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STATUS SURVEY OF THE KHASI HILLS ROCK TOAD (*BUFOIDES MEGHALAYANA) AT CHERRAPUNJEE, MEGHALAYA*

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INTRODUCTION AND BRIEF HISTORY

The Khasi Hills Rock Toad (*Bufoides meghalayana*) was first collected on 17th April, 1970 amongst the leaf axils of Screw Pine trees (*Pandanus furcatus*) from the plateau of a large hill at Mawblang, about 5 km south-east of Cherrapunjee town in East Khasi Hills district of Meghalaya State, Northeastern India by G.M. Yazdani and S.K. Chanda. The collectors described the species as *Ansonia meghalayana* assuming its relationship with *Ghatophryne ornata* of Brahmagiri hills in Coorg, Karnataka due to "absence of parotoid glands" but thought it distinct from it by presence of cranial ridges and the hidden tympanum (Yazdani and Chanda, 1971). The describers observed the species breeding in the leaf axils of screw pines where they also collected egg capsules measuring 91-122 mm with 23-40 eggs in them, each measuring about 4 mm in diameter. They presumed that these tiny toads migrated to the screw pine trees from elsewhere for breeding purpose and bred in the rain water accumulated in the leaf axils due to non-availability of suitable water bodies on the Mawblang plateau and also to secure better protection for their brood.

Later Pillai and Yazdani (1973) again surveyed the Mawblang area of Cherrapunjee where they found these toads breeding only in elevated pot-holes on boulders, half a meter above the ground. These pot-holes were 12-25 cm in diameter and 25-40 cm in depth, contained only 1-3 liters of water and sheltered up to 400 metamorphosed toadlets but no eggs or dead tadpoles. These authors concluded that the tadpoles of this species fed on eggs and dead tadpoles in the pot-holes or resorted to cannibalism. The small size of the tadpoles and comparatively short larval duration supported their conclusion. Due to absence of sucker-like oral discs in tadpoles and as the adults do not breed in running water of streams like *Ghatophryne*, led these authors to accommodate the species in a new genus *Bufoides*.

Das *et al.* (2009) re-discovered the species from the deep horizontal cleft of a sandstone boulder along a dry rocky stream about 100 meters from Mawblang village. The toads exhibited "unken" reflex and both sexes were found to possess parotoid glands.

Specimens reported earlier as *Bufoides meghalayana* from Ngengpui Wildlife Sanctuary and Dampa Tiger Reserve in Mizoram by Pawar and Birand (2001) and the one collected from Tura in Garo hills of Meghalaya by Firoz Ahmed were examined and found to be undescribed species of the genus *Bufoides* which is endemic to India and currently considered monotypic (Das *et al.*, 2009).

METHODOLOGY

To determine the population status of the Khasi Hills Rock Toad (*Bufoides meghalayana*) in and around Cherrapunjee, Meghalaya, a status survey tour was conducted for 16 days from 25th June to 11th July, 2010 in the above mentioned areas of the East Khasi Hills. The three-member survey team conducted day and night surveys in all places likely to harbour this Rock Toad. This included the plateau of Mawblang, rocky ravines around Mawsmai caves, Eco-park and Thangkharang Park, hill streams near Saitsophen (Lower Sohra), areas around Mawmluh Cement Factory and the areas with screw pine vegetation atop Nohkhalikhai and Dainthlein Waterfalls. These areas were first visited during the daytime and possible habitats of the Rock Toad were earmarked which were visited during the evening with powerful torch lights to locate these unique anurans. GPS readings were taken at all these sites to determine the exact localities

of occurrence of these amphibians using a Garmin C-12 Global Positioning System. Air temperatures inside the rock crevices where these toads were located were also taken with a digital thermometer.

OBSERVATIONS AND RESULTS

The Khasi Hills Rock Toad (*Bufoides meghalayana*) was located at only three sites among all the areas surveyed in and around Cherrapunjee town of the East Khasi Hills, Meghalaya. The names, geographical co-ordinates and altitude of these three sites are given below :

1) Rock-crevices inside sandstone boulders in the wet stream on the eastern side of Mawblang plateau :

25.13893-25.13898 N

91.44018-91.44020 E

Between the altitudes of 1084-1093 meters above mean sea level.

2) Crevices among boulders in the nearby hill-stream with water on the southern side of Mawblang plateau :

25.13857 N

91.43916 E

altitude: 1113 m

3) Forested rocky ravine near Mawsmai Cave area :

25.14586 N

91.43477 E

altitude : 1192 m

The three sites where the species were located were all within 1.5 kilometer of each other. The descriptions of the three sites are given below :

First Stream :

The first was a wet stream (25.13893-25.13898 N, 91.44018-91.44020 E, altitude: 1084-1093 meters above mean sea level) on the eastern side of the Mawblang plateau, within 100 meters of Mawblang village. There was no running water in the stream during June-July but the stream-bed was wet due to heavy rains. The surfaces of rocks and sandstone boulders were covered with moss and were consequently very slippery. This stream was well-shaded by canopy cover provided by several screw pine (*Pandanus furcatus*) trees. A few pot-holes were located on boulders down-stream. These were 30-50 cm in diameter but only 15-20 cm in depth. They contained water to the brim and sheltered several tadpoles of the Twin-spotted Tree Frog (*Rhacophorus bipunctatus*) which is a species very common around Cherrapunjee. None of the pot-holes contained any tadpoles of the Rock Toad (*Bufoides meghalayana*). The adult Rock Toads were found hiding inside several clefts of sandstone boulders in the stream. However, the total population in this stream was definitely less than 50.

Second Stream :

Another stream on the southern side of the Mawblang plateau (25.13857 N, 91.43916 E and altitude : 1113 meters above mean sea level) also sheltered a few Rock Toads (*Bufoides meghalayana*). This stream was less steep and less rocky with few sandstone boulders. However this stream was more shaded with screw pine trees. There was more water in the stream than the previous one although the stream did not have running water in June-July. Most of the water was restricted to huge rock-pools on the stream-bed and they all contained hundreds of tadpoles of the Twin-spotted Tree Frog (*Rhacophorus bipunctatus*). None of the rock-pools had any tadpoles of the Rock Toad (*Bufoides meghalayana*). Very few adult Rock Toads were found hiding inside the crevices of the sandstone boulders on the side of the stream. Their population here was definitely less than 30.

Third Stream :

As we could not find any other hill-streams on or near the Mawblang plateau which was strewn with huge boulders and covered at several places with Screw Pine (*Pandanus furcatus*) trees, we searched for the Rock toads among crevices of the boulders on the plateau itself and among the leaf axils of the Screw Pine trees but could not locate any. We therefore continued our survey in other localities in and around Cherrapunjee. Opposite to the Mawblang plateau is the seven cascades of the Nohsngithiang waterfalls on the top of which is another flat plateau which is called as the Eco-park. This area unlike the Mawblang plateau has no vegetation and is totally exposed to the scorching sun. Although like the Mawblang plateau this area too had a number of rocky pot-holes, no tadpoles of any anurans were found in them.

We continued our survey in the sacred grove forested area near the Mawsmai cave about a kilometer from the Eco-park. This is the largest sacred grove in and around Cherrapunjee. This area has some good mixed forest with canopy cover. On the way to this sacred forest we found two streams but both had sandy banks with no boulders and hence no Rock Toads. Finally while surveying inside the sacred forest at Mawsmai cave area we located a very narrow hill-stream passing through a rocky ravine (25.14586 N, 91.43477 E and altitude : 1192 m) just opposite to the entrance

area of the Mawsmai cave but deep inside the forest. This hill-stream had very small rocks and boulders but was completely shaded and covered by a canopy of mixed deciduous trees. There were some screw pine trees in the vicinity of the stream too. While overturning the rocks on the stream-side we located eggs of *Xenophrys sp* in the afternoon. Later in the evening we heard *Xenophrys parva* calling and saw some *Amolops gerbillus* on the stream-side. Among the clefts of the rocks on the stream-side of this rocky ravine we suddenly located a single Rock Toad (*Bufoides meghalayana*). This stream being narrow with little water and very few small rocks on the sides sheltered a very small population of the Rock Toad which was estimated to be less than 20.

The air temperatures inside the rock clefts and crevices in the three streams where the Rock Toad was found varied from 21.5°C-24.5°C at around 8 pm. Considering the rarity of the species, only five specimens were collected (3 males and 2 females) from the three hill-streams mentioned above. The snout to vent lengths of the males varied from 38.4-39.1 mm (n = 3) and the females from 38.8-39.6 mm (n = 2) thus showing no significant differences in size. However, the males had bright yellow marblings on the lower flanks near the hind legs and in the inguinal region which was absent in the females.

Both sexes exhibited "unken" reflex on capturing, a response widespread in anurans with noxious dermal secretions. The thickness of the fleshy dermal pads on the palm and sole seemed to be similar in both sexes and they could both climb vertical surfaces just like geckos. Both sexes also possessed parotoid glands.

Data on annual rainfall at Cherrapunjee from 1973-2009 was gathered from the Meteorological Station of the India Meteorological Department at Saitsophen, Lower Cherrapunjee. The data showed no decrease or significant fluctuations in rainfall at Cherrapunjee over the last 37 years.

Many other areas in and around Cherrapunjee like the exposed and vegetation-less streams near the Fire Service Station at Saitsophen (Lower Sohra); the small but exposed streams near Mawmluh Cement Factory, Mawmluh; the areas having *Pandanus* trees atop the Nohkhalikhai and Dainthlein Waterfalls in Upper Sohra were thoroughly surveyed but none harboured any Rock Toads (*Bufoides meghalayana*).

Extensive rock-blasting and stone-quarrying activities were observed in and around Cherrapunjee and all over the Khasi hills. Large portions of the hills were being blasted with dynamite. Even the plateau at Mawblang and the hill near Saitsophen (Lower Cherrapunjee) were being blasted everyday. Stones were being quarried by large number of labourers using bull-dozers and these were being carried away to Shillong in huge trucks throughout the night.

DISCUSSION

This survey revealed that this highly saxicolous and extremely flattened rock toad (*Bufoides meghalayana*) was specialized and adapted to live inside clefts and crevices of boulders in three rocky hill-stream beds on the Mawblang plateau and near the Mawsmai cave area of Cherrapunjee, East Khasi hills of Meghalaya, Northeastern India. Air temperatures inside these rocky clefts and crevices varied from 21.5 – 24.5 °C. It was noticed that canopy-covered rocky streams had a better chance to harbour these Rock Toads. The total lengths and the thickness of the fleshy dermal pads on the palm and sole did not vary between sexes and cannot be used to identify males and females as claimed by Pillai and Yazdani (1973). However, males had bright yellow marblings on the lower flanks near the hind legs and in the inguinal region which was absent in the females. Both sexes possessed parotoid glands, exhibited unken reflex and could climb vertical rock surfaces with ease.

Data on annual rainfall at Cherrapunjee from 1973-2009 gathered from the Meteorological Station of the India Meteorological Department at Saitsophen, Lower Cherrapunjee revealed no significant fluctuations in rainfall at Cherrapunjee over the last 37 years except for some lower rainfall in certain years like 2005, 2006 and 2009.

RAINFALL CHART OF CHERRAPUNJEE

Year	Rainfall (in mm)
1973	10910.1
1974	24555.3
1975	11961.4
1976	9019.4
1977	12109.7
1978	6950.3
1979	12094.8
1980	9132.9
1981	9417.5
1982	10380.8
1983	9764.0
1984	16760.7
1985	11816.3
1986	8139.5

Year	Rainfall (in mm)
1987	13153.3
1988	17930.4
1989	13460.0
1990	11597.7
1991	13505.9
1992	8536.5
1993	12801.3
1994	11204.8
1995	14209.8
1996	12896.6
1997	8993.6
1998	14536.9
1999	12502.8
2000	12262.2
2001	8971.5
2002	12262.0
2003	10498.8
2004	14970.8
2005	9758.0
2006	8734.1
2007	12646.8
2008	11414.6
2009	9069.9

Extensive rock-blasting and stone-quarrying activities in and around Cherrapunjee and also in the Mawblang plateau area, the type locality and only known area of occurrence of the Rock Toad is definitely affecting the population of the species and is a cause of serious concern for the future survival of *Bufoides meghalayana*.

The Khasi Hills Rock Toad (*Bufoides meghalayana*) could be located in only three sites, all rocky hill-stream beds with good canopy cover, although all possible localities were thoroughly searched in and around Cherrapunjee of the East Khasi hills. These small but extremely flattened toads were found to hide inside rocky clefts and crevices of boulders in these three sites merely 1.5 kilometer apart and surrounding the type locality of the species. Their total population in the three hill-streams seemed to be less than 100 individuals. The IUCN currently considers the Khasi Hills Rock Toad (*Bufoides meghalayana*) as Endangered. Considering their highly specialized saxicolous habit and extremely small distribution range so far known, we propose that this species be considered as Critically Endangered (CR) as it meets the following criteria set by IUCN (B2biiiC2ai):

B. Geographical Range

2. Area of occupancy estimated to be less than 10 sq km.

b. Continuing decline observed in

iii. Area, extent and quality of habitat.

C. Population size estimated to number fewer than 250 mature individuals.

2. A continuing decline observed in number of mature individuals.

a. Population structure in the form of the following

i. No subpopulation estimated to contain more than 50 mature individuals.

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Fig. 1. Rocky plateau at Mawblang with Screw Pines

Fig. 2. Horizontal rock cleft on boulder inside which Rock Toad resides

Fig. 3. Searching for Rock Toad inside cleft of boulder.

Fig. 4. Wet stream at Mawblang with boulders & canopy cover.

Fig. 5. Male of Khasi Hill Rock Toad (*Bufoides meghalayana*)

Fig. 6. Male and female Rock Toads

Fig. 7. Rock Toad showing unken reflex.

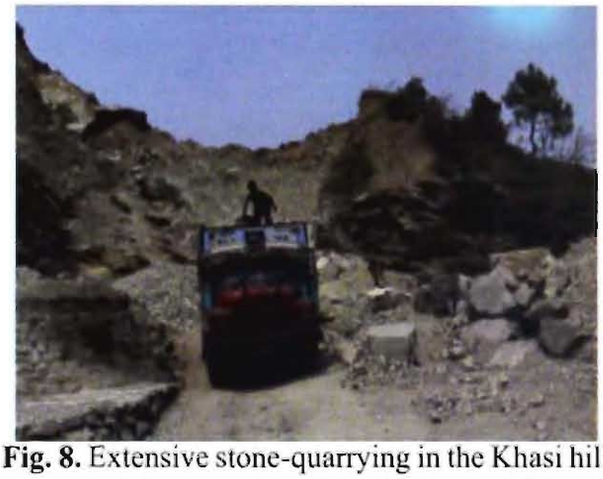

Fig. 8. Extensive stone-quarrying in the Khasi hills