Pakistan J. Zool., pp 1-7, 2023. **DOI**: https://dx.doi.org/10.17582/journal.pjz/20230330190305

Squamate Fauna of Southern Khyber Pakhtunkhwa (Tank and Lakki Marwat Districts), Pakistan

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Article Information
Received 30 March 2023
Revised 20 April 2023
Accepted 04 May 2023
Available online 27 July 2023
(early access)

Authors' Contribution
MS and FU conducted the field survey, gathered data, identification, and data analysis. MS also prepared the research article. AM supervised the research work and provided all the facilitations. MR drafted and finalized the manuscript. SNK, MAK, TA and SK provided assistance in field visits and study design.

Key words
Lizards, Snakes, Diversity, Species list, Venomous

ABSTRACT

Reptiles constitute a significant percentage of vertebrate biomass and occupy an important position in the ecosystem. They are considered important indicators of ecosystem health. Populations of many reptiles are declining globally due to numerous threats. Lack of information about the geographical distributions of species hinders research and management agendas. Species checklist and herpetofauna inventories of various areas of Pakistan are available, but many geographical areas of the country have still not been explored. We, therefore, conducted the present study to fill this gap. We carried out this study in 21 randomly selected sites featuring mountain regions, tropical dry deciduous forests, sandy patches, sand dunes, hard clay cliffs, hard soil, and small rivers in southern Khyber Pakhtunkhwa from April 2021 to October 2022. We collected a total of 28-eight squamate species distributed over 13 families. We documented 13 lizards (eight families) and 15 snakes (five families) species from the study area. Our findings will enhance existing knowledge of the herpetofauna of the country and could be used to prepare species atlas of the country in the future.

INTRODUCTION

Like other components of biodiversity, species of snakes and lizards hold an important position in the ecosystem. They are found in a wide range of habitats including deserts featuring extreme environmental conditions (Ghadage, 2012; Gibbons *et al*., 2000). They constitute a significant percentage of the vertebrate biomass (Burkett-Cadena *et al*., 2008). They are important indicators of ecosystem health (Hanlin *et al*., 2000). Reptiles are threatened with extinction globally due to a multitude of threats (Cox *et al*., 2022).

The information about geographical distributions of species at local as well as global scale is poor- the Wallacean shortfall (Whittaker *et al*., 2005). The reptilian fauna of Pakistan is diverse. Reptiles are represented by testudines, lizards, snakes, and crocodile species in Pakistan (Khan, 2006). Species checklist and herpetofauna inventories of various areas of Pakistan are available (Hamid *et al*., 2021; Ali *et al*., 2016, 2021; Bibi *et al*., 2013, 2020; Adil *et al*., 2020b; Khalid *et al*., 2019; Jamal *et al*., 2018; Balouch *et al*., 2016; Rais *et al*., 1997, 2011, 2015, 2021; Masroor, 2011; Baig *et al*., 2006, 2008), but many geographical areas of the country have still not been explored. We, therefore, conducted the present study to fill this gap and report the squamate fauna (snakes and lizards) of Southern Khyber Pakhtunkhwa (Tank and Lakki Marwat Districts) for the first time. Our findings will enhance existing knowledge

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0030-9923/2023/0001-0001 $ 9.00/0

of the herpetofauna of the country and could be used to prepare species atlas of the country in the future.

MATERIALS AND METHODS

The study was conducted in southern Khyber Pakhtunkhwa: Tank (32.2752 N, 70.3837 E) and Lakki Marwat (32.6080 N, 70.9114 E) Districts, Pakistan, from April 2021 to October 2022. We randomly selected 21 sites for data collection (Fig. 1) representing seven habitats: mountain regions, tropical dry deciduous forests, sandy patches, sand dunes, hard clay cliffs, deserted hard soil, and small rivers (Fig. 2).

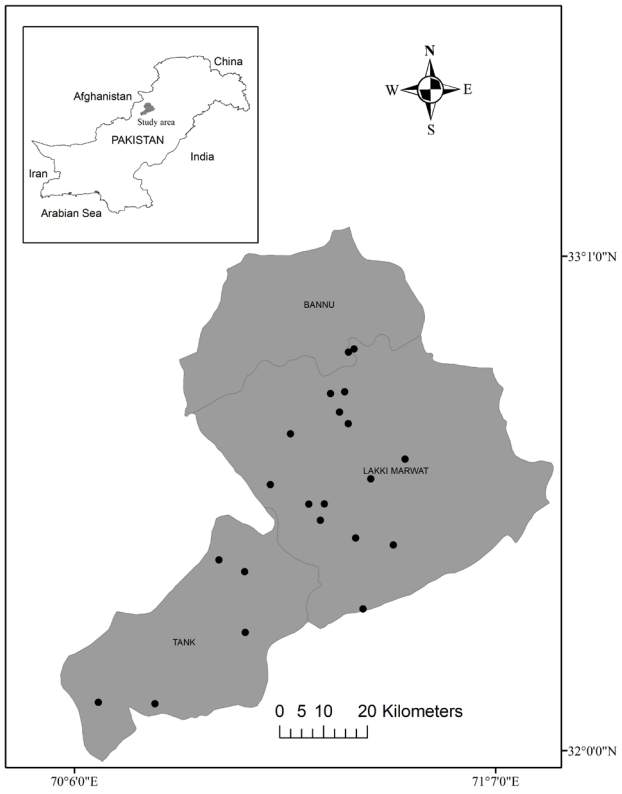

Fig. 1. Map showing sampling sites randomly selected in the areas of Southern Khyber Pakhtunkhwa in the districts of Tank and Lakki Marwat.

Tank Districts has a lowland area with some hills located in the southern parts. It has a total area of 1, 679 km^2. It is bounded by Lakki Marwat District in the northeast, Dera Ismail Khan in the east and southeast, and South Waziristan in the southwest, west, and northwest. The Lakki Marwat District also features a lowland area and some parts of mountains. The southern boundary of the Lakki Marwat is covered by a range of low hills ranging from Dara Tang Pass to Sheikh Badin (Dara Pezu). The total area of Lakki Marwat is 3,164 km² (Ullah *et al*., 2014). The climate of both districts is arid to semi-arid. Annual rainfall ranges between 250-300 mm. High temperatures are recorded in June and July (35-45 °C). The coldest months of the year are December, January, and February (5-8 °C) (Marwat *et al*., 2012). The main crops of both districts are Wheat, Gram, Maize, Sugar Cane, vegetables, Fruits, Dates, Melon, and Watermelon (Saeed and Khan, 2014).

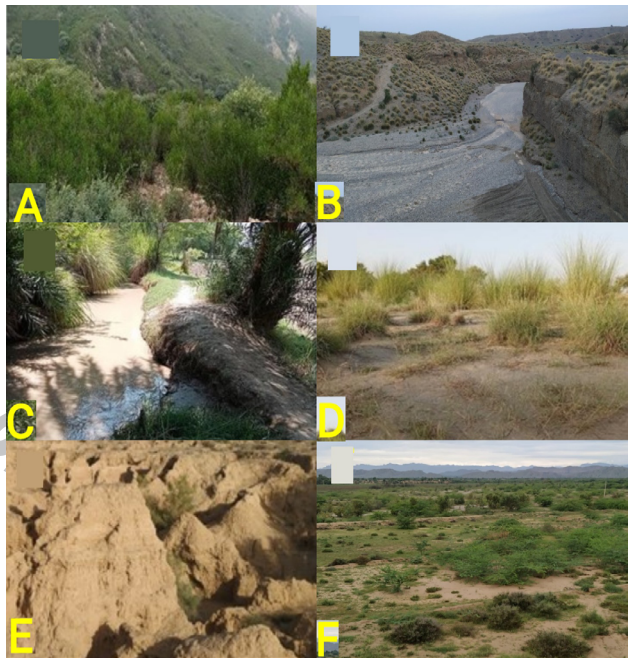

Fig. 2. Major habitats of the study area, Mountainous areas (A-B), Small Wetlands (C), Sandy Dunes (D), Hard Clay Cliffs (E), and Tropical dry deciduous forests (F).

We carried out a total of 13 field surveys from April 2021 to October 2022. We followed the active searching method. We observed and collected specimens using a snake stick, and noose traps. We handled the specimen using gloves. We recorded the geographical coordination of the collection sites using GPS (MAPS. ME- Offline maps, travel guides and navigation). The specimens were collected and euthanized using ethanol. We then fixed and preserved the specimens in a 10% formalin solution (Ziegler, 2007). The specimens were identified using keys given by Khan (2006).

RESULTS

The studied southern Khyber Pakhtunkhwa districts showed heterogeneous squamate assemblage. We collected a total of 28-eight squamate species distributed over 13

families. We documented 13 lizards (eight families) and 15 snakes (five families) species from the study area (Table I).

Table I. Species of snakes and lizards recorded from southern Khyber Pakhtunkhwa (Tank and Lakki Marwat, Districts), Pakistan.

Scientific name (Common name)	Museum Tag#
Family Agamidae	
1. *Laudakia nupta* (Large-scaled rock agama, Fig. 3A)	PMNH5018, KUST 7, KUST 12
2. *Trapelus rubrigularis* (Red-throat agama, Fig. 3D)	PMNH5021
Family Eublepharidae	
3. *Eublepharis macularius* (Common leopard gecko, Fig. 3B)	PMNH5015, PMNH5016, KUST 20
Family Gekkonidae	
4. *Cyrtopodion* sp. (Rough tailed gecko)	PMNH5017, PMNH5023
5. *Hemidactylus persicus* (Persian leaf-toad gecko, Fig. 4C)	PMNH5022
6. *Hemidactylus brookii* (Spotted house gecko)	
7. *Hemidactylus flaviviridis* (Common house gecko, Fig. 3F)	
Family Lacertidae	
8. *Acanthodactylus cantoris* (Blue-tailed sand lizard, Fig. 3E)	PMNH5019, PMNH5020, KUST 1
Family Scincidae	
9. *Eutropis dissimilis* (Striped grass skink, Fig. 4D)	
10. *Ablepharus pannonicus* (Asian snake-eyed skink)	
Family Uromastycidae	
11. *Saara hardwickii* (Indian spiny-tailed lizard, Fig. 3C)	PMNH5013, PMNH5014, KUST 13, KUST 14
Family Varanidae	
12. *Varanus bengalensis* (Indian monitor lizard, Fig. 4A)	KUST 4, KUST 10
13. *Varanus grieus* (Grey monitor, Fig. 4B)	
Family Typhlopidae	
14. *Indotyphlops* sp. (Slender worm snake)	PMNH5011
Family Boidae	
15. *Eryx conicus* (Smooth scale sand boa, Fig. 5F)	
16. *Eryx johnii* (Smooth-scaled sand boa, Fig. 5E)	PMNH5007
Family Colubridae	
17. *Platyceps ventromaculatus* (Glossy-bellied racer snake)	PMNH5008, KUST 8,9,11,13,15,19
18. *Boiga trigonata* (Common cat snake)	PMNH5009, KUST 4,3
19. *Spalerosophis diadema* (Royal snake, Fig. 5A, C)	PMNH5010, PMNH5012
20. *Spalerosophis arenarius* (Red-spotted royal snake, Fig. 5B)	
21. *Amphiesma stolatum* (Buff striped keelback)	KUST 10
22. *Ptyas mucosus mucosus* (Common rat snake, Fig. 6C)	
23. *Lycodon aulicus* (Indian wolf snake)	
24. *Psammophis schokari* (Schokari sand racer)	
Family Elapidae	
25. *Naja naja* (Black cobra, Fig. 6A)	KUST 2, KUST 12
26. *Naja oxiana* (Central Asian cobra, Fig. 6D)	
27. *Bungarus caeruleus* (Common krait, Fig. 6E)	
Family Viperidae	
28. *Echis carinatus* (Saw scaled viper, Fig. 6B)	

IDs with KUST stored at KUST Systematic Lab and with PMNH stored at Pakistan Museum of Natural History.

Fig. 3. Lizards recorded from the study area *Laudakia nupta* (A), *Eublepharis macularius* (A-B), *Saara hardwickii* (C), *Trapelus rubrigularis* (D), *Acanthodactylus cantorus* (E), *Hemidactylus* sp. (F).

Fig. 4. Lizards recorded from the study area *Varanus bengalensis* (A), *Varanus griseus* (B), *Hemidactylus persicus* (C), *Eutropis dissimilis* (D).

DISCUSSION

The information about geographical distributions of the species at local as well as global scales is poor- the Wallacean shortfall (Whittaker *et al*., 2005). Although there is a dearth of literature on the species inventory of various parts of Khyber Pakhtunkhwa (Hamid *et al*., 2021; Bibi *et al*., 2020; Khalid *et al*., 2019; Jamal *et al*., 2018), there are still many geographical areas of the province which have not been studied. We report the squamate fauna of Tank and Lakki Marwat Districts for the first time.

Fig. 5. Snakes recorded from the study area *Spalerosophis diadema* (A and C), *Spalerosophis atriceps* (B) *Lycodon aulicus* (C), *Boiga trigonata* (D), *Eryx johnii* (E), *Eryx conicus* (F).

Fig. 6. Snakes recorded from the study area *Naja naja* (A), *Echis carinatus* (B), *Ptyas mucosa* (C), *Naja oxiana* (D), *Bungarus caeruleus* (E).

Laudakia nupta was collected and observed from hard clay cliffs and rocky hills from different sites in district Tank. It is high in number in the study area. In Pakistan, it is documented from Balochistan, southwestern Sindh, the Waziristan mountains in Khyber Pakhtunkhwa, and the Kalabagh area in northwestern Punjab, along with the western bank of the Indus (Khan, 2003). Khan (1980) reports that it is sometimes found on hard clay cliffs instead of rocks and very common in towns on walls and graves built of earth, but equally common on rocky hills far from dwelling places (Smith, 1935) only on rocks jutting from a salt pan (Hellmich, 1959).

Trapelus rubrigularis was collected from gravel plains in Tank District. It is endemic to Pakistan and has been reported from Waziristan, Baluchistan, and some parts of Sindh (Khan, 2006). *Eubeipharis macularius* was collected from rocky terrain hills, mudflats with sparse vegetation and bushes, and clayey land during the night in different sites of the two districts. In Pakistan, this species was reported from AJ & K, northern Punjab, Baluchistan, and lower Sindh (Khan, 2006). This lizard species is caught in the wild and is traded illegally. From the genus *Hemidactylus,* three species were documented in this study: *Hemidactylus persicus, Hemidactylus brookii,* and *Hemidactylus flaviviridis. H. persicus* was encountered from barren rocky terrain hills. This species is found in Baluchistan, southern parts of Khyber Pakhtunkhwa, and westernmost parts of Sindh in Pakistan (Muhammad and Khan, 2004). *H. brookii* is regarded as a species complex (Kathriner *et al*., 2014; Lajmi *et al*., 2016) and commonly inhabits the bark of trees, logs, leaf litter, piles of dead branches, and other rubbish. The common Indus Valley house gecko *H. flaviviridis* is the most familiar house gecko throughout the subcontinent (Muhammad and Khan, 2004) and commensal with human habitations.

A. cantoris was collected along the sandy patches of the Gomal Zam River and their branches, the species is reported from similar habitats found in other parts of Pakistan (Khan, 2006). *Eutropis dissimilis* was observed from croplands mostly during the daytime. It inhabits moist open grass fields and extends into tilled land. Rais *et al*. (2015) and Baig *et al*. (2008) reported the species from Chakwal and the Cholistan Desert. *Saara hardwickii* was collected from barren open hard soil areas with sparse vegetation from throughout Tank District. This species is trapped and killed in large numbers by local black people either for eating or extracting oil purposes. In Punjab, it has been recorded throughout Bahawalnagar, Dera Ghazi Khan, and Mianwali Districts and Cholistan Desert Ali *et al*. (2017). It is also distributed in the Indus Valley and extends into Las Bela southern Baluchistan and Margala Hill National Park (Khan, 2004, 2006; Masroor, 2011; Adil *et al*., 2020a; Balouch *et al*., 2016). Among the Genus *Varanus* two species were documented: *V. bengalensis* and *V. griseus.* The former was collected in areas with soft and clay soils, rocky hills, and near the villages in the two studied districts. In Pakistan, it is documented throughout the plains of Punjab and Sindh, sub-Himalayan tracts, and Waziristan (Khan, 2003). *V. griseus* was collected from near Gambila Bridge, tehsil Naurang district Lakki Marwat.

Rough-scaled sand boa was collected from croplands and from villages. Hameed *et al*. (2021) reported it from Sheikh Baddin National Park, Khyber Pakhtunkhwa. Colubrids are advanced snakes and occur nearly worldwide, although marginally in Australia. The family constitutes almost two-thirds of the living snakes (Webb *et al*., 1978). We found the majority of the recorded snake species from this family. Four species of venomous were collected from the study area: *Bungarus caeruleus*, *Naja naja, Naja oxiana,* and *E. carinatus*. These snake species are reported in Pakistan from a variety of habitats (Khan, 2006).

ACKNOWLEDGEMENT

We owe a deep sense of gratitude to Rescue 1122, Khyber Pakhtunkhwa (KPK), Kohat University of Sciences and Technology (KUST) and PMAS Arid Agriculture University Rawalpindi for providing assistance, equipment and supplies. We thank Shahzeb Sherani, Taimur Khan, Nabeel ur Rehman and Mussadiq Zaman for their help during this work.

Funding

The study received no external funding.

IRB approval

The study was approved by the Department Graduate Committee, KUST, Kohat, KPK.

Statement of conflict of interest

The authors have declared no conflict of interest.

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