

Documentation of Snakes Species Richness in Palpa, Nepal

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Abstract:- Snakes are elongated limbless reptiles whose body covered with scales which are arranged in rows. The present study was carried out on February 2016 till the end of September 2018 in selected habitat in Palpa districts. Six sampling stations were conducted in the study areas. The aim of this study is (i) to document the richness of snakes (ii) to explore the venomous and non-venomous snakes in Palpa district. Eight standardized 10 x 200 m strip transects and 20 standard quadrat sizes of 20 x 20 m were set in each station. Observed museum specimens in hospitals, campus and questionnaire survey were also conducted during data collection. A total of 23 species of snakes were recorded from 5 families (Boidae, Colubridae, Elapidae, Typhlopidae, and Viperidae). The most dominant snake families of the study areas were Colubridae with 14 species ($n = 14$; 60.86%) followed by the Elapidae ($n = 5$; 21.73%), family Viperidae ($n = 2$; 8.69%). The remaining families were Typhlopidae ($n = 1$; 4.34%) and Boidae ($n = 1$; 4.34%). During the study period, a total of 115 snake species were recorded. In this study, out of total, 7 species of venomous snakes (2 families with Elapidae and Viperidae) and 16 non venomous species (families Typhlopidae, Boidae and Colubridae) were recorded. Agricultural fields, riparian areas, ponds, wet lands provide a variety of habitats for frogs and their ophidian predators. Such types of habitat were suitable for the richness of snake species. The study areas were diverse microhabitats due to the elevation from 190 m to 1320 m with plain, Churia range and mountain range.

Keywords:- Snakes, Habitat, Venomous, Non-Venomous.

I. INTRODUCTION

Snakes are elongate, legless, ectothermic, and carnivorous reptiles whose body is covered by overlapping scales. Variation of their body temperature influences in metabolism, growth, development, reproduction, behavior, etc. They typically have poor eyesight and hearing but are able to detect their surroundings using other senses. Due to various mode of life, their sizes, shapes and colours are different. They are found in a wide range of different habitats including human habitations. They are extremely well-adapted to almost all kinds of landscapes like aquatic, fossorial, arboreal and other terrestrial forms. Although small in size, significant variation in climate, topography and soil

properties have given rise to striking variety of forest types that provide habitats to the snakes (Somaweera, 2004).

Biodiversity supports life on Earth, and human beings frequently depend on biodiversity to satisfy basic needs such as food, refuge, medicine, combustibles, and industrial products (Dirzo & Raven, 2003). Diversity has variously been related to other attributes of the community or properties of the environment, among which are time, spatial heterogeneity, stability, primary production, productivity, competition, predation, niche structure and evolution (Vyas, 2000). Ecological studies, including monitoring and biodiversity inventories, need survey methods that permit the most ancient and comprehensive completion of study objectives (Hutchens & De Perno, 2009). The species composition and richness of tropical and temperate zones change over gradient in soil moisture (Friend & Cellier, 1990), altitude (Fauth *et al.*, 1989), and forest type (Crump, 1971). Owen (1989) showed the relationships between snake species richness and climate.

Snakes have an extremely large global distribution. There are near about 3,783 types of snake species in the world (Bansode *et al.*, 2016). There are 58 poisonous species in India (Raut *et al.*, 2014). South east-Asian countries such as Myanmar, Thailand, Malaysia, Singapore, Borneo, Java and Bali covered the half (276 species) snake (Das, 2012).

Nepal has diverse topography, altitude variations, different ecosystems and changing climatic conditions that host a large variety of faunal elements including the snakes (Shah, 1998). Schleich (1995) contributed checklist of Nepalese herpetofauna comprising 53 snakes' species; Shrestha (2001) reported 90 species, and Shah and Tiwari (2004) claimed 80 species of snakes in Nepal. Schleich and Kastle (2002) in their publication 'Amphibian and Reptile of Nepal' provide the 77 species of Nepal. Rai (2003) reported the total of 53 species of snakes from eastern development region of Nepal. Thapa and Thapa (2006) reported 14 species of snakes from Biratnagar area. Chhetry (2010) reported 6 species of snakes from Koshi Tappu wildlife reserve and its surroundings. Pandey (2010) recorded 31 species from Chitwan national park. A total of 20 species of snakes were recorded in Pokhara valley (Shah and Gautam, 2010).

Snakes can be categorized as venomous, semi-venomous, and non-venomous. Only around 375 snake species are venomous, and only a small proportion of these

are potentially harmful to humans (Snake facts, 2013). Most species are non-venomous and those that have venom use it primarily to kill and suppress prey rather than for self-defense. Out of 500 venomous species, 52 venomous species were found in Indian subcontinent (Punde, 2008). Madagascar harboured a rich snake fauna including about 96 species corresponding to the three families of Typhloidae, Boidae, and Lamprophiidae in which there were 12 species of Typhlopidae and three or four species of Boidae (Kaloloha *et al.*, 2011). The herpetofauna in Thummalapalle uranium mining areas resulted in a collection of 52 species belonging to 17 families. Snakes were the dominant group with 20 species (Reddy *et al.*, 2013).

Shakya and Thapa (1994) reported that about 10% snakes of Nepal are poisonous. The venomous snakes include 4 species of Karait, 3 species of Cobra including King cobra, 1 species of each coral snake, 11 species of green pit vipers, Himalayan pit viper (*Gloydies himalayanus*) and Russell’s Pit viper (*Daboia russelli*). Fifty six species belong to 3 families of Typhlopidae,

Boidae and Colubridae represent non-venomous group of snakes in Nepal (Shah, 2003). Sharma *et al.* (2013) also added significant knowledge on herpetology in venomous snake of Nepal.

Snakes are attractive, and form an important component of the ecosystem. They are integral part of an ecosystem as predators of food chain and help in the nutrient flow (Soubhagya *et al.*, 2014). They have great economic, ecological, religious and cultural, educational and inspirational values. Beside fat, skins, bones, flesh, bile and whole body of many snake species 20 different traditional medicines are prepared from snakes in Nepal (Shah, 1997).

The snakes are poorly studied and determined in terms of the distribution, population status and habitat suitability. Such type of study has not been carried out in these study areas. The aim of this study is (i) to document the richness of snakes (ii) to explore the venomous and non-venomous snakes in Palpa district. It helps to generate the current status of snakes, their categories and habitat situation.

II. MATERIAL AND METHOD

A. Study Area

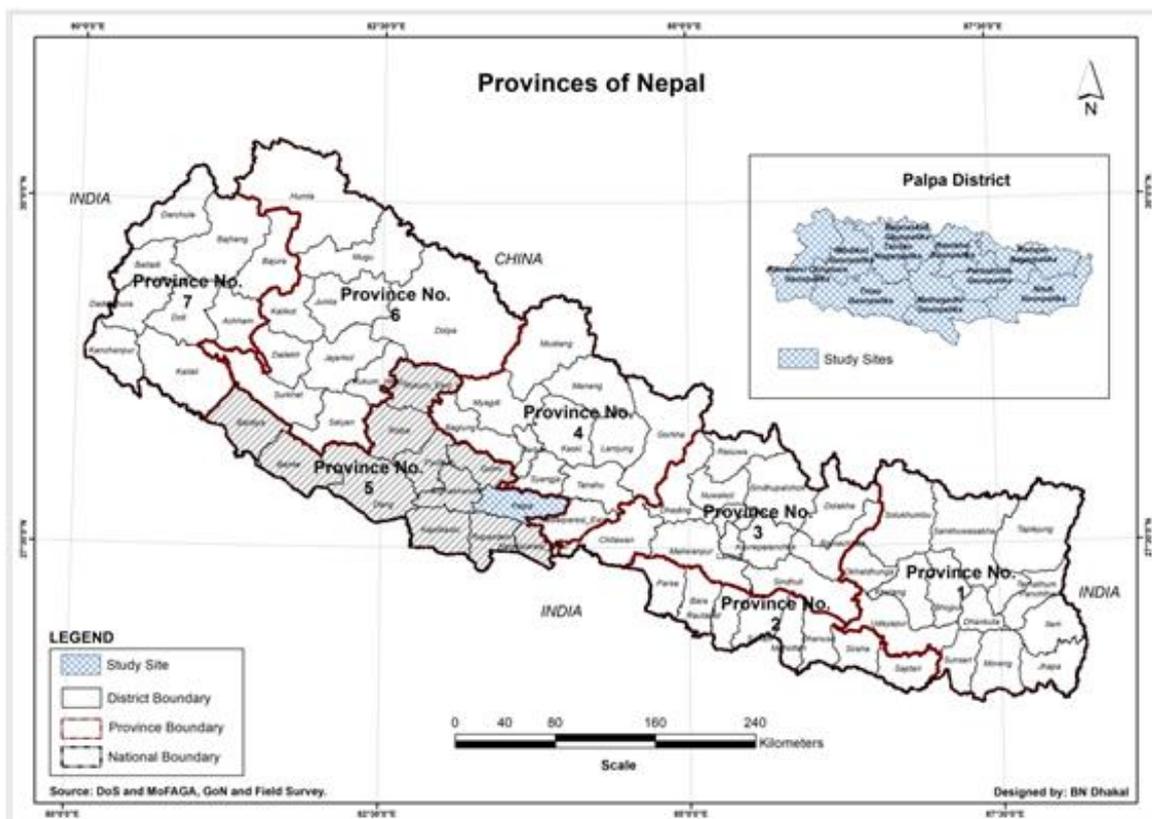


Fig 1:- Map of Nepal showing Palpa Districts in Province No. 5.

The study survey was conducted beginning from February 2016 till the end of September 2018 in selected habitat at different stations of Palpa district in Province No. 5. It extends from 83°15’ to 84°22’ east and 27°24’ to

27°57’ north. It is hilly district and covers an area of 1,373 km². Several terrestrial macro-habitat types, potentially available to snakes, were sampled throughout the study.

Ser. No.	Stations	Location	Elevations	Habitat types
	Tansen	27° 86' 683' N 83° 54' 865" E	652-1320 m	Agricultural fields, wetlands, urban areas and community forest
	Dovan	27° 49' .055" N & 83° 08' 55" E	585-990 m	Wetlands, subtropical forest, few agricultural lands and village areas
	Rampur	27° 49' 055" N & 83° 42' 685' E	190-800 m	Small valley, agricultural lands, small urban area and community forest.
	Somadi - Sardewa	27° 91' 595" N & 83° 39' 785 'E	710-1245 m	Riparian areas, forest, agricultural lands and small village
	Jhadewa	27° 49' 995" N & 83° 42' 665' E	450- 635 m	Riparian, forest, agricultural lands and small village
	Ringneraha	27° 82' 595" N & 83° 74' 785' E	785-920 m	Riparian, forest, agricultural lands, small village

Table 1:- Stations, Locations, Elevations and Habitat Types in Study Areas

B. Data Collection

Six sampling stations were selected in Palpa district. The data were collected in this district based on sources: (1) Voucher species of snake were observed in united mission hospital, Tansen, regional Rampur hospital, Palpa and Tribhuvan Multiple Campus, Palpa. (2) Individual encounters were conducted during field work by the researcher and others persons who accompanied the researcher. The surveys were conducted in 8 standardized 10 x 200 m strip transects and 20 standard quadrat sizes of 20 × 20 m were laid in each habitat type in each station. The data was analyzed by Microsoft Excel 13.

C. Identification

Identification of the species was carried out by using the identification keys developed by field guide of Smith (1981), Dixon (2000), Schleich & Kaestle (2002), and Rai (2003). Amphibian specimens were also identified with the aid of Bossuyt & Dubois (2001), Dutta & Manamendra-Arachchi (1996), Das (2008), Kabir *et al.* (2009) etc. The species encountered were identified using field guides and color photographs (Shah & Tiwari, 2004).

Morphologically venomous species were identified by observing shape of head, pupil of eye, position of supra-

labial scales, structure of bite signs, body scale, color patterns, various type of strips and ring on body, tail etc. described by (Shkya & Thapa, 1994), Kastle(2002), Rai, (2003), and Shah, 2003).

III. RESULTS AND DISCUSSION

Total of 23 species of snakes belonging to five families were recorded in different habitats and around the human habitations of resident people of Palpa district. Recorded families were Boidae, Colubridae, Elapidae, Typhlopidae, and Viperidae (Table: 2). During the study period, a total of 115 snake species were recorded. A total of 23 species of 18 genera belonging to 5 families were documented. Based on the above data, recorded families and their species clearly indicate high richness of snakes in the study area.

The most dominant snake families of the study areas were Colubridae with 14 species ($n = 14$; 60.86%) followed by the Elapidae ($n = 5$; 21.73%). The third most specious snake family was Viperidae, with a total of 2 species ($n = 2$; 8.69%). The remaining families were Typhlopidae ($n = 1$; 4.34%) and Boidae ($n = 1$; 4.34%) (Fig: 2).

S. No.	Family	Scientific name	Station						No. of individual	%
			Tansen	Dovan	Rampur	Somadi	Jhadewa	Ringneraha		
1	Boidae	<i>Python molurus</i> (Linnaeus,1758)	-	-	-	+	+	-	2	1.7391
2	Typhlopidae	<i>Ramphotyphlops braminus</i> (Daubin,1803)	+	-	-	-	-	-	3	2.608
3	Colubridae	<i>Amphiesma solatum</i> (Linnaeus,1758)	+	+	-	-	+	-	6	5.217
4		<i>Boiga forsteni</i> (Dumeril, Bibron & Dumeril 1854)	-	-	+	-	-	-	1	0.869
5		<i>Boiga ochracea</i> (Gunther, 1868)	+	-	-	-	+	-	3	2.608

6		<i>Boiga trigonata</i> (Schneider in: Bechstein, 1802)	+	+	-	+	+	-	9	7.826
7		<i>Coelognathus helena</i> (Daubin,1803)	+	+	-	+	+	-	8	6.956
8		<i>Coelognathus radiates</i> (Boie, 1827)	+	+	-	+	-	-	10	8.695
9		<i>Dendrelaphis trisis</i> (Daubin,1803)	+	-	-	+	-	-	2	1.739
10		<i>Lycodon aulicus</i> (Linnaeus,1758)	+	-	+	-	-	+	12	10.43
11		<i>Oligodon arnensis</i> (Shaw,1802)	+	-	-	+	-	-	3	2.608
12		<i>oligodon erythrogaster</i> (Boulenger, 1907)	-	-	-	+	-	-	1	0.869
13		<i>Orthriophis hodgsonni</i> (Gunther, 1860)	+	-	-	-	+	+	3	2.608
14		<i>Ptyas mucosa</i> (Linnaeus,1758)	+	+	+	+	+	+	16	13.91
15		<i>Xenochrophis piscator</i> (Schneider, 1799)	+	-	+	-	-	+	4	3.478
16		<i>Xenochrophis sanctjohannis</i> (Boulenger, 1890)	+	-	-	-	-	-	1	0.869
17	Elapidae	<i>Bungarus caeruleus</i> (Schneider, 1801)	+	-	+	-	-	-	3	2.608
18		<i>Hemibunarus macclellandii</i> (Gunther, 1858)	+	-	+	-	-	-	7	6.086
19		<i>Naja kaouthia</i> (Lesson, 1831)	+	-	-	-	-	-	1	0.869
20		<i>Naja naja</i> (Linnaeus,1758)	-	+	+	+	-	-	2	1.739
21		<i>Ophiophagus hannah</i> (Cantor, 1836)	-	+	-	+	-	-	3	2.608
22	Viperidae	<i>Trimeresus albolabris</i> (Gray, 1842)	+	+	+	+	+	+	12	10.43
23		<i>Ovophis monticola</i> (Gunther, 1864)	-	-	-	+	+	-	3	2.608
Total									115	

Table 2:- Species of Snakes in Palpa District

Species richness is the total number of different organisms present. It does not take into account the proportion and distribution of each species within the local aquatic community. The richness of snakes (N=23) reported in Palpa district correspond to 26.13% species known and for a whole country (N=88, Shah and Tiwari, 2004). Two species *Ptyas mucosa* and *Trimeresus albolabris* were commonly observed in all sites. *Naja kaouthia*, *Indotyphlops braminus*, *Xenochrophis sanctjohannis*, *oligodon erythrogaster*, and *Boiga forsteni*

(Table 2) were found in separate stations as single species. *Trimeresusalbolabris* (10.43%), *Ptyas mucosa* (13.91%), *Lycodon aulicus*(10.43%) were relatively abundant in study sites. and *Ptyas mucosa* and *Trimeresus albolabris* were commonly observed in all sites. *Naja kaouthia*, *Xenochrophis sanctjohannis*, *oligodon erythrogaster*, and *Boiga forsteni* all had single species (0.869%).

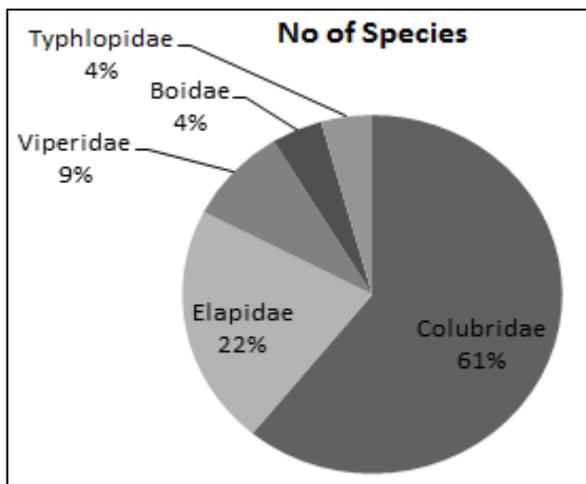


Fig 2:- No. of Snake Species According Family

This district represents different agro-climate zones comprising of valley, flat land to middle hills and high hills. With regard to the topography of the district, it has Siwalik or low mountainous range and Mahabharat or mid mountainous range. It has a number of valleys famous for agricultural production mainly paddy. Some of them are: Rampur, Madi, Arghali, Kachal and Darpuk (DTMP, 2012). Agricultural fields, riparian areas, ponds, wet lands etc provide a variety of habitats for frogs and their ophidian predators. Human activities increase the rodent population which also becomes the regular prey items for many snakes. Thus such type of habitat is suitable for the richness of snake species. In general, people cannot distinguish the poisonous and non-poisonous snakes. They think every snake is poisonous. So, they kill snakes whenever and wherever they meet them. Thus, the snake species are decreasing day by day.

The *Coelognathus helena* was recorded from Tansen (Fleming and Fleming 1974), *Coelognathus helena*, *Dendrelaphis tristis*, *Lycodon aulicus*, *Orthiophis hodgsonii* and *Bungarus caeruleus* were reported by Shah and Tiwari (2004) from Palpa. Similarly Thapa (2016) reported 27 species of snakes in his dissertation work from this districts.

According to Shakya and Thapa (1994), venomous snakes included 4 species of Karait, 3 species of Cobra including King cobra, 1 species of each coral snake, 11 species of green pit vipers, Himalayan pit viper (*Gloydies himalayanus*) and Russell's pit viper (*Daboia russelli*). The result showed that the majority of snake's species rescued were non-venomous type. In this study, out of total, 7 species of venomous snakes (2 families with Elapidae and Viperidae) and 16 non venomous species (families Typhlopidae, Boidae and Colubridae) were recorded. Shah (2003) also reported that families of Typhlopidae, Boidae and Colubridae represent non-venomous group of snakes in Nepal. The venomous species found were *Bungarus caeruleus*, *Hemibungarus maccllellandii*, *Naja kaouthia*, *Naja naja*, *Ophiophagus hannah*, *Trimeresurus albolabris* and *Ovophis monticola*. The nonvenomous species were *Python molurus*, *Indotyphlops braminus*, *Amphiesma*

solatum, *Boiga ochracea*, *Boiga forsteni*, *Boiga trigonata*, *Coelognathus helena*, *Coelognathus radiates*, *Dendrelaphis tristis*, *Lycodon aulicus*, *Oligodon arnensis*, *Oligodon erythrogaste*, *Orthriophis hodgsonni*, *Ptyas mucosa*, *Xenochrophis piscator*, and *Xenochrophis sanctjohannis*.

IV. CONCLUSION

During this study, a total of 23 species of snakes were observed. There were 115 individuals recorded including 5 families with 18 genera. *Ptyas mucosa* ($n=16$; 13.91%) and *Trimeresurus albolabris* ($n=12$; 10.43%) *Lycodon aulicus* ($n= 12$; 10.43%) were commonly observed in all sites. *Naja kaouthia*, *Xenochrophis sanctjohannis*, *Oligodon erythrogaster*, and *Boiga forsteni* all had single species (1; 0.869%). The most dominant snake families of the study areas were Colubridae with 14 species ($n = 14$; 60.86%) followed by the Elapidae ($n = 5$; 21.73%). The other snake family were Viperidae 2 species ($n = 2$; 8.69%), Typhlopidae ($n = 1$; 4.34%) and Boidae ($n = 1$; 4.34%). There were 23 species of snakes in which 7 species were venomous species under 2 families (Elapidae and Viperidae) and 16 non-venomous species under 3 families (Boidae, colubridae and typhlopidae). Palpa district has Siwalik or low mountainous range and Mahabharat or mid mountainous rang which has agricultural fields, riparian areas, ponds, wet lands etc. Such type of habitat is suitable for the richness of snake species.

REFERENCES

- [1]. Bansode, S. A, More, V. R. and Mirza, K. A. 2016. A study on snakes from Mokhada and Jawhar (Dist. Palghar) Maharashtra, India. *International journal of fauna and biological studies*, 3(5), 103-115.
- [2]. Chhetry, D.T. 2010. Diversity of herpetofauna in and around the Koshi Tappu wildlife reserve. *Bibechana*, 6, 15-17.
- [3]. Das, I. 2012. *Snakes of south east-Asia* including Myanmar, Thailand, Malasia, Singapore, Borneo, Java and Bali. John Beautiful Publication Ltd, UK.
- [4]. District Transport Master Plan (DTMP): Palpa. 2012. Government of Nepal, Ministry of Local Development Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR) and Rural Access Improvement and Decentralization Project (RAIDP) Project Coordination Unit (PCU) Jawalakhel, Lalitpur
- [5]. Dirzo, R. and Raven, P. H. 2003. Global state of biodiversity and loss. *Annual review of environmental resource*, 28, 137-167.
- [6]. Hutchens, S. J., & DePerno, C. S. 2009. Ecacy of sampling techniques for determining species richness estimates of reptiles and amphibians. *Wildlife biology*, 15, 113–122.
- [7]. Kaloloha, A., Misandeau, C. and Gehring, P.S. 2011. Notes on the diversity and natural history of the snake fauna of Ambodiriana - Manompana, a protected rainforest site in north-eastern Madagascar: *Herpetology Notes*, 4, 397-402.

- [8]. Fleming, R. L. and Fleming, R. L. 1974. Some snake from Nepal. *Journal of Bombay natural history museum society*, **70**(3), 426-437.
- [9]. Majumder, J., Bhattacharjee, P. P., Majumdar, K., Debnath, C. and Agarwala, B. K. 2012. Documentation of herpetofaunal species richness in Tripura, northeast India. *NeBIO* **3**, (1), 60-70.
- [10]. Owen, J. G. 1989. Patterns of herpetofaunal species richness: relation to temperature, precipitation, and variance in elevation. *Journal of Biogeography*, **16**(2), 141-150.
- [11]. Pandey, D. P. 2010. *Snake in the vicinity of Chitwan national park*. Sidhababa Oxford Press, Bharatpur, Nepal.
- [12]. Pradhan, S., Mishra, D. R. and Sahu, K. R. 2014. An inventory and assessment of snake diversity of Gandhamardan hills range of Western Orissa, India, *International journal of pure and applied Zoology*, **2**(3), 241-245.
- [13]. Punde, D. P. 2008. Meet the Expert: Management of Snake Bite Report Kochi. *Apicon*, **18**.
- [14]. Rai, K. R. 2003. *Environmental impacts, systematics and distribution of herpetofauna*. From East Nepal ((Unpublished doctoral dissertation) Central Department of Zoology, Institute of Science and Technology, Tribhuvan University Kirtipur, Kathmandu Nepal.
- [15]. Reddy, Y. A., Sadasivaiah, B., Indira, P. & Pullaiah, T. (2013). Herpetofauna of Thummalapalle uranium mining areas: Andhra Pradesh, India. *International journal of biodiversity and conservation*, **5**(8), 515-522.
- [16]. Sakya, S. R. and Thapa, V. K. 1999. *An introduction of biology of Nepal*. Curriculum development center, second edition. TU, Kathmandu, Nepal.
- [17]. Schleich, H. H., and Kastle, W. (2002). *Amphibians and Reptiles of Nepal: Biology, Systematic, Field Guide*. A. R. G. Gantner Verlag, Germany.
- [18]. Joshi, D. D. and Chhetri, M. K. (ed). 1998. Snakes of Nepal. Public health and medical officer training in snakebite management in Nepal. National zoonoses and food hygiene research centre, Tahachal, Kathmandu, 131.
- [19]. Shah, K. B. (1998). Checklist of the herpetofauna of Nepal with English and vernacular names. *NAHSON bulletin. Nat. Hist. Soc. of Nepal*. **8**(1- 4), 26-30.
- [20]. Shah, K. B., & Tiwari, S. 2004. *Herpetofauna of Nepal: Conservation companion*. IUCN Nepal, Kathmandu.
- [21]. Shah, K.B. 2003. *Snake bites management guideline* HMG/Ministry of health, department of health services epidemiology and diseases control division, Kathmandu, Nepal.
- [22]. Shah, P. J. and Gautam, R. 2010. Brief Survey on the snake of Pokhara valley, *Journal of natural history museum*, **25**, 252-255.
- [23]. Sharma, B. D. and Kumari, T. K. (ed). 1999. *Snakes: The specialized reptiles: Snakes in India*, A source book. Asiatic Publishing House, Delhi, India, 352
- [24]. Sharma, S. K., Pandey, K. B., Tillack, F., Chappuis, F., Thapa, C. L., Alirol, E. and Kuch, U. 2013. *Venomous Snakes of Nepal: A photographic guide*. B. P. Koirala Institute of Health Sciences, Dharan, 76.
- [25]. Shrestha, T. K. 2001. *Herpetology of Nepal: a field guide to amphibian and reptiles of transhimalayan region of Asia*. Mrs Bimala Shrestha, Kathmandu Nepal.
- [26]. Smith, M. A. 1981. *The fauna of British India, Ceylon and Burma: Today and tomorrow's printers and publishers* New Delhi, India.
- [27]. Somaweera, R. 2004. Sri Lankan colubrid snakes: *Srilanka naturalist, journal of ecology and nature*, A young zoologists association of Srilanka, **6**, 3-4.
- [28]. Thapa, M. and Thapa, R. B. 2006. Common snakes of Biratnagar, Morang district, Nepal. *Natural resource management ecological society*. PG Campus, Biratnagar, Nepal biological society, Biratnagar and ecological society, Kathmandu, Nepal, 373-383.
- [29]. Vyas, R. 2000. A Review of reptile studies in Gujarat state, *Zoos' Print Journal Vadodara Gujarat India*, **15**(12), 386-390.
- [30]. www.arkive.org/snakes/ Snake facts, 2013