

## Distribution of *Rhacophorus burmanus* (ANDERSSON, 1939), with notes on its natural history

The frog genus *Rhacophorus* KUHL & VAN HASSELT, 1822, is represented by 88 species (FROST et al 2015) twelve of which are known from India. The occurrence of *Rhacophorus kio* OHLER & DELORME, 2006, in India is doubtful. Members of the genus are identified by the presence of webbing and discs on the tips of fingers and toes (BOULENGER 1890), surrounded by a marginal groove. In most species, fingers and toes are fully webbed (LIEM 1970).

*Polypedates (Rhacophorus) dennysii burmana* was described by ANDERSSON (1939) from a single specimen collected in 1934 at Kambawti village in northeast Myanmar, close to the Chinese border. In his description, the author characterized the frog by its pointed snout, distinct canthus rostralis and distinct supratemporal fold. Unlike many other species of the genus, the toes and fingers are not completely webbed (fingers with webbing: I 1–1¼ II 1–2½ III 1–1 IV, according to OHLER 2009), the membrane touching the disc of the 4th finger and the outer side of the 2nd finger (SMITH 1940).

In 1940, SMITH described *Rhacophorus taronensis* from Patsarlamdam in northern Myanmar, and YANG & SU (1984) *Rhacophorus gongshanensis* from Pumansao, Baoshan County, Yunnan. AO et al. (2003) reported *R. gongshanensis* as new for India based on eleven specimens collected from Puliebadze, Nagaland. WILKINSON & RAO (2004) implied *Polypedates (Rhacophorus) gongshanensis* to be a subjective junior synonym of *R. taronensis* after comparison with the holotypes and a paratype from Myanmar. He considered the variations to be attributed to sexual dimorphism and normal ranges of differences within a species. AHMED et al. (2009) listed *R. taronensis* from Nagaland in northeastern India. OHLER (2009) synonymized *R. taronensis* and *R. gongshanensis* with *R. burmanus* (ANDERSSON, 1939) based on the similarities among the type specimens and considering the variations between them to be intraspecific.

*Rhacophorus burmanus* is said to occur in the Hengduan Mountains, western Yunnan (Gaoshan, Tengchong, and Baoshan counties), and northern Myanmar (AO et al. 2003). In India, it is reported from Puliebadze in Nagaland (AO et al. 2003; STUART et al. 2008; OHLER 2009). The authors of the present note report *R. burmanus* from Kohima, Khonoma, Dzuku and Dzuleke in Nagaland and Shiroi village in Manipur. The Manipur location is the first record of the species from the state and extends the known range by 65 km south of previous records from India. There is a photographic record of the species from Eagle Nest Wildlife Sanctuary in Arunachal Pradesh which needs to be verified (SHEETH 2010).

The distribution map (Fig. 1) was prepared using 71 locations (Appendix I) collected from literature surveys, online museum databases (VertNet < <http://portal.vertnet.org/> > and Global Biodiversity Information Facility < <http://www.gbif.org/> >) and field surveys conducted independently by the authors (Appendix I). The locality search in the online museum databases was done using the taxa *Rhacophorus/Polypedates taronensis* and *Rhacophorus/Polypedates gongshanensis*. Location data was cleaned and only the geo-referenced locations were used to prepare the map.

The locations were used to run the species distribution model in MaxEnt (ver. 3.3.3k) to assess the probable range of the species in the landscape. To make sure not to over-parameterize the model with redundant climate data, only two ecologically relevant environmental variables were used based on the biology of the species being an amphibian with active breeding period during monsoon. The variables were precipitation, minimum and maximum temperature of the months from April to October. These environmental layers of current conditions with grid size of 1 km<sup>2</sup> were downloaded from WorldClim (ver. 1.4) (HIJMANS et al. 2005). These data layers were generated through interpolation of average monthly climate data from weather stations around the world on a 30 arc-second resolution grid (HIJMANS et al. 2005). Prior to use, the WorldClim grids were clipped in ArcGIS based on the extent of the locations. The presence only model was run using the default settings. The mean area

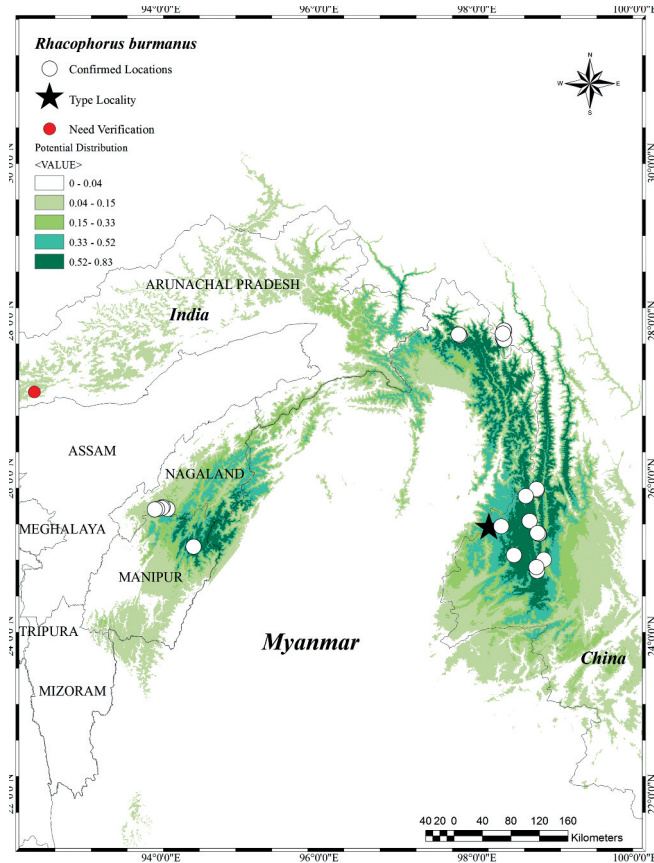


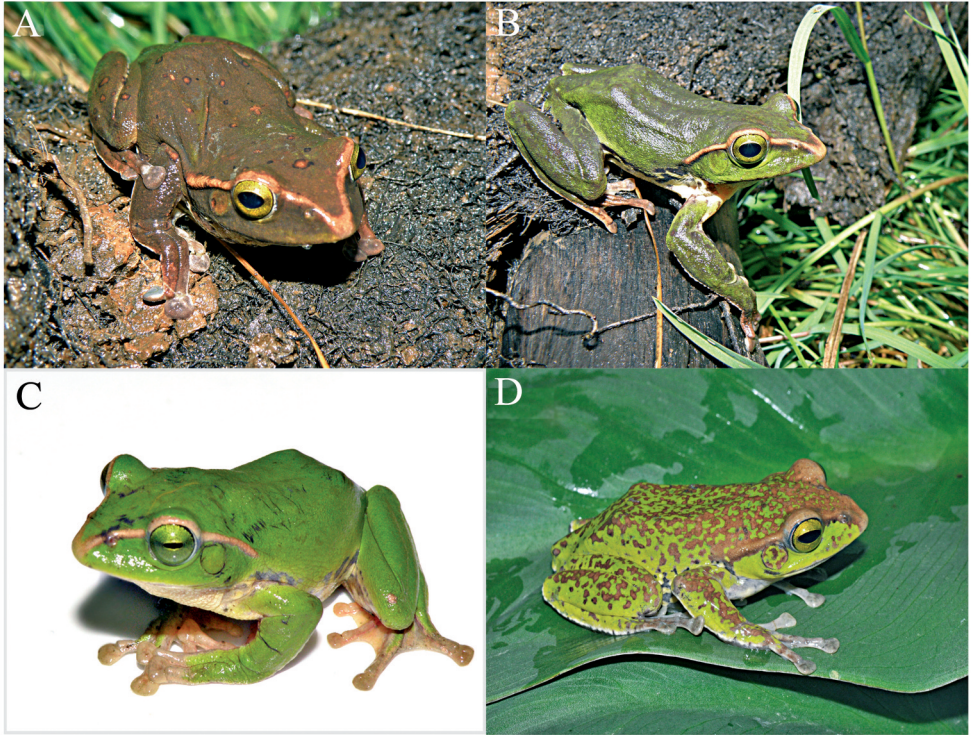
Fig. 1: Map showing predicted distribution of *Rhacophorus burmanus* (ANDERSSON, 1939), in South East Asia, prepared using 71 record localities specified in Appendix I.

under the curve (AUC) value of the model generated was 0.987. This falls within the accepted range of model evaluation. The distribution model clearly shows that the species has discontinuity in the predicted range and the probability of distribution is high (0.5 to 0.8) between altitudes of 962 to 2,972 m a.s.l. (Fig. 1).

The natural history of the species is poorly known and not documented in the literature. The following account is based on the authors' personal observations. *Rhacophorus burmanus* is an early breeder. In Nagaland and Manipur states, breeding activity of the species was recorded from March to May. The breeding season coincides with the pre-monsoon season charac-

terized by few heavy showers. During that time, *R. burmanus* is relatively abundant in Nagaland at elevations from 1,200 m to 2,580 m a.s.l.

Maximum breeding activity was observed during March-April. Pairs in inguinal amplexus were recorded both by day and night at an ambient temperature of 13.8 °C and 77 % humidity; water temperature was 11 °C. For breeding this species uses ponds and tanks (smaller than 100 m<sup>2</sup>), waterlogged terraces, cultivation areas or accumulated water of a seasonal stream, as well as puddles along the road. The eggs are laid in a foam nest. The foam nests are often seen along the edges of the above water bodies or are attached to overhanging



Figs. 2A – 2D: Four color morphs of *Rhacophorus burmanus* (ANDERSSON, 1939), collected at Shiroi Village, Manipur (Shiroi-Kasom Hill range), India.

small woody shrubs, ca. 0.6 to 0.9 m above the water surface. The eggs are whitish.

During nighttime, individuals were observed calling from wet ground and rain-water puddles on the road. During daytime, individuals were found taking refuge under the thick moist grass carpet along the banks of ponds and at the base of tall (1 m) grasses near terrace cultivation.

Coloration in life: Dorsally (including limbs) green to light green with many irregular sized brown spots and variable in number, sometimes without any spots. A white line extends from the tip of the snout across the canthus, along the edge of the upper eyelid and along the entire supratympanic fold. The line may be absent or gray in color. The dark brown maculation of the flanks encloses cream spots. Occasionally, these spots are joined to form an uneven line from axilla to groin. The upper lip is the same color as the

dorsum, the lower lip is whitish or gray. Ventrally, the coloration is creamy with small dark brown flecks; their number is increased on throat, chest and sides. Thigh and shank are ventrally creamy to white with dark brown spots. The forelimbs are the same color pattern as the hind limbs. The hind part of the thigh is maculated with dark brown lines and spots with white centers. The iris is golden in color.

This species is extensively harvested as food, locally. In Nagaland the frog is locally known as “Khereeer” and regarded as a delicacy. Peak harvesting season coincides with the peak breeding activity (March–April) however, in Manipur (Shiroi-Kasom Hill range) local people were seen collecting this species in the month of July in Shiroi Village. Out of the four adult frogs as collected by them, three were brown on the dorsum and one was dull green, but all three

individuals turned into bright green within three hours after they were kept in a jar (Fig. 2). Morphological characters match the description of *R. burmanus* (Maximum snout to vent length = 60 mm, dorsal skin granular, circum-marginal grooves present on fingers and toes, sub articular tubercles single and distinct). Prior to this, there is no published record of the species from Manipur.

Syntopic species of amphibians recorded from the localities are *Tylotriton verrucosus* ANDERSON, 1871, *Duttaphrynus himalayanus* (GÜNTHER, 1864), *Duttaphrynus chandai* DAS, CHETIA, DUTTA & SENGUPTA, 2013, *Hyla annectans* (JERDON, 1870) and *Rhacophorus maximus* GÜNTHER, 1858.

The earlier ambiguity in the taxonomy of the species led IUCN to recognize the two species separately and lists the species *Rhacophorus gongshanensis* as near threatened (DATONG & SHUNQING 2004) and *Rhacophorus taronensis* as data deficient (VAN DIJK & WOGAN 2004). It is recommended here to merge both, apply the name *Rhacophorus burmanus* and keep the status "data deficient" as the map clearly shows that there are gaps in the information available on the distribution of the species (Fig. 1). Further studies on the extent of its occurrence, status and ecological requirements are needed.

Appendix I. The record localities of *Rhacophorus burmanus* (ANDERSSON, 1939) that entered the analyses. The data sources are available from the authors upon request.

India - Puliebadze, Nagaland (25.617° N, 94.0832225° E); Shirol, Manipur (25.141° N, 94.414° E); Eaglenest Wildlife Sanctuary, Arunachal Pradesh (27.1° N, 92.4° E); Khonoma village, Nagaland (25.642° N, 94.0251568° E); Hievibakie hill, Nagaland (25.629° N, 94.011775° E); Dzuku Base camp, Dzuleke, Nagaland (25.619° N, 93.9531726° E); Puihwa, Nagaland (25.612° N, 93.9221665° E).

Myanmar - Kauliang, Kambawti Kachin State (25.4° N, 98.152130° E); Hkakabo Razi National Park, Putao District (27.829° N, 97.7661094° E), Hkakabo Razi National Park, Putao District (27.818° N, 97.7781094° E), Nagmung Township: Hkakabo Razi National Park, Naga War Village (27.829° N, 97.7661094° E); Nagmung Township Hkakabo Razi National Park Naga War Village (27.818° N, 97.778° E); Nagmung Township Hkakabo Razi National Park Naga War Village (27.829° N, 97.7661095° E).

China - Xiao Di Fang Village (25.87° N, 98.7542168° E); Xiao Di Fang Village (25.858° N, 98.759° E); Houqiao Township (25.399° N, 98.3052580° E); Kongdang Township in Dulong Valley

(27.881° N, 98.341536° E); Dulong Valley (27.842° N, 98.3281443° E); Dulong Valley (27.839° N, 98.331° E); MingGuang Township, ZiZhi (25.782° N, 98.616° E); Zhengding, Xiao Di Fang Village (24.881° N, 98.752° E); GuChenShan (Mountain) Nature Reserve (24.832° N, 98.7622031° E); Zhengding (24.846° N, 98.7571956° E); Jin Chang He (River), Bai Hua Ling (25.313° N, 98.766° E); Jin Chang He (River), Bai Hua Ling (25.301° N, 98.7842000° E); BaoShan (25.302° N, 98.783° E); Dulong Valley, Bapo (27.771° N, 98.337° E); Dulong Valley, Bapo (27.771° N, 98.337° E); Dulong Valley, Bapo (27.786° N, 98.333° E); Dulong Valley, Bapo (27.762° N, 98.346° E); Dulong Valley, Kongdang (27.874° N, 98.336° E); Dulong Valley, Kongdang (27.841° N, 98.329° E); Dulong Valley, Kongdang (27.841° N, 98.329° E); Dulong Valley, Kongdang (27.881° N, 98.34329° E); Baoshan Shi (24.975° N, 98.847° E); ZhengDing Hebei (24.846° N, 98.7571956° E); Gu Chen Shan (Mountain) Nature Reserve (24.832° N, 98.7622031° E); ZhengDing XiaoDiFang Village (24.881° N, 98.752° E); JinChang-He River BaiHuaLing (25.301° N, 98.7842000° E); Tengchong County Houqiao Township (25.399° N, 98.3052580° E); Tengchong County Xiaodifang Village (25.858° N, 98.759° E); Tengchong Xian (25.467° N, 98.667° E); Tengchong Xian (25.033° N, 98.467° E); Tengchong County Xiaodifang Village (25.858° N, 98.759° E); BaiHuaLing Station (25.302° N, 98.783° E); Tengchong Xian (25.033° N, 98.467° E); Xiaodifang Village (25.858° N, 98.759° E); Tengchong Xian (25.033° N, 98.467° E); Houqiao Township (25.399° N, 98.3052580° E); Xiaodifang Village (25.87° N, 98.752168° E); Tengchong Xian (25.467° N, 98.667° E); Tengchong County Houqiao (25.399° N, 98.3052580° E); JinChangHe River BaiHuaLing (25.313° N, 98.76648° E); TengChong Co. (25.782° N, 98.61649° E); Dulong Valley Bapo (27.771° N, 98.337° E); Dulong Valley, Bapo-Kongdang road (27.839° N, 98.331° E); Dulong Valley Bapo, Bapo-Kongdang road (27.771° N, 98.337° E); Dulong Valley, Bapo-Kongdang road (27.842° N, 98.3281443° E); Dulong Valley Kongdang-Gougshan road (27.881° N, 98.343° E); Dulong Valley, Bapo-Kongdang road (27.783° N, 98.333° E); Dulong Valley, Bapo-Kongdang road (27.771° N, 98.337° E); Dulong Valley, Bapo-Kongdang road (27.786° N, 98.333° E); Dulong Valley, Bapo-Kongdang road (27.762° N, 98.346° E); Kongdang township in Dulong Valley (27.881° N, 98.341536° E); Dulong Valley, Bapo-Kongdang road (27.841° N, 98.329° E).

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