

Taxonomic Review of the Genus *Sinocrossocheilus* Wu (Teleostei: Cyprinidae), with a Description of Four New Species

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Rui-Feng Su, Jun-Xing Yang and Gui-Hua Cui (2003) Taxonomic review of the genus *Sinocrossocheilus* Wu (Teleostei: Cyprinidae), with a description of four new species. *Zoological Studies* 42(3): 420-430. All *Sinocrossocheilus* species, except *S. microstomatus*, are reviewed. Four new species, *S. labiata*, *S. papillolabia*, *S. nigrovittata*, and *S. longibulla*, are described. The genus *Sinocrossocheilus* differs from other genera of Cyprinidae by the last simple dorsal fin ray being unserrated and unossified, the last unbranched anal fin ray being unserrated and unossified, the 5-branched anal fin rays, the mouth gap being inferior, the rostral cap covering the lower jaw and connecting directly with the lower lip, a row of fleshy lobes on the lower jaw, and a cloudy black spot above the pectoral fin. *Sinocrossocheilus labiata* is small and has 22 predorsal scales; *S. longibulla* has a very large air bladder; *S. papillolabia* possesses a well-developed ventral fin and a wide band covered by fleshy papillae on the lower lip; and *S. nigrovittata* possesses black longitudinal stripes along the lateral line. *Crossocheilus bamaensis* and *Crossocheilus liuchengensis* are transferred to the genus *Sinocrossocheilus*. *Sinocrossocheilus* species are endemic to the central and eastern Yunnan-Guizhou Plateau of China, where river systems are anfractuous, including seasonal rivers, cave rivers, underground rivers, and streamlets between mountains. These separated rivers probably provide conditions for the allopatric speciation of the *Sinocrossocheilus*. <http://www.sinica.edu.tw/zool/zoolstud/42.3/420.pdf>

Key words: Taxonomy, Cyprinidae, *Sinocrossocheilus*, New species, China.

The genus *Sinocrossocheilus* Wu (Cyprinidae), assigned to the subfamily Labeoninae (Chen et al. 1984) of the Cyprinidae, was established in 1977. *Sinocrossocheilus* species are endemic to the Pearl and Yangtze Rivers of the central and eastern Yunnan-Guizhou Plateau. The type species of the genus *Sinocrossocheilus*, *S. guizhouensis* Wu, was first reported in the Wu R. (a tributary of the Yangtze R.) in Guizhou Prov. (Fig. 1). *Sinocrossocheilus tridentis* Chu and Cui (Chu and Cui 1987) was found in the Nanpan R. (upper reach of the Pearl R.) in eastern Yunnan Prov. *Sinocrossocheilus microstomatus* (Wang and Chen 1989) was described from the Hongshui R. (middle reach of the Pearl R.). Both *Crossocheilus bamaensis* (Fang 1981) and *Crossocheilus liuchengensis* (Liang 1987) from the

Pearl R. were referred to the genus *Sinocrossocheilus* in Su et al. (2000).

In 1999, we surveyed the river systems of Guizhou Prov. and collected about 3000 fish specimens. Upon identifying them, we found 3 *Sinocrossocheilus* species which had not been described or named. One of them was collected from the Cishui R. (a tributary of the Yangtze R.). Specimens collected from the Dagou R. (a tributary of the Pearl R.) represent another. The 3rd new species was found in the Sancha R. (a tributary of the Pearl R.). Specimens of the 4th new species were from the Beipan R. (upper Pearl R.) in Guizhou.

Furthermore, the phylogenetic status of *Sinocrossocheilus* has not been ascertained. Wu (1977) suggested that *Sinocrossocheilus* Wu is

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similar to *Paracrossochilus* Popta, which is distributed in Borneo, but they differ in mouth characters. Bănărescu (1986) suggested that the 3 genera of *Crossocheilus* (Hasselt 1823), *Epalzeorhynchos* (Bleeker 1855), and *Paracrossochilus* form a monophyletic lineage called the *Crossocheilus*-group which may also include 3 East Asian genera *Sinocrossocheilus*, *Rectoris* (Lin 1935), and *Pararectoris* (Su et al. 2001), assigned to the sub-family Labeoninae. Some similar characters among *Sinocrossocheilus*, *Rectoris*, and *Pararectoris* were presented in Su et al. (2001). However, their relationship can be determined and clarified only if their osteology and molecular biology are phylogenetically researched.

The purpose of the present article was to describe these new species, and provide a synopsis for the genus.

MATERIALS AND METHODS

Because specimens of *S. microstomatus* were not available for examination, data in this paper on that species were obtained from Wang

and Chen (1989). Specimens studied in this article were deposited at the collection of the Kunming Institute of Zoology (KIZ), Chinese Academy of Sciences, Kunming, Yunnan. Some specimens of *S. guizhouensis*, viewed in this article, were deposited at the collection of the Institute of Hydrobiology (IHB), Chinese Academy of Sciences, Wuhan, Hubei Prov. Counts and measurements follow Chu and Chen (1989). The following abbreviations are used in table 1: lateral line scales (LLS), scales below the lateral line (SBLL), scales over the lateral line (SOLL), predorsal scales (PreDS), caudal peduncle scales (CPS), standard length (SL), body depth (BD), head length (HL), snout length (SNL), number of gill rakers on the outside of the 1st gill arch (GR), eye diameter (ED), interorbital width (IW), predorsal length (PreDL), caudal peduncle length (CPL), caudal peduncle depth (CPD), distance between ventral fin and anus (V-a), distance from ventral fin to anal fin (V-A), ventral fin length (V), pectoral fin length (P), mouth width (MW), maxillary barbels (MB); rostral barbels (RB), width of band covered with fleshy papillae on lower lip (BW), and width of central lobe of lower lip (CLW).

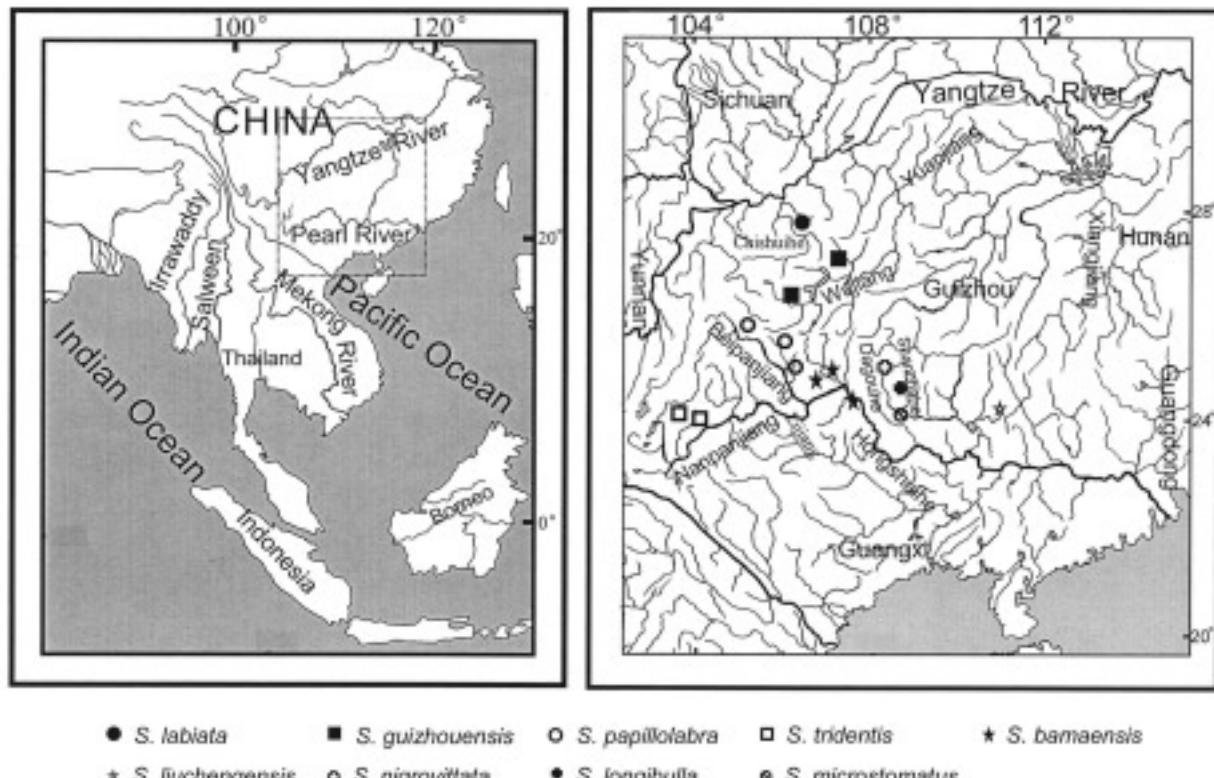


Fig. 1. Maps showing the distributions of *Sinocrossocheilus* fishes in Asia.

Table 1. Morphometric and meristic characters of *Sinocrossocheilus* species

Character	Pearl River					Yangtze River		
	<i>S. papillolabia</i>	<i>S. tridentis</i>	<i>S. nigrovittata</i>	<i>S. longibulla</i>	<i>S. bamaensis</i>	<i>S. liuchengensis</i>	<i>S. guizhouensis</i>	<i>S. labiata</i>
LLS	43-46	41-43	40-42	39-42	41-42	42	39-42	42-45
SOLL	5-6	4-5	4-5	1-5	4-5	6	5-5.5	6.5
SBLL	4-5	4-5	5	5	4-5	4	3.5-4.5	3.5-4.5
PreDS	11-14	13-15	13	11-17	8-13	irregular	16-17	22
CPS	16	16-18	16	16	16	16	14	14-16
GR	15-20	19-25	14-17	17-18	19-22		13-15	10
SL	86-104	106-127	81.5-97	88.5-104	76-139	64-67	66-79	45-75
BD	21-27	25-35	23-27.5	20.5-29.5	17-36	17	16.5-20.5	9-13
HL	16.5-22.5	21-26	17.5-21	19-21	16-24	14-15	14.5-18	10.5-16
SNL	7-10	9-11.5	8-9.5	8.5-10	7-10	5.5	7-9.5	4.5-7
IW	9-14	13-16	10-10.5	9-11	9-15	7.8	8-10.5	5-8.5
ED	4-5	4-5.5	3.5-5	4-5	4-4.5	3-3.5	3	2.5-4
MW	6-9.5	8-10	6-7.5	6.5-9	8-10	4-5	6.5-8.5	4.2-7
CPL	11-19.5	17-22	17-17.5	16-20	13-28	11-12	10-15	7-12
CPD	9-13	13-15	12-15	12-14.5	10-19	7.8	8-10	6-8
PreDL	34-51	49-66	40-46	42.5-52.5	35-61	30.5-31.5	32.5-41	21-35
V-A	17-25	22-28	15-20	19-22	24.5-30.5	12.5-15.5	14-18.5	12-16
V-a	16-20	21-25	14-17	15.5-19.5	21.5-26.2	11.5-14	13-15.5	11.5-13.5
V	16-21	19-22	16-20	17.5-20.5	19.8-23	10-12.5	12-14.5	10-13
P	19-26	22-28	18-23.5	19.8-22	23-26	12-14	13-16.8	11.5-15.5
ED % of IW	33.3-45.5 (39.7)	28.6-39.3 (34.7)	35-48 (41.5)	36.4-50 (43.3)	26.7-30.8 (29.6)	42.9-53.3 (48)	28.6-37.5 (33.1)	40-66.7 (51.6)
MB % of IW	21.5-29.2 (25.5)	18.8-29.2 (23.1)	30-38.1(34)	30.5-50 (43.1)	23.3-34.6 (31.6)	42.9-57.1 (48.6)	28.6-31.3 (30)	32.9-54.5 (41.3)
RB % of IW	23.1-31(26.5)	17.8-26.3 (21.1)	20-21(20.5)	27.3-34.5 (30.2)	21.5-26.7 (24)	25-37.1 (31.6)	23.8-31.3 (27.6)	33.3-50 (39.7)
MB % of ED	60-89 (80.8)	54.5-76 (63.5)	80-88.9 (85)	71.1-125 (100.2)	100-111 (102)	85.7-133.3 (108)	83.3-100 (92)	57.5-88.6 (73.4)
BW % of ED	44.4-66.7 (57.5)	36-40 (38.1)	20-28.9 (25)	40-75 (51)	22.2-37.5 (28.4)	50-62.5 (55.1)	66.7	55-120 (94)
CLW % of MW	63.2-75 (70.9)	64.8-72.2 (69)	66.7	50-61.5 (56.4)	65-75.8 (69)	60-75 (66.1)	58.8-61.5 (60.2)	62.5-76.9 (66.7)
BW % of MW	25-35 (29.9)	19-21(20)	13.3-16.7 (15)	25-38.5 (30.1)	10.5-18.8 (13.2)	37.5-45 (41.4)	44.7-61.5 (53.1)	31.4-54.5 (48)

RESULTS

Genus *Sinocrossocheilus* Wu, 1977

Sinocrossocheilus Wu, 1977: (original description: type species, *Sinocrossocheilus guizhouensis* Wu 1977; type locality, the Wu R. (the middle Yangtze R.), Zunyi City, Guizhou Prov.).

Diagnosis: A cyprinid genus distinguishable from other genera of the subfamily Labeoninae by the cylindrical body; the last simple dorsal fin ray unossified and unserrated; the last simple anal fin ray unossified and unserrated; mouth gap inferior; upper lip retrogressive; rostral cap enclosing upper jaw; fimbriated prefringe of rostral cap densely covered with fleshy papillae; a row of tiny fleshy papilla on upper jaw; lower lip composed of 3 parts, the center with straight lateral margin wide (1/2-4/5 of lower lip) and expanded as a horse-shoe-shaped area; prefringe of lower lip with fleshy papillae; both upper and lower jaws with sharp horny premargin; a cloudy black spot above pectoral fin; and ventral scale in the advance of ventral fin base absent.

Key to species of *Sinocrossocheilus*

1. Pharyngeal teeth in 2 rows 2
- Pharyngeal teeth in 3 rows 4
2. Caudal peduncle scales 12 *S. microstomatus*
- Caudal peduncle scales 14 or 16 3
3. Predorsal scales 16-17; eye small (eye 16.6%-20.7% of head width; mean, 18.7%); center lobe of lower lip narrow (center lobe 58.8%-61.5% of lower lip of mouth width; mean, 60.2%); maxillary barbels reaching anterior margin of orbit only, rostral barbels not extending past posterior margin of nostril *S. guizhouensis*
- Predorsal scales 22; eye large (eye 23.3%-30% of head width); center lobe of lower lip wide (lower lip 62.5%-76.9% of mouth width; mean, 66.7%); maxillary barbels reaching 1/2 or 2/3 of orbit, rostral barbels extending past posterior margin of nostril *S. labiata* sp. nov.
4. Air bladder well developed, posterior chamber wider than anterior one (diameter of the posterior chamber 1.5-2 times that of anterior one) *S. longibulla*
- Air bladder poorly developed, posterior chamber narrower than anterior one (diameter of the posterior chamber 1/2 that of anterior one) 5
5. Body side with a black longitudinal stripe *S. nigrovittata* sp. nov.
- Body side without a black longitudinal stripe 6
6. Horny tubercles absent from snout tip, body side with a row of black specks (about 9-11) *S. liuchengensis*
- Horny tubercles present on snout tip, body side without a row of black specks 7
7. Ventral fin extending over anus, papillate band on lower lip wide (ranging 44.4%-66.7% of eye diameter and 25%-35% of mouth width) *S. papillolabia* sp. nov.
- Ventral fin never reaching anus, papillate band on lower lip narrow (shorter than 40% of eye diameter and 21% of

- | | |
|--|---------------------|
| mouth width)..... | 8 |
| 8. Prefringe of rostral cap split into 8-12 tiny lobes; maxillary barbels shorter than eye diameter (its length 54.5%-76% of eye diameter; mean, 63.5%); intestine stunted (with a diameter 55%-64% of eye diameter)..... | <i>S. tridentis</i> |
| - Prefringe of rostral cap split into 5-6 tiny lobes; maxillary barbels longer than eye diameter (with a length 100%-111% of eye diameter; mean, 102%); intestine slender (with a diameter 10%-14.6% of eye diameter)..... | <i>S. bamaensis</i> |

Sinocrossocheilus guizhouensis Wu, 1977

Sinocrossocheilus guizhouensis Wu, 1977: (type locality: the Wu R., Guizhou Prov.)

Materials examined: KIZ 78060518, KIZ78060519, 2 specimens, 66-79 mm SL, Wu R. 106°3'20"E, 27°2'10"N, elev. 1600 m, Qianxi Co., Guizhou Prov.; 5 June 1978. Specimens from IHB were not measured but viewed only.

Diagnosis: Dorsal fin rays, III, 8. Pectoral fin rays I, 14. Ventral fin rays I, 8. Anal fin rays III, 5. It is distinguishable from other *Sinocrossocheilus* species by the pharyngeal teeth in 2 rows, 5.3-3.5; 13-15 gill rakers on outside of the 1st gill arch; the center lobe of lower lip narrow (58.8%-61.5% of mouth width; mean, 60.2%); 16-17 predorsal scales; eye small (16.6%-20.7% of head width; mean, 18.7%); maxillary barbels reaching the anterior margin of orbit; rostral barbels not extending to posterior margin of nostril; ventral fin not reaching anus, 2-3 lateral line scales from ventral fin tip to anus; anterior chamber of air bladder oval, posterior one slender and 1.5 times length of anterior one; and a black speck over pectoral fin.

Distribution: *S. guizhouensis* is known from the Wu R. (the middle Yangtze R.) in Qianxi Co. and Zhunyi City. This species lives in the lower layer of areas with rapid flow and in intermontane streams.

Sinocrossocheilus labiata sp. nov.

Holotype: KIZ 995338, 58 mm SL, Tongzi R. 109°40'E, 28°8'N, in Gaoqiao Village, Tongzi Co. Guizhou Prov., China; 6 May 1999.

Paratypes: KIZ 995325, 995326, 995327, 995328, 995329, 995330, 995331, 995332, 995333, 995334, 995335, 995336, 995337, 995339, 995340, 995341, 995342, 995344, 995346. Nineteen specimens, 45-72 mm SL, same data as for holotype.

Diagnosis: This species has the following distinct characters: body size very small (32-72 mm

SL); eye large (23.3%-30% of head width; 40%-66.7% of interorbital width; mean, 51.6%); center lobe of lower lip broadened (62.5%-76.9% of mouth width; mean, 66.7%); papillate band of lower lip wide (55%-120% of eye diameter; mean, 94%; 31.4%-54.5% of mouth width; mean, 48%); 10 gill rakers and 22 predorsal scales; 14 circumpeduncle scales; ventral fin never reaching anus; anterior chamber of air bladder oval and stunted, posterior chamber slender (its length 1.5-2.5 times that of anterior one).

Description: Dorsal fin rays III, 8. Pectoral fin rays I, 14. Ventral fin rays I, 8. Anal fin rays III, 5. Lateral line scales 42-45, 6.5 rows of scales between lateral line and dorsal fin base, 3.5-4.5 rows of scales from lateral line to ventral fin base. Pharyngeal teeth in 2 rows, 3.5-5.3. Gill rakers 10. Circumpeduncle scales 14. Predorsal scales 22. Vertebrae 41. Other morphometric and meristic characters are listed in table 1.

Body stunted (body depth 18.2%-24.4% of body length). Head obtuse (head 21.3%-25% of standard length). Eye large (eye 23.3%-30% of head length; 40%-66.7% of interorbital width; mean, 51.6%) and at midpoint between snout tip and postmargin of opercle. Distance between orbits narrow (interorbital width 41.7%-58.8% of head length). Snout tip with several rows of horny tubercles restricted to below postmargin of nostril. Rostral cap completely enclosing upper jaw and upper lip, with prefringe split into 18-22 fimbriations covered by fleshy papillae. A row of tiny lobes on upper jaw. Mouth gape straight. Prefringe of lower jaw horny and sharp. A groove between lower lip and lower jaw. Horse hoof-shaped center lobe of lower lip with straight lateral margin, with prefringe heavily covered by papillae. Two pairs of barbels, rostral barbels equal to or slightly longer than maxillary, maxillary extending over 1/2 or 2/3 of orbit.

Lateral line complete and horizontal, with 42-45 scales. Ventral scales of body smaller than those of sides of body, reduced near pectoral fin.

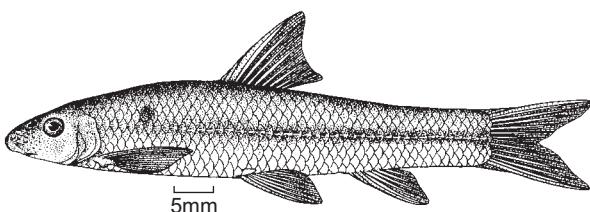


Fig. 2. Lateral view of *Sinocrossocheilus labiata* sp. nov. holotype (KIZ 995338), Tongzi R., Tongzi Co., Guizhou Prov.

Five to 6 lateral line scales from pectoral fin tip to ventral fin origin. Gap between ventral fin tip and anal fin origin about 2-3 lateral line scales.

Anus closer to anal fin origin than to ventral fin, ventral fin not reaching anus. Ventral fin commencing below 3rd or 4th branched dorsal fin rays. Outer margin of anal fin somewhat concave. Dorsal fin commencing at midpoint from snout tip to base of caudal fin.

Anterior chamber of air bladder oval, posterior one long (its length 1.5-2.5 times anterior one). Intestine slender.

Color pattern in alcohol. Dorsal and sides of head black grayish green. Ventral of head yellow. Dorsal part of head black or grayish yellow. Scales on sides of body yellow with postmargin covered densely with many black spots, forming a reticulated pattern. A distinct black spot on upper part of pectoral fin origin. A conspicuous black longitudinal stripe from dorsal fin base on lateral line to base of caudal fin. Dorsal fin rays and pectoral fin rays black. Simple caudal fins black. All other fins yellow. Ventral part of body yellow.

Distribution and Ecology: *Sinocrossocheilus labiata* is found in the Tongzi R. (flowing eventually into the Chishui R.; the middle Yangtze R.) in Gaogiao Village. It is 23 km from Tongzi to this village, which is situated in a mountainous basin. No pollution is obvious in this village, and the river is very pellucid. This species lives only under rocks of the lower layer of fast-flowing parts or montane streams. It was not collected in slow-flowing areas in the same river. It is called "fat fish" by the locals.

Etymology: The specific name refers to its wider center of the lower lip compared to that found in other *Sinocrossocheilus* species.

***Sinocrossocheilus tridentis* Cui and Chu, 1987**

Sinocrossocheilus tridentis Cui and Chu, 1987: (type locality: Yiliang, Yunnan Prov., China).

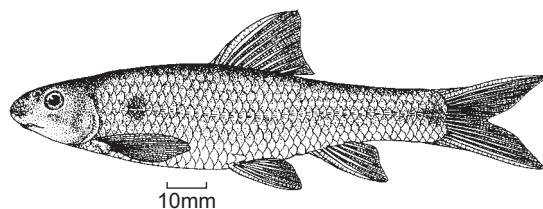


Fig. 3. Lateral view of *Sinocrossocheilus papillolabia* sp. nov. holotype (KIZ 8811693), Beipan R., Zhenfeng Co., Guizhou Prov.

Materials examined: KIZ 774079, 774083, 774099, 7740103, 4 specimens, 106-121 mm SL, Nanpan R. (upper Pearl R.), 103°8'16"E, 24°54'5"N, Yiliang Co., Yunnan Prov.; collected by X. L. Chu and G. H. Cui; Apr. 1977. KIZ 88111063, 88111065, 88111070, 88111071, 4 specimens, 117-127 mm SL, Nanpan R., 104°24'16"E, 25°12'N, in Xingyi Co., Guizhou Prov.; collected by Y. R. Chen, G. H. Cui, and W. Zhou; Oct. 1988.

Diagnosis: This species is distinguished from all its congeners by the following characters: prefringe of rostral cap split into 8-12 tiny lobes; maxillary barbels shorter than eye diameter (its length 54.5%-76% of eye diameter; mean, 63.5%); intestine stout (its diameter 55%-64% of eye diameter); 4-5 rows of scales between lateral line and dorsal fin base, 4-4.5 rows of scales from lateral line to ventral fin base; ventral fin never reaching anus; 5-6 lateral line scales between pectoral fin tip and ventral fin origin; pectoral fin short (16.5%-17.5% of standard length; mean, 17.3%); eye small (28.6%-39.3% of interorbital width; mean, 34.7%); maxillary barbels almost equal to rostral barbels and shorter than eye diameter (54.7%-76% of eye diameter; mean, 63.5%); papillate band on lower lip narrow (36%-40% of eye diameter; mean, 38.1%; 19%-21%; mean, 20% of interorbital width); 3-4 rows of horny tubercles on tip and sides of snout limited to premargin of nostril; vertebrae 40.

Color pattern in alcohol. Body blackish yellow. Many black punctuations on scales of sides and dorsal. All fins grayish black. Pectoral fin base and ventral fin base red. Outer margin of caudal fin black.

Distribution and Ecology: This species is distributed in the Nanpan R. and its tributaries, and inhabits the lower layer of fast-flowing rivers or montane streams. Local people call them “fat fish”.

Sinocrossocheilus papillohabra sp. nov.

Holotype: KIZ8811693, 128.5 mm SL, Baicengxiaohe (a tributary of the Beipan R., the upper Pearl R.), 105°38'5"E, 25°23'19"N, Zhenfeng Co. Guizhou Prov.

Paratypes: KIZ8811686, 8811703, 2 specimens, same data as for holotype. KIZ8811871, 8811872, 8811873, 8811878, 8811879, 8811880, 8811882, 7 specimens, 86-101 mm SL, the Datian R. (a tributary of the Beipan R., upper reach of the Pearl R.), 105°38'10"E, 25°23'22"N, Zhenfeng Co. Guizhou Prov.; 17 Nov. 1988. KIZ 8811128,

8811129, 8811130, 8811131, 8811132, 8811134, 8811152, 8811171, 8 specimens, 91-104 mm SL, Ximi R. (a tributary of the Beipan R., upper reach of the Pearl R.), 105°20'25"E, 25°18'39"N, Qinlun Co. Guizhou Prov.; 4 Nov. 1988.

Diagnosis: This species differs from other *Sinocrossocheilus* species in the following characters: body large; 5-6 scales from lateral line to dorsal fin base; papillate band on lower lip wide (44.4%-66.7% of eye diameter; mean, 57.5%; 25%-35% of mouth width; mean, 29.9%); 4-5 rows of horny tubercles on snout tip and confined to premargin of nostril; eye large (33.3%-45.5% of interorbital width; mean, 39.7%); maxillary barbels longer than or equal to rostral ones and shorter than eye diameter (60%-89% of eye diameter; mean, 80.8%); ventral fin extending over anus; pectoral fin well developed and strong (20%-22% of SL; mean, 20.5%), 2-3 lateral line scales between pectoral fin and ventral fin. Vertebrae 42.

Description: Dorsal fin rays III, 8. Pectoral fin rays I, 13. Ventral fin rays I, 7-8. Anal fin rays III, 5. Lateral line with 44-46 scales, 5-6 rows of scales between lateral line and dorsal fin origin, 3-5 rows of scales from lateral line to ventral fin base. Pharyngeal teeth in 3 rows, 2.4.5-5.4.2. Nineteen gill rakers on outside of 1st gill arch. Caudal peduncle scales 16. Predorsal scales 10-14. Vertebrae 42. Other morphometric and meristic characters are listed in table 1.

Head long (21.7% of standard length) and obtuse. Distance between orbits narrow (interorbital width 58.3% of standard length). Snout tip with several rows of horny tubercles restricted below premargin of nostril. Rostral cap well developed with prefringe of 13-17 fimbriations. A row of tiny lobes on upper jaw. Mouth gape arch-like and wide (36.4%-42.2% of head length). Lower lip consisting of 3 lobes, horse hoof-shaped center one with straight lateral margins, with prefringe heavily covered by papillae. Prefringe of lower jaw horny and sharp. A groove between lower lip and lower jaw. Two pairs of barbels, maxillary barbels longer than rostral ones.

Lateral line complete and horizontal, with 43-46 scales. Scales on ventral part of body between midpoint of pectoral fin and origin of ventral fin smaller. Two lateral line scales from pectoral fin tip to ventral fin origin.

Anus close to anal fin, ventral fin extending over anus, reaching anal fin in some specimens. Posterior margin of anal fin somewhat concave. Dorsal fin, pectoral fin, and ventral fin well developed. Dorsal fin commencing at midpoint from

snout tip to base of caudal fin, and anterior to origin of ventral fin. Dorsal fin length 24.8%-27.5% SL. Ventral fin originating below 3rd simple or 1st branched dorsal fin ray. Caudal peduncle short.

Anterior chamber of air bladder cone-shaped, the posterior one slender, its length variable. Intestine very thin and long.

Color pattern in alcohol. Body and head deep brown. A distinct black spot on upper part of pectoral fin origin. Dorsal fin ray and pectoral fin ray black. Simple caudal fin black. Ventral body grayish yellow or white. Prefringe of rostral cap covered by fleshy grayish yellow or white papillae.

Ecology and Location: It is distributed in the Beipan R. and its tributaries. This species inhabits the lower layer of fast-flowing areas or montane streams. Local people call them "fat fish".

Etymology: "Papillo" in Latin means papilla, and "labra" in Latin means lip, so *papillolabra* alludes to the lower lip densely covered with papillae and the width of the papillate area being larger than that of other species of *Sinocrossocheilus*.

Remarks: Specimens identified as *S. tridentis* from the Beipan R. and Nanpan R. are divided in several characters: those from the former region have a wide papillate band on the upper lip (44.4%-66.7% of eye diameter; mean, 57.5%; 25%-35% of mouth width; mean, 29.9%), well-developed pectoral fin (20%-22.2% of standard length; mean, 21%), ventral fin reaching anus, 2-3 lateral lines in the gap between pectoral fin tip and ventral fin base; and large eyes (22.7% of head length; 33.3%-45.5% of interorbital width; mean, 39.7%). Specimens from the latter region, on the other hand, possess a narrow papillate band of the upper lip (36%-40% of eye diameter; mean, 38.1%; 19%-21% of mouth width; mean, 20%); poorly-developed pectoral fin (16.8%-17.5% of standard length; mean, 17.2%), ventral fin not reaching anus, and small eyes (21.4% of head length; 28.6%-39.3% of interorbital width; mean, 34.7%). Therefore specimens from the Beipan R. are distinguished from those of the Nanpan R. and the former represents the new species, *S. papillolabra*.

Sinocrossocheilus bamaensis (Fang, 1981)

Crossocheilus bamaensis Fang, 1981: (type locality: Bama and Tiane of Guangxi Prov., China).

Materials examined: KIZ 86061961, 86061963, 86061965, 86061966, 86061969, 86061971, 6 specimens, 76-139 mm SL, underground river, 108°5'35"E, 23°54'50"N, Duan Co.,

Guangxi Prov.; June 1986. KIZ86082580, 86082582, 86082932, 3 specimens, 72-76 mm SL, underground river, 108°5'35"E, 23°54'50"N, Duan Co., Guangxi Prov.; Aug. 1986. KIZ87087544, 1 specimen, 62 mm SL, underground river, 108°5'35"E, 23°54'50"N, Duan Co., Guangxi Prov.; Aug. 1987.

Diagnosis: It is identified by the following characters: body (79-159 mm TL) largest among species of *Sinocrossocheilus*; prefringe of rostral cap split into 5-6 fimbriations with fleshy papillae; papillate band of lower lip very narrow (22.2%-37.5% of eye diameter; mean, 28.4%; 10.5%-18.8% of mouth width; mean, 13.2%); 2-3 rows of horny tubercles confined to snout tip and never reaching nostril; fleshy papilla sparsely arranged in rostral cap and lower lip; ventral fin not reaching anus; intestine very slender (diameter of intestine about 10%-14.6% of eye diameter); interorbital wide (62.4% of head length); calvaria high, a deep groove between snout tip and calvaria; maxillary barbels longer than eye diameter (its length 100%-111% of eye diameter; mean, 102%); vertebrae 39-40.

Color pattern in alcohol. Upper part of sides and dorsum of body brown and black; lower part of sides and ventral part of body yellow and brown; sides of body with a conspicuous black blotch on upper part of pectoral fin origin; prefringe of rostral cap and lower lip gray and white; outer margin of dorsal fin with a black band, 2 lateral margins of caudal fin black.

Distribution and Ecology: This species is distributed in the Hongshui R. (upper reach of the Pearl R.) and its rivulets. It inhabits clefts between rocks in fast-flowing sections. During spring and summer, it leaves its caves to find food in the morning and at night. In winter, it always lives in caves. In May or June, this species moves out into the floodwaters to reproduce. Local people also call it "fat fish".

Remarks: Local people call *Sinocrossocheilus*, *Rectoris*, *Pararectoris*, and *Discogobio* fishes as "fat fish" because they are rich in fat.

Sinocrossocheilus liuchengensis (Liang, 1987)

Crossocheilus liuchengsis Liang, 1987: 77-80, (type locality: Liucheng, Guangxi Prov., China).

Materials examined: KIZ 86072021, 86072025, 86072132, 86072177, 86072199, 86072253, 86072270, 86072271, 8 specimens, 63-67 mm SL, underground rivers, 108°5'35"E, 23°54'50"N, Duan Co., Guangxi Prov.; July 1986.

Diagnosis: This species is distinguished from its congeners in the following characters: mouth gap deeply arched; rostral cap split into 11-13 fimbriations with fleshy papillae; horny tubercles absent from snout tip and sides; about 9-10 black spots on body sides; maxillary barbels much longer than rostral ones and eye diameter (42.9%-57.1% of interorbital width; mean, 48.6%; 85.7%-133.3% of eye diameter; mean, 108%); predorsal scales irregularly arranged; ventral fin never reaching anus; vertebrae 40.

Color pattern in alcohol. Dorsal and sides of body yellowish white; ventral whitish gray; a row of black blotches (about 9-10) arranged along lateral line; all fins without pigment, translucent.

Distribution: Until now, this species has only been known from underground rivers in Guangxi.

***Sinocrossocheilus microstomatus* Wang and Chen, 1989**

Sinocrossocheilus microstomatus Wang and Chen, 1989: (type locality: Libo, Guizhou Prov., China)

No specimens of this species are available. Diagnosis is cited from Wang and Chen (1989).

Diagnosis: This species is identified by caudal peduncle scales 12; branched dorsal fin rays 7; 8-10 gill rakers on outside of 1st gill arch; 4.5-5 scales between lateral line and dorsal fin base; 3-4 scales from lateral line to ventral fin base; maxillary barbels equal to or longer than rostral ones; ventral fin not reaching anus; posterior chamber of air bladder narrower and twice as long as anterior one.

Remarks: This species is distributed in the Pearl R. with the other 5 *Sinocrossocheilus* species. *Sinocrossocheilus microstomatus*, having 12 caudal peduncle scales and 7 branched dorsal fin rays, is dissimilar with other *Sinocrossocheilus* species with 8 branched dorsal fin rays and 14 or 16 caudal peduncle scales. It is interesting that *S. microstomatus* is similar to 2 species from the Yangtze R. by sharing 2 rows of pharyngeal teeth. Therefore, this species is important for studying the origin and evolution of *Sinocrossocheilus* fishes. We hope it may provide further evidence to understand the relationship between the ichthyofaunas of the Pearl and Yangtze Rivers.

***Sinocrossocheilus nigrovittata* sp. nov.**

Holotype: KIZ 99052020, 97 mm SL, the Dagou R., 107°52'5"E, 25°24'N, (a tributary of the

middle Pearl R.), Libo Co., Guizhou Prov., 30 May 1999.

Paratype: KIZ 99052240, 1 specimen, 81.5 mm SL; same data as for holotype.

Diagnosis: This species is the most distinctive member of the genus *Sinocrossocheilus* because of the following characters: an obviously wide (3 rows of scales) black longitudinal stripe along the lateral line which is complete; a transverse oblique black stripe on the dorsal fin; many cloudy black blotches on dorsum and sides; ventral fin extending over anus and almost reaching anal fin base; 13 predorsal scales regularly arranged; caudal peduncle deep (14.7%-15.5% of standard length; mean, 15.1%; 70.6%-85.7% of caudal peduncle length; mean, 78.2%); a shallow transverse groove between calvaria and snout tip.

Description: Dorsal fin rays III, 8. Pectoral fin rays I, 14. Ventral fin rays I, 8. Anal fin rays III, 5. Lateral line scales 40-42. Four to 4 and a half rows of scales between the lateral line and dorsal fin base, 5 rows of scales from the lateral line to ventral fin base. Pharyngeal teeth in 3 rows, 2.4.5-5.4.2. Gill rakers 14-17. Caudal peduncle scales 16. Predorsal scales 13. Other morphometric and meristic characters are listed in table 1.

Body stunted (body depth 28.2%-28.4% of standard length; mean, 28.3%). Head short (head length of standard length 21.5%-21.6%). Interorbital narrow 50%-57.1% of head length; mean, 53.6%). A transverse groove between dorsum of head and snout tip. Three rows of horny tubercles from snout tip to postnostril. Mouth gape straight. Rostral cap completely covering upper jaw. A row of tiny lobes on upper jaw. Lower and upper jaws horny, with sharp prefringe. Lower lip with 3 lobes, horse hoof-shaped central one with straight lateral margin, wide (66.7% of mouth width). Narrow prefringe of lower lip covered with fleshy papillae (its width 15% of mouth width, and 24.3% of eye diameter). Two pairs of barbels, maxillary ones longer than rostral ones and shorter

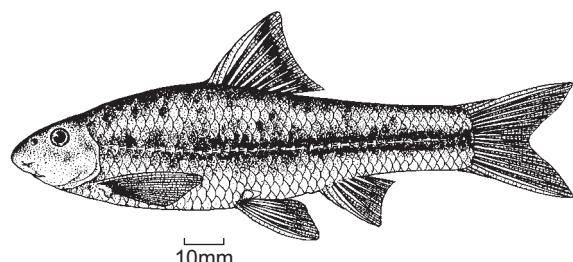


Fig. 4. Lateral view of *Sinocrossocheilus nigrovittata* sp. nov. holotype (KIZ 99052020), Dagou R., Libo Co., Guizhou Prov.

than eye diameter (80%-88.9% of eye diameter; mean, 85%).

Lateral line complete, with 40-42 scales. Scales absent from part of pectoral fin base to ventral fin base. Three to 4 lateral line scales in gap from pectoral fin tip to ventral fin origin. Five lateral line scales in gap between ventral fin tip and caudal fin base.

Ventral fin reaching anus. The anterior chamber of air-bladder oval-shaped; the posterior one tube-shaped and 2-2.5 times length of anterior one. Intestine very slender (its diameter 10%-15% of mouth width, 20%-25% of eye diameter).

Color pattern. Dorsal color dull olive grayish green. Ventral part yellow. Dorsum and sides of body with many cloudy black blotches. A distinct black spot on pectoral fin origin. Caudal fin rays black. A transverse oblique black stripe in middle of dorsal fin. All other fins yellow.

Distribution and Ecology: *Sinocrossocheilus nigrovittata* is known from the Dagou R. (a tributary of the Xi R., middle Pearl R.). It lives in the lower layer of fast-flowing rivers. According to fishermen who collect specimens of this species, this species is not easy to be obtained. *Sinocrossocheilus nigrovittata* emerges into the upper layers of rivers only during floods with heavy rains, and then a few may be collected. We obtained only 2 specimens of this species but 76 specimens of *Discogobio textrabrbatus* from a fisherman at the same time. Local people call it and *Discogobio* "fat fish".

Etymology: "Nigro" in Latin means black; "vittata" means a longitudinal stripe. "nigrovittata" alludes to the longitudinal stripe on the side of the body of this species.

***Sinocrossocheilus longibulla* sp. nov.**

Holotype: KIZ 9907002, 91 mm SL, Sancha R., $108^{\circ}0'50"E$, $25^{\circ}24'N$ (a tributary of the Xi R., middle Pearl R.), Dongtang Village, Libo Co.,

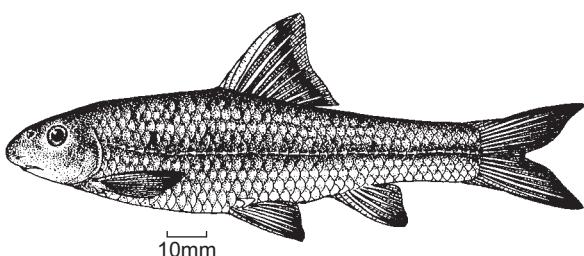


Fig. 5. Lateral view of *Sinocrossocheilus longibulla* sp. nov. holotype (KIZ 9907002), Sancha R., Libo Co., Guizhou Prov.

Guizhou Prov., July 1999.

Paratypes: KIZ 9907001 9907003, 9907004, 9907005, 9907006, 9907007, 6 specimens, 88.5-104 mm SL; same data as for holotype.

Diagnosis: This species is distinguished from other *Sinocrossocheilus* species by the following characters: air bladder very large, the anterior chamber of air bladder oval-shaped, the posterior one outsized (3.5-4.5 times length of anterior one; its diameter 1.5-2 times that of anterior one); ventral fin extending over anus; snout long (snout length of head length 43.6%-48.8%; mean, 46.4%); maxillary barbels reaching midpoint of eyes (its length 71.1%-125% of eye diameter; mean, 100.2%); horny tubercles concentrated on snout tip; center lobe of lower lip narrow (width 50%-61.5% of mouth width; mean, 56.4%).

Description: Dorsal fin rays III, 8. Pectoral fin rays I, 13-14. Ventral fin rays I, 7-8. Anal fin rays III, 5. Lateral line scales 39-42, five rows of scales between lateral line and dorsal fin origin, 5 rows of scales from lateral line to ventral fin origin. Pharyngeal teeth in 3 rows, 2.4.5-5.4.2. Gill rakers 17-18. Caudal peduncle scales 16. Predorsal scales 13. Other morphometric and meristic characters are listed in table 1.

Body stunted (body depth 22.3%-28.4% of standard length; mean, 26.1%). Head short (20.2%-22.5% of standard length). Interorbital narrow (47.4%-53.7% of head length; mean, 51.2%). Eye at midpoint between postmargin of opercle and snout tip. Three rows of horny tubercles on snout tip. Mouth gape straight. Well-developed rostral cap completely covering upper lip and upper jaw. Prefringe of rostral cap split into 13-15 short fimbriations. A row of tiny lobes on upper jaw. Lower and upper jaws with sharp horny prefringe. A shallow groove between lower jaw and lower lip. Lower lip consisting of 3 lobes, horse hoof-shaped central one with narrow straight lateral margin (its width 50%-61.5% of mouth width; mean, 56.4%). Prefringe of lower lip covered with fleshy papillae, wide (its width 30.1% of mouth width and 51% of eye diameter). Maxillary barbels longer than rostral ones and equal to or longer than eye diameter (71.1%-125% of eye diameter; mean, 100.2%).

Lateral line complete and horizontal, with 39-42 scales. Ventral scales between pectoral fin tip and ventral fin base smaller than others, and disappearing near pectoral fin base. Five lateral line scales in gap from pectoral fin tip to ventral fin origin.

Ventral fin extending over anus but not reach-

ing anal fin base. Ventral fin commencing from below 1st branched dorsal fin ray. Dorsal fin origin closer to snout tip than to base of caudal fin.

Air-bladder well developed, anterior chamber of air bladder oval-shaped; the posterior one very long (3.5-4.5 times anterior one's length) and wide (2-2.5 times anterior one's width). Intestine very sturdy (its diameter 33%-40% of mouth width, and 60%-75% of eye diameter).

Color pattern in alcohol. Dorsal and sides of head dull blackish gray. Ventral part of head whitish yellow. A distinct black spot located above pectoral fin origin. Ventral part of body blackish yellow. Caudal fin rays black. Wide transverse oblique black stripe at middle of dorsal fin. Outer margin of pectoral fin, ventral fin, and caudal fin black.

Distribution and Ecology: *Sinocrossocheilus longibulla* was collected from the Sancha R. (a tributary of the Xi R., middle reach of the Pearl R.). It inhabits lower layers of fast-flowing deep streams. The local name is also “fat fish”.

Etymology: “*longi*” in Latin means long; and “*bulla*” means air bladder. “*longibulla*” alludes to the elongate air-bladder of this species.

DISCUSSION

When *Sinocrossocheilus* Wu was established, pharyngeal teeth in 2 rows were regarded as an important generic diagnostic character. However, Chu and Cui (1987) found that *S. tridentis* has pharyngeal teeth in 3 rows. After reexamination, different *Sinocrossocheilus* species with 3 or 2 rows of pharyngeal teeth exhibited (1) overlapping distributions, (2) numerous similar external characters, including the anterior margin of rostral cap formed into short fimbriae covered densely by fleshy papilla, upper lip in the shape of a row of tiny fleshy lobes on the upper jaw, lower lip consisting of 3 parts, horseshoe-shaped center of the lower lip having straight lateral margins, a black speck on the pectoral fin origin; and (3) same osteal characters, for example, the anterior part of the dentary formed into a broadened vertical plane, and the orbitosphenoid smooth and without a ridge, and so on. Moreover, chaos in taxonomy between *Sinocrossocheilus* and *Crossocheilus* in China has resulted mainly from the diagnoses of the 2 genera. After close examination, we noticed that *Sinocrossocheilus* is easily distinguished from *Crossocheilus* by the following characters: *Sinocrossocheilus*, 1) a row of tiny fleshy lobes

present on the upper jaw; 2) the anterior margin of the rostral cap is formed into a row of short tassels; 3) having a horse hoof-shaped central lobe of the upper lip with 2 straight margins; and 4) with a cloudy black spot over the pectoral fin; versus *Crossocheilus*, 1) fleshy lobes absent from the upper jaw; 2) rostral cap formed into elongate tassels; 3) the central lobe of the upper lip with 2 oblique margins; and 4) without cloudy black spots over the pectoral fin. Other differences between *Crossocheilus* and *Sinocrossocheilus* are listed in Su (2000). Because *Crossocheilus bamaensis* Fang, 1981 and *Crossocheilus liuchengensis* Liang, 1987 possessed *Sinocrossocheilus* diagnostic characters, they were moved into the *Sinocrossocheilus*.

Sinocrossocheilus includes 9 species: *S. labiata* and *S. guizhouensis* are from the Yangtze R., whereas others (*S. papillolabra*, *S. tridentis*, *S. bamaensis*, *S. liuchengensis*, *S. longibulla*, *S. nigrovittata*, and *S. microstomatus*) are from the Pearl R. Why do *Sinocrossocheilus* fishes distributed in the same river show strong interspecific homological variations at the species level, especially in the Pearl R.? In Guizhou, Guangxi, and southeastern Yunnan Prov., there are well-developed karst and anfractuous river systems (i.e., seasonal rivers, underground rivers, cave rivers, and intermontane streamlets) especially in areas occupied by the Pearl R. *Sinocrossocheilus* species inhabit the lower layer of these fast-flowing rivers; *S. labiata* from the upper reaches of intermontane fast-flowing streamlets, *S. liuchengensis* from underground rivers, *S. longibulla* from pools below waterfalls, *S. nigrovittata* from the Dagou R. during flooding, *S. bamaensis* from a cave river belonging to Hongshui R. These rivers form separate habitats. So we assume that allopatric speciation of *Sinocrossocheilus* occurred in these various habitats of the same river.

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