



Short Communication

Ecological Assortment of Snakes in Southern Punjab, Pakistan

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ABSTRACT

Snakes captured, dead or alive, from different habitats of the southern Punjab, Pakistan, were identified based on external morphological features. Total 521 specimens collected/captured belonged to 5 families, 16 genera and 25 species. Indian cobra (*Naja naja*) (8.83%; N = 46), Glossy-bellied racer (*Coluber ventromaculatus*) (7.87%; N = 41) and Common krait (*Bungarus caeruleus*) (7.49%; N = 39) were higher in prevalence. Northern wolf snake (*Lycodon striatus striatus*), Sind long-nose sand snake (*Lytorhynchus paradoxus*) and Afghan awl-head snake (*L. ridgewayi*) (0.38%; N = 2) were the least abundant. Snakes were more frequent in croplands and least frequent in barren areas.

Article Information

Received 27 July 2016

Revised 23 March 2017

Accepted 28 July 2017

Available online 18 January 2018

Authors' Contribution

ZH designed and performed the experiment. SMA and MW participated in identification of snakes. MSK collected, compiled and analyzed the data and wrote the manuscript.

Key words

Snakes, Indian cobra, Glossy-bellied racer, Wolf snake, Sind long nose sand snake, Owl-head snake.

Snakes are valuable for humanity. Snakes play an important role in the conservation and formation of soil (Shine, 1995; Farooq *et al.*, 2007) by controlling agricultural pests thus increasing productivity of agricultural fields.

Diversity of snakes is not fully explored in Pakistan. Pakistan has world's three of the eight bio-geographic realms (Indo-Malayan, Palearctic and Africo-tropical Realms), four of the world's ten 'biomes' (desert, temperate grassland, tropical seasonal forest and mountain Biomes) and three of the world's four 'domains' (polar/montane, humid temperate and dry Domains) (Roberts, 2005). Biodiversity, at all levels, is continuously under threat in Pakistan due to unwise management of community structure, and the development of higher yielding varieties of agricultural crops to feed the rapidly increasing human population (Chaudhry *et al.*, 1999). The use of chemicals and sprays has increased manifold during recent years causing serious threat to soil fauna. Combination of all these factors affects the habitat quality significantly (Akram and Qureshi, 1995; Farooq *et al.*, 2007).

Snake fauna record in Pakistan has not been updated for some decades, on the basis of ecology, taxonomy and their distribution (Farooq *et al.*, 2007). The present study was conducted to describe the ecological assortment of snakes of southern Punjab, Pakistan. Such local studies are important for compiling a more comprehensive faunal picture of the country.

Materials and Methods

The southern Punjab (28.20°-31.02' N, 69.25°-73.12' E; area 105,504 km²) is administratively divided into three civil divisions *viz.*, Bahawalpur, Multan and DG Khan. Based on topography, parent soil material and vegetation structure, the land of southern Punjab can be divided into croplands, natural forests, irrigated forest plantations, riverine forest/areas and desert areas.

The mean annual rainfall varies from 100 mm in the west to 250 mm in the east, chiefly falling during summer monsoon (July- September). Duration and frequency of rainfall are very inconsistent (Salma *et al.*, 2012). The mean summer temperature ranges between 38-40 °C (may shoot up to 54.6 °C) while mean winter temperature lies between 14- 16 °C (Khattak and Ali, 2015).

Snakes were collected dead or alive (captured with snake stick and anesthetized/ killed with chloroform) from different localities with the help of local farmers and villagers. The dead specimens were preserved in 10% formalin, identified to species level using available keys (Minton, 1962; Mertens, 1971; Khan and Mirza, 1977; Khan, 1983; Khan and Baig, 1988; Akram and Qureshi, 1995; Farooq *et al.*, 2007). Each specimen was sexed and broad habitat of collection place was noted.

Collected data were analyzed statistically following Steel and Torrie (1960).

Results and discussion

We collected 521 snake specimens, falling in 5 families, 16 genera and 25 species (Table I). Maximum relative abundance was recorded for family Colubridae

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0030-9923/2018/0001-0397 \$ 9.00/0

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Table I.- Relative abundance, sex ratio, diversity, evenness, dominance and richness of snake species in southern Punjab.

Family	Species Name		Abundance		Sex ratio		Diversity indices		
	Name	Common name	No	Relative (%)	Male	Female	Shannon Index	J	Simpson Index R
Boidae	<i>Eryx johnii johnii</i>	Indian sand boa	5.76	30	12	18	0.1644	0.1113	0.8887 7.3504
	<i>Ganglylophis Conicous</i>	Russell's sand boa	0.77	4	1	3	0.0374	0.0621	0.9379 18.0337
Colubridae	<i>Boiga trigonata trigonata</i>	Indian gamma snake	6.53	34	13	21	0.1781	0.1163	0.8837 7.0895
	<i>Coluber rhodorachis rhodorachis</i>	Jan's Cliff Racer	3.45	18	10	8	0.1163	0.0926	0.9074 8.6494
	<i>Coluber ventromaculatus</i>	Glossy-bellied racer	4.41	23	16	7	0.1377	0.1012	0.8988 7.9732
	<i>Lycodon aulicus aulicus</i>	Common wolf snake	7.87	41	23	18	0.2001	0.1240	0.8760 6.7321
	<i>Lycodon striatus striatus</i>	Northern wolf snake	4.03	21	12	9	0.1294	0.0979	0.9021 8.2115
	<i>Lytrohynchus paradoxus</i>	Sindh awl-headed	0.38	2	2	0	0.0214	0.0709	0.9291 36.0674
	<i>Lytrohynchus ridgewayi</i>	Afghan awl-headed	0.38	2	0	2	0.0214	0.0709	0.9291 36.0674
	<i>Oligodon arnensis</i>	Russet kukri snake	2.69	14	8	6	0.1163	0.1014	0.8986 9.4731
	<i>Psammomphs condanarus</i>	Indian sand snake	2.30	12	5	7	0.0869	0.0805	0.9195 10.0607
	<i>Psammomphs leithi</i>	Pakistan ribbon snake	1.54	8	4	4	0.0641	0.0710	0.9290 12.0225
	<i>Psammomphs lineolatus</i>	Steppe ribbon snake	0.38	2	0	2	0.0214	0.0709	0.9291 36.0674
	<i>Psammomphs schohari</i>	Afro-Asian sand snake	1.34	7	3	4	0.0579	0.0685	0.9315 12.8475
	<i>Ptyas mucosus</i>	Dhaman rat snake	5.95	31	11	21	0.1679	0.1126	0.8874 7.2802
	<i>Spalerosophis arenarias</i>	Red spotted diadema	4.41	23	13	10	0.1377	0.1012	0.8988 7.9732
Elapidae	<i>Spalerosophis atriceps</i>	Royal snake	5.57	29	17	12	0.1608	0.1099	0.8901 7.4244
	<i>Spalerosophis diadema</i>	Eastern diadema snake	4.80	25	14	11	0.1457	0.1042	0.8958 7.7667
	<i>Xenochrophis piscator piscator</i>	Checkered keelback snake	7.29	38	21	17	0.1910	0.1209	0.8791 6.8727
	<i>Xenochrophis sancti-johannis</i>	Johan's water snake	6.33	33	18	15	0.1748	0.1151	0.8849 7.1500
	<i>Bungarus caeruleus</i>	Indian krait	63.53	331	178	154	0.2882	0.1144	0.8856 4.3088
	<i>Naja naja</i>	Indian cobra	7.49 (39)	39	23	16	0.1940	0.1220	0.8780 6.8240
			8.83 (46)	46	27	19	0.2143	0.1289	0.8711 6.5297
			16.31(85)	85	50	35	0.2958	0.1533	0.8467 5.6273
	<i>Ramphotyphlops braminus</i>	Brahminy blind snake	4.03	21	*	*	0.1294	0.0979	0.9021 8.2115
	<i>Typhlops porrectus</i>	Slender blind snake	2.69	14	*	*	0.0972	0.0848	0.9152 9.4731
Viperidae	<i>Echis Carinatus</i>	Saw-scaled viper	6.72	35	*	*	0.1814	0.1175	0.8825 7.0317
			6.91	36	19	17	0.1846	0.1186	0.8814 6.9764
			6.91	36	19	17	0.1846	0.1186	0.8814 6.9764

*Sexes un-identified.

(63.53%: N = 331), and minimum for family Boidae (6.53%: N = 34). Indian cobra *Naja naja naja* (8.83%, N = 46; family Elapidae), Gray's rat snake *Coluber ventromaculatus* (7.87%, N = 41; family Colubridae), Common krait *Bungarus caeruleus* (7.49%, N = 39; family Elapidae) and Checkered keel-back *Xenochrophis piscator piscator* (7.29%, N = 38; family Colubridae) were the most abundant and diversified species, whereas Northern wolf snake *Lycodon striatus striatus*, Sindh long-nose sand snake *Lytrochynchus paradoxus* and Afghan awl-head snake *L. ridgewayi* (0.38%; N = 2, family Colubridae) were the least abundant. Variations in abundance could be ascribed to nature of habitat (Pauwels *et al.*, 2008), structure of canopy (important for natural refuges) and type of vegetation (Amr, 2008). Earlier similar findings have been recorded by Khan and Baig (1988), Akram and Qureshi (1995) and

Farooq *et al.* (2007) for various regions of Pakistan.

The highest diversity was recorded for family Elapidae (0.2958) and minimum for family Boidae (0.1781). Diversity was the highest for Indian cobra (0.2143) and lowest for Northern wolf snake, Sindh longnose sand snake and Afghan awl-head snake (0.0214). Evenness was the maximum for family Elapidae (0.1533) and the least for family Colubridae (0.1144). At species level, it was the maximum for Indian cobra (0.1289) and lowest for Northern wolf snake, Sindh longnose sand snake and Afghan awl-head snake (0.0709). Dominance was the highest for family Colubridae (0.8856) and the lowest for family Elapidae (0.8467) whereas, at species level it was the maximum for Russell's boa or Rough-scaled sand boa *Gangylophis conicous* (0.9379) and the lowest for Glossy-bellied racer (0.8760). Richness was the maximum for

Table II.- Relative distribution of different snake species in different habitats and administrative divisions.

Family	Species	Habitat								Divisions		
		Crop-land	Shallow water bodies	Desert with small vegetation	Human settlement near crops	Loose soil	Bare soil with small vegetation	Barren area with thick plantation	House gardens/lawns	BWP	MLT	DGK
Boidae	Indian sand boa	-	-	+	-	+	-	-	-	+	+	+
	Russell's sand boa	-	-	+	-	+	-	-	-	+	-	-
Colubridae	Indian gamma snake	+	-	-	-	-	-	-	-	+	+	+
	Jan's Cliff Racer	+	-	+	+	-	+	-	-	+	+	+
	Glossy-bellied racer	+	-	+	+	-	+	-	-	+	+	+
	Common wolf snake	+	-	-	-	-	+	-	-	+	+	+
	Northern wolf snake	+	-	-	-	-	+	-	-	+	-	-
	Sindh awl-headed	-	-	+	-	-	+	-	-	+	-	-
	Afghan awl-headed	-	-	+	-	-	+	-	-	-	-	+
	Russet kukri snake	-	-	-	-	-	+	-	-	+	+	+
	Indian sand snake	-	-	+	-	-	-	-	-	+	-	+
	Pakistan ribbon snake	-	-	+	-	-	-	-	-	+	-	+
	Steppe ribbon snake	-	-	+	-	-	-	-	-	-	-	+
	Afro-Asian sand snake	-	-	+	-	-	-	-	-	+	-	+
	Dhaman rat snake	+	-	-	+	-	-	-	-	+	+	+
	Red spotted diadema	+	-	-	+	-	+	-	-	+	-	+
	Royal snake	+	-	-	+	-	+	-	-	+	+	+
	Eastern diadema snake	+	-	-	+	-	+	-	-	+	+	+
Elapidae	Checkered keelback snake	+	+	-	-	-	-	-	-	+	+	+
	Johan's water snake	+	+	-	-	-	-	-	-	+	+	+
	Indian krait	+	-	+	+	-	+	-	-	+	+	+
Typhlopidae	Indian cobra	+	-	+	-	-	+	+	-	+	+	+
	Brahminy blind snake	-	-	-	-	-	-	-	+	+	+	+
Viperidae	Slender blind snake	-	-	-	-	-	-	-	+	-	-	+
	Saw-scaled viper	-	-	+	-	-	-	-	-	+	+	+

BWP, Bahawalpur; MLT, Multan; DGK, Dera Ghazi Khan.

family Boidae (7.0895) and minimum for family Colubridae (4.3088). Sand snake *Psammophis condanarus*, Northern wolf snake, *Sindh* long-nose sand snake and Afghan awl-head snake exhibited the same higher richness values (36.0674); while Glossy-bellied racer (6.7321) held minimum richness (Table I). Similar findings of richness values were reported by Khan and Baig (1988), Akram and Qureshi (1995), Farooq *et al.* (2007), Pauwels *et al.* (2008) and Amr and Disi (2011).

Habitat comprises of desert area with small plantation, shallow water bodies, loose soil, croplands, bare soil with small vegetation, barren area with thick plantations (non-cultivated area), and housing settlements near croplands area.

Maximum snake population was recorded in croplands (25%), followed by deserts with low vegetation (25%), bare soil with sparse short vegetation (23%) (Table II).

High cropping density, deserts with sparse short vegetation (Akram and Qureshi, 1995; Farooq *et al.*, 2007) and bare soil with sparse short vegetation (Amr and Disi, 2011) provide perfect natural camouflaging habitat for a snake. Floor and dense canopy is a suitable habitat for snakes. In contrast, lowest population was recorded from shallow water bodies, loose soil, house gardens/lawns (4%) and barren areas with plantation (2%). In such areas, human interference was higher, not preferred by snakes (Amr, 2008; Al-Quran, 2009; Amr and Disi, 2011). Moderate population was present in human settlements near crops (13%); snakes from crops of nearby fields visit human settlements for food and if proper refuge is available the snakes start living there (El Din, 2006).

Population abundance was compared between three administrative divisions to evaluate the role of topography and farm habitat for future conservation of snakes (Table II). Dera Ghazi Khan and Bahawalpur Divisions held equal abundance (37-38%). These tracts include bare soil with short vegetation, desert with small vegetation, loose soil; all providing suitable habitat and camouflage for snakes (Akram and Qureshi, 1995; Farooq *et al.*, 2007; Amr and Disi, 2011). Multan Division held lower snake abundance (25%), attributable to higher human interference and higher use of pesticides (Al-Quran, 2009; Amr and Disi, 2011).

During the present study, it was concluded that intensive deforestation, expansion of agriculture and increased urbanization were major causes of snake population decline (Stuart *et al.*, 2000). Along with these issues, use of snakes as food in some human communities was another threat to their abundance (Zhou and Jiang 2005) but this issue is not faced in Pakistan. Herpetological research needs to be strengthened to recommend/adopt measures for the conservation of snake fauna. Alteration/destruction of habitat should be reduced up to ETL (economic threshold level) especially around the newly settled colonies to save snakes from decline.

Acknowledgment

The authors are grateful to the Punjab Wildlife & Parks Department for providing the facility, space and time to complete this study. The authors are also grateful to the Department of Biological Sciences, University of Okara, Okara, Pakistan for providing laboratory facilities.

Statement of conflicts of interest

Authors declare that they have no conflict of interest.

References

- Akram, S. and Qureshi, J., 1995. *Snake-Nittagun*, **27**: 25-30.
- Al-Quran, S., 2009. *Am. Eurasian. J. Agric. environ. Sci.*, **6**: 385-391.
- Amr, Z., 2008. Biodiversity of reptiles and mammals in the Eastern Desert. In: *Jordan's Arid Badia: Deepening our understanding*. Smith Gordon and Co., UK.
- Amr, Z.S. and Disi, A.M., 2011. *Vert. Zool.*, **61**: 179-266.
- Chaudhry, M., Hussain, S., Khan, S., Hussain, F. and Anwar, J., 1999. *J. Sci. Tech. Develop.*, **18**: 1-5.
- El Din, S.B., 2006. *A guide to reptiles and amphibians of Egypt*. American University Press, Cairo, Egypt.
- Farooq, Z., Akram, S.M. and Tahir, T., 2007. *Life Sci. Int. J.*, **1**: 330-334.
- Khan, M.S. and Baig, K.J., 1988. *The Snake*, **20**: 156-161.
- Khan, M.S. and Mirza, M.R., 1977. *Biologia*, **23**: 41-64.
- Khan, S., 1983. *The Snake*, **15**: 101-105.
- Khattak, M.S. and Ali, S., 2015. *J. Himalayan Earth Sci.*, **48**: 42-61.
- Mertens, R., 1971. *Senckenberg. Biol*, **52**: 7-15.
- Minton, S.A., 1962. *An annotated key to the amphibians and reptiles of Sind and Las Bela, West Pakistan*. American Museum of Natural History.
- Pauwels, O.S., Wallach, V. and David, P., 2008. *Hydrobiology*, **595**: 599-605. https://doi.org/10.1007/978-1-4020-8259-7_58
- Roberts, T.J., 2005. *Field guide to the small mammals of Pakistan*. Oxford University Press.
- Salma, S., Rehman, S. and Shah, M., 2012. *Pakistan J. Meteorol.*, **9**: 37-47.
- Shine, R., 1995. *Australian snakes: A natural history*. Cornell University Press.
- Steel, R.G.D. and Torrie, J.H., 1960. *Principles and procedures of statistics*. McGraw-Hill Book Co., Inc., NY, pp. 6-8.
- Stuart, B.L., Smith, J., Davey, K., Din, P. and Platt, S., 2000. *Traff. Bull.-Cam.-Traff. Int.*, **18**: 115-124.
- Zhou, Z. and Jiang, Z., 2005. *Biodivers. Conserv.*, **14**: 3525-3536. <https://doi.org/10.1007/s10531-004-0826-5>