

A new species of *Megophrys* (Amphibia: Anura: Megophryidae) from the northwestern Hunan Province, China

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Abstract A new species of *Megophrys* (Amphibia: Anura: Megophryidae), *Megophrys tuberogranulatus* Shen, Mo et Li, sp. nov. (Holotype HNUL 03080902, adult male, SVL: 38.2 mm), from Sangzhi County, Hunan Province, is described. *Megophrys tuberogranulatus* is closely related to both *Megophrys kuatunensis* and *Megophrys minor*. Characters of the new species that differentiate this species from close relatives are skin granulated with big tubercles on the dorsal sides of both thigh and tibia, the bigger inner metacarpal tubercle, upper eyelid wider than the interorbital space, hind limbs longer, overlapping of the left and right calcaneal parts. The type specimens are deposited in the Animal Museum of Life Sciences College of Hunan Normal University [Current Zoology 56 (4): 432–436, 2010].

Key words Zootaxy, Megophryidae, *Megophrys*, New species, China

Kuhl and van Hasselt (1822) established *Megophrys* based on the type species of *Megophrys montana* (Liu, 1950). Rao and Yang (1997) reported another new genus—*Panophrys* based on the type species of *Megophrys omeimontic*, but it also included some species of *Megophrys* and *Megophrys parva*. However, Dubois and Ohler (1998) considered that *Panophrys* as a synonym of *Xenophrys* Gunther (1864) which was classified as a subgenus of *Megophrys*. Recently, Ohler (2003) and Dubois (2007) upgraded the *Xenophrys* subgenus to a level of genus. Li and Wang (2008) considered that both *Xenophrys* and *Megophrys* were effective and suggested that the Chinese species which were considered as *Megophrys* originally should be proposed as *Xenophrys*. In this study, we adopted the concept of *Megophrys* including all the domestic horn toads as well as species of *Xenophrys*, which are widely accepted by scholars in China (Liu, 1950; Liu and Hu, 1961; Tian and Jiang, 1986; Fei, 1999; Fei et al., 1990, 2005, 2009; Shen, 1994; Ye et al., 1993; Xie and Wang, 2000; Zhao and Adler, 1993).

During collecting trips to Nature Reserves of Tianpingshan, Simenyan and Tianzishan, Sangzhi County, Hunan Provinces in 1988 (between June and August) and 2003 (August), we collected specimens of *Megophrys* which could not be assigned to any known species. Moreover, the specimens exhibited a series of characteristics such as snout shield-like projecting beyond the

lower jaw, canthus rostralis distinct, tiny teeth in upper jaw, vertical pupils that differ from other Chinese species of *Megophrys*. After consultation with colleagues at the Chengdu Institute of Biology (CIB), we concluded that the unidentified toad represents a previously unrecognized species.

1 Materials and Methods

1.1 Specimens

Ten specimens (9 ♂, 1 ♀) were obtained from Tianpingshan Mountain of Badagongshan Nature Reserve and Tianzishan Mountain Nature Reserve located in Sangzhi County in the northwestern part of Hunan Province in April, July and August 1988 and August 2003. The type specimens are deposited in the Animal Museum of Life Sciences College of Hunan Normal University (HNUL).

1.2 Comparative materials

The comparative materials include the specimens of *Megophrys minor* Stejneger 1926 ($n = 12$) and *Megophrys kuatunensis* Pope 1929 specimens ($n = 10$). The former are from Emei Mountain in Sichuan Province, and the latter are from Jianyang, Guadong and Chongan in Fujian Province. All specimens are now deposited in Chengdu Institute of Biology. The numbers for the specimens of *Megophrys minor* are CIB 89963, 89964, 89965, 89966, 89967, 89968, 89969, 89970, 89973, 89974, 89975 and 89976. The numbers for the speci-

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mens of *Megophrys kuatunensis* are CIB 6412135, 6412137, 6412138, 6412300, 6411299, 6414025, 6414026, 6413345, 6413547 and 6413547.

1.3 Statistical analysis

The snout-vent length (SVL), interorbital space (IOS), width of upper eyelid (UEW), diameter of eye (ED), diameter of tympanum (TD), space of tympanum and eye (STE), hindlimb length (HLL) and tibia length (TL) of the type specimens and comparative materials were measured using vernier caliper. The SPSS program (version12.0) was used to perform the regular tests. One-way analysis of variance (ANOVA) was used to compare the mean differences in the three groups, and the least significance difference (L.S.D.) test was used for multiple comparison. The significance level was set at $P = 0.05$.

2 Results and Conclusions

Megophrys tubergranulatus Shen, Mo et Li, sp. nov.

2.1 Type specimen

Holotype (Fig. 1, Fig. 2)

HNUL 03080902, adult male, SVL:38.2 mm.

Tianzishan Nature Reserve, Sangzhi County, Hunan Province (29°20'-29°50'N, 110°20'-110°30'E), elevation 1130 m, collected in August 9, 1988 by Youhui Shen.

Allotype HNUL 880800853, adult female, SVL: 50.5 mm

Simenyan, Badagongshan Nature Reserve, Sangzhi County, Hunan Province, elevation 1130m, (20°20'-29°50'N, 109°50'-110°30'), collected in August 1988 by Youhui Shen.

Paratype HNUL 03080904, 880800851, 880800852, 880700751, 880700752, 880700753.

Tianzishan Nature Reserve, Sangzhi County, Hunan Province (29°20'-29°50'N, 110°20'-110°30'E); elevation 1123 m for Qinjiayan, 1088 m for Huziya, 1076 m for Tianchi; collected in July and August 1988 and by Youhui Shen.

HNUL 88062801, 88062802; Simenyan, Tianpinshan, Sangzhi County, (29°20'-29°50'N, 109°50'-110°30'E), collected in July and August 1988 and by Youhui Shen

Etymology The new species's skin is granulated with tubercles, especially big tubercles on the dorsal sides of thighs and tibias, so it is named *Megophrys tubergranulatus* sp. nov.

2.2 Diagnosis (Fig.1, Fig. 2)

Snout shield-like, projecting beyond the lower jaw, canthus rostralis distinct, tiny teeth in the upper jaw, vertical pupils distinguish *Megophrys* from other genera of *Megophryidae*. The smaller body size, tympanum

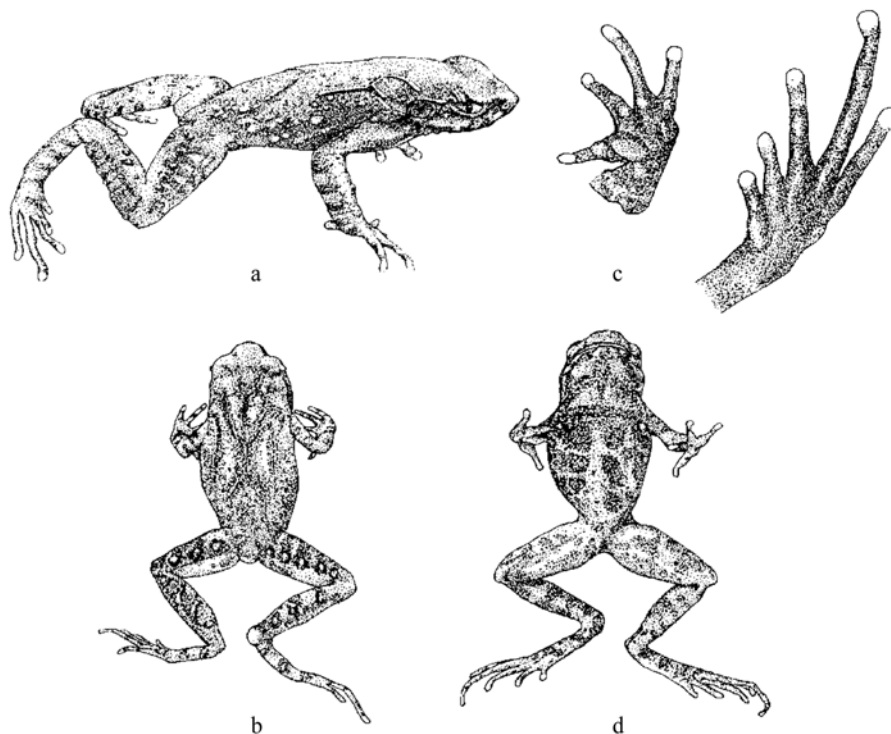


Fig. 1 Biological picture of *Megophrys tubergranulatus* Shen, Mo et Li, sp. nov.

Holotype HNUL 03080902, adult male, Sangzhi, Hunan, China.

a. Lateral view. b. Dorsal view. c. Left hand and left foot ventral view. d. Ventral view.



Fig. 2 Photos of *Megophrys tuberogranulatus* Shen, Mo et Li, sp. nov. (Holotype HNUL 03080902, adult male, SVL: 38.2)

distinct, no vomerine teeth, single internal subgular vocal sac, no membranous edge of toes, slight rudiment of web at toes base are similar to those of *Megophrys kuatunensis* and *Megophrys minor*. The basic measurements of three species, *Megophrys tuberogranulatus*, *Megophrys minor* and *Megophrys kuatunensis*, are shown in Table 1 and Table 2. The results of one-way ANOVA show that all measurement differences are significant ($P < 0.001$). Multiple comparison indicates differences for measurements SVL, TD, STE and HLL between *Megophrys minor* and *Megophrys tuberogranulatus* are not significant, however, the differences for other measurements IOS, UEW, ED and TL are significant. All the measurements differences between *Megophrys tuberogranulatus* and *Megophrys kuatunensis* are significant.

2.3 Dorsal skin granulated with tubercles forming a linear pattern along folds; big tubercles in the black transverse stripes on the dorsal side of thighs, and scattered granules between big tubercles; distinct tubercles along the underside of the digits distinguish *Megophrys tuberogranulatus* from both *Megophrys kuatunensis* and *Megophrys minor*. Although *Megophrys palpebralespinosa* also has skin that is granulated, presence of many big granules on the upper eyelid and some extending outside in spine shape, well-developed membranous edges and web at toes base distinguish *Megophrys tuberogranulatus* from *Megophrys palpebralespinosa*.

2.4 Big internal metacarpal tubercles (but not presenting ball-like projections), and the width of upper eyelid greater than interorbital space are similar to those of *Megophrys kuatunensis* but different from *Megophrys minor*.

2.5 The bigger body size (37.16 ± 2.17 mm), the longer hind limbs, and overlapping of the left and right

calcaneal parts are similar to those of *Megophrys minor* but different from *Megophrys kuatunensis*.

3 Description of type species (Fig. 1, Fig. 2)

3.1 Body size and description of the head

The new species is of small body size, moderately slender. The male's SVL is 37.16 ± 2.17 ($33.2 - 39.6$) mm and the female, 50.5 mm (Table 1). The head is slightly flattened, nearly equal in length and width. Snout short and shield-like, projecting beyond the lower jaw, canthus rostralis distinct and loreal region concave. Nostrils halfway between eye and snout, not distinguishable from the dorsal view. Interorbital space is less than the width of the upper eyelid. Tympana large, round or elliptical, about one half of eye diameter. With fine teeth in the upper jaw, and no vomerine teeth. Tongue round, thick and in ping-pang bat shape, and not notched behind.

3.2 Description of limbs

Fore limbs are slender with the forearm longer than the humerus. The tips of the slender fingers are slightly dilated. The third finger is the longest, with the first and fourth almost of the same in length, and the second the shortest. No obvious subarticular tubercles, and the finger bases are swollen in long spine shape with base tubercles. Two metacarpal tubercles are oval in shape, of which the outer is the smaller. Hind limbs are slightly stronger and shorter. The HLL of the male is about 156.3 percent of the SVL while for the female, 145.4 percent (Table 1). Tibia longer than thigh, and the TL of the male is about 50.8 percent of the SVL while for the female's, 45.2 percent (Table 1). The left and right calcaneal parts overlap. Toes slender, no subarticular tubercle, the inner metatarsus tubercle in oval shape and the outer metatarsus tubercle flattened, with a slight rudiment of web at base, and the toe tips dilated in ball shape. The descending order in terms of digit length is 4, 3, 5, 2, 1 (Fig. 1 C).

3.3 Skin

The skin is granulated with faint folds and tubercles. There is an interocular fold along with the posterior part of the upper eyelids formed a small triangle mark; two or three transverse fine folds are at the middle of upper eyelid, of which the outside of the anterior one projects in angle shape; the distinct temporal fold is comparatively slender at its anterior part and becomes bigger after it bends downward; at the mid-dorsal side of the body, a distinct fold in "X" shape extends forward to the

Table 1 Measurements of adults of *Megophrys tuberogranulatus* Shen, Mo et Li, sp. nov. (Sangzhi, Hunan)

Measurements	Holotype ♂ HNUL 03080902		Allotype ♀ HNUL 880800853		Paratype ♂♂ (n = 8)		
	Length	Ratio	Length	Ratio	Mean ± SD	Range	Ratio
Snout-vent length	38.2		50.5		37.1 ± 2.2	33.2–39.6	
Head length	13.3	34.8 %	14.8	29.3 %	12.8 ± 0.4	12.1–13.3	34.5 %
Head width	13.6	35.6 %	15.6	30.9 %	12.6 ± 0.5	11.5–13.0	33.9 %
Snout length	5.3	13.9 %	6.5	12.9 %	4.6 ± 0.9	4.3–4.9	12.8 %
Internasal space	4.2	11.0 %	5.4	10.7 %	4.3 ± 0.2	4.0–4.4	11.5 %
Interorbital space	3.3	8.6 %	4.3	8.5 %	3.3 ± 0.2	3.0–3.5	8.9 %
Width of upper eyelid	4.5	11.8 %	4.7	9.3 %	3.8 ± 0.2	3.6–4.2	10.4 %
Diameter of eye	6.4	16.8 %	7.2	19.5 %	5.3 ± 0.3	5.0–5.6	14.4 %
Diameter of tympanum	3.2	8.4 %	3.8	7.3 %	2.5 ± 0.2	2.1–2.7	6.8 %
Length of lower arm and hand	18.4	48.2 %	22.2	44.0 %	17.6 ± 1.1	15.7–19	47.5 %
Diameter of lower arm	3.4	8.9 %	3.9	7.7 %	3.6 ± 0.4	3.1–4.4	9.7 %
Hand length	10.2	26.7 %	12.7	25.2 %	9.4 ± 0.6	8.5–10.6	25.5 %
Hindlamb length	59.7	156.3 %	73.4	145.4 %	52.9 ± 4.8	43.5–61.3	142.7 %
Tibia length	19.4	50.8 %	22.8	45.2 %	16.9 ± 1.7	13.5–19.4	45.6 %
Tibia width	4.3	11.3 %	5.8	11.5 %	4.4 ± 0.4	3.8–5.0	11.9 %
Length of foot and tarsus	27.0	70.7 %	33.5	66.3 %	25.0 ± 2.3	21.3–28.8	67.5 %
Foot length	18.6	48.7 %	21.5	42.6 %	15.9 ± 1.5	13.7–17.5	42.9 %

Note: The ratio is each measurement (mm) to Snout-vent length.

temporal regions and backward to the groin region; two longitudinal faint folds are at the dorsolateral sides. The dorsum of the head is flattened with scattered small tubercles; the lower and the upper lips are smooth, and small granules are evident between eye and tympanum; bigger tubercles present on the sides and posterior part of the body, especially with three or four big tubercles on the dorsal sides of thighs and four or five big tubercles in the black transverse stripes on the dorsal sides of tibias; the tubercles at sides of vent and around are more and bigger; the belly is smooth while tubercles present on the ventral sides of thighs. Two small, round and white glands are at thoracic sides; the oval femoral glands are distinct at the midpoint of the hind sides of thighs.

3.4 Coloration in life

The color on the back is dark or yellow brown with black brown or black bars or spots (Fig. 2). There is a black connecting-bar between eyes, big black bars (thick or thin) in “X” shape on the mid-dorsal region of the body, some smaller “X” bars (or none) between the eyes connecting bar and the mid-dorsal “X” bar, and irregular black spots on the sides of the body. Bars are usually accompanied with folds and tubercles, in particular big tubercles scattered at the transverse bars on the dorsal sides of four limbs, which distinguish *Megophrys tuberogranulatus* from the other species. Scarlet marks are very noticeable at groin region and thigh sides. After preservation with formalin, the scarlet

marks become indistinct or disappeared. There are longitudinal black bars and small white spots mixing on upper and lower jaws, and black brown spots on dark gray ground from lower jaw to sternum region. The belly is gray with irregular round spots. The ventral sides of the digits are gray with various transverse oval bars. The digital tips are dark gray.

3.5 Secondary sex characteristics

Males are smaller. The nuptial pads of the male on the inner dorsal sides of the first finger base and the palms are in oblong oval shape, and the nuptial pad on the inner dorsal sides of the second finger base is smaller and in oval shape. Black nuptial spines are obvious under microscope. Single internal subgular vocal sac with smaller opening, which situates between tongue and mouth angle.

4 Ecological habit

Megophrys tuberogranulatus likes living at moist and dripping places and inhabiting beside mountain streams, under rocks or underbrush, which are not easy to be found. During June to August, the male will be croaking “jia, jia, jia” monosyllabically in their habitats.

5 Distribution

Megophrys tuberogranulatus is found in the scrub and frost region of Wuling Mountain area above 1000 m altitude. The specimens were collected in Tianpingshan Mountain of Badagongshan Nature Reserve and

Simenyan Mountain of Tianzishan Mountain Nature Reserve located in Sangzhi County, Hunan Province, China.

In conclusion, the species in this study presents a series of characteristics of *Megophrys*, but some features are different significantly from known species of *Megophrys* such as *Megophrys minor* and *Megophrys kuatunensis*. It was identified as a new species.

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