

## A GREEN-EYED *LEPTOBRACHIUM* (ANURA: MEGOPHYRIDAE) FROM SOUTHERN LAOS

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**ABSTRACT.** – A new species of Megophryidae, *Leptobrachium buchardi*, new species, is described from the Boloven Highlands, Laos. It is a small sized member of the subgenus *Leptobrachium* (*Leptobrachium*). In life, it can be distinguished from all other species of this group by its pale green eye color. This species is characterized by a tympanum as large as its distance to eye, by a bluish-grey dorsum bearing darker markings, and by a bluish-grey vent covered with white dots.

**KEY WORDS.** – *Leptobrachium*, *Leptobrachium buchardi*, new species, Megophryidae, Laos.

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### INTRODUCTION

The genus *Leptobrachium* Tschudi, 1838 (Megophryidae Bonaparte, 1850) includes two groups: a group with adult males bearing spines on upper lip (subgenus *Vibrissaphora* Liu, 1945) and a second group of thin-legged frogs devoid of such secondary sexual characters (subgenus *Leptobrachium*). The first group includes four species occurring in China and a single species in the neighbouring region of northern Vietnam, whereas the twelve members of the second group occur all over the Oriental region (northeastern India, Myanmar, Thailand, Laos, Vietnam, China, Cambodia (by extension), Malaysia, Indonesia, Philippines).

The taxonomic status of the groups in the genus is not clear: Dubois & Ohler (1998) argued for retaining them as subgenera, as the distribution of larval characters does not correspond to the groups formed on the basis of secondary sexual characters. Despite the absence of revision in the group, several new species have been described recently from Vietnam and Thailand (Dubois & Ohler, 1998; Lathrop et al., 1998; Matsui et al., 1999, Ho, 2000).

From these works and from studies on other amphibian taxa (Glaw & Vences, 1997; Stubbing & Wong, 2000) it seems evident that colouration of eye is an important taxonomic character. The iris of *Leptobrachium* are usually divided into two parts: in many species the upper third is bright coloured whereas the lower part is dark brown or black. The sclera surrounding the iris might be white or blue. In groups like *Leptobrachium*, where external morphology seems rather conservative and eye colour is so distinct in the different species (Dubois & Ohler 1998; Lathrop et al., 1998; Matsui et al., 1999), this might play a role in behaviour, especially in intraspecific relationships. Matsui et al. (1999) also discussed phylogenetic significance of this character. Thus the discovery in southern Laos (Teynié et al., 2004) of a *Leptobrachium* with green iris (Fig. 1) is particularly interesting. A similar colour has been observed before only in *Vibrissaphora* Liu, 1945. In *Leptobrachium* (*Vibrissaphora*) *echinatum* Dubois & Ohler, 1998, the colour can be best described as yellowish green whereas in the specimens from Laos the colour is pale green. Considering the particular colour differentiation, we describe the single specimen collected from Laos as a new species.

## MATERIAL AND METHODS

The specimen was described in the same format and methodology as in Ohler et al. (2000, 2002). The webbing formulae are given according to Myers & Duellman (1982).

Measurements of holotype were taken with a slide calliper to the nearest 0.1 mm, or, for values below 5 mm, with an ocular micrometer to the nearest 0.01 mm. The list and description of measurements are as follows:

**Body:** SVL. – Snout-vent length.

**Head:** EL. – Eye length; EN. – Distance from anterior corner of eye to nostril; HL. – Head length (from posterior corner of mandible to tip of snout); HW. – Head width, at the angle of jaws; IBE. – Distance between posterior corner of eyes; IFE. – Distance between anterior corner of eyes; IN. – Internarial distance; IUE. – Minimum distance between upper eyelids; MBE. – Distance from posterior corner of mandible to posterior corner of eye; MFE. – Distance from posterior corner of mandible to anterior corner of eye; MN. – Distance from posterior corner of mandible to nostril; NS. – Distance from nostril to tip of snout; SL. – Distance from anterior corner of eye to tip of snout; TYD. – Maximum tympanum diameter; TYE. – Distance between tympanum and posterior corner of eye; UEW. – Maximum width of upper eyelid.

**Forelimb:** FLL. – Forelimb length (from elbow to base of outer palmar tubercle); HAL. – Hand length (from base of outer palmar tubercle to tip of third finger); TFL. – Third finger length (from base of first subarticular tubercle).

**Hindlimb:** FFTF. – Distance from maximum incursion of web between fourth and fifth toe to tip of fourth toe, toes being spread; FL. – Femur length (from vent to knee); FOL. – Foot length (from base of inner metatarsal tubercle to tip of fourth toe); FTL. – Fourth toe length (from base of first subarticular tubercle); IMT. – Length of inner metatarsal

tubercle; ITL. – Inner toe length; MTFF. – Distance from distal edge of metatarsal tubercle to maximum incursion of web between fourth and fifth toe, toes being spread; MTTF. – Distance from distal edge of metatarsal tubercle to maximum incursion of web between third and fourth toe, toes being spread; TFOL. – Length of tarsus and foot (from base of tarsus to tip of fourth toe); TFTF. – Distance from maximum incursion of web between third and fourth toe to tip of fourth toe, toes being spread; TL. – Tibia length; TW. – Maximum tibia width.

Museum abbreviation. MNHN: Muséum National d'Histoire Naturelle, Paris, France.

## TAXONOMY

### *Leptobrachium buchardi*, new species (Figs. 1, 2)

**Material examined.** – Holotype - adult female (SVL 49.5 mm) (MNHN 2003.1167 [field number S0064]), Ban Sepian (1200-1250 m; 106°22' E, 15°08' N), Paksong District, Boloven Highlands, Champasak Province, Lao People's Democratic Republic (Laos). The holotype was collected under a stone in a disturbed area. A second specimen was observed under similar condition, but not collected.

**Diagnosis.** – A small-sized *Leptobrachium* (adult female: SVL 49.5 mm) with dorsal part of iris pale green; dorsal pattern indistinct and belly brown with small white dots; no distinct pattern on flanks; tympanum small, as large as its distance to eye.

**Etymology.** – This species is dedicated to Mr. Michel Buchard (General Manager of *Etablissements E. Leclerc* in Clermont-Ferrand, France) for his generous support to natural history since 1998, especially to Entomology and Herpetology, an attitude quite rare and meriting to be highlighted.

**Description of the holotype (Fig. 2).** – (A) Size and general aspect. (1) Specimen of moderate size (SVL 49.5 mm), body rather stout.

(B) Head. (2) Head large, slightly longer (HL 21.7 mm) than wide (HW 20.6 mm; MN 18.5 mm; MFE 15.0 mm; MBE 9.1 mm), flat. (3) Snout rounded, not protruding; its length (SL 9.61 mm) longer than horizontal diameter of eye (EL 7.24 mm). (4) Canthus rostralis angular, loreal region flat; obtuse in cross section (5) Interorbital space flat, larger (IUE 6.58 mm) than upper eyelid (UEW 5.66 mm) and than internarial distance (IN 4.34 mm); distance between front of eyes (IFE 10.6 mm) about two third of distance between back of eyes (IBE 16.9 mm). (6) Nostrils rounded, without flap of skin; closer to tip of snout (NS 3.55 mm) than to eye (EN 4.34 mm). (7) Pupil oval, vertical. (8) Tympanum (TYD 2.63 mm), indistinct, rounded; tympanum-eye distance (TYE 2.63 mm) equal its diameter. (9) Pineal ocellus absent. (10) Vomerine ridge absent. (11) Tongue large, cordate, emarginate; median lingual process absent. Tooth-like projection on maxilla absent. (12) Supratympanic fold absent.



Fig. 1. *Leptobrachium buchardi*, new species. Life photograph of adult female MNHN 2003.1167.

(C) Forelimbs. (13) Arm long, very thin, fore-arm (FLL 14.8 mm) longer than hand (HAL 12.5 mm), not enlarged. (14) Finger I rather long, thin; fingers II and IV short, thin; finger III long, thin (TFL 6.2 mm). (15) Relative length, shortest to longest: IV < II < I < III. (16) Tips of fingers I to IV rounded, not enlarged, without grooves. (17) Fingers without dermal fringe; webbing absent. (18) Subarticular tubercles absent, but ridges beneath all fingers and metacarpus present. (19) Prepollex rounded, prominent; single, round, prominent palmar tubercle; supernumerary tubercles absent.

(D) Hindlimbs. (20) Shanks three times longer (TL 17.1 mm) than wide (TW 5.4 mm), shorter than thigh (FL 18.8 mm) and distance from base of internal metatarsal tubercle to tip of toe IV (FOL 18.3 mm). (21) Toes short, thin, toe IV (FTL 8.5 mm) longer than third of distance from base of tarsus to tip of toe IV (TFOL 18.3 mm). (22) Relative length of toes, shortest to longest: I < II < V < III < IV. (23) Tips of toes rounded, not enlarged, without grooves. (24) Webbing small: I 1 – 2 II 1 – 2½ III 1 – 3½ IV 3½ – 2 V (WTF n.m.; WFF n.m.; WI n.m.; WII n.m.; MTTF 8.29 mm; MTFF 8.68 mm; FTFT 8.82 mm; FFTF 9.34 mm). (25) Dermal fringe along

toe V to level of proximal subarticular tubercle, poorly developed. (26) Subarticular tubercles absent, but ridges beneath all toes present. (27) Inner metatarsal tubercle short, distinct, its length (IMT 2.63 mm) 1.4 times in length of toe I (ITL 3.55 mm). (28) Tarsal fold absent. (29) Outer metatarsal tubercle absent; supernumerary tubercles and tarsal tubercle absent.

(E) Skin. (30) Dorsal and lateral parts of head and body: snout smooth; between eyes and side of head sparsely granular; back and flank covered with fine ridges forming reticulum. (31) Cephalic ridges absent. (32) Laterodorsal folds absent; "Fejervaryan" line absent; lateral line system absent. (33) Dorsal parts of limbs: covered with longitudinal folds. (34) Ventral parts of head, body and limbs: covered with dense, small glandular warts. (35) Macroglands: small white femoral gland present.

(F) Colouration in alcohol. (36) Dorsal and lateral parts of head and body: grayish with indistinct marbling and few small dark dots; loreal region grayish with dark gray line on canthus; tympanum and tympanic region grayish; upper lip with a

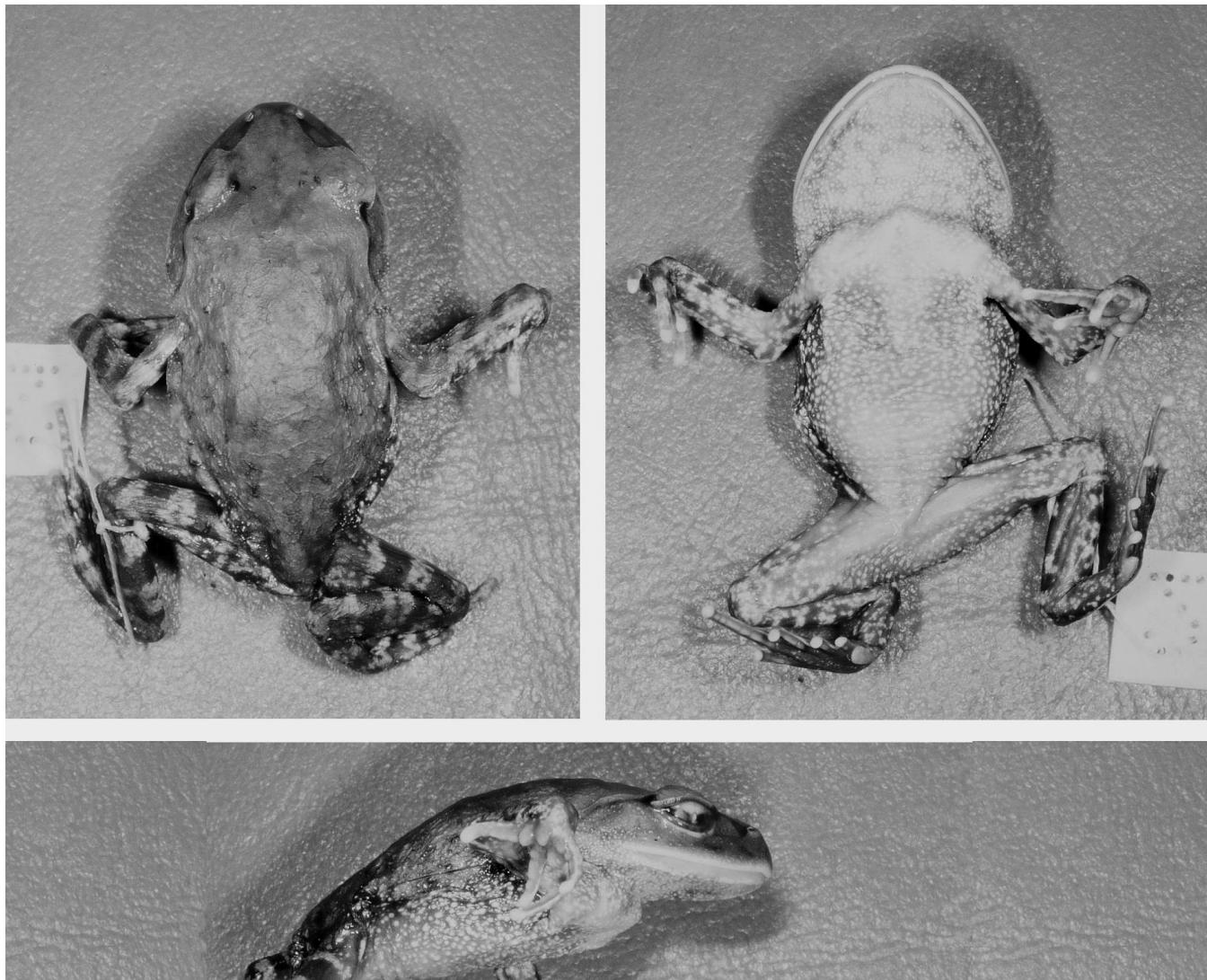


Fig. 2. *Leptobrachium buchardi*, new species. Holotype (MNHN 2003.1167), adult female (SVL 49.5 mm): dorsal and ventral view of body; lateral view of head.

Table 1. Morphological and color characters of *Leptobrachium* (*Leptobrachium*).

Species or population	Size of males	Size of females	Size of tympanum	Color of eye	Color of dorsum	Color of venter	Color of tibiotarsus	References
<i>L. buchardi</i> Laos	—	49.5	equal to its distance to eye	pale green	bluish-gray with indistinct darker marking	bluish gray with white dots	gray with white marbling	This paper
<i>L. abbotti</i> (Borneo) Malaysia	43.5-74.1	60.1-95.0	smaller than its distance to eye	black	dark brown with faint dark pattern	heavily parked with a bold black and white mottling	—	Inger & Stuebing 1997; Dubois & Ohler 1998; Matsui et al., 1999
<i>L. banae</i> Vietnam	57.2-70.0	72.1-84.2	larger than its distance to eye	white	dark brown with lighter spots	black with small white pustules	uniform brown	Lathrop et al., 1998
<i>L. chapaense</i> (Sapa) Vietnam	44.6-53.8	50.7-57.8	larger than its distance to eye	dark	brown with numerous small dark spots	white with dark mottling	white and brown banding	Dubois & Ohler 1998; this paper
<i>L. gunungense</i> (Borneo) Malaysia	41.3	—	as large as its distance to eye	dark brown	black brown	black gray with small whitish dots	—	Malkmus 1996; Dubois & Ohler 1998; Matsui et al., 1999
<i>L. hainanense</i> (Hainan) China	50.2-55.1	—	about as large as its distance to eye	blue	purple brown with irregular scattering	white in the middle, purple brown on border	—	Ye et al., 1993
<i>L. hasseltii</i> Malaysia, Indonesia	37.2-46.6	45.7-77.2	larger than its distance to eye	red	grayish with discrete dark markings	white with dark spots	—	Dubois & Ohler 1998; Matsui et al., 1999
<i>L. hendricksoni</i> S-Thailand, Malaysia	43.7-49.8	50.2-64.4	larger than its distance to eye	scarlet or yellow	discrete dark pattern on back	white with numerous small dark dots	—	Matsui et al., 1999; Inger & Stuebing 1997; Dubois & Ohler 1998
<i>L. montanum</i> (Borneo) Malaysia	46.7-62.7	50.2-64.4	as large as its distance to eye	black with a narrow, bluish white ring	dirty gray without markings	conspicuous dark pattern	—	Inger & Stuebing 1997; Dubois & Ohler 1998; Matsui et al., 1999; this paper
<i>L. nigrops</i> (Borneo) Malaysia	30.2-33.2	34.7-46.0	—	black	gray to brown, with a conspicuous pattern of black, oval spots	white marbled with darker pigmentation	—	Inger & Stuebing 1997; Dubois & Ohler 1998; Matsui et al., 1999
<i>L. pullum</i> Thailand, Vietnam	44.4-47.0	49.4-52.8	larger than its distance to eye	scarlet or yellow	uniform; small white spots on flanks	beige with white dots	gray brown	Matsui et al., 1999; pers. observ.
<i>L. smithi</i> S Thailand, Myanmar, India	36-68	50-78	larger than its distance to eye	scarlet or yellow	discrete dorsal marking	white with darker infusions on throat and vent	—	Matsui et al., 1999
<i>L. xanthospilum</i> Vietnam	62.8-73.4	83.2-84.8	larger than its distance to eye	white	dark brown, large creamy white spots on flanks	dark brown with light brown pustules	uniform brown	Lathrop et al., 1998

narrow whitish band. (37) Dorsal parts of limbs: grayish with dark brown large bands; posterior part of thigh dark brown with small white dots. (38) Ventral parts of head, body and limbs: throat, margin of throat and chest creamy white with indistinct brown marbling, top of glands forming creamy white spots; belly brown with small white dots corresponding to top of glands; webbing dark brown.

Colouration in life. Dorsum and head uniform bluish gray getting lighter on flanks; temporal region bluish dark grey; sides of head and body with brownish shine, indistinct in natural light, but quite visible in artificial light; upper and lower lip whitish; upper side of forearms and legs grey with darker transversal bands; ventral surface of belly and legs bluish gray with small white spots on glandular warts. Iris upper part pale green, lower part dark brown.

(G) Female sexual characters. (39) Oviduct convoluted, pigmented. (40) Ovary with large, black and white oocytes.

## DISCUSSION

*Leptobrachium* are members of the Megophryidae with generalized tadpoles and large headed adults with long, thin forearms and short legs. Their body colouration is dull, uniformly brown or with darker pattern on back, all shades from whitish to dark brown on underside (Fig. 1). Some species, such as *L. xanthospilum* Lathrop, Murphy, Orlov & Ho, 1998, and *L. chapaense* (Bourret, 1937) show distinct coloured spots on side of body. The distinguishing character is the eye colouration: the iris is usually in its ventral part of dark colour and in its upper third of a bright colour. Four colour patterns have been observed until now in the subgenus *Leptobrachium*: scarlet or orange coloured eyes (*L. smithi* Matsui, Nabhitabhata & Panha, 1999, *L. pullum* (Smith, 1921), *L. hendricksoni* Taylor, 1962, *L. hasseltii* Tschudi 1838); blue coloured eyes (*L. hainanense* Ye & Fei, 1993); white coloured eyes (*L. xanthospilum*, *L. banae* Lathrop, Murphy, Orlov & Ho, 1998); and dark eyes that show no differentiated colouration in dorsal part of iris (types of *L. chapaense*, *L. abbotti* Cochran, 1926, *L. montanum* Fischer, 1885, *L. nigrops* Berry & Hendrickson, 1963, *L. gunungense* Malkmus, 1996). The pale green colour of *L. buchardi* is a different colour type for this group of frogs. Like the blue colour green eye colour in *Leptobrachium* is shared with the subgenus *Vibrissaphora* Liu, 1945, and either one of these colours should be plesiomorph in the genus *Leptobrachium*. In the field the frog with its mimetic colouration is very difficult to observe. When eyes are completely open attention is drawn to the bright part of the iris (Ohler, pers. observation) and covering of this part by the upper lid makes the frog invisible but still enables it to see as the pupilla still is uncovered.

Males of the subgenus *Vibrissaphora* bear horny spines on upper lip. In adult females and young small white horny sockets can be observed instead of these spines. No such structures are present on the upper lip of the holotype. So this adult female clearly belongs to the subgenus

*Leptobrachium*. It can be easily distinguished in life from all the species of this subgenus by its eye colouration. It can be separated from *L. pullum*, *L. smithi*, *L. chapaense*, *L. banae* and *L. xanthospilum* by its smaller tympanum, which is larger than distance to eye in the other species. The only known adult female of *L. buchardi* is distinctly smaller than the adult females of *L. banae* and *L. xanthospilum*. *L. hainanense*, *L. pullum* and *L. smithi* have light coloured belly whereas the belly of the new species from Laos is gray. *L. hendricksoni* has unique belly colouration showing numerous small dark dots on white ground. *L. pullum* can also be distinguished by its uniform back colouration and *L. smithi* by its discrete dorsal marking. In *L. buchardi* the dorsal markings are indistinct.

Stuart (1999) recorded *Leptobrachium pullum* from the Annamite Foothills of Centre Laos. From southern Laos, this author mentioned *L. banae* Lathrop et al., 1998, which has been described together with *L. xanthospilum* of central Vietnamese highlands. The type locality of *L. pullum* (Ap Tram Hanh) also lies on the central Vietnamese highlands. It seems evident that several species of *Leptobrachium* may be sympatric sharing the large geographical space that includes central Vietnamese highlands and Boloven highland. This geographical region is, beside Borneo, the region with the highest species diversity for this subgenus. More data are necessary for estimating precise distribution, sympatry and ecology of the different taxa in Central Vietnam and southern Laos.

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