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Research paper

Study of Lacertilian (Lizards) diversity of District Dir (L), KPK, Pakistan

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Abstract

The current study enlightens the comprehensive picture, relative population status, and species diversity of lizard fauna in the lower Dir district of Khyber Pakhtunkhwa province, Pakistan. This study was designed to collect the data and record/investigate the population status and the diversity of lizard species from six different tehsils (Towns) in this district. We used the latest keys for identification of the collected and observed specimens. A total of 288 specimens of Lizards were examined, the collected specimens belonged to 6 families, 11 genera, and 14 species. The most abundant and observed species was *H. brookii* and the most abundant and observed family was Gekkonidae in this area during the current study. In this study, we have identified a new species of the genus *Cyratopodion*, and we will publish it after a thorough investigation in near future. The present study provides a baseline for future extensive studies on lizard habitat analysis, population dynamics, systematics, and phylogeny for incoming researchers and experts of herpetology.

Keywords: *Lizards; Diversity; Dir Lower; KPK; Pakistan.*

1. Introduction

Pakistan is truly rich in herpeto faunal diversity. Reptiles of Pakistan are rich, diverse and interesting due to its unique zoogeographic location, located in the transition zone of three zoogeographic zones of the Palearctic, Ethiopian and oriental regions of the six major regions of the world (Safi et al., 2021). Lizards are a group of reptiles that exhibit many morphological and ecological changes that enable them to survive and adapt to global temperatures and environments. Some reptiles, such as lizards, which have become an important part of people's homes in Pakistan, are known and best known to the public due to their close association with human homes. to them. attract. People live in the fields on rodents, fowl, rotting food, and skins, and feed on crops and their larvae. Deserts have their lizard fauna that can survive in heat and lack of water (Khan, 1999). The diversity and distribution of reptiles is closely related to the climatic conditions and the geographical location of a region; compared to warm-blooded vertebrates, these cold-blooded vertebrates can live and survive in harsher ecosystems because they can use more energy (Ali et al., 2018).

Our knowledge of reptilian fauna can be traced back to the subcontinent, from Günther's (1860, 1864) publication "Reptiles of British India" followed by Boulenger's (1891) "Fauna of British India" series. The lizard section was later revised by Smith (1935) in a separate volume of the series and Minton, (1962) contributed more to the modern era of herpetological research in Pakistan, which was followed and developed by Merten's publication (1969). Since then, many taxonomic studies on herpetology have been carried out in Pakistan, with different scientists describing many new reptile species, making new records, and expanding what is known about some species, providing a better help in the understanding of reptiles of Pakistan (Khan, 1999).

Pakistan is located in a unique region that includes many land areas with almost a dozen major biotic zones (Ahmed et al., 2006). These zones include the Siachin glaciers and cold desert in the north of the country and the dry subtropical desert in the south; from the dry coniferous forests of the inner Himalayas to the temperate deciduous forests of the Himalayan foothills; from the west side of the mountains of Sulaiman ranges in Balochistan and KPK to the Indus plain forest in the center; The swamps and river communities of the Indus River and its tributaries, and the grasslands of Punjab, KPK and Upper Sindh, the grassy fields of the Indus Delta and the mangrove's forests of coastal area in the south (Roberts, 1997). Located at the nexus of three biogeographic regions, Pakistan is home to extraordinary flora and fauna, with six of the ten largest regions in the world (desert, tropical, rainforest seasonal forest, coniferous forest, temperate deciduous forest, and mountainous) (Cox and Moore, 1993). The lizard fauna in Pakistan belongs to eight families naming; Agamidae, Chamaeleonidae, Eublepharidae, Gekkonidae, Lacertidae Scincidae, Uromastycidae, and Varanidae (Khan, 2000). The number shows a steady increase from (Minton, 1962, 1966) 65 species, Merten's (1969), Khan (1980), to Khan (1999), 101 species and subspecies, belonging to 35 genera (Khan, 1999), 179 species (Hashmi et al. 2013), 197 species (Khalid et al. 2019).

Khan et al., (2017) provide a key and checklist to the gecko's diversity of Pakistan. They reported *Bunopus tuberculatus* of genus *Bunpus* from south-western Sindh, two species *Mediodactylus walli, Mediodactylus dehakroense* from Benazirabad District, *P. homolepis* of genus

Ptyodactylus which is the only recorded species of this genus from Pakistan, which was recorded from western Kirthar Range in north-western Sindh in 1876 by Blanford, since there is no subsequent record of this species from Pakistan, largely because of the absence of collection from this area.

The Northern Areas of Pakistan are at the boundary between the Palearctic and the Oriental biogeographical realms. This mountainous region is at the junction between major mountain ranges this area is home to; *Altiphylax stoliczkai, Laudakia himalayana, L. pakistanica,* and *Varanus bengalensis* species of lizards (Casiraghi, 2010). *Cyrtodactylus dattanensis* is found in Datta, District Mansehra, Hazara Division (Khan, 1980).

The aims and objectives of the current study are;

i) To study the status of lizard diversity of district Dir Lower.
ii) To evaluate the clear picture of lizard fauna in District Dir Lower.
iii) To determine the relative adaptability and morphological variation in lizards with different sub-habitat.

2. Material and methods

2.1. Study area

The present study was conducted in District Dir Lower, KP, Pakistan. The District lies in the Hindukush range between 35° 10 to 35° 16 N Latitude and 71° 50 to 71° 83 E Longitudes (Khan, 1999). In the Northwest of the District is the District of Chitral, in the south is Malakand Agency, in the East is the District of Swat, while in the West it adjoins Afghanistan. The elevation of the District ranges from 1200 m to 2800 m above sea level. The climate of the District largely depends on altitude. The climatic data of the station show that July is the hottest month (15.67 to 32.52°C), while January and February are the coldest months and the temperature generally falls below the freezing point. The mean maximum and minimum temperatures are 11.22°C and 2.39°C. The winter season is from mid-November to March. The relative humidity is higher in January, February, August, and December. Snowfall starts from December to March and remains up to June and July on high mountains, adding to the beauty of the valley (Khan, 1999). The specimens were taken from twenty-four villages of District Dir Lower including; Shah Alam Baba, Khadagzai kamala, Ramora, Asbanr, Ouch, Ziarat Talash, Qila Shamshi Khan, Bandagi, Bagh dushkhail, Sado, Malakand payeen, Standaro, Muslim Abad, Odigram, Shalkandai, Khazana, Karramar, Ghakhe kandaw, Gumbir, Maskinay, Darbar, Kumbar, Zaimdara and Mirgam Payeen. Every visit lasted from a minimum of two to a maximum of five days.

2.2. Methodology

Lizards were collected during the summer rain, and intense humid weather; fields were visited from dawn to dusk. Arboreal species like Calotes versicolor farooqi were searched for tree branches, leaves under bark areas and bushes. For the genus *Laudakia* and some geckos, researchers surveyed rocky places and searched them in the crevices in between rocks. And for nocturnal species like *Eublepharis macularius*, the researcher visited small rocky areas at night. The specimens were identified with the help of the most recent keys available in the literature (Khan, 1999). We used a practical technique to identify a specimen through compound microscopy. Help was also taken from Professor Rafaqat Masroor (Associate Curator at Pakistan Museum of Natural History Islamabad), Islamabad, Pakistan.

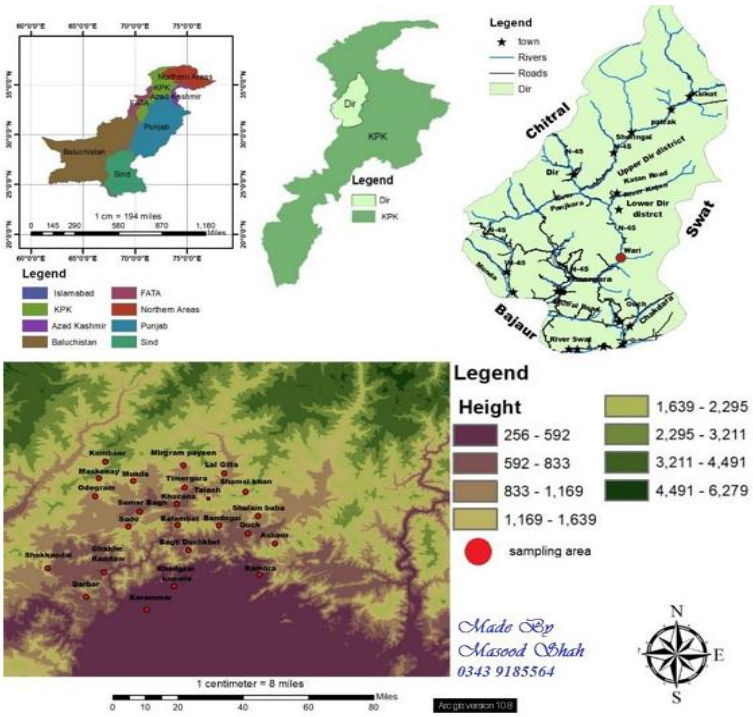

Fig. 1: Map of Pakistan, KP, and District Dir Lower.

Table 1: Tehsil-Wise Coordinates of Our Work

S. No.	TEHSIL	VILLAGES	COORDINATES
1.	Adenzai	Shah Alam Baba	34.721525N 72.081076E
		Ouch (sharqi, gharbi)	34.739562N 72.014272E
		Ramora	34.671797N 72.068899E
		Asbanar	34.792881N 72.121046E

		Khadagzai kamala	34.638175N 71.821712E
		Ziarat Talash	34.732522N 71.871686E
		Qila Shamshi khan	34.748408N 71.859511E
2.	Timergara	Sado	34.788708N 71.858696E
		Bandagai	34.751702N 71.830745E
		Bagh dushkhail	34.760648N 71.846042E
		Malakand payeen	34.858436N 71.812113E
3.	Balambat	Odigram	34.882450N 71.475453E
		Muslim Abad	34.856907N 71.829949E
		Stanadaro	34.849457N 71.762737E
		Shalkandai Shahidan	34.879026N 71.709633E
4.	Munda	karramar	34.763963N 71.597843E
		Ghakhe kandaw	34.830426N 71.544958E
		Khazana	34.805503N 71.789848E
		Gumbir	34.918154N 71.644854E
5.	Samarbagh	Miskinay	34.916509N 71.647048E
		Darbar	34.921351N 71.576471E
		Kumbar	34.963591N 71.812025E
6.	Lalqila	Zaimdara	35.020579N 71.782278E
		Mirgam Payeen	35.019388N 71.802507E

3. Results

The data collection was conducted in two summer seasons of the year 2021 and 2022 District Dir Lower, KP. During the work, it was observed that almost 288 specimens out of which 183 were collected from six tehsils of the district (Adenzai, Timergara, Balambat, Munda, Samar Bagh, and Lal Qilla). Our specimens belong to six lizard families (Agamidae, Eublipharidae, Varanadae, Lacertidae, Scincidae, and Geckknidae). Of these collected specimens, 45 belonged to Agamidae, 17 belonged to Eublipharidae, 6 showed their relation to Varinadae, 24 belonged to Lacertidae, 9 were identified as the members of Scincidae and 82 specimens showed their relation with Geckonidae. In our work 11 genera and 14 species were identified, among the 183 specimens; 23 belonged to the genus *Laudakia* (11 specimens of *L. tuber-culata* 9 of *L. agrorensis*, and 3 of *L. pakistanica affunbergi*), 22 specimens of *Calotes versicolor farooqi* followed by 17 specimens of *Eublipharus macularius*. 51 specimens from the genus *Hemidactylus* (35 individuals of *Hemidactylus brookii* and 16 of *Hemidactylus flaviviradis*), 4 individuals of *Mediodactylus brachykolon*, 27 specimens of *Cyratodactylus (Cyratopodian* new spp). 6 specimens of *Varanus bengalensis* of the genus Varanus, 24 specimens of *Ophisops jerdoni* of the *Ophisop*s genus, 4 individuals of *Eurylapus tenoiolatus* of the *Eurylapus* genus and 5 *Ablipharus pannonicus*. Species identification was made by their diagnostic characteristics such as body length, scales count, keel morphology, finger number and relative size, body color, head shape, snout, nails, and lateral folds, with the help of keys provided by Khan (1999).

Table 2: List of Collection from Different Tehsil of District Dir Lower

S. No.	Name of specie	Observed Spp.	Collected Spp.	Adenzai	Timergara	Balambat	Munda	Samrbagh	Lal Qila
1	*H. brookii*	44	34	15	5	3	5	4	2
2	*H. flavivirids*	24	16	9	7	0	0	0	0
3	*Cyrtopodian*	39	27	2	20	0	5	0	0
4	*M. brachykolon*	7	4	2	0	0	2	0	0
5	*Ablepharus pannonicus*	10	5	0	2	2	0	1	0
6	*Eurylepis taeniolatus*	9	4	0	0	0	4	0	0
7	*Calotes versicolor Farooqi*	24	22	9	4	2	5	2	0
8	*Laudakia agrorensis*	17	9	6	2	1	0	0	0
9	*Laudakia tuberculata*	26	11	10	1	0	0	0	0
10	*L. pakistanica affenbergi*	7	3	2	0	0	1	0	0
11	*Varanus bengalensis*	14	6	4	1	1	0	0	0
12	*Eublepharis macularius*	22	17	0	3	7	2	2	3
13	*Ophisops jerdonii*	39	24	18	3	0	0	3	0
14	*Heremites septemtaeniats*	6	1	0	0	0	0	0	0

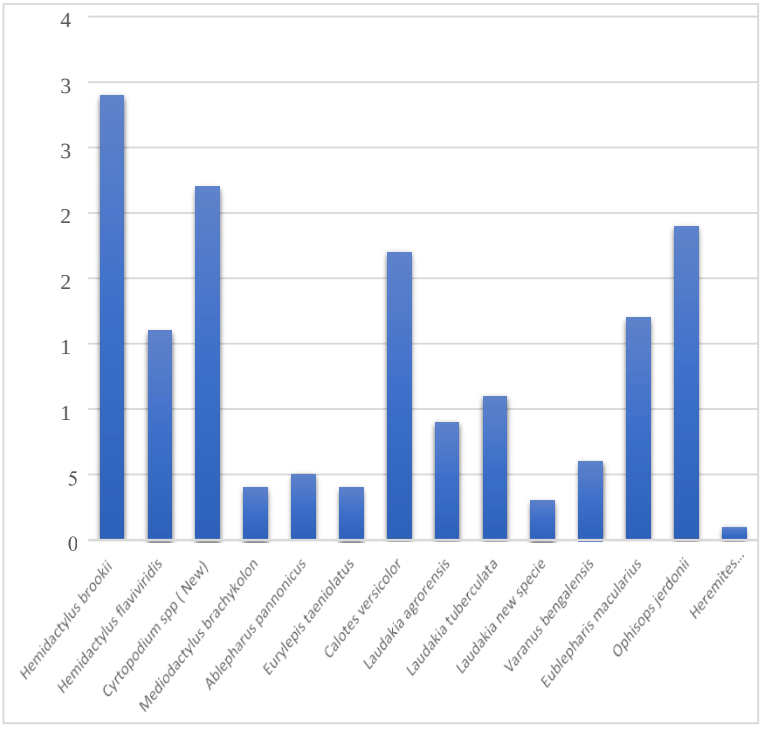

Fig. 2: Graphical Representation of Collected Species of Lizard's Fauna of District Dir Lower.

Table 3: Relative Percentage Abundance of Observed and Collected Families.

S. No.	Family	Observed specimen	Collected specimen	Percentage of observed spp	Percentage of collected spp
1	Gekkonidae	114	82	39.58%	51.57%
2	Scincidae	25	9	8.68%	5.66%
3	Agamidae	74	45	2.56%	28.30%
4	Varanidae	14	6	4.86%	3.77%
5	Eublepharidae	22	17	7.63%	10.69%
6	Lacertidae	39	24	13.54%	15.09%

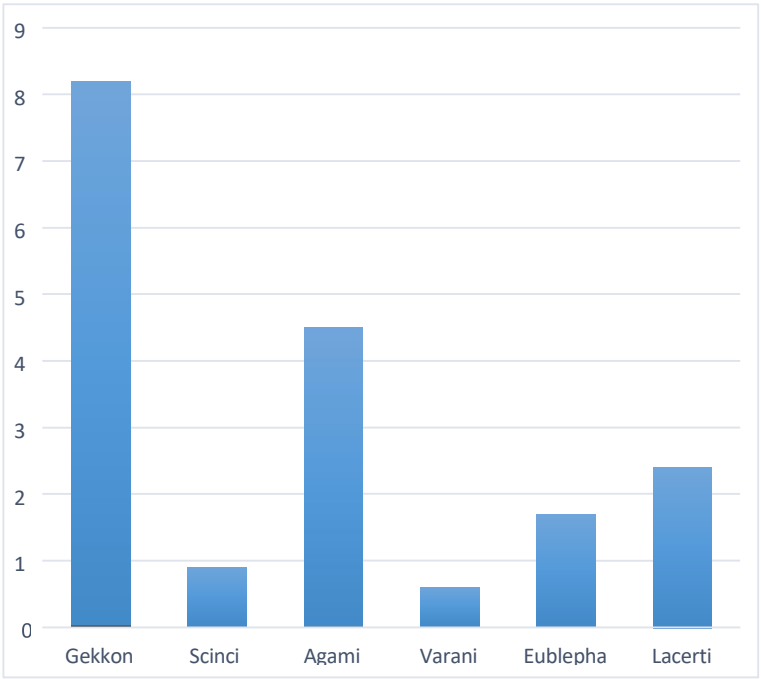

Fig. 3: Graphical Representation of Family's Distribution of Lizards in District Dir Lower.

3.1. Family Geckonidae Gray, 1825

This family was represented by 3 genera in our study work that are *Hemidactylus, Cyrtopodion, Mediodactylus.*

i.Hemidactylus brookii Gray, 1845 (Fig. 4)	
Order	Squamata Oppel, 1811
Family	Gekkonidae Gray, 1825
Genus	*Hemidactylus Gray, 1825*
Species	*H. brookii Gray, 1845*

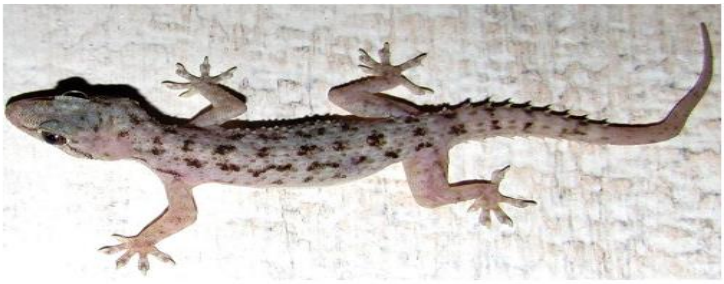

Fig. 4: *Hemidactylus Brookii* Collected from Tehsil Adenzai (Shah Alam Baba).

Remarks: In our research work, *Hemidactylus brookii* was recorded from District Dir Lower. A total of 34 specimens are collected from all the selected regions. However, this species is abundant in every part of the District Dir Lower because its habitat is human houses.

ii.*Hemidactylus flaviviridis Rüppell*, 1835 (Fig. 5)	
Order	Squamata Oppel, 1811
Family	Gekkonidae Gray, 1825
Genus	*Hemidactylus Gray, 1825*
Species	*H. flaviviridis*

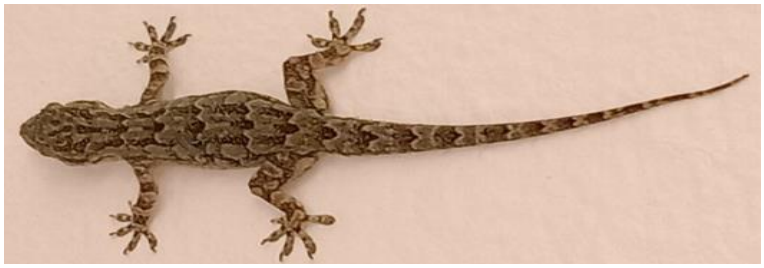

Fig. 5: *Hemidactylus Flaviviridis* Collected from Tehsil Adenzai (Khadagzai Kamala & Shah Alam Baba).

Remarks: In our research work, we collected a total of 16 specimens of this species from two localities. This species is most abundant in Tehsil Adenzai.

ii.Cyrtopodion Fitzinger, 1843 (Fig. 6)	
Order	Squamata Oppel, 1811
Family	Gekkonidae Gray, 1825
Genus	*Cyrtopodion Fitzinger, 1843*
Species	*Cyrtopodion sp.*

Fig. 6*:* *Cyrtopodion Sp.* Collected from Tehsil Timergara (Village Sado).

Remarks: The species of genus *cyrtopodion* were collected from crevices in-between rocks during the daytime. Some specimens were collected from high elevated areas and some collect from low elevated areas. A total of 27 specimens were collected from localities in Tehsil Timergara, Adenzai, Munda. These specimens are not identified till the species level. We apply some keys but could not confirm.

v.Mediodactylus brachykolon (Krysko, Rehman & Auffenberg, 2007) (Fig. 7)	
Order	Squamata Oppel, 1811
Family	Gekkonidae Gray, 1825
Genus	*Mediodactylus Szczerbak and Golubev, 1977*
Species	*M. brachykolon*

Fig. 7: *Mediodactylus Brachykolon* Collected from Tehsil Adenzai and Munda.

Remarks: This species is recorded for the first time from District Dir Lower. A total of four specimens were collected from the village Asbanar in the tehsil Adenzai and from Khanaza in Tehsil Munda. Collected from a deserted house wall during a clear sunny day. Observed nowhere other than of tehsil Adenzai and Munda.

3.2. Family scincidae gray, 1825

Scincidae is represented by two genres in our research work that are *Ablepharus, Eurylepis,* and *Hermites*.

3.2.1. *Ablepharus pannonicus* (fitzinger, 1824) (Fig. 8)

Order	Squamata Oppel, 1811
Family	Scincidae Gray, 1825
Genus	*Ablepharus Lichtenstein, 1823*
Species	*A. pannonicus*

Fig. 8: *Ablepharus Pannonicus* Collected from Tehsil Timergara (Ziarat Talash).

Remarks: This species is reported first time from the District Dir Lower. A total of 4 species were collected from three localities of District Dir Lower in the daytime and one specimen was collected at night time.

3.2.2. *Eurylepis taeniolatus* Blyth, 1854 (Fig. 9)

Order	Squamata Oppel, 1811
Family	Scincidae Gray, 1825
Genus	*Eurylepis Blyth, 1854*
Species	*E. taeniolatus*

Fig. 9: *Eurylepis Taeniolatus* Collected from Tehsil Balambat (Muslim Abad).

Remarks: Literature shows no prior records of E. taeniolatus from the Dir Lower. We collected a total of four specimens from two localities of Tehsil Munda. All the four specimens were captured during bright sunny days. The habitat showed sandy and rocky topography.

3.2.3. *Heremites septemtaeniatus* (Reuss, 1834)

Order	Squamata Oppel, 1811
Family	Scincidae Gray, 1825
Genus	*Heremites Gray, 1845*
Species	*H. septemtaeniatus*

Remarks: Six specimen were observed in the tehsil Adenzai during day time. Only specimen was collected from village Ouch because of their sudden escape.

3.3. Family agamidae gray, 1827

Agamidae is represented by two genera in our work genus Laudakia Gray, 1845 and Calotes.

3.3.1. *Calotes versicolor* (Daudin, 1802) (Fig. 10)

Order	Squamata Oppel, 1811
Family	Agamidae Gray, 1827
Genus	*Calotes Cuvier, 1817*
Species	*C. verscilor*

Fig. 10: *Calotes Versicolor Farooqi* Collected from Tehsil Adenzai (Shah Alam Baba, Ramora).

Remarks: Calotes vesicolor farooqi was for the first time reported by Jamal et al (2018) from the District Dir Lower. We collected a total of 22 specimens from different areas of the district (9 individuals from Adenzai, 4 from Timergara Tehsil La, 2 from Balambat, 5 from Munda, 2 from Samarbagh). Some of the specimens were found on high while the others were found at low elevations. *Calotes vesicolor farooqi* is widely distributed in the district but is abundant in Tehsil Adenzai and Munda.

3.3.2. *Laudakia agrorensis* (stoliczka, 1872) (fig. 11)

Order	Squamata Oppel, 1811
Family	Agamidae Gray, 1827
Genus	*Laudakia Gray, 1845*
Species	*L. agrorensis*

Fig. 11: *Laudakia Agrorensis* Collected from Tehsil Adenzai (Ramora).

Remarks: For the first time, Laudakia agrorensis from District Dir Lower was reported by Jamal et al 2018. We collected a total of 9 specimens were from Ramra, Dir Lower. The specimens were caught near water streams atop rocks and some alongside the road.

3.3.3. Laudakia tuberculata (Gray, 1827) (Fig. 12)

Order	Squamata Oppel, 1811
Family	Agamidae Gray, 1827
Genus	*Laudakia Gray, 1845*
Species	*L. tuberculata*

Fig. 12: *Laudakia Tuberculata* Collected from Tehsil Adenzai (Asbanar).

Remarks: For the first time, we were reporting *Laudakia tuberculata* from District Dir Lower. During our recent work, we have collected a total of 11 individuals at the altitudes of Asbanar Tehsil Adenzai District Dir Lower. The specimens were found atop rocks at relatively high elevations along the roadsides and high up in the mountain.

3.3.4. *Laudakia pakistanica auffenbergi* baig & böhme, 1996 (fig. 13)

Order	Squamata Oppel, 1811
Family	Agamidae Gray, 1827
Genus	*Laudakia Gray, 1845*
Species	*L. pakistanica (Baig, 1989)*
Subspecies	*L. pakistanica auffenbergi*

Fig. 13: Laudakia Pakistanica Affunbergi Collected from Tehsil Adenzai, Munda (Shalkandai Shahidan, Karramar).

Remarks: This species is new to Dir Lower, we collected a total of 2 specimens of the said species, from a village named Shalkandai Shahidan, Karramar located in Tehsil Munda District Dir Lower. The individuals were shot with bow-stone. The locality was populated with common vegetation such as scattered olive trees, spines, and rain-dependent farm fields.

3.4. Family varanidae merrem, 1820

A single species of genus *Varanu*s were recorded from District Dir Lower.

3.4.1. *Varanus bengalensis* (Daudin, 1802) (fig. 14)

Order	Squamata Oppel, 1811
Family	Varanidae Merrem, 1820
Genus	*Varanus Merrem, 1820*
Species	*V. bengalensis*

Fig. 14: Varanus Bengalensis Collected from Tesil Adenzai (Ouch Sharqi, Gharbi).

Remarks: This species is for the first time reported by (Jamal et al., 2018). We collect a total of Six specimens, three specimens were collected from shahidan banda and dehri while one specimen was collected from Adenzai Ouch Sharqi, Gharbi. This species is distributed in every corner of District Dir Lower, (Tehsil samarbagh, Tehsil munda, Tehsil timergara, Tehsil balambat, Tehsil lalaqilla, Tehsil Adenzai) but abundant in Tehsil Adenzai.

3.5. Family eublipharidae boulenger, 1883

This family is represented by a single species of genus *Eublepharis* in District Dir Lower.

Eublepharis macularius (Blyth, 1854) (Fig. 15)	
Order	Squamata Oppel, 1811
Family	Eublipharidae Boulenger, 1883
Genus	*Eublepharis Gray, 1842*
Species	*E. macularius*

Fig. 15: *Eublepharis Macularius* Collected from Tehsil Balambat (Odigram, Malakand Paeen) and Tehsil Munda (Ghakhe Kandaw, Khazana).

Remarks: This species was reported for the first time by (Jamal et al., 2018) from Dir Lower. During our recent work a total of 12 specimens were collected from five localities; Takoro, Dehri, Zaimdara, Ghlo tangay, Andheri, and Saddo, of the district Dir Lower. *Eublepharis macularius* are found in every locality of District Dir Lower. But in Tehsil Timergara it is found abundantly.

3.6. Family lacertidae

This family is represented by single genus ophisops in District Dir Lower.

3.6.1. *Ophisops jerdonii* (blyth, 1853) (fig. 16)

Order	Squamata Oppel, 1811
Superfamily	Lacertoidea Oppel, 1811
Family	Lacertidae Oppel, 1811
Subfamily	Lacertinae Oppel, 1811
Genus	*Ophisops Ménétries, 1832*
Species	*O. jerdonii*

Fig. 16: *Ophisops Jerdonii* Collected from Tehsil Adenzai (Shah Alam Baba), and Tehsil Samarbagh (Gamber, Miskinay, and Darbar).

Remarks: This species is already described from District Dir Lower. We collected a total of 24 specimens from Tehsil Adenzai (village Shah Alam Baba), Tehsil Samarbagh (village Gamber, Miskinay and sadbar). This specie is almost found in most locality but is abundantly found in Tehsil Adenzai and Samarbagh.

Table 4: Collected Species, Families and Their Feeding Habits with IUCN Status

S. No.	Family	Common name	Scientific name	IUCN status
1	Gekkonidae	Spotted house gecko	*Hemidactylus Brookii*	Stable
		Yellow-belly gecko	*Hemidactylus flaviviridis*	Stable
			Cyrtopodion new specie	N E
		Short-limbed bend-toed gecko	*Mediodactylus brachykolon*	Rare
2	Scincidae	Asian snake-eyed skink	*Ablepharus pannonicus*	N E
		Ribbon sideded skink	*Eurylepis taeniolatus*	Rare
		Golden Grass Mabuya	*Heremites septemtaeniatus*	Rare
3	Agamidae	Common garden lizard	*Calotes versicolor farooqi*	Stable
		Agrora agama	*Laudakia agrorensis*	Rare
		Kashmir rock agama	*Laudakia tuberculata*	Stable
			Laudakia new specie	N E
4	Varanidae	Bengal minitor lizard	*Varanus bengalensis*	Stable
5	Eublepharidae	Leopard gecko	*Eublepharis macularius*	Rare
6	Lacertidae	Punjab snake eyed lizard	*Ophisops jerdonii*	Stable

4. Discussion

This project aims to investigate the diversity of lizard fauna in the Dir Lower district of KPK, Pakistan. Samples were observed and recorded from April 2021 to September 2022. During our study, 6 families of Gekkoidae were identified in the study area; This study area includes 6 tehsils (towns); Tehsil Adenzai, Balambat, Timergara, Samarbagh, Munda, and Lalqilla. We compare our results with previous studies.

Masroor (2011) conducted an extensive study in Margalla Hills National Park in Islamabad. In his research, he recorded members of six to eight families in the Margalla Hills National Park, namely the family Eublepharidae with one species *Eublepharis maulousius* and the family Gekkonidae with three species (*Crytopdion scabrum*.). Brooke's hemitodon. *Hemidactylus flaviviridis*), a family containing three species (*Calotes versicolor farooqi, Laudakia agrorensis, and Saara Hardwickii*), a family containing two recorded species (*Acanthodactylus cantoris* and *Ophisops jerdoni*), a family containing one species (*Acanthodactylus cantoris* and *Ophisopsopsopsophons). jerdoni),* Lizardidae is represented by one species (*Varanus bengalensis*) and Lizardidae is represented by three species (*Eutropis dissimilis, Eurylepis taeniolatus* and *Asymblepharus Himalayanus).*

Khan et al (2004) study the status of the lizard population in Karachi. Three lizard species, one of which is similar to our research project. Manzoor et al (2019) studied the distribution, status and conservation of reptiles, especially turtles, in the coastal area of Karachi. They reported about eight species of lizards including *Calotes versicolor, Hemidactylus brookii, Hemidactylus flaviviridis, Hemidactylus persicus, Hemidactylus tryrus, Hemidactylus turcicus, Ablepharus cantoris, Mediodactylusson, Hemidactylus turcicus, Ablepharusson cantoris, Ablepharusson cantoris and hemidactylus turcicus. can toris, Mediodactylusson and Varanus turcicus, Ablepharus cantoris, Mediodactylusson, Varanus turcicus, Ablepharus cantoris, Mediodactylusson* and *Varanus benasona*. In our study, we found 4 species similar to these. The similarity may be due to similar habitats and climates.

Hashmi et al (2013) studied the status, distribution, and threats of monitor lizard species (*Varanus bengalensis* and *V. griseus*) in Karachi and Thatta, Sindh. They reported three lizard species from the family Saurididae: *Varanus bengalensis, V. griseus, and V. flaviscens*. Lizard is the same as our research project.

Hassan et al. (2018) studied the distribution of reptiles in Tolipir National Park, Pakistan. They reported *Eurylepis taeniolatus, Hemidactylus brookii, Eublepharis maulousius, Laudakia agrorensis, and Laudakia tuberculata* (Hassan et al., 2018). All of the genres they publish are similar to our work. The similarity may be due to the same location and climate.

Adil et al (2020) studied the amphibian and reptile diversity in Daphar Forest Reserve in Mandi Bahadin District, Pakistan. In their research work, they reported *Hemidactylus flaviviridis, Agama agama, Trapelus agilis pakistanensis, Saara Hardwickii, Laudakia agrorensis, and Acanthodacytylus cantoris* (Adil et al., 2020). In our current study, two species appeared to be similar to reported lizard species.

Hamid et al (2021) Study on amphibians and reptiles in Sheikh Badin National Park, KP: diversity, threats and conservation prospects. They collected data from the national park's primary habitat from July 2017 to August 2018, using visual encounter methods assisted by trapping and hopper trapping. Clouded Lizard, *Laudakia agrorensis, Laudakia nupta, Trapelus spp., Eubblepharis macularius, Cyrtodactylus battalensis, Hemidactylus flaviviridis, Hemidactylus persicus, Acanthodactylus cantoris, Eury flaviviridis, Hemidactylus pers in 2021*. The five lizard species included in this study are similar to our current research.

Khalid et al (2019) studied the diversity and distribution of lizard fauna in Tehsil Samar Bagh in KP Dir Lower district of Pakistan. They reported six species among five species. *Laudakia agrorensis, Calotes Versicolor, Eubblepharis maulousius, Hemidactylus frenatus, Hemidactylus flaviviridis and Varanus bengalensi*). In our recent research work, we reported 14 lizard species belonging to 11 genera and 6 families. The species we reported include *Hemidactylus brookii, Hemidactylus flaviviridis, Cyrtopoazole spp, Mediodactylus brachykolon, Ablepharus pannonicus, Eurylepis taeniolatus, Calotes Versicolor farooqi, Laudakia agrorensis, Laudakia tubercula new, Laudakia tuberculata, Laudakia tuberculata, Laudakia tuberculata. hisops jerdon ii and Heremites septemtaeniatus.* Five types were similar between the two studies. This may be due to the same location and climate in Dir Lower district of Samar Bagh as it is close to some of the areas selected in our research project. Cemal et al. (2018) studied the diversity and distribution of two squamate species in the unique ecoregion of Dir, a sub region of the Himalayas in northern Pakistan. They conducted regular surveys (from March to September each year) for three consecutive years (i.e., from 2013 to 2016) at various selected locations in Dir Lower and Dir Upper districts. The areas selected for the survey work are Badwan, Shah Alam Baba, Asbanr, Laram Ghar, Timergara and Qambo in Dir Lower district while Qarodara, Wari, Dir and Dog Dara in Dir Upper district. They reported 11 species in 10 genera and 6 families. Reported species *Calotes versicolor farooqi, Laudakia agrorensis, Cyrtopodion scabrum, Hemidactylus flaviviridis, H. brookii, Eurylepis taeniolatus, Eutropis dissimilus, Asymblepharus Himalayanus, Eubble, imal, lahiiian ajiz, Oujahi sionalsileialhphotoa and lehealsheangle sov.* The species we reported *are Hemidactylus brookii, Hemidactylus flaviviridis, Cyrtopoazole spp, Mediodactylus brachykolon, Ablepharus pannonicus, Eurylepis taeniolaversad, dakia. ius, Ophisop s jerdonii and Heremites septemtaeniatus.* Eight species were similar between the two studies. This similarity may be due to similar habitat and climate. However, since both studies were conducted in the same Lower Dir region, they also conducted research in Upper Dir and reported some species there.

Ali et al (2018) studied the fauna and diversity of reptiles in Kalabagh Game Reserve in Mianwali District, Punjab Province, Pakistan. A 9-month study was conducted from July 2015 to March 2016 in the Kalabagh Game Reserve, located 25 km south of the city of Kalabagh in the Mianwali District of Punjab Province, Pakistan. They reported 13 species of lizards in their research study. These are *Calotes versicolor, Laudakia Nadakia Nadakia, Trapelaus Braviviridis, EutropSaib, Eutrophadion Floodiviridis, Hemidactylion Flaviviridis, Hemidact Gryanr, Marphaarus Gryanr, Eutropis mair* (Ali), etc., 2018. Five species were similar in both studies. This may be because the two study areas have similar habitats.

Ali et al. (2018) studied amphibians and reptiles collected from different habitats in Kasur district of Punjab province of Pakistan. A one-year study was conducted in four Tehsils (Pattoki, Chunian, Kot Radha Kishan and Kasur) of Kasur district from January to December 2014 (Ali et al., 2018). They show five species of lizards. These are the tawny lizard, Bengal spotted lizard, yellow spotted lizard, gray lizard and yellow spotted lizard. According to our current research work, only the two species are similar.

5. Conclusion

Our current study focused on surveys to determine the richness of lizard fauna in six Tehsils (Adenzai, Timergara, Balambat, Munda, Samarbagh and Lalqilla) of Dir Lower district. Our observation period extends from April 2021 to September 2022 in dispersed and remote areas, and we reported 14 lizard species belonging to 6 families. The Gecko family still dominates. Three genera of the families *Mediodactylus, Hemidactylus and Cyrotopodian* were identified. A total of 4 species belonging to 3 genera were collected and identified from Family Geckonidae, including *Hemidactylus brookii and Hemidactylus flaviviradus* belonging to the *Hemidactylus genus and Mediodactylus brachycolon belonging* to the *Mediodactylus* genus. Two genera, *Calotes* and *Laudakia*, represent the family Lizardidae. *Calotes versicolor farooq*i from the genus *Calote*s and three species; *Laudakia agrorensis, Laudakia tuberculata and Laudakia pakistanica affenbergi* from the genus *Laudakia*. The family Scincidae is represented by three genera; *Ablepharus, Eurylapis* and the *Heremites*; and three types; *Ablepharus pinnanicus* belongs to the genus *Ablipharus, Eurylepis taenulatus* belongs to the genus Eurylepis, and *Heremites* belongs to the genus *septemtaeniatus.* Among the specimens in our collection, *Eublipharidae* is represented by a single species. Similarly, *Eublepharus macularis* from the Lecirtidae family is represented by a species called *Ophisopis jerdonii*. The family Varinadae is represented by *Varanus bengalensis,* a species from the genus *Varanus.*

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Conflict of interest

The authors declare that they have no conflict of interest.

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