

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

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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.

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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 facilities. 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

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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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).

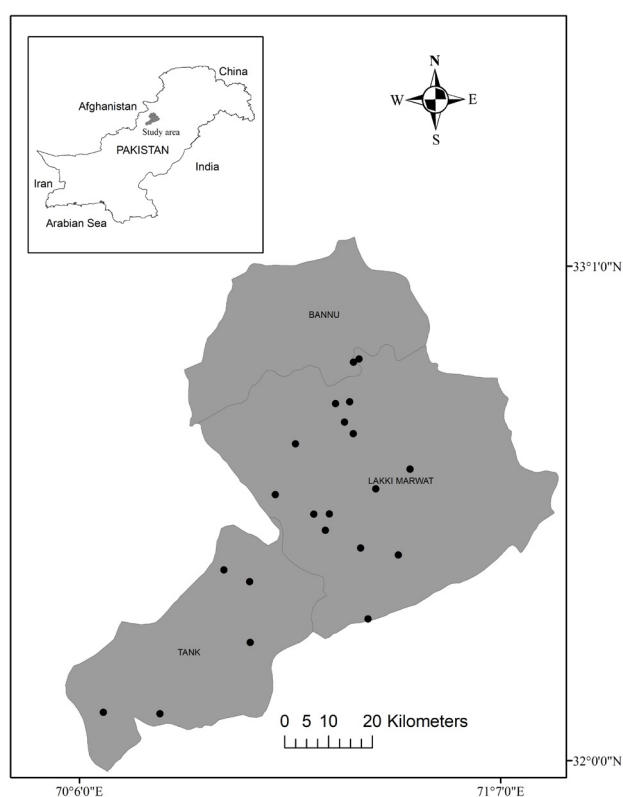


Fig. 1. Map showing sampling sites randomly selected in the areas of Southern Khyber Pakhtunkhwa in the districts of Tank and Lakki Marwat.

Tank Districts has a lowland area with some hills located in the southern parts. It has a total area of 1,679 km². 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).

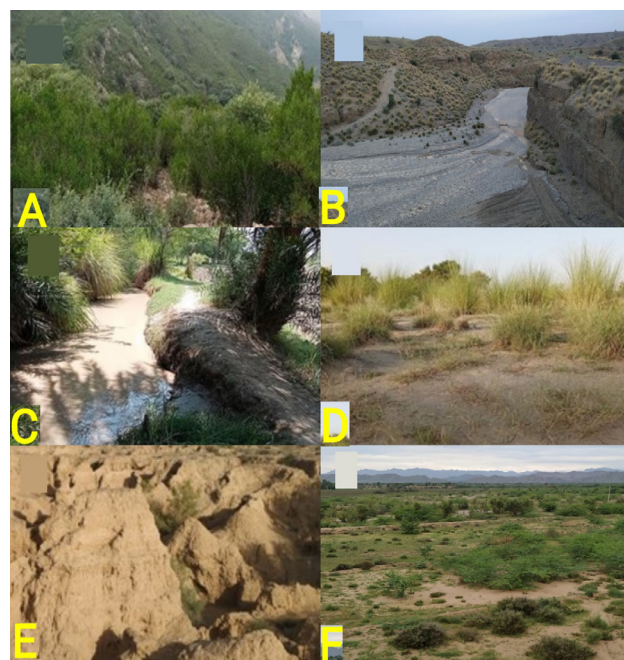


Fig. 2. Major habitats of the study area, Mountainous areas (A-B), Small Wetlands (C), Sandy Dunes (D), Hard Clay Cliffs (E), and Tropical dry deciduous forests (F).

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

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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.

REFERENCES

- Adil, S., Ijaz, S., Aslam, H., Kanwal, R. and Afsheen, S., 2020a. Diversity of amphibians and reptiles in Daphar Forest Sanctuary, district Mandi Bahaudin. *Pak. J. Wildl. Ecol.*, **4**: 15-26.
- Adil, S., Shermeen, I., Hira, A., Rimsha, K. and Sehrish, A., 2020b. Diversity of amphibians and reptiles in Daphar Forest Sanctuary, district Mandi Bahaudin. *Pak. J. Wildl. Ecol.*, **4**: 15-26.
- Ali, W., Arshad, J., Ali, H., Syed, M.B. and Saddam, H., 2021. Preliminary assessment of the diversity and

- habitat preferences of herpetofauna in Cholistan Desert, Pakistan. *Russ. J. Herpetol.*, **28**: 375-379. <https://doi.org/10.30906/1026-2296-2021-28-6-375-379>
- Ali, W., Arshad, J., Syed, M.H., Hamda, A. and Ghazala, J., 2016. The amphibians and reptiles collected from different habitat types in district Kasur, Punjab, Pakistan. *Pakistan J. Zool.*, **48**: 1201-1204.
- Ali, W., Arshad, J., Waseem, A.K., Ali, H., Rizwan, A., Mubeen, A. and Sajid, A.Q., 2017. Diversity and habitat preferences of herpetofauna at Kalabagh game reserve, District Mianwali, Punjab, Pakistan. *Russ. J. Herpetol.*, **24**: 267-274. <https://doi.org/10.30906/1026-2296-2019-24-4-267-274>
- Baig, K.J., Mohammad, R.A. and Naeem, A., 2006. Ecological studies and zoogeographic affinities of the amphibians and reptiles found in Chagai desert, Balochistan, Pakistan. *Pakistan J. Zool.*, **38**(2): 145.
- Baig, K.J., Rafaqat, M. and Arshad, M., 2008. Biodiversity and ecology of the herpetofauna of Cholistan Desert, Pakistan. *Russ. J. Herpetol.*, **15**: 193-205.
- Balouch, S., Rais, M., Hussain, I. and Akram, A., 2016. Squamate diversity in different croplands of district Chakwal, Punjab, Pakistan. *J. King Saud Univ. Sci.*, **28**: 255-260. <https://doi.org/10.1016/j.jksus.2016.01.003>
- Bibi, F., Ali, Z., Qaisrani, S.N., Shelly, S.Y. and Andleeb, S., 2013. Biodiversity and its use at taunsa barrage wildlife sanctuary, Pakistan. *J. Anim. Pl. Sci.*, **23**: 174-181.
- Bibi, S., Khan, M.F. and Rehman, A., 2020. *An annotated checklist of herpeto fauna of District Haripur, KPK, Pakistan*. <https://doi.org/10.22541/au.158896261.10893691>
- Burkett-Cadena, N.D., Sean, P.G., Hassan, K.H., Craig, G., Micky, D.E., Charles, R.K. and Thomas, R.U., 2008. Blood feeding patterns of potential arbovirus vectors of the genus *Culex* targeting ectothermic hosts. *Am. J. Trop. Med. Hyg.*, **79**: 809. <https://doi.org/10.4269/ajtmh.2008.79.809>
- Cox, N., Bruce, E.Y., Philip, B., Miguel, F., Julie, M., Giovanni, R., Monika, B., Thomas, M.B., Hedges, B. and Craig, H-T., 2022. A global reptile assessment highlights shared conservation needs of tetrapods. *Nature*, **605**: 285-290. <https://doi.org/10.1038/s41586-022-04664-7>
- Ghadage, M.K., 2012. *Ecological studies of reptiles from Khed tahasil of Pune district (Maharashtra), India*.
- Gibbons, J.W., David, E.S., Travis, J.R., Kurt, A.B., Tracey, D., Tuberville, B.S.M., Judith, L.G., Tony, M., Yale, L. and Sean, P., 2000. The global decline of reptiles, Déjà Vu Amphibians: Reptile species are declining on a global scale. Six significant threats to reptile populations are habitat loss and degradation, introduced invasive species, environmental pollution, disease, unsustainable use, and global climate change. *BioScience*, **50**: 653-666. [https://doi.org/10.1641/0006-3568\(2000\)050\[0653:TGD ORD\]2.0.CO;2](https://doi.org/10.1641/0006-3568(2000)050[0653:TGD ORD]2.0.CO;2)
- Hamid, H.N., Rais, M., Arif, M. and Noor, R., 2021. Amphibians and reptiles of Sheikh Baddin National Park, Khyber Pakhtunkhwa: Diversity, Threats and Conservation Prospects. *Pakistan J. Zool.*, **53**: 785. <https://doi.org/10.17582/journal.pjz/20190826180828>
- Hanlin, H.G., Martin, F.D., Wike, L.D. and Bennett, S.H., 2000. Terrestrial activity, abundance and species richness of amphibians in managed forests in South Carolina. *Am. Midl. Nat.*, **143**: 70-83. [https://doi.org/10.1674/0003-0031\(2000\)143\[0070:TAAASR\]2.0.CO;2](https://doi.org/10.1674/0003-0031(2000)143[0070:TAAASR]2.0.CO;2)
- Hashmi, M., Usman, A. and Khan, M.Z., 2013. Studies of basking activity in monitor lizard (*Varanus bengalensis*) from Thatta of Sindh. *Int. J. Fauna Biol. Stud.*, **1**: 32-33.
- Hellmich, W., 1959. Bemerkungen zueiner kleinen Sammlung von Amphibien und Reptilien aus Süd-Persien. *Opuse, Zool. München*, **85**: 9.
- Jamal, Q., Idrees, M., Ullah, S., Adnan, M., Zaidi, F., Zaman, Q. and Rasheed, S.B., 2018. Diversity and altitudinal distribution of Squamata in two distinct ecological zones of Dir, a Himalayan sub-zone of northern Pakistan. *Pakistan J. Zool.*, **50**: 1835-1839. <https://doi.org/10.17582/journal.pjz/2018.50.5.1835.1839>
- Kathriner, A., Mark, O. and Hinrich, K., 2014. Re-examination of hemidactylus tenkatei van lidth de Jeude, 1895: Populations from Timor provide insight into the taxonomy of the H. brookii Gray, 1845 complex (Squamata: Gekkonidae). *Zootaxa*, **3887**: 583-599. <https://doi.org/10.11646/Zootaxa.3887.5.5>
- Khalid, S., Attaullah, M., Waris, A., Baset, A., Masroor, R., Khan, A.U. and Khan, I., 2019. Diversity and distribution of lizard fauna in tehsil Samar Bagh, Dir lower, khyber Pakhtunkhwa, Pakistan. *Int. J. Fauna Biol. Stud.*, **6**: 20-25.
- Khan, M.S. and Mirza, M.R., 1977. An annotated checklist and key to the reptiles of Pakistan, Part II: Sauria (Lacertilia). *Biologia*, **23**: 41-64.
- Khan, M.S., 1980. Affinities and zoogeography of

- herpetiles of Pakistan. *Biologia*, **26**: 113-171.
- Khan, M.S., 1999. Herpetology of habitat types of Pakistan. *Pakistan J. Zool.*, **31**: 275-289.
- Khan, M.S., 2002. *A guide to the snakes of Pakistan*. Vol. 16, Edition Chimaira Frankfurt am Main.
- Khan, M.S., 2004. Annotated checklist of amphibians and reptiles of Pakistan. *Asiat. Herpetol. Res.*, **10**: 191-201.
- Khan, M.S., 2006. *Amphibians and reptiles of Pakistan*: Krieger Publishing Company Malabar, Florida, USA.
- Khan, M., 2003. Checklist and key to lizards of Pakistan. *Pakistan J. Zool.*, **1**: 1-43.
- Kisiel, W., Mark, A.H. and Earl, W.D., 1976. Factor X activating enzyme from Russell's viper venom: Isolation and characterization. *Biochemistry*, **15**: 4901-4906. <https://doi.org/10.1021/bi00667a023>
- Lajmi, A., Varad, B.G. and Karanth, P.K., 2016. Molecular data in conjunction with morphology help resolve the *Hemidactylus brookii* complex (Squamata: Gekkonidae). *Org. Divers. Evol.*, **16**: 659-677. <https://doi.org/10.1007/s13127-016-0271-9>
- Marwat, S.K., Khalid, U., Ejaz, A.K., Said, G., Jalaluddin, B., Abdul, M.T. and Fazal, R., 2012. Ethnobotanical studies on the dwarf palm (*Nannorhops ritchieana* (Griff.) Aitchison) and date palm (*Phoenix dactylifera* L.) in Dera Ismail Khan, KPK, Pakistan. *Am. J. Pl. Sci.*, **3**: 1162. <https://doi.org/10.4236/ajps.2012.38141>
- Masroor, R., 2011. An annotated checklist of amphibians and reptiles of Margalla Hills National Park, Pakistan. *Pakistan J. Zool.*, **43**: 1041-1048.
- Minton, S.A., 1966. *A contribution to the herpetology of West Pakistan*. Bulletin of the AMNH; v. 134, article 2.
- Muhammad, S. and Khan, K., 2004. *Hemidactylus geckos of Pakistan*. Natural History and Captive Breeding. Reptilia, the European Herp Magazine.
- Prakash, I., 1972. Notes on little known lizards from the Rajasthan desert. *J. Bombay natl. Hist. Soc.*, **69**: 424-428.
- Price, A.H., 2021. ELAPIDAE. In: *Venomous snakes of Texas*, University of Texas Press. pp. 75-81.
- Rais, M., Ayesha, A., Syeda, M.A., Muhammad, A.A., Misbah, J., Muhammad, J.J., and Maqsood, A., 2015. Qualitative analysis of factors influencing the diversity and spatial distribution of the herpetofauna in Chakwal tehsil (Chakwal District), Punjab, Pakistan. *Herpetol. Conserv. Biol.*, **10**: 801-810.
- Rais, M., Jamal, A., Aiman, N., Arooj, B., Aqsa, S., Razia, B. and Anum, S., 2021. Field surveys along habitat gradients revealed differences in herpetofauna assemblage in Margalla Hills National Park, Islamabad, Pakistan. *Biodivers. Data J.*, **9**: e61541. <https://doi.org/10.3897/BDJ.9.e61541>
- Rais, M., Muhammad, Z.K., Darakhshan, A., Ghulam, A. and Rub, N., 2011. A qualitative study on wildlife of Chotiari Reservoir, Sanghar, Sindh, Pakistan. *Pakistan J. Zool.*, **43**: 237-247.
- Rais, M., Sara, B., Javeria, R., Maqsood, A., Iftikhar, H. and Tariq, M., 2011. Diversity and conservation of amphibians and reptiles in North Punjab, Pakistan. *Bridges*, **122**: 16-25.
- Saeed, T.U. and Daulat, K., 2014. Assessment and conservation of groundwater quality: A challenge for agriculture. *Br. J. appl. Sci. Technol.*, **4**: 1256. <https://doi.org/10.9734/BJAST/2014/6353>
- Smith, M.A., 1935. *Fauna of British India including ceylon and Burma: Reptilia and amphibia*. Vol. II, Indian Reprint, 1974. Sauria, New Delhi.
- Stemmler-Gyger, O., 1965. Zur Biologie der Rassen von *Echis carinatus* (Schneider) 1801. *Salamandra*, **1**: 29-46.
- Ullah, S., Muhammad, R.K., Naseer, A.S., Sayed, A.S., Muhammad, M. and Muhammad, A.F., 2014. Ethnomedicinal plant use value in the Lakki Marwat District of Pakistan. *J. Ethnopharmacol.*, **158**: 412-422. <https://doi.org/10.1016/j.jep.2014.09.048>
- Vyas, R., 2012. A contribution to the herpetology of Northern Pakistan: The amphibians and reptiles of Margalla Hills National Park and surrounding regions by Rafaqat Masroor. *J. Threat. Taxa*, **4**: 2670-2672. <https://doi.org/10.11609/JoTT.03218.2670-2>
- Wall, F., 1908. A popular treatise on the common Indian snakes. Part 7, the saw-scaled viper or Echis (*Echis carinata*). *J. nat. Hist. Soc. Bombay*, **18**: 525-542.
- Webb, J.E., Wallwork, J.A. and Elgood, J.H., 1978. Advanced snakes. In: *Guide to living reptiles*, Springer. pp. 138-151. https://doi.org/10.1007/978-1-349-04288-3_9
- Whittaker, R.J., Araújo, M.B., Jepson, P., Ladle, R.J., Watson, J.E. and Willis, K.J., 2005. Conservation biogeography: Assessment and prospect. *Divers. Distribut.*, **11**: 3-23
- Ziegler, T., 2007. *Field surveys and collection management as basis for herpetodiversity research and nature conservation in Vietnam*. Ho Chi Minh City People's Committee, Viet Nam Union of Science and Technology Associations, Colivam, PTC (Hrsg.). Development of Hochiminh City Museum of Natural History, pp. 12-15.