

A NEW SPECIES OF THE GENUS *VIBRISSAPHORA* (ANURA: MEGOPHRYIDAE) FROM YUNNAN PROVINCE, CHINA

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ABSTRACT: A new species in the genus *Vibrissaphora* was found during a 2003 survey of the southern part of Yunnan Province, China. The new species appears intermediate between the genera *Vibrissaphora* and *Leptobrachium*. Unlike other species of *Vibrissaphora*, it has a small body size similar to *L. chapaense*, but has spines on each side of the upper lip characteristic of *Vibrissaphora*. The spines are much smaller and more numerous than are those of any species of *Vibrissaphora*, including the sympatric *V. ailaonica*.

Key words: *Leptobrachium*; Megophryidae; New species; Taxonomy; *Vibrissaphora*, *Vibrissaphora promustache* sp. nov.; Yunnan; China

THE MUSTACHE toads of the genus *Vibrissaphora* are characterized by having spines on the upper lip. There are five known species in this genus (*V. ailaonica* Yang, Chen, and Ma, 1983; *V. boringii* Liu, 1945; *V. echinata* [Dubois and Ohler, 1998]; *V. leishanensis* Liu and Hu, 1973, and *V. liui* Pope, 1947), distributed in southern China and northern Vietnam (Frost, 2004). The species differ from each other by the number of spines on the upper lip, with the minimum number of two to six spines occurring in *V. liui*, and the maximum number of 52 to 61 spines in *V. echinata* (Dubois and Ohler, 1998). The new species presented here has much smaller and more numerous (over 160) spines on the upper lip than does any other species in this genus. This new species was found on Mount Dawei in Pingbian County, Yunnan Province, China (Fig. 1), during a survey and investigation on the habitat and breeding behavior of *V. ailaonica*. The two species were breeding sympatrically at only this location, although the new species was breeding approximately 10–15 days later than was *V. ailaonica*.

MATERIALS AND METHODS

Nine individuals (six males and three females) were collected on Mount Dawei, Pingbian County, Yunnan Province, China, on 26–28 November 2003 by D.-Q. R. and M.-W. Z. Specimens were fixed in 10% formalin and are kept in 75% ethanol at the Kunming

Institute of Zoology, Chinese Academy of Sciences, Kunming, Yunnan Province, China (KIZ). Measurements were taken with digital calipers to the nearest 0.1 mm as follows: snout–vent length (SVL), head length (HD), head width (HW), interorbital distance (IOD), forearm length (FAL), forearm width (FAW), hand length (HAL), combined tarsal and foot length (TFL), tibia length (TIL), and foot length (FL). Because some specimens (KIZ 03007–KIZ 03009) were dissected for chromosomal analyses, only incomplete measurements were possible.

SPECIES DESCRIPTION

Vibrissaphora promustache sp. nov.

Holotype.—KIZ 03005, an adult male (Figs. 2, 3) from a forest stream near the top of Mount Dawei, Pingbian County, Yunnan Province, China, elevation 2089 m, 22° 54' 28.5" N, 103° 41' 45.1" E, obtained on 28 November 2003 by D.-Q. R.

Paratypes.—Four males (KIZ 03001, 03002, 03008, 03009) and three females (KIZ 03003, 03004, 03006) all collected at the type locality on 26 and 27 November 2003 by D.-Q. R. and M.-W. Z.

Diagnosis.—A small-sized frog, the male having an average SVL of 56.7 mm and the larger female having an average SVL of 61.1 mm; male typically with over 160 tiny, unequal and randomly arranged black spines on upper lip; tympanum indistinct; nostril to eye distance almost equal to that of nostril to tip of snout; supratympanic fold extending from rear

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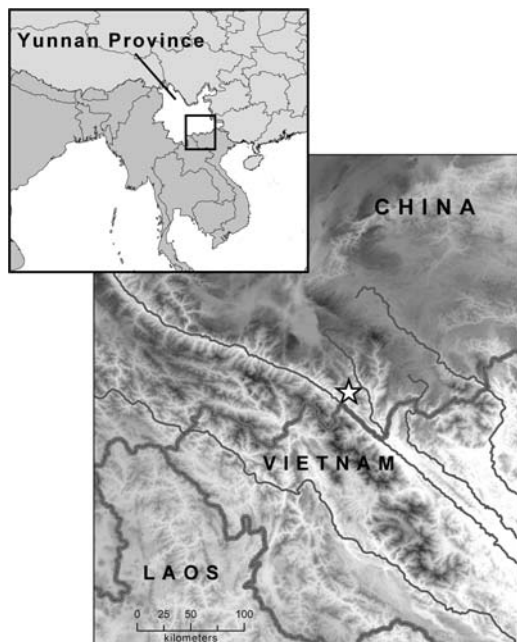


FIG. 1.—Type locality of *Vibrissaphora promustache* sp. nov. (indicated by star) in southern Yunnan Province, China.

corner of eye to articulation of jaw, bending sharply ventrally just posterodorsal to tympanic region; interorbital distance one-third of head width; single vocal sac present, internal, subgular; dorsal skin with weak reticulate ridges; axillary gland located in armpit, behind insertion of arm; arm of male slightly enlarged; inner metacarpal tubercle large, dome shape, slightly protuberant, larger than outer metacarpal tubercle, especially for male; femoral gland not distinct; linea masculina absent.

Because of the presence of spines on the upper lip, *V. promustache* is placed within *Vibrissaphora*. It differs from all other species within this genus by having a smaller body size, by the female being slightly larger than the male, and by smaller and more numerous spines on the upper lip (Table 1).

Description of holotype.—Body short; head length 41.3% of SVL, head width equal to head length, greater than width of body; head dorsoventrally flattened with top of head slightly concave; interorbital and frontal areas mostly flat, but sloping ventrally near snout in lateral view, snout rounded in dorsal view; nostril equidistant between eye and tip of snout; canthus rostralis rounded, loreal region obli-



FIG. 2.—Dorsal and ventral views of the holotype of *Vibrissaphora promustache* (KIZ 03005). Scale bar = 10 mm.

que and concave. Eighty-one tiny black spines of two different size classes arranged randomly on left side and 84 on right side of upper lip. Eyes large and anterolaterally protuberant, almost as wide as snout; tympanum indistinct, annulus obscured by thick skin and spines; supratympanic fold extending from posterior corner of eye to posterodorsal region of tympanum, bending sharply ventrally to articulation of jaw; small tubercles situated between eye and jaw articulation; eyes widely separated, interorbital distance one third of head width; vomerine teeth absent; choanae oval, wholly visible in ventral view; tongue shallowly notched, posterior half free; single vocal sac present, internal, subgular; vocal slits bilateral.

Arm slightly enlarged; axillary gland adjacent to armpit, under insertion of arm; relative



FIG. 3.—Lateral view of the head, palmar view of the left hand, and planter view of the left foot of the holotype of *Vibrissaphora promustache* (KIZ 03005). Scale bar = 5 mm.

length of fingers $3 > 4 > 1 > 2$ with first finger only slightly longer than second; tips of fingers tapered; webbing between fingers absent; lateral fringes present, distinct; subarticular tubercles present on a midventral ridge and tubercles present at base of each finger; inner metacarpal tubercle large, dome shape, slightly protuberant, larger than outer metacarpal tubercle. Legs short, heels do not meet when legs at right angles to body; relative length of toes $4 > 5 > 3 > 2 > 1$, 3 only slightly shorter than 5; basal webbing present on toes, distinctly fringed; no subarticular tubercle on toe 1, one on toe 2, multiple, weak, tubercles on toes 3, 4, and 5; inner metatarsal tubercle large and elongate, more than half of length of first toe, outer metatarsal tubercle absent.

TABLE 1.—Comparison of diagnostic characters between species of *Vibrissaphora*.

Species of <i>Vibrissaphora</i>	Male mean SVL	Female mean SVL	Number of spines on upper lip	Vocal Sac	Source ¹
<i>ailaonica</i>	75.6	72.9	20–59	absent	1, 2, 5
<i>boringii</i>	76.7	66.8	9–16	absent	1, 3
<i>echinata</i>	77.3	54.2	52–61	absent	1
<i>leishanensis</i>	82.4	70.1	4–5	absent	1
<i>liui</i>	86.1	71.3	2–6	present	1, 4
<i>promustache</i>	56.7	61.1	165–194	present	5

¹ (1) Dubois and Ohler, 1998; (2) Ho et al., 1999; (3) Liu, 1945; (4) Pope, 1947; (5) present study.

Dorsum with weak reticulate network of thin ridges; limbs with thin vertical folds; throat, chest, abdomen, and ventral surface of legs smooth; flanks with small white pustules; femoral gland present, but indistinct.

Coloration in life.—Loreal region dark brown; eye with black margin around outer eyelid, dark nictitating membrane, iris bi-colored (dorsal half light blue, ventral half black); dark line bordering lower edge of supratympanic fold (Fig. 4); dorsum reddish brown with irregularly shaped black spots, becoming more numerous on posterior portion of dorsum and flank; chest and throat mostly white with some black mottling and numerous tiny dark brown points; groin black with small white points; limbs dark brown with three wide black transverse bands on the dorsal aspect of forearm, one on hind-arm, four on thigh, and three on tibiotarsus, continuing on inferior surface (Fig. 4); ventral aspect of arms, thighs, and feet reddish brown with white mottling or spots; ventral aspect of hands including tubercles pale gray; ventral aspect of feet reddish brown; tips of digits white; inner and outer metacarpal tubercles and inner metatarsal tubercle white.

Coloration in preservative.—Dorsum and limbs dark brown with some tan and dark brown spotting; ventral color pattern same as when live but paler tan and light brown mottling; banding on legs dark brown.

Variation.—The coloration, such as spots on the dorsum and flank and transverse bands on limbs, the roughness of the dorsum, and number of spines on the upper lip vary between holotype and paratypes. One specimen (KIZ 03008) has smaller and more numerous dark spots on the dorsum, and more defined transverse banding on limbs. Others



FIG. 4.—Diagonal view of an amplexant pair of *Vibrissaphora promustache* (male KIZ 03001, female KIZ 03003).

have larger spots (KIZ 03003, KIZ 03006) or fewer spots (KIZ 03001, 03002, KIZ 03004) on the dorsum. Even though the holotype and KIZ 03006 have a weak, but visible, reticulate network of ridges on the dorsum, the remaining types have a more pronounced network of skin ridges on the dorsum. Total number of spines on upper lip varies from 165 (holotype) to 194 (KIZ 03001).

Sexual dimorphism.—Males slightly smaller than females (Fig. 4, Table 2); males with numerous, randomly arranged, tiny, black spines on upper lip, (Fig. 4); females with small white markings generally corresponding to position of spines in males (Fig. 4); males with relatively thicker, but shorter, arms, and shorter hands, females have slender and longer arms and hands; inner metacarpal tubercle of males much larger than the outer; loreal region light brown in females (Fig. 4).

Call.—The call of *V. promustache* is monosyllabic; the voice is soft but high pitched, not as loud and deep as that of *V. ailaonica*; approximately one call is emitted every two to three minutes.

Karyotype.— $2N = 26$, karyotypical formula is $9M+1SM+3T$, No. 3 pair is SM, Nos. 11, 12,

13 are T chromosomes; $NF = 50$, the Ag-NORs in both chromosomes of pair No. 6 show complete difference, with one having a strong Ag-NORs positive staining, while the other is absent.

Etymology.—The specific name is derived from the Greek *Pro-* meaning primitive or original, and the Greek *mustax* meaning spines. The name implies that the numerous tiny black spines on the upper lip may be a more ancestral character to the larger and

TABLE 2.—Measurements of the type series of *Vibrissaphora promustache*. Mean (in mm) followed by standard deviation, and range below in parenthesis. See text for abbreviations.

	Male $n = 5$	Female $n = 3$
SVL	56.7 ± 4.2 (51.7–61.5)	61.1 ± 2.1 (58.7–62.4)
HD	23.2 ± 1.0 (22.2–24.5)	25.4 ± 0.2 (25.2–25.6)
HW	23.8 ± 1.2 (22.5–25.0)	25.6 ± 0.5 (25.2–26.2)
IOD	7.6 ± 0.4 (7.2–8.2)	8.2 ± 0.3 (7.8–8.4)
FAL	30.3 ± 0.8 (29.4–30.9)	33.9 ± 1.0 (33.0–35.0)
FAW	6.1 ± 0.4 (5.6–6.4)	4.4 ± 0.3 (4.0–4.6)
HAL	14.8 ± 0.7 (13.6–15.3)	16.9 ± 0.5 (16.3–17.2)
TFL	33.6 ± 1.8 (31.6–35.2)	36.8 ± 1.0 (35.8–37.7)
TIL	24.6 ± 0.8 (24.0–25.5)	24.9 ± 0.3 (24.6–25.1)
FL	23.9 ± 1.4 (22.2–25.1)	25.8 ± 0.3 (25.6–26.2)

fewer spines seen in other species of *Vibrissaphora*.

Distribution and ecology.—Presently, the species is known only in forested streams near the summit of Mount Dawei, 13 km from Pingbian County Township. This species breeds in forested streams in mid November, males were calling beside the stream, usually from just under the soil (three males were dug out from the soil). Individuals were found from 2089 m elevation, approximately 80% of the way to the summit (2600 m). One pair was collected from under a stone within the stream. The streams were moderate in size and slow flowing. Only *V. ailaonica* was observed breeding during the same season. During the previous summer, *Megophrys daweimontis* and *Leptolalax* sp. were found active in the same stream. The tadpoles of *V. ailaonica* and *V. promustache* were sympatric. At present we are unable to distinguish confidently between the tadpoles of *V. promustache* and *V. ailaonica* except that we believe those of *V. ailaonica* are larger with fewer black spots on the tail fin (Chen et al., 1984; Fei, 1999; Ho et al., 1999).

Air temperature was 13 C at night and early morning, 18 C at noon; the humidity was approximately 90% in the evening, at night and early morning, and 58% at noon; the water temperature in the current was 11–12 C.

Remarks.—*Vibrissaphora promustache* is placed within the genus *Vibrissaphora* based on the possession of spines on the upper lip, a character unique to this genus. However, *Vibrissaphora* has been considered a junior synonym of *Leptobranchium* (Dubois, 1980) or a subgenus within *Leptobranchium* (Dubois and Ohler, 1998; Tian and Hu, 1985) because of the high number of shared characters between the two genera. Characters that have been used to separate *Vibrissaphora* from *Leptobranchium* are a larger body size (smaller in *Leptobranchium*), reverse size sexual dimorphism (typical size sexual dimorphism of females larger than males in *Leptobranchium*), indistinct tympanum (distinct in *Leptobranchium*), rough dorsal skin (smoother or less conspicuous dorsal ridges in *Leptobranchium*), vocal sacs lacking in most species (vocal sacs present in all species of *Leptobranchium*), enlarged arms in males (arms not

enlarged in *Leptobranchium*), and linea masculina absent (present in *Leptobranchium*).

Vibrissaphora promustache possesses some characters shared with the genus *Leptobranchium*. For example, the male of *V. promustache* is much smaller in body size than are the other known species of *Vibrissaphora* and more approaches those in *Leptobranchium*. In addition, the characteristic reverse size sexual dimorphism in *Vibrissaphora*, in which the male is larger than the female, is not expressed in *V. promustache*. Instead the female appears to be slightly larger than the male although the sample size is small and more specimens are required to confirm this trend. Also, as with all species in *Leptobranchium*, *V. promustache* possesses a vocal sac (though also present in *V. liui*).

However, in addition to spines on the upper lip, *V. promustache* possesses an indistinct tympanum (even hidden in all but two of the specimens), enlarged arms in the male (though not to the extent of other species in *Vibrissaphora*), and dorsal ridges (though not as conspicuous as other species of *Vibrissaphora*), but does not possess a linea masculina, consistent with species of *Vibrissaphora*. Due to this mixture of characters, *V. promustache* appears to be intermediate between the two genera and may represent a basal taxon of *Vibrissaphora*.

Because males of *V. promustache* are smaller in size than are the males of other species of *Vibrissaphora* and more approach the size of males of *L. chapaense* also found in the same region, they may be confused as such. However, they can be distinguished from the males of *L. chapaense* chiefly by presence of spines on the upper lip (absent in *L. chapaense* throughout its range). *Vibrissaphora promustache* can also be distinguished from *L. chapaense* by a much more sloping snout and lore region (more truncated snout and less sloping lore region in *L. chapaense*); an indistinct tympanum (distinct in *L. chapaense*); absence of light blotching on the chest region (present in *L. chapaense*); inner metacarpal tubercle very large, dome shape, slightly protuberant, much larger than outer metacarpal tubercle, especially in males (inner metacarpal tubercle, round, same size or slightly larger than outer metacarpal tubercle, and not protuberant in *L. chapaense*); femoral

gland not distinct (distinct in *L. chapaense*); and slightly more extensive webbing on the foot, reaching to the second subarticular tubercle of the third toe (more basal position on the third toe in *L. chapaense*). *Leptobrachium chapaense* was redescribed by Lathrop et al. (1998) based on specimens they collected from approximately 250 km south-east of the type locality in Northern Vietnam. Based on this redescription, *V. promustache* should also differ from *L. chapaense* by the following characters: distance from nostril to eye almost equal to that of nostril to tip of snout (twice that of nostril to tip of snout in *L. chapaense*); interorbital distance one third of head width (half of head width in *L. chapaense*); dark spots present on dorsum (absent in *L. chapaense*); lack of orange blotches (present on sacral region, flanks, and limbs of *L. chapaense*); and dorsal half of iris light blue (white in *L. chapaense*).

We found that *L. chapaense* from localities in Yunnan Province, China, also differed from the redescription by Lathrop et al. (1998) and were more similar to *V. promustache* in the above characters. Because the known range of *L. chapaense* is large (known from China, India, Laos, Myanmar, Thailand, and Vietnam) and morphological variation between populations exist (Dubois and Ohler, 1998; Lathrop et al., 1998; Yang, 1991), *L. chapaense* may represent a species complex that requires further investigation.

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APPENDIX I

Specimens Examined

Vibrissaphora ailaonica: KIZ 0311JP001–007 (Jinping, Yunnan, China); KIZ 0311PB001–007, 010, 011 (Pingbian, Yunnan, China); KIZ 0402JD006–016 (Jingdong, Yunnan, China); KIZ 0402NJ006–008, 010–013, 019 (Nanjian, Yunnan, China); KIZ 0303LCh001, 002 (Luchun, Yunnan, China).

Leptobrachium chapaense: KIZ 95L9501–010 (Tengchong, Yunnan, China).