

Additional records of the Schneider's Toad *Duttaphrynus scaber* (Anura: Bufonidae) from India, with notes on its natural history

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Abstract

Schneider's Toad, *Duttaphrynus scaber* (Schneider, 1799) is known to be distributed over the coastal peninsular, northern parts of central India and northeastern states of India. However, despite the availability of multiple published reports, there are few verified records of its occurrence from central India. Herein, we present two records of *D. scaber*, one from the Vidarbha region of Maharashtra State, central India with morphometric data, another from northern Western Ghats, from the Goa region, with morphometric, as well as molecular, data. The site selection for dormancy, sympatric species, and microhabitat preferences during the breeding season of *Duttaphrynus scaber* is discussed.

Received: 19 August 2020

Accepted: 22 November 2020

Published online: 31 December 2020

Key words: Geographic distribution, natural history, range extension, Vidarbha Region, India

Introduction

Duttaphrynus scaber (Schneider, 1799) was described as *Bufo scaber* from "Indis Orientali". The nomen *Bufo fergusonii* Boulenger, 1892 (type locality, Trevandrum on the Cavalry Parade Ground, Kerala, India) and *Bufo stomaticus peninsularis* Rao, 1920 (type locality, Mavkote and Watekille, Coorg, Karnataka, India) are currently treated as junior synonyms of *Duttaphrynus scaber* (Frost, 2020).

Duttaphrynus scaber is considered endemic to India and Sri Lanka (Dutta, 1997). In India, most of its distribution records in peninsular India are from Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, Odisha, West Bengal, (Frost, 2020). Additionally, there is a recent report from the Panna Tiger Reserve, Madhya Pradesh (Prasad et al., 2020) and another from Manipur (Mathew and Sen, 2009) in northeastern India (Frost, 2020).

The IUCN Red list of threatened species considered the conservation status of the species as Least Concern (IUCN, 2020).

Padhye et al. (2013) provided detailed information on the advertisement call pattern of *Duttaphrynus scaber* and its range of distribution, with genetic data. They also provided an additional record, in the form of the northernmost limit for the species in the northern Western Ghats, at Supdahad, Gujarat, India. Based on their collections, a record at Thiruvananthapuram, Kerala, India, is the southern limit and one at Manipur is the eastern limit, based on their literature survey (Padhye et al., 2013).

Problems in the identification of the species and its misidentification in peninsular India and their account details were discussed by Padhye et al. (2013); Srinivasalu et al. (2013) and Ganesh et al. (2020).

This species can be distinguished and identified by a combination of morphological characters in having the head broader than long; less prominent cranial ridges; rounded snout; snout length less than the eye diameter; canthus rostralis not sharp; loreal region concave; interorbital space flat, less than the eye diameter; nostrils rounded, closer to tip of snout; tympanum half the eye diameter; tympanum to eye distance less than half tympanic diameter; parotid glands very prominent, round, not warty or spiny but thickened and somewhat uneven; tongue elongate; supratympanic fold absent; forelimbs moderate compared to hind limbs; finger tips round, but not dilated; subarticular tubercles prominent, double; a single prominent, rounded palmar tubercle; and palms and fingers with many tubercles (Dubois and Ohler, 1999).

During our amphibian explorations in the Western Ghats and the central Indian region, we collected some small-sized toads from multiple locations. They matched the description of *D. scaber* and here we report them, with their morphological details, genetic data, some aspects of natural history, and an updated map showing the distribution range for the species (Fig. 1).

Material and Methods

The collected individuals of *D. scaber* were photographed in situ using a Canon EOS Rebel T5 and a Canon SX50HS digital camera. Specimens were euthanized using MS222 (Tricaine methanesulfonate). Thigh muscle tissue samples were extracted from ZSI/WRC/A/2172 for genetic studies. After removing the tissue sample for the molecular studies, the specimens were fixed in 4% formalin solution, after 24 hours of fixation the samples were washed thoroughly in running tap water and preserved in 70% ethanol. Specimens were deposited in the National Zoological Collection of the ZSI, WRC, Pune, Maharashtra, India (ZSI/WRC/A/2172; ZSI/WRC/A/2182; ZSI/WRC/A/2240).

Collection localities

One calling male specimen of *D. scaber* was collected from a temporary mud pool in Chegule village, Belgaum, Karnataka, India (15°44'27.59"N, 74°12'39.59"E, elevation 777 m a.s.l.) in July, 2014 (ZSI/WRC/A/2172). One adult male of *D. scaber* (Fig. 2) was collected on 26 June 2017 from the backyard seasonal puddle of Gulzeb Pathan's residency, Sufiyan Nagar No. 2, Amravati, Maharashtra (20°57'30.96"N, 77°43'57.71"E, elevation 331 m a.s.l.) (ZSI/WRC/A/2182). Two additional males were collected from Wadgaon Mahure, Amravati, Maharashtra, India (20°58'15.95"N, 77°47'49.92"E, elevation 346 m a.s.l.) on 13 October 2017 (ZSI/WRC/A/2182). Also, another calling male specimen was collected from the paddy fields in Tenkasi, Tamil Nadu, India

(8°57'15.12"N; 77°18'13.6794"E, elevation 170 m a.s.l.) in August 2019 (ZSI/WRC/A/2240).

Mapping

Location data were used based on the data provided by Padhye et al. (2013), Ganesh et al., (2020), Prasad et al., (2020) and our collections from central India and the Western Ghats. The map was generated using the DIVA-GIS open source geographic information system software (Fig. 1, and Table 1).

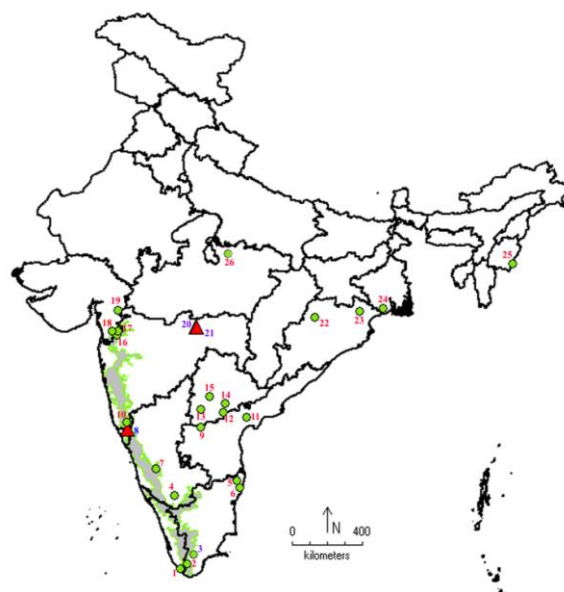


Figure 1: Map showing distribution of *Duttaphrynus scaber* in peninsular India (see Table 1).

Phylogenetic studies

DNA extraction, PCR amplification, sequencing and phylogenetic reconstruction protocols follow Dinesh et al. (2015). Mitochondrial 16S rRNA sequences from Padhye et al. (2013) and our sequence from Belgaum, Karnataka, India (northern Western Ghats) (see Table 2) were used.

Morphological studies

All the specimens were examined using a Leica MZ75, stereomicroscope (Leica Microsystems Ltd, Business Unit SM, CH-9435 Heerbrugg, Switzerland). Morphological measurements were measured using a Mitutoyo vernier caliper (to the nearest 0.1 mm) and listed in Table 3. The specimens were identified after Daniel (1963a, b), Dubois and Ohler (1999) and Padhye et al. (2013). Comparisons were made with materials deposited in the Collection of the Zoological Survey of India, Western Regional Centre, Pune, Maharashtra, India.

Abbreviations used for the morphometric characters are as follow: AG—axilla to groin distance; EL—eye length (horizontal distance between the bony orbital borders of the eye); FL1—first finger length (tip of

Table 1: Reported localities of *Duttaphrynus scaber* from India (Figure 1).

No.	Collection localities	Latitude (N)	Longitude (E)	Reference details
1	Trivandrum, Kerala	8° 30' 35.99"	76° 57' 0"	Boulenger, 1892; Daniels, 2005
2	Kalakkad, Tamil Nadu	8° 47' 21.84"	77° 18' 13.67"	Vijaykumar, 2002
3	Tenkasi, Tamil Nadu	8° 57' 15.12"	77° 18' 13.67"	new record
4	Mysore, Karnataka	12° 18' 36"	76° 39' 0"	Daniel, 1963b
5	Chengleput, Tamil Nadu	12° 41' 52.8"	80° 1' 36.83"	Das and Martin, 1998
6	Nungambakkam, Tamil Nadu	13° 3' 59.75"	79° 53' 39.84"	Rao, 1915
7	Lakkavalli, Karnataka	13° 42' 3.96"	75° 39' 21.95"	Krishnamurthy, 1999
8	Chegule, Belgaum, Karnataka	15° 44' 25.8"	74° 12' 41.76"	new record
9	Kurnool, Andhra Pradesh	15° 49' 48"	78° 1' 48"	Srinivaslu et al., 2007
10	Kolhapur, Maharashtra	16° 6' 2.98"	74° 7' 24.95"	Modak et al., 2013
11	Guntur, Andhra Pradesh	16° 18' 36.71"	80° 25' 26.75"	Srinivaslu et al., 2007
12	Nagarjun Sagar	16° 34' 21.72"	79° 12' 0.71"	Srinivaslu et al., 2007
13	Mahabubnagar, Telangana	16° 44' 4.92"	77° 59' 15.72"	Srinivaslu et al., 2007
14	Nalgonda, Telangana	17° 3' 35.99"	79° 15' 36"	Srinivaslu et al., 2007
15	Hyderabad, Telangana	17° 24' 39.96"	78° 26' 49.91"	Donahue and Daniel, 1966
16	Nashik, Maharashtra	20° 33' 33.91"	73° 38' 2.03"	Padhye et al., 2013
17	Dangs, Gujarat	20° 45' 19.36"	73° 41' 0.24"	Padhye et al., 2013
18	Vansda, Gujarat	20° 45' 43.2"	73° 22' 0.84"	Harshil Patel, pers. comm., 2019
19	Shoolpaneshwar	21° 49' 23.87"	73° 40' 46.91"	Modak et al., 2013
20	Amravati, Maharashtra	20° 57' 30.96"	77° 43' 57.71"	new record
21	Wadgaon Mahure, Maharashtra	20° 58' 15.95"	77° 47' 49.92"	new record
22	Sambalpur, Odisha	21° 28' 11.99"	83° 58' 11.99"	Dutta, 1988
23	Mayurbhanj, Odhisa	21° 45' 50.03"	86° 19' 0.11"	Dutta et al., 1999
24	Purba Medinapur, West Bengal	21° 54' 36.71"	87° 32' 26.88"	Mahapatra and Ghorai, 2019
25	Moreh, Maipur	24° 15' 13.67"	94° 17' 46.68"	Mathew and Sen, 2009
26	Panna National Park, Madhya Pradesh	24° 44' 3.48"	80° 0' 52.99"	Prasad et al., 2020

Table 2: Details of sequences used in the phylogenetic analysis (Figure 3).

Species considered in the present study	Accession number	Locality as per GenBank	Species name as per GenBank	Reference as per GenBank
<i>Duttaphrynus scaber</i>	AB530643.1	Mudigere, Chickkamagaluru, Karnataka, India	<i>Duttaphrynus scaber</i>	Hasan et al., 2014
<i>Duttaphrynus scaber</i>	MW052562.1	Chegule, Belgaum, Karnataka, India	<i>Duttaphrynus scaber</i>	Present study
<i>Duttaphrynus scaber</i>	JQ898086.1	India	<i>Duttaphrynus scaber</i>	Padhye et al., 2013
<i>Duttaphrynus scaber</i>	EU071741.1	India	<i>Bufo scaber</i>	Unpublished
<i>Duttaphrynus scaber</i>	AB530644.1	Mudigere, Chickkamagaluru, Karnataka, India	<i>Duttaphrynus scaber</i>	Hasan et al., 2014
<i>Duttaphrynus scaber</i>	KT991343.1	India	<i>Duttaphrynus scaber</i>	Chandramouli et al., 2016
<i>Duttaphrynus parietalis</i>	FJ882784.1	Not Available	<i>Duttaphrynus parietalis</i>	Bocxlaer, et al., 2009
<i>Duttaphrynus melanostictus</i>	EU071753.1	India	<i>Bufo melanostictus</i>	Unpublished
<i>Duttaphrynus melanostictus</i>	EU071759.1	India	<i>Bufo melanostictus</i>	Unpublished
<i>Duttaphrynus brevirostris</i>	FJ882786.1	Not Available	<i>Duttaphrynus brevirostris</i>	Bocxlaer et al., 2009
<i>Duttaphrynus hololius</i>	FJ882781.1	Not Available	<i>Duttaphrynus hololius</i>	Bocxlaer et al., 2009
<i>Duttaphrynus stomaticus</i>	KT991344.1	India	<i>Duttaphrynus stomaticus</i>	Chandramouli et al., 2016
<i>Duttaphrynus stomaticus</i>	KY000461.1	Not Available	<i>Duttaphrynus stomaticus</i>	Unpublished
<i>Duttaphrynus stomaticus</i>	KY000458.1	Not Available	<i>Duttaphrynus stomaticus</i>	Unpublished
<i>Duttaphrynus stomaticus</i>	KY000460.1	Not Available	<i>Duttaphrynus stomaticus</i>	Unpublished
<i>Duttaphrynus stomaticus</i>	KY000457.1	Not Available	<i>Duttaphrynus stomaticus</i>	Unpublished
<i>Duttaphrynus stomaticus</i>	AY028500.2	Not Available	<i>Duttaphrynus stomaticus</i>	Pramuk et al., 2001

finger to proximal palmar tubercle); FL2—second finger length (tip of finger to proximal palmar tubercle); FLL—forelimb length (elbow to the base of the outer palmar tubercle); FOL—foot length

(base of the inner metatarsal tubercle to the tip of the fourth toe); FTL—fourth toe length (base of proximal sub articular tubercle to toe tip); HAL—hand length (base of the outer palmar tubercle to the

tip of the third finger); HL—head length (rear of the mandible to the tip of the snout); HW—head width, at the angle of the jaws; IBE—distance between posterior corner of eyes; IFE—distance between anterior corner of eyes; IMT—length of inner metatarsal tubercle; IN—internarial distance; ITL—inner toe length; IUE—inter upper eyelid width (shortest distance between the upper eyelids); MBE—distance from the rear of the mandible to the posterior most orbital border; MFE—distance from the rear of the mandible to the anterior most orbital border; MN—distance from the rear of the mandible to the centre of the nostril; NE—nostril to eye distance; NS—nostril to snout tip distance; ShL/FL—thigh length; SL—snout length (tip of the snout to the anterior most orbital border); SVL—snout to vent length; Tal—tarsus length; TE—tympanum to posterior corner of eye distance; TFL—third finger length (tip of finger to proximal palmar tubercle); TiL—tibia length; TYD—tympanum diameter; UEW—maximum upper eyelid width; WBS—body width behind shoulders; WFG—body width in front of groin. AGCZRL—Abasaheb Garware College Zoology Research Laboratory; ZSI/WRC/A—Zoological Survey of India, Western Regional Centre, Pune.

Results and Discussions

In the phylogenetic analysis, our mt 16s rRNA sequences for *D. scaber* from Belgaum, Karnataka forms a monophyletic clade with the other sequences for the species (Fig. 3). Our sequences from Belgaum, Karnataka were homologous with the sequence AB530643.1 from Mudigere; 0.2% genetically divergent with the sequence AB530644.1 from Mudigere; 0.7% genetically divergent with the sequence JQ898086.1 from Gujarat; 1.4% genetically divergent with the sequence KT991343.1 from Andaman Islands and 9.0% genetically divergent with the sequence EU071741.1 from India.

The small genetic divergence of the sequence KT991343.1 from Andaman Islands, raises the possibility of a new taxon of *Duttaphrynus* which could be explored with both morphological and other integrated taxonomic approaches. The large genetic divergence (9.0%) of the sequence EU071741.1 from India needs further analysis too (Table 2).

Morphological descriptions from our specimens from Maharashtra, Karnataka and Tamil Nadu closely match the original description of *D. scaber* by Schneider (1799), and subsequent reports by Padhye et al. (2013); Srinivasalu et al. (2013) and Ganesh et al. (2020) from peninsular India (Fig. 1).

The metric data generated in the present study were within the range of collections made from Supdahad, Gujarat, Thrissur, and Kerala by Padhye et al. (2013). No morphological variations were documented which

could create confusion in the identification of the species (Figs. 2, 5, 6 and 7).



Figure 2: Adult male of *Duttaphrynus scaber* from Amravati, Maharashtra, India, advertising in microhabitat.

Earlier distribution records for *D. scaber* were from Andhra Pradesh (Srinivasalu et al., 2007), Gujarat (Padhye et al., 2013; Patel et al., 2018), Karnataka (Daniel, 1963a; Krishnamurthy, 1999), Kerala (Boulenger, 1892; Daniels, 2005), Manipur (Mathew and Sen, 2009), Odisha (Dutta, 1988; Dutta et al., 1999), Tamil Nadu (Rao, 1915; Vijayakumar, 2002), Telangana (Donahue and Daniel, 1966); western parts in Maharashtra (Padhye et al., 2013; Modak et al., 2013) and Madhya Pradesh (Prasad et al., 2020), states of India (Fig. 1, and Table 1).

The present study of *D. scaber* from Amravati is the first record of this species for Central India as well as the Vidarbha region of Maharashtra state. Earlier reports on amphibians (Chandra and Ray, 2007; Sawarkar and Kasambe, 2009, and Wagh et al., 2017) did not report this species in Central India. Amravati is located 405 km north of Hyderabad, Telangana, the previously closest known locality of *Duttaphrynus scaber* and is a range extension (Fig. 1).

Additionally, the species is also recorded from central Maharashtra (Sufiyan Nagar and Wadgaon Mahure, Amravati), the regions adjoining the states of Goa and Karnataka (Chegule, Kankumbi, Belgaum, Karnataka) and Tenkasi town (Tenkasi, Tamil Nadu) from India.

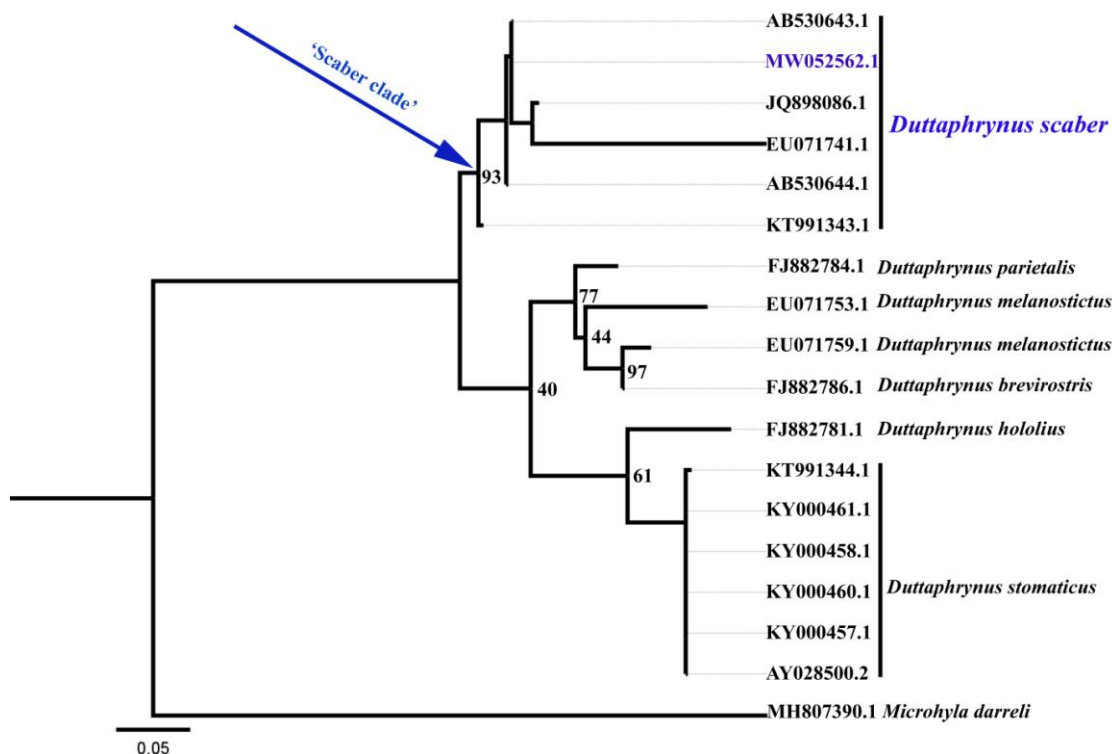


Figure 3: Maximum Likelihood tree for the members of the genus *Duttaphrynus* based on 531 bp of mt 16s rRNA.

Table 3: Morphometric data (to nearest 0.1 mm) for *Duttaphrynus scaber* from India.

Character	ZSI/WRC/ A/2182a	ZSI/WRC/ A/2182b	ZSI/WRC/ A/2182c	ZSI/WRC/ A/2172	AGCZRL 41	AGCZRL 42	AGCZRL 98
	Present study Male	Present study Male	Present study Male	Present study Male	Padhye et al. (2013) Male	Padhye et al. (2013) Male	Padhye et al. (2013) Female
SVL	26.1	26.6	28.7	32.0	24.2	25.5	36.0
HW	9.2	9.5	10.7	11.2	8.5	8.8	12.8
HL	9.0	9.2	8.7	8.1	7.4	7.8	11.8
IN	1.7	1.9	1.8	1.6	1.5	2.0	3.2
NE	1.8	1.2	2.0	2.3	—	—	—
MN	6.9	7.6	7.1	7.3	—	—	—
MFE	5.9	6.2	6.0	5.9	—	—	—
MBE	2.3	3.6	3.1	3.4	—	—	—
SL	2.7	2.9	3.0	3.5	0.9	1.1	1.7
EL	2.9	3.2	3.3	3.6	2.6	2.8	3.8
IUE	2.2	2.3	2.3	3.1	2.7	2.9	3.4
UEW	2.6	2.7	2.9	3.1	1.8	2.3	3.1
IFE	4.5	4.8	4.4	6.0	—	—	—
IBE	8.3	8.1	8.7	9.9	—	—	—
TYD	1.6	1.5	1.3	2.0	1.0	1.1	2.6
TE	0.4	0.3	0.4	Nil	0.8	0.9	0.3
FLL	6.7	6.2	6.8	7.1	—	—	—
HAL	6.3	5.4	5.7	7.2	—	—	—
FL1	1.9	1.8	2.0	3.0	—	—	—
FL2	2.5	2.4	2.7	3.1	—	—	—
TFL	3.5	4.3	4.7	4.6	—	—	—
AGL	12.3	13.1	14.4	11.5	—	—	—
WBS	10.9	11.4	12.3	11.6	—	—	—
WFG	13.0	11.7	12.8	10.2	—	—	—
ShL/ FL	9.7	8.3	9.1	12.4	6.6	7.0	11.7
TIL	9.5	9.6	9.9	11.5	8.4	8.5	11.6
Tal	6.1	5.7	6.1	7.7	—	—	—
FOL	10.0	6.8	8.1	12.5	13.1	13.7	18.3
FTL	5.2	3.8	4.4	6.6	—	—	—
ITL	1.6	1.5	1.7	—	—	—	—
IMT	0.8	0.8	1.0	—	—	—	—

During active periods, the toads were found to be abundant after dark, in lentic water bodies around Wadgaon Mahure (Fig. 4) and the Pohra–Malkhed Reserved Forest (PMRF), within semi-arid and scrub forests and degraded dry and deciduous forests. Males are comparatively more vocal after first rains,

particularly after dusk. One female specimen (Fig. 5) was observed emerging from refuge inside a termite mound. Another individual (Fig. 6) shows unusual yellowish colors, here interpreted as a partially xanthochromatic individual.



Figure 4: Habitat view of collection site of *Duttaphrynus scaber* in Wadgaon Mahure, India.



Figure 5: Female of *Duttaphrynus scaber* (not collected) during emergence from brumation from Amravati, Maharashtra, India.



Figure 6: An adult xanthochromatic individual of *Duttaphrynus scaber* from Amravati, Maharashtra, India.

The specimen collected at Chegule village (Fig. 7) was calling at 1900 hrs from a temporary muddy pool

surrounded by agricultural land, during the month of July 2014, which is the peak monsoon period in the area.

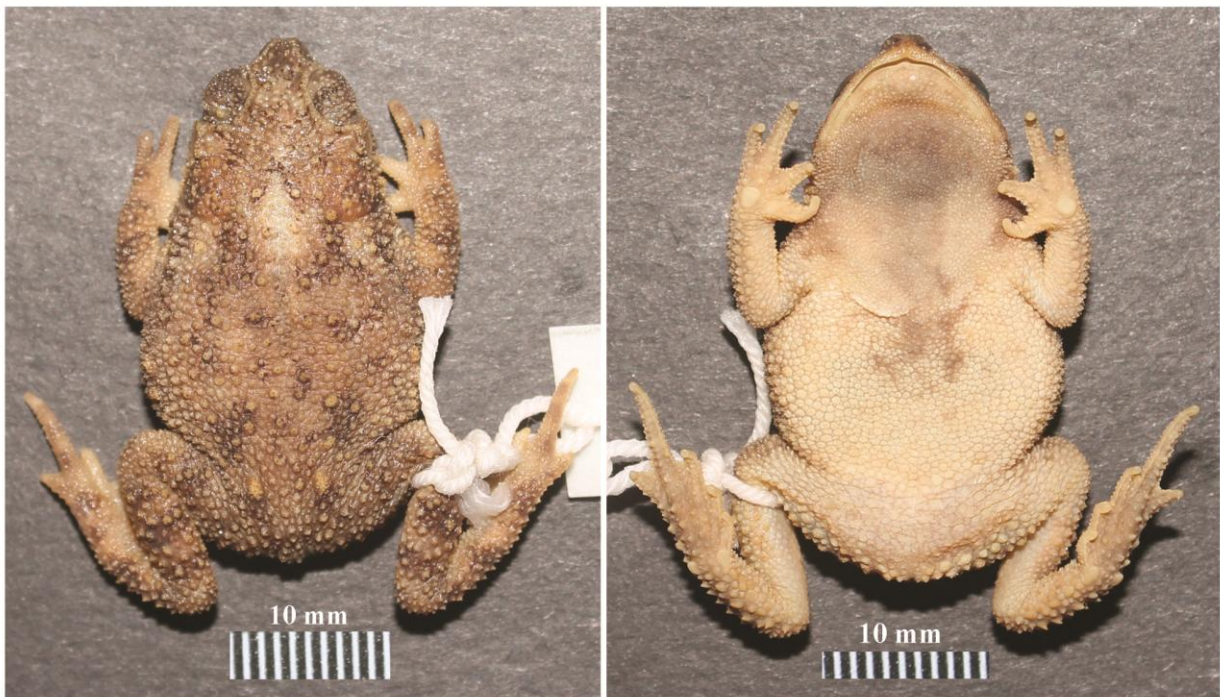


Figure 7: *Duttaphrynus scaber* (ZSI/WRC/A/2172) in the National Zoological Collections of ZSI, WRC, Pune, India.

Other sympatric amphibian species calling were *Microhyla nilphamariensis* Howlader, Nair, Gopalan, and Merilä, *Minervarya gomantaki* (Dinesh, Vijayakumar, Channakeshavamurthy, Torsekar, Kulkarni, and Shanker), *Minervarya syhadrensis* (Annandale), *Hoplobatrachus tigerinus* (Daudin) and *Polypedates maculatus* (Gray). Male individuals were found to call from emergent leaves of bushes submerged in the muddy pools.

Individuals sighted at Tenkasi town were found calling around 19 hrs in the stagnant paddy fields during August, as these areas fall within the rain shadow region bordering the Western Ghats. Other sympatric amphibian species calling with *D. scaber* were *Minervarya agricola*, *M. syhadrensis* and *Hoplobatrachus tigerinus*.

Barve and Chaboo (2011) reported ectoparasitic larvae of chlaeniines beetles of the family Carabidae infesting *D. scaber* in April 2008 near Karanji Lake, within the campus of the Regional Museum of Natural History, Mysore, Karnataka, India. Habitat loss, especially due to anthropogenic activities and developmental projects, including mining is a potential threat to the species.

Further population level studies, based on extensive field surveys, are warranted to understand the distribution and the threats this species is facing. Other studies include the effects of water contamination, developmental deformities, natural history and population status of *D. scaber* in central India.

Acknowledgements

Part of this publication is an outcome of the Open Taxonomy Initiative, supported by Kartik Shanker and Seenapuram Palaniswamy Vijayakumar at the Evolutionary Ecology Lab, Centre for Ecological Sciences (CES), Indian Institute of Science (IISc), Bangalore. KPD would like to thank the Department of Biotechnology, Government of India and Science and Engineering Research Board (SR/FR/LS-88/210/09.05.2012) for a fellowship and financial assistance to conduct part of this work, and is grateful to the Director of the Zoological Survey of India (ZSI), Kolkata and the Officer-in-Charge, ZSI, WRC, Pune for encouragement. NUK is thankful to the Trustees of Mhadei Research Centre (MRC) for their continuous support. The authors also thank Saipari Sailo, Ahsan Sheikh, Yadav Tarte, Sawan Deshmukh and Vaibhav Dalal for their contributions to the field survey and Harshil Patel, for his support in the study. KA extends gratitude to Cuckoo Mahapatra (Department of Zoology, North Orissa University, Mayurbhanj, Odisha) for laboratory support and her comments during manuscript preparation. Our thanks also go to Indraneil Das (University Malaysia Sarawak, Malaysia) and the anonymous reviewers for their valuable comments and corrections on the manuscript.

Conflict of interest

All the authors declare that there are no conflicting issues related to this research article.

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