Microhylidae	1	33·33	1	5.55
Ranidae	1	33·33	10	55.55
CHELONIANS		total=12		total=15
Emydidae	3	25	4	26·66
Testudinidae	1	8·33	2	13·33
Cheloniidae	4	33·33	4	26·66
Dermochelyidae	1	8·33	1	6.66
Trionychidae	3	25	4	26·66

CROCODELIANS		total=2		total=2
Crocodylidae	1	50	1	50
Gavialidae	1	50	1	50
LIZARDS		total=28		total=88
Gekkonidae	11	39·28	33	37·5
Agamidae	5	17·85	23	26·13
Chamaeleonidae	1	3·75	1	1·13
Lacertidae	3	10·71	12	13·63
Scincidae	7	25	15	17·04
Varanidae	1	3·75	4	4·54
OPHIDIANS		total=34		total=72
Typhlopidae	1	2·94	2	2·77
Leptotyphlopidae	1	2·94	2	2·77
Boidae	2	5·88	4	5·55
Colubridae	16	47·05	39	54·16
Elapidae	2	5·88	3	4·16
Hydrophiidae	7	20·58	14	19·44
Viperidae	4	11·76	7	9·72
Crotalidae	1	2·94	1	1·38

TABLE II

STATUS AND GEOGRAPHICAL DISTRIBUTION OF HERPETILE TAXA OF PAKISTAN

	Baluchistan	Sind	Punjab	N.W.F.P.	Status
Family Bufonidae					
B. himalayanus	—	—	—	+	Himalayan
B. melanostictus	—	—	—	+	Oriental

	Blauchistan	Sind	Punjab	N.W.F.P.	Status
B. olivaceus	+	—	—	—	Mediterranian
B. stomaticus	+	+	+	+	Indo-Oriental
B. surdus	+	—	—	—	Central Asian
B. viridis arabicus	+	—	—	—	Sharo-Mediterranian
B. viridis pseudoraddei	—	—	—	+	Endemic
Family Microhylidae					
M. ornata	—	—	+	+	Oriental
Family Ranidae					
R. breviceps	—	+	+	+	Indian
R. cyanophlyctis	+	+	+	+	Oriental
R. syhadrensis	—	+	+	+	Indian
R. pleskei	—	—	—	+	Himalayan
R. ridibunda	+	—	—	—	Mediterranian
R. sternosignata	+	—	—	—	Central Asian
R. tigerina	+	+	+	+	Oriental
R. strachani	—	+	—	—	Endemic
R. vicina	—	—	+	+	Himalayan
Rana hazarensis	—	—	—	+	Endemic
Family Emydidae					
Geoclemys hamiltonii	—	+	—	—	Oriental
Hardella thurjii	—	+	+	—	Oriental
Kachuga smithii	—	+	+	—	Oriental
K. tecta tecta	—	+	—	—	Oriental
Family Testudinidae					
Tsetudo elegans	—	+	—	—	Indian
T. horsfieldii	+	—	—	—	Central Asian

	Baluchistan	Sind	Punjab	N.W.F.P.	Status
Family Cheloniidae					
Chelonia mydas japonica	+	+	—	—	Indo-Pacific
Eretmochelys imbricata	+	+	—	—	Indo-Pacific
Lepidochelys olivacea	+	+	—	—	*Indo-Pacific*
Caretta caretta gigas	—	+	—	—	Indian
Family Dermochelyidae					
Dermochelys coriacea	—	+	—	—	Circum-tropical
Family Trionychidae					
Chitra indica	—	+	—	—	Oriental
Lissemys punctata	—	+	+	+	Oriental
Trionyx gangeticus	—	+	+	—	Oriental
T. hurum	—	+	—	—	Oriental
Famiiy Crocodylidae					
Crocodylus p. palustris	+	+	—	—	Oriental
Family Gavialidae					
Gavialis gangeticus	—	+	+	—	Indian
Family Gekkonidae					
Agamura agamuroides	+	—	—	—	Irano-Turanian
A. famoralis	+	—	—	—	Endemic
A. persica	+	+	—	+	Irano-Turanian
Alsophylax tuberculatus	+	+	—	—	Saharo-Sindian
Eublepharis macularius	+	+	+	+	Irano-Turanian
Gymnodactylus chitralensis	—	—	—	+	Endemic
G. fedtschenkoi	+	—	—	—	Irano-Turanian
G. k. kachhensis	+	+	+	—	Indian
G. k. watsoni	+	—	+	+	Endemic

	Baluchistan	Sind	Punjab	N.W.F.P.	Status
G. montiumsalsorum	—	—	+	—	Endemic
G. scaber	+	+	+	—	Saharo-Sindian
G. stoliczkai	—	—	—	+	Endemic
G. walli	—	—	—	+	Endemic
G. x dattonensis	—	—	—	+	Endemic
Hemidactylus b. brookii	+	+	+	+	Oriental
H. flaviviridis	+	+	+	+	Oriental
H. frenatus	—	+	—	—	Oriental
H. leschenaultii	+	+	+	—	Indian
H. persicus	+	+	—	+	Saharo-Sindian
H. t. triedrus	—	+	—	—	Indian
H. t. turcicus	+	+	—	—	Mediterranian
Ptyodactylus homolepis	—	+	—	—	Endemic
Stenodactylus lumsdenii	+	—	—	—	Endemic
S. maynardi	+	—	—	—	Irano-Turanian
S. orientalis	+	+	—	—	Endemic
Teratolepis fasciata	—	+	—	—	Endemic
Teratoscincus microlepis	+	—	—	—	Irano-Turanian
T. scincus	+	—	—	—	Irano-Turanian
Tropiocolotes depressus	+	—	—	—	Endemic
T. helenae	+	+	—	—	Endemic
T. p. persicus	+	—	—	—	Endemic
T. p. euphorbiacola	+	—	—	—	Endemic
Pristurus rupestris	+	+	—	—	Endemic
Family Agamidae					
Agama agalis isolepis	+	+	+	—	Inano-Turanian

	Baluchistan	Sind	Punjab	N.W.F.P.	Status
A. agrorensis	—	—	+	+	Endemic
A. c. caucasica	+	—	—	—	Irano-Turanian
A. h. himalayana	—	—	—	+	Himalayan
A. megalonyx	+	+	—	—	Irano-Turanian
A. m. melanura	+	+	+	+	Irano-Turanian
A. melanura lirata	+	—	—	—	Endemic
A. nupta nupta	+	—	—	—	Irano-Turanian
A, n. fusca	+	—	—	—	Endemic
A. rubrigularis	+	+	—	—	Irano-Turanian
A. ruderata blauchiana	+	+	—	—	Endemic
A. tuberculata	—	—	÷	+	Himalayan
A. minor	—	+	+	—	Indian
Calotes versicolor	+	+	+	+	Oriental
Phrynocephalus clarkorum	+	—	—	—	Seistanian
P. euptilopus	+	—	—	—	Endemic
P. luteoguttatus	+	—	—	—	Endemic
P. m. maculatus	+	+	—	—	Irano-Turanian
P. ornatus	+	—	—	—	Endemic
P. scutellatus	+	—	—	—	Seissanian
Sitana ponticerata	—	+	—	—	Indian
Uromastyx asmussi	+	—	—	—	Seistanian
U. hardwickii	+	+	+	+	Indian
Family Chamaeleonidae					
Chamaeleo chamaeleon zeylanicus	—	+	—	—	Indian
Family Lacertidae					
Acanthodactylus c. cantoris	+	+	+	—	Irano-Turanian

	Baluchistan	Sind	Punjab	N.W.F.P.	Status
A. c. blanfordi	+	—	—	+	Irano-Turanian
A. micropholis	+	—	—	—	Seistanian
Eremias acutirostris	+	—	—	—	Seistanian
E. aporosceles	+	—	—	—	Endemic
E. brevirostris	+	—	+	—	Irano-Turanian
E. fasciata	+	—	—	+	Irano-Turanian
E. guttulata watsonana	+	+	+	—	Irano-Turanian
E. scripta	+	—	—	—	Irano-Turanian
E. velox persica	+	—	—	+	Seistanian
Ophisops e. elegans	—	—	+	—	Seistanian
O. jerdonii	+	+	+	+	Indian
Family Scincidae					
Ablepharus pannonicus grayanus	+	+	—	—	Indian
A. p. pannonicus	+	+	+	+	Irano-Turanian
Chalcides O. ocellatus	+	+	—	—	Irano-Turanian
Eumeces schneiderii blythianus	+	+	—	+	Seistanian
E. s. zarudnyi	+	—	—	—	Seistanian
E. taeniolatus	—	+	+	+	Saharo-Sindian
Leiolopisma himalayana	—	—	—	+	Irano-Turanian
L. ladacensis	—	—	—	+	Himalayan
Mabuya dissimilis	+	+	+	+	Indian
M. macularia	+	+	—	—	Oriental
M. aurata	—	+	—	—	Irano-Turanian
Ophiomorus blanfordi	+	—	—	—	Seistanian
O. brevipes	+	—	—	—	Irano-Turanian
O. raithmai	—	+	—	—	Endemic
O. tridactylus					

	Baluchistan	Sind	Punjab	N.W.F.P.	Status
Riopa punctata	—	+	+	+	Seistanian
Family Varanidae					
Varanus flavescens	—	+	+	—	Indian
V. b. bengalensis	+	+	+	+	Irano-Turanian
V. griseus caspius	+	—	—	—	Irano-Turanian
V. g. koniecznyi	—	+	+	—	Saharo-Sindian
Family Typhlopidae					
Typhlops braminus	—	+	+	+	Oriental
T. porrectus	—	+	+	+	Indian
Family Leptotyphlopidae					
Leptotyphlops blanfordii	+	+	+	+	Endemic
L. macrorhynchus	+	+	—	—	Saharo-Sindian
Family Boidae					
Eryx conicus	+	+	—	—	Indian
E. j. johnii	+	+	+	+	Indian
E. tataricus speciosus	+	—	—	—	Irano-Turanian
Python m. molurus	—	+	—	—	Oriental
Family Colubridae					
Boiga t. trigonata	—	+	+	+	Oriental
B. t. melanocephala	+	—	—	—	Irano-Turanian
Argyrogena fasciolata	—	+	+	—	Indian
Coluber k. karelini	+	—	+	—	Irano-Turanian
C. k. mintonorum	+	—	—	—	Endemic
C. florulentus	+	—	—	—	Endemic
C. r. ravergieri	+	—	—	+	Irano-Turanian
C. rhodorachis ladacensis	+	+	+	+	Saharo-Sindian
C. ventromaculatus	+	+	+	+	Irano-Turanian

	Baluchistan	Sind	Punlab	N.W.F.P.	Status
C. gracilis	—	+	—	—	Endemic
Dendrelaphis tristis	—	+	—	—	Indian
Eirenis persica walteri	+	+	+	+	Central Asian
Enhydris pakistanica	—	+	—	—	Endemic
Lycodon a. aulicus	—	+	+	—	Indian
L. s. striatus	+	+	+	+	Indian
L. s. bicolor	+	+	+	+	Irano-Turanian
L. travancoricus	—	+	—	—	Indian
Lytorhynchus maynardi	+	—	—	—	Endemic
L. paradoxus	—	+	+	—	Endemic
L. ridgewayi	+	—	+	—	Irano-Turanian
Natrix platyceps	—	—	—	+	Himalayan
N. sieboldii	—	—	—	+	Himalayan
N. stolata stolata	—	+	+	+	Oriental
N. tessellata tessellata	—	—	—	+	Endemic
N. cerasogaster	—	+	—	—	Oriental
N. p. piscator	+	+	+	+	Oriental
Macropisthodon plumbicolor	—	+	—	—	Indian
Oligodon arnensis	+	+	+	+	Indian
O. taeniolatus	+	+	+	+	Indian
Psammophis c. condanarus	—	+	+	—	Indian
P. leithii	+	+	—	+	Indian
P. lineolatus	+	—	—	—	Central Asian
P. schokari	+	+	+	+	Saharo-Sindian
Ptyas mucosus	+	+	+	+	Oriental
Spalerosophis arenarius	+	+	—	—	Endemic

	Baluchistan	Sind	Punjab	N.W.F.P.	Status
S. d. d'adema	+	+	+	+	Indian
S. d. schirazianus	+	—	—	+	Irano-Turanian
Elaphe helenae	—	+	—	—	Indian
Telescopus rhinopoma	+	+	—	+	Seistanian
Family Elapidae					
Bungarus caeruleus	+	+	+	+	Oriental
Naja n. naja	+	+	+	+	Oriental
N. n. oxiana	+	—	+	+	Irano-Turanian
Family Hydrophiidae					
Astrotia stokesii	+	+	—	—	Indo-Pacific
Enhydrina schistosa	+	+	—	—	Indian
Hydrophis c. caerulescens	+	+	—	—	Indo-Oriental
H. cyanocinctus	+	+	—	—	Indo-Oriental
H. f. faciatus	—	+	—	—	Indian
H. lapemoides	+	+	—	—	Indian
H. mamillaris	+	+	—	—	Indian
H. o. ornatus	+	+	—	—	Indian
H. spiralis	+	+	—	—	Indo-Oriental
Lepemis curtus	+	+	—	—	Indo-Pacific
Microcephalophis cantoris	+	+	—	—	Indian
M. g. gracilis	+	+	—	—	Indian
Pelamydrus platurus	+	+	—	—	Indo-Pacific
Praescutata viperina	+	+	—	—	Indian
Family Viperidae					
Echis carinatus pyramidum	+	+	+	+	Saharo-Sindian
E. c. astole	Island Astola off the Makran coast				Endemic

	Baluchistan	Sind	Punjab	N.W.F.P.	Status
Eristicophis macmahonii	+	—	—	—	Seistanian
Pseudocerastes p. persicus	+	—	—	+	Seistanian
P. bicornis	—	—	—	+	Endemic
Vipera lebetina obtusa	+	—	—	+	Sahro-Central Asian
V. r. russelii	—	+	+	—	Oriental
Family Crotalidae					
Agkistrodon himalayanus	—	—	—	+	Himalayan

Distribution of various Herpetelian taxa in Pakistan

The herpetiles are distributed throughout Pakistan. However they show certain pattern, taken in detail in the following section (Table II, V).

Cosmopolitan amphibian family Bufonidae is represented by single genus *Bufo*, with 6 species and one sub-species. Indian taxon *B. stomaticus*, the commonest toad of Pakistan (Khan, 1972) has Palearctic affinities, but it do not cross through Baluchistan to reach Iran. It is represented in Afghanistan. The wide ranging *B. olivaceus* is Saharo-Mediterranian-Sindian in distribution. However in Pakistan it is represented by two races ; one in north-western Baluchistan *v. arabicus*, while the other *v. pseudoraddei* in the northern North Western Frontier Province. Central Asian taxon *B. surdus* has been reported from north-western Baluchistan. Wide ranging Indo-Oriental taxon *B. melanostictus* and Himalayan mountain toad *B. himalayanus* confine themselves to the north-western N. W. F. P. Genus *Rana* is represented by 10 taxa. Indo-Oriental elements, *R. cyanophlyctis, syhadrensis, tigerina* are wide ranging, while *breviceps* has spotty distribution and *strachani* confines to Indus delta. Himalayan mountain ranids are represented by *R. pleskei* and *vicina* and confine to the north-eastern N. W. F. P. and alpine Punjab respectively. Recently, Dubois and Khan (1979) have collected a new frog beloging to the *labiegi* group from the eastern N. W. F. P. Wide ranging Saharo-Mediterranian ranid *R. ridibunda*, just enters the northern Baluchistan, similar is the case of Central Asian ranid *R. sternosignata*.

The land tortoises are represented by tropicopolitan family Testudinidae with cosmopolitan genus *Testudo*, which is represented by ~~two~~ one taxon,

Indian *T. elegans* reaching to the south-eastern Sind, while Central Asian *T. horsfieldii* just enters north-western Baluchistan. The fresh water family Emydidae is represented by three genera, all Oriental. *Geoclemys hamiltonii* reaching to lower Sind, *Hardella thurjii* up to the southern Punjab along the course of Indus. Genus *Kachuga* is represented by two taxa *smithii* in Sind and Punjab water courses, while *K. tecta* in lower Sind valley.

The mud turtle family Trionychidae is represented by Indo-Oriental genera *Chitra* in Sind valley, *Lissemys* with much wider distribution, Sind, Punjab and N. W. F. P. While the third genus *Trionyx* is cosmopolitan and represented by two Oriental taxa, *T. geneticus* in Sind valley and Punjab, and *T. hurum* in lower Sind. Sea turtles are represented by two families, cosmopolitan in distribution, Cheloniidae with four genera. Indo-Pacific genus *Chelonia* is represented by circumtropical taxon *C. mydas*, almost all along the Pakistani coastal strip. Similarly genus *Lepidochelys* is represented by Indo-Pacific *L. olivacea*, inhabiting warm waters. The Indian genus *Caretta* is represented by single, almost Indian taxon *C. gigas*, entering in tidal creeks, marches and river mouths. The warm sea turtles family Dermochelyidae is represented by single circumtropical genus *Dermochelys*. This genus is represented by wide ranging taxon *D. coriacea*.

Crocodyles are represented by two families each with a genus and single species. Family Crocodylidae, circumtropical in distribution is represented by genus *Crocodylus* with an Indian species *palustris*, reported from Indus valley, extending up to the southern Punjab and south-western Baluchistan. Indian family Gavialidae, is represented by genus *Gavialis* with single taxon *gangeticus*, inhabiting Indus valley extending into Punjab. From Punjab it is largely exterminated.

Lizards are represented by 6 families. Cosmopolitan family Gekkonidae is represented by Mediterranian and Indo-Oriental elements. The Mediterranian genera restricted to Saharo-Sindian Sub-Region are *Alsophylax*, *Ptyodactylus*, *Stenodactylus*, *Tropiocolotes* and perhaps *Pristurus*. *Alsophylax tuberculatus* enters the north-western Baluchistan, is quite rare in lower Indus valley, while *Ptyodactylus homolepis* is endemic of western Sind, confining to Kirthar Range. *Stenodactylus* is represented by three taxa : *S. lumsdenii* north-western Baluch endemic, *S. maynardi* entering north-western Baluchistan corridor, and the coastal Sind endemic *S. orientalis*, is ranging from the southern Thar Desert to the foot of Kirthar Range. The three taxa of *Tropiocolotes*, *depressus* ; *helenae*, *persicus* are the endemics

of north-western Baluchistan. The population of *T. persicus* is represented by two races, *p. persicus* confined to the north-western Baluchistan and *p. euphorbiacola* in the south-eastern Baluchistan. There are reports of the occurrence of *helenae* in lower Sind. *Pristurus rupestris*, a gekko found in the eastern most part of Iran, has been reported by Murray (1884 a) from Karachi, since this record is not confirmed. Irano-Turanian genus *Teratoscincus* is represented by two taxa *microlepis* and *scincus*, both enter Baluchistan, through the north-western corridor, and have not been able to cross deep. Central Asian genus *Gymnodactylus* is represented by 9 species. Irano-Turanian *fedtschenkoi* confines to the western Baluchistan, while Saharo-Sindian *scaber* is reported from south-western Baluchistan, Sind valley and central Punjab. Indo-Oriental taxon *kachhensis* is represented by two races, *k. kachhensis* inhabits south-east Baluchistan, Sind valley and most of the Punjab, *k. watsoni* is recorded from the north-eastern Baluchistan, north-western Punjab and most of the northern N. W. F. P. Five taxa of gymnodactyles are endemics of Pakistan, *chitralensis, montiumsalsorum, stoliczkai, walli, watsoni* and *G. sp* (a new gekko being described from the eastern N.W.F.P. Khan, in press) All these new taxa have been described from the northern and north-western N. W. F. P. Seistanian genus *Agamura* is well represented by three species : Irano-Turanian *agamuroides* just enters the north-western Baluchistan, while *persica* extends from coastal Sind to the north-western Baluchistan, and thence to the south-western N.W.F.P. *A. femoralis* is endemic of the north-western Baluchistan Desert Basin. The Indo-Oriental geckonid genera which are represented are *Eublepharis* and *Hemidactylus*. Irano-Turanian *E. macularius* is widely distributed throughout Pakistan. Hemidactyles are represented by seven taxa. Wide ranging, circum-Mediterranian *turcicus* extends beyond Baluchistan into Sind valley, while Saharo-Sindian *persicus* populates Baluchistan, N. W. F. P. and crosses into Sind valley. Indian hemidactyles are represented by two taxa *leschenaultii* and *triedrus*, former extending to the south-eastern Baluchistan, throughout Sind to central Punjab, while the latter enters through the southern Sind, not extending deep. Out of the three Oriental taxa *brookii, flaviviridis* are wide ranging throughout Pakistan, while third *frenatus* inhabits Sind valley. Monotypic genus *Teratolepis*, is to all the available evidence, a Sind endemic.

The Oriental family Agamidae is represented by 5 genera, Saharo-Sindian elements being dominant and are represented by two genera, *Agama* and *Uromastyx*. Agamids are distinguished into mountain taxa *nupta, melanura, caucasica, tuberculata, agrorensis* and *himalayana* ; and terrestrial

taxa *agalis*, *megalonyx*, *minor*, *ruderata* and *rubrigularis*. Irano-Turanian taxa *agalis* inhabits the north-western Baluchistan, sandy parts of Sind and Punjab, *caucasica* confines itself to the north-western sandy basin of Baluchistan, *megalonyx* has been recorded from the north-central Baluchistan and extends to the western margin of Indus. The populations of *melanura* and *nupta* in Pakistan are distinguished into two races, *m. melanura* having relatively wide range penetrate deep through the Sofed Koh corridor, radiating out to east to Salt Range in the northern Punjab, west to Pab Hills and south to plains of Sind. While second race *m. lirata* is the endemic of southern Baluchistan. *A. n. nupta* do not cross the north-western desert basin, while *n. fusca* is almost covering the whole of the northern and southern Baluchistan and is endemic of this area. The northern and eastern Baluchistan, western Sind, at the foot of Kirthar Range is inhabited by *rubrigularis* which do not cross east beyond the Indus. Himalayan *himalayana* and *tuberculata* are recorded from the northern N. W. F. P. and Azad Kashmir, however *tuberculata* extends in the alpine Punjab. Indian *A. minor* has recently been demonstrated from central-western Punjab (Khan and Mirza, 1972), however Murray (1886) has reported from Thar Parker, Sind ; suggesting the penetration route through Pakistan. Since the capture of a specimen of this agama no other specimen has been caught, perhaps suggesting its extreme crepuscular and nocturnal (?) secretive habits. However its distribution appears to be spotty. The northern endemic *A. agrorensis* confines to alpine Punjab, N. W. F. P. and Kashmir, while south-western endemic *A. ruderata baluchiana* inhabits the north-central Baluchistan extending to north-western Sind.

The second Saharo-Sindian genus *Uromastyx* is represented by one Seistanian taxon *asmussi* inhabiting Baluchistan desert basin, and one Indian taxon *hardwickii* having wider distribution, from south-east Baluchistan, through Sind, the north-western Punjab and the southern N. W. F. P. Central Asian genus *Phrynocephalus* is represented by six species. Irano-Turanian *P. maculatus* extends through central Baluchistan crosses the Kirthar Range and extends to the western bank of Indus. Seistanian element *P. clarkorum* and *P. scutellatus* are recorded from the north-western and western Baluchistan, respectively, however for the latter there are doubtful records from Sind. Three taxa *P. euptilopus*, *P. luteoguttatus* and *P. ornatus* are endemics of Baluchistan desert basin. Indo-Oriental genera *Sitana* and *Calotes*, each with one representative species, are variedly distributed. *S. ponticerata* has been reported, unconfirmedly from south-eastern Sind, while *C. versicolor* is common throughout the southern Baluchistan, lower Sind valley, Punjab and N. W. F. P.

Ethiopial family Chamaeleonidae is represented by wide ranging single genus *Chamaeleo* with an Indian taxon *zeylanicus*. It penetrates through south-eastern Sind from southern India, where reported to be common in bushes. On the other hand the Ethiopial family Lacertidae is well represented by three Saharo-Sindian genera. *Acanthodactylus*, *Eremias*, and *Ophisops*. *Acanthodactylus* is represented by one Irano-Turanian element *cantoris*, with wide distribution from south-western Baluchistan through Indus valley, and the north-western and southern Panjab. The population of this taxon in desert basin of Baluchistan, and south-western N. W. F. P. has been designated to *c. blanfordi* race. Seistanian element *micropholis* do not extend beyond north-western Baluchistan desert basin. Genus *Eremias* is represented by seven taxa. Seistanian elements *acutirostris* populates the north-western Baluchistan, while *velox persica* extends northward to south-western N. W. F. P. Irano-Turanian taxa are *brevirostris* reported from south-eastern Baluchistan to the north-western Punjab, *fasciata* is recorded from west-central Baluchistan and south-western N. W. F. P., while *scripta* remains within Baluchistan desert basin. *E. guttulata watsonana* has some what wider distribution, from the south-eastern Baluchistan, eastern Sind to Punjab. While *E. aporosceles* is endemic to the north-western Baluchistan desert basin. Genus *Ophisops* is represented by two taxa, Seistanian *elegans* reported from Kalabagh, central-western Punjab, probably is an entrant through Sofed Koh corridor, while the Indian taxon *jerdonii* is widely distributed, from north-western Baluchistan to Sind and western, and north-western Punjab and south-western N. W. F. P.

Cosmopolitan family Scincidae is represented by 7 genera, with varied affinities. Irano-Turanian genera *Ablepharus* and *Ophiomorus* are represented by two and three taxa respectively. The Ablepharan population restricted to north-western Baluchistan and the southern Sind has been designated to Indian *p. grayanus* race, while *p. pannonicus*, an Irano-Turanian race has much wider range, from north-western Baluchistan, through Sind to central-western Punjab and south-western N. W. F. P. The *Ophiomorus* population is derived from two Seistanian elements, *blanfordi* populating the south-western Baluchistan, while *tridactylus* has much wider distribution, from north-western Baluchistan, Sind and south-western Punjab *O. raithmai* is southern Sind endemic. Mediterranian genus *Chalcides* has one taxon *ocellatus* recorded along the Baluchistan and Sind coastal strip. Sino-Japanese genera *Eumeces* and *Mabuya* are well represented. Mediterranian *E. schneiderii* is represented by two Seistanian races, *s. blythianus* in

Baluchistan and south-eastern Sind, and *s. zarudnyi* in southern Baluchistan, Saharo-Sindian *E. taeniolatus* has been reported from south-eastern Sind, Punjab and N. W. F. P. The second Sino-Japanese genus *Mabuya* by one widely distributed Indian taxon *M. dissimilis* reported from north-western Baluchistan, Sind, Punjab and south-western N. W. F. P. Oriental *M. macularia* has been reported from south-eastern Baluchistan and lower Sind valley, while Irano-Turanian *M. aurata* has been reported from Sind.

Oriental genera *Leiolopisma* and *Riopa* are represented by two and one taxa respectively. Irano-Turanian *L. himalayana* and Himalayan *ladacensis* have been reported from northern N. W. F. P. Genus *Riopa* is represented by single taxon *punctata* recorded from Sind, central Punjab and eastern N. W. F. P.

Ethiopo-Oriental family Varanidae by single wide ranging genus *Varanus*, which is predominantly represented by western and southern Mediterranian elements. Indian *V. flavescens* has been reported from north-western Sind and eastern Punjab at low elevations, and is quite rare. Irano-Turanian *bengalensis* is quite wide-spread throughout Pakistan. Population of *griseus* has been distinguished into two non-sympatric races, Irano-Turanian *g. caspius*, in northern Baluchistan. While Saharo-Sindian *g. koniecznyi* has been reported from southern Sind and central and western Punjab.

Cosmopolitan family Typhlopidae is represented by Oriental genus *Typhlops*, whieh is represented by Oriental *braminus* and Indian *porrectus*, distributed almost throughout Pakistan except for Baluchistan plateau and the mountains. Oriental family Leptotyphlopidae is represented by an endemic taxon *blanfordii*, recorded from Baluchistan desert basin, Sind valley, Punjab and N.W.F.P. Saharo-Sindian *macrorhynchus* extends from Baluch desert basin to the Sind valley. Oriental family Boidae is represented by two genera. Saharo-Sindian *Eryx* is represented by two Indian taxa *conicus*, extending through western Sind to the south-eastern edge of Baluchistan, *johnii* almost occurring throughout Pakistan except for the high altitudes. Irano-Turanian taxon *E. tataricus* just enters north-western Baluchistan. Oriental genus *Python* is represented by single taxon *molurus*, entering through western Sind, and not extending into west, however there are vague records from upper Sind valley.

Cosmopolitan family Colubridae, contributes dominantly. It is represented by 16 genera. Monotypic Indian genus *Argyrogena* to which recently

Coluber fasciolata has been referred, by Wilson (1967), extends to the western Sind and central Punjab. Oriental genera represented in Pakistan are *Boiga, Dendrelaphis, Enhydris, Lycodon, Macropisthodon, Oligodon, Ptyas* and *Elaphe*. Genus *Boiga* is represented by two races Oriental *t. trigonata* extending through Sind, Punjab and N. W. F. P., while Irano-Turanian *t. melanocephala*, populates the western Baluchistan. Oriental *Dendrelaphis tristis*, Indian *Elaphe helenae* and *Macropisthodon plumbicolor* have entered the lower Sind valley. *Lycodon* is represented by three taxa. Indian *aulicus* has been reported from Sind valley and central Punjab, while Saharo-Sindian *striatus* has its Indian race *s. striatus* distributed from south-east Baluchistan, Sind and Punjab, while its Irano-turanian race *s. bicolor* is inhabiting north-western Baluch desert basin and south-western N. W. F. P. extending into Sind valley. Indian *L. travancoricus* has doubtful record from lower Sind valley. Oriental genus *Oligodon* is represented by two Indian taxa, *taeniolatus* and *arnensis*, both reported from almost throughout Pakistan, avoiding high elevations. Genus *Ptyas* is represented by wide ranging taxon *mucosus*, except for its doubtful records from Baluchistan, it is well represented throughout Pakistan.

Two Holarctic genera *Coluber* and *Natrix* are well represented in the herpetofauna of Pakistan. Coluber, is represented by six taxa. Irano-Turanian *C. karelini* has been recorded from north-western Baluch desert basin. An aberrent race of it seems to inhabit arid north-western Punjab (Khan, 1977). where it is a texonomic puzzel. However a race of *karelini* has recently been described from desert basin of Baluchistan, as *k. mintonorum* (Mertens, 1969). Irano-Turanian *C. ravergieri* has been reported from eastern Baluchistan to north-western N. W. F. P., while *ventrimaculatus* has wider distribution, from south-eastern Baluchistan through Sind, Punjab to north-western N. W. F. P. Saharo-Sindian *rhodorachis* is most widely distributed colubrid, from western Baluchistan, Sind, along north-western Punjab and N. W. F. P. to north-east Kashmir, *C. gracilis* has been described from Sind valley, as endemic to this area. Similarly. *C. florulentus* is an endemic of Desert basin of Baluchistan. The second Holarctic genus *Natrix* is represented by six taxa, all Indo-Oriental. Himalayan montane elements are *platyceps* and *sieboldii* just entering the south-western N. W. F. P. The Oriental taxa *stolata* is reported from the upper and lower Indus Plain, estern N. W. F. P. and south-western Azad Kashmir. *N. piscator* has much wider distribution it inhabits almost all the inland Pakistani waters. On the other hand *cerasogaster* is restricted to lower Indus valley. Endemic taxon *tessellata* confines itself to the north-western N. W. F. P.

Saharo-Sindian elements are represented by genera *Eirenis, Lytorhynchus* and *Spalerosophis*. Genus *Eirenis* is represented by Central Asian taxon *persica*, which has penetrated through Sofed Koh corridor to reach in the northern Punjab through south-western N. W. F. P. and the north-western Baluchistan corridor to penetrate deep in Sind valley. Irano-Turanian *L. ridgewayi* has penetrated through north-western Baluchistan and Waziristan Hills to penetrate to the central Punjab. The endemic taxa *L. maynardi* inhabits the north-western Baluchistan; while *L. paradoxus* is the endemic of lower Sind valley, and central western Punjab. *Spalerosophis* is represented by two taxa Indian *diadema* with wide distribution throughout Pakistan and endemic *arenarius*. Indian *diadema* is represented by two races *d. diadema* represented throughout Pakistan, and *d. schirazianus*, Irano-Turanian entering through north-western Baluchistan and north-western N. W. F. P. The second taxon *arenarius* is endemic of south-eastern Makran coast.

Ethiopial colubrid genera *Psammophis* and *Telescophis* are represented by five taxa. Indian *P. condanarus* penetrates through lower Sind valley and central Punjab, while north Indian taxon *leithii* has much wider distribution, entering through south-western N. W. F. P. The second penetrating point is the south-eastern Sind to reach the south-eastern Baluchistan. Central Asian taxon *P. lineolatus* enters the north-western Baluchistan, not penetrating deep. Saharo-Sindian texon *schokari* has taken the route leading through the Waziristan Hills to reach through central Baluchistan, on south and radiate to north-east in the north-central Punjab and central-west N. W. F. P. Genus *Telescophis* is represented by a Seistanian taxon *rhinopoma*, entering through the north-western Baluchistan and south-western N. W. F. P. and somehow reaches the lower Sind valley.

Oriental family Elapidae is represented by two Oriental genera *Bungarus* and *Naja*. Indo-Oriental *B. caeruleus* is almost common throughout the plains of Pakistan, while it extends only to the south of Baluchistan and south-western N. W. F. P. Genus *Naja* is represented by two races. Oriental *n. naja* is reported throughout the plains, where it is common, while it is more or less rare in south-eastern Baluchistan. On the other hand Irano-Turanian *n. oxiana*, having differentiated in north-western Baluchistan desert radiate out in the Mediterranian Sub-Region. It has been reported also from northern Punjab. The Pakistani coast is inhabited by various Indo-Oriental and Indo-Pacific taxa of sea snakes.

Widely distributed Arctogean family Viperidae is represented by four genera. Ethiopo-Saharo-Sindian genus *Echis* is represented by two races, *carinatus pyramidum* with wide distribution in the arid parts of Baluchistan, Sind, Punjab and N. W. F. P., mainly entering through Makran coast, north-western Baluchistan and Waziristan Hills. The second race is *c. astole*, recently been described, from the population inhabiting Astole Island off the Makran coast (Mertens, 1969). Monotypic genus *Eristicophis* is represented by Seistanian taxon *E. macmahonii* in the north-western Baluchistan. Saharo-Sindian genus *Pseudocerastes* is represented by Seistanian *persicus* in desert basin of Baluchistan, while south-western N. W. F. P. is inhabited, perhaps, by endemic *P. bicornis*. Ethiopio-Saharo-Sindian genus *Vipera* is represented by two taxa, Saharo-Central Asian *lebetina* has been reported from north-western Baluchistan, while Oriental *russelii* is common in eastern Punjab and Sind. Irano-Turanian-Japanese family Crotalidae is represented by Americo-Asian genus *Agkistrodon* by Himalayan taxon *A. himalayanus* in the Himalayan Pakistan.

TABLE III

STATUS OF THE PAKISTANI GENERA OF HERPETILES

Genus	Status
Bufo	Cosmopolitan
Rana	Cosmopolitan
Microhyla	Oriental
Geoclemys	Indo-Oriental
Hardella	Indo-Oriental
Kachuga	Indo-Oriental
Testudo	Central Asian
Chelonia	Circum-tropical
Eretmochelys,	Indo-Pacific
Lepidochelys	Indo-Pacific
Caretta	Indian
Dermochelys	Circum-tropical

Chitra	Indo-Oriental
Lissemys	Indo-Oriental
Trionyx	Indo-Pacific
Crocodylus	Circum-tropical
Gavialis	Indian
Agamura	Seistanian
Alsophylax	Irano-Turanian
Eublepharis	Indo-Oriental
Gymnodactylus	Central-Asian
Hemidactylus	Oriental
Ptyodactylus	Saharo-Sindian
Stenodactylus	Saharo-Sindian
Teratolepis	Endemic
Teratoscincus	Irano-Turanian
Tropiocolotes	Saharo-Sindian
Pristurus	Saharo-Sindian
Agama	Saharo-Sindian
Sitana	Indo-Oriental
Calotes	Indo-Oriental
Phrynocephalus	Irano-Turanian
Uromastyx	Saharo-Sindian
Chamaeleo	Ethiopial
Acanthodactylus	Saharo-Sindian
Eremias	Saharo-Sindian
Ophisops	Saharo-Sindian
Ablepharus	Irano-Turanian
Chalcides	Mediterranian

Eumeces	Sino-Japanese
Leiolopisma	Oriental
Mabuya	Sino-Japanese
Ophiomorus	Irano-Turanian
Riopa	Oriental
Varanus	Ethipio-Oriental
Typhlops	Oriental
Leptotyphlops	Oriental
Eryx	Saharo-Sindian
Python	Oriental
Argyrogena	Indian
Boiga	Oriental
Coluber	Holarctic
Dendrelaphis	Oriental
Eirenis	Saharo-Sindian
Enhydris	Oriental
Lycodon	Oriental
Lytorhynchus	Saharo-Sindian
Macropisthodon	Oriental
Natrix	Holarctic
Oligodon	Oriental
Psammophis	Ethiopial
Ptyas	Oriental
Spalerosophis	Saharo-Sindian
Telescopus	Ethiopial
Elaphe	Oriental
Bungarus	Oriental

Naja	Ethiopial
Echis	Ethiopial
Eristicophis	Endemic
Pseudocerastes	Saharo-Sindian
Vipera	Saharo-Ethiopial
Agkistrodon	Holarctic

TABLE IV

ZOOGEOGRAPHICAL DISTRIBUTION OF THE HERPETILES OF PAKISTAN (SPECIES)

Family	Med.	Ira-Tur.	Cent. As.	Sah. Sind.	Seist.	Or.	Ind.	En.
Bufonidae	1	—	1	1	—	1	2	1
Ranidae	1	—	1	—	—	3	3	2
Microhylidae	—	—	—	—	—	1	—	—
Emydidae	—	—	—	—	—	4	—	—
Testudinidae	—	—	1	—	—	—	1	—
Cheloniidae	—	—	—	—	—	3	1	—
Dermochelyidae	circum-tropical							
Trionychidae	—	—	—	—	—	4	—	—
Crocodylidae	—	—	—	—	—	1	—	—
Gavialidae	—	—	—	—	—	—	1	—
Gekkonidae	—	7	—	3	—	3	4	16
Agamidae	1	7	—	—	3	1	4	7
Chamaeleonidae	—	—	—	—	—	—	1	—
Lacertidae	—	6	—	—	4	—	1	1
Scincidae	—	4	—	1	4	1	4	1
Varanidae	—	2	—	1	—	—	1	—
Typnlopidae	—	—	—	—	—	1	1	—

Family	Med.	Ira.-Tur.	Cent. As.	Sah. Sind.	Seist.	Or.	Ind.	En.
Lpetotyphlopidae	—	—	—	1	—	—	—	1
Boidae	—	—	—	—	1	1	2	—
Colubridae	—	7	2	2	1	5	15	6
Elapidae	—	1	—	—	—	2	—	—
Hydrophiidae	—	—	—	—	—	—	14	—
Viperidae	—	—	—	2	2	1	—	2
Crotalidae	—	—	—	—	—	—	1	—
Total	3	34	5	11	15	32	56	37

Legend : Cent. As=Central Asian ; En.=Endemic ; Ind.=Indian ; Ira.-Tur=Irano-Turanian; Med.=Mediterranian; Or.=Oriental; Sah-Sind.=Saharo-Sindian ; Seist.=Seistanian.

Zoogeographical Regions of Pakistan

Wallace (1876) created Mediteranian Sub-Region of Palearctic Region, which includes south-western Asia (southern Europe, north Africa, north half of Arabia, Iran, Afganistan and Baluchistan). Wallace's idea has been enjoying general acceptance for a considerable time (Bartholomew, *et al.* 1911, Swan and Leviton, 1962), However the transitional position of the Mediterranian Sub-Region has been pointed out by Beaufort (1951), Darlington (1957) and many others.

More detailed studies of the herpetofauna of this sub-region has revealed the vagueness, surrounding Wallace's proposal (Nikol'skii, 1916 ; Terent'ev and Chernov, 1949). It has been explained that the vagueness is due to the lumping togather of three diverce territories, distinct from each other, in general ecology and fauna. Thus Wallace's Mediterranian Sub-Region has been divided further into Mediterranian (*sensu stricto*), Irano-Turanian (Turkey, Syria, Iraq, Iranian Plateau, Afghanistan, U.S.S.R. (Turkmenistan, Uzbekistan, Tadzhiskistan and southern Kazakhstan) and Pakistan except for the Makran coastal strip and Sind valley.) and Saharo-Sindian (Sahara, Nubian Desert, Saudi Arabia, Yemen (except Aden and its surrounding area), Oman, United Arab Emirates. Kuwait, southen Iraq, coastal strip of Iran, Makran coast to lower Sind valley, up to Multan). (Andarson, 1969 ; Haas and Werner, 1959 ; Klemmer, 1969).

The north-western part of the Indian Sub-Region of Oriental Region, now known as Pakistan, has been regarded distinct due to its topography, environments and composition of herpetofauna from the rest of the Indian Sub-Region. (Smith, 1931 ; Darlington, 1957). The transitional nature of this region has repeatedly been demonstrated by Minton (1966), Mertens (1969), and Ali and Ripley (1964). Hass and Werner (1969) have included the whole of Pakistan (except Makran coast and lower Sind valley, which they include in Saharo-Sindian sub-region) in Irano-Turanian sub-region of Mediterranian, Recently, Akhtar (1974), while studying the zoogeography of the termite fauna of Pakistan, includes Baluchistan west of Kirthar Range, the northern part of the North West Frontier Province and the Murree Hills in Palearctic Region, while rest of the country in the Oriental Region. Mirza (1975) working on the zoogeography of the fishes of Pakistan, includes almost whole of Pakistan in Oriental Region, except north-western Baluchistan, which he includes in Palearctic Region.

Minton (1966) has shown that the herpetofauna of Pakistan is derived almost equally from Palearctic and the Oriental elements. He further distinguishes nine herpetofaunal regions in Pakistan, basing on the distributional pattern : *Thar desert* with dominant Indian penninsular elements ; *Upper Indus basin,* with a mixture of species from north Indian plain, western deserts and mountains ; *Lower Indus valley,* with plain, desert and fresh-water species, from Saharo-Sindian and Indian Sub-Regions ; *Sind desert,* with deserticolous Saharo-Sindian and Indian elements occupying humid areas like oases etc. ; *Makran coast,* with mountaneous deserticolous species derived from Saharo-Sindian and Indian sub-regions ; *Baluchistan desert basin,* with mostly endemic and Palearctic elements ; *Northwestern upland,* with Palearctic and Central Asian elements ; *Himalayan upland,* with the Indian Mountain elements and the *Marine zone.* However, Minton do not suggest the division of Pakistan between Palearctic and Oriental Regions. Present study, almost closely agree with the zonal divisions of Minton.

In the present study, from the available data a zoogeographic analysis of the herpetofauna of the provinces of Pakistan has been undertaken. On the basis of the evidence, following salient features of the herpetology of Pakistan shape out.

North Western Frontier Province (N. W. F. P.) : Of all the 77 texa reported from this province, 36 occur along Afghanistan-Baluchistan border. They show dominant Palearctic elements 20, 11 Indo-Oriental

and 5 Himalayan mountain species. Four taxa are endemic to this part (Table V.) The eastern border has 14 species in all, one Palearctic, 10 Indo-Oriental and 3 Pakistan endemics. The endemism is mainly in central part of the province in *Gymnodactyles*. About 11 endemics have been recorded from this province *Bufo viridis pseudoraddei, Rana vicina, Rana hazarensis Gymnodactylus chitralensis, G. kachhensis watsoni, G. stoliczkai, G. walli, G. sp., Agama agrorensis, Natrix tessellata,* and *Pseudocerastes bicornis.*

Herps with general distribution all over N. W. F. P. fall in 21 taxa, with predominance of Indo-Oriental 13 and 7 Palearctic elements, indicating that the western border of N. W. F. P, falls in the Irano-Turanian sub-region of Mediterranian Region, while the eastern main part belongs to Indian Sub-Region (Map 3). However, Haas and Werner (1959) have included whole of N. W. F. P. in Irano-Turanian sub-region.

Punjab : About 74 species have so far been reported from the environs of Punjab. Mostly Indo-Oriental 40, while 30 are Palearctic. Moreover the Indo-Oriental elements have a generalized distribution, while the Palearctic are almost localized along the western border of the Punjab. Plains of Punjab almost have no endemics while five Pakistan endemics are confined in the Alpine Punjab. *Gymnodactylus montiumsalsorum* is mainly confined to the salt range.

Baluchistan : Records accord 103 taxa to the environs of Baluchistan, with dominant Palearctic elements 61 and Indo-Oriental 18. Palearctic taxa are mainly concentrated (35) in the north-western Baluchistan Desert Basin, while the rest have almost a generallized distribution, however there is an indication of secondary concentration in south-east Baluchistan of Indo-Oriental taxa. Records show Makran coastal strip having 12 taxa which are raised to 18 on its south-east and fall to 3 at its south-western edge.

Endemism in Baluchistan is very marked, about 19 species and subspecies are recorded to be endemics: *Stenodactylus lumsdenii, S. orientalis, Tropiocolotes depressus, T. helenae, T. persicus euphorbiacola, T. p. persicus, Agama femoralis, A. melanura lirata, A. nupta fusca, A. ruderata baluchiana, Phrynocephalus euptilopus, P. luteoguttatus, P. ornatus, Eremias aporosceles, Leptotyphlopus blanfordi, Coluber karelini mintonorum, C. florulentus, Lytorhyncus maynardi. Echis carinatus astole.* North-western Desert Basin of Baluchistan seems to be an active center of evolution of many these

endemic forms, about 13 texa are endemic to this area. While central and coastal Baluchistan, each have two endemics.

Zoogeographical division of Baluchistan follows a line passing along the Kirthar and Sulaiman Ranges. Further analysis of Palearctic elements shows that 5 elements belong to Saharo-Sindian, 33 Irano-Turanian, 6 central Asian, 2 Mediteranian, and one Saharo-Mediterranian. One fact can not be ignored in the herpetology of Baluchistan, that a considerable number of species, about 13, are those which have evolved in the Seistan Plateau, which lies just north to the point where the borders of Iran, Afghanistan and Baluchistan meet. It has been described as an oasis in the desert. It is actually an island of herbage and palm trees in a sea of yellow sand (Annandale and Carter, 1919). It is an undulating low plateau, less than 2000 feet above sea level, and consists of stiff grey clay. It is infact the inland delta of Helmand River and the basin into which the river water drains. Seistan has divercified ecology, with several very distinct types of environments. In winter the temperature sanks below freezing point, while the summer temperature is high. It receives 2 inches of rain throughout the year, commencing in December till April. The vegetation is quite distinct from Oriental Region (Annandale and Carter, op. cit.).

The forms known to have evolved in this region are : *Phrynocephalus clarkorum, P. scutellatus, Uromastyx asmussi, Acanthodactylus micropholis, Eremias acutirostris, E. velox persica, Ophisops elegans elegans, Eumeces schneiderii blythianus: E. s. zarudnyi, Opiomorus blanfordi, O. tridactylus, Eristicophis macmahonii, Pseudocerastes persicus persicus.* Thus the evidence is suggestive of the further division of Irano-Turanian sub-region into Seistanian district, the elements of which are discernable throughout Pakistan and Indian sub-region.

Out of 103 total taxa reported from Baluchistan only 9 have a generalized distribution, suggesting greater habitat selectivity by the herps of this region.

Sind : About 161 species have been recorded from geographical bounds of Sind. They consist of 25 Palearctic and 59 Indo-Oriental elements. These taxa have a generalized distribution, however indications of concentration of Palearctic on western side and Indo-Oriental on the eastern side seems to be quite natural. The generalized distribution is suggestive of the absence of specialized habitat in Sind. However 9 endemics mostly from lower Indus valley have been recorded ; *Rana stra-*

chani, Ptyodactylus homolepis, Teratolepis fasciata, Pristurus rupestris, Ophiomorus raithmai, Coluber gracilis, Enhydris pakistanica, Lytorhynchus paradoxus, Spalerosophis arenarius.

A concentration of Saharo-Sindian species in the lower Indus valley cannot escape notice, suggesting the Palearctic bonds through the costal Sind via coastal Makran, though not as strong as suggested by the studies of Haas and Werner (1969).

TABLE V

DISTRIBUTION OF HERPS IN THE PROVINCES OF PAKISTAN
(No. of Species)

North Western Frontier Province

	Eastern	North-western	South-western	General
Pakistan Endemics	3	3	1	1
Saharo-Sindian	—	2	—	3
Seistanian	—	—	4	—
Irano-Turanian	1	4	6	3
Central Asian	—	1	—	—
Saharo-Mediterranian	—	—	1	1
Himalayan	2	3	2	—
Indian	4	5	4	3
Oriental	4	1	1	10

Punjab

	N/E	N	N/W	C	S	S/E	W/C	General
Pakistan endemics	—	2	1	1	—	—	—	1
Saharo-Sindian	—	4	1	3	—	1	2	1
Seistanian	—	—	—	—	—	—	2	—
Irano-Turanian	—	1	2	2	1	1	3	3
Central Asian	—	1	—	—	—	—	—	—
Himalayan	—	—	—	—	—	—	—	—

Indian	2	2	1	5	—	2	3	5
Oriental	1	1	—	1	1	1	—	15

Baluchistan :

	N/W	N/E	S/E	S/W	C	E	W	Coastal	General
Pakistan endemic	13	1	3	—	2	—	—	2	—
Saharo-Sindian	2	—	—	1	1	—	1	—	1
Seistanian	9	—	—	1	1	—	1	1	—
Irano-Turanian	18	1	5	1	2	1	3	2	2
Central Asian	6	—	—	—	—	—	—	—	—
Mediterranian	2	—	—	—	—	—	—	1	—
Saharo-Mediterranian	1	—	—	—	—	—	—	—	—
Indian	3	—	7	—	—	—	1	—	3
Oriental	1	—	2	—	—	1	—	3	3
Indo-Pacific	—	—	—	—	—	—	—	3	—

Sind :

	N/W	L.I.V.	S/E	E	Coastal	W	General
Pakistan endemics	1	5	—	—	5	2	—
Saharo-Sindian	—	3	1	—	2	—	2
Seistanian	—	1	2	—	—	—	1
Irano-Turanian	1	—	—	1	3	3	6
Central Asian	—	—	—	—	—	1	—
Mediterranian	—	—	—	—	—	—	1
Indian	2	8	5	—	4	1	12
Oriental	—	8	1	—	1	—	—

Legend :

C : Central, E : Eastern, L.I.V. : Lower Indus Valley,
N : North, N/E : North-eastern, N/W : North-western,
S : Southern, S/E : South-eastern, S/W : South-western,
W : Western, W/C : West-central.

TABLE VI

RELATIONSHIP OF THE HERPETOFAUNA OF PAKISTAN WITH THAT OF NEIGHBOURING COUNTRIES

(open figures represent number of genera, while figures in parenthesis are the number of species).

Family	Pakistan	Afghanistan	Iran	India	Nepal	USSR
Bufonidae	1(7)	1(2)	1(4)	1(3)	1(3)	1(2)
Microhylidae	1(1)	—	—	1(1)	1(1)	—
Ranidae	1(11)	1(3)	1(2)	1(5)	1(5)	1(1)
Emydidae	3(4)	—	—	3(4)	3(4)	—
Testudinidae	1(2)	1(1)	1(1)	1(2)	—	2(1)
Chelonidae	4(4)	—	—	4(4)	—	—
Dermochelyidae	1(1)	—	—	1(1)	—	1(1)
Trionychidae	3(4)	—	—	3(4)	3(4)	1
Crocodylidae	1(1)	—	—	1(1)	1(1)	—
Gavialidae	1(1)	—	—	1(1)	1(1)	--
Gekkonidae	11(33)	6(11)	7(11)	5(10)	1(3)	4(3)
Agamidae	5(23)	4(16)	4(13)	4(8)	3(4)	2(4)
Chamaeleonidae	1(1)	—	—	1(1)	—	—
Lacertidae	3(12)	3(7)	3(7)	3(3)	1(1)	2(4)
Scincidae	7(15)	5(8)	4(8)	5(7)	3(5)	4(4)
Varanidae	1(4)	1(2)	1(1)	1(3)	1(1)	1(1)
Typhlopidae	1(2)	—	1(1)	1(2)	1(2)	1
Leptotyphlopidae	1(2)	1(1)	1(1)	1(1)	—	—
Boidae	2(4)	1(2)	1(2)	2(3)	1(1)	1(1)
Colubridae	16(39)	10(18)	10(15)	13(23)	9(15)	12(12)
Elapidae	2(3)	2(2)	1(1)	2(2)	2(2)	1(1)

Viperidae	4(7)	4(4)	3(3)	2(3)	1(1)	2(2)
Crotalidae	1(1)	1(1)	—	1(1)	1(1)	1
Hydrophidae	7(14)	—	7(14)	7(14)	—	—
Total	: 79(195)	41(78)	46(84)	65(107)	35(55)	35(45)
percentage of overlapping on the total of Pakistan						
Genera :	53.16	58.22	82.27	45.56	44.30	
Species :	(40.00)	(43.07)	(54.87)	(27.17)	(23.07)	
Percentage of non-overlapping on the total of Pakistan						
Genera :	46.83	41.77	17.72	54.43	55.69	
Species :	(60.00)	(56.92)	(45.12)	(72.82)	(76.92)	

Comparison of Pakistani Herpetofauna with that of adjascent countries

Comparative study of the herpetofauna of Iran, Afghanistan, U. S. S. R., Nepal and India with that of Pakistan, reveals certain interesting facts, and through light on the origin of the Pakistani herpetofauna. For the herpetofauna of Iran Anderson (1963, 74), Afghanistan Leviton and Anderson (1970), U. S. S. R. Bannikov et. al. (1977) and Nikol' skii (1915, 19), Nepal Swan and Leviton (1962), India Smith, (1931, 35, 43) and for the herpetofauna of Pakistan Minton (1966), Mertens (1969), Khan (1976), Khan and Mirza (1976, 77) have been consulted.

Iran :

A great plateau stretches between the Armenian Knot on the west and Pamirs on the east. The northern part of this Plateau is occupied by Afghanistan, while the eastern by Baluchistan. The main and the western part constitute the great Iranian plateau. Thus geographically western Pakistan (Baluchistan) is continuous with Iran.

Out of 79 Pakistani genera and 195 species of herps 46 genera and 84 species have been reported from Iran. They constitute 2 cosmopolitan

21 Palearctic, 8 Oriental, 1 Sino-Japanese, 2 Ethiopial, and 2 Holarctic genera ; with 56 Palearctic, 9 Oriental, and 5 Pakistan endemic taxa. The Preponderence of Palearctic elements and fall in the Oriental ones is suggestive of the absence of barriers in former case and presence in later. Percentage of overlapping at generic level being 58·22% while at specific level 43·07% (Table VI).

Afghanistan :

Except for a strip of the Plains of Turkistan on the North, the whole of Afghanistan is occupied by lofty mountains and elevated plateaus. Afghanistan lies along the north-western borders of Pakistan, separated by the north-western hilly tracts.

Out of 79 genera and 195 taxa of herps of Pakistan, 42 genera and 78 species are shared with Afghanistan. The shared comprises of 2 cosmopolitan, 20 Palearctic, 9 Oriental, 1 Sino-Japanese, 3 Ethiopial, 3 Holarctic, and one Pakistani endemic genus, with 26 Palearctic, 18 Oriental, 3 himalayan, and 10 Pakistani endemic species. Thus sharing is greater in Palearctic elements, at generic (53·16%) as well as at specific level. (40%).

U. S. S. R.

It includes almost the whole area lying to the north and west of the Himalayas. Zoogeographically the Himalayas form a very effective physical barrier between the two faunae.

36 genera and 47 species stand common with the herpetofauna of U. S. S. R. Palearctic shared genera are 15, while Oriental 8, Central Asian 1, Sino-Japanese 2 and Holarctic wide ranging genera 2 ; with 27 Palearctic, 5 Oriental, 1 Himalayan, and one Holarctic taxon. Palearctic genera are dominant while Oriental have declined in strength. Oriental genera *Trionyx*, *Eublepharis*, *Typhlopus*, *Elaphe*, Palearctic genus *Ophiomorus* and Holarctic genera *Natrix* and *Agkistrodon* are represented by different forms.

The percentage of overlapping between two herpetofaunae at generic level being 44·30% while at specific level 23 07%.

Nepal :

Though Nepal is far flung from Pakistan, lying along the curve of Himalayas, but it is almost continuous with north-eastern Pakistan, through

Himalayan ridges. Another interesting fact is, Nepal marks the northern boundry of Indo-Oriental Region, while Pakistan north-western. The comparative study of the herpetofaunae of both areas reveals interesting relationships.

About 36 genera and 53 species are common Palearctic genera being 3, Oriental 18, 1 circumtropical genus *Crocodylus*, 1 Sino-Japanese, 2 Holarctic and two Ethiopial genera are represented by 35 Indo-Oriental, 3 Palearctic, Himalayan 7 and 1 circumtropical taxon. The cut down in the number of Palearctic and increase in the Indo-Oriental elements becomes more meaningful when compared with Iran and Afghan herpetofaunae. The differences are suggestive of the acuteness of the barriers between the Palearctic and Indo-Oriental Regions along the north-western highland of Pakistan.

India :

Along the south-eastern border of Pakistan lies India. With no effective barrier except the great Indian Desert. Along the northern side extend the Himalayas, while Indo-Gangetic Plain almost form a continuvum. Similarly the Great Indian Desert is continuous with the deserts within Pakistan (Map. 2). The absence of any effective barrier between these regions is depicted when the herpetofaunae are considered togather.

About 65 genera and 107 taxa are common. The overlapping is markedly between Indo-Oriental genera and taxa.

Origion and the Relationship of Pakistani Herpetofauna

When Pakistan is viewed in its geographical perspective, the zoogeographical importance of its situation becomes understandable. On the north of Indo-Pak sub-continent lies the high rampart formed by the lofty Himalayan peaks, while on the south lies the deep blue waters of Indian ocean. Across these unsurpassable barriers is the strip of land—Pakistan. The north-western and western half of which is dry and occupied by rocky mountains, while the south-eastern half is almost levelled plain, a part of Indo-Gangetic Plain, and is almost with homogenous conditions and general prevailing dryness. Since Pakistan lies between Eurasia on one hand and south-east Asia on the other, for the better understanding of the origin of its herpetofauna, we have to study the general geographical relationships with these two vast areas and Pakistan.

From the Pamir Knot, in the northern most leg of Pakistan, three mountaneous ranges are given off along east, and other three on west.

The eastern ranges mostly lie outside Pakistan, in occupied Kashmir and India, while western ranges lie in Pakistan (Fig. 3). They can be distinguished in three series (stamp, 1967).

(*i*) North-western Trans-Alai, Alai and Hissar Mountains, in USSR.

(*ii*) The south-western Hindu Kush Range, continuing westward along north of Iran, passing into Elburz Mountains, after giving a Trans-Caspian branch——the Caucasus Mountains. The Elburz Mountains pass through the Armenian Knot and continue along the north of Asia Minor as Pontic Range.

(*iii*) The Sulaiman Mountains, arising from Hindu Kush, extend southward and continue into Kirthar Hills, as the bounding ridges of Siestan-Iran Plateau on the south. Continuing along the south-western coastal border of Iranian mainland as the Zagros system to meet the Armenian Knot, then passes along the south-west of Anatolia as the Taurus Chain.

The westward extensions of Hindu Kush and Sulaiman Range enclose important plateus :

Siestanian Plateau, Iranian Plateau and Anatolian Plateau. All these Plateaus lie in the east and south-east of Mediteranian, and have semiarid to arid climate, almost for the last eight thousand years (Ali and Repley, 1968). This area has become the arena in which the deserticolous Mediterranian and Saharan genera have undergone genetic diversification. Moreover, the homogenosity of environments have encouraged many species from Mediterranian (*senso stricto*) to travel eastward and Oriental deserticolous forms to travel westward. Similar movements have taken place in the Saharan and Ethiopial forms through low lying southern coastal strip of Iranian plateau and Makran coast, through peninsular Arabia.

Geographic relationships with the south-east Asia are quite obvious. There is structural continuity with mainland Indo-Pak and the Peninsulas of south-eastern Asia. Climatically the conditions gradually fade from equatorial conditions of south-east Asia to Arid and dry climate of Indo-Pak sub-continent. Apart from climatic barrier there is no other barrier between these regions. For the last two hundred years the Indo-Gangetic plain has been subjected to the influence of man. The natural habitat of the herps has been interfered due to the industrialisation and reclamation of land for crop production. Similarly the rising of the beds of the

rivers in Punjab cause their overflow, almost every year, destroying the habitat of many lizards and snakes. But on the other hand these factors promote the spread of amphibians throughout the plains. Ranids like *R. tigerina R. cyanophlyctis, R. syhadrensis* and *R. breviceps* and microhylid *M. ornata* are widely distributed Indo-Oriental forms which enjoy the wide distribution throughout Pakistan, but fail to extend beyond Indus, except for *R. cyanophlyctis*, a form extending up to Arabia. Moreover, south-east Asia has played an important role in the evolution of, apart of ranids, colubrids and also of elapids, one finds many south-eastern forms in Pakistan with a wide distribution, and passing across in the Mediterranian Region. The movements of various forms from south-east Asia to north-west have been much more extensive than vice versa.

Indo-Oriental Elements : About 26 genera of Indo-Oriental origin are recorded from Pakistan : *Microhyla, Geoclemys, Hardella, Kachuga, Caretta, Chitra, Lissemys, Gavialis, Eublepharis, Hemidactylus, Sitana, Calotes, Leiolopisma, Riopa, Typhlops, Leptotyphlops, Python, Argyrogena, Boiga, Dendrelaphis, Enhydris, Lycodon, Oligodon, Ptyas, Elaphe* and *Bungarus.*

The differential penetration through Pakistan to reach Afghanistan and Iran is very interesting, *Hemidactylus, Eublepharis, Leiolopisma, Calotes Leptotyphlops, Boiga, Lycodon, Oligodon, Ptyas, Naja* and *Bungarus* penetrate through Pakistan to reach Afghanistan. On the other hand comparatively small number of genera reach Iran, *Hemidactylus, Eublepharis, Typhlops, Leptotyphlops, Boiga, Ptyas,* and *Calotes.* Those Indo-Oriental genera which are at their north-western most leg of distribution and are confined to the environs of Pakistan are most of the fresh water tortoises like *Geoclemys, Hardella, Kachuga, Canetta, Chitra, Lissemys,* and crocodyle like *Gavialis,* lizards like *Sitana, Riopa,* and snakes like *Python, Argyrogena, Dendrelaphis, Enhydris* and *Elaphe.*

There is a line of those Indo-Oriental taxa which do not penetrate through Pakistan to reach Afghanistan or Iran : *Bufo melanostictus, B. himalayanus, B. stomaticus, Rana syhadrensis, R. tigerina, R. breviceps, R. vicina, Microhyla ornata, Testudo elegans,* almost all the fresh-water tortoises, Crocodyles, *Hemidactylus leschenaultii, H. triedrus, Mabuya macularia, M. dissimilis, Hemidactylus brookii, H. frenatus, Eryx conicus, Python molurus, Argyrogena fasciolata, Dendrelaphis tristis, Natrix cerasogaster, Macrophisthodon plumbicolor, Psammophis condanarus, Elaphe helenae* and *Vipera russelii.* There are some other Indo-Oriental taxa represented in Pakistan, which extend in Palearctic Region by another

race like *Rana cyanophlyctis* it is represented by a race *seistanica* in south-eastern Iran and another race *ehrenbergi* represented in Arabia. *Boiga trigonata* has an Irano-Turanian race *melanocephala*, *Lycodon striatus* has Irano-Turanian race *bicolor*, similarly *Spalerosophis diadema* has its Irano-Turanian race *schirazianus* while *Naja naja* has *oxiana* race beyond the borders of Pakistan.

Palearctic Elements : About 23 genera represent the Palearctic elements in the herpetofauna of Pakistan (Table III). These genera can be divided in four catagories according to their distribution :

Saharo-Sindian : These genera mostly deserticolous range from Sahara through Arabian desert to Sind through the Iranian coastal strip. These genera are wide ranging with a wide range of genetical radiation : *Ptyodactylus*, *Stenodactylus*, *Tropiocolotes*, *Pristurus*, *Agama*, *Uromastyx*, *Acanthodactylus*, *Eremias*, *Ophiosophis*, *Eirenis*, *Lytorhynchus*, *Spalerosophis*, *Pseudocerastes*, are typical of this group.

Irano-Turanian : These genera mostly are typical of the central Iranian desert basin : *Alsophylax*, *Teratoscincus*, *Phrynocephalus*, *Ablepharus*, *Ophiomorus*, and *Chalcides*.

Siestanian : The environs of Helmond in Siestan province of Iran (where the borders of Baluchistan, Iran and Afghanistan meet), have great impact on the genetical isolation of various Palearctic forms (Table II). However there is one genus typical of this area : *Agamura*.

Central Asian : The central Asian mainland has provided a vast area for the genetical differentiation of the various herpetile groups. However there are two central Asian genera represented in Pakistan ; *Testudo*, and *Gymnodactylus*.

There is considerable number of genera of Palearctic origin not penetrating through Pakistan to reach the Indo-Oriental Region : *Teratoscincus*, *Tropiocolotes*. *Telescopus*, *Lytorhynchus*, *Pseudocerastes*, *Ptyodactylus*, *Phrynocephalus*, *Ophiomorus*, *Alsophylax*, *Pristurus*, they are at their south-eastern most distribution border. Similarly there is a row of Palearctic species confined to the environs of Pakistan, mostly to the south-western and western upland : *Bufo olivaceus*, *B. viridis*, *Rana sternosignata*, *R. ribibunda*, *Agama caucasica*, *A. ruderata*, *Eremias velox*, *Chalcides ocellatus*, *Eumeces schneiderii*, *E. taeniolatus*, *Eryx tataricus*, *Coluber karelini*, *C. ravergieri*, *Natrix tesseliata* and *Vipera labetina*.

There are few Palearctic genera which are represented in Indo-Oriental Region by typical forms as genus *Agama* is represented by *A. minor* confined to the Peninsular India extending through south-eastern Sind to Punjab. *Uromastyx* has a wide ranging Indian form *hardwickii* similar is the case with *Eryx conicus* which is confined to Peninsular India, Bihar, Orissa extending into Pakistan through Sind to Baluchistan. Genus *Ophisophis* has purely Indian forms like *beddomei* and *microlepis* while *jerdonii* extends in Pakistan. Wide ranging Palearctic toad *Bufo viridis* is represented by two races *v. arabicus* represented in Baluchistan, while *v. pseudoraddei* recorded from North Western Frontier Province.

The entire amphibian fauna, prior to 1974 (Minton 1966 and Mertens 1969) was known to belong to the two cosmopolitan genera *Bufo* and *Rana*, But the discovery of *Microhyla ornata* (Khan 1974) from Punjab has made to recognise the Oriental contribution to the amphibian fauna of this region.

Scincid genera *Eumces* and *Mabuya* have Sino-Japanese affinities, while Ethiopial elements are represented by the various forms of the genera *Varanus*, *Chamaeleo*, *Psammophis*, *Telescophis*, and *Naja*. Wide ranging Ethiopio-Saharo-Sindian genera *Echis* and *Vipera* are represented. Wide ranging Holarctic genera *Coluber*, *Natrix* and *Agkistrodon* have contributed greatly to the Ophidian fauna of Pakistan.

The peripheral position of Pakistan in respect to the Oriental and Palearctic Regions do suggest that its fauna was received in waves from the various centers of its origin. Darlington (1959) has shown that larger areas with diverce environments tend to have more diverce and larger faunae than do the smaller ones. Moreover these larger areas form the source for the faunae of adjascent smallar areas. (Inger 1954).

The multiple origion of the Pakistani herpetofauna suggests the wide ranging variations in habitat and topography so that a variety of herpeto-fauna has been able to adopt itself here. The north-west and western mountains and hilly tracts have diverce local and regional variations, moreover, they form an effective barrier for most of the Indo-Oriental deserticolous plain adopted forms which, so we see, do not cross beyond Indus. Similarly the Indus plains are effective barriers for most of the highland Palearctic forms, which remain concentrated in the north-west and western part of Pakistan, not been able to descend the highland to penetrate deep to south-east,

SUMMARY

1. Topography of Pakistan is divided in two main parts : one, the highland consisting on the north the western part of the Himalayas, on north-west Hindu Kush, Koh-i-Sofed, Waziristan Hills and on the west Sulaiman, Pak and Kirthar Ranges. Second the Plains, western most part of the great Indo-Gangetic Plain—the Indus Valley. Which generally is a continuvum of the great Indian Desert.

2. Herpetiles of Pakistan fall in 24 families, 79 genera and 195 taxa. The composition of herpretofauna shows preponderence of lizards 45·12%. most aboundant of the lizards are geckos represented by 33 species, followed by agamids 23 species, Scincids 15 and lacertids 12 species, while varanids are represented by 4 species. Ophidians are the second largest group with 72 taxa (36.92%). Most frequent group of snakes being the colubrids with 39 taxa. 11 poisonous land forms are represented. Third largest group being the amphibians, represented by 18 texa, followed by chelonians with 15 taxa. Smallest group being the crocodelians with two taxa.

3. Indo-Oriental texa being dominant 126, distinguishable in to Himalayan, Indian and Oriental ; while Palearctic taxa stand to 68, and can be distinguished into Saharo-Sindian, Irano-Turanian and Seistanian elements.

4. Ethiopial elements are represented only at the generic level, *Chamaeleo*, *Telescopus*, *Psammophis*, *Naja* and *Echis* are represented by their Palearctic or Indo-Oriental forms. Similar case is with Holarctic genera *Coluber*, *Natrix* and *Agkistrodon*.

5. Palearctic taxa which reach Pakistan are of two catagories, mainly mountain and few deserticolous. Mountain forms do not descend in the Indus valley, while deserticolous ones penetrate deep in the Indus valley and extend even in Indo-Oriental Region. On the other hand the Indo-Oriental forms are mainly deserticolous and few Himalayan mountain forms, former extending deep in the Palearctic Region and even to north of Sahara, while latter forms remain confined to the highland of Palearctic Region.

6. Distributional studies of herptiles show various centers of evolution of herpetiles in Pakistan :

(*i*) Western Himalayas extending in northern Pakistan ; *Rana*.

(*ii*) Central, North Western Frontier Province : *Gymnodactylus*,

(*iii*) Iran-Pak-Afghan Border=Seistan : *Agamura*,

(*iv*) Chaghi Desert (North-western Baluchistan Desert Basin) : *Stenodactylus*, *Tropiocolotes*, *Agamura*, *Phrynocephalus*, *Coluber*, *Leptotyphlopus*.

7. Zoogeographical division of Pakistan in Palearctic and Oriental Regions is clearly demarcated by herpetological studies. The dividing line passes west to the Kirthar Range, extending through Sulaiman and Chitral Hills : thus most of the Baluchistan, western strip of Punjab and south-western and western border of N. W. F. P. lie in Palearctic Region, while the eastern plains belong to the Oriental Region.

8. Herpetiles of Pakistan show closest relations with Indian herpeto-fauna (overlap at generic level being 82·27% while at specific level 54.87%). Second close relations are with Iran, then Afghanistan, Nepal and USSR.

9. Invasion routs taken by the Palearctic elements are through Hindu Kush, Sofed Koh, north-western desert basin of Baluchistan and Makran coastal strip, same routs are taken by the Indo-Oriental texa to invade the west.

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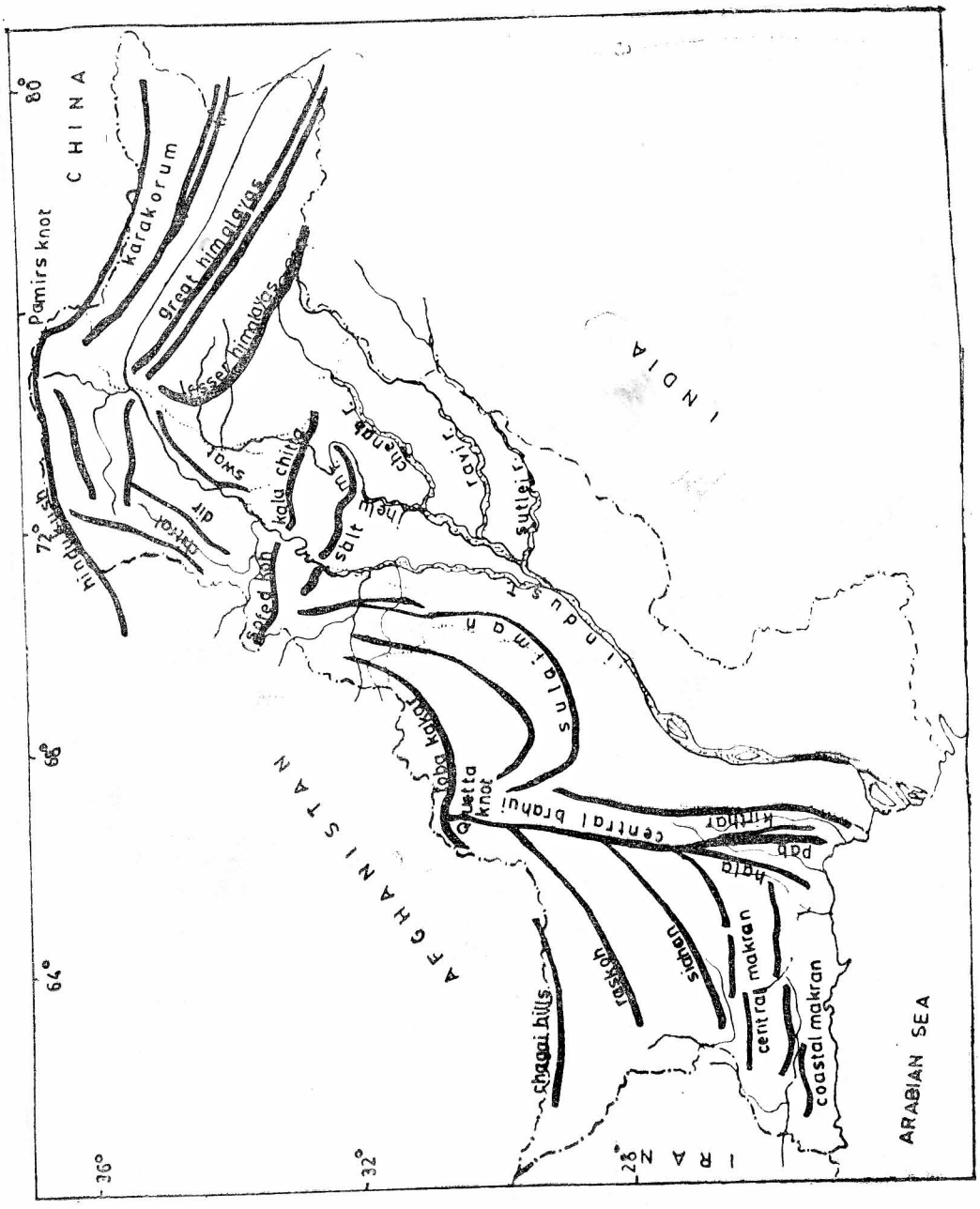

Fig. 1. Pakistan: Physical

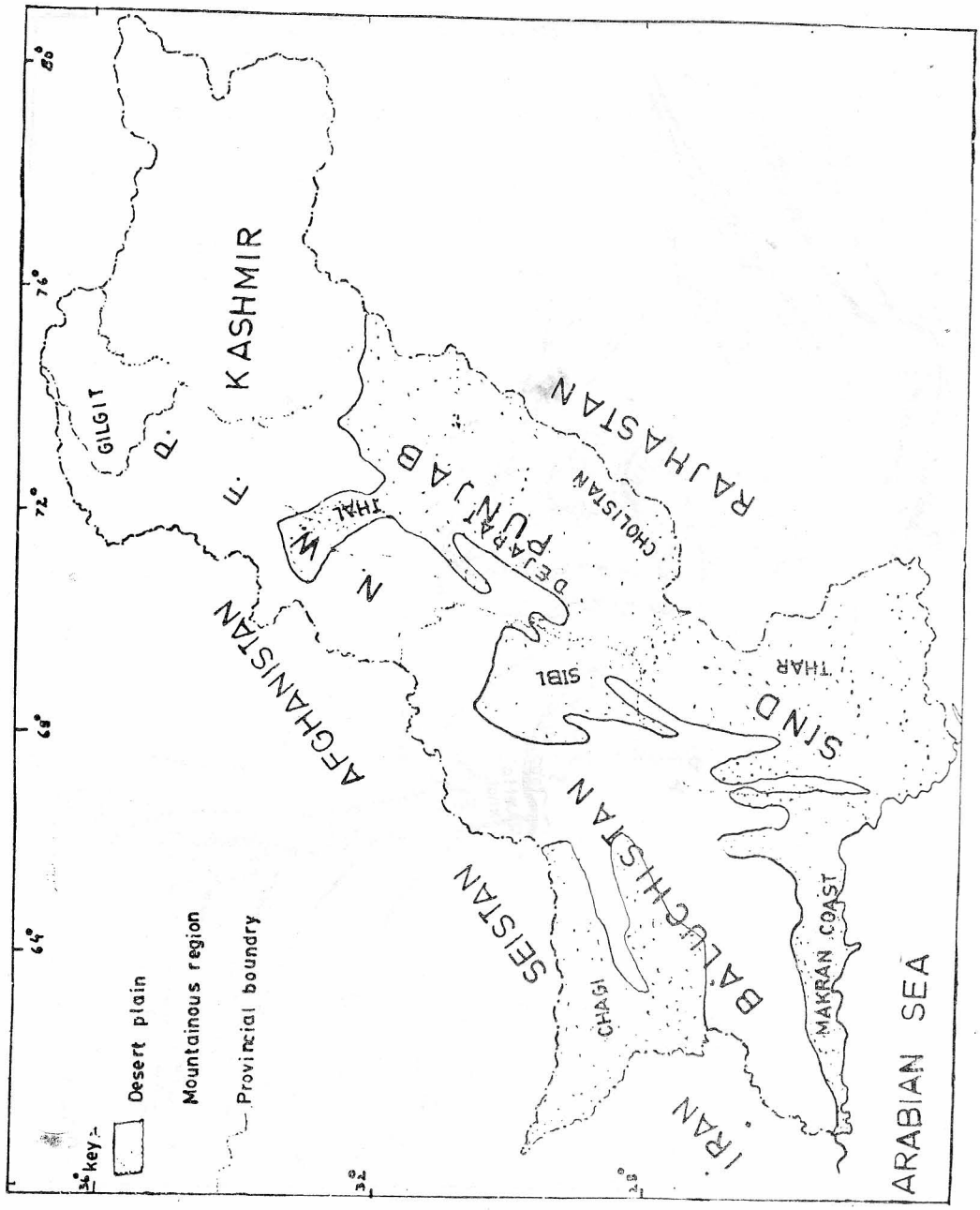

Fig. 2. Pakistan : Extention of Desert

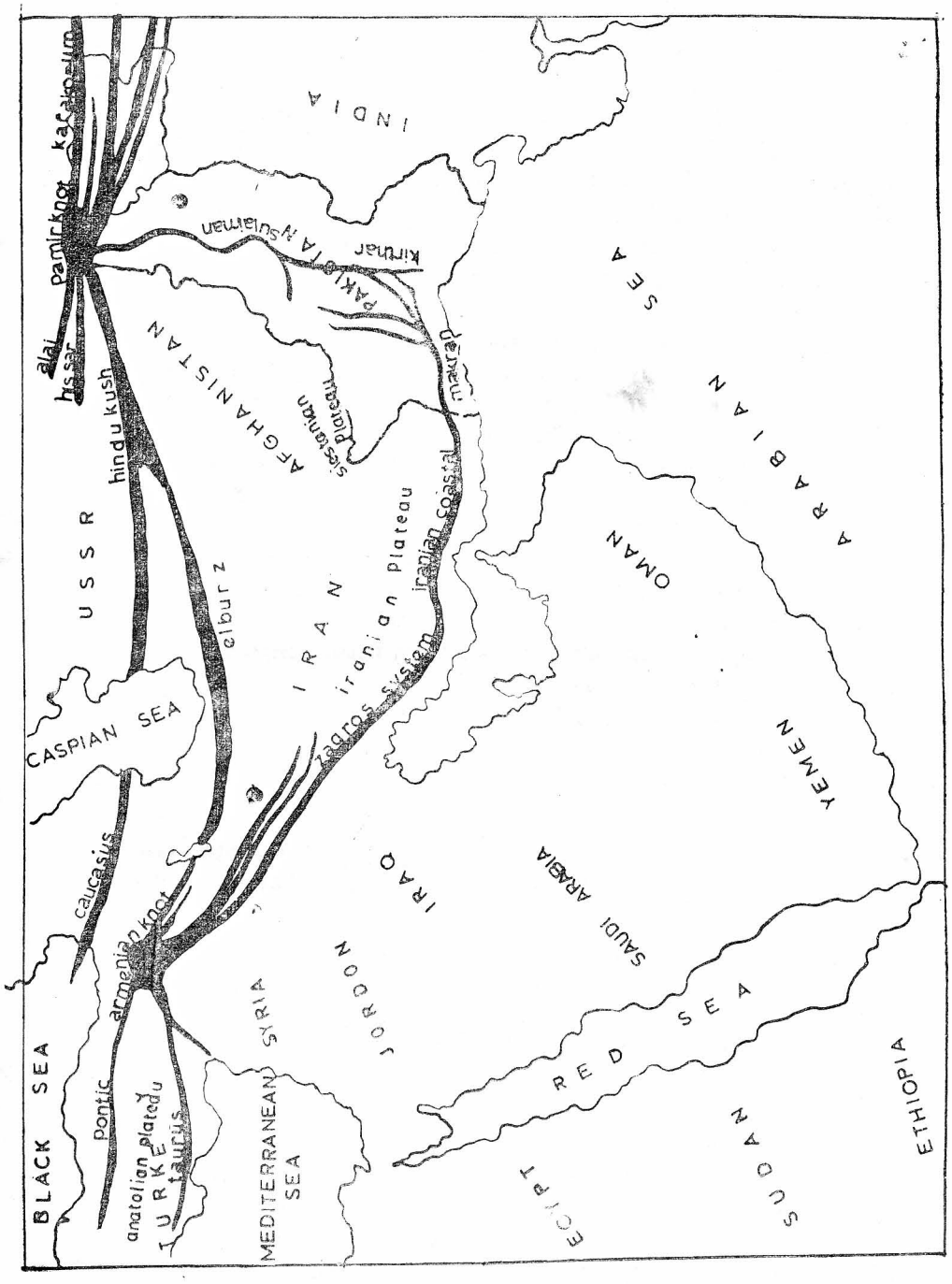

Fig. 3. Pakistan and its relationship with the Orography of Middle East