



Speolabeo hokhanhi, a new cavefish from Central Vietnam (Teleostei: Cyprinidae)

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Abstract

Speolabeo hokhanhi, new species, is here described from Hang Va Cave in Phong Nha-Ke Bang National Park (Son River basin) in Central Vietnam. It can be distinguished from *S. musaei* by having no papillae on the lower lip, no hump immediately behind the head, a duckbilled snout, a shorter caudal peduncle (length 16.8–18.6% SL), and the pelvic fin inserted closer to the snout tip than to the caudal-fin base.

Key words: *Speolabeo*, new species, cavefish, Central Vietnam

Introduction

Kottelat and Steiner (2011) described *Bangana musaei* as a new species from the Xe Bangfai, a stream of the Mekong River basin in Central Laos. This troglobitic fish species, in terms of its original description, matched the definition of *Bangana* sensu Zhang & Chen, 2006 with the exception of the number of branched dorsal-fin rays and troglomorphic characters such as lack of eyes and loss of pigments; these characters separate it from all other then-identified congeneric species from India, Laos, and South China (Mai 1978; Kottelat 2000, 2001a, 2001b; Yue 2000; Nguyen *et al.* 2001). The generic placement of this cavefish still remained tentative because *Bangana*, from Kottelat and Steiner's (2011) point of view, was an artificial assemblage. The non-monophyletic nature of this genus was unveiled in a molecular phylogenetic analysis performed by Yang *et al.* (2012) for the Labeonini. Based on this, Kottelat (2017) provided a taxonomic revision of the genus *Bangana*, establishing a new genus *Speolabeo* for the cavefish *B. musaei*.

Although cave systems in Vietnam and Laos are abundant in number and variable in size, only six species of subterranean fishes have been reported from karst regions of two countries: *Schistura spekuli* Kottelat 2004; *Schistura mobbsi* Kottelat & Leisher 2012; *Draconectes narinus* Kottelat 2012; *Pterocryptis cucphuongensis* (Mai, 1978); *Speolabeo musaei*, (Kottelat & Steiner 2011); *Troglocyclocheilus khammouanensis* Kottelat & Brehier, 1999 (Mai 1978, Kottelat 1998, 2000, 2001a, 2001b, 2012, 2017; Kottelat & Brehier 1999; Nguyen & Ngo 2001; Serov *et al.* 2006; Kottelat & Leisher 2012). More new cavefish species are expected to be discovered if more efforts are made to sample these cave systems.

A fish survey conducted by the first author on 21 April 2014 into the Hang Va Cave (17°29'29"N, 106°17'06"E) in Phong Nha-Ke Bang National Park at Tan Trach commune, Bo Trach District, Quang Binh Province, Central Vietnam yielded the collection of six specimens referable to *Speolabeo*. Careful examination of these specimens showed that they represent a species distinct from *S. musaei*, the single species currently recognized in the genus. Here, we provide a formal description of this new species.

Material and methods

Measurements were taken point to point with digital calipers that were linked directly to a data recording computer and data recorded to the nearest 0.1 mm. Measurements and counts, made on the left side of individuals whenever possible, followed those of Kottelat (2001b). Snout length, interorbital width, and eye diameter were not taken as eyes are missing in this cavefish. Predorsal, prepectoral, prepelvic, and preanal lengths were taken from the snout tip to the dorsal-, pectoral-, pelvic-, and anal-fin origin, respectively. Vertebrae were counted from radiographs following the method outlined by Roberts (1989). Weberian vertebrae and the urostylar complex were included in the counts of vertebrae. The number of specimens with a given meristic count is indicated in parentheses after each count. All values for the holotype are indicated by asterisks in the text. Measurements of parts of the head are given as proportions of the head length (HL). The head length and measurements of other parts of the body are given as percentages of the standard length (SL). Abbreviations here used are: IHB, Institute of Hydrobiology, Chinese Academy of Sciences, and IEBR, Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology.

Speolabeo hokhanhi sp. nov.

(Figs. 1–3)

Holotype. IHB 2016092883, 74.6 mm SL, Hang Va Cave (17°29'29"N, 106°17'06"E), Phong Nha-Ke Bang National Park (Son River basin) at Tan Trach Commune, Bo Trach District, Quang Binh Province, Central Vietnam; coll. Nguyen Dinh Tao, 21 April 2014.

Paratypes. IEBR 2884–5, 2 specimens, 50.7–54.4 mm SL, IHB 2016092886–8, 3 specimens, 61.8–69.0 mm SL; all other data same as holotype.

Diagnosis. *Speolabeo hokhanhi* can be easily distinguished from *S. musaei* by having a lower lip without papillae (vs. with a band of papillae along its anterior margin), no hump immediately behind the head (vs. present), a duckbilled (vs. pyramidal) snout, the pelvic fin inserted closer to the snout tip than to the caudal-fin base (vs. midway between the snout tip and caudal-fin base) and a shorter (vs. longer) caudal peduncle (length 16.8–18.6% SL vs. 19.6–22.7%). All data here used for *S. musaei* are from Kottelat and Steiner (2011).

Description. Morphometric measurements and meristic counts of the type specimens are provided in Table 1. See Figures 1 and 2 for general appearance and Figure 3 for the ventral view of the head. Body elongate, slightly compressed laterally. Dorsal profile of head slightly concave. Predorsal profile of body slightly convex or nearly straight without distinctive hump behind head, straight along dorsal-fin base. Postdorsal profile somewhat concave or nearly straight. Ventral profile of head almost straight, slightly convex from pectoral-fin insertion to pelvic-fin insertion, then slightly concave between pelvic-fin insertion and anal-fin origin, and concave from anal-fin origin to caudal-fin base.

Head depressed anteriorly, wider than deep. Snout duckbilled in lateral view and rounded in dorsal view, with broad interorbital space. Eyes fully absent in all examined specimens. Mouth inferior and arched, close to tip of head. Rostral fold pendulous, with irregularly crenulated distal margin, connected from lips. Upper and lower lips continuous around corners of mouth. Lateral portions of upper lip in normal state, not covered by rostral fold, but with median portion greatly reduced into thin skin fold closely reflected on upper jaw behind cutting edge. Upper jaw laterally enclosed by upper lip and medially bearing thin, flexible horny sheath on cutting edge. Lower lip not papillated, laterally in normal condition and medially separated from lower jaw by shallow groove in larger specimens or adnate to it behind its cutting edge in smaller specimens. Lower jaw laterally enclosed in lower lip, medially bearing thin flexible horny sheath on cutting margin, distally not covered by lower lip. Postlabial groove deep, long, anteriorly extended, with wide median interruption. Rostral barbels rooted at anterior end of sub-lachrymal groove on side of snout, extending greatly beyond maxillary-barbel base; maxillary barbels positioned at corners of mouth or next to lateral extremity of rostral fold, longer than rostral barbels, extending to preoperculum.

Dorsal fin with 3 simple and 7 (6*) branched rays, last simple ray smooth or without serration along posterior edge of lower portion; distal margin slightly concave or nearly straight; origin halfway between snout tip and caudal-fin base, or slightly more anteriorly positioned, and anterior to pelvic-fin insertion. Pectoral fin short, with 1 simple and 12 (4*) or 13 (2) branched rays, tip of adpressed fin not reaching pelvic-fin insertion. Pelvic fin falcate, with 1 simple and 7 (6*) branched rays, inserted halfway between pectoral-fin insertion and anal-fin origin, tip of

adpressed fin not extending to vent. Anal fin with 3 simple and 5 (6*) branched rays; origin equidistant to pelvic-fin insertion and caudal-fin base; distal margin truncate. Caudal fin deeply forked.

TABLE 1. Morphometric data and meristic counts for type specimens of *Speolabeo hokhanhi*.

| | Holotype | Paratypes (n=5) | | |
|---------------------------------|----------|----------------------------------|---------|------|
| | | Range | Average | SD |
| SL (mm) | 74.6 | 50.7–69.0 | 60.9 | 8.33 |
| Morphometric data | | | | |
| PercentSL | | | | |
| Body depth | 21.7 | 21.2–23.7 | 22.2 | 0.83 |
| Head length | 24.3 | 23.2–25.3 | 24.1 | 0.75 |
| Caudal-peduncle length | 16.8 | 17.2–18.6 | 18.0 | 0.56 |
| Caudal-peduncle depth | 12.5 | 11.3–12.4 | 11.7 | 0.47 |
| Dorsal-fin length | 23.7 | 24.2–27.6 | 26.0 | 1.20 |
| Pectoral-fin length | 15.9 | 21.5–23.0 | 22.3 | 0.59 |
| Ventral-fin length | 19.9 | 17.9–20.5 | 19.0 | 1.21 |
| Anal-fin length | 21.1 | 17.9–22.8 | 20.1 | 2.08 |
| Predorsal length | 50.4 | 49.2–52.6 | 50.5 | 1.37 |
| Prepectoral length | 25.3 | 24.0–26.0 | 25.3 | 0.71 |
| Preventral length | 50.8 | 50.8–53.7 | 52.4 | 1.15 |
| Preanal length | 74.4 | 72.8–76.4 | 74.8 | 1.21 |
| Percent HL | | | | |
| Head width | 68.0 | 64.9–74.8 | 70.2 | 4.03 |
| Head depth | 71.5 | 62.7–70.6 | 66.8 | 3.29 |
| Percent caudal-peduncle length | | | | |
| Caudal-peduncle width | 74.1 | 63.4–67.9 | 65.3 | 1.65 |
| Percent pelvic to anal distance | | | | |
| Vent to anal distance | 18.0 | 18.8–28.7 | 22.7 | 3.88 |
| Meristic counts | | | | |
| Branched dorsal-fin rays | 7 | 7 (5) | | |
| Branched anal-fin rays | 5 | 5 (5) | | |
| Branched pectoral-fin rays | 12 | 12 (3) or 13 (2) | | |
| Branched pelvic-fin rays | 7 | 7 (5) | | |
| Lateral-line scales | 37 | 35 (1), 36 (1), 37 (1) or 38 (2) | | |
| Scales above lateral line | 5 | 4½ (2) or 5 (3) | | |
| Scales below lateral line | 4 | 3½ (2) or 4 (3) | | |
| Circumpeduncular scales | 14 | 14 (5) | | |
| Vertebrae | 36 | 36 (4) or 37 (1). | | |

Body scaled; scales medium-sized. Lateral line complete, extending along mid-lateral body from upper extremity of gill opening to middle of caudal fin, with 35 (1), 36 (1), 37 (2*), or 38 (2) pored scales. Scale rows above lateral line 4½ (2) or 5 (4*) and below lateral line 3½ (2) or 4 (4*); 14 (6*) circumpeduncular scales. Vertebrae 36 (5*) or 37 (1).

Coloration. In preserved specimens, body and head uniformly pale yellow; all fins white. In freshly captured individuals, body white to pinkish; all fins transparent (Figs. 1–2).

Etymology. The specific epithet is named in honor of Mr. Ho Khanh who discovered many caves in Phong

Nha–Ke Bang National Park. He was a local guide of the cavefish survey conducted by the first author during 2014 into the cave where the type specimens were collected and provided detailed information about the collection site. As common names, we suggest Hokhanh’s Blind-cavefish (English) and cá mù hang va hò-khanh (Vietnamese).

TABLE 2. Comparison of main diagnostic characters for *Speolabeo* and closely related genera.

| | <i>Speolabeo</i> | <i>Bangana</i> | <i>Altigena</i> | Unnamed genus |
|---|---|-----------------------------------|-----------------------------------|--|
| Branched dorsal-fin rays | 7–8 | 10–13 | 10–12 | 10–12 |
| Ethmoidal furrow | Absent | Present | Absent | Absent |
| Lateral lobe of rostral fold | Absent | Present | Absent | Absent |
| Upper lip | Partially or fully apart from upper jaw; smooth | Fully enclosing upper jaw; smooth | Fully enclosing upper jaw; smooth | Fully enclosing upper jaw; laterally papillose |
| Horny sheath on cutting margin of upper jaw | Present | Absent | Absent | Absent |
| Post-oral groove | Absent or shallow and interrupted | Deep and not interrupted | Deep and not interrupted | Deep and not interrupted |
| Anterior margin of lower lip | Not free; smooth or with a band of papillae | Free; papillated on inner surface | Free; papillated on inner surface | Free; papillated on inner surface |
| Post-labial groove | Interrupted | Interrupted | Uninterrupted | Interrupted |
| Lateral-line scales | 35–38 | 39–43 | 39–48 | 40–48 |
| Circumpeduncular scales | 14 | 20 | 16–20 | 20–24 |



FIGURE 1. Lateral view of *Speolabeo hokhanhi*, IHB 2016092883, holotype 74.6 mm SL; central Vietnam, Son River basin, Hang Va Cave.



FIGURE 2. *Speolabeo hokhanhi* sp. nov., fresh individual immediately after capture. Lateral view.

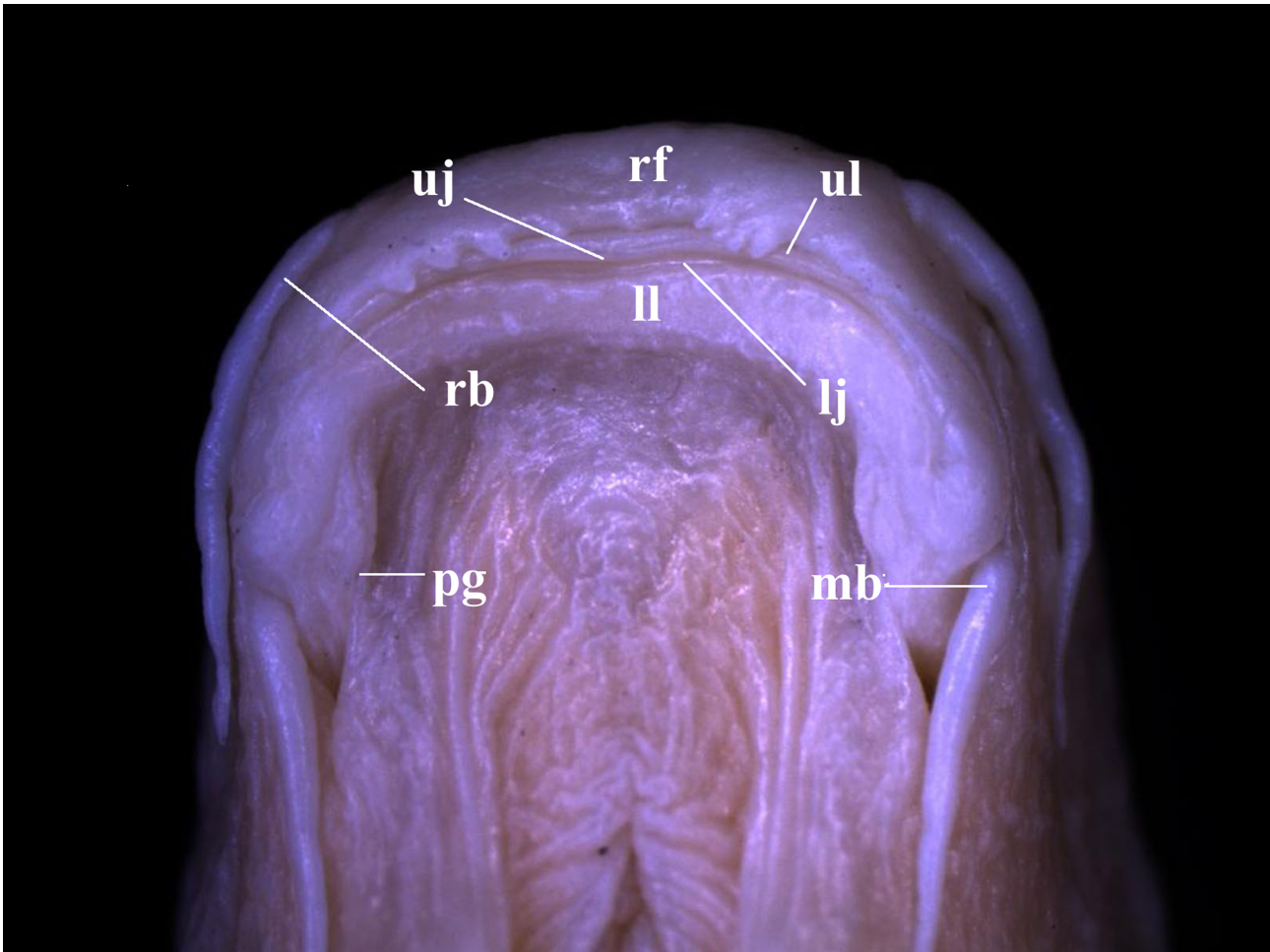


FIGURE 3. Oromandibular structures in *Speolabeo hokhanhi* sp. nov.; lj, lower jaw; ll, lower lip; mb, maxillary barbel; pg, postlabial groove; rb, rostral barbel; rf, rostral fold; ul, upper lip; uj, upper jaw.

TABLE 3. Differences in soft-tissue structures of the mouth in *S. hokhanhi* and *S. musaei*.

| Characters | <i>S. hokhanhi</i> | <i>S. musaei</i> |
|-------------------|---|--|
| Upper lip | Laterally in normal state and uncovered by rostral cap, but with median portion greatly reduced into a thin skin fold closely adnate to upper jaw behind cutting margin | Separated from upper jaw and greatly reduced into a thin skin fold closely adnate to it behind cutting margin; not covered by rostral cap |
| Upper jaw | Bearing a thin and flexible horny sheath on cutting margin of its median portion | Bearing a thick and sharp horny sheath on cutting margin of its entire length |
| Lower lip | Laterally in normal state and anteromedially separated from median part of lower jaw by a shallow groove adnate to it behind its cutting margin; non-papillated | Fully separated from median part of lower jaw and adnate to it behind cutting edge, but from lateral parts by postoral grooves; papillated |
| Lower jaw | Distally uncovered by lower lip, bearing a thin flexible horny sheath on cutting edge; laterally enclosed in lower lip | Completely exposed or uncovered by lower lip; laterally disconnected from lips |
| Postoral groove | Absent | Present, restricted to corner of mouth |
| Postlabial groove | Deep; anteromedially extended | Shallow; anteriorly extended |

Distribution and habitat. *Speolabeo hokhanhi* is known only from the type locality (Fig. 4). Hang Va Cave is roughly 35 km south of Phong Nha village, rather close to Hang Son Doong, the world's largest known cave that is 5 km long, 200 m high and 150 m wide. A 24 km southward drive along the West Ho–Chi–Minh highway starting from the tourism center of the Phong Nha–Ke Bang National Park leads to the point closest to the cave site of the Hang Son Doong. From there, roughly 1.5 hours' northward walk following a narrow stony track through thick forest arrives at Hang Va Cave. Its entrance is about 30 meters above the ground. A descent of 15 m from the entrance reaches a cave passage containing a subterranean stream. Downstream for approximately 200 meters, there is a shallow water pool with many stalagmites, usually 2–3 m tall (Fig. 5), where the type specimens of the new species were collected during the dry season. At this time, the pool had a muddy substrate and was 0.5–1.5 m in depth, 10 m wide, and 25 m long. More than 30 individuals of about the same size were observed in the pool; only six were captured using a hand-net. The fishes were swimming slowly and haphazardly, rather close to the water surface; when disturbed, they swam deeper, but did not seek shelter. A new shrimp species was found to sympatrically occur with the cavefish (Do & Nguyen 2014).

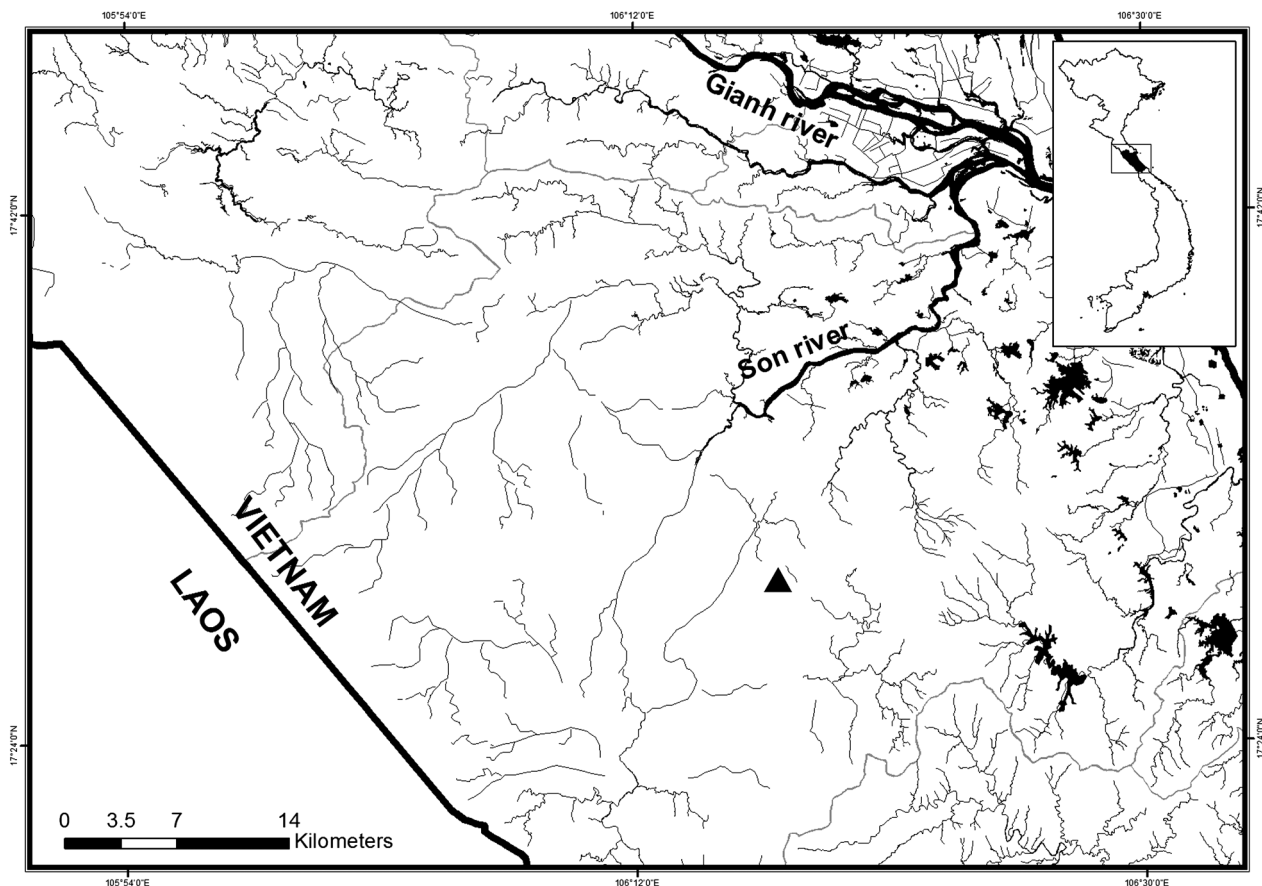


FIGURE 4. Distribution of *Speolabeo hokhanhi* (▲).

Discussion

Although the species under description is designated to *Speolabeo*, its generic classification remains tentative. Kottelat's (2017) generic definition of *Speolabeo* included characters typical for *S. musaei*, the only included species of the genus. In addition to characters common to cavefish such as absence of eyes and loss of pigments (pinkish in life) (Proudlove 2006), these two species possess the following characters: 7 or 8½ dorsal-fin branched rays, pelvic fins inserted at the vertical between the first unbranched and first branched dorsal-fin rays, no tubercles on the snout, upper jaw not fully enclosed in the upper lip, postlabial groove medially interrupted, distal dorsal-fin edge straight or slightly concave, and 35–38 pored lateral-line scales. These characters are useful to distinguish *Speolabeo* from *Bangana*, *Altigena* and an unnamed genus represented by the '*B.*' *lemassoni* species group

(Kottelat 2001a, 2001b, 2017; Nguyen *et al.* 2016). These three genera primarily differ in the structures of their lips and postlabial grooves, as shown in figs. 1A–C of Zhang & Chen (2006). Our comparison with Chinese species of *Bangana s.l.* found that some other characters are also diagnostic for *Speolabeo*: circumpeduncular scales 14 (vs. 20 in *Bangana s.s.*; 16–20 in *Altigena*, and 20–24 in the unnamed genus); upper jaw bearing a thin, flexible horny sheath on the cutting edge of its median portion (vs. absent, entirely enclosed in upper lip); lower jaw with a thin and flexible (vs. thick and sharp) horny sheath on cutting margin of its median portion; postoral groove shallow and medially interrupted or absent (vs. deep and medially uninterrupted); no lateral lobe of rostral fold (vs. present in *Bangana s.s.*); and no ethmoidal furrow (vs. present in *Bangana s.s.*) (Table 2).



FIGURE 5. Vietnam: Son River basin: Hang Va Cave. a) habitat of *Speolabeo hokhanhi*, b) the pool where type specimens were collected.

However, there are still marked differences in the mouthpart soft-tissue structures of *S. hokhanhi* and *S. musaei* (Table 3). It is illustrated in Fig. 5 on page 496 of Kottelat (2017) that *S. musaei* has an upper lip separated from the upper jaw, but adnate to it behind the horny sheath on its cutting margin; a lower lip anteriorly adnate to the median portion of the lower jaw and separated from the lateral portions by a shallow postoral groove, bearing a band of papillae along its anterior margin; a lower jaw completely exposed or uncovered by the lower lip and laterally discontinuous from the inner surface of the confluence between upper and lower lips around the corners of mouth; and a postlabial groove shallow anteromedially extended, but not meeting its counterpart. In *S. hokhanhi* (Fig. 3), the upper lip is laterally in normal condition, and medially greatly reduced into a thin skin fold adnate to upper jaw behind its cutting margin; the lower lip is non-papillated, laterally in the normal state, and anteromedially separated from the lower jaw by a shallow groove or adnate behind the cutting edge, and posteriorly continuous with the gular region; the lower jaw is laterally enclosed in the lower lip, but with its median portion separated from the lower lip, bearing a thin and flexible horny sheath on the cutting margin, and distally exposed; and the postlabial groove is deep and anteriorly extended, but not meeting its counterpart (Table 3). *Speolabeo musaei* shares the following characters with *Bangana*, *Altigena*, and an unnamed genus represented by the '*B.*' *lemassoni* species group: postoral grooves setting the lower lip apart from the two sides of the lower jaw; a lower lip papillated and laterally discontinuous from the confluence between the upper and lower lips; and a thick sharp horny sheath on the cutting edge of the lower jaw. These characters are missing in *S. hokhanhi*. By contrast, *S. hokhanhi* has a non-papillated lower lip laterally enclosing the lateral part of the lower jaw, a thin flexible horny sheath on the median portion of the upper jaw, and no postoral grooves. None of these characters are shared with *Bangana*, *Altigena*, an unnamed genus represented by the '*B.*' *lemassoni* species group, and *S. musaei*. In terms of the morphology of mouthpart soft-tissue structures, *S. musaei* seems to be more closely related to these three genera than to *S. hokhanhi*. The phylogenetic relationship of the new species and *S. musaei* among the Labeonini and their generic classification need further investigation, especially on the basis of molecular evidence.

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