



STUDY OF HERPETOFAUNA OF KHAJJAR LAKE OF CHAMBA DISTRICT, HIMACHAL PRADESH, INDIA.

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ABSTRACT: A study of Khajjar lake area of Chamba District of Himachal Pradesh (India) was conducted from June 2008 to June 2012 which revealed the presence of six species of herpetofauna (two amphibians and 4 reptiles) spread over 2 orders and 5 families. Family Colubridae have two species while all other families Scincidae, Agamidae, Ranidae and Bufonidae are represented by single species each. Out of six species only one reptilian species *Ptyas mucosus* (Indian Rat Snake) is place in Wild Life Protection Act, 1972 in schedule-II.

Key words: Amphibian, Reptile, Khajjar Lake, diversity.

INTRODUCTION

Herpetofauna include amphibians and reptiles. Amphibians are poikilothermic (cold blooded) vertebrates with smooth skin leading a bimodal life i.e. life in water as well as land (Amphi-meaning "on both sides" and -bios meaning "life"). The three modern orders of amphibians are Anura (tailless and limbless animals like toads and frogs), Caudata (tailless animals e.g. salamanders and newts), and Gymnophiona (caecilians, limbless amphibians that resemble snakes). Amphibians are ecological indicators and in recent decades there has been a dramatic decrease in their populations. Many species are now threatened or extinct. Reptiles are cold-blooded vertebrates which breathe by lungs throughout their life and their body is covered by scales. Unlike amphibians, reptiles do not have an aquatic larval stage. As a rule, reptiles are oviparous (egg-laying), although certain species of squamates retain the eggs until hatching and a few are viviparous. Of the 19 orders of reptiles, only 4 survive today and they are typically recognized. Of these, Crocodylia includes crocodiles, gavials, caimans, and alligators having 23 species. Second order is Sphenodontia having two species found in New Zealand. Third order is Squamata which includes lizards, snakes and worm lizards having approximately 9,150 species. Last order is Testudines which includes turtle, terrapins and tortoises having about over 300 species.

Amphibians are the least amongst the vertebrates and comprise nearly 6.6% of the total vertebrate life on the earth [1]. Total number of species in the world has been estimated around 3,140 and in India 214 species are known, while in Himachal Pradesh only 17 species belonging to 4 families has been recorded. This is 7.8% of the total Indian species [2]. Reptiles are diverse in south Asia with approximate 632 species belonging to 185 genera and 25 families. India harbours 456 species of reptiles belonging to 25 families and 4 orders including 3 species of Crocodylia, 31 of Testudines, 178 of lizards and 244 species of serpents.

There have been some herpetological studies in different parts of the country and the state. The information on the amphibian fauna of different parts of the state is available in the works of Annandale, Boulenger, Kriplani, Dubois, Tilak and Mehta and Mehta [3-8]. Some of the important contribution to amphibian research in India is made by some other workers [10-13]. Recently, Venugopal [14] has revealed the presence of 199 species of lizards within the boundaries of India. Saikia and Sharma [15] reported 17 species belonging to 10 families from Simbalbara Wildlife Sanctuary. A list of 55 species of reptiles belonging to 40 genera and 14 families has been prepared from Himachal Pradesh by Saikia [16]. Some other useful works on the reptilian fauna of Himachal Pradesh are those of Saikia and Sharma [17] who studied the Herpetofauna of Pin Valley National Park, Saikia and Mehta [18] elucidated the reptilian diversity of Pong Dam Wetland. But none of these has worked on the herpetofauna of present study area of Khajjar Lake.

STUDY AREA AND METHODOLOGY

Khajjiar Lake “The Mini Switzerland of Himachal Pradesh” is present in the western part of Chamba district of Himachal Pradesh. Khajjiar Lake lies 32° 26′ north and 76° 32′ east about 6300 feet (1920 meters) above sea level between Chamba and Dalhousie. The average depth of this lake is stated to be thirteen feet as per district gazetteer. Khajjiar Lake has a clump of reeds and grasses exaggeratedly called an island in it. Fed by slim streams this small lake rests in the centre of large glade of Khajjiar.

This glade is greenish in its turf and contains in its centre a small lake having approximate area of 5000 square yards (Fig. 1). Khajjiar Lake has thick forest of Kala Top sanctuary surrounding its soft green grass. There is a ‘golden’ domed temple at the edge of this meadow, dedicated to the deity ‘Khajjinag’, from whom the area derives its name. Khajjiar Lake is situated in Khajjiar- Kalatop wild life sanctuary. This small sanctuary lies in the catchments of the Ravi river, located in western part of Chamba District (Fig. 2). It is one of the oldest preserved forests of state (notified on 01.07.1949). Total area of sanctuary is 2,026.89 hectares (20.69 sq. km.). Its mean annual rainfall is 800 mm. Temperature varies from -10° C to 35°C. The climate of Khajjiar summers being mild and winters cold and bitter. It experiences south-western monsoon rains in July-September.

The amphibians were sampled using the methods described by Vasudevan [19]. Amphibians were sampled on the basis of combination of adaptive cluster sampling, visual encounters surveys, audio surveys and opportunistic records. Adaptive sampling was done along the lake and forest floor. Areas (not Quadrats) of adequate size were selected for study. These areas were searched carefully turning the leaf litter, rocks, as well as by prodding the cavities on the forest floor to look for amphibian species. The reptiles were sampled using the general methods described by Ishwar [20]. Reptiles were studied by using combination of adaptive cluster sampling and forest transects.



Fig 1: Google imagery of Khajjiar area (Source: www.googleearth.com)

Identification of all the species was based on morphological characters. The scientists and experts of related animal group of different research institutes were consulted to confirm the exact taxonomic identifications. Related research literature, identifying keys and earlier records of related species along with their distributional ranges were taken into consideration. Collected specimens of invertebrates and photographs of vertebrates were used for identification purposes. The identification was confirmed and authenticated at High Altitude Zoological Regional Station, ZSI, Solan Himachal Pradesh.

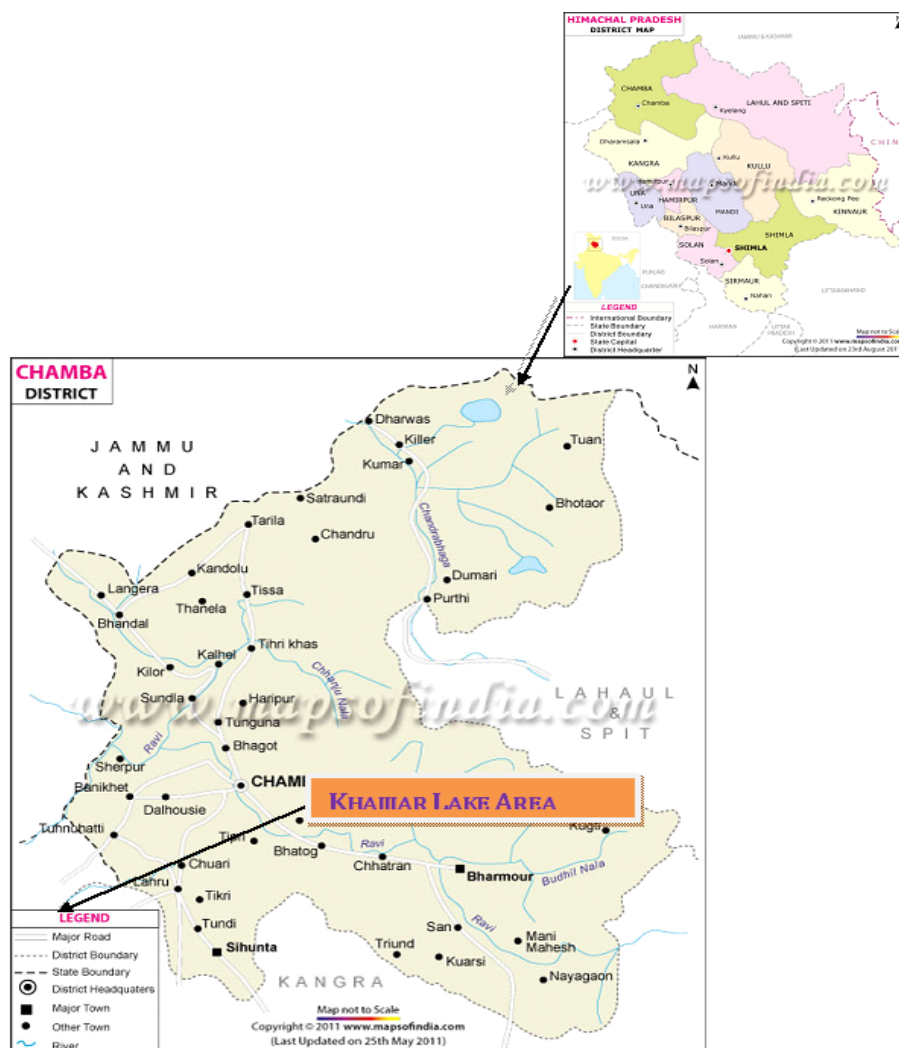


Fig. 2: Map of Chamba district showing the study area of Khajjiar lake (Source: www.mapsfindia.com)

RESULT

Present study revealed the presence of six species of herpetofauna (two amphibians and 4 reptiles) spread over 2 orders and 5 families. Family Colubridae have two species while all other families Scincidae, Agamidae, Ranidae and Bufonidae are represented by single species each. A detail account of diagnostic characters, habits and habitat of these species is given below.

AMPHIBIA

Only two species of Amphibia belonging to two different families were recorded from Khajjiar pasture. A good population of *Bufo himalayanus* has been recorded from the lake area especially during monsoon season, however, a single specimen of *Rana liebigii* has been observed during the whole study period.

Order: Anura

Family: Bufonidae

Animals of this family are known as true toads and are characterized by squat, plump bodies with short legs, and skin rough-warty. True toads are widespread and occur natively on every continent except Australia.

Genus: *Bufo* Laurenti, 1868

1708. *Bufo* Laurenti, *Syn. Kept.*, pp. 25

They have large parotid glands. They also lack an anterior breastbone and do not have teeth. Males develop dark nuptial pads on the thumbs and inner fingers that assist in amplexus. In most species, breeding males develop a dark throat.

***Bufo himalayanus* Gunther, 1864 (Himalayan Toad)**

1864. *Bufo melanostictus* var. *himalayanus* Gunther, *Reptiles of British India*, pp. 422

1882. *Bufo himalayanus* Boulenger, *Fauna of British India*, pp. 505

Diagnostic Characters: one of the largest *Bufo* of India. Crown deeply concave, with low, blunt supra-orbital ridges; Snout short and blunt; inter-orbital space broader than the upper eyelid, tympanum very small and indistinct. Fingers free, first finger does not extend beyond second. Toes half to two-third webbed, with single subarticular tubercles; inner and outer metatarsal tubercles present; without tarsal fold. Dorsal side of the body with irregular, distinctly porous warts; parotids very prominent, large, elongate, at least as long as the head. Live colour brown. Males without vocal sacs.

Distribution: In India found in Sikkim, Meghalaya, Arunachal Pradesh, West Bengal, Uttar Pradesh, Jammu & Kashmir and Himachal Pradesh. Also present in Nepal.

Habits and Habitat: The species show defensive behavior and when handled, secretes a corrosive fluid both from the parotids and warts on the dorsum. Pesticides and fertilizers used in the nearby orchards have adverse effects on this species. Also contamination of breeding grounds is a major threat to this animal.

Observations: Recorded in good number from Khajjiar meadow area.

Family: Ranidae

Members of this family have smooth, moist-skin, with large, powerful legs and extensively webbed feet with pointed toes. Key characteristics of true frogs include bony breast bones and horizontal eyes. They also have slim waist and have toothed upper jaws. They vary greatly in size. Breeding for true frogs typically occurs during the spring with groups of males calling-in females to the breeding areas. Breeding males have swollen forelimbs and thumbs that facilitate pectoral amplexus. They are known as true frogs.

Genus : *Rana* Linnaeus 1700

1700. *Rana* Linnaeus, *Syst. Nat.* I: 354

The tibio-tarsal articulation reaches the tip of the snout, or beyond. On dorsal side skin smooth, seldom warty. Colour brown above and a black line on the canthus rostralis and on the temporal region.

***Rana liebigii* Gunther, 1830**

1830. *Rana liebigii*, Gunther *P. Z.S.*, 157

1830. *Rana liebigii* Boulenger *Cat. Batr. Sal.*, 21

Diagnostic Characters: Head moderate and much depressed, snout very short and rounded. Inter orbital space nearly as broad as the upper eyelid and tympanum small and hidden. Fingers moderate, first finger not extending beyond the second. Toes also moderate, truncated or slightly swollen at the end. Toes entirely webbed and don't have any tarsal fold. Nuptial excrescences well developed; inner metatarsal tubercle oval, not very prominent; no outer tubercle. Lateral folds black-margined, legs indistinctly cross-barred. Male with internal vocal sacs. During the breeding season remarkable on account of the extreme thickness of the arms and of the patches of spinose warts on the breast, the inner side of the arms, and the inner fingers.

Distribution: In India, found in Sikkim, and in states of western Himalayas.

Habits and Habitat: Lives in a damp climate, but not so essentially aquatic in its habits but is found in damp jungles.

Observations: *Rana liebigii* also known as *Rana vicina* (synonym) but is smaller in size than the later and found in western Himalayas. During present investigations recorded from a small stream near the lake.

REPTILIA

Present study revealed the presence of 4 species of reptiles belonging to 4 genera spread over 3 families and 1 order from Khajjiar area. It was recorded that family Colubridae has been represented by a maximum of 2 species and other families namely Agamidae and Scincidae were represented by a single species each.

Order: Squamata

Family: Agamidae

Members of this family have scaly bodies, well-developed legs, and a moderately long tail. They cannot shed their tails and regenerate. Many agamid species are capable of limited change of their colours to regulate their body temperature. The key distinguishing feature of the agamids is their teeth, which are borne on the outer rim of the mouth. In some species, males are more brightly coloured than females and colours play a part in signalling and reproductive behaviours.

Genus: *Laudakia* Gray, 1845

1845. *Laudakia* Gray, *Cat. Liz. Brit. Mus.* p. 254

Throat and chest brownish, profusely spotted with dark blue; upper side of head light brown.

***Laudakia tuberculata* (Hardwicke & Gray, 1827) (Kashmir Rock Agama)**

1827. *Agama tuberculata* Hardwicke & Gray, *Zool. Journ.* 3: 218

1935. *Laudakia tuberculata* Smith, *Fauna Brit. Ind.* 2: 214

Diagnostic Characters: Overall body sturdy with a flat head. Head depressed and elongated, tympanum large and distinct. Colour of the dorsal side dark-olive brown with numerous dark-brown spots on either side of a lighter vertebral line. Adult male specimens have bluish tinge on the dorsal side. Upper side of head light brown. Throat and chest brownish, profusely spotted with dark blue. Belly of adult as well as young ones, whitish. An elongated patch of enlarged scales present on the belly. Limbs moderately strong and toes longer. Fifth toe extends beyond the first toe. Tail depressed, longer than the head and body. Upper portion of the tail strongly keeled and almost equal scaled.

Distribution: Found in western Himalayas (Kashmir, Northern Punjab, Himachal Pradesh and Uttarakhand). In Himachal Pradesh, found throughout the state including the Trans-Himalayan districts of Lahoul & Spiti, and Kinnaur. Elsewhere: Afghanistan, Pakistan and Nepal.

Habits and Habitat: The species is diurnal and terrestrial, inhabiting the holes, crevices and such other rocky structures. Omnivorous in feeding habits and its food mainly comprises the insects like ants, small orthopterans, lepidopterns etc. Breeding season varies from May to August, lays 7-20 eggs in a single clutch. Frequent fighting breaks out between males.

Observations: Some male adults during present study were observed to have beautiful and brilliant shades of bright yellow, orange bluish black, purple and black on shoulders, breast, flanks, under parts and throat during the months of May to August. Recorded from rocky area near entrance gate of the Khajjiar wildlife sanctuary.

Family: Scincidae

This family is the largest of the sixteen or so families of lizards and members are generally called skinks. They look roughly like true lizards, but most species have no pronounced neck. They have relatively long-snouted and somewhat flattened skulls. The head is usually covered with enlarged plates. Some genera, have reduced limbs, lack forelegs, and in some genera number of digits less than five. In such species, locomotion resembles that of snakes more than that of lizards. Most species of skinks have long, tapering tails that can be shed during pursuit of life.

Genus: *Scincella* Mittleman, 1950

1950. *Scincella* Mittleman, *Herpetologica* 6 (2): 17-20.

***Scincella himalayanus* Gunther, 1864 (Himalayan Ground Skink)**

1864. *Scincella himalayanus* Günther, *The Reptiles of British India*, 452 pp.

Diagnostic Characters: A small skink having a bronze dorsum with indistinct lighter and darker markings and dark brown vertebral stripe. Lateral stripe of brass colour and having irregular margins. A broad, dorsal, dark-brown stripe emerges from snout and reaches up to the proximal part of tail through eye and upper side of the forelimbs.

Another, lower, broad stripe bordered below by a narrow, irregular, white stripe edged with black; distal body colour bronzy, with numerous light and dark-brown spots. Top of the head and upper side of the limbs bronzy, with dark dots all over; belly bluish-white.

Snout small and bluntly pointed; ear-openings oval, smaller than eyes; the lower eyelids with undivided transparent disc. Limbs short and digits long and sub-cylindrical. Tail one and half times as long as the head and body.

Distribution: Found in Kashmir, Himachal Pradesh and Uttar Pradesh. Elsewhere: present in Pakistan, Nepal and southern Turkistan.

Habits and Habitat: Prefers damp areas or open grasslands. Also present in lake sides, banks of rivers and gardens. The species is insectivorous and viviparous (produces 3 or 4 young ones at a time).

Observations: During present study a number of specimens of this species have been reported from meadow area around the lake.

Family: Colubridae

Members of this family are distinguished from other snakes primarily by the dentition, which usually comprises solid teeth on the maxilla, palatine, pterygoid and dentary, but never on the premaxilla. A few species have enlarged and/or grooved posterior maxillary teeth, which channel venom from the supralabial. Members have enlarged ventral scales in a single row, a more or less cylindrical tail in which all sub-caudals are divided.

Genus: *Amphiesma* Dumeril, Bibron & Dumeril, 1854

1854. *Amphiesma* Dumeril, Bibron & Dumeril, *Erpetologie generale ou Histoire Naturelle complete des Reptiles*. Vol. 7, 780 S.

Amphiesma platyceps (Blyth, 1854) (Eastern Keelback)

1854. *Tropidonotus platyceps* Blyth, *J. Asiatic Soc. Bengal*. 23: 297

Diagnostic Characters: Colourations variable, generally olive brown above, with small black spots; sometimes with a dorso-lateral series of white spots; frequently two white black-edged parallel lines, or an elliptical mark on the nape, or a white black-edged streak on each side of the head, or a black line near eye; lips white or yellow, belly yellowish, with or without blackish dots, bordered with bright red in living specimens; frequently a black line or a series of elongated black spots along each side of belly; lower surface of tail mottled with black; throat sometimes black.

Distribution: Found from western to eastern Himalayas in suitable habitat types.

Habits and Habitat: Prefers hill streams.

Observations: During present investigation, observed at night in the pine forests near streams in the meadow area.

Genus: *Ptyas* Fitzinger, 1843

1843. *Ptyas* Fitzinger, *Systema Reptilium. Amblyglossae*, pp 106.

Ptyas mucosus (Linnaeus, 1758) (Indian Rat Snake)

1758. *Coluber mucosus* Linnaeus, *Mus. Ad. Frid*, 37, pl. 23

1864. *Ptyas mucosus* Gunther, *Reptiles of British India*, pp. 249

Diagnostic Characters: A large slender snake, reaches up to 3500 mm in length. Head distinctly broader than the neck. Live colouration olive green to brown, yellowish or greyish above, with irregular and strongly marked black cross-bars on the posterior half of the body; yellowish-white below, the posterior ventrals and sub-caudals edged with black; lips and throat white, the scales edged with black.

Distribution: Found throughout India. From Himachal Pradesh reported from all parts of the state except Trans-Himalayas. Elsewhere, Sri Lanka, Pakistan, Afghanistan, Nepal, Bangladesh, Myanmar and southern China.

Habits and Habitat: Feeds mainly on small mammals, toads and birds. Common in status, conservation status WLP, 1972 schedule-II.

Observations: During present investigation recorded only once from the Khajjiar meadow in summers of 2010.



A: *Rana liebigii* B: *Laudakia tuberculata*

Fig. 3: Some Amphibians and reptiles recorded in Khajjiar lake area.

DISCUSSION

Overall bio-diversity decreases with increase in altitude and the presence of only 6 species of herpetofauna in Khajjiar, at middle Himalayan zone of the state, gets support from some previous studies like Mehta [21] who reported 14 reptile species from Renuka wetland, and Saikia and Sharma [22] reported 17 species from Simbalbara Wildlife Sanctuary, both in lower or Shivalik zone. Out of six species only one reptilian species *Ptyas mucosus* (Indian Rat Snake) is place in Wild Life Protection Act, 1972 in schedule-II. But due to heavy intervention of human activities in Khajjiar area, ecology and habitat of this species have been disturbed. There is a heavy load of tourism which is resulting in construction activities hence reduction and disturbance in wild habitat [23]. Pesticides and fertilizers used in the nearby orchards have adverse effects on some species. Contamination of breeding grounds is a major threat to some animal. So this area needs immediate attention for the specific conservation intervention for herpetofauna. Amphibians are more prone to these threats. They do not cause any depredation to agriculture crops, fruits and vegetables. On the contrary their food mainly consists of small insects and their larvae, algae, snails etc. which are pests of crops and vectors of some diseases. Amphibians are ecological indicators and in recent decades there has been a dramatic decrease in their populations. Only two species of amphibian were recorded during the present study while India has the third largest amphibian population in Asia. The amphibian fauna of India comprises of 214 species of which 167 (66.3%) are endemic to the country. In spite of its broad variety of species, India holds second place on the list of countries having the most number of threatened amphibian species in Asia, with 67 (25%) of its species facing possible extinction. Further specific studies are required related to the habitat, ecology, climate change and impact of human intervention on this herpetofauna. One of such kind study has been conducted by Bahuguna [24] who studied altitudinal variations in morphological characters of *Laudakia tuberculata* from Western Himalayas (Uttarakhand), India.

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REFERENCES

- [1] Lagler, K.F., John, E.B. and Robert, R.M., 1962. Ichthyology, the study of fishes. John Willy and Sons, New York and London, p 543.
- [2] Mehta, H.S., 2005. Fauna Western Himalaya (Part-2). Zoological Survey of India, Kolkata, p 359.
- [3] Annandale, N., 1907. The distribution of *Bufo andersonii*. Records of Indian Museum, 1: 171-172.
- [4] Boulenger, G.A., 1920. A monograph of south Asian Pipuan, Melanesian and Australian frog of genus *Rana*. Records of Indian Museum, 20: 1- 226.

- [5] Kriplani, M., 1952. On Indian tadpoles with suctorial disc. Records of Indian Museum, 50: 359-366.
- [6] Dubois, A., 1975. Un nouveau sous-genre (Paa) et trois nouvelles espèces du genre Rana. Remarques sur la phylogénie des Ranides (Amphibiens, Anoures). Bailey Museum of Natural History, 231: 1093-1145.
- [7] Tilak, R. and Mehta, H.S., 1983. On a collection of amphibians of the Sirmour District (Himachal Pradesh). Research Bulletin of Panjab University, 34: 157-166.
- [8] Mehta, H.S., 2000 a. Amphibia. In: Fauna of Renuka Wetland. Zoological Survey of India, 151-161.
- [9] Smith, M., 1935. The Fauna of British India including Ceylon and Burma. Reptilia and Amphibia. Vol. 2. Sauria. Taylor and Francis Ltd., London, 583.
- [10] Gruber, U., 1981. Notes on the Herpetofauna of Kashmir and Ladakh. British Journal of Herpetology, 6: 145-150.
- [11] Dutta, S.K., 1997. Amphibians of India and Sri Lanka (checklist and bibliography). Odyssey Publishing House, Bhubaneswar, India, p 342.
- [12] Chanda, 2002. Hand book. Indian Amphibians. Zoological Survey of India, Kolkata p 335.
- [13] Dinesh, K.P., Radhakrishnan, C., Gururaja, K.V. and Bhatta, G.K., 2009. An annotated checklist of Amphibia of India with some insights into the patterns of species discoveries, distribution and endemism. Records of Zoological Survey of India, 302: 1-153.
- [14] Venugopal, P.D., 2010. An updated and annotated list of Indian lizards (Reptilia: Sauria) based on a review of distribution records and checklists of Indian reptiles. Journal of Threatened Taxa, 2: 725-738.
- [15] Saikia, U. and Sharma, D.K., 2009. Faunal Biodiversity of Simbalbara wildlife Sanctuary. Zoological Survey of India, Kolkata, 41: 65-79.
- [16] Saikia, U., Sharma, D.K. and Sharma, R.M., 2007. Checklist of the Reptilian fauna of Himachal Pradesh. Reptile Rap, 8: 6-9.
- [17] Saikia, U. and Sharma, D.K., 2008. Herpetofauna. In: fauna of Pin Valley National Park. Zoological Survey of India, 34: 93-96.
- [18] Saikia, U. and Mehta, H.S., 2009. Faunal Biodiversity of Pong Dam. Zoological Survey of India, 12: 99-108.
- [19] Vasudevan, K., Kumar, A. and Chellam, R., 2001. Structure and composition of rain forest amphibian communities in Kalalad-Mundunthurai Tiger Reserve. Current Science, 80: 406-412.
- [20] Ishwar, N.M., Chellam, R. and Kumar, A., 2001. Distribution of forest floor reptiles in the rainforest of Kalakad-Mundanthurai Tiger Reserve, South India., Current Science, 80: 413-418.
- [21] Mehta, H.S., 2000 b. Reptilia, In: Fauna of Renuka wetland. Zoological Survey of India, 163-168.
- [22] Saikia, U. and Sharma, D.K., 2009. Faunal Biodiversity of Simbalbara wildlife Sanctuary. Zoological Survey of India, Kolkata, 41: 65-79.
- [23] Singh, V. and Banyal, H.S., 2012. Diversity and Ecology of Mammals in Kalatop-Khajjiar Wildlife Sanctuary, District Chamba (Himachal Pradesh), India. International Journal of Science and Nature, 3: 125-128.
- [24] Bahuguna, A., 2008. Altitudinal Variations in Morphological Characters of *Laudakia tuberculata* Hardwicke and Gray, 1827 from Western Himalayas (Uttarakhand), India. Russian Journal of Herpetology, 15: 207-211.