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A new fish of the genus *Krusensterniella* (Zoarcoidei: Zoarcidae) from the Kuril Islands

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ABSTRACT

A new species of prickled eelpouts of the genus *Krusensterniella* Schmidt, 1904 (subfamily Gymnelinae Gill, 1863) from the waters of the Kuril Islands (Western North Pacific) is described. Moppet eelpout *K. infans* sp. nov. differs from other species by a combination of characters. Vertebrae are numerous (124 versus 100–122), as well as all spiny rays of the dorsal fin (77 vs. 40–74); number of preoperculomandibular pores is reduced (6 vs. 7 in most species); pungent spines of the dorsal fin (X in number) are located posteriorly (*D*-fin formula 67 X 44). The holotype, a juvenile with a length of *TL* 83 mm, is found in the southern group of the Kuril Islands (Urup Strait) at a depth of 240 m. The ancestral form of the prickled eelpouts probably lived in the boreal Pacific waters near the Japanese Islands, where the generalized *K. squamosa* Chernova, 2022 is found. Other species with similar characters, *K. maculata* Andriashev, 1938, *K. kurilensis* Chernova, 2022, and *K. pseudomaculata* Chernova, 2022, with relatively low number of vertebrae and pungent spines, may have derived in nearby waters, the Sea of Japan and the southern Kuril Islands. Dispersion to the north (into the Sea of Okhotsk) led to the speciation of two pairs of prickled eelpouts. One pair is *K. notabilis* Schmidt, 1904 and *K. infans* with low number of pungent spines but numerous vertebrae (113–124); the other pair is *K. multispinosa* Soldatov, 1922 and *K. pavlovskii* Andriashev, 1955 with a relatively low number of vertebrae but multiple pungent spines (XV–XXV). This may mean that northward dispersion events could have occurred at least twice.

Key words: Gymnelinae, *Krusensternella infans* sp. nov., Kuril Islands, new species, Zoarcidae

Новый вид рыб рода *Krusensternella* (Zoarcoidei: Zoarcidae) из вод Курильских островов

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РЕЗЮМЕ

Описан новый вид бельдюговых рыб рода *Krusensterniella* Schmidt, 1904 (подсемейство Gymnelinae Gill, 1863) из вод Курильских островов. Крузенштерниелла-крошка *K. infans* sp.nov. отличается от остальных видов рода сочетанием признаков: большим числом позвонков (124 против 100–122) и всех колючих лучей спинного плавника (77 против 40–74), уменьшенным числом преоперкуломандибулярных пор (6 против 7 у большинства видов), а также смещенным назад положением шипиковидных лучей спинного плавника (их X, формула *D* 67 X 44). Голотип, молодой экземпляр длиной *TL* 83 мм, найден в проливе Уруп южной группы Курильских островов на глубине 240 м. Предковая форма крузенштерниелл,

вероятно, обитала в бореальных водах Тихого океана у Японских островов, где встречается генерализованный вид *K. squamosa* Chernova, 2022. Другие виды со сходными признаками, *K. maculata* Andriashev, 1938, *K. kurilensis* Chernova, 2022 и *K. pseudomaculata* Chernova, 2022, с относительно небольшим числом позвонков и шипиковидных лучей, могли сформироваться в близлежащих водах Японского моря и южных Курильских островов. Расселение на север (в Охотское море) привело к видообразованию двух пар колючих бельдюг. Одну пару составляют *K. notabilis* Schmidt, 1904 и *K. infans* с небольшим числом шипиковидных лучей, но с многочисленными позвонками (113–124), другую пару – *K. multispinosa* Soldatov, 1922 и *K. pavlovskii* Andriashev, 1955 с относительно небольшим числом позвонков, но увеличенным числом шипиковидных лучей (XV–XXV). Это может означать, что расселение на север могло происходить как минимум дважды.

Ключевые слова: Gymnelinae, *Krusensternella infans* sp. nov., Курильские острова, новый вид, Zoarcidae

INTRODUCTION

Prickled eelpouts *Krusensterniella* Schmidt, 1904 are small fish of the subfamily Gymnelinae Gill, 1863, distributed on the shelves of the Far-Eastern seas (Anderson 1994; Anderson and Fedorov 2004). They differ from other Gymnelinae by the presence of a group of pungent spines (hard spiny rays) in the middle part of the dorsal fin (*D*), the number and location of which are specific and used for diagnostics. All species are rare (known from a few specimens) and poorly studied. Until recently, the genus included 4 species from the Sea of Japan, the Sea of Okhotsk and off eastern Kamchatka (Soldatov 1922; Andriashev 1955; Makushok 1961; Lindberg and Krasyukova 1975). In the course of a latest revision, two multi-spine species, *K. multispinosa* Soldatov, 1922 and *K. pavlovskii* Andriashev, 1955 (with the number of pungent spines *D* XV–XX and XXIII–XXVI, respectively) were redescribed (Chernova 2020). Also, in the few-spine *Krusensterniella* group, three new species have been described (Chernova 2022). Of these, the Kuril prickled eelpout *K. kurilensis* Chernova, 2022 and the tricksy prickled eelpout *K. pseudomaculata* Chernova, 2022 are similar to the maculate prickled eelpout *K. maculata* Andriashev, 1938 in the number of pungent spines *D* (X, VI–XI and VII–VIII, respectively), and the scaly prickled eelpout *K. squamosa* Chernova, 2022 is similar to the *K. notabilis* Schmidt, 1904 (pungent spines II and I–IV).

In the course of the analysis of the ichthyological collections of the Zoological Institute of the Russian Academy of Sciences (ZIN), a small specimen was found which is so different from the known prickled eelpouts that it can be distinguished into a separate species.

MATERIALS AND METHODS

The methods used earlier for the study of *Krusensterniella* were applied (Chernova 2020, 2022). *D*, *A*, *P* and *C* are the dorsal, anal, pectoral and caudal fins. Three portions of the dorsal fin are as follows: D_1 is the number of flexible spiny rays in the anterior section (up to pungent spines), D_2 is the number of pungent spines in the middle section (in the *D* formula are indicated by Roman numerals), D_3 is the number of soft rays in the posterior section (after pungent spines); $D_1 D_2 D_3$ – dorsal fin formula. Other designations: *AC* – caudal part of the body from *A*-fin origin to the end of caudal fin, *c* – head length, *Hc* – head height, *TL* – total length.

SYSTEMATICS

Suborder Zoarcoidei

Family Zoarcidae Swainson, 1839

Subfamily Gymnelinae Gill, 1863

Genus *Krusensterniella* Schmidt, 1904

***Krusensternella infans* Chernova sp. nov. – Moppet eelpout**

(Figs 1–4)

Holotype. ZIN no. 56858, juv. *TL* 83 mm. Kuril Islands, Urup Strait, 46°22.5 N, 150°46 E, depth 240 m, October 8, 1987, Large Fishing Freezer Trawler "Tikhookeanskiy", station 430, collector A.A. Balanov.

Etymology. Since the species is described from a juvenile specimen, the name comes from the Latin "*infans*" which means baby, moppet.

Fig. 1. Moppet eelpout *Krusensterniella infans* sp.nov. *TL* 83 mm, holotype.

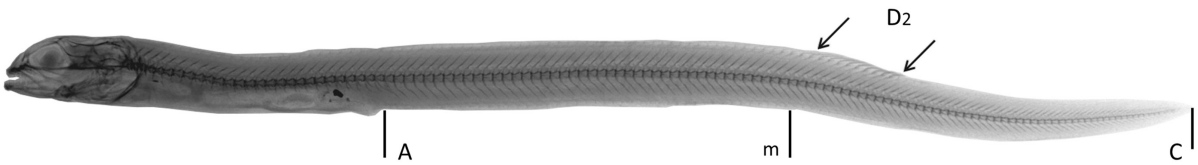

Fig. 2. *Krusensterniella infans*, radiogram of the holotype. The middle (*m*) of the caudal part of the body (*AC*) and the position of the pungent spines of the dorsal fin (D_2) are indicated.

Diagnosis. The new species differs from other *Krusensternella* by a combination of characters: vertebrae 124 (precaudal 26), *D* 121 (67 X 44, all spiny rays 77); pungent spines *D* are associated with vertebrae 70–80; preoperculomandibular pores 6; scales are developed only on the caudal part of the body.

Description. The head is laterally compressed, small (8.1 times in *TL*), its height (*Hc*) is less than half the length of the head (44% *c*), and head width is less than its height (84% *Hc*). The body is evenly low; the height above the origin of *A* is 18.4 times in *TL*. Eye large (3.4 times in *c*), snout shorter than eye diameter. The mouth is terminal, but the lower jaw protrudes slightly forward; the upper jaw reaches the vertical of the center of the eye. The gill opening reaches the level of the middle of the base of *P*; the tip of the opercular lobe is directed upwards. The jaw teeth are conical, in 1–2 rows; palatine and vomer teeth strong.

Cephalic sensory pores are large: 2 nasal, 6 infraorbital, 4 temporal (1 postorbital + 3 posterior), 6 preoperculomandibular pores (3+3); coronal pore 1; in the occipital commissure 3 pores.

Radiogram. Vertebrae 124 (26 abdominal and 98 caudal, including urostyl). Dorsal fin rays 121 (67 X 44). Pungent spines originate behind the middle of the caudal part of the body and are associated with vertebrae 70–80 (with the caudal vertebrae 44–54). The first pterygiophore of *D* occupies a position between neural processes 2 and 3. Anal-fin rays 106. There are 3 pterygiophores bearing *A*-rays in front of the 1st hemal spine. Caudal-fin rays *C* 6 (?).

Pectoral-fin rays *P* 9. The base of pectoral fin is 25% of *P*-fin length. The base of the D_2 is 11% of the length of the caudal part of the body (*AC*), same of the D_3 36%; the base of D_2 is 30% of the base of D_3. Trunk part of the body is naked; scales developed on caudal part, not extending anteriorly to beginning of *A* by a distance about equal to head length.

Measurements, in % *TL*: head length 12.3, its height 5.4 and width 4.6; body height above the beginning of *A* 5.4; snout length 3.1, eye diameter 3.6, predorsal 13.3 and preanal 30.1 distances; *P*-fin length 7.2; *AC* 68.7; in %*c*: head height 44.1 and width 37.3, body height above the beginning of *A* 44.1, snout length 25.5, eye diameter 29.4, interorbital 14.7, postorbital length 60, upper jaw 39.2, lower jaw 45.6; gill slit 29.4; predorsal distance 108; *P*-fin length 59 and *P*-base 17.6.

Comparisons. *Krusensterniella infans* sp. nov. differs from other species in a large number of vertebrae (124 versus 100–113) and all spiny rays (77 versus 40–69, in *K. pavlovskii* 71–74).

By number of vertebrae (124), the new species is most similar to *K. notabilis* (*Vert* 113–122), but differs in the number of pungent spines (X versus I–IV) and all spiny rays (77 vs. 53–60), as well as by reduced number of preoperculomandibular pores (6 vs. 7).

Apart from the number of vertebrae, the new species differs from *K. multispinosa* and *K. pavlovskii* in having fewer pungent spines (X vs. XV–XX and XXIII–XXVI, respectively); the base of D_2 is relatively shorter, 36% of the base of D_3 (vs. 43–72% and 84–112%, respectively).

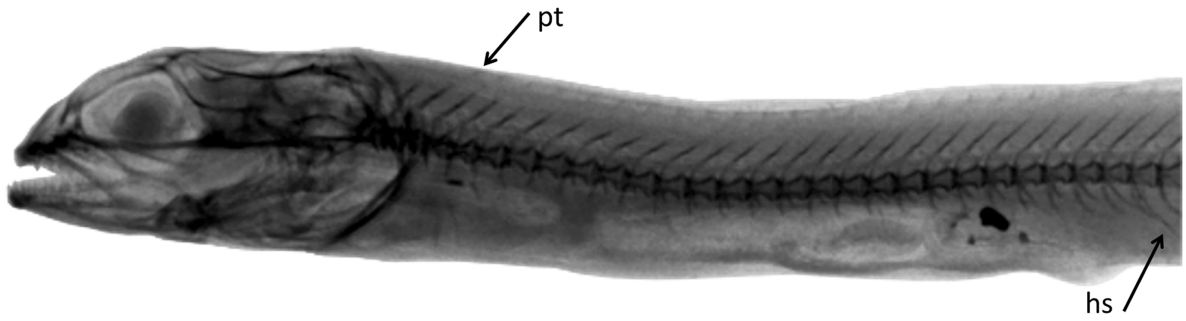

Fig. 3. *Krusensteriella infans*, part of the radiograph. The positions of the first pterygiophore of the dorsal fin (*pt*) and the hemal process of the first caudal vertebra (*hs*) are indicated.

In addition to the number of vertebrae, the new species differs from *K. squamosa* in a larger number of all spiny rays (77 vs. 45) and pungent spines (D_2 X vs. II), which are located in the posterior half of the caudal part of the body (*AC*), but not in its anterior half, and also by the absence of scales in front of the caudal part.

From species with a similar number of pungent spines (VI–XI in *K. maculata*, *K. kurilensis*, and *K. pseudomaculata*), the new species differs, in addition to numerous vertebrae and all spiny rays, in the number of preoperculomandibular pores (6 vs. 7) and the absence of scales on the precaudal part of body.

Distribution. The only specimen was found in the southern group of the Kuril Islands (Urup Strait, closer to the Black Brothers Islands), at a depth of 240 m.

DISCUSSION

The genus *Krusensternella* currently contains 8 species (including a new one) found on the shelf of the Far-Eastern seas. As in other groups of family Zoarcidae (Anderson 1994), the evolution of *Krusensternella* proceeded in the direction of an increase in the number of vertebrae, which varies from 100 to 124 in different species. Also, the total number of spiny rays in *Krusensteriella* increases (from 40 to 77), as well as the number of pungent spines of the dorsal fin (from I to XXVI); the scale cover in a number of species is partially reduced.

Krusensternella squamosa can be considered the most generalized species of the genus with a relatively low number of vertebrae (102) and spiny rays (D_1 + D_2 45), a small number of pungent spines (D_2 II) located in the anterior half of the caudal part (*AC*), and a scale cover well-developed on the entirely body. This most generalized species is known from the Pacific waters of the northern Japanese islands.

Krusensternella maculata, *K. pseudomaculata*, and *K. kurilensis* belong to the group of species with a close to generalized state of these characters. Compared to *K. squamosa*, they have somewhat more vertebrae (*vert.* 104–113) and pungent spines (D_2 VI–XI), and, in addition, there is a tendency to an increase in the number of spiny rays (D_1 + D_2): from 40 in *K. kurilensis* up to 50–55 in *K. pseudomaculata*, and up to 62–67 in *K. maculata*. At the same time, pungent spines of the dorsal fin in this series of species shift caudally, occupying the position in the front half of the tail part of the body (*AC*) in the first species, in the middle part in the second, and in its rear part in the third species. These fishes inhabit the Sea of Japan and the southern Kuril Islands.

There is another group of species in which, while maintaining a small number of pungent spines (I–XI), there is a tendency to a noticeable increase in the total number of vertebrae (apomorphy): *K. notabilis* has 113–122 of them, while *K. infans* has 124. Similarly to the previous group, the number of all spiny rays (D_1 + D_2) also increases: *K. notabilis* has 53–60 of them, *K. infans* 77; the scaly cover on the anterior part of the body is reduced in both. This pair of species occurs along the Kurile Islands and in the Sea of Okhotsk, that is, in more northern areas than the previous ones.

Another pair of species from the Sea of Okhotsk should be noted, with a different evolutionary trend. *Krusensteriella multispinosa* and *K. pavlovskii* have relatively innumerous vertebrae (100–112, as in the *K. maculata* group), but the number of pungent spines is sharply increased (apomorphy) compared to all

Fig. 4. Locality of the holotype *Krusensterniella infans*. Map https://www.google.com/maps

other species (XV–XXVI vs. I–XI). They also have more spiny rays $D_1 + D_2$ than most congeners: 60–74 vs. 45–60 (the exception is *K. maculata* with $D_1 + D_2$ 62–67). This gives reason to suggest that these multi-spine species represent a separate evolutionary line derived from an ancestral form independently of the others. This does not contradict the molecular data obtained from the nucleotide sequences of the genes COI, cytochrome b, 16S rRNA mtDNA (Radchenko et al. 2015).

Taking into account the morphological data, the history of the evolution and dispersion of *Krusensterniella* may be as follows. The ancestral form probably lived in the boreal Pacific waters near the Japanese Islands, where the generalized *K. squamosa* is found. Other species with similar characters, *K. maculata, K. kurilensis* and *K. pseudomaculata*, with relatively low number of vertebrae and pungent spines (with a tendency to increase the number of all spiny *D*-rays), may have derived in nearby waters, the Sea of Japan and the southern Kuril Islands. Dispersion to the north (into the Sea of Okhotsk) led to the speciation of two pairs of prickled eelpouts. One pair is *K. notabilis* and *K. infans* with low number of pungent spines but numerous vertebrae (113–124). The other pair is *K. multispinosa* and *K. pavlovskii* with a relatively low number of vertebrae but multiple pungent spines (XV–XXV).This may mean that the events of northward dispersion could have occurred at least twice. Whether this hypothesis is correct will be shown by additional studies of fish of this little-studied genus.

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