



Johnius taiwanensis, a new species of Sciaenidae from the Taiwan Strait, with a key to *Johnius* species from Chinese waters

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Abstract

A new sciaenid fish, *Johnius taiwanensis*, is described from the southeast coast of mainland China from Zhejiang to Guangdong, Hong Kong, and west coast of Taiwan. *Johnius taiwanensis* **sp. nov.** can be distinguished from other *Johnius* species by having a grayish dorsal half of body divided by a clear line from a whitish ventral half, and a black spot at the dorsal half of pectoral-fin axil, appearing as a distinct dot at the most dorsal point of the pectoral-fin base. First dorsal fin black tipped, other fins pale to dusky but never darkly pigmented. The species lacks distinctly enlarged teeth on upper and lower jaws. Body scales ctenoid, moderately large, with five or six rows between first dorsal-fin origin and lateral line. It is one of the most abundant sciaenids found in the shallow coastal waters (<20 m) of southeast mainland China and the west coast of Taiwan. It has often been misidentified as *J. macrorhynchus* in the region. Phylogenetic analysis from all 27 sciaenid species found in Chinese waters based on the complete *COI* and *16S* rRNA gene sequences confirmed that the genus *Johnius* is monophyletic and *J. taiwanensis* is placed as a sister species of *J. trewavasae*. Acoustic analysis has shown that *J. taiwanensis* produces a unique sound among fishes in Taiwan coastal waters.

Key words: Sciaenidae, *Johnius taiwanensis*, monophyly, West Pacific, China

Introduction

Indo-West Pacific region has near 100 species of sciaenid fishes (Trewavas, 1977; Lal Mohan *et al.*, 1984; Sasaki, 1989; Chao *et al.*, 2015). The genus *Johnius* is a group of small- to medium-sized sciaenids with 35 recognized species, all endemic to the region. The genus *Johnius* Bloch, 1793, type species, *Johnius carutta* Bloch, 1793, designated by Gill, 1862, had been widely applied to several sciaenid fishes of Indo-West Pacific. Trewavas (1977) reviewed the nomenclature and synonyms of *Johnius*; Sasaki (1989) defined the genus and the tribe Johniini by synapomorphic characters, including a hammer-shaped gas bladder with 13–17 arborescent lateral appendages. The first lateral branch extends to dorsal corner of gill opening, appearing externally on the supracleithrum bones under the skin, which is a diagnostic character for the genus *Johnius* (Fig. 1). It is also unique in having a large paired triangular-shaped sagittal otolith, and a paired relatively large lapillus (Fig. 2).

Here we described a new species, *Johnius taiwanensis*, which is commonly found along both sides of the Taiwan Strait, from Zhejiang to Guangdong and Hong Kong on the west side, and from west coast of Taiwan on the east side. This species has been misidentified for decades, as *Johnius belangerii*, *J. macrorhynchus*, *J. sina* or *Wak sina* (Chu *et al.*, 1963; Yu & Shen, 1987; Shen, 1993; Lin *et al.*, 2007). Preliminary descriptions in Chinese were found in two co-authors' MSc dissertations (Liou, 2016; Guo, 2017).

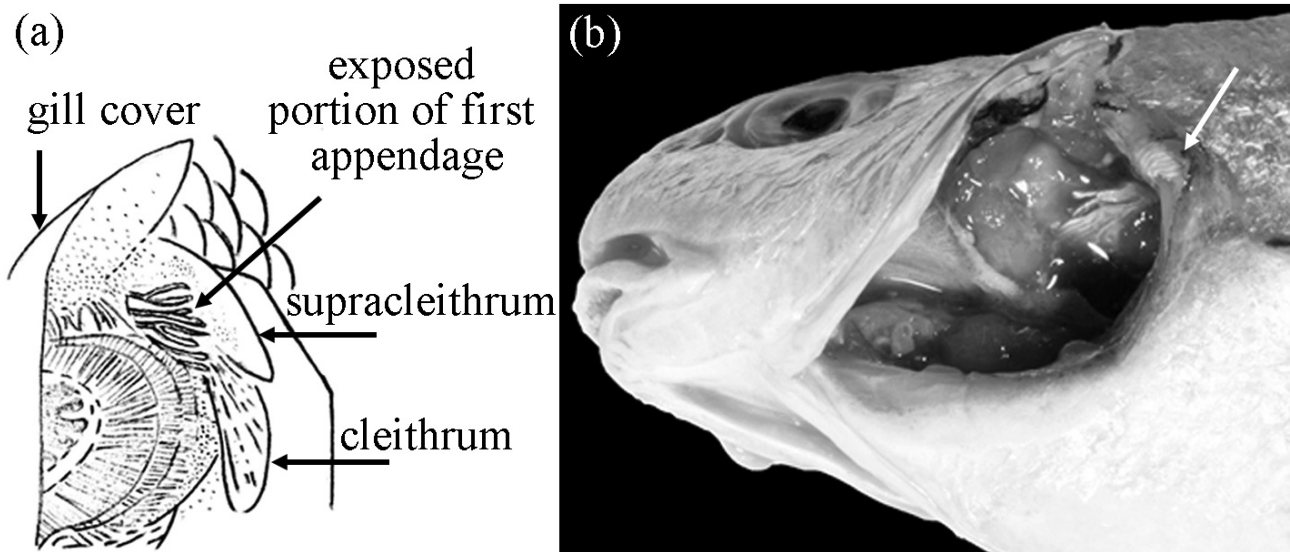


FIGURE 1. Lateral branch of the anterior appendage of the gas bladder visible externally at the junction of cleithrum and supracleithrum (under gill cover) in all *Johnius* species. (a) Redrawn from Sasaki 2001, p.3119; (b) a head photo of a *Johnius* species with the arrow indicating the exposed first appendage.

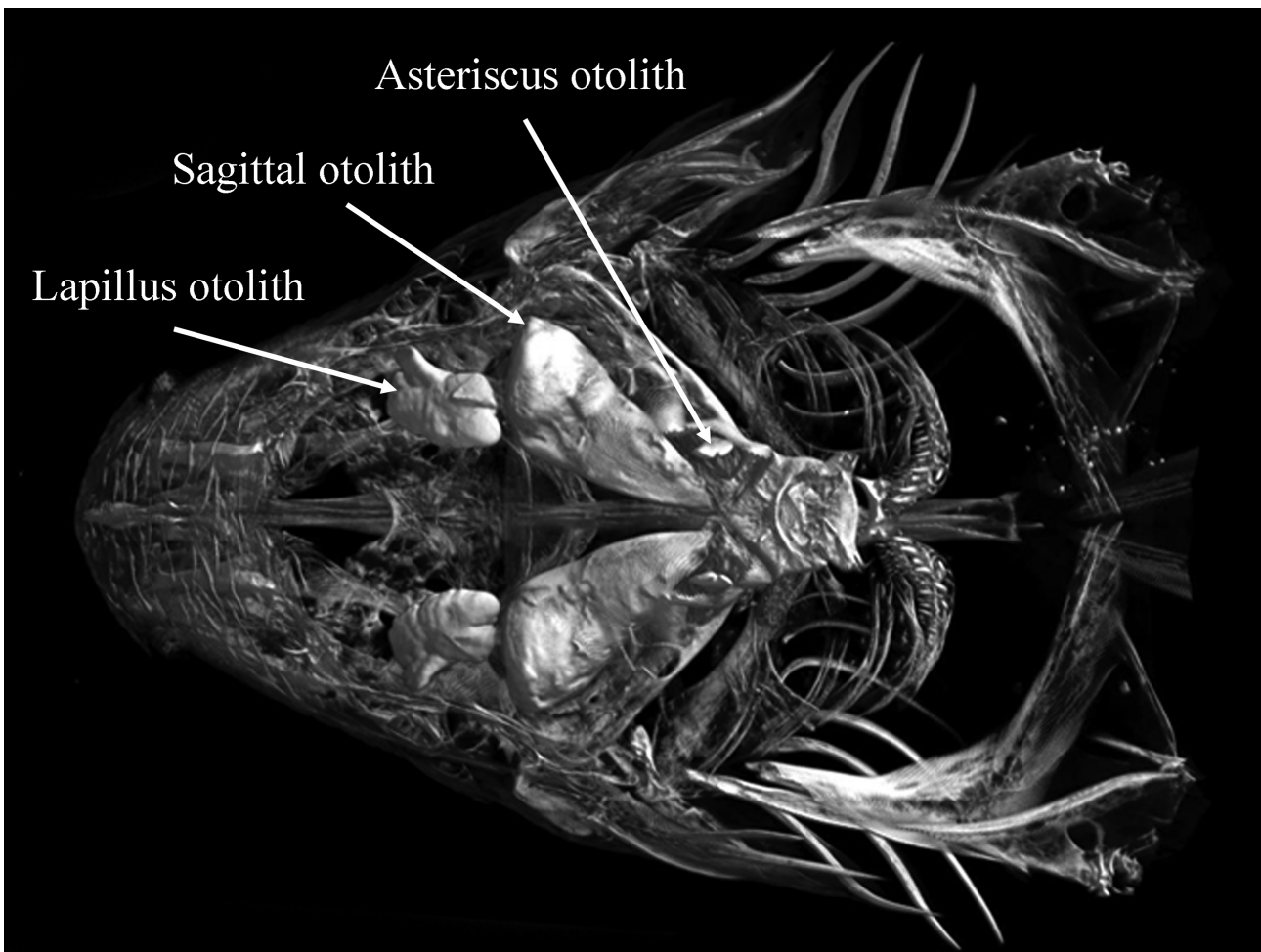


FIGURE 2. Head CT scan of a *Johnius belangerii* individual showing the *in situ* position of three pairs of otoliths; a pair of large triangular shaped sagitta, and the relative enlarge lapillus in front and a pair of small asteriscus located postero-lateral of the sagitta. (CT Scan by Andrew Williston, MCZ, Harvard University, with permission to use one time here)

Johnius species usually have a small mouth, sub-terminal to inferior in position, and four species with a short barbel on the chin (*J. amblycephalus*, *J. fuscolineatus*, *J. macropterus* and *J. mannarensis*). *Johnius taiwanensis* lacks a chin barbel. The subgenus *Johnius* (*Johnieops*), e.g. *J. borneensis*, *J. distinctus* and *J. philippinus* have a distinctly enlarged outer row teeth on upper jaw, especially the front ones; the inner row teeth on lower jaw are also noticeably enlarged (Trewavas, 1977; Lal Mohan *et al.*, 1984; Sasaki, 1999, 2001) (Fig. 3a). *Johnius taiwanensis* belongs to the subgenus *Johnius* (*Johnius*), which has slightly enlarged outer row teeth on upper jaw, with lower jaw teeth that are villiform and set in a narrow band (Fig. 3b).

Most *Johnius* species have a limited distribution range (Trewavas, 1977; Lal Mohan, 1976; Sasaki, 1992, 1999). A few species of *Johnius* are widely distributed in the Indo-West Pacific, and distribution of *J. amblycephalus*, *J. belangerii*, *J. borneensis*, *J. carouna*, *J. distinctus*, *J. grypotus* and *J. trewavasae* overlap with that of *J. taiwanensis*. The body shape and pigmentation are also similar in many *Johnius* species, which has made identification quite confused in the literature (Chu, 1956; Chu *et al.*, 1963; Yu & Shen, 1987; Shen, 1993). The misidentification is often due to including species that are outside the region, e.g. *J. dussumeiri* and *J. macrorhynchus*; using junior synonyms, e.g. *J. sina* and *J. tingi*; being unaware of the diagnostic characters, e.g. *J. belangerii*, *J. borneensis* and *J. macrorhynchus*; or all of these. Furthermore, there are also resurrected species, *Johnius grypotus* (Richardson, 1846), *J. heterolepis* Bleeker, 1873 and *J. cantori* Bleeker, 1874, from the West Pacific by Sasaki (1990, 1992). Therefore, a key to species of *Johnius* in Chinese waters has been included.

We also carried out a phylogenetic analysis of all 27 species of Sciaenidae in Chinese waters using complete *COI* and *16S* rRNA gene sequences to understand the relationship of *J. taiwanensis* with other sciaenids. Lin *et al.* (2007) analyzed the sound character of “*J. macrorhynchus*” and indicated that it produces a unique sound character among coastal fishes of Taiwan. The analyzed species is currently confirmed to be *J. taiwanensis*.

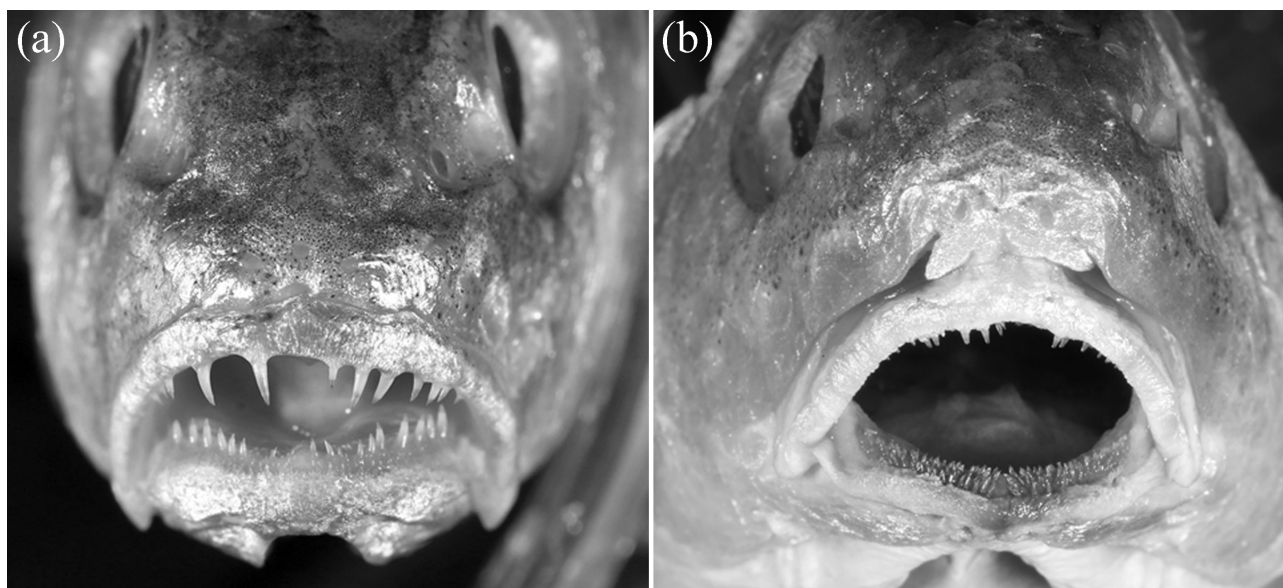


FIGURE 3. (a) The distinctly enlarged teeth on upper and lower jaws from *Johnius borneensis* (121 mm SL) (front view). (b) The slightly enlarged teeth on upper jaw; small and uniform teeth on lower jaw from *Johnius taiwanensis* (144 mm SL) (front view).

Materials and methods

We have examined numerous specimens of *Johnius* from fish collections and in the field. We also used descriptions and identification keys to check against the new species (Cuvier & Valenciennes, 1930; Trewavas, 1977; Lal Mohan *et al.*, 1984; Sasaki, 1992, 1999, 2001).

Specimen collection. Specimens of *J. taiwanensis* were collected from fish markets, landing ports and monitoring surveys, by trawling and hook-and-line from Zhoushui River, Central Western Taiwan, and coastal waters of Fujian and western Hong Kong. Collections were made by Department of Oceanography, National Sun Yat-sen University (Kaohsiung) and College of Ocean and Earth Sciences, Xiamen University (Xiamen), China. Type speci-

mens are deposited at the National Museum of Marine Biology and Aquarium (NMMBA), California Academy of Sciences (CAS), Museum of Comparative Zoology (MCZ) and National Museum of Natural History (USNM), and additional non-type specimens will be distributed to other collections.

Morphological study. Methods of counting and measuring follow Hubbs and Lagler (2004), terms of morphological structure and descriptions for sciaenids followed Trewavas (1977), Chao (1978) and Sasaki (1989). Length of all specimens are given as standard length (SL in mm). Fin-ray counts use Roman numerals for spines and Arabic numerals for soft rays. Gill-raker counts are the total number on the first gill arch and include rudimentary tubercles. The lateral-line scale count is the number of scales perforated by lateral-line pores exclusive of those on the structural base of the caudal fin (hypural plates). Sagitta and lapillus were extracted and described. To examine the arborescent lateral appendages on the expanded anterior portion of the gas bladder, an extensive incision was often cut through the isthmus between the cleithrum bones. The existence of drumming muscles is noted.

Phylogenetic analysis. To construct the phylogenetic relationship of *J. taiwanensis* with other sciaenid species from Chinese waters, the complete *COI* and *16S* rRNA gene sequences of all 27 sciaenid species occurring in the region were retrieved from GenBank, and most uploaded from the study of Guo (2017). The Red drum, *Sciaenops ocellatus*, an introduced species in China Seas, was included. Three species, including one in the family Epinephelidae and two in the family Polynemidae, were selected as the outgroup. Alignments of *COI* and *16S* gene sequences were conducted by using multiple sequence MAFFT (version 7.222) plugin in Geneious program with the default settings of the E-insi algorithm. The aligned sequences were 3,293 bp in length, corresponding to the combinations of 1,552 bp *COI* gene and 1,741 bp *16S* rRNA gene. The Neighbor-Joining (NJ) tree was inferred using MEGA 6.06 with 1000 bootstrap pseudo-replications.

Taxonomy

Diagnosis. *Johnius taiwanensis* differs from other species of the subgenus *J. (Johnieops)*, e.g. *J. borneensis* and *J. distinctus*, by lacking an enlarged outer row teeth on the upper jaw (Fig. 3). It has a unique body color pattern of a grayish dorsal part divided by a distinct line from the whitish ventral one third (Fig. 4). *Johnius belangerii* has smaller scales, with 7–8 transverse-scale rows between dorsal-fin origin and lateral line, while all other *Johnius* in Chinese waters have larger scales in 5–6 rows. *Johnius taiwanensis* has a black dot on uppermost axilla of pectoral fin that is absent in other *Johnius* species except *J. carouna*. *Johnius carouna* has a longer second anal-fin spine, greater than 35% of head length (less than 30% in *J. taiwanensis*). *Johnius trewavasae* also has a silvery gray back and whitish belly, but the head is strongly cavernous and soft, and the scales on the body fall off easily, while *J. taiwanensis* has a cavernous but firm head and firmly attached scales. *Johnius trewavasae* also has very short, tubercle-like gill rakers and a thicker second anal-fin spine than *J. taiwanensis*. Also, *J. taiwanensis* produces a sound that is unique amongst sciaenids in the coastal waters of Taiwan (Lin *et al.*, 2007).

Description. Dorsal fin, IX–XI + I, 24–28; anal fin, II, 7–8; pectoral fin, 17–18; gill rakers, 5–7 + 10–12 = 15–19 (Fig. 5); preopercular margin finely serrated; lateral line pored scales 48–50, least transverse scales 5–6 from dorsal-fin origin to lateral line, 9–10 between anal-fin origin and lateral line.

Body elongate, dorsal profile smoothly arched, ventral profile rather flat; head conical, 3.3–3.4 in standard length. Snout blunt, projecting slightly in front of upper lip, 3.4 in head length; its lower margin with three upper and five marginal sensory pores. Eye moderate, 4.4–5.1 in head length; the orbit rounded, somewhat oval in small specimens. Interorbital region firm, slightly convex and cavernous.

Mouth inferior, moderately large, upper jaw 2.6 in head length; a vertical line from the end of maxilla passing 2/3 of eye, between posterior borders of pupil and eye. Underside of lower jaw with five mental pores (Fig. 6). Upper jaw teeth in a narrow band, with a slightly enlarged outer row of closely set teeth, the longest not exceeding one quarter of pupil diameter, and teeth on lower jaw villiform, set in narrow bands (Fig. 3b).

Inside of opercle grayish dark dorsally extend to the roof of mouth, with a paler ventral margin. Gill rakers short, much shorter than gill filaments (Fig. 5). Preopercular margin finely serrated, without conspicuous spine. Upper end of opercle with a scaled flap or flat spine.

Anal fin truncate, the second spine strong but short, 3.3 in head length or about half of the first soft ray length. Caudal fin S-shaped, about 2/3 of head length. Pectoral-fin tip reaching slightly beyond pelvic-fin tip, but much short of vent; pelvic-fin tip with a short filamentous prolongation.

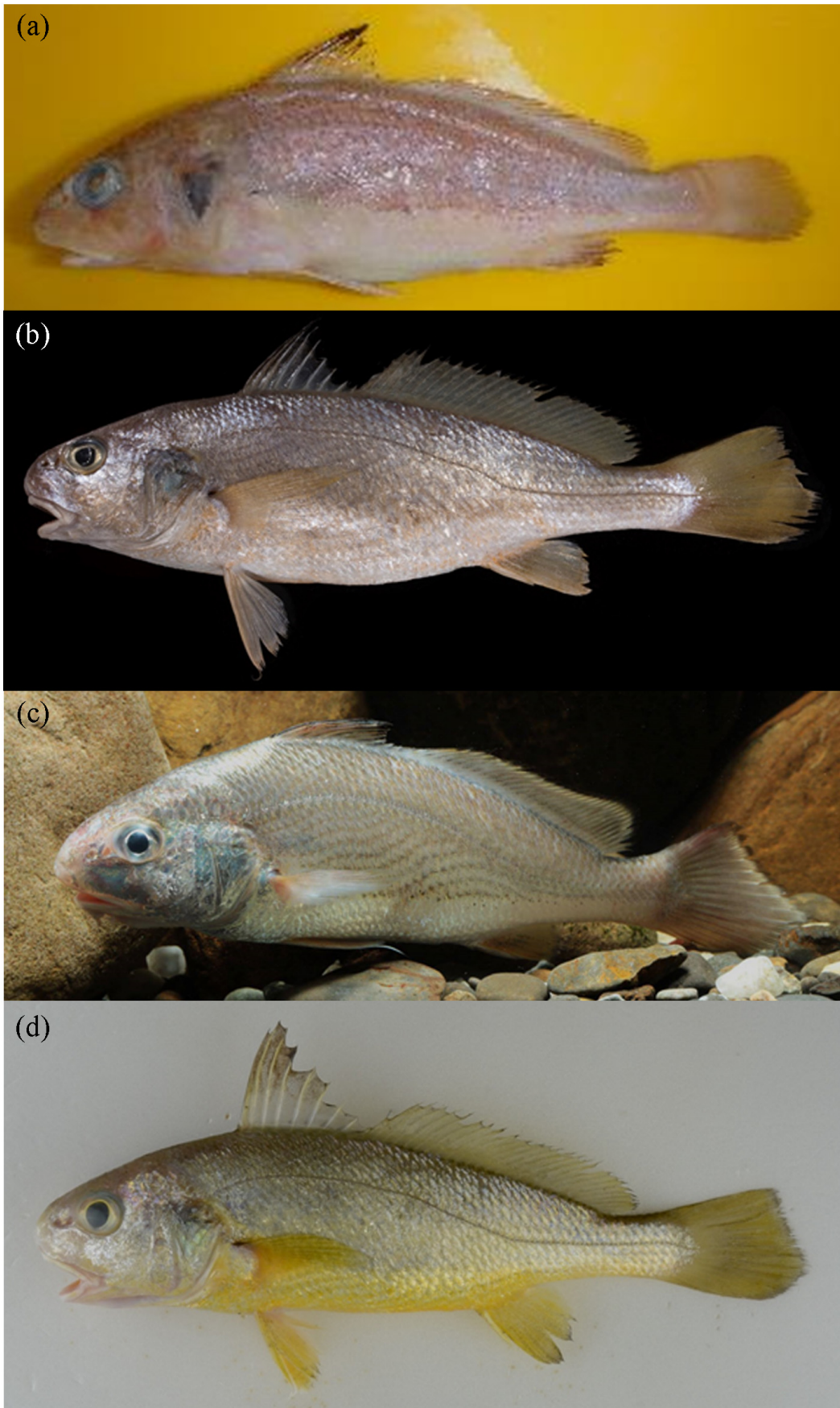


FIGURE 4. *Johnius taiwanensis*. (a) Holotype, NMMBP 23063 (126 mm SL), Jianjun Port, Tainan, Taiwan; (b) a specimen of 158 mm SL, Dongshan, Fujian.; (c) Paratype, NMMBP 31331 (111 mm SL) photographed live from Taoyuan, Taiwan (photo by Ming-Tai Chou); (d) a fresh specimen from Budai Port, Taiwan (photo by Dr. Guo-Shu Chen).

Scales strongly ctenoid, cycloid beneath opercular flap, on pre-pelvic region and below pectoral base. Head squamation cycloid except ctenoid on nape and interorbital region, cycloid on lachrymal and on opercle bones; scales reduced and somewhat embedded on snout. Inter-spinous membrane naked on first dorsal fin; second dorsal and anal fins uniformly invested with small cycloid scales up to 3/4 of fin height. Caudal fin finely scaled. Lateral line pored scales ctenoid, indented in middle of posterior margin, of equal size to the scales of adjacent rows. Canal system on scale arborescent.

Anterior end of gas bladder expanded to a T-shaped chamber, with 14–15 pairs of arborescent diverticula attached to the anterior and lateral sides of the main chamber, become tubular posteriorly (Fig. 7). The most anterior pair of diverticulae pierces through the septum transversum, reaching to the base of the cranium (basioccipital and exoccipital bones). The second pair of diverticula extends laterally to the external surface of the cleithrum, set on the lateral surface of supracleithrum and visible externally under the thin skin (Fig. 1).

Three pairs of otoliths in the inner ear have occupied near half of cranial cavity (Fig. 2). Sagitta thick and triangular-shaped; sulcus with a small ovoid ostium, bent strongly antero-laterally, cauda narrow and short, ending in a deep crater-like groove, outer surface with crest-like elevations (Fig. 8). Lapillus large, about 1/3 of sagitta in height, with a forked anterior flange; inner surface smoothly convex, outer surface roughly concave (Fig. 8). Asteriscus triangular, thin, with a notch on top and a lanceolate groove near ventral margin of its inner surface.

Drumming muscles are only found in males and position on the lateral body cavity wall; they are absent in females (Fig. 9).

Coloration. Body color brownish in alcohol, top of head darker on nape and interorbital region (Fig. 4a). Fresh fish mostly grayish silver, upper two third of body darker separated from whitish to yellowish belly by a distinct line (Fig. 4b,d). Tip of snout and chin pale, tongue and inside of mouth pale anteriorly, roof turns darker toward gill chamber, with dark lines along the skin folds. Inside of operculum and cleithrum black with pale distal margin, pale around pseudobranchiae, variably dusky or punctuate elsewhere. Inside of operculum sprinkled with melanophores, often showing through the operculum externally as a triangular patch behind the upper edge of preoperculum. A live fish (Fig. 4c) grayish with pale to yellowish belly, the upper part of body with wavy dots along the oblique scale rows; the snout and mouth pinkish, the pectoral-fin base orange with a distinct black dot on upper end of axil.



FIGURE 5. The first gill arch of *Johnius taiwanensis* (144 mm SL).

Spinous dorsal fin black tipped, covered with large melanophores, soft dorsal fin with slightly dark distal half and light basal portion, often appear as a white stripe along the dorsal-fin base. Caudal fin evenly dusted with small chromatophores. Anal fin punctuate, becoming dark toward trailing edge. Upper half of pectoral fins sprinkled with chromatophores, a distinct dark spot or densely pigmented patch on the upper most pectoral-fin base and axilla. Pelvic fin pale at base but densely punctuate distally. Peritoneum membrane heavily punctuated, dark gray to blackish.

Distribution. *Johnius taiwanensis* is a shallow coastal species commonly found along both sides of the Taiwan Strait, the west coast of Taiwan from Taoyuan to Kaohsiung and southeast coast of mainland China from Zhoushan Islands of Zhejiang, to Fujian, Guangdong and Hong Kong.

Etymology. It is first recognized from specimens collected from Southwest Taiwan, and commonly found along both sides of the Taiwan Strait; therefore, it is named as *Johnius taiwanensis*.

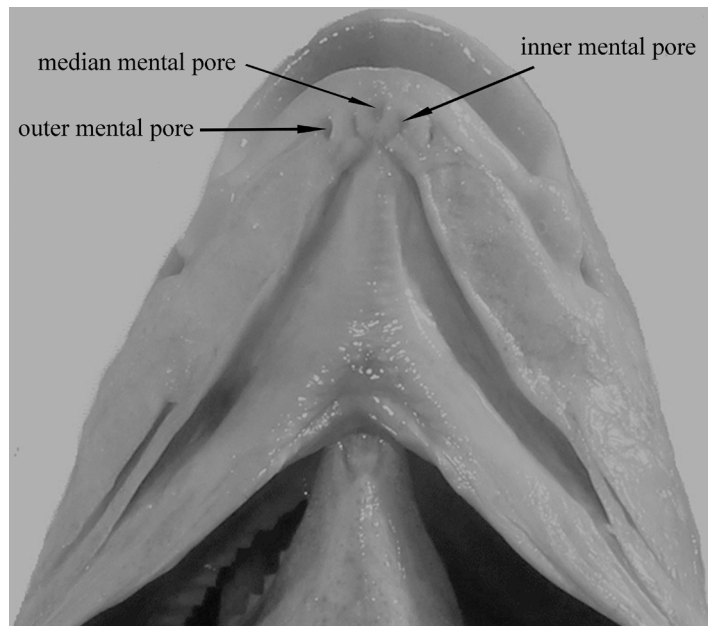


FIGURE 6. Five mental pores of *Johnius taiwanensis* (148 mm SL) at lower jaw (ventral view).

Material examined. Holotype. NMMBP 23063 (126 mm SL), June 19 2014, Jiangjun Port, Tainan, Taiwan.

Paratypes. Taiwan: CAS 244361, 2 (128–130 mm SL), March 13 2013, Taizi, Yunlin (from NMMBP 19373). MCZ 172798, 2 (130–152 mm SL), March 13 2013, Taizi, Yunlin (from NMMBP 19373). NMMBP 8464, 1 (118 mm SL), May 06 2005, Wuqi Harbor, Taichung. NMMBP 19365, 3 (133–160 mm SL), March 14 2013, Wenzai Port, Zhanghua. NMMBP 19373, 9 (115–162 mm SL), March 13 2013, Taizi, Yunlin. NMMBP 23065, 2 (128–134 mm SL), September 12 2014, Mailiao, Zhoushui River, Yunlin. NMMBP 23067, 1 (135 mm SL), June 19 2014, Jiangjun Port, Tainan. NMMBP 23070, 1 (88.7 mm SL), May 27 2014, Mailiao, Zhoushui River, Yunlin. NMMBP 23580 1 (170 mm SL), August 8 2016, Matzu. NMMBP 24335, 1 (99 mm SL), July 13 2016, Kezai Liao Port, Kaohsiung. NMMBP 24925, 2 (116–133 mm SL), March 24 2016, Mailiao, Zhoushui River, Yunlin. NMMBP 25882, 3 (110–130 mm SL), June 19 2014, Jiangjun Port, Tainan. NMMBP 27962, 2 (117–126 mm SL), September 18 2017, Budai Port, Chiayi. NMMBP 31330, 3 (153–164 mm SL), March 22 2019, Zhubei Harbor, Miaoli. NMMBP 31331, 1 (111 mm SL), March 15 2019, Zhuwei Port, Taoyuan. USNM 244361, 2 (127–133 mm SL), March 13 2013, Taizi, Yunlin (from NMMBP 19373). **Fujian Province:** CAS 244474 1 (132 mm SL), October 31 2017, Dongshan. MCZ172776 1 (140 mm SL), October 30 2017, Dongshan. NMMBP 23023, 2 (141–186 mm SL), October 19 2015, Dongshan. NMMBP 24237, 4 (109–143 mm SL), October 20 2015, Dongshan. NMMBP 27621, 1 (141 mm SL), October 20 2015, Dongshan. NMMBP 27964, 4 (111–145 mm SL), October 31 2017, Dongshan. NMMBP 27965, 3 (133–161 mm SL), October 30 2017, Dongshan. NMMBP 30143, 1 (138 mm SL), October 31 2017, Dongshan.

Additional non-type specimens: NMMBP 17852, 3 (head broken for otoliths samples), August 30 2010, Xiamen, Fujian. NMMBP 19368, 2 (125–144 mm SL), March 13 2013, Jiangjun Port, Tainan, Taiwan. NMMBP 19374, 3 (125–141 mm SL), March 14 2013, Wenzai Port, Zhanghua, Taiwan. NMMBP 23016, 4 (127–137 mm SL), March 14 2013, Poziliao Port, Yunlin, Taiwan. NMMBP 23064, 6 (110–135 mm SL), December 15 2012, Xihuwei River, Yunlin, Taiwan. NMMBP 23066, 4 (63–133 mm SL), August 21 2012, Mailiao, Zhoushui River, Yunlin, Taiwan. NMMBP 23067, 1 (168 mm SL) June 17 2014, Jiangjun Port, Tainan, Taiwan. NMMBP 23068, 7 (84.9–144 mm SL), December 15 2012, Mailiao, Zhoushui River, Yunlin, Taiwan. NMMBP 23069, 1 (117 mm SL), December 15 2012, Mailiao, Zhoushui River, Yunlin, Taiwan. NMMBP 23071, 1 (130 mm SL), August 21 2012, Mailiao, Zhoushui River, Yunlin, Taiwan. NMMBP 23088, 1 (57.8 mm SL), September 4 2014, Mailiao, Zhoushui River, Yunlin, Taiwan. NMMBP 27185, 1 (37.2 mm SL), December 4 2013, no locality, Taiwan. NMMBP 23086, 1 (47.8 mm SL), Xihuwei River, Yunlin, Taiwan. NMMBP 23087, 1 (63.2 mm SL), Mailiao, Zhoushui River, Yunlin, Taiwan. NMMBP 23088, 1 (57.8 mm SL), Mailiao, Zhoushui River, Yunlin, Taiwan. NMMBP 24335, 1 (99 mm SL), Ke-tzailiao Port, Kaohsiung, Taiwan. NMMBP 27961, 2 (141–145 mm SL), November 18 2017, Budai Port, Chiayi, Taiwan.

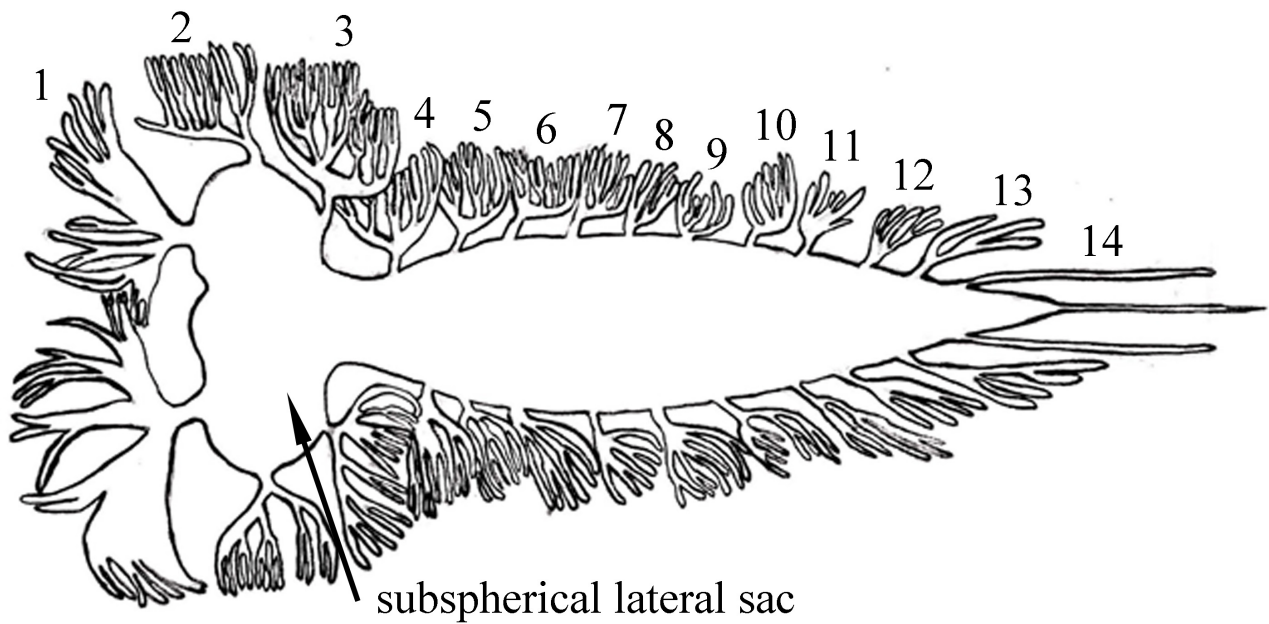


FIGURE 7. The gas bladder of *Johnius taiwanensis* (148 mm SL) with 14–15 aborescent lateral appendages (ventral view).

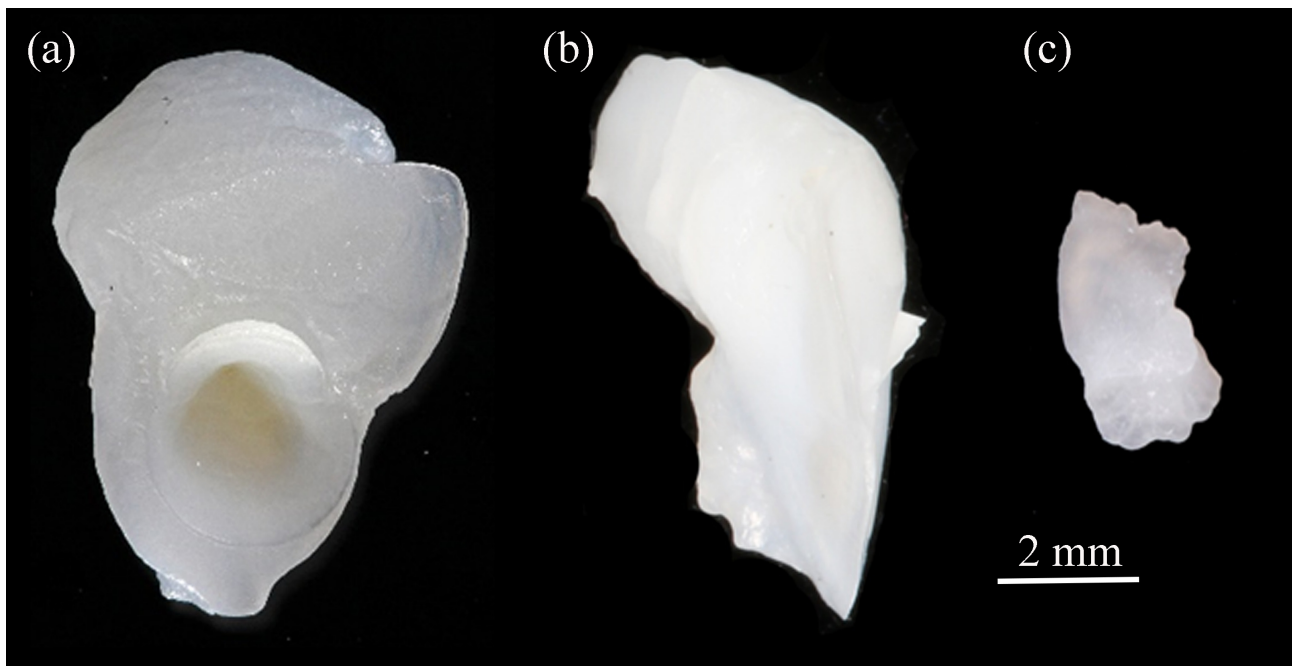


FIGURE 8. Right side sagitta (a, medial view; b, lateral view) and right side lapillus (c, medial view) of *Johnius taiwanensis* (121 mm SL).

Key to species of the genus *Johnius* in Chinese waters

- 1a. Chin with barbel; scales on body cycloid, smooth to touch. *J. amblycephalus* (Bleeker)
- 1b. Chin without barbel; scales on body most ctenoid, rough to touch 2
- 2a. Upper jaw with much enlarged outer row teeth, more than twice size of inner rows; inner row of lower jaw teeth slightly enlarged (Fig. 3a) 3
- 2b. Upper jaw with a slightly enlarged outer row teeth; lower jaw teeth uniform in size (Fig. 3b). 4
- 3a. Lateral line with conspicuous white streak; spinous dorsal fin with distinct black blotch on upper 1/3; soft dorsal fin with dark margin and distinct dotted line running along the entire base of dorsal fins *J. distinctus* (Tanaka)
- 3b. Lateral line without conspicuous white streak; spinous dorsal fin often dark tipped or grayish, but never a black blotch on distal

- portion; soft dorsal fin dusky along distal half but never with distinct dark line on dorsal fins *J. borneensis* (Bleeker)
- 4a. Top of head cavernous, spongy to the touch; scales large and loosely attached to body, 5–6 transverse scales between dorsal-fin origin and lateral line; caudal peduncle high, 2.3 times of less in peduncle length *J. trewavasae* Sasaki
- 4b. Top of head with firmly attached ctenoid scales, rough to touch; scales small, 7–8 transverse scales between dorsal-fin origin and lateral line; caudal peduncle height more than 2.3 in peduncle length 5

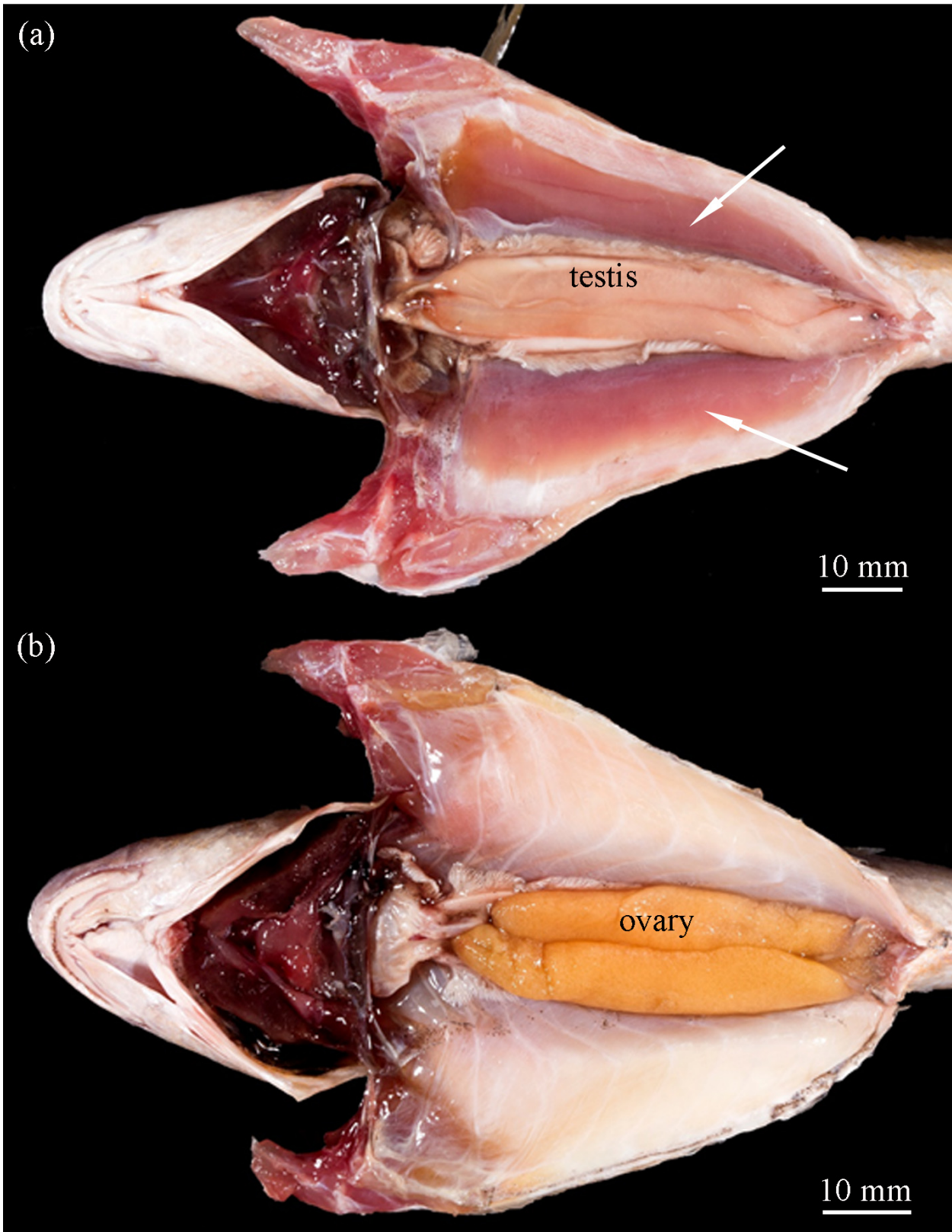


FIGURE 9. (a) Drumming muscles (arrows) position on the lateral body wall from a male *Johnius taiwanensis*; (b) a female *Johnius taiwanensis* without drumming muscles.

- 5a. Pre-pelvic to isthmus region ctenoid scales, rarely with scattered cycloid scales; caudal fin pointed in adult; gill rakers slender about 50% of gill filaments width at corner of first gill arch *J. grypotus* (Richardson)
- 5b. Pre-pelvic to isthmus region with ctenoid scales, gradually turning to cycloid toward isthmus; caudal fin double truncate or S-shaped, never pointed in adults; gill rakers short or tubercle on the first gill arch <40% of gill filament width at corner of first gill arch 6
- 6a. Body darkish, lower fins (pelvic, anal and caudal) dark pigmented; side often with dark vertical patches; inside gill cover dusky, but not showing through gill cover externally; upper half of pectoral axilla with dark patch, but not appearing at base of uppermost ray *J. belangerii* (Cuvier)
- 6b. Body silvery, first dorsal fin with dark distal margin, other fins pale to yellowish; upper half of pectoral axilla with dark patch at upper-most pectoral-fin base and axilla 7
- 7a. Body yellowish silvery darker above pale below, with pale to yellowish fins; second anal-fin spine strong about 3/4 of first anal-fin ray *J. carouna* (Cuvier)
- 7b. Body silvery gray, upper 2/3 grayish, lower 1/3 pale to yellowish with a distinct longitudinal splitting line; second anal-fin spine short, less than half of the first anal-fin ray *J. taiwanensis* Chao *et al.* new species

Phylogeny of *Johnius taiwanensis*

Based on the NJ tree analysis, the genus *Johnius* is revealed to be monophyletic and *J. taiwanensis* was placed as a sister species to *J. trewavasae* (Fig. 10). Minimum interspecific K2P and *p*-distance divergences in complete *COI* and *16S* gene sequences among the all eight *Johnius* species in the range are 16.41% and 14.36%, respectively, while this figure becomes 10.04% and 9.29% between *J. taiwanensis* and *J. trewavasae* which have high bootstrap values giving high confidence in species relationship.

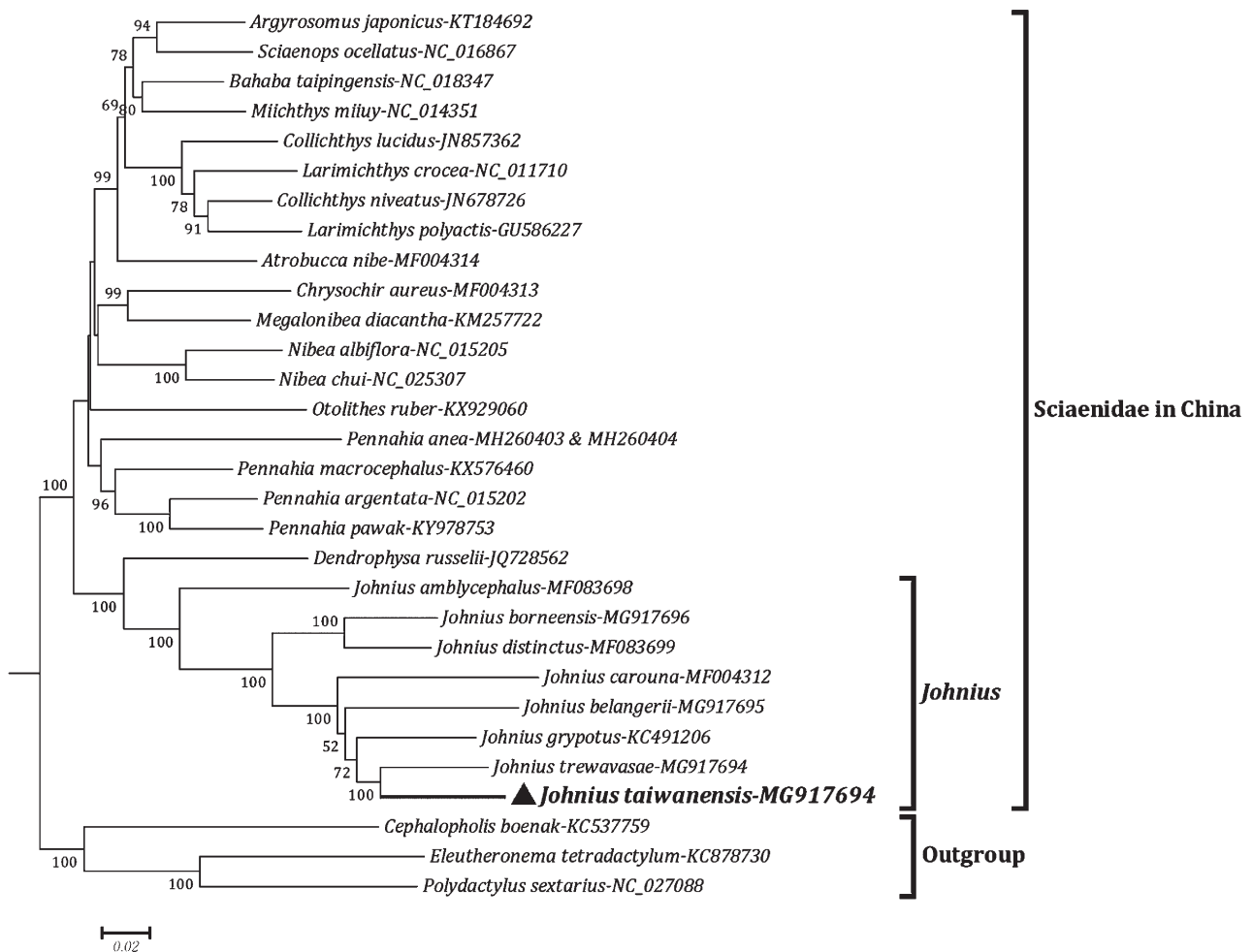


FIGURE 10. Phylogenetic relationship of all 27 sciaenid species from Chinese waters and three outgroup species based on Neighbor Joining (NJ) analyses. Nodes are supported by bootstrap values of distance matrix. Only values $\geq 50\%$ are presented.

Acknowledgements

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