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DISTRIBUTION, POPULATION ESTIMATION AND AWARENESS OF INDIGENOUS COMMUNITY FOR THE INDIAN PANGOLIN (*MANIS CRASSICAUDATA*) IN THE KOHAT DISTRICT, PAKISTAN

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ABSTRACT

The Indian pangolin (*Manis crassicaudata*), categorized as "Endangered "by the IUCN and included in the Appendix-I of the CITES, is illegally hunted for its scales in Pakistan and its population is declining rapidly for the last decade. The species has stayed neglected in the province of Khyber Pakhtunkhwa, where studies focusing on its ecology and illegal trade are scanty. The current study, therefore, aimed at determining the distribution and estimating the population of Indian pangolin in Kohat district, one of species known range. Field visits to the study area were made each month during September 2018 to July 2019 for data collection. Results showed that Indian pangolin had limited distribution in the study area; being recorded at only three out of seven sampling sites surveyed, at elevation ranging from 390 m to 471 m. Field signs of the species like its active living burrows were recorded at three positive sampling sites only. Mean population density of Indian pangolin estimated from the field data was found to be very low, 0.29 individuals/km^2, Questionnaire survey conducted involving local community revealed poaching and illegal killing of Indian pangolin for its scales, being the main threat to its little remaining population in the Kohat District. Majority of respondents thought that the population of the species had declined greatly in the study area during past few years. The study recommends strict law enforcement along with creating more awareness among local people to conserve the species in the study area.

Key Words: Indian pangolin, population density, threats, illegal trade, Kohat.

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INTRODUCTION

Globally, there are eight species of pangolins, grouped under single order "Pholidota", and distributed across two continents only: Asia and Africa. Indian pangolin (*Manis crassicaudata*) is one of the four Asian species, that occurs in four range countries only including Pakistan, India, Sri Lanka, and Nepal (Mahmood *et al.,* 2019a). The species has been categorized as "Endangered" by IUCN red list of threatened species (Mahmood *et al.,* 2019a) due to its continuously declining populations, while it is also included in the Appendix-I of the CITES because of its illegal trade across different countries. The species is facing the biggest threat of illegal trade for its body scales, which are smuggled internationally (from Pakistan and other countries) to China and Vietnam, which are the two biggest destinations for its scales, where these scales are used in traditional medicines (Challender *et al.,* 2015). According to recent reports, due to strict law enforcement in other countries and protection being provided to other pangolin species, the pressure has shifted to Indian pangolin in Pakistan for international demand for its scales, as a result the species has been poached heavily from different areas of its range in the country and resultantly its population has been declining. According to Irshad *et al.* (2015), approximately 79% population of Indian pangolin has been reduced in the Pothwar Plateau of the country.

In Pakistan, the Indian pangolin is a protected species included in Schedule-III, of all four provincial and Federal and AJ&K laws. However, poaching, and illegal killing of the species has been reported in the country since long (Mahmood *et al.,* 2012). During the last decade, many hundreds of pangolins have been reported to be killed in the Pothwar Plateau, in some areas of Khyber Pakhtunkhwa province, and from Azad Jammu & Kashmir (Akrim *et* al., 2017; Mahmood *et al.,* 2019b).

Roberts (1997) had reported distribution of Indian pangolin in different areas of the four provinces of the country. However, in the province of Khyber Pakhtunkhwa (KP), its occurrence records are still not well established. Recently, few areas (like Mansehra and Mardan Districts) previously not reported for existence of Indian pangolin, have been found having population of the species. Coupled with the fact of reports of poaching and illegal killing, the focal aim of the current study was to investigate the occurrence of Indian pangolin in Kohat District of Khyber Pakhtunkhwa province, particularly determining the areas of occurrence of the species, estimating its population and collecting data from local communities for their perception about pangolins.

MATERIALS AND METHODS

Study area: The current study was conducted in the Kohat District, which is the southern most of the three districts of the Peshawar division and lies between north latitude 32° 47' and 33° 53' and east longitude 70° 34' and 72° 17' (Fig. 1). It comprises the greater portion of the rough hilly country that lies between the open valleys of Peshawar and Bannu. It covers an area of approximately 7,700 km^2 and a human population 0f 562644 people. The temperature of the area averages 22.8 °C, while average annual rainfall here is 529 mm with the least occurring in the month of November during the year. However, the greatest amount of precipitation occurs in the month of August. For administrative purposes, Kohat district is divided in to two Tehsils including Kohat and Lachi (Zubair *et al.,* 2009).

Methods: Distribution of Indian pangolin was studied by conducting field surveys to different parts of the study area. A total of seven potential sampling sites were selected after reconnaissance survey for recording field data about the species. The sampling sites were visited for data collection and searched for recording the direct and indirect signs of the Indian pangolin (including burrows, foot tracks, faecal material, and body prints). The sites having any of the signs and occurrence of species, were marked as "positive" and their geographical coordinates and elevation data were recorded using the Global positioning system (GPS: Garmin eTrax vista).

For estimating population of the Indian pangolin in the study area, sampling transects (each of 1 km length and variable width) were established at selected sampling sites and surveyed for recording active living burrows of the species, to use burrow density method. Burrows of Indian pangolin were distinguished into two types: feeding and living burrows. Feeding burrows were found less deep and excavated during foraging on ants and termite nests, while the living or permanent burrows were found much deeper and served for living or resting purposes. Living burrows were further categorized in the field into active and inactive burrows. The number of active living burrows was recorded in transects and utilized for estimating the population of the species following Begon (1979), and Mahmood *et al.* (2015). The number of pangolins in each burrow were determined by establishing footprints outside of each burrow during the survey. For population density estimation of Indian pangolin, we used the following formula:

$$D = n / A$$

where n represents the numbers of active living burrows and A stands for area sampled in each study site.

Data on threats being faced by the Indian pangolin in the study district were collected through direct field surveys as well as by using self-designed questionnaire by interviewing the local community around the pangolin habitats. The questionnaires were filled by collecting information from local people including the local hunters, shop keepers, staff of the provincial wildlife department, farmers, and school children. The collected data were analyzed statistically.

RESULTS

Distribution of the species: The distribution of Indian pangolin in District Kohat, KP, was found very patchy. Out of seven selected sampling sites (Table 1), that were surveyed, field signs (burrows and scats) of Indian pangolin were found at only three sites including Mondori, Jabber and Tilkan. During the study period, a total of 31 km^2 area was surveyed for recording pangolin field signs, which, at three positive sites, were found at elevation ranging from 390 m to 471 m, while no signs of occurrence of the species were recorded at elevation 500 m or above (Ghumbat site).

Burrows of the species: At the three positive sampling sites, two types of burrows of Indian pangolin were recorded: the feeding burrows and the living burrows (Fig. 2). It was noticeable that the living burrows were much deeper than the feeding burrows. Out of all sampling sites, feeding burrows were recorded at only two sites Mondori and Tilkan (Table 1). Although living burrows were found at Jabber site, no feeding burrows were observed at this positive site. These feeding burrows of Indian pangolin were recorded at an elevation of 462 m and 384, m respectively. Termites and insects colonies were observed near each recorded burrow. A total of seven living burrows were recorded at three positive sampling sites of the study area (Table 1). One living burrow was recorded at "Mondori site" at elevation of 470 m. A total of four living burrows were recorded at second site (Jabber site) at elevation ranging from 414 m to 450 m. At the third positive site "Tilkan site", two living burrows were recorded side by side at the elevation of 390 m (Table 1; Fig. 2). However, no living burrows were recorded at the other four sites which included

"Tughmangara", "Koterimarchungi", "Muslim Abad", and "Ghumbat" site (Table 2).

Pangolin Density estimates: Population density of Indian pangolin was estimated in the study area at selected sampling sites using data on active living burrows that were found at each sampling site. It is established that each active living burrow is occupied by only one pangolin. A total of 31 km^2 area was surveyed and a total of nine (09) active living burrows of Indian pangolin were recorded at three positive sampling sites (Table 2). The sampling site-II (Jabber site) showed comparatively greater population density of Indian pangolin (1 individual/km^2), followed by at site-III, Tilkan site (0.75 individuals / km^2), and least at site-I, Mondori (0.66 individuals/ km^2). Mean population density of Indian pangolin in the study area was found very low, 0.29 individuals/km^2 (Table 2).

A paired sample *t-test* used showed statistically significant difference between the population densities of Indian pangolin among the studied sampling sites ($t = 9.47$, $df = 8$, $p < 0.005$).

Threats to Indian pangolin population: In the current study, a total of N=186 respondents were interviewed for collecting data on different kinds of threats being faced by Indian pangolin in the Kohat District. Out of total respondents, n =121 (65%) belonged to the rural areas living around the habitat of Indian pangolin, and included farmers, local hunters, drivers, shopkeepers and labors.

According to the data collected, the illegal killing was found to be the main threat to the population of Indian pangolin in the study area as was perceived by 77% of the total respondents (Fig. 3). These killings were believed to be due to different reasons such as one for the negative myths of the locals (minor factor) but mainly (61%) for the illegal trade in pangolin scales. Majority of the respondents (72%) showed a negative perception and were of the wrong myth that pangolins dig graves and feed on the human dead bodies, while remaining 28% respondents did not agree with that, but still the difference was statistically (Chi-Square test) significant ($\chi2=196.2$, $df=1$, $p < 0.001$). About 66 % respondents thought that pangolins are useless animals and are harmful to the people around (Fig. 3). The majority of the respondents (76%) reported that in addition to selling pangolin scales, they also make necklaces of those scales which bring good fortune to them, while the remaining respondents (24%) did not agree with it ($\chi2 = 94.7$, $df =1$, $p < 0.001$).

Among the total respondents interviewed, only n = 32 respondents (17%) had observed live pangolins in the field (Fig. 3) while majority of the respondents (83%) did not encounter any live pangolin ($\chi2 = 67.8$, $df = 1$, $p < 0.005$). Out of those who encountered live pangolin, majority (87%) had tried to kill that pangolin while the rest (13%) were afraid to do so ($\chi2= 44.9$, $df =1$, $p < 0.005$).

The local hunters were found to kill more pangolins (86%) than the farmers and other groups (Fig.3). The majority of the killings were done using the local tools like stone, bricks, axe, burning or throwing the pangolin into the boiling water tank. The scales were sold to the nomads of the areas, who used to sell those scales to the bigger parties of illegal trade of pangolin to transporting to other big cities. Majority of the respondents (82%) were of the view that that the population of Indian pangolin has greatly reduced in the area during the past few years just because of the poaching and illegal killing by the hunters and farmers ($\chi2=335.1$, $df =1$, $p < 0.005$).

Table 1. Details about the two types of burrows (feeding and living) of Indian pangolin recorded at three different sites of District Kohat (KP).

Site #	Site name	Number of burrows (N)	Burrow type	Height (cm)	Width (cm)	Depth (cm)
1	Mondori (N=2)	1	Feeding	8.90	8.54	13.71
		1	Living	9.31	9.14	39.28
2	Jabber (N=4)	0	Feeding	-	-	-
		4	Living	9.62 ± 1.66	9.35±1.08	47.65 ± 3.48
3	Tilkan (N=3)	1	Feeding	9.21	8.91	15.47
		2	Living	9.50 ± 0.25	9.27±0.36	49.31 ± 4.25
4	Tugh Mangara (N=2)	2	Living	-	-	-
5	Koteri Marchungi	-	-	-	-	-
6	Muslim Abad	-	-	-	-	-
7	Ghumbat	-	-	-	-	-

Table 2. Details of feeding and living burrows of Indian pangolin (*Manis crassicaudata*), and estimated population density of the species at selected Sampling sites of Kohat District, Khyber Pakhtunkhwa.

Site No.	Sampling sites	Numbers of burrows (n)	Burrow type	Geographical Coordinates	Elevation (m)	Area surveyed. (km^2)	No. of Active living burrows (N)	Population Density/km^2 D= N/A
1	Mondori	1	Feeding	33° 26.191″ N, 71° 24.444″ E	462 m	3	2	0.66
		1	Living	33° 26.531″ N, 71° 24.695″ E	470 m			
2	Jabber	2	Living	33° 32.004″ N, 71° 48.146″ E	414 m	4	4	1.00
		2	Living	33° 32.049″ N, 71° 48.141″ E	414 m			
3	Tilkan	2	Living	33° 31.783″ N, 71° 47.733″ E	450 m	4	3	0.75
		1	Feeding	33° 29.211″ N, 71° 46.531″ E	384 m			
4	Tugh Mangara	2	Living	33° 29.315″ N, 71° 46.352″ E	390 m	**5**	**0**	**-**
		-	-	33° 34.470″ N, 71° 32.480″ E	370 m			
5	Koteri Marchungi,	-	-	33° 30.697″ N , 71° 26 .936 E	400 m	6	-	-
6	Muslim Abad	-	-	33° 28.50" N, 71° 24.40" E	410 m	4	-	-
7	Ghumbat	-	-	33° 30. 0" N, 71° 40. 0" E	380 m	5	-	-
	Total	**11**				**31**	**09**	**0.29/ km^2**

Fig. 1. GIS based map of Pakistan showing A) location of Kohat District, Khyber Pakhtunkhwa province, B) locations of pangolin occurrence in the district.

Fig. 2. Field photographs of the burrows of Indian pangolin recorded at sampling site-III (Tilkan) of District Kohat, Khyber Pakhtunkhwa.

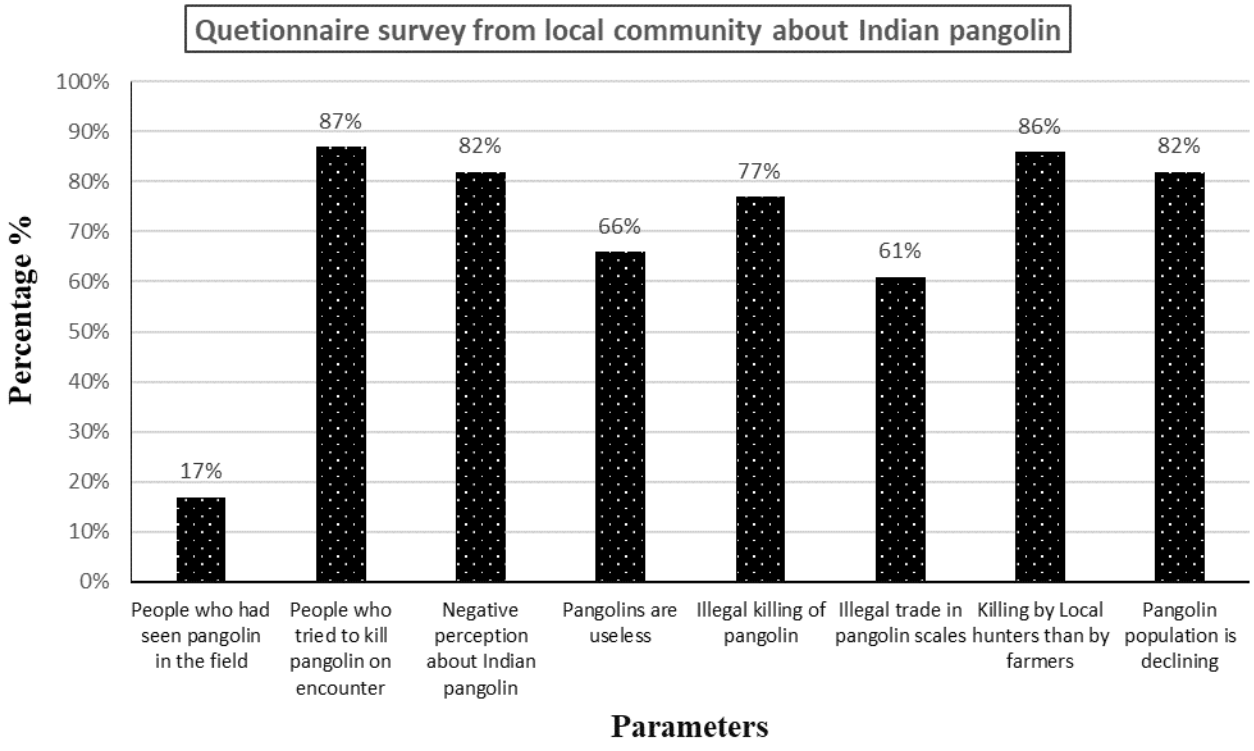

Fig. 3. Response of local community about different aspects of Indian pangolin (*Manis crassicaudata)* in Kohat District, Khyber Pakhtunkhwa, Pakistan.

DISCUSSION

The Indian pangolin occurs in different areas of Pakistan ranging from Punjab to Khyber Pakhtunkhwa, in some areas of Sind, a couple of areas in Baluchistan and Mirpur division in Azad Jammu & Kashmir. Recently, the species has been listed as "Endangered" by IUCN due to its declining population trend in its entire range mainly because of illegal hunting and killing for its scales and meat (Mahmood *et al.,* 2012; Mahmood *et al*., 2019b). This rapid decline due to illegal killing can also be worsen by its low rate of reproduction (Roberts, 1997). There are numerous reports that the illegal and indiscriminate killings and poaching of Indian pangolin in its natural habitat has widely affected its distribution pattern and resulted in its decreased population (Mahmood *et al.,* 2015a; Akrim *et al.,* 2017).

The findings of the current study indicate that Indian pangolin occurs thinly in the Kohat District. The species was recorded at only three sampling sites at an elevation ranging from 390 m to 471 m above sea level. While all other four sites did not show any field signs of Indian pangolin occurrence. Earlier on Mahmood *et al.* (2015a) had reported the occurrence of Indian pangolin up to 1046 m elevation above the sea level but in the current study, the signs of Indian pangolin have been recorded at much lower elevation. Distribution of Indian pangolin was previously reported by Irshad *et al.* (2015) in Jhelum district at 221m to 690 m elevation, in Chakwal district at 523m to 942 m elevation, in Rawalpindi district at 500m to 650 m elevation and in Attock district at 312m to 573 m elevation. The Indian pangolin occurs in both hilly and plain areas (Prater, 1971). On the other hand, if we compare Indian pangolin occurrence with other pangolin species, the distribution of Chinese pangolin is restricted to 1524 m elevation in Nepal (Frick, 1968) and Bhutan (Mitchell, 1975). This difference may be due to the different topography of the areas and natural habitat of both the study also differ containing rock type which in the current study were unsuitable for digging above the stated elevation.

In the present study, during field surveys, only three sampling sites were found positive for occurrence of Indian pangolin. The two types of burrows were recorded which were excavated by the Indian pangolin: living burrows and feeding burrows. The feeding burrows were temporary as they were less deep and just dig during the foraging on ants and termites, the living burrows were the permanent ones, as they were deeper as compared to the feeding burrows, the living burrows were used for sleeping and living. In general, a greater number of living burrows were found in the study sites as compared to feeding burrows. Feeding burrows were only observed at places where there was abundance of ants and termite's species.

In the current study, mean population density of Indian pangolin in the study area was found to be 0.29 individuals/km^2, which is very low, also these pangolins are found patchily in different sampling sites while other sites being vacant. In an earlier published study, Irshad *et al.* (2015) reported that within a period of three years, a steep decline occurred in the population of Indian pangolin in the Pothwar region of Pakistan. The average population density of Indian pangolin was estimated as 0.36 individuals/km^2 in Margalla Hills National Park, Islamabad (Mahmood *et al.* (2015a). Mahmood *et al*. (2014) also recorded the mean population density of Indian pangolins as 1.0 individuals/km^2 at different sampling sites of District Chakwal, Punjab, Pakistan.

The data regarding the population dynamics of the pangolin species is lacking in entire distribution range of the species in its four range countries, probably because the species is solitary, nocturnal and very secretive in nature, very few scientific studies have been focused on the population of Indian in its natural habitats. Indian pangolin occurs thoroughly in India but very little is reported about its distribution and population status from India (Tikader, 1983). Chao *et al*. (2005) reported that the population of Indian pangolin is rapidly decreasing due to destruction and stealing of the natural habitat. During 2012, about 118 Indian pangolins were reported to be hunted and killed illegally by the local hunters and these animals were sold at a price of US$ 108-163 per animal (Mahmood *et al.,* 2012). The major cause of massive killings of Indian pangolin is its scales (Nowak, 1999) and it is reported to produce about 1 kg of scales from a single average Indian pangolin (Akrim *et al.,* 2017). Many parts of the Bangladesh now lack Indian pangolin due to illegal hunting and killings (Khan, 1985).

Analysis of data on threats and illegal trade of Indian pangolin in Kohat District collected using self-designed questionnaire, have revealed that the major threat to pangolin population in Kohat district is the illegal killing of the species for its body scales as was highlighted by 77% respondents. Local hunters are the major cause of these illegal killings of the species in the study area as was pointed out by 86% of respondents. Majority of respondents (82%) had developed negative perception about Indian pangolin and they (87% tried to kill pangolin when encountered in the field. The majority of the respondents (82%) were of the view that pangolin population was declining in the study area for the last decade.

Although Pakistan has strict legislation for protection of Indian pangolin in the country, the species included in Schedule-III of all provincial, Federal and AJ&K laws. These laws and regulations are applicable in all distribution range but still poaching and the illegal killing of Indian pangolin is increasing day by day and this is mainly because of the very weak law enforcement

and precious and valuable scales of this mammal or the local myths about these mammals.

Conclusion: The Indian pangolin is thinly distributed in District Kohat, occurring at an elevation range between 390 m to 471 m. A very low population density of 0.29 individuals per km^2 has been estimated in the study area . Poaching and illegal killing is the main threat to the Indian pangolin population in the Kohat District. The majority of local community have got negative perception about the species, and they also think that the population of the species is declining in the study area. The study recommends strict law enforcement in the area to stop illegal killing of the species along with creating awareness among local community about ecological importance of the species and its conservation.

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