

BARBUS SPELEOPS NEW SPECIES, A BLIND CAVEFISH FROM THAM PHU KHIEO, MEKONG BASIN, THAILAND

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A B S T R A C T

Barbus speleops, the first true cavefish of the family Cyprinidae found in Thailand, is described from three adult and two juvenile specimens collected in Tham Phu Khieo. The eyes are relatively well developed in juveniles, but in adults are withdrawn to the back of the orbit, leaving a large eye hole opening into a vacant orbital space. Apart from reduction of eyes and loss of pigmentation the species is a morphologically primitive or generalized member of the subfamily Barbinae. The population density is relatively high, 65 to 150 individuals per hundred meters of underground stream.

I N T R O D U C T I O N

This paper provides a description of the first true cave species of the fish family Cyprinidae known from Thailand. The type specimens were collected by cave biologist Philip Chapman, who also kindly provided background information on the type locality. The types are deposited in the California Academy of Sciences, San Francisco (CAS), and Thailand Institute for Scientific and Technological Research (TISTR). Apart from its reduced or vestigial eyes and coloration, the new species is morphologically similar to many surface dwelling barbines. Its phyletic relationship to surface dwelling forms is unknown, and therefore it is assigned arbitrarily to the barbine type genus *Barbus* Cuvier 1816 (type species *Cyprinus barbuis* Linnaeus 1758). Population density of the fish in Tham Phu Khieo was estimated at 65 to 150 individuals per 100 m over the approximately 500 m where fish were observed. Stomach contents of one adult and one juvenile consist predominantly of minute calcite crystals, with some finely divided insect remains and perhaps some plant remains (no whole insects or plant parts observed in either specimen). The same species also was observed by Chapman in Tham Pathewada, another cave near Tham Phu Khieo, but the population density was much lower and no specimens were collected there.

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Barbus speleops new species

Figures 1–4

Holotype. — CAS 67194, 122 mm, Tham Phu Khieo, Phu Khieo Wildlife Sanctuary, 101° 32' 10" E, 16°2' 05" N, 9 April 1989, P. Chapman.

Paratypes. — CAS 76112, 2: 59.2 – 121 mm, and TISTR 2642-3, 2: 57.9 – 124 mm, same data as holotype.

Diagnosis. — A cave-inhabiting barbine, with greatly reduced eyes and pigmentation. Juveniles with small eye free from orbital rim but otherwise apparently normal; adults with depigmented eyeball retracted to posterior wall of orbital socket; orbit retaining a large opening (eye hole) throughout life. Last unbranched dorsal fin spine strongly serrated. Body completely covered with scales of normal (or nearly uniform) size; lateral line complete, scales in lateral series 29 – 30; transverse scale rows 5/1/2. Vertebrae 25 + 14 = 39.

Description. — Proportional measurements and counts are given in Table 1. All were taken in the manner defined by HUBBS & LAGLER (1947). Measurements are expressed as times in standard length.

Barbus speleops is a morphologically primitive or generalized barbine, and most of its characteristics occur in many other barbine species, including nearly all of the counts and measurements in Table 1. The combination of 29 – 30 scales in the lateral series and 39 vertebrae might be distinctive, but insufficient information is available on number of vertebrae in barbines.

Head and mouth moderately large; mouth about as wide as long, gape restricted to anterior third of head; snout broadly rounded. Anterior and posterior barbels well developed, about equally elongate (Table 1). In the three larger (adult) specimens the eye hole is open and the orbital space is large; the eyeball, apparently consisting mainly of lens surrounded by connective tissue, is small and retracted to the posterior orbital wall, leaving most of the eye socket empty. In the two juvenile specimens, eyeball nearly flush with and as large as eye opening, but slightly retracted from it, so that orbital rim is entirely free. I have not observed such a condition in any surface-dwelling barbine. Lips relatively thin; free posterior margin of lower lip broadly interrupted medially; median chin barbel (fleshy mental lobe) absent.

Like nearly all features except those involving the eyes, the gill rakers and pharyngeal teeth are morphologically generalized or even primitive. Gill rakers simple, short, widely spaced, and relatively few in number (Table 1). Pharyngeal teeth (examined only in 121-mm specimen), moderately hooked or uncinata, in three rows (Fig. 4a). Left pharyngeal arch with only 4 teeth in main row, and no sign of a tooth socket where the right pharyngeal arch has a small, peglike, anteriormost fifth tooth. Except this single tooth, all teeth on both arches with slightly to well-developed hooks. In the specimen figured, the number of teeth actually present is 1.3.4/4.3.2 (left/right). There are, however, well developed sockets for the second tooth of the lesser (outer) row on the left side, and for the third (middle) tooth of the main (inner) row on the right. Therefore the pharyngeal tooth count is given as 2.3.4/5.3.2 in Table 1. The teeth are very clearly aligned in inner, middle and outer rows. In number, size, and shape they are very similar to those of other

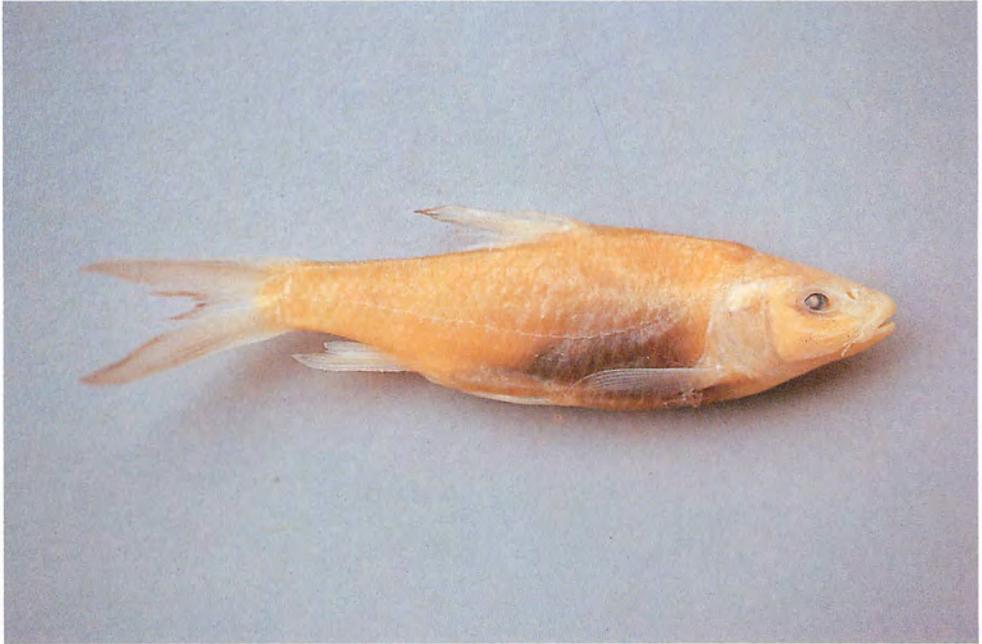


Figure 1. *Barbus speleops*, 59.2- mm paratype.



Figure 2. *Barbus speleops*, 122-mm holotype.



Figure 3. *Barbus speleops*, 122- mm holotype, close-up of head.

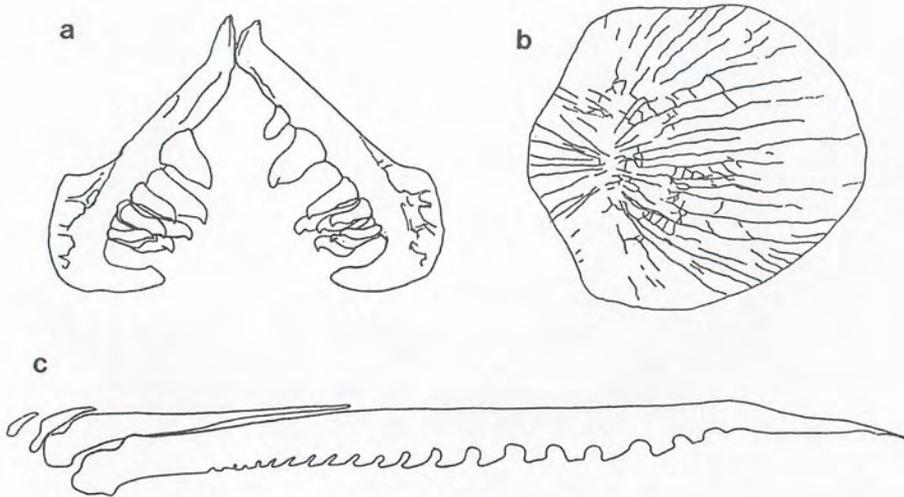


Figure 4. *Barbus speleops*. a, pharyngeal arches (dorsal view), 121-mm paratype; b, scale from side of body midway between dorsal-fin base and lateral line, 122-mm holotype; c, unbranched rays of dorsal fin, 121- mm paratype.

barbines with three pharyngeal tooth rows I have examined, including mountain stream species of *Neolissochilus* and *Tor* which do not seem particularly closely related to *Barbus speleops*.

Body moderately elongate and laterally compressed, caudal peduncle somewhat slender (Table 1). Dorsal fin margin distinctly concave; dorsal fin origin slightly anterior to vertical line through pelvic fin insertion. Last simple (fourth) dorsal fin ray with well developed serrae extending entire length of ray (Fig. 4c) and increasing in number from 12 to 21 in individuals of 59 – 122 mm (Table 1). Pectoral and pelvic fins slightly falcate; tip of adpressed pectoral fin extending slightly beyond pelvic fin insertion. Tip of adpressed pelvic fin falls considerably short of anal fin origin. Anal fin moderately lobate. Caudal fin deeply forked, lobes pointed.

Squamation generalized. Body completely covered with scales of nearly uniform size, those on breast smaller than others. Scale from 122 mm holotype with radii evident on all fields (Fig. 4b), circuli confined to anterior (proximal) and lateral fields, and what appear to be seven or eight growth rings (annuli?). Scale sheaths on dorsal, anal, and caudal fins weakly developed, those on dorsal and anal fins consisting of but one scale row. Transverse scale rows and circumpeduncular scales relatively few (Table 1). Lateral line complete; lateral line tubules simple, straight, extending length of exposed portion of apical field of each scale in lateral line series; some tubules with one or two short, ventroposteriorly-directed branches.

Head and body of larger specimens entirely or almost entirely devoid of melanophores; juveniles with fine melanophores on dorsolateral portions. All specimens with distal margin of dorsal and especially caudal fins darkened by numerous fine melanophores. Fine melanophores extending lengths of upper and lower-most 3 – 4 principal caudal fin rays and their interradiial membranes, presumably the remnant or vestige of well-marked upper and lower marginal stripes on the surface dwelling forms ancestral to the cave species. This color pattern is particularly evident in the 59.2-mm paratype (Fig.1). Such stripes are characteristic of many (but not all) moderately large-sized Southeast Asian barbine species.

Etymology. — The name *speleops* is from the Greek *speos*, cave and *ops*, eye.

B I O L O G I C A L O B S E R V A T I O N S

The following comments on habitat, ecology, and food habits of *Barbus speleops* are based mainly on information provided by the collector, Philip Chapman. Tham (Thai for 'cave') Phu Khieo is some 2,800 m long and 170 m deep. The steep entrance passage is clean-washed, suggesting that the cave is a major flood-sink during the rainy season. Fish thought to be the same species were observed but not collected in Tham Phathewada, several kilometers away but probably part of the same (largely phreatic) stream system. A small stream flowing directly into Tham Phathewada may provide the only permanent year-round surface input into the underground system, which otherwise probably is fed largely from percolation sinks around its margins. Other than the stream flowing into the entrance of Tham Phathewada there seem to be no or almost no direct surface connections, except

Table 1. *Barbus speleops*. Proportional measurements and counts from holotype and two paratypes.

	Holotype	Paratype	Paratype
Standard length (mm)	122	121	59.2
Proportional measurements			
head length	3.1	2.8	3.2
head width	5.9	4.9	6.6
snout	8.1	7.0	9.1
orbit	33.4	28.1	25.7
eyeball	97.6	46.5	25.7
interorbital width	9.2	8.7	10.7
cheek width	8.8	8.0	9.4
gape	9.2	7.5	10.8
upper jaw length	9.0	8.1	11.1
lower jaw length	8.6	7.6	8.7
anterior barbel	10.5	11.4	11.0
posterior barbel	10.2	10.5	12.9
predorsal length	1.7	1.8	1.9
body depth	3.5	3.9	3.4
caudal peduncle length	6.4	5.7	5.9
caudal peduncle depth	9.2	10.2	9.0
dorsal fin length	3.9	4.5	3.7
anal fin length	5.3	5.6	4.8
pectoral fin length	3.7	4.2	3.9
pelvic fin length	4.9	5.4	4.7
Counts			
pharyngeal teeth	—	2.3.4/5.3.2	—
gill rakers	4 + 8 = 12	4 + 8 = 12	3 + 8 = 11
dorsal fin rays	iv 7 1/2	iv 8 1/2	iv 8 1/2
dorsal fin serrae	21	18	12
anal fin rays	iii 5 1/2	iii 5 1/2	iii 5 1/2
pectoral fin rays	15	15	15
pelvic fin rays	9	10	9
caudal fin rays	9, 10/9, 8	11, 10/9, 10	8, 10/9, 10
lateral line pored scales	29 + 2	30 + 2?	30 + 2
predorsal scales	12	12?	12
transverse scales	5/1/2	4/1/2	5/1/2
circumpeduncular scales	12	12	13
vertebrae	25 + 14 = 39	25 + 14 = 39	25 + 14 = 39

the presumed but untested resurgence into the Huai Lam Chi near Ban Lon. The cave streams of Tham Phu Khieo and Tham Pathewada appear to be inhabited by only one true cavefish, the *Barbus speleops*; a small pigmented and normal-eyed loach (nemacheiline?) was seen in Tham Pathewada. At the time of collection, April 1989, the cavefish was very abundant in Tham Phu Khieo, with an estimated 65 – 150 individuals per 100 m of stream. In view of the large size of *B. speleops* compared to most other cavefish species, this represents a remarkably high population density and high biomass, suggesting a large input of plant detritus into the cave ecosystem during the rainy season, and this in turn suggests an important role for large open sink caves as routes for seasonal food input. Most caves in Thailand have substantial bat populations, but the river passage of Tham Phu Khieo was occupied only by a few trident bats (species unidentified) at the time the fish were collected. Their droppings probably do not represent a major source of food for the fish. Tham Pathewada has a large population of fruit bats (species unidentified), and their droppings may be an important source of fish food, but the cavefish population in this cave is much less than that in Tham Phu Khieo. No fish were seen in the entrance area of Tham Pathewada reached by light, but only in the dark parts of the cave. The entire length of the underground river in Tham Phu Khieo is in darkness. The fish live in shallow running water, in pools 10 to 50 cm deep with large rocks. Stream gradient (measured with Suunto inclinometer) 1 – 4%, water temperature about 23°C. The cavefish are common in a 500 m stretch of underground river beginning about 250 m from the entrance to the cave and ending in a sump. Small fish, of about the size collected, were only slightly more numerous than large ones. The gut of the 121-mm paratype is 190 mm long, largely filled with finely particulate matter, the bulk of which seems to be calcite crystals, with some particulate organic matter, some insect and some plant, but most of it unidentifiable. The gut of the 59.2-mm paratype is 90 mm long, with similar contents. No whole insect or entire plant parts present in either specimen.

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REFERENCE

- HUBBS, C.L. and K.F. LAGLER. 1947. Fishes of the Great Lakes Region. *Cranbrook Institute of Science Bull.* 26, 186 pp.

