Japanese Journal of Ichthyology
Vol. 19, No. 2 September 20, 1972

魚類学雑誌
19巻2号 1972年9月20日

Botia eos, a New Spiny Loach from Thailand and Laos, with Notes on Some Related Forms in Asia

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(Received April 8, 1972)

Abstract *Botia eos* is described as a new species from the Menam Chao Phya and the Mekong drainages in Thai-Lao region. The new species is distinguished from other related species primarily by having 10–11 branched dorsal rays. Its closest relatives appear to be *B. horae* and *B. lecontei*. The holotype and other specimens of *B. lecontei* are also described to supplement the original description. The genus *Botia* is usually divided into three subgenera, i.e., *Botia, Hymenophysa*, and *Sinibotia*. In *Hymenophysa*, which is represented by a Burmese and all Thai-Lao species except *B. helodes*, two distinct species-groups are recognized: one, *hymenophysa*-group, is characterized chiefly by the premaxillae with sickle-shaped anterior projections surrounding a cavity between them and small, simple mental lobes on the lower lip, and the other, *modesta*-group, to which *B. eos* is to be referred, by the ordinary premaxillae not surrounding a cavity and relatively large mental lobes with a pair of small fleshy papillae on each the lobe. The two species-groups, however, agree with each other in having a large fontanelle on the top of cranium, a less developed osseous capsule of gas-bladder, and a large posterior chamber of gas-bladder. *B. macracantha* is generally regarded as belonging to the subgenus *Botia* together with all Indian forms. However, though it approaches the subgenus *Botia* in the feature of the mental lobe, it shares the characters of the fontanelle and the gas-bladder with *Hymenophysa* rather than *Botia*. The morphological distinctness of *B. macracantha* and its range far apart from the main habitat of the subgenus *Botia* in India may probably suggest its unique phylogenetic position.

Introduction

In the collection of freshwater fishes in 1966–1967 (Taki, 1968), 1969, and 1970–1971 at several places in the drainage of the Mekong River, my attention was called especially to the cobitids among many other groups. With fairly a substantial material at hand, and our rather scanty knowlege in the past, I was led to attempt a revisional work, which is progressing now, on the species referred to the genus *Botia*.

Preliminary to the revisional study, I shall report in the present paper one species which is believed new to science, studies on some morphological characters which are shared by the species and related forms, and warrant species and species-group diagnoses, and also a concept on subgeneric relationships in the genus *Botia*. The present study was made based on eight Thai-Lao and Indonesian species numbering in total 298 specimens mostly derived from original collection made in the region, and three Indian-Burmese species numbering 23 specimens mostly loaned from other institutions.

The new species, *Botia eos*, was described on total of 31 specimens. The types of *B. lucasbahi* Fowler and *B. lecontei* Fowler were examined, and the former was synonymized with *B. beauforti* Smith. Also, the holotype of *B. lecontei* together with other specimens in my own collection was fully described to supplement the original description.

Status of the genus *Botia* and the problems on its subgenera

In his study of the botine fishes in China, Fang (1936) divided the fishes into two genera, *Botia* and *Leptobotia*, mainly based on the structure of the preorbital spine, namely those with bifid spine into *Botia* and those with

simple spine into *Leptobotia*. In *Botia* he recognized three subgenera, *Botia* s. str., *Hymenophysa,* and *Sinibotia*, referring to the combination of characters of the barbels, cheek scales, gas-bladder, and fontanelle on the top of the cranium. He reported the presence of cheek scales not only in *Leptobotia* but also in *Hymenophysa*, and hence assigned several Chinese and a Japanese species possessing both cheek scales and bifid spine to *Hymenophysa*. Nalbant (1963) pointed out that the sides of the head are not covered with scales in two Thai and one Burmese species referrable to *Hymenophysa*, and also that the bifid spine of these Chinese and Japanese species differs from that of Thai-Burmese forms of *Hymenophysa* in the size and position of the dorsocaudal process (branched prong in my definition). He hence distinguished the two subgenera chiefly by the presence (in *Leptobotia*) or absence (in *Botia*) of cheek scales, and allocated these Chinese and Japanese forms under *Leptobotia* together with other Chinese species having simple spine. This generic arrangement appears to be clear from the distributional viewpoints: according to the classification *Leptobotia* occurs in China and Japan, while *Botia* ranges in Southeast and Southwest Asia with the exception of the monotypic subgenus *Sinibotia* which occurs in western China. In the subgeneric classification of *Botia* he retained Fang's subdivision in general, and distinguished them by the feature of the mental lobe, fontanelle, and gas-bladder.

According to Bănărescu and Nalbant (1968), the subgenus *Botia* is represented by all Indian forms, one Assam-Burmese species, *B. histrionica* Blyth, and one Indonesian species, *B. macracantha* (Bleeker), the subgenus *Sinibotia* by a single Chinese species, *B. superfiliaris* Günther, and the subgenus *Hymenophysa* probably by all Thai species. However, *B. helodes* Sauvage, which is known from Thailand (or Cambodia, locality ambiguous) merely by the original description (Sauvage, 1876), has eight barbels, in which it approaches typical *Botia*.

In the course of my study of *Botia* collected in Thai-Lao region, I have recognized the existence of two distinct species-groups among the forms referred to *Hymenophysa*, the two being distinguishable from each other by the features of the barbels, mental lobe, cranium, and premaxilla. I have also noticed that *B. macracantha* differs from the Indian-Burmese representatives of the subgenus *Botia* in the internal characters as well as in its distributional pattern. These facts seem to suggest the necessity of taxonomic re-arrangement of the fishes of the genus *Botia* and their phylogenetic clarification in relation to their geographical distribution.

Material studied

A large part of the specimens examined in the present study was derived from my own collection made from 1966 to 1971 in Thailand, Laos, and Indonesia. These specimens are deposited in the Institute for Breeding Research, Tokyo University of Agriculture (IBRP), the Department of Zoology, National Science Museum, Tokyo (NSMT), and the Academy of Natural Sciences of Philadelphia (ANSP). Other material studied includes IBRP specimens other than those derived from the original collection, and specimens loaned from ANSP, Zoological Survey of India (ZSIF), Kasetsart University, Bangkok (KUMF), and Museum National d'Histoire Naturelle, Paris (MNHN). The material treated in the present study is listed below by species. The collection data of *B. eos* are given preceding the description.

B. hymenophysa (Bleeker) —14 specimens, 59.5–97.0 mm in standard length, Koke-Tong, Ayuthya Province, Thailand, Dec. 14, 1964 (IBRP 5601) —7 (1, 125.0 mm, cleared and stained, Fig. 4A), 108.3–147.5 mm, Lake Bung Borapet, near Nakornsawan, Thailand, Oct. 31, 1968 (IBRP 3169) —35 (2 cleared and stained), 33.5–49.0 mm, Qua-Yai River near Nakornsawan, Thai-

land, Nov. 1, 1968 (IBRP 3170) —3, 56.4–60.5 mm, Rajburi, Thailand, Nov. 13, 1968 (IBRP 3175) —5 (2 cleared and stained), 131.4–170.5 mm, Nam Ngum R. at Tha Ngon, Laos, Nov. 27, 1969 (IBRP 3208) —3, 62.0–67.2 mm, Mekong R. at Hatdokkeo, near Vientiane, Laos, Dec. 2, 1969 (IBRP 3250) —30, 54.6–78.0 mm, Nam Khouk R. at Vieng Khouk, near Tha Bo, Thailand, Dec. 9, 1969 (IBRP 3291) —5, (1, 87.0 mm, Fig. 2A), 67.0–96.5 mm, Nam Ngum R. at Tha Ngon, Laos, Oct. 9, 1970 (NSMT-P 14544).

B. beauforti Smith —1, holotype of *B. lucasbahi* Fowler, 57.0 mm, Tachin, Thailand (ANSP 68005) —1, 135.0 mm, Thailand (KUMF, non-catalogued) —4 (2 cleared and stained), 33.5–48.8 mm, Qua-Yai R. near Nakornsawan, Thailand, Nov. 1, 1968 (IBRP 3172) —10, 37.6–48.0 mm, Rajburi, Thailand, Nov. 13, 1968 (IBRP 3174) —1, 52.5 mm (Fig. 3B), Nam Ngum R. at Tha Ngon, Laos, Sep. 12, 1970 (IBRP 4529) —1, 48.0 mm, Se Done R. at Pakse, Laos, Sep. 15, 1970 (IBRP 4554) —2, 57.0 and 57.4 mm. Nam Ngum R. at Tha Ngon, Laos, Oct. 6, 1970 (NSMT-P 14545).

B. berdmorei (Blyth) —4, syntypes, 76.0–108.6 mm, Tenasserim, Burma (ZSIF 2636/1) —2, 58.5 and 60.0 mm, Wangjing Stream, near Wangjing, Manipur, India (ZSIF 9866/1) —2, 94.8 and 109.0 mm, Khurda Stream near Thanga, Manipur, India (ZSIF 9871/1) —2, 72.3 and 79.2 mm (Fig. 3A), Manipur, India (IBRP 3453).

B. modesta Bleeker —1, holotype of *B. rubripinnis* Sauvage, later synonymized with *B. modesta,* ca. 59.5 mm, Thailand or Cambodia (MNHN 9545), only photographs and radiographs examined —10, 40.0–110.0 mm, Koke-Tong, Ayuthya Province, Thailand, Dec. 14, 1964 (IBRP 5602) —16 (2 cleared and stained, 1 of 2, 132.0 mm, Fig. 4B), 82.0–132.0 mm, Lake Bung Borapet, near Nakornsawan, Thailand, Oct. 31, 1968 (IBRP 3165) —2, 51.5 and 60.6 mm, Mekong R. at Hatdokkeo, near Vientiane, Laos, Dec. 2, 1969 (IBRP 3251) —1, 75.5 mm, Nam Ngum R. at Tha Ngon, Laos, Oct. 6, 1970 (IBRP 4561) —27, 46.0–78.5 mm, locality as IBRP 4561 above, Oct. 7, 1970 (IBRP 4576) —9, 47.0–77.2 mm, locality as IBRP 4561 and 4576, Oct. 9, 1970 (NSMT-P 14540) —9, (1, 72.5 mm, Fig. 2B), 64.0–74.3 mm, Nam Ngum R. at the Nam Ngum dam site, near Thalat, Laos, Oct. 14, 1970 (IBRP 5245).

B. lecontei Fowler —1, holotype, 78.5 mm (Fig. 3D), Kemrat, Thailand (ANSP 68006) —1, 73.0 mm, Mekong R. at Hatdokkeo, near Vientiane, Laos, Dec. 2, 1969 (IBRP 3255) —1, 74.0 mm, Mekong R. at Pakse, Laos, Dec. 5, 1969 (IBRP 3248) —6, 38.0–46.0 mm, Mekong R. at mouth of Houei Mong R., near Tha Bo, Thailand, Oct. 8, 1970 (IBRP 4607) —15 (1 cleared and stained), 60.2–101.0 mm, Mekong R. at Hatsalao, near Pakse, Laos, Feb. 9, 1971 (NSMT-P 14541).

B. horae Smith —10 (3 cleared and stained), 24.0–29.6 mm, Qua-Yai R. near Nakornsawan, Thailand, Nov. 1, 1968 (IBRP, non-catalogued) —1, 31.5 mm, Lake Bung Borapet, near Nakornsawan, Thailand, Nov. 20, 1969 (NSMT-P 14542) —4, 20.8–24.0 mm, Klong Kreing Klai R. near Nakornsawan, Thailand, Dec. 11, 1969 (IBRP 3287) —1, 32.0 mm (Fig. 3E), Mekong R. at Hatsalao, near Pakse, Laos, Mar. 2, 1971 (IBRP 5022).

B. sidthimunki Klausewitz —2, 21.0 and 22.2 mm (Fig. 3F), Mekong R. at Vientiane, Laos, Aug. 30, 1966 (NSMT-P 14543) —14 (3 cleared and stained), 20.0–26.0 mm, Rajburi, Thailand, Nov. 13, 1968 (IBRP, non-catalogued) —5, 20.6–22.8 mm, Se Done R. at Pakse, Laos, Sep. 15, 1970 (IBRP 4555).

B. macracantha (Bleeker) —9 (1, 89.5 mm, cleared and stained, Fig. 3I), 43.5–89.5 mm, Djambi, Sumatra, Indonesia, Nov. 22, 1969 (IBRP 3183).

B. almorhae Gray —1, 107.5 mm, Almorah, India (ZSIF 9148/1) —3, 35.5–41.0 mm, Markunda R., India (ZSIF 11174/1) —2,

102.5 and 114.2 mm, Kosi R., Almorah, India (ZSIF 208/2) —1 (partly cleared), 102.0 mm (Figs. 2D and 3G), Almorah, India (IBRP 3451).

B. birdi Chaudhuri —3, syntypes, 120.0–134.5 mm, Sirhind Canal, Punjab, India (ZSIF 3578/1—3580/1) —2, 77.2 and 102.0 mm, Kashmir, India (ZSIF 10113/1) —1 (partly cleared), 72.0 mm (Fig. 3H), Sinagar, India (IBRP 3452).

Methods of study

The measurements of body parts were made in a usual way as practiced in the treatment of other groups of fishes, however, it is pointed out that the height of both pectoral and pelvic fins was expressed by the longest ray of respective fin. The vertebral counts were made on radiographs, and the second and third centra, though fused, were counted as separated. The structure of the skull and the osseous capsule of gas-bladder was traced on cleared specimens as well as radiographs. The nomenclature of the skull elements and the gas-bladder capsule mostly followed that of Ramaswami (1953) and Alexander (1964) respectively.

Botia eos sp. nov.

(Figs. 1, 2C, and 3C)

Holotype—52.5 mm in standard length (SL), sex not determined, collected from Nam Ngum River, a tributary to Mekong R., at the mouth of Nam Khon R., a small stream flowing into Nam Ngum R., at Tha Ngon, about 22 km north of Vientiane, Laos, on Oct. 9, 1970, by Yasuhiko Taki, by means of a dip-net (NSMT-P 14537) (Figs. 1 and 3C).

Paratypes—1, 49.0 mm SL (NSMT-P 14538); 2, 49.0 and 52.5 mm SL (ANSP 109914), taken together with the holotype —1, 52.2 mm SL, from the type locality, Aug. 4, 1970 (IBRP 4355) —7 (1, 52.6 mm, cleared), 47.0–52.6 mm SL, Nam Khon R. at a point about 100 m upstream from its mouth to Nam Ngum R., at Tha Ngon, Laos, Oct. 6, 1970 (IBRP 4556) (1 of 7, 52.6 mm, Fig. 2C) —11 (1, 42.4 mm, cleared), 34.2–48.0 mm SL, Nam Ngum R. at the Nam Ngum dam site, near Thalat, Laos, Oct. 14, 1970 (IBRP 5246) — 1, 48.4 mm SL, Mekong R. at Hatdokkeo, near Vientiane, Laos, Dec. 2, 1969 (IBRP 3249) —1, 54.5 mm SL, Mekong R. at Tha Bo, Thailand, Dec. 9, 1969 (IBRP 3290) —2, 34.0 and 39.5 mm SL (NSMT-P 14539); 2, 36.0 and 38.0 mm SL (ANSP 109915); 2, 30.0 and 40.5 mm

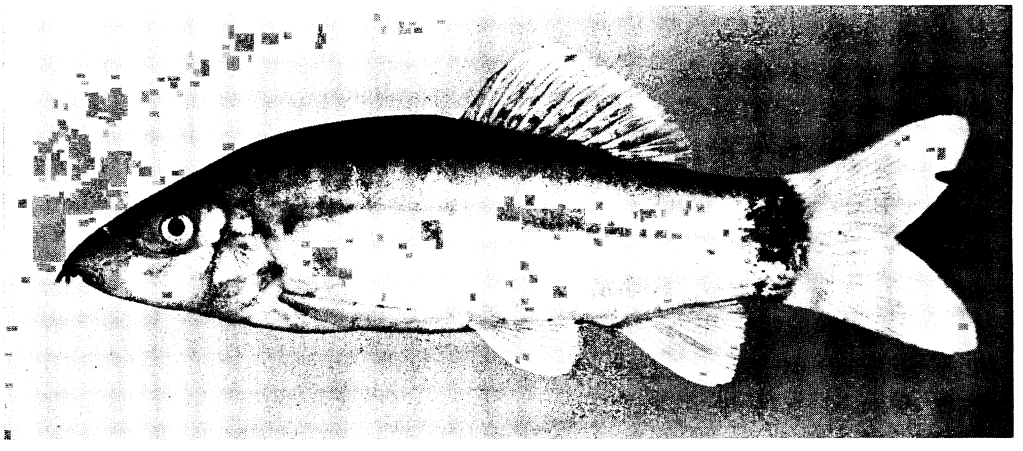


Fig. 1. *Botia eos* sp. nov. Holotype, 52.5 mm SL, NSMT-P 14537. Nam Ngum R. at Tha Ngon, Laos, Oct. 9, 1970. Collected by the author.

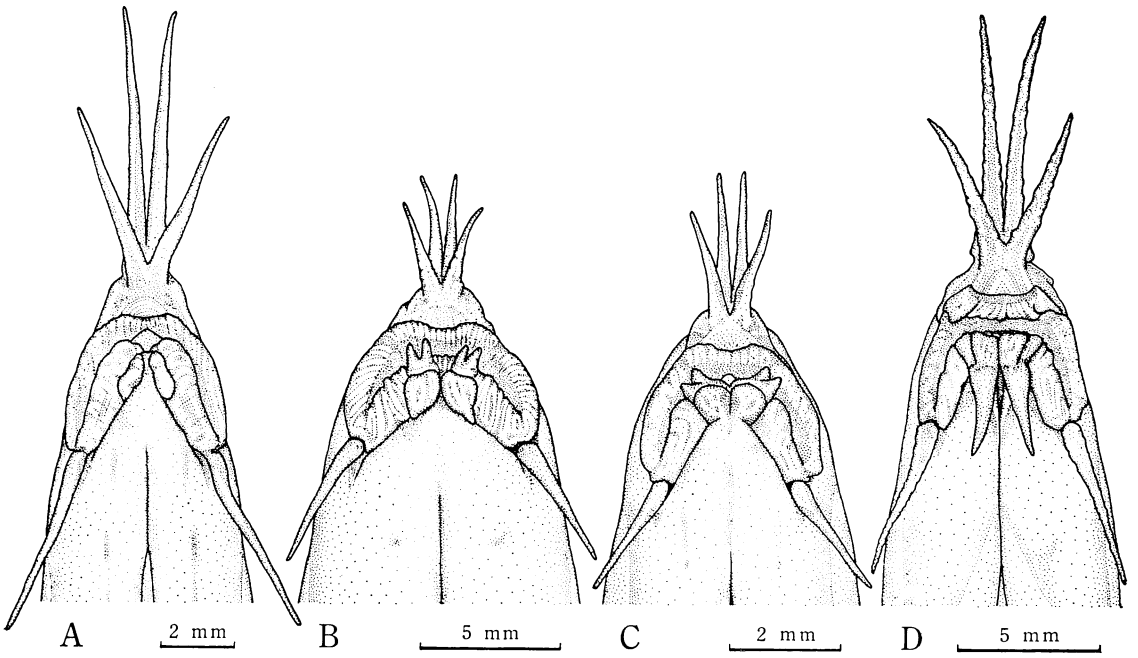


Fig. 2. Ventral view of mouth and barbels in the four species of *Botia*. (A) *B. hymenophysa*, 87.0 mm SL; (B) *B. modesta*, 72.5 mm SL; (C) *B. eos*, 52. 6 mm SL; (D) *B. almorhae*, 102.0 mm SL.

SL (IBRP 3286), Lake Bung Borapet, near Nakornsawan, Thailand, Nov. 20, 1969.

Diagnosis

A species of *Botia* in the subgenus *Hymenophysa*, distinguishable from all other forms in the subgenus by the character combination of: long-based (22–26% of SL, 66–83% of head length) dusky orange dorsal fin with a distinctly outlined colorless transparent distal margin; 10 – 11 branched dorsal rays; mental lobe with a pair of conical fleshy papillae; moderately curved preorbital spine reaching middle to posterior border of pupil, with a long dorsocaudal process; broad anterior portion of premaxilla with straight inner edge.

Description

The following description of morphological characters other than color pattern is based on the holotype and all of the paratypes. Proportional measurements and variations in the number of branched dorsal rays and pectoral rays are given in Tables 1 and 2 respectively.

Dorsal rays 3–4/10–11; anal 2–4/5; pectoral 11–14; pelvic 8; caudal 19 or rarely 20; vertebrae 31–33 and modally 32. Body moderately elongate, somewhat compressed; greatest depth at a point slightly in front of or at origin of dorsal; greatest width at halfway between insertions of pectoral and pelvic; caudal peduncle compressed, slightly deeper than long. Dorsal profile arched; ventral profile usually less curved (Fig. 1). Head moderately long, high. Snout pointed, rather short, its length equal to or shorter than half of head length, its tip separated from tuft of rostral barbels by a horse-shoe shaped ridge of skin. Nostrils nearer to eye than tip of snout. Mouth small, subinferior, oblique, greatly arched. Lips thick, upper and lower ones continuous basically and separated from each other by a shallow cleft at each angle of mouth; upper lip continuous, separated from skin of rostrum by a deep groove along its entire

Table 1. Proportional measurements of *B. eos* and *B. lecontei* expressed as percentages of standard length.

	B. eos					*B. lecontei*		
	Mekong R. drainage			Lake Bung Borapet		Mekong R. drainage		
	Holotype NSMT-P 14537	Paratypes N=24		Paratypes N=6		Holotype ANSP68006	Hatsalao specimens N=17	
		Range	$\bar{x}$*	Range	$\bar{x}$		Range	$\bar{x}$**
Standard length (mm)	52.5	34.2–54.5		30.0–40.5		78.5	60.2–101.0	
Body depth	30.9	27.7–32.1	30.1	28.0–32.6	29.8	27.1	24.4–28.8	26.4
Body width	15.2	13.7–16.3	15.2	13.2–14.8	13.8	15.4	13.7–16.4	15.0
Head length	30.7	28.8–32.7	30.8	29.6–33.3	31.3	27.3	25.8–30.8	27.8
Head depth at occiput	23.0	21.3–23.4	22.4	21.3–22.8	22.1	20.0	18.5–20.8	19.5
Snout length	14.9	13.9–16.2	14.8	13.1–15.0	13.7	13.0	12.2–14.4	13.2
Interorbital width	8.8	8.5–9.1	8.8	8.4–8.9	8.7	8.0	7.9–9.1	8.5
Caudal peduncle length	15.6	14.9–16.7	15.4	15.0–16.8	15.8	15.2	13.2–17.0	15.1
Caudal peduncle depth	17.1	15.5–17.8	16.6	15.6–17.8	16.6	15.3	14.6–16.3	15.5
Predorsal length	57.5	54.1–58.6	56.4	56.9–59.5	58.1	52.2	52.5–55.1	53.5
Preanal length	76.2	74.0–78.1	76.2	76.3–78.0	76.9	77.5	74.1–79.3	76.4
Prepectoral length	30.5	29.0–33.8	31.4	29.4–32.9	31.0	27.8	25.7–30.7	27.9
Prepelvic length	56.4	55.7–59.6	57.3	54.3–57.0	56.1	55.4	52.0–57.7	54.9
Eye diameter	4.8	4.4–5.6	4.9	4.9–5.7	5.2	4.2	3.7–4.7	4.1
Rostral barbel (dorsal pair)	5.1	4.1–6.0	5.0	5.1–6.2	5.5	5.4	5.2–6.5	5.8
Rostral barbel (ventral pair)	3.4	3.1–4.1	3.7	3.5–4.7	4.1	3.3	3.0–4.5	3.6
Maxillary barbel	4.8	4.0–6.4	5.1	3.8–5.7	4.7	6.1	5.5–7.1	6.2
Dorsal base	23.8	21.8–24.9	23.3	22.0–25.6	24.3	17.8	16.4–18.4	17.5
Anal base	10.9	9.9–11.3	10.4	10.3–11.4	10.8	9.3	8.9–10.1	9.4
First branched dorsal ray	16.6	16.1–19.1	17.4	16.3–19.0	17.2	17.6	16.0–19.1	17.2
First branched anal ray	15.6	14.9–16.8	15.8	14.5–17.3	15.5	15.3	14.4–15.9	15.1
Longest pectoral ray	19.8	18.8–21.8	20.2	18.1–20.7	19.4	19.1	17.0–19.7	18.1
Longest pelvic ray	15.2	14.3–16.3	15.0	13.7–16.3	14.8	15.3	13.6–16.0	14.6

* $\bar{x}$ for Mekong specimens including the holotype.

** $\bar{x}$ for Hatsalao specimens excluding the hototype.

Table 2. Counts of dorsal (branched) rays and pectoral (total) rays in the five species of *Botia* referred to the *modesta*-group. *B. eos* from two distinct drainages are also compared.

Dorsal rays	7	8	9	10	11		$\bar{x}$	N
B. eos								
Mekong drainage				15	10		10.40	25
Menam Chao Phya drainage (Lake Bung Borapet)				3	3		10.50	6
B. lecontei		24					8.00	24
B. modesta	1	70	3				8.03	74
B. horae		16					8.00	16
B. sidthimunki	6	15					7.71	21
Pectoral rays	**11**	**12**	**13**	**14**	**15**	**16**	$\bar{x}$	**N**
B. eos								
Mekong drainage	2	8	13	2			12.60	25
Menam Chao Phya drainage (Lake Bung Borapet)		4	1	1			12.50	6
B. lecontei			3	17	4		14.04	24
B. modesta			13	44	16	1	14.07	74
B. horae		10	6				12.37	16
B. sidthimunki		6	12	3			12.86	21

border, mesial portion of upper lip depressed downward, finely fringed; lower lip notched at symphysis, roughly ridged, separated from skin of chin by a deep groove laterally and continuous with skin of chin mesially by a pair of mental lobes; mental lobe fleshy, set at each side of symphysis, with a pair of small conical fleshy papillae at its anterior end (Fig. 2C). Barbels six, four rostral, two maxillary, rostral ones consisting of a dorsal pair and a ventral pair, the former longer than the latter, bases of the both pairs united together forming a short tuft at tip of snout; maxillary barbels slightly longer or in fewer cases slightly shorter than dorsal pair of rostral barbels (Fig. 2C). Eye small. Interorbit rather narrow, convex. Preorbital spine bifid, moderately curved, erectile up to about 90°, its origin nearer to nostrils than eye when erected, its tip extending to middle or posterior border of pupil when folded in a crescent-shaped groove below eye; dorsocaudal process long, moderately curved. Scales cycloid, embedded, minute; side of head not covered with scales. Lateral line complete. Origin of dorsal in posterior half of body, slightly in advance of insertion of pelvic (Fig. 1). Dorsal long-based, first branched ray usually longest. Pectoral longer than dorsal, inserted right behind gill opening. Pelvic short, simple ray and first branched ray shorter than second and third branched rays. Anal short-based, first branched ray usually longest. Caudal broadly folked, its length slightly shorter than head length, each lobe obtusely pointed; origin of rudimentary rays considerably in advance of distal tip of hypural bones.

Anterior portion of premaxillae broadened, presenting a roundish projection; inner edge of premaxilla of either side straight, not surrounding a cavity space between the bones of both sides (Fig. 3C); rostal process (see Fig. 4, rpp) long, ridged along its inner edge. Prepalatine columnar, short. Preethmoid rather long, broad. Top of supraethmoid [this portion was named anterofrontal by Monod and Le Danois (1966)] narrow, with a shallow groove on its surface. Anterior portion of orbitosphenoids [anterior portion of the bones as called orbitosphenoids by Ramaswami (1953) was named ectethmoids by Monod and Le Danois (1966)] assuming an angular shape in dorsal view. Frontals long, narrow, a long spinous fringe near each

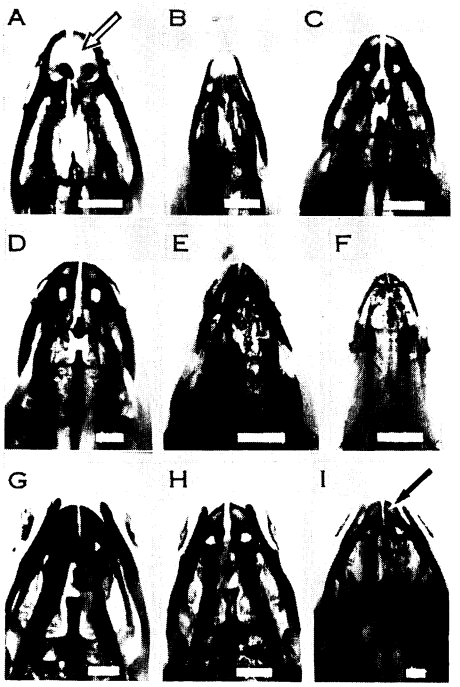


Fig. 3. Radiographs in dorsal view of forehead in the nine species of *Botia* showing the two types of premaxilla. (A) *B. berdmorei*, 79.2 mm SL; (B) *B. beauforti*, 52.5 mm SL; (C) *B. eos*, holotype, 52.5 mm SL; (D) *B. lecontei*, holotype, 78.5 mm SL; (E) *B. horae*, 32.0 mm SL; (F) *B. sidthimunki*, 22.2 mm SL; (G) *B. almorhae*, 102.0 mm SL; (H) *B. birdi*, 72.0 mm SL; (I) *B. macracantha*, 89.5 mm SL. A and B, the arched-type, open arrow indicates cavity space between the left and right anterior processes of premaxilla; C~I, the entire-type, solid arrow indicates thin portion of the anterior processes of premaxilla. Scales indicate 1 mm.

anterior corner. Fronto-parietal fontanelle large. Anterior chamber of gas-bladder entirely enclosed in fibrous coat and partly covered by osseous capsule; the capsule consisting of fourth and second parapophyses, the former roofing entire dorsal surface of the chamber and the latter covering anteior and latero-ventral part of the chamber. Posterior chamber of gas-bladder well developed, naked.

Coloration of fresh-caught specimens. The following description of color pattern is based on the holotype, all of the paratopotypes, and the Bung Borapet specimens. Ground color of body yellowish to reddish brown, darkest along mid-dorsal line and gradually lightened toward ventral surface, all part covered with green-golden to blue-golden irridescent luster except on ventral surface. A very broad irregular-shaped bluish black band at posterior end of caudal peduncle, the bands on both sides meeting above and below. Back and side of body with six very indistinct broad cross bands, three anterior and three posterior to origin of dorsal, the bands alternated with the same number of narrower faint bands; broad bands as wide as or narrower than interspace, narrower bands about half to one third width of broad bands: each band on both sides forming a saddle on back, extending to or below lateral line but not reaching ventral surface; all bands blackish basically with bluish metalic sheen; in three specimens (48.4–54.5 mm SL) the bands invisible. Dorsal hemmed with a narrow colorless transparent distal margin, rest of the fin uniformly yellowish orange, shaded with dusky melanophores, with two faint transverse stripes. Basal half of pectoral and pelvic yellow to orange-yellow, ranging to pale on distal half. Anal without stripes, other coloration same as dorsal. Caudal yellow to yellowish orange, sparsely covered with melanophores, distal margin of each lobe pale.

Coloration of preserved specimens. In formalin irridescent luster disappears, ground color turns pale. Cross bands on back and sides of body fade to light brownish gray, but their outlines become distinct; a small dark spot appears on second broad cross band above lateral line; band on posterior end of caudal peduncle remains dark. Dusky shade on dorsal, anal, and caudal somewhat or well faded; three transverse rows of brownish spots become distinct on dorsal.

Distributional and ecological notes. *B. eos* occurred in the lowland mainstreams and small- to large-sized tributaries of the Mekong River and also in the Lake Bung Borapet which is connected to the Menam Chao Phya

River system. These waters are mostly mud- or sand-bottomed, and show large seasonal fluctuation of the water level. Species of *Botia* collected together with *B. eos* were *B. hymenophysa*, *B. beauforti*, *B. modesta*, and *B. horae*. *B. eos* and all these associates were observed to dwell in the middle and bottom layers of the waters and move in schools. In *B. hymenophysa* and *B. modesta*, both of which are the commonest species of the genus *Botia* throughout the region, seasonal movement following the level fluctuation of the water was also witnessed during the collection. During rainy season from May through August when the water level rises, they disperse to small streams, often invading flooded plains. With incoming of dry weather they return to large rivers from the preceding habitats where no more water stays. From the collection of *B. eos* in Tha Ngon area referring to its season (beginning of dry season) and sites (at a small stream flowing into Nam Ngum River, and Nam Ngum River at the mouth of the small stream), it seems apparent that the species also performs similar seasonal migration. It is also probable that *B. eos* inhabits the mainstreams and tributaries of Menam Chao Phya River as well as the Lake Bung Borapet.

Etymology. *Eos*, Greek goddess of the dawn, refers to the shining yellowish or reddish brown body and the brilliant orange fins.

Botia lecontei Fowler

(Fig. 3D)

Botia lecontei Fowler, 1937: 156, figs. 71–74, Kemrat, Thailand; Smith, 1945: 291, (copied, key); Klausewitz, 1957: 36, 37, fig. 3, Thailand (description).

Description of the holotype. Proportional measurements, and branched dorsal and total pectoral ray counts are given in Tables 1 and 2 respectively, together with those for other specimens of the species derived from the original collection. Dorsal 4/8; anal 4/5; pectoral 14; pelvic 8; caudal 19; vertebrae 36. Mental lobe moderately developed, with a pair of small fleshy papillae. Preorbital spine moderately curved, its tip reaching two thirds in eye; dorsocaudal process long, moderately curved. Origin of dorsal much nearer to base of caudal than tip of snout, and in advance of insertion of pelvic. Anterior portion of premaxillae broadly rounded, no cavity space between left and right premaxillae (Fig. 3D).

Coloration of adults. The following description of color pattern is based on fresh-caught specimens (60.2–101.0 mm SL, Mekong R. at Hatsalao, Laos, Feb. 9, 1971, NSMT-P 14541). Ground color of body brown, darker dorsally, lighter ventrally, covered with greenish golden metalic sheen except on ventral surface. A large blue-black irregular-shaped blotch on caudal peduncle in front of caudal base, the blotch on each side continuous on mid-dorsal line but not meeting ventrally. Dorsal brownish yellow with greenish tint, with two dark brown irregular transverse stripes. Pectoral dusky yellow. Pelvic faint yellow basally, distal half almost colorless. Basal half of anal light brownish yellow, ranging to pale on distal half. Caudal yellow with greenish tint.

Coloration of juveniles. The following description of color pattern is based on fresh-caught specimens (38.0–46.0 mm SL, Mekong R. at mouth of Houei Mong R., Thailand, Oct. 8, 1970, IBRP 4607). Ground color of body light brown, darker dorsally, lighter ventrally, covered with greenish to silverly iridescent luster. A broad brownish black cross band at posterior end of caudal peduncle, the bands on both sides continuous above and below. Back and side of body with rather broad brownish black cross bands, usually five anterior to, four posterior to, and one at origin of dorsal; the bands alternated with about the same number of faint brownish black narrow bands; each band on both sides meeting above and extending downward to or slightly below lateral line. Dorsal yellow, with two irregular transverse rows of small

dark spots. Pectoral, pelvic, and anal light brownish yellow. Caudal brownish yellow, tip of each lobe pale.

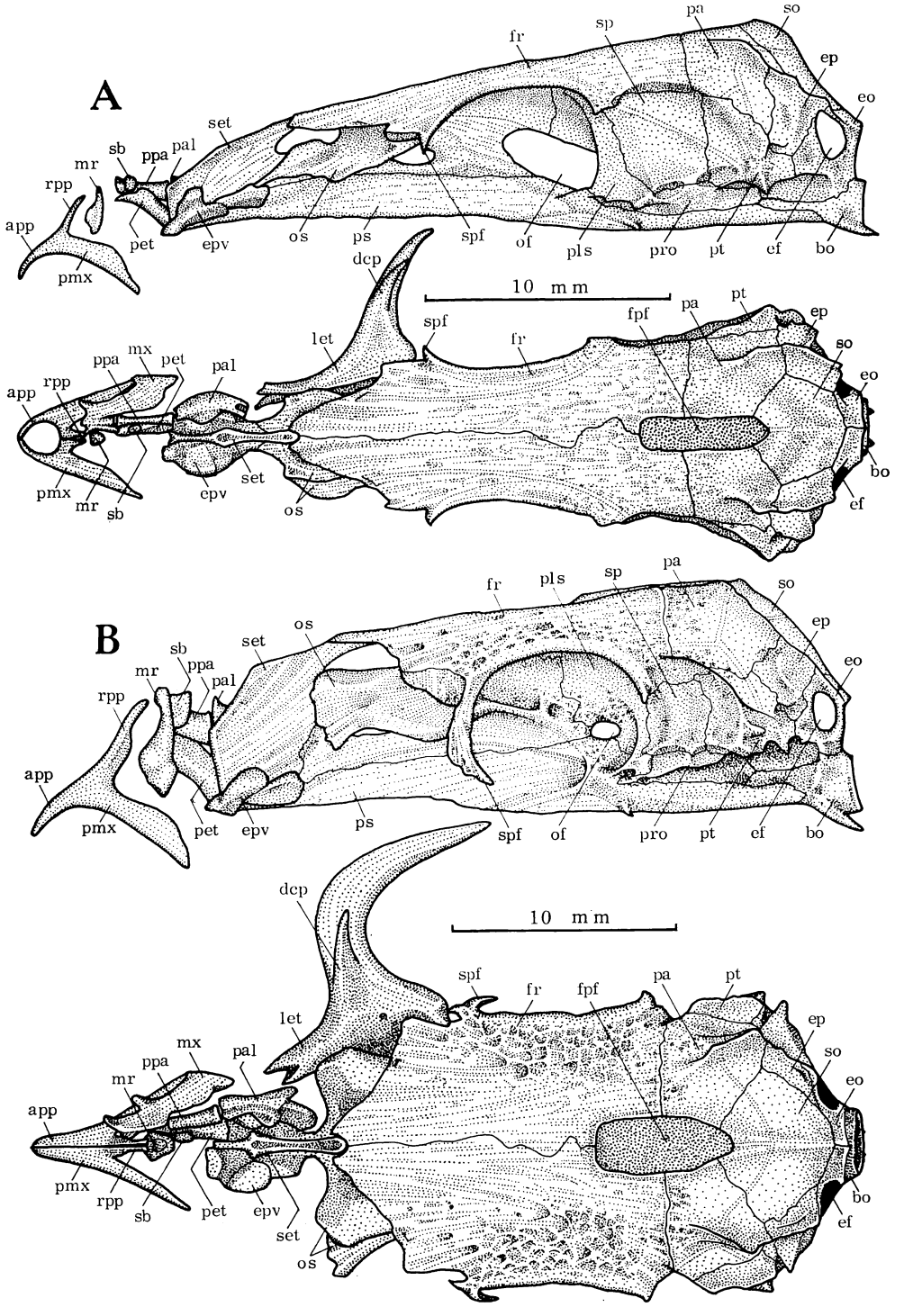
Remarks. Klaųsewitz (1957) published a description and a figure of *B. lecontei* from Thailand. The specimens on which the description and figure were based show significant difference from the holotype and my original samples chiefly in having longer head, longer caudal, and longer preorbital spine extending to the posterior border of the eye.

Mutual relationships of the species referable to the subgenus *Hymenophysa*

Prior to discussing the status of subgenera in *Botia* and the position of *B. eos*, I shall refer to the mutual relationships of the fishes belonging to the subgenus *Hymenophysa* and to the grouping of these fishes for the convenience of developing discussions. Ramaswami (1953) reported that the premaxilla of the subfamily Botiinae differed from that of other two subfamilies in Cobitidae, i.e., the Cobitinae and Nemacheilinae. He also expressed that in the Botinae "the rostral process of premaxilla takes place its origin not at the anterior end as in other examples of Cobitidae, but at the middle of the bone so much so, there is a semi-circular arch of the premaxilla formed in front for supporting the tuft of rostral (erroneously named maxillary in the text) barbels." Monod and Le Danois (1966), however, figured the ordinary-shaped premaxillae, that is, premaxillae without semicircular arches but with straight anterior portion, though they did not refer to Ramaswami's observation. In the material dealt with in the present study, the remarkable structure of the premaxilla as shown by Ramaswami was recognized only in three species which are to be referred to the subgenus *Hymenophysa,* i.e. *B. hymenophysa, B. berdmorei,* and *B. beauforti.* In these three species, the anterior portion of the premaxilla is arched or sickle-shaped, and there is a large roundish cavity space surrounded by the sickle-shaped anterior portions of the left and right premaxillae (Figs. 3A and B, and 4A). While, in all other forms examined in the present study, which fall into either *Hymenophysa* or *Botia*, the premaxilla is ordinary: the inner edge of the premaxilla of either side is straight, and there is no cavity between the left and right premaxillae (Figs. 3C–I, and 4B). Thus, it appears evident that there are two groups of species recognized in *Hymenophysa* referring to the structure of the premaxilla. In the forms with premaxilla ordinary (=entire), its anterior portion is wide (*B. eos, B. lecontei, B. horae,* and *B. sidthimunki,* Figs. 3C–F), or elongate (*B. modesta,* Fig. 4B). In the other forms the anterior portion is sickle-shaped. In both cases, irrespective of the shape of the bone, the anterior portion conspicuously projects antero-ventrally, which is called anterior process.

Radiographs of the two types of the premaxillae will further suggest close relationship of the two types: it is obvious that in the entire premaxilla the thickness of the bone is not uniform, and the inner portion of the anterior process is much thinner compared with other

Fig. 4. Upper jaw elements and cranium in the two species of *Botia* in the subgenus *Hymenophysa*, shown by lateral and dorsal views. (A) *B. hymenophysa*, 125.0 mm SL; (B) *B. modesta,* 132.0 mm SL. In the drawings the lateral view excludes maxillae, lacrimojugals, and lateral ethmoids; the dorsal view excludes maxilla, sesamoid bone, prepalatine, preethmoid, palatine, and lateral ethmoid of left side, and lacrimojugals of both sides. app, anterior process of premaxilla; bo, basioccipital; dcp, dorsocaudal process of lateral ethmoid; ef, exoccipital fenestra; eo, exoccipital; ep, epiotic; epv, ethmoprevomer; fpf, fronto-parietal fontanelle; fr, frontal; let, lateral ethmoid; mr, median rostral; mx, maxilla; of, optic foramen; os, orbitosphenoid; pa, parietal; pal, palatine; pet, preethmoid; pls, pleurosphenoid; pmx, premaxilla; ppa, prepalatine; pro, prootic; ps, parasphenoid; pt, pterotic; rpp, rostral process of premaxilla; sb, sesamoid bone; set, supraethmoid; so, supraoccipital; sp, sphenotic; spf, spinous fringe of frontal.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portion of the bone, and also, that the thin portion of the entire premaxilla corresponds in position to the cavity space in the sickle-shaped one (compare Figs. 3C–I with Figs. 3A and B). It may be reasonably presumed from these observations that the sickle-shaped premaxilla may have derivatively specialized from the entire one by the indentation of the thin portion.

In addition to the difference in the feature of the premaxilla, it was revealed from the material at hand that the two groups in *Hymenophysa* are distinguished from each other also in other characters. I propose to call them *hymenophysa*- and *modesta*-group. The two species-groups may be characterized as follows:

hymenophysa-group: (Figs. 2A, 3A and B, and 4A). Rostral and maxillary barbels long. Mental lobe relatively small, without fleshy papillae. Anterior process of premaxilla sickle-shaped, surrounding a cavity between left and right processes; rostral process short, without a ridge along its inner edge. Preorbital spine receded, the angle between median line of spine and the line uniting anterior and posterior ends of basal part (see Nalbant, 1963) more than 90°. Anterior portion of orbitosphenoids [=ectethmoids of Monod and Le Danois (1966)] assuming a roundish contour in dorsal view. Spinous fringe near either anterior corner of frontals short. Optic foramen large.

modesta-group: (Figs. 2B and C, 3C–F, and 4B). Rostral and maxillary barbels short. Mental lobe relatively large, with a pair of fleshy papillae at its anterior end. Anterior process of premaxilla entire, not surrounding a cavity; rostral process rather long, with a more or less distinct ridge along its inner edge. Preorbital spine not receded, the same angle above mentioned less than 90°. Anterior portion of orbitosphenoids (=ectethmoids) assuming an angular shape in dorsal view. Spinous fringe of frontals very long, or short only in *B. sidthimunki*. Optic foramen small.

The *hymenophysa*-group is represented by three species, i.e. *B. hymenophysa, B, berdmorei,* and *B. beauforti* [=*B. lucasbahi* and *B. beauforti formosa* Pellegrin and Fang (1940)]. *B. hymenophysa* is widely distributed in Indochina, Thailand, Malay Peninsula, and Indo-Australian Archipelago. *B. berdmorei* and *B. beauforti* are closely related to each other, but in the geographical distribution they are segergated from each other, the former occurring in upper and lower Burma while the latter in the Thai-Lao region (Fig. 5A). The *modesta*-group is represented by six species, i.e., *B. modesta* (=*B. rubripinnis*), *B. horae, B. lecontei, B. sidthimunki, B. eos,* and probably also by *B. morleti* Tirant, though the species named last is known solely from the original description (Tirant, 1885). All the forms of this species-group are recorded from the continental Southeast Asia probably excluding Burma (Fig. 5A).

From the characters of the two species-groups defined above, it may be recognized that the difference between the two is mostly concerned with rather small degree of specialization or exaggerative development of organs. The difference in the premaxilla seems to be not very essential in view of the intimate morphogenetic relationship between the two types of premaxilla. The similarity in the structure of both the fontanelle and the gas-bladder in these two species-groups, as well as the closeness in other characters as mentioned above, seems to indicate their close phylogenetic positions. Accordingly, I place both the groups in the subgenus *Hymenophysa,* and they are treated merely as species-groups.

Status of subgenera in the genus *Botia*

In his subdivision of *Botia*, Fang (1936) allocated under the subgenus *Botia* all species possessing eight barbels, i.e. all Indian forms, nine in number, one Indonesian and one Thai species. He stated, in the synopsis to subgenera of *Botia,* that in the subgenus *Botia* the fontanelle of cranium was present

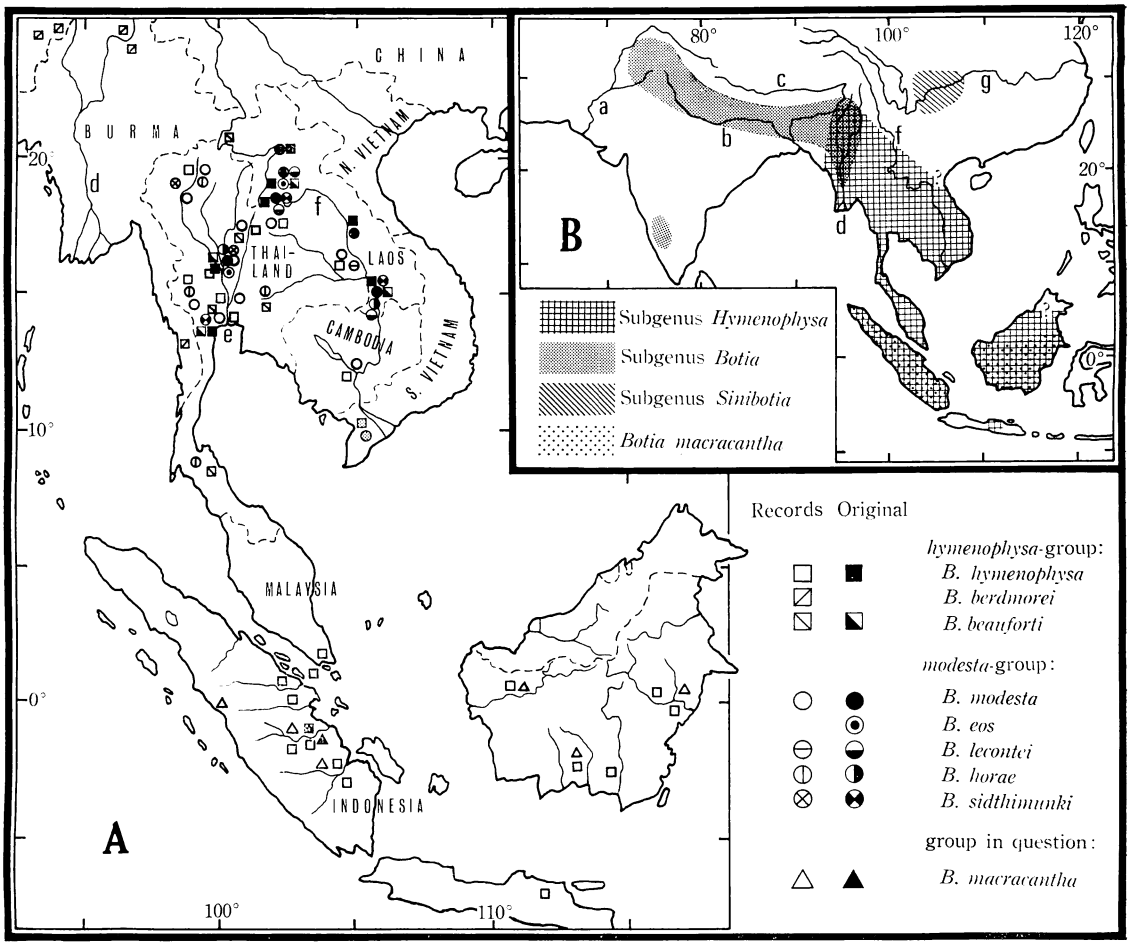

Fig. 5. Distribution maps of the genus *Botia*. (A) Localities of the eight species in the subgenus *Hymenophysa* and *B. macracantha*, based on both published records and the original collection. Open symbols denote localities from records, and solid and semisolid symbols from the original collection. It is noted that shaded symbols indicate specimens collected by Dr. N. Kawamoto. In many cases, particularly in those of the original collection, one symbol represents multiple collections from same locality or several localities in proximity. (B) Approximate ranges of the three subgenera and *B. macracantha*, based on both literature and the original. The rivers are designated as: a, Indus; b, Ganges; c, Brahmaputra; d, Irrawaddy; e, Menam Chao Phya; f, Mekong; g, Yangtze.

and the gas-bladder capsule was less developed or, following Hora's (1922 a, b) account, exceptionally well developed in *B. almorhae*. He also showed, in other page of the text, that the fontanelle was narrow and elongate in *B. almorhae*. These internal characters of the subgenus *Botia* are, however, based apparently on only two species, the Indonesian *B. macracantha* and the Indian *B. almorhae*, and as to other majority member of the subgenus, which mostly occur in India, he did not make any particular reference. Subsequently, a well-developed osseous capsule of gas-bladder has been reported in a few Indian species besides *B. almorhae*: in *B. lohachata* Chaudhuri by Ramaswami (1953), and in *B. dario* (Hamilton-Buchanan) and *B. dayi* Hora by Nalbant (1963). In the original paper he listed *B. dario* and *B. almorhae*, but the specimen identified with the latter species was afterward assigned to *B.*

dayi by Bănărescu and Nalbant, 1968.

In the materials examined in the present study, I have also recognized that the osseous capsule of gas-bladder is well developed in *B. birdi* as well as in *B. almorhae,* and also that the fontanelle is very much reduced in its width in *B. almorhae* and rather reduced in *B. birdi.* Thus, according to these observations, it can be recognized that the Indian species of the subgenus *Botia* are characterized by the well-developed osseous capsule of gas-bladder and the reduced fontanelle. Whilst the Indonesian *B. macracantha,* though it shares the feature of the mental lobe with these Indian forms of typical *Botia*, does not agree with these Indian species in having a large fontanelle and a less-developed gas-bladder capsule against the reduced fontanelle and the well-developed capsule as in the Indian species. In view of its morphological distinction from the Indian species of the subgenus *Botia*, which include the type species of the subgenus, *B. almorhae,* as well as its isolated distribution in the Greater Sunda Islands (Fig. 5 A and B), *B. macracantha* is hereinafter treated apart from the subgenus *Botia* for facilitating comparison and understanding line of relationships of the fishes of the genus *Botia.*

On the basis of my observation on the material and literature reviewed, the three subgenera and *B. macracantha* are characterized as follows, and their relationships are diagrammed in Fig. 6:

1. Mental lobe not forming a barbel. Front-parietal fontanelle large. Anterior chamber of gas-bladder partly covered by osseous capsule; posterior chamber large. Top of supraethmoid (=anterofrontal) narrow. Optic foramen large or small... .....*Hymenophysa*
2. Mental lobe forming a barbel. Fontanelle large. Anterior chamber of gas-bladder partly covered by osseous capsule; posterior chamber large. Top of supraethmoid (=anterofrontal) very broad. Optic foramen rather small..... .....*Botia macracantha*
3. Mental lobe forming a barbel. Fontanelle greatly or rather reduced in its width. Anterior chamber of gas-bladder almost completely covered by osseous capsule; posterior chamber large or rather reduced. Top of supraethmoid (=anterofrontal) narrow or broad. Optic foramen very small .....*Botia*
4. Mental lobe not forming a barbel. Fontanelle absent. Anterior chamber of gas-bladder completely covered by osseous capsule; posterior chamber reduced (Fang, 1936). Preorbital spine with dorsocaudal process small and close to base (Nalbant, 1963). .....*Sinibotia*

As is generally recognized, the trend of specialization within the Cobitidae is directed toward the development of the osseous capsule of gas-bladder, the reduction of the posterior chamber of gas-bladder, and the complication of the mental lobe. The specialization of the gas-bladder is usually regarded as reflecting bottom-living habit of the fishes in rapid-running waters (Hora, 1922 a and Alexander, 1964). In the genus *Botia* the correlation between the specialization of the gas-bladder and both habit and habitat of the fishes is rather clearly exhibited: whilst almost all species of the subgenus *Hymenophysa* are more or less vigorous swimmers and long-distance travellers in lowland waters as already referred to in the present paper, and possess the generalized feature of the gas-bladder, the subgenera *Botia* and *Sinibotia* are in principle inhabitants of running waters, mostly in upland area, and show the specialized features of the gas-bladder. The fontanelle of the Botiinae is diverse in its structure, and some species of the subfamily bear peculiar structure which is not shared by other two subfamilies. In the Cobitinae and Nemacheilinae, a large fontanelle is usually noticed on the top of cranium (Ramaswami, 1953). In the genus *Botia* it is well developed in the subgenus *Hymenophysa* and *B. macracantha,* but somewhat or greatly reduced in the subgenus *Botia* or even absent in the subgenus *Sinibotia* (Fang, 1936). It

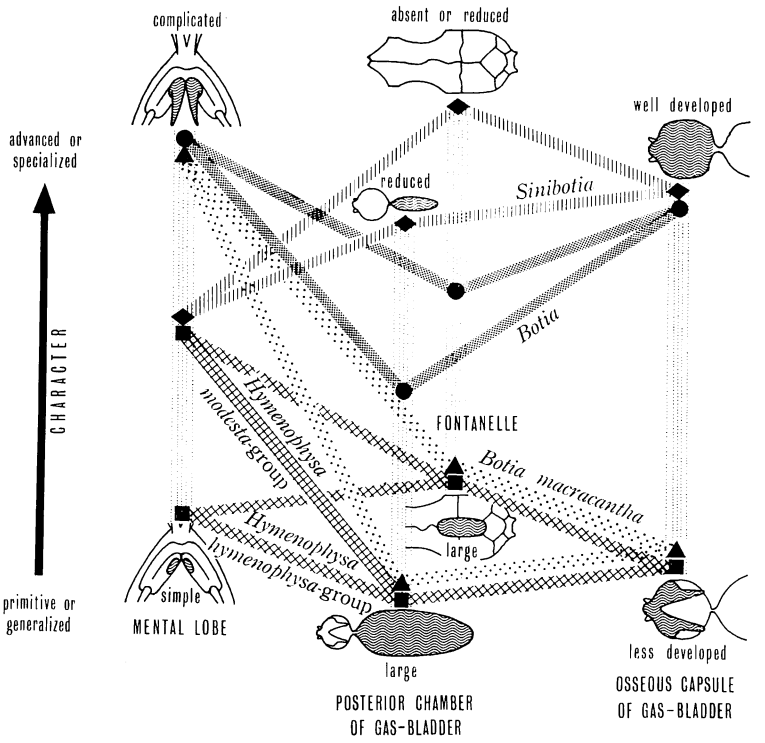

Fig. 6. Diagram showing the conception of the phyletic relationships of the three subgenera in *Botia* and *B. macracantha* reached upon the morphological specialization found in four organs bearing accepted (Hora, 1922a, and others) evolutionary significance in cobitids. For dispersion of the four groups, see Fig. 5.

is also absent in the genus *Leptobotia* (Fang, 1936). According to Gregory (1933: 193), Sagemehl (1891) was inclined to regard the occurrence of fontanelle in cyprinids as an ancient hereditary or reversional feature of the whole cyprinoid stem. Fang (1936) also considered the absence or reduction of the fontanelle in the Botiinae as indicating advanced cranial development.

In other groups of cyprinoids, the fontanelle is present in probably all catostomids, in many forms of gastromyzonids, in some species of homalopterids, and generally absent in cyprinids (Ramaswami, 1952 a and b, 1953, 1955, and 1957). Such patterns of its occurrence do not appear to prevent presuming its phylogenetic significance, though many arguments (Ramaswami, 1957; Greenwood et al., 1966) have been presented against the primitiveness of catostomids in which a large fontanelle is usually noticed. In the genus *Botia*, particularly, the occurrence of the fontanelle is not sporadic, but the change in its size is gradual, coinciding with the phylogenetic and taxonomic grouping of the fishes and apparently correlating with the environmental conditions of their habitats. Therefore, I follow in essence Fang's opinion, and, at least for the genus *Botia*, regard the possession of the fontanelle as a retention of an ancestral character. For mental lobe, though its structure might have some ecological significance, there is no apparent correlation recognized between its feature and the condition of habitat.

Of the three subgenera in *Botia*, according to these characters, *Hymenophysa*, particularly the *hymenophysa*-group, is most primitive and generalized. *Sinibotia* appears most advanced

and specialized except in the mental lobe, and is separated from *Hymenophysa* by a more or less distinguished gap (Fig. 6). This subgenus also shows a similarity to the genus *Leptobotia* in the structure of the preorbital spine (Nalbant, 1963) and the fontanelle (Fang, 1936). The subgenus *Botia* is intermediate in the degree of development of the characters employed, and *B. macracantha* appears to afford a phenotypic link between the subgenera *Hymenophysa* and *Botia*. From the morphological characters and the distributional patterns of the fishes (Figs. 6 and 5B), and in view of the correlation between the specialization of the gas-bladder and the environmental conditions including the topographic factors, it may be reasonable to presume the following line of differentiation of the subgenera. (1) All species of the genus *Botia* may have derived from closely related ancestors or even from a common origin, and the ancestors of *Botia* have probably had a large fontanelle, a less-developed gas-bladder capsule, and a large posterior chamber of gas-bladder. (2) The subgenus *Hymenophysa* may be closest to the ancestral form. (3) The subgenus *Sinibotia* may occupy remoter position from the ancestral form than the subgenus *Botia* may. (4) The ancestral stock of the genus *Botia* may have originated in lowland rather than upland at the period of its occurrence; *Hymenophysa* may have remained in lowland waters, where it have retained its primitive and generalized characters, while typical *Botia* and *Sinibotia* may have migrated or been lifted to mountainous areas perhaps in accordance with upheaval of land, where they have acquired their advanced and specialized features.

Fang (1936) postulated that the ancestors of *Botia* might have originated in Indo-Australian Archipelago or in Burma and Thailand. The present distributional pattern of these fishes, centered abundantly in India and Thai-Lao region (Fig. 5B), might deny one possibility that the ancestors have originated in the Indonesian region, rather it will suggest their appearance in some northern part of Southeast Asia.

B. macracantha agrees with the subgenus *Botia* in the feature of the mental lobe, but differs from the subgenus in the fontanelle and the gas-bladder capsule. On the other hand, it approaches *Hymenophysa* in the structure of the fontanelle and the gas-bladder capsule, but differs from the subgenus in the mental lobe. In these characters *B. macracantha* appears, if anything, to be more closely related to the subgenus *Hymenophysa* than to the subgenus *Botia*. However, it is a fact that the structure of the mental lobe is stable and uniform in either of the species-groups in *Hymenophysa* and in the subgenus *Botia* as already demonstrated in the present paper, and therefore the structure of the organ should be considered as bearing phylogenetic significance at least in subgeneric level and downward. Thus, the similarity of *B. macracantha* to the subgenus *Botia* in this character cannot be ignored.

The present ranges of *B. macracantha* and the subgenus *Botia*, which are greatly separated by the present range of *Hymenophysa* (Fig. 5B), and the characters of the three subgenera and *B. macracantha* may suggest two possibilities as to the origin of *B. macracantha*: it may have evolved from ancestors common with or close to those of the subgenus *Botia*, but have transferred southward through its own dispersal route and have retained the primitive internal characters in lowland waters, or it may have derived from common phyletic line with *Hymenophysa* and have attained its complicated mental lobe in parallel with the subgenus *Botia*. *B. helodes* may be traced along similar phylogenetic route with *B. macracantha*.

In either event, the morphological distinctness of *B. macracantha* and its phylogenetic position presumably divergent from other forms seem to warrant erection of a new taxon for the species and perhaps *B. helodes*. However, no definite taxonomic treatment was attempted for the species in the present study, because I failed to assign definite status to *B.*

Table 3. Comparison of the five species of *Botia* referred to the *modesta*-group.

Character	*B. sidthimunki*	*B. horae*	*B. eos*	*B. lecontei*	*B. modesta*
Preorbital spine	greatly curved	moderately curved	moderately curved	moderately curved	greatly curved
Anterior process of premaxilla	wide	wide	wide	wide	elongate
Spinous fringe of frontal	short	long	long	long	long
Branched dorsal rays	7—9*	8	10—11	8	7—9
Pectoral rays	11—14*	12—13	11—14	13—15	13—16
Color pattern	longitudinal stripes on back and side	a longitudinal stripe on back and cross bands on side	cross bands on back and side in juveniles	cross bands on back and side in juveniles	cross bands on back and side in juveniles

* Nine branched dorsal rays are recorded by Monkolprasit et al. (1971), and 11 pectoral rays by Klausewitz (1959) and Monkolprasit et al. (1971).

macracantha, nor have I examined *B. helodes* and forms of the subgenus *Botia* other than *B. almorhae* and *B. birdi.*

Botia eos and its position in the *modesta*-group

In table 3 *B. eos* is compared with other species in the *modesta*-group. The most remarkable difference between *B. eos* and other forms of the group is the number of dorsal rays (Table 2). In other characters these fishes are closely and rather intricately related.

B. eos agrees with *B. sidthimunki* in the number of pectoral rays (Table 2) and the structure of the premaxilla, but they show a high species separation in other characters. *B. sidthimunki* appears to be the remotest from *B. eos* and from the rest in the group as well in having a short spinous fringe of frontal (Table 3). *B. eos* differs from *B. horae* in the color pattern, but there is a gross similarity between the two species in other external and internal characters. *B. eos* agrees with *B. lecontei* in the color pattern, the premaxilla (Figs. 3C and D), and the preorbital spine. But in the body proportion *B. lecontei* is a little slenderer than *B. eos* (Table 1). In the color pattern, *B. eos* shows an affinity also to *B. modesta,* but they do not share in common any other characters employed in the present study. From the above observations, it may be recognized that *B. eos* occupies a peculiar position in the species-group in having 10 - 11 branched dorsal rays against generally eight as in all other species, and that in other characters it is most closely related to both *B. horae* and *B. lecontei.*

B. eos occurs in both Thailand and Laos (Fig. 5A). It is sympatric and syntopic with *B. modesta* in the area, but their ecological isolation is not known. *B. horae* is so far recorded widely from the Menam Chao Phya, the Mekong, and the Tapi River drainages (Smith, 1931; Fowler, 1934, 1937), and it is sympatric with *B. eos* in the Lake Bung Borapet, Central Thailand (see Fig. 5A). However, *B. horae* seems rare in the Mekong River basin, especially in northern and central Laos where most of the samples of *B. eos* were obtained. *B. lecontei* is so far known only from the Mekong River system.

Acknowledgments

I wish to thank Dr. Morizumi Nakamura, National Science Museum, Tokyo, for his valuable suggestions. I am very grateful to H. I. H. the Crown Prince of Japan, who granted me many specimens of *Botia.* I am also indebted to Dr. James E. Böhlke of the Academy of Natural Sciences of Philadelphia, for the loan of study material. Dr. A. G. K. Menon, Zoological Survey of India, Miss Ladda Wongrat and Mr. Prachit Wongrat, Kasetsart University, Bangkok, made facilities to study at their institutions specimens in their care. Mr. F. d'Aubenton, Museum

National d'Histoire Naturelle, Paris, provided me photographs and radiographs of specimens under his care. Field work was made possible by the support of many institutions and persons: I wish to thank Dr. Norio Kondo of my institute, who afforded me opportunities to make field research. I am also thankful to Mr. Chertchai Amatyakul and Mr. Suchit Bhingyoing, Department of Fisheries, Thailand, Mr. Sisavang Chanthepha and Mr. Pane Sengsart, Direction des Eaux, Forêts, et Chasses, Laos, Mr. Saburō Sugitani and Mr. Gonjirō Suzuki, U. S. Consultants, Inc., Laos, Mr. Tetsuo Watanabe and Mr. Tousei Urushido of my institute, for their help in executing my collection in Thailand and Laos. Dr. Katsuzō Kuronuma read the manuscript and supplied many valuable suggestions and criticisms, to whom I express high gratitudes.

Literature cited

Alexander, R. M. 1964. The evolution of the Weberian apparatus in the Cobitidae. Proc. Zool. Soc. London, 142: 177–190, figs. 1–5.

Bănărescu, P. and T. Nalbant. 1968. Cobitidae (Pisces, Cypriniformes) collected by the German Indian Expedition. Mitt. Hamburg. Zool. Mus. Inst., 65: 327–351, figs. 1–15, pls. 1–2.

Fang, P. W. 1936. Study on the botoid fishes of China. Sinensia, 7 (1): 1–49, figs. 1–6.

Fowler, H. W. 1934. Zoological results of the third de Schauensee Siamese expedition. Part 1. Fishes. Proc. Acad. Nat. Sci. Philadelphia, 86: 67–163, figs. 1–129.

Fowler, H. W. 1937. Zoological results of the third de Schauensee Siamese expedition. Part 8. Fishes obtained in 1936. Proc. Acad. Nat. Sci. Philadelphia, 89: 125–264, figs. 1–300.

Greenwood, P. H., D. E. Rosen, S. H. Weitzman, and G. S. Myers. 1966. Phyletic studies of teleostean fishes, with a provisional classification of living forms. Bull. Amer. Mus. Nat. Hist., 131, art. 4: 339–455, figs. 1–9, pls. 21–23, charts 1–32.

Gregory, W. K. 1933. Fish skulls. A study of the evolution of natural mechanisms. Trans. Amer. Phil. Soc., 23, part 2, new edition in 1959, Eric Lundberg: i–vii, 75–481, figs. 1–302.

Hora, S. L. 1922a. Notes on fishes in the Indian Museum. 3. On fishes belonging to the family Cobitidae from high altitudes in Central Asia. Rec. Indian Mus., 24: 63–83, figs. 1–5.

Hora, S. L. 1922b. Notes on fishes in the Indian Museum. 4. On fishes belonging to the genus *Botia* (Cobitidae). Rec. Indian Mus., 24: 313–321, 1 fig.

Klausewitz, W. 1957. Über einige Fische aus Thailand. Senckenbergiana Biol., Frankfurt am Main, 38 (1–2): 33–39, figs. 1–4.

Klausewitz, W. 1959. *Botia sidthimunki*, eine neue Schmerle aus Thailand (Pisces, Cobitidae). Senckenbergiana Biol., Frankfurt am Main, 40 (1–2): 51–53, figs. 1–3.

Monkolprasit, S., S. Sontirat and P. Wongrat. 1971. Additional descriptive material on *Botia sidthimunki* Klausewitz, 1959, from Thailand (Pisces, Cobitidae). Notes Fac. Fish. Kasetsart Univ., Bangkok, 6: 3–4, fig. 1.

Monod, T. and Y. Le Danois. 1966. Anatomie fonctionelle de la région préorbitaire du poisson cobitide *Botia macracanthus* Bleeker. Japan. J. Ichthyol., 13 (4–6): 127–144, figs. 1–17.

Nalbant, T. 1963. A study of the genera of Botiinae and Cobitinae (Pisces, Ostariophysi, Cobitidae). Trav. Mus. Nat. "Grigore Antipa", Bucaresti, 4: 1–37, figs. 1–5, pls. 1–4.

Pellegrin, J. and P. W. Fang. 1940. Poissons du Laos recueillis par Mm Delacour, Greenway, Ed. Blanc. Description d'un genre, de cinq espèces et d'une variété. Bull. Soc. Zool. France, 65: 111–123, figs. 1–6.

Ramaswami, L. S. 1952a. Skeleton of cyprinoid fishes in relation to phylogenetic studies. 3. The skull and other skeletal structures of homalopterid fishes. Proc. Nat. Inst. Sci. India, 18 (6): 495–517, figs. 1–7.

Ramaswami, L. S. 1952b. Skeleton of cyprinoid fishes in relation to phylogenetic studies. 4. The skull and other skeletal structures of gastromyzonid fishes. Proc. Nat. Inst. Sci. India, 18 (6): 519–538, figs. 1–9.

Ramaswami, L. S. 1953. Skeleton of cyprinoid fishes in relation to phylogenetic studies. 5. The skull and the gasbladder capsule of the Cobitidae. Proc. Nat. Inst. Sci. India, 19 (3): 323–347, figs. 1–9.

Ramaswami, L. S. 1955. Skeleton of cyprinoid fishes in relation to phylogenetic studies. 7. The skull and Weberian apparatus of Cyprininae (Cyprinidae). Acta Zool., Stockholm, 36: 199–242, figs. 1–21.

Ramaswami, L. S. 1957. Skeleton of cyprinoid fishes in relation to phylogenetic studies. 8. The skull and Weberian ossicles of Catostomidae. Proc. Zool. Soc. Calcutta, Mookerjee Mem. Vol.: 293–303, figs. 1–3.

Sagemhel, M. 1891. Beitrage zur vergleichenden Anatomie der Fische. 4. Das Cranium der Cyp-

rinoiden. Morphol. Jahrb., 17: 489–595, pls. 38–39. (not seen).
Sauvage, M. H. 1876. Sur quelques poissons des eaux douces du Laos cambodien. Bull. Soc. Philom. Paris, ser. 6, 13: 97–100.
Smith, H. M. 1931. Description of new genera and species of Siamese fishes. Proc. U. S. Nat. Mus., 79, art. 7: 1–48, figs. 1–22, 1 pl.
Smith, H. M. 1945. The fresh-water fishes of Siam, or Thailand. U. S. Nat. Mus. Bull., 188: I–XI, 1–622, figs. 1–107, pls. 1–9.
Taki, Y. 1968. Notes on a collection of fishes from lowland Laos. U. S. Agency for International Development, Mission to Laos: 1–47, 1 text-fig., figs. 1–51.
Tirant, G. 1885. Notes sur les poissons de la Basse-Cochinchine et du Cambodge. in Excursions et reconnaissances, X: 91–198.

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タイおよびラオスより得られたドジョウ科の一新種 *Botia eos*, ならびに近似種の検討

多紀 保彦

メコンおよびメナムチャオパイア両河系より得られたドジョウ科の *Botia* 亜科に属する一新種 *Botia eos* を記載した．本種は，10–11 本の背鰭分枝軟条を有する点で，通常 8 内外の分枝軟条数を有する近縁種と特に明らかに区別される．

インドシナ半島およびタイ地方の *Botia* 属魚類は，原記載以後報告のない一種を除き，すべて *Hymenophysa* 亜属に属するが，この中に，前上顎骨と口部周辺の形態その他を異にする *hymenophysa* グループと *modesta* グループの二群が認められた．前者では左右の前上顎骨の先端が鎌状を呈し中央にやや丸い空間部をはさみ，また下唇中央部の mental lobe は比較的小型で肉質突起を欠く．他方，後者では前上顎骨の先端に空間部がみられず，また mental lobe は比較的大型で前端に肉質突起がある．*B. eos* は *modesta* グループに含まれる．しかしこの両グループは，大きな額門 (fontanelle) と比較的発達していない鰾の骨嚢を有することにおいて共通しており，その点で他の二亜属，*Botia* および *Sinibotia* と明らかに異なっている．ただし，インド，ビルマ地方を主棲息地とする *Botia* 亜属の中で唯一のインドネシア産魚種とみなされている *B. macracantha* は，mental lobe の形状では同亜属の特徴を示すが，額門および鰾の骨嚢のそれにおいては *Hymenophysa* 亜属と同一の特徴を示す．このような形態的な差異とかけはなれた分布からみて，*B. macracantha* は *Botia* 亜属とは異なった系統的，分類学的地位を占めるものと推定される．

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