

Notes on Cranial-Ridged Toads of Pakistan and Description of a New Subspecies (Amphibia: Bufonidae)

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Abstract. The southeast Asian toad *Bufo melanostictus* has recently been found to be confined to Siwaliks of Pakistan. Morphological analysis of this toad from Pakistan distinguishes it from the southeast Asian toads, thus validating it as a distinct subspecies.

INTRODUCTION

Until Khan (1969) *Bufo melanostictus* was regarded to be the common toad of Pakistan (Khan, 1965, 1968), an assumption which was based on acceptance of statements of several herpetologists (Murray, 1884; Annandale and Rao, 1918; Günther, 1864; Boulenger, 1890). When published (Khan, 1965), Dr. Mertens (personal comm., 1967) wrote to point out that the common toad referred to in the paper as *Bufo melanostictus* is actually *B. stomaticus* Lütken. Earlier, Minton (1962, 1966) identified the common toad of Pakistan as *B. andersoni*. Mertens (1969) and Khan (1969) discussed this problem at length. It is unbelievable that a toad (Fig. 1A, *B. melanostictus* (with so characteristic morphology was "common" in a territory (Pakistan) back in 1884 (Murray) and 1918 (Annandale and Roa) has been exterminated and replaced or confused by another morphologically different species (Fig. 2, *B. stomaticus*). Apparently, early authors were carried by wrong assumptions creating confusion in literature (Khan, 1969; Mertens, 1969). However, along the eastern border of Pakistan *B. melanostictus* "is the commonest among Indian species and also the amphibian most likely to be seen", (Daniel, 1963). In India *B. melanostictus* extends from sea level to 6000 ft in the hills. McCann (1928) is stated to have observed thousands of young toads migrating in Rajputana area.

Mertens (1969) and Khan (1969) reported this species from Hazara Division, Eastern NWFP, Pakistan. Subsequently, the species was found to be quite common in several cities in western Hazara Division: Ooghi Fort, a little town in the north of Manshera, Datta, Phagla (both near Manshera) and Islamabad. In Goi Madan, District Kotli southern Azad Kashmir, it is quite common species.

I received two pairs of toads for comparison from Taiwan through curtesy of a friend, and a collection of 13 museum specimens from Sri Lanka through curtesy of Dr. George Zug, Curator Amphibians and Reptiles United States National Museum, Washington. In the present report this material is compared with Pakistani toads, which differ morphologically from its Southeast Asian congeners.

Characteristics of cranial-ridged toads

Prominent cranial crests and heavily tuberculated body distinguish *B. melanostictus* and *B. himalayanus* from rest of the Pakistani (Khan and Tasnim, 1987) and Indian species of toads (Daniel, 1963). Typically an adult *B. melanostictus* has an extensive system of bony prominences arising from the dorsal lateral sides of the skull (Fig. 1B). Canthal ridge marks the canthus rostralis, extends onto preorbital, supraorbital, orbito-parotidal, supratympanic and supraparotidal areas with an occasional short parietal ridge. Prominent dark brown or black cornifications line the cranial crests, lips, tympanum, eyelids, parotid glands, tip of fingers and toes, web and body tubercles, giving a hardy sturdy appearance to the toad. Juvenile toad develop cranial prominences at 20-30 mm snout-vent length which are cornified at 35-40 mm (Daniel, 1963).

In the following section short description and notes on natural history of Pakistani bony-ridged toads are provided.

Bufo himalayanus Günther
(Himalayan broad-skulled toad)

1864 *Bufo melanostictus* var. *himalayanus* Gunther, Rept. brit. India; 422.

Type locality
Sikkim and Nepal.

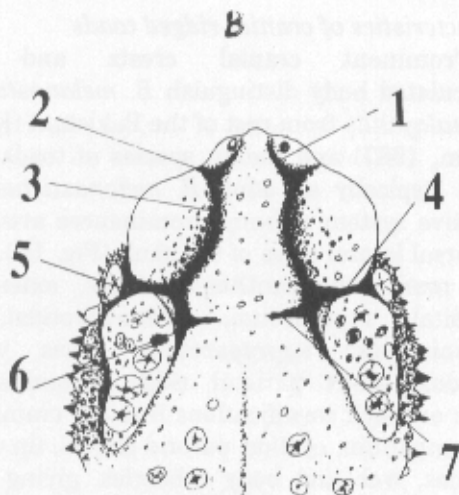
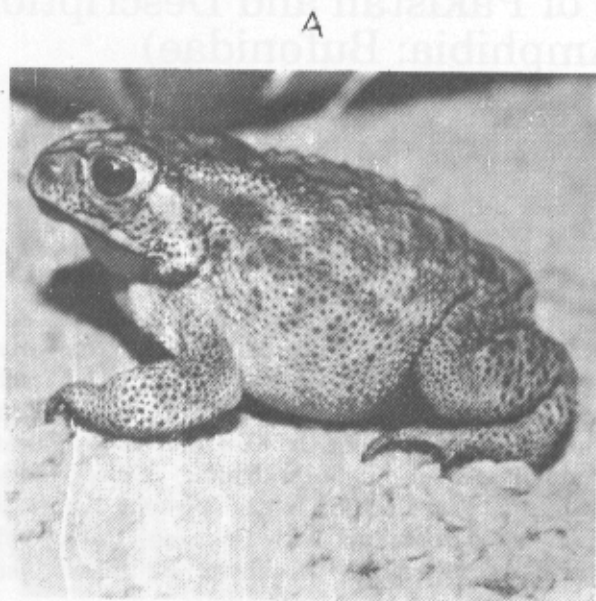


Fig. 1. A; *Bufo melanostictus hazarensis* new subspecies, holotype, from Islamabad, Pakistan; B, dorsal side of head, cranial ridges (crests): 1, Canthal; 2, Preorbital; 3, Supraorbital; 4, Orbitoparotid; 5, Supratympanic; 6, Supraparotid; 7, Parietal.

Diagnosis

First described as a variety of *B. melanostictus*, from which it differs in following characters:

1. Head deeply concave with only supraorbital ridges.
2. Interorbital space broader than upper eyelid.
3. Tympanum very small or indistinct.
4. First finger does not extend beyond second.

5. Toes with single subarticular tubercle, no tarsal fold.
6. Parotid as long as head.
7. Body with irregular porous tubercles.

Snout-vent length 130-132 mm.

Colour

Uniform brown. Cranial crest and tips of digits dark brown.

Tadpole

Head flat, body darker, bulging, tail weak, low fins; naris slightly nearer eye than snout; eyes small sunken; oral disc anteroventral, labial tooth row formula typically bufonid: 2(2)/3, beak serrated, oral papillae lateral; colour uniformly black, ventrum lighter. The tadpoles are found, at high elevation in the Himalayan range, in small, calm pools along torrents, with algal vegetation.

Total length of tadpole 28-30, tail 19-20 mm.

Natural history notes

B. himalayanus is a mountain species. Primarily nocturnal, however, often it is seen moving about in broad day light among rocks and vegetation feeding on grasshoppers, moths, ants and other invertebrate animals. It rests during day under stones or in fissures and holes in ground.

Breeding activity starts after a downpour, during May-July, males croak in low tone "curr, curr" repeated several times. Eggs are laid in double string of jelly, in shallow pools along torrents. The toad hibernates during winter under stones and in fissures in ground from September to March.

Distribution

It has been recorded from Nepal and Sikkim in the Himalayas at 2000-3500 m of elevation. In Pakistan it is known from Azad Kashmir, and Hazara Division, Northwestern Frontier Province.

Bufo melanostictus Schneider
(Southeast Asian broad-skulled toad)
(Fig. 1)

1799 *Bufo melanostictus* Schneider, Hist. Amph., 1: 216.

Type locality
India.

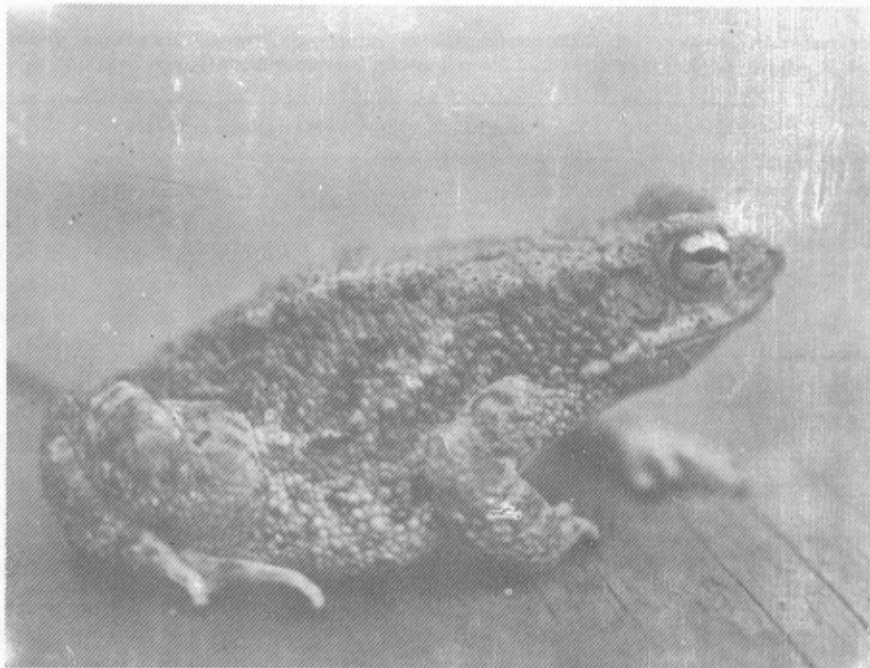


Fig. 2. *Bufo stomaticus* Lutken, from Rabwah, Punjab, Pakistan.

Diagnosis

1. Head with distinct canthal, preorbital, supraorbital, postorbital and a short orbito-tympanic, cranial crests.
2. Interorbital space much broader than upper eyelid.
3. Tympanum very distinct, at least two third the diameter of eye.
4. First finger generally but not always extends beyond second.
5. Toes with single subarticular tubercles.
6. Parotid elongated, kidney-shaped with dark brown scattered branching concretions.
7. Skin heavily tuberculated on flanks tubercles usually tipped with dark brown spines. Cranial crests, lips, digit tips, metacarpal and metatarsal tubercles are cornified with dark brown, which tend to peel off in preserved specimens; head almost smooth.

Largest toad of Pakistan, female exceeds 150 mm in snout-vent length.

Colour

Dorsum uniform gray of various shades, brown or reddish with dark spots, ventrum uniform dirty white, speckled with light brown on chin and throat.

The throat of breeding male is light orange or yellow. It develops cornified pads on inner side of first and second fingers.

Tadpole

The tadpoles are uniform dark, inhabits side pools along hilly torrents, schools of them swarm along the marginal waters of ponds and puddles feeding on any type of algal material. The body is typically bufonid, globular with weak tail, dorsal fin is broad while ventral is narrow. The oral disc is typically bufonid, with 2(2)/3 labial tooth row formula, the oral papillae are lateral. The beak is finely serrated and sharp (Khan, 1991).

Total length of larva 26-27 mm, tail 19-20 mm.

Natural history notes

The Southeast Asian toad is moderately rare in Pakistan and confined to northern hilly ranges and Azad Kashmir. The toad is nocturnal, it appears soon after sunset, during day, and it hides under stones, logs, under vegetation, in holes and crevices in ground. Once a suitable place is selected, it is permanently shared with several toads.

The toad is lethargic timid animal. It moves about with deliberate hops from place to place in search of insects on which it feeds. In tropical

Table I. Morphological comparison of *Bufo melanostictus hazarensis* new subspecies from Ooghi, Manshera, Islamabad, Pakistan with *B. melanostictus* from Taiwan (measurements in mm).

Character	Ooghi		Manshera & Datta		Taiwan	
	Male	Female	Male	Female	Male	Female
Sex						
Snout-vent length	65-83	79-111	65-80	80-95	65	72-75
Head length	20-24	22-33	23-25	23-27	14-18	20-22
Head breadth	20-31	29-39	24-27	23-36	20-22	21-27
Snout shape	round	round	obtuse	obtuse	round	round
Rostral ridge	+		+		+	
Temporal ridge	Slight		Slight			
Paratoid shape	kidney		kidney		ellipsoidal	
Paratoid length	14-20	15-22	13-22	20-24	11-13	15
Paratoid breadth	6-8	7-11	9-10	8-10	5-5.5	9-8
Tympanic diameter	4-5	5-5	4-5	4-5	3-4	4-5
Orbit diameter	8-10	9		9-10	7-8.5	8-9
Width of upper eyelid	4-7	6-7		6-7	7-8	5-5
Interorbital space	8-11	10-13		10-11	8-8.6	8-9.5
Tibial length	25-31	29-37		30-34	23-25.5	26
Tarso-metatarsal joint	eye		eye		eye	
Middorsal tubercles	6/7-9/7	7/9-9/6		7/7		7/6
Subarticular tubercles under penultimate pharynx	double		double		3rd finger double	
Dorsal colour	dark brown		light brown		dark brown	

southeast Asia it is most common and comes out after sunset in large numbers, frequenting mostly human habitations, where it congregates under street lamps to feed on photophilic insects (Church, 1960).

In temperate environs of western Himalayas, monsoon rains, from July to August initiate breeding. Males, gather in shallow side-pools along torrents and ponds. The call in low melodious "curr, curr, curr" repeated several times ending in a whistling note. The calling males become aggressive, tugging and jumping over each other, males for exceed female in numbers. McCann (1928) records it to breed in the every available space containing any amount of water as soon as first showers of monsoon come. Males are considerable smaller than females. However, in tropical Southeast Asia, this toad is known to breed throughout the year (Church, 1960).

Calling males occasionally jump over each other and try to secure a nuptial hold. However, kicks and zestful wriggling dislodge them from each other and soon they resume calling. Female lurch round, as soon one comes close, a calling male jumps over it and quickly tightens its nuptial clasp, the other suitors are shaken off as the nuptial pair moves to a quieter place away from the site.

Eggs are laid in double jelly string, in quitter water, which are wound round the submerged vegetation as female moves round submerged vegetation to wound the egg string round it. Eggs are enclosed in double gelatinous capsule (Khan, 1982).

Swarms of recently metamorphosed toadlets from synchronized pairings leave water, many fall pray to predators and are crushed under passing traffic.

Distribution

This toad is confined to District Hazara, northeastern Northwestern Frontier Province, Alpine Punjab and Azad Kashmir (Mertens, 1969; Khan, 1972; Khan and Tasnim, 1987). It is the most common and widely distributed toad in southeast Asia (Church, 1960) extending throughout northern and peninsular India (Daniel, 1963).

Comparison

Sexual dimorphism is clearly marked in Pakistani population of *Bufo melanostictus*, females are much larger in body proportions than males (Table I), as characteristic of this toad throughout its range. The specimens from Sri Lanka in the

collection of USNM consists of mostly young animals (snout-vent length of largest female 87.7).

Pakistani toads differ from southeast Asia population (in parenthesis) by their kidney shaped parotids (elliptical), subarticular tubercles double under penultimate plalynx of all fingers (only under 3rd finger), rostral ridge absent (present), temporal ridge indicated (not indicated), dorsum light brown (dark brown). These difference strongly suggest subspecific recognition of Pakistani toads, which is being described as a new race.

Bufo melanostictus hazarensis, new subspecies
(Fig. 1).

Type locality

Toads from Ooghi, Manshera and Data, Hazara Division, eastern NWFP, Pakistan.

Description and comparison

Table I compares morphometric data of *B. melanostictus hazarensis* new subspecies with Southeast Asian *B. melanostictus*. The new Pakistani toad differs from southeast Asian bony ridge bearing toads (in parenthesis) by their kidney shaped parotids (elliptical), subarticular tubercles double under penultimate phalaynx of all fingers (only under 3rd finger), rostral ridge absent (present), temporal ridge indicated (not indicated), dorsum light brown (dark brown).

DISCUSSION

Blair (1970) recognized two major adaptive lines: southern line of broad-skulled (or thick-skulled) group, which includes *B. melanostictus* and *B. himalayanus*, which evolved from a *melanostictus*-like ancestor. The northern line narrow-skulled (or thin-skulled) group, which includes *stomaticus* and *viridis* toads, evolved from a *calamita*-like ancestor. Several species with intermediate skulls are recognized which Savage (1973) suggests form ancestral bufonid stock of all toads.

Two centers of Cretaceous development of bufonids have been suggested (Savage, 1973): first tropical African which remained confined to Africa, second tropical South American which radiated to north through Isthmian links into tropical North

America in Paleocene. In the Eocene tropical North American group (broad-skulled) crossed the Bering land bridge and radiated to the tropical Asia to (*viridis*-group). Later Indo-Pakistan subcontinent was invaded from the east by Indo-Malayan line (*melanostictus*) and from the northeast and northwest by northern forms (*viridis*).

Perhaps wide range of *Bufo melanostictus* throughout Southeast Asia, neighboring India and Sri Lanka (Daniel, 1963), prompted herpetologists, in past, to believe that *B. melanostictus* is also widely ranged and is the common toad of Pakistan (Mertens, 1969; Khan, 1969).

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(Received 12 August 1999)