

Microphysogobio rapidus, a New Species of Gudgeon (Cyprinidae, Pisces) from Korea, with Revised Key to Species of the Genus *Microphysogobio* of Korea

Byung-Soo Chae* and Hong-Jun Yang

Department of Biology Education, Teacher's College, Kyungpook National University, Taegu 702-701, Korea

Key Words:

Rapid small gudgeon
Microphysogobio rapidus
Microphysogobio yaluensis
Cyprinidae

A new species of gudgeon, *Microphysogobio rapidus* is described from 25 specimens collected from the Naktong River system, Korea. The new species is similar to *Microphysogobio yaluensis* but is distinguished from the latter and congeners by the combination of the following characteristics: number of papilla on the upper lip, 4.5 scales above the lateral line, short distance from the anus to the origin of the anal fin, wide scaleless area of the abdomen, nuptial colour consisting of a longitudinal green stripe on the lateral side of the body and bright blue colour of the suborbital region and operculum. A key to the species of *Microphysogobio* from Korea is also included.

The genus *Microphysogobio* are small fishes distributed throughout freshwater bodies of Korea, China, and Taiwan (Uchida, 1939; Cheng and Zheng, 1987). In the Korean Peninsula, four species have been recorded: *Microphysogobio koreensis*, *M. yaluensis*, *M. sp.* and *M. longidorsalis* (Uchida, 1939). Thereafter, *M. sp.* was reported as a subspecies, *M. tungtingensis uchidai* (Banarescu and Nalbant, 1973), but was treated recently as a distinct species, *M. uchidai* (Kim, 1997). Among the above four species, *M. yaluensis* distributed most widely and showed geographic variations in their morphology (Kim and Lee, 1982a, b).

During a survey of *M. yaluensis* from the southern Korean Peninsula, the authors collected peculiar samples at several localities in the Naktong River system which were very similar to *M. yaluensis* in appearance, but possessed different colour patterns during the breeding season. It was found that those samples had been misidentified as *M. yaluensis*. Since this species is different with *M. yaluensis* and its congeners, we here describe it as a new species.

The methods of counting and measurements were followed by Hubbs and Lagler (1964). The length of the abdomen represented the distance from the origin of the pectoral fin to the anus and the length of the scaleless abdomen as the distance from the origin of the pectoral fin to the end point of the scaleless part. Number of papillae on the upper lip was counted in the left half, from the center to the lateral end. Type specimens were deposited at the Department of Biology Education, Teacher's College, Kyungpook

National University (BEKU).

Systematic Accounts

Family Cyprinidae Cuvier, 1817
Genus *Microphysogobio* Mori, 1935

Microphysogobio rapidus sp. nov.
(New Korean name: Yeo-ul-ma-ja, 여울마자)
(New English Name: rapid small gudgeon)
(Fig. 1)

Holotype: BEKU 15025, 57.1 mm SL (standard length), male, Yong-gang River (128° 16' 01" E, 36° 31' 49" N), a tributary of the Naktong River system. Toegang-ri, Sabol-myon, Sangju-shi, Kyongsangbuk-do, May 13, 1995.

Paratypes: BEKU 15001-15010, 48.4-68.4 mm SL, 5 males and 5 females, Chongdochon River (128° 39' 01" E, 35° 24' 11" N), Naktong River system, Myongsong-ri, Chodong-myon, Miryang-shi, Kyongsangnam-do, Korea, May 5, 1994; BEKU 15011-15014, 54.6-68.2 mm SL, 3 males and 1 female, Yangchon River (128° 59' 73" E, 35° 17' 30" N), Naktong River system, Shingi-ri, Shinan-myon, Sanchong-gun, Kyongsangnam-do, Korea, May 29, 1994; BEKU 15015-15024, 63.5-77.9 mm SL, 5 males and 5 females, Yong-gang River (128° 16' 01" E, 36° 31' 49" N), Naktong River system, Toegang-ri, Sabol-myon, Sangju-shi, Kyongsangbuk-do, Korea, June 6, 1994.

Diagnosis: *Microphysogobio rapidus* sp. nov. is distinguished from *M. yaluensis* and its congeners by the combination of the following characters: number of papilla on the upper lip; 4.5 scales above the lateral

* To whom correspondence should be addressed.
Tel: 82-53-950-5912, Fax: 82-53-950-6809

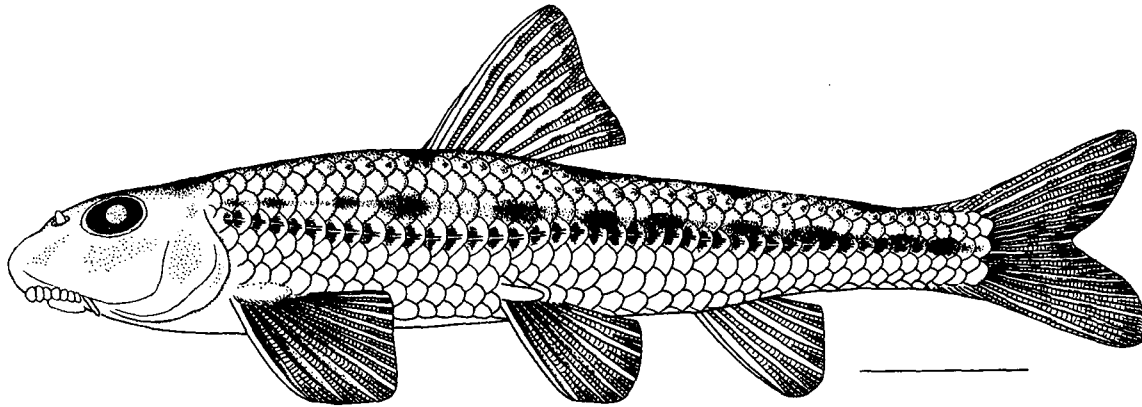


Fig. 1. *Microphysogobio rapidus* sp. nov. holotype (BEKU 15025), 57.1 mm SL, male. Scale bar=10 mm.

line; short distance from anus to origin of anal fin; wide scaleless area of abdomen; nuptial colour consisting of a green stripe from rear edge of gill opening to caudal fin base and bright blue colour of suborbital region and operculum.

Description: Meristic and morphometric characters for holotype and paratypes are shown in Table 1. Dorsal fin rays iii, 7 (8); anal fin rays iii, 6 (7); pectoral fin rays i, 12 (13); ventral fin rays i, 7 (8). Lateral line scales 39-41. Scales above lateral line 4.5 (5). Number of papillae from center to lateral end of upper lip 9-15.

Body small, elongated. Mouth inferior, crescent-shaped, papillose; median papillae of upper lip one row, lateral papillae several rows; size of median

papillae more or less bigger than other species of congeners. Mental pads behind lower lip heart-shaped. A pair of barbels on the lateral end of maxilla. Scale large, cycloid. Lateral line complete and slightly bent downward anteriorly. Most part of abdomen scaleless, only less than a third of the posterior abdomen covered with scales. Origin of dorsal fin anterior than the origin of the ventral fin and nearer to the tip of the snout than caudal fin base; upper margin of dorsal fin slightly concave or straight. Origin of anal fin situated behind last soft ray of dorsal fin, its outer margin straight or slightly concave. Caudal fin deeply forked, its lobes pointed.

Sexual dimorphism: Small protuberances appeared on

Table 1. Meristic and morphometric (Mean±SD) characters of *Microphysogobio rapidus* sp. nov.

Characters	Holotype		Paratypes	
	Male	Male	Male	Female
No. of individuals	1	13		11
Standard length (mm)	57.1	51.2-71.6		48.4-77.9
Meristic*				
dorsal fin rays	iii, 7	iii, 7 (8)		iii, 7
anal fin rays	iii, 6	iii, 6 (7)		iii, 6 (7)
ventral fin rays	i, 7	i, 7 (8)		i, 7
pectoral fin rays	i, 12	i, 12 (13)		i, 12 (13)
scales above lateral line	4.5	4.5 (5)		4.5
lateral line scales	41	39-41 (40.4±0.6)		39-41 (40.1±0.7)
papillae on upper lip (left half)	9	9-15 (11.7±1.6)		9-13 (10.5±1.2)
Morphometric				
In standard length (%)				
head length	22.8	21.3-24.2 (23.0±0.9)		22.5-24.3 (23.1±0.5)
snout length	9.5	8.2-9.9 (9.0±0.5)		5.5-9.6 (8.6±1.1)
eye diameter	7.0	6.8-7.8 (7.1±0.2)		6.3-7.7 (6.9±0.4)
predorsal fin length	43.8	41.7-45.0 (43.3±1.1)		42.8-46.4 (44.6±1.2)
prepectoral fin length	22.9	21.5-25.0 (23.3±1.0)		22.3-24.3 (23.0±0.6)
preventral fin length	49.9	49.2-50.7 (49.8±0.4)		49.4-53.0 (51.0±1.3)
preanal fin length	71.5	71.3-73.5 (72.0±0.7)		71.7-74.6 (72.9±0.9)
body depth	18.9	17.6-20.6 (19.1±0.7)		18.5-20.4 (19.6±0.7)
caudal peduncle length	20.5	17.9-20.5 (19.2±0.8)		17.3-19.7 (18.6±0.6)
caudal peduncle depth	8.2	7.8-8.7 (8.2±0.3)		7.5-8.1 (7.8±0.2)
interorbital width	6.0	5.6-6.6 (6.1±0.3)		5.3-6.1 (5.6±0.2)
distance from anus to origin of anal fin	9.8	10.9-13.1 (11.6±0.6)		8.2-12.3 (10.8±1.0)
In abdomen length (%)				
scaleless abdomen length	66.4	58.0-69.7 (64.8±2.9)		62.2-68.6 (65.4±1.9)
In caudal peduncle length (%)				
caudal peduncle depth	40.2	39.2-47.7 (42.9±2.4)		40.3-46.6 (41.9±1.6)

*In meristic characters, numerals in parentheses represent rare cases.

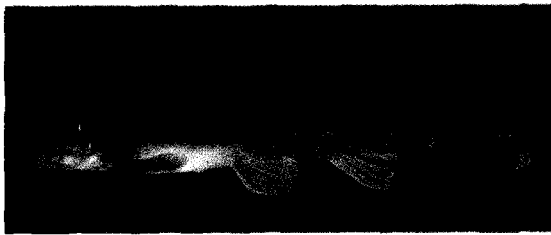


Fig. 2. Nuptial colour pattern of the male of *Microphysogobio rapidus* sp. nov. in breeding season. Scale bar=10 mm.

the pectoral fin rays in the breeding season. These protuberances were well developed in males, three to four rows on each soft ray, but absent or very few in females.

Colour: In life, the side of the body above the lateral line brown, and below the lateral line and abdomen pale, greyish brown. Operculum and suborbital region greyish white. Lateral line scales with two black spots divided by pore. Longitudinal stripe on the side of body slightly dark. In the breeding season, the longitudinal stripe turned green and operculum and suborbital region turned bright blue in both sexes; side of body above lateral line turned dark brown; pectoral and ventral fin turned red-brown; the nuptial colour slightly weak in females than in males (Fig. 2). In formalin, longitudinal stripe dark brown with about 8 to 10 distinct pupil-size black spots on it; the side of body above the stripe brown and below the stripe pale yellowish brown; abdomen blackish; isthmus and breast yellowish.

Distribution: This species was found in several tributaries of the Nakdong River system, Korea (Fig. 3): Panbyon, Yong-gang, Wichon, Hoichon, Nam, Chongdochon and Miryang Rivers.

Ecological notes: *Microphysogobio rapidus* sp. nov. usually inhabits fast flowing, shallow waters in which the bottom is covered with gravel. Their habitats located from the lower to the mid-lower reach of each tributary.

Etymology: The name of the new species is derived from the Latin word *rapidus* meaning "fast rate" and the English word rapids meaning, "a part of river where the current is fast and the surface is usually broken by obstruction" in reference to the habit of this species which inhabits mainly fast flowing, shallow regions of streams.

Remarks: *M. rapidus* sp. nov. is frequently mistaken with *M. yaluensis* in stock specimens and in the nonbreeding season. However, *M. rapidus* sp. nov. differs from *M. yaluensis* by scales above the lateral line (4.5 instead of 3.5), lateral line scales (39-41

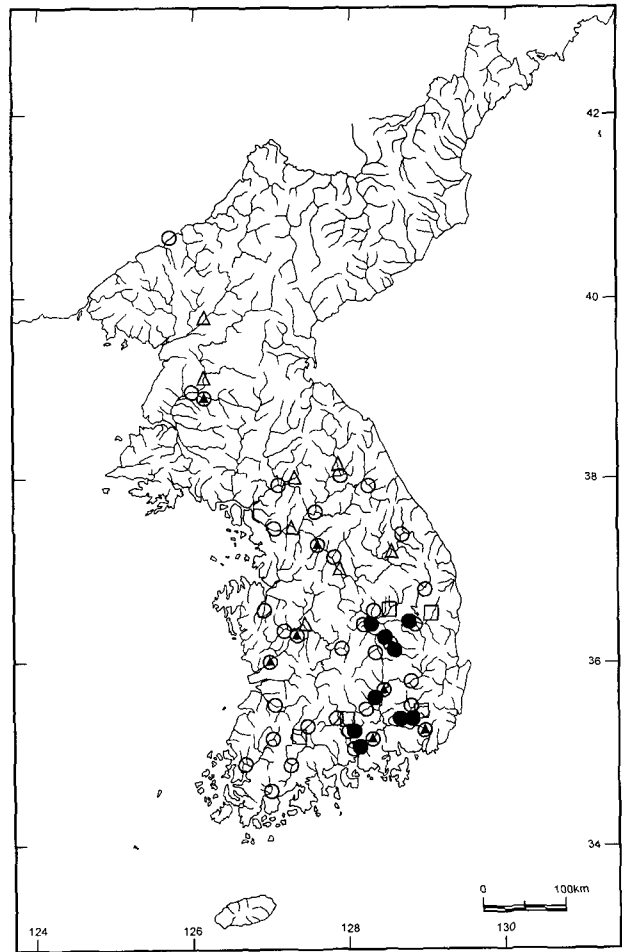


Fig. 3. Map showing the distribution of fishes of the genus *Microphysogobio* in the Korean Peninsula. *M. rapidus* sp. nov. (●), *M. yaluensis* (○), *M. koreensis* (□), *M. longidorsalis* (△), and *M. uchidai* (⊙).

instead of 36-40), pectoral fin rays (12 instead of 11), distance from anus to origin of anal fin (8.2-13.1% of SL instead of 13.0-19.3%), wide, scaleless area of abdomen and in particular, the nuptial colour (longitudinal stripe green instead of dark brown, operculum and suborbital area blue instead of silver grey, pectoral, and ventral fin red instead of yellow). Pearl organs on the anterior margin of the pectoral fin do not appear in *M. rapidus* sp. nov., but numerous small protuberances appear on the soft rays of the pectoral fin. It is considered that these protuberances have the same function as the pearl organs of *M. yaluensis* (Table 2 and Table 3).

The new species was always sympatric with *M. yaluensis* and rarely with *M. uchidai* but their microhabitat was distinctly different. *M. yaluensis* and *M. uchidai* were found mainly in the slowly flowing region of streams with sandy or small graveled bottoms but *M. rapidus* sp. nov. in the fast flowing region with small or large graveled bottoms.

M. yaluensis was distributed in most rivers which

Table 2. Comparison of colour, pearl organ and habitat between *Microphysogobio rapidus* sp. nov. and *M. yaluensis*

Characters		<i>M. rapidus</i> sp. nov.	<i>M. yaluensis</i>
Colour (at spawning season)	abdomen	yellowish white	silver white
	longitudinal stripe	green	black
	dorsum ♂	dark brown	dark brown
	♀	dark brown	brown
	operculum	bright blue	silver white
pectoral fin	red	yellow	
ventral fin	red	yellow	
Pearl organ of pectoral fin	♂	on the soft rays (3-4 rows/ray)	on the anterior margin and soft rays (1 row/ray)
	♀	none	none
Habitat	rate of flow bottom structure	rapid pebble (large)	slow sand or pebble (small)

drained into the West and the South Sea of the Korean Peninsula, but other species of the congener were restricted to some rivers: *M. uchidai* in the Naktong, Kum, Han and Daedong Rivers, *M. longidorsalis* in the Han, Daedong and Chongchon Rivers and *M. koreensis* in the Naktong and Somjin Rivers (Uchida, 1939; Jeon, 1980; Kim, 1997). *M. rapidus* sp. nov., however, was found only in the Naktong River, showing the most limited distribution among the fishes of the genus *Microphysogobio* (Fig. 3). It is biogeographically significant that *M. rapidus* sp. nov., as well as *Niwaella multifasciata* and *Pseudobagrus brevicaudus* which are endemic species to Korea, were found only in the Naktong River system (Choi et al., 1990).

Key to the species of *Microphysogobio* from Korea

1. Dorsal fin large, upper margin convex *M. longidorsalis*
Dorsal fin small, upper margin straight or slightly concave 2
2. Most part of abdomen densely covered with scales 3
Posterior abdomen covered with scales, occasionally mid-abdomen, loosely covered 4

3. Number of papilla on the upper lip 15 to 23 *M. koreensis*
Number of papilla on the upper lip absent or very few *M. uchidai*
4. Scales above lateral line 3.5; distance from anus to origin of anal fin long *M. yaluensis*
Scales above lateral line 4.5; distance from anus to origin of anal fin short *M. rapidus*

Comparative materials. *Microphysogobio yaluensis*: 16 specimens, 39.8-50.7 mm SL, Naktong River, Myongsong-ri, Chodong-myon, Miryang-shi, Kyongsangnam-do, Korea, May 5, 1994; 13 specimens, 43.0-73.0 mm SL, Somjin River, Hogok-ri, Kodal-myon, Koksong-gun, Chollanam-do, Korea, Nov. 12, 1989; 14 specimens, 59.4-79.7 mm SL, Kum River, upnae-ri, Muju-up, Muju-gun, Chollabuk-do, Korea, Jun. 14, 1990; SMWU-4469 (Sangmyung Women's University), 11 specimens, 45.7-63.3 mm SL, Namhan River, Bangye-ri, Munmak-myon, Wonju-shi, Kangwon-do, Korea, Apr. 16, 1989; SMWU-1833, 11 specimens, 39.7-53.7 mm SL, Imjin River, Jondong-ri, Paikhak-myon, Yonchon-gun, Kyonggi-do, Korea, Jun. 27, 1989.

Table 3. Comparison of morphological characters between *Microphysogobio rapidus* sp. nov. and *M. yaluensis*

Characters	<i>M. rapidus</i> sp. nov.	<i>M. yaluensis</i>				
		Naktong River	Somjin River	Kum River	Namhan River	Imjin River
No. of individuals	25	16	13	14	11	11
Standard length (mm)	48.4-77.9	39.8-50.7	43.0-73.0	59.4-79.7	45.7-63.3	39.7-53.7
Meristic						
No. of pectoral fin rays	12-13 (12.2±0.4)	10-11 (10.8±0.4)	10-11 (10.4±0.5)	10-11 (10.3±0.5)	10-11 (10.5±0.5)	10-11 (10.3±0.5)
No. of lateral line scales	39-41 (40.3±0.6)	37-39 (38.1±0.4)	38-40 (38.8±0.8)	38-40 (38.9±0.6)	38-39 (38.6±0.5)	38-39 (38.6±0.5)
No. of scales above lateral line	4.5-5.0 (4.5±0.1)	3.5	3.5	3.5-4.0 (3.5±0.1)	3.5	3.5
Morphometric						
Head length (% of SL ¹)	21.3-24.3 (23.0±0.9)	20.6-23.3 (21.8±0.8)	20.2-21.8 (21.1±0.6)	18.5-21.6 (20.5±0.9)	19.3-21.4 (20.4±0.8)	19.9-23.2 (21.4±0.9)
Body depth (% of SL)	17.6-20.6 (19.1±0.8)	17.3-19.7 (18.8±0.7)	16.7-18.4 (17.6±0.6)	16.5-18.8 (18.1±0.6)	16.5-21.0 (19.0±1.2)	17.6-20.6 (18.7±0.9)
DAAF ² (% of SL)	8.2-13.1 (11.6±0.6)	14.3-18.3 (15.6±0.9)	15.0-18.1 (16.4±1.1)	13.8-19.0 (15.6±1.4)	13.8-17.1 (15.1±0.9)	14.2-17.4 (15.7±1.0)
Scaleless abdomen length (% of abdomen length)	58.0-69.7 (64.7±3.0)	29.6-55.2 (44.4±6.9)	16.9-46.9 (33.9±8.8)	55.2-66.7 (60.3±3.9)	54.6-69.0 (61.1±4.5)	50.9-66.2 (60.5±4.5)

¹Standard length, ²Distance from anus to origin of anal fin.

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