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Two New Gymneline Eelpouts (Perciformes: Zoarcidae) from Hokkaido, Japan

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Abstract Two new species of gymneline eelpout are described from waters off Hokkaido, Japan. The first, *Bilabria gigantea*, is distinguished from its only congener, *B. ornata*, by its 2–3 interorbital pores, presence of a third supraorbital pore posterodorsal to the eye, both vomerine and palatine teeth usually absent, color pattern and large size (the largest gymneline known). The second, *Davidijordania yabei*, is distinguished from its four congeners by its color pattern, relatively long gill slit, high vertebral counts and single interorbital pore.
Key words: Zoarcidae, Gymnelinae, *Bilabria gigantea* sp. nov., *Davidijordania yabei* sp. nov., Hokkaido, Japan.

From October 2005 to January 2006 the first author was a visiting professor at the Hokkaido University Museum, Japan. The focus of his studies was on collections of Japanese zoarcid fishes. We examined specimens of 2 undescribed gymneline species of the genera *Davidijordania* Popov, 1931 and *Bilabria* Schmidt, 1936 collected since the early 1960s and 1970s respectively that were described in a Hokkaido University dissertation but never published (Toyoshima, 1983). The purpose of this paper is to finally describe and illustrate these 2 new species.

The genus *Bilabria* was established for *Lycenchelys ornatus* Soldatov, 1922 and was thought to be close to the primitive gymneline genus *Davidijordania*. Anderson (1994) concurred and diagnosed both genera on the basis of numerous characters. The monotypic *Bilabria* was found to possess a unique character in Zoarcidae, the expanded (fan-shaped) distal end of the first epibranchial bone in addition to the eponymous bilobed upper lip.

Popov (1931) established *Davidijordania*, type species *Lycenchelys lacertinus* Pavlenko, 1910, and included *Lycenchelys poecilimon* Jordan and Fowler, 1902 and *L. ornatus*. Schmidt (1936) revised *Davidijordania* (improperly emended to *Davidojordania*) adding *Lycenchelys brachyrhynchus* Schmidt, 1904, removing *L. ornatus* to the new genus *Bilabria* and naming a new species, *D. jordaniana*, incorrectly attributing authorship to A. M. Popov. Fowler (1943) named *Lycenchelys spilotus* from Japan and later placed it in *Davidojordania* [sic] (Fowler, 1958). Anderson (1994) showed that incorrect counts given for the type had been perpetuated in the literature and synonymized *D. spilota* with *D. poecilimon*. Matsubara (1936) described *Davidijordania abei* for a northern Japanese species, but Shinohara *et al*. (2002) showed this was not a gymneline, but rather a lycodine, and erected *Japonolycodes* for it.

Materials and Methods

All measurements are straight-line distances made with calipers to the nearest 0.1 mm. Counts of features of the axial skeleton were made from radiographs. Definitions and terminology of zoarcid characters follows that of Anderson (1982, 1994). Museum abbreviations are: HUMZ, the Hokkaido University Museum;

Fig. 1. *Bilabria gigantea* holotype, HUMZ 194804, 313 mm SL, off Kushiro, Hokkaido, Japan.

NSMT, National Museum of Nature and Science, Tokyo; SAIAB: South African Institute of Aquatic Biodiversity (formerly RUSI), Grahamstown; and ZIN, Zoological Institute, Russian Academy of Sciences, St. Petersburg. Other abbreviations are: HL, head length and SL: standard length.

Comparative materials *Bilabria ornata*: CAS 61023 (1, 160 mm SL) and ZIN 20168 (holotype, 162 mm SL; radiograph only), both Sea of Okhotsk. *Davidijordania poecilimon*: SAIAB 64315 (5, 67–82 mm SL) and SAIAB 64316 (3, 118–128 mm SL), both northern Japan. *Davidijordania brachyrhyncha*: HUMZ 140477 (1, 87 mm SL), HUMZ 140677 (1, 70 mm SL), HUMZ 141128 (1, 69 mm SL), HUMZ 141130 (1, 64 mm SL) and HUMZ 141134 (1, 45 mm SL), all Sakhalin Island, Russia. In addition, see Anderson (1994) for other gymnelines studied.

Bilabria gigantea sp. nov.

(Japanese name: Hirokuchi-genge)

(Figs. 1–4)

Bilabria sp.: Toyoshima, 1984: 306, pls. 273 I, J; Anderson, 1994: 29, 116; Hatooka, 2002: 1030.

Holotype. HUMZ 194804 (male, 313 mm SL), Japan, Hokkaido, off Kushiro: 42°43.0′N, 144°30.2′E, 150–156 m, 6 Sep. 2005.

Paratypes. Japan, Hokkaido, off Erimo: HUMZ 45746 (male, 405 mm SL), 42°53.0′N, 144°18.2′E, 180 m, 15 July 1975. HUMZ 75984 (female, 225 mm SL) and HUMZ 75985 (female, 227 mm SL), 42°53.0′N, 144°21.0′E, 80 m, 14 July 1978. Hokkaido, off Kushiro: HUMZ 36833 (sex unknown, cleared and stained, 268+mm), 98 m, 17 July 1974. HUMZ 36834 (male, 368 mm SL), 86 m, 17 July 1974. HUMZ 36843 (male, 222 mm SL), 140–170 m, 6 Sep. 1974. HUMZ 88101 (female, 229 mm SL), 70 m, 13 May 1980. HUMZ 92655 (female, 342 mm SL), HUMZ 92658 (male, 278 mm SL), HUMZ 92659 (male, 274 mm SL), HUMZ 92661 (male, 405 mm SL), HUMZ 92915 (male, 280 mm SL), NSMT-P 76021 (formerly HUMZ 92654, female, 317 mm SL) and NSMT-P 76022 (formerly HUMZ 92657, male, 277 mm SL), 92 m, 17 Aug. 1981. Hokkaido, off Nemuro: HUMZ 92965 (female, 252 mm SL), 90–110 m, 19 July 1981. Hokkaido, off Shiretoko Peninsula: HUMZ 87596 (male, 178 mm SL), 10 July 1978. Hokkaido, off Sarufutsu: HUMZ 98034 (female, 322 mm SL), 45°23.95′N, 142°33.72′E, 83 m, 29 June 1983. HUMZ 98328 (male, 250 mm SL), 45°15.0′N, 142°36.0′E, 3 July 1983. No data: HUMZ 45750 (male, 379 mm SL). HUMZ 150395 (male, 394 mm SL).

Diagnosis. A species of *Bilabria* as defined

by Anderson (1994) with the following combination of characters: interorbital pores 2–3; third supraorbital (supraoccipital) pore present posteromesial to eye; vomerine and palatine teeth usually absent; body and tail with characteristic W-shaped saddles; attains over 40 cm SL.

Description. Counts and measurements (holotype first followed by range of paratypes in parentheses): vertebrae 23+103=126 (22–25+94–102=118–127); dorsal-fin rays 123 (117–126); anal-fin rays 105 (98–107); caudal-fin rays 9 (8–9); pectoral-fin rays 15 (15–17); pelvic-fin rays 3 (3); vomerine teeth 0 (0–8); palatine teeth 0 (0–3); gill rakers 3+11=14 (3–4+10–12=13–16); branchiostegal rays 6/7 (6/6, 6/7, 7/7); pseudobranchial filaments 7 (6–9). Proportions as % SL: HL 15.7 (11.6–17.4); head width 9.0 (6.0–10.2); head depth 8.2 (6.3–8.9); postorbital head length 8.6 (7.7–9.9); pectoral-fin length 8.7 (7.7–9.7); predorsal length 12.8 (10.7–14.3); preanal length 31.2 (30.1–33.4); body depth 8.6 (6.4–10.6); gill slit length 5.2 (4.5–6.3). Proportions as % HL: head width 57.1 (40.5–61.0); head depth 52.2 (45.3–62.0); postorbital head length 54.9 (55.3–64.5); upper jaw length 50.8 (41.1–66.3); pectoral-fin length 55.5 (49.3–69.0); snout length 20.5 (14.5–26.7); eye diameter 14.6 (12.8–24.4); gill slit length 33.3 (31.7–39.6); interorbital width 10.6 (7.8–10.6); interpupillary width 30.5 (23.1–31.3); pelvic-fin length 13.2 (13.7–22.9); caudal-fin length 3.1 (2.8–8.3). Pectoral base/length ratio (%): 46.9 (39.9–53.1).

Head ovoid, dorsal profile depressed at nape, snout gently sloping in adults, steeper in juveniles. Head slightly longer in adult and subadult males, length 13.4–17.4% SL (mean 15.3) in 12 males 222–405 mm SL, than females, length 12.7–14.8% SL (mean 13.7) in 7 females 227–342 mm SL, typical of gymnelines (Anderson, 1982, 1994). Head broader in these males, width 7.1–10.2% SL (mean 8.3), width 6.0–7.9% SL (mean 6.9) in same females. Scales in largest specimens (over about 270 mm SL, including holotype) on top of head extend anteriorly to line through first postorbital pore or rear margin of eye, on abdomen to isthmus, pectoral base and axil, and on unpaired fins to half their height anteriorly, to 80% their height on posterior part of tail; no scales on cheeks, lower part of head or pelvic fins. Eye round, entering dorsal profile of head. Gill slit extending ventrally almost to lower end of pectoral base, to opposite second to fourth ray from bottom. Upper end of gill slit squared off or slightly rounded, extending forward about one eye diameter or slightly more in largest specimens. Pectoral fin origin below body midline, higher in juveniles than adults, insertion on abdomen; posterior margin of fin rounded, rays 4–9 longest.

Mouth inferior, upper jaw extending to rear margin of eye (females and juveniles) or well beyond it (adult males, including holotype); posterior end of upper jaw hidden in fleshy pocket. Upper jaw generally longer in males than females of comparable sizes, length 48.1–66.3% HL (mean 56.8) in same males measured above for head dimensions, 41.1–56.2% HL (mean 49.2) in same females. Nostril tube small, not reaching upper lip when pressed forward. Upper lip adnate to snout tip, lower lip with fleshy lobe in largest specimens. Oral valve reaching anterior edge of vomer, coalesced with palate at sides. Females with slightly more jaw teeth than males at comparable sizes owing to largest males losing most of anterior inner row of small teeth. Premaxillary teeth 7–19 (mean 14.4) in 12 males as above, 20–27 (mean 23.4) in 7 females as above. Dentary teeth 9–19 (mean 14.4) in same males, 17–27 (mean 19.9) in same females. Specimen HUMZ 150395 with enlarged caniniform jaw teeth, and anterior 2 rows in left dentary of only 6 teeth (Fig. 2). Vomerine and palatine teeth absent except in HUMZ 98034 which has 8 vomerine and 2 (left) or 3 (right) palatine teeth, and HUMZ 98328 which has 5 vomerine and 3 left palatine teeth (right palatine without teeth).

Cephalic lateralis system with 2 anterior (nasals) and a third supraorbital pore, the nasals set anteromesial and dorsoposterior to nostril tube, the third supraorbital set dorsoposterior to eye (Fig. 3). Eight preoperculomandibular pores, 4 arising from dentary, 1 from anguloarticular

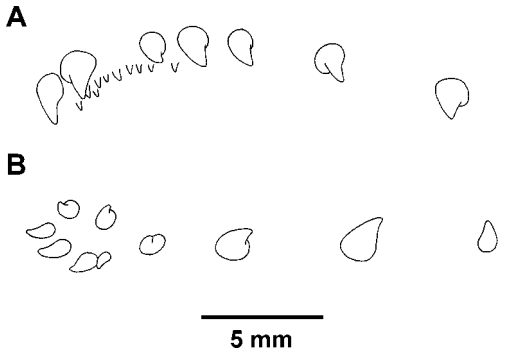

Fig. 2. Left dentition of adult male *Bilabria gigantea*, HUMZ 150395, 394 mm SL. A, upper jaw; B, lower jaw.

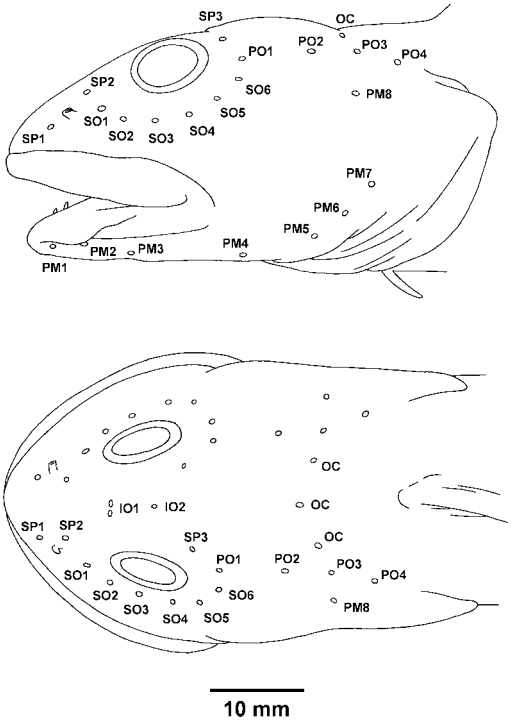

Fig. 3. Head pore pattern of *Bilabria gigantea* holotype, HUMZ 194804, 313 mm SL.

and 3 from preopercle. Usually 6 suborbital pores in a semicircle under and behind eye, exceptions are HUMZ 45746 with 7 pores on each side, HUMZ 75983 with 7 pores on the right and 6 on the left and HUMZ 75984 and HUMZ 88101 with 7 pores on the left and 6 on the right. Usually 4 postorbital pores, exception is HUMZ 36834 with 5 pores (at position two, from the sphenotic bone, the pore is doubled on both sides). Occipital pores three, no variation. Interorbital pores usually 2, an anterior and posterior, exceptions are the holotype and HUMZ 45676, 75983, 92661, 92965 and NSMT-P 76021 which have the anterior pore doubled (Fig. 3). Specimens HUMZ 98034 and 98328 have only the posterior interorbital pore opened, area for the anterior pore is a pigmentless swelling. Body lateral line mediolateral, commencing just posterior to fourth postorbital pore.

Dorsal fin origin slightly anterior to vertical through pectoral base; predorsal length 72.0–89.5% HL (81.5% in holotype). Two dorsal-fin pterygiophores inserted anterior to neural spine of first vertebra. Anal-fin origin associated with ultimate, or less often penultimate (including holotype) precaudal vertebra, with 4–6 (5 in holotype) ray-bearing pterygiophores inserted anterior to haemal spine of first caudal vertebra. Pterygiophore of last dorsal-fin ray associated with fourth preural vertebra except with third preural in NSMT-P 76021; pterygiophore of last anal-fin ray associated with second preural vertebra in all, with usually 1 ray (including holotype), rarely 2, articulating with its haemal spine. Caudal fin with 2 epural, 3–4 (4 in holotype) upper hypural and 3–5 (3 in holotype) lower hypural rays.

Gill rakers on upper limb of first arch short, acute, as are ventralmost 4–5 on lower limb in juveniles. Middle gill rakers with blunt tips. Ventralmost rakers on lower limb of large specimens with bifurcate or trifurcate tips (sometimes both) and denticles on tips and inner surfaces. First epibranchial bone with fan-shaped distal end (Fig. 4), as in *B. ornata* (see Anderson, 1994: fig. 32). Pseudobranch filaments long. Pyloric caeca 2, elongate, equal to or longer than eye. Branchiostegal rays usually 6 except 4 specimens [HUMZ 36843, 75985, 92965 and 194804 (holotype)] with 6 on one side and 7 on the other, and 1 (HUMZ 36833) with 7 rays on each side.

Fresh coloration of holotype (Fig. 1). Background of body and tail pinkish white, darkening

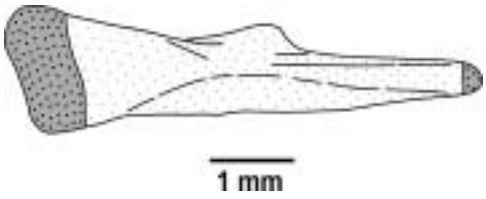

Fig. 4. Left first epibranchial bone of *Bilabria gigantea*, HUMZ 36833.

dorsally, with 12 W-shaped brownish orange saddles; centers of W with reddish blotches. Head dark brown, branchiostegal membranes bright orange. Dorsal fin orange distally, with 13 small black blotches. Distal margin of anal fin black for about two-thirds its length, typical of male gymnelines (Anderson, 1982). Pelvic fins and distal half of pectoral fin black in membranes between rays.

Etymology. From the Latin "gigantis" (large) alluding to the species attaining the largest body size (to 408 mm in total length) known for a gymneline eelpout.

Distribution. Pacific and Okhotsk coasts of Hokkaido, Japan, from off Cape Erimo to Sarufutsu in 70–180 m depth.

Remarks. Anderson (1994: fig. 15) had difficulty resolving the relationships of the genera of Gymnelinae as he defined them. The status of *Bilabria* was suggested by a single unique apomorphy, the fan-like first epibranchial bone. The discovery of a second gymneline with a bilobed upper lip and a fan-like first epibranchial bone corroborates the placement of these 2 species at the generic level.

The new species differs from its only congener, *B. ornata*, in a few trenchant characters. It is the largest gymneline discovered to date, attaining 405 mm SL (HUMZ 45746 and 92661) vs. 219 mm SL for specimens of *B. ornata* that we are aware of (ZIN 43977). The head pore configuration in *B. gigantea* has 2–3 interorbitals vs. 1 for *B. ornata* and a supraoccipital pore vs. no supraoccipital in *B. ornata*. Vomerine teeth are absent in all but 2 *B. gigantea* vs. present in *B. ornata*. Finally, the color patterns between the 2 species are different, with *B. gigantea* having W-shaped body saddles vs. irregular body variegations that extend onto the fins.

Davidijordania yabei sp. nov.

(New Japanese name: Kurakake-sarasagaji)

(Figs. 5, 6)

Holotype. HUMZ 101869 (female, 157 mm SL); off Usujiri, Hokkaido, 18 June 1984.

Paratypes. JAPAN: off Usujiri, Hokkaido; set net in ca. 80 m; 27 May 1975; H. Yoshida and M. Yabe: HUMZ 46074 (female, 167 mm SL), HUMZ 46075 (male, 160 mm SL), HUMZ 46076 (female, 164 mm SL), HUMZ 46077 (male, 164 mm SL), HUMZ 46078 (female, 166 mm SL), NSMT-P 76023 (formerly HUMZ 46072, female, 166 mm SL), NSMT-P 76024 (formerly HUMZ 46073, male, 152 mm SL). Usujiri, Hokkaido, no other data: HUMZ 95339 (female, 158 mm SL) and HUMZ 97358 (female, 160 mm SL). RUSSIA: Olga Bay: 43°45′N, 135°20′E; beam trawl in Zostera patches; 2–5 m; 12:00–16:00 hrs; 17 Aug. 1994; M. Yabe and party: HUMZ 133724 (female, 167 mm SL).

Diagnosis. A species of *Davidijordania* as defined by Anderson (1994) with the following combination of characters: vertebrae 22–24+96–103=118–125; gill slit extending ventrally almost to lower margin of pectoral-fin base; body and tail with characteristic cream and reddish brown W-shaped saddles; single interorbital pore.

Description. Counts and measurements (holotype first, followed by range of paratypes in parentheses): vertebrae 22+103=125 (22–24+96–102=118–124); dorsal-fin rays 123 (116–123); anal-fin rays 107 (100–106); caudal-fin rays 9 (9–10); pectoral-fin rays 17 (15–17); pelvic-fin rays 3 (3); vomerine teeth 2 (2–5); palatine teeth 12/12 (8–15/8–16); gill rakers 2+9=11 (1–2+8–9=9–11); branchiostegal rays 6 (6); pseudobranchial filaments 6 (5–6). Proportions as % SL: HL 13.6 (13.6–15.7); head width 6.5 (6.1–7.4); head depth 6.8 (6.5–7.6); postorbital head length 8.1 (7.5–9.2); pectoral-fin length 8.8 (7.9–9.8); predorsal length 12.6 (13.9–15.2); preanal length 29.9 (30.1–33.6); body depth 7.5 (7.1–8.0); gill slit length 4.4 (3.7–5.0). Proportions as % HL: head width 47.7

Fig. 5. *Davidijordania yabei* holotype, HUMZ 101869, 157 mm SL, off Usujiri, Hokkaido, Japan

(38.1–48.7); head depth 50.0 (45.6–52.9); postorbital head length 59.4 (55.2–61.9); upper jaw length 49.1 (45.4–50.8); pectoral-fin length 64.5 (55.2–63.6); snout length 20.6 (21.1–25.9); eye diameter 20.6 (19.2–22.6); gill slit length 32.2 (25.8–32.0); bony interorbital width 11.2 (9.2–11.2); interpupillary width 30.4 (23.0–28.8); pelvic-fin length 15.0 (13.8–16.8); caudal-fin length 9.4 (3.9–8.8). Pectoral base/length ratio (%): 39.1 (35.1–43.2).

Following based on 11 adults, juveniles unknown. Head roughly triangular, snout steeply sloping, nape gently sloping to dorsal-fin origin. Head slightly longer in males (n=3), 14.9–15.7% SL, than in females (n=8), 13.6–14.5% SL, typical of gymnelines (Anderson, 1982, 1994). Head broader in largest male (164 mm SL), width 7.4% SL, than in all 8 females (157–167 mm SL), width 6.1–6.5% SL. Scales on body commence at about pectoral-fin base, present in pectoral axil and abdomen to lower end of pectoral base; no scales on head, nape, isthmus, fins or pectoral base. Eye round, entering dorsal profile of head. Gill slit extending ventrally almost to lower end of pectoral base, to opposite second to third (second in holotype) ray from bottom. Upper corner of gill slit rounded, extending forward about one-third eye diameter. Pectoral-fin origin slightly below body midline, insertion on abdomen, posterior margin of fin rounded, rays 4–7 longest.

Mouth inferior, upper jaw extending nearly to rear margin of eye (including holotype), or just beyond it. Upper jaw longer in the three males (49.4–50.8% HL) than 8 females (45.4–49.1% HL). Nostril tube small, not reaching upper lip when pressed forward. Upper lip free across snout, anterior lower lip lobe slight. Oral valve reaching anterior edge of vomer, coalesced with palate at sides. No discernible differences in numbers of jaw teeth with sex in this small sample. Vomerine teeth in small patch, palatine teeth in single series.

Cephalic lateralis system with 2 anterior (nasal) supraorbital pores, 1 set anteromesial to nostril tube, the other dorsoposteriorly (Fig. 6). Eight preoperculomandibular pores, 4 arising

from dentary, 1 from anguloarticular and 3 from preopercle. Usually 6 suborbital pores in a semicircle under and behind eye, except HUMZ 46077 which has 8 pores on the right, 6 on the left. Usually 4 postorbital pores, except HUMZ 46078 which has 5 on the right, 4 on the left. Occipital pores 3, no variation. Single interorbital pore in posterior position. Body lateral line mediolateral, commencing posterior to fourth postorbital pore.

Dorsal fin origin above (including holotype) or slightly in advance of vertical through pectoral base; predorsal length 92.5 (holotype)–105.9% HL. One or 2 (including holotype) dorsal fin pterygiophores inserted anterior to neural spine of first vertebra. Anal-fin origin associated with penultimate (including holotype) or ultimate precaudal vertebra, with first caudal vertebra in 1, with 4–6 (5 in holotype) ray-bearing pterygiophores inserted anterior to haemal spine of first caudal vertebra. Pterygiophore of last dorsal-fin ray associated with third or fourth (including holotype) preural vertebrae; pterygiophore of last anal-fin ray associated with second preural vertebra, with two rays articulating with haemal spine in some. Caudal fin with 2 epural, 4 upper hypural and 3–4 (3 in holotype) lower hypural rays.

Gill rakers on upper limb of first arch short, acute. Uppermost rakers on lower limb blunt, triangular, lowermost rakers shorter and more acute. Pseudobranch filaments long. Pyloric caeca 2 nubs. Branchiostegal rays 6 in all.

Fresh coloration of holotype (Fig. 5). Background off-white, with a series of pale yellowish W-shaped saddles with thick maroon borders that extend onto entire dorsal fin and anal fin posteriorly. Head with same pale yellow and maroon-bordered eye band with another band above it extending onto cheek. Pectoral fin pale yellow. Anal fin whitish. Anal fin dark in preserved males, probably black in life as in other gymnelines (Anderson, 1982, 1994).

Etymology. Named in honor of Dr. Mamoru Yabe, Hokkaido University, in recognition of his numerous contributions to the systematics of marine fishes of the North Pacific Ocean.

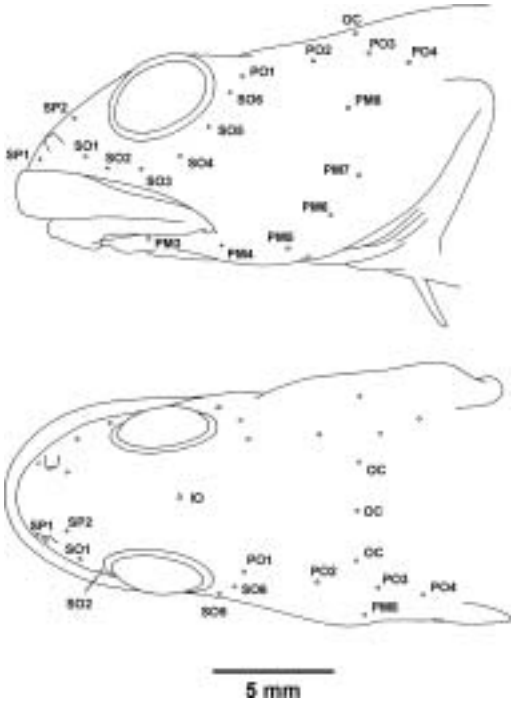

Fig. 6. Head pore pattern of *Davidijordania yabei* holotype, HUMZ 101869, 157 mm SL.

Distribution. Known only from off Usujiri, Hokkaido, Japan and Olga Bay, Russia (Sea of Japan) in about 2–80 m depth.

Remarks. The genus *Davidijordania* is in need of a thorough review (Anderson, 1994). Specimens of *D. lacertina* and *D. jordaniana* are very rare in collections and critical zoarcid characters (and their variation) established by Anderson (1994), such as squamation, configurations of the lateral line and head pores, and counts of the axial skeleton have not been reliably documented for most species of *Davidijordania*. All 5 species that we recognize have characteristic color patterns and further research should describe individual and ontogenetic variation in this. In addition to coloration and despite the lack of other systematic data, we find that 2 morphological groups of the 5 species can be established by 2 characters (G. Shinohara, personal communication).

Group 1 contains *D. brachyrhyncha* and *D. jordaniana*. It has less than 110 vertebrae and a

relatively restricted gill slit (extending ventrally to above half the pectoral base height). Group 2 contains *D. lacertina*, *D. poecilimon* and *D. yabei* sp. nov. It has 112 or more vertebrae and a longer gill slit, extending ventrally below half the pectoral base height. In group 2, *D. lacertina* may be characterized by its body and tail having large, black inverted V-shaped saddles in two rows and the dorsal and anal fins with multiple, dark transverse rows (Lindberg and Krasukova, 1975: fig. 137). It also has 6–7 suborbital, one interorbital and no third supraorbital head pore (Balanov *et al*., 2006). In *D. poecilimon* the body and tail are marked with characteristic reddish H-shaped saddles with the center bar of the "H" blackening with age (Toyoshima, 1984: pl. 273H). It also has 8 suborbital, 2–3 interorbital and a third supraorbital pore. In *D. yabei* the body and tail are marked with characteristic maroon-bordered W-shaped saddles that extend onto the dorsal and anal fins (Fig. 5). It also has usually 6 suborbital, one interorbital and no third supraorbital pore.

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