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Abstract.—A new polychaete, *Pileolaria aurita* new species, of the family Spirorbidae from the Pacific coast of Honshu, Japan is described. This species clearly differs from all other species of *Pileolaria* Claparède, 1868 in the morphology of the brood chamber, which bears distally two cone-shaped projections resembling cat ears. Besides, it is the only species of *Pileolaria* with collar chaetae that lack cross-striation. Worms were found at depths of 20–22 m attached to empty oyster shells directly or to bryozoans covering those shells. The shells were collected from sandy bottoms below artificial reefs constructed for recreational scuba diving.

Keywords: brood chamber morphology, North Pacific, Spirorbidae

Traditionally, the family Serpulidae is divided into three subfamilies: Spirorbinae, Serpulinae, and Filograninae (e.g., Rioja 1923, Fauvel 1927). Pillai (1970) elevated the Spirorbinae to the family status. Later, a number of authors (e.g., ten Hove 1984, Smith 1991, Kupriyanova 2003, Kupriyanova et al. 2006), based on the results of cladistic analyses of morphological and molecular data sets, concluded that spirorbins are monophyletic and nested inside Serpulidae. Kupriyanova (2003) states that Spirorbinae is a sister group to Serpulinae; however, the results of analyses of both molecular (Lehrke et al. 2007, Kupriyanova et al. 2009) and combined morphological and molecular data sets (Kupriyanova et al. 2006) indicate that neither Serpulinae nor Filograninae are monophyletic and that Spirorbinae is a sister group to a clade containing mostly ''filogranins'' and some ''serpulins.'' Nevertheless, an elaborated taxonomic system below the family level in the Spirorbidae needs to be revised if the rank of the group is to be lowered to the subfamily and such a revision is clearly out of the scope of this paper. Therefore, for the time being, we maintain family Spirorbidae for practical reasons.

Pileolaria Claparède, 1868 is the largest spirorbid genus (about 20 species) belonging to the subfamily Pileolariinae Knight-Jones, 1978. The representatives of this subfamily incubate embryos within a cup formed by invagination of the opercular ampula. Genera *Pileolaria* and *Simplaria* Knight-Jones, 1978 have completely closed brood chambers without soft-walled sacs; their primary opercula are not fused with the mature brood chambers and usually detach after the chamber is completely formed. Species of *Pileolaria* have sickle chaetae at third thoracic chaetigers and thus, differ from species of the morphologically similar genus *Simplaria* that lacks sickle chaetae at the third thoracic chaetiger.

A previously undescribed species of *Pileolaria* (Polychaeta: Spirorbidae: Pileolariinae) was found in the material

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collected from off the Pacific coast of Honshu, Japan. This species is described below as a new species, *Pileolaria aurita*.

Materials and Methods

The material was collected using SCUBA by the authors during a short field trip in October 2000. Specimens were fixed in 4% formalin and preserved and stored in 70% ethanol; their chaetal structure and distribution were studied on temporal glycerin slides. The body of one specimen without an operculum (stored separately) was mounted in polyvinyl-lactophenol (PVLP).

The holotype is deposited in the Zoological Institute of the Russian Academy of Science, St. Petersburg, Russia (ZISP). Paratypes are deposited in the ZISP; Kitakyushu Museum of Natural History & Human History, Kitakyushu, Fukuoka, Japan (KMNH); Natural History Museum and Institute, Chiba, Chiba, Japan (CBM); Benthic Invertebrate Collection of Scripps Institution of Oceanography, University of California, San Diego, U.S.A. (SIO); Natural History Museum, London, UK (NHML); Australian Museum, Sydney, Australia (AM), and private collection of Alexander V. Rzhavsky stored in A. N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow (IEE).

Family Spirorbidae Pillai, 1970

Tube calcareous, spirally coiled dextrally or sinistrally; body asymmetrical, abdomen turned over thorax 90 degrees in achaetigerous zone between thorax and abdomen; thorax adjoins to substratum dorsally; 3–5(7?) thoracic chaetigers; collar chaetae simple or with special fin-and-blade chaetae; sickle chaetae sometimes present in 3–5 thoracic chaetigers; abdominal chaetae flat geniculate; embryos incubated in tube or in opercular brood chamber; larvae lecithotrophic, pelagic stage brief or absent.

Subfamily Pileolariinae Knight-Jones, 1978

Type genus.—*Pileolaria* Claparède, 1868

Embryos within chamber (or cup) formed by invagination of opercular ampulla and sometimes used for more than one brood. With two types of adult opercula: one only distal plate with talon and another brooding chamber of various structure. Larvae with single white attachment gland. Thoracic uncini narrow, with 1–3 longitudinal rows of teeth and blunt anterior peg. Abdominal uncini distributed symmetrically. Largest abdominal tori located in anterior or posterior half of abdomen. Abdominal chaetae flat geniculate, pennant-shaped, usually with thick (optically dense) projecting heel; blade length usually somewhat shorter than that of largest collar chaetae, width decreases regularly toward tip.

Genus *Pileolaria* Claparède, 1868

Type species.—Pileolaria *militaris* Claparède, 1868

Talon of distal plate generally small and slightly eccentric, but not peripheral; distal plate shed during brood chamber development; brood chamber deeply invaginated sac totally enclosing embryos, except for pore capable of opening and closing; lining of brood chamber forming calcified dome distally, but not calcified proximally or on side bearing pore; opercular peduncle inserted between first and second radioles on left side, so that non-calcified part of chamber near center of branchial crown; tubes always sinistral; collar and thoracic membrane margins not fused dorsally; special collar chaetae with basal fins and blades that bear marginal serration and usually distinct cross-striation; sickle chaetae present in third thoracic fascicles; 3 thoracic chaetigers.

***Pileolaria aurita*, new species**
Fig. 1

Material examined.—Holotype. Body without tube in ethanol. Operculum with embryos in brood chamber detached from body, in same vial (ZISP 1/50575), 35°09′36″N, 139°08′46″E (diving spot "Rock Triangle," off Iwa, Manazuru Peninsula, Sagami Bay, Honshu, Japan), 18 Oct 2000, depth 20–22 m, on empty oyster shell, coll. A. V. Rzhavsky & E. Nishi.

Paratypes.—5 specimens in ethanol (ZISP 2/50576); 2 specimens in ethanol (KMNH, IvR 500.494, 500.495) and 3 specimens in ethanol (CBM-ZW 1029, 1030, 1031) (Japan); 5 specimens in ethanol (SIO A1915); 5 specimens in ethanol (NHML 2010.223–2010.227); 2 specimens in ethanol (AM W.36830); 5 specimens in ethanol and one whole mount of body on slide, detached operculum in ethanol (IEE 1/2748, 2/2749, 2a/2749). Same location as holotype.

Description.—Tube (Fig. 1A) chalky white sinistrally coiled, up to 2 mm in whorl diameter; coiling initially in one plain, tight and steep-sided, but distal whorl often overlaps previous one, mouth ascending and often facing upward from substratum; with 1–3 (often 2) distinct longitudinal ridges, high or low. When median ridge absent, tube almost quadrangular in cross-section. Tube surface between these two ridges usually only slightly convex or almost flat. Sometimes only one outer ridge present.

Specimens with primary opercula absent in material. Domed distal part of brood chamber and its lateral walls from side opposite branchial crown calcified. Two distal cone-shaped projections located symmetrically outside of branchial crown and resembling cat ears. Projections divided by V-shaped gap. Laterally from top of ear-shaped projections two seams continuing up to lower border of calcified zone where small gaps with rounded edges present (Fig. 1B, C). Some brood chambers with about 10 embryos.

Collar and thoracic membrane with free dorsal margins. Preserved specimens uncolored or flesh-colored. Crystalline patches not observed. First chaetal fascicles each with 4–7 collar chaetae (Fig. 1D); special chaetae bent fin-and-blade, with finely serrated blade without cross-striation and well-defined gap between fin and blade; some capillary chaetae (Fig. 1E) also present in first fascicle. Chaetae of second and third thoracic chaetigers simple (Fig. 1F) and sickle chaetae (Fig. 1G) with coarsely serrated blades and smooth basal parts also present in third fascicle. Serrated part of sickle chaetae approximately 3–4 times longer than smooth basal part. Two thoracic tori on each side of body. Thoracic uncini (Fig. 1H, J) with blunt anterior pegs and 1–2 longitudinal rows of teeth. Size of individual uncini in each torus significantly decreasing away from notochaetae. Smallest thoracic uncini of same length as abdominal uncini, largest about 3 times longer. About 12–17 abdominal chaetigers. Two abdominal chaetae (Fig. 1K) per fascicle throughout length of abdomen. Some anterior abdominal chaetigers bearing three chaetae and posterior only one. These flat geniculate, with "knee" projecting beyond shaft and distinctly serrated tapering blade; blade length shorter than blades of smallest collar chaetae. Hooked capillary chaetae not observed in specimens examined by compound microscopy. Abdominal uncini (Fig. 1L) with blunt anterior peg and numerous longitudinal rows of teeth, distribution fairly symmetrical on both sides of body. Largest tori in middle-posterior part of abdomen.

Differential diagnosis and remarks.—The new species differs from all *Pileolaria* in having two symmetrical projections on the distal part of the brood chamber and two lateral seams. Many species of the genus bear projections on the distal part

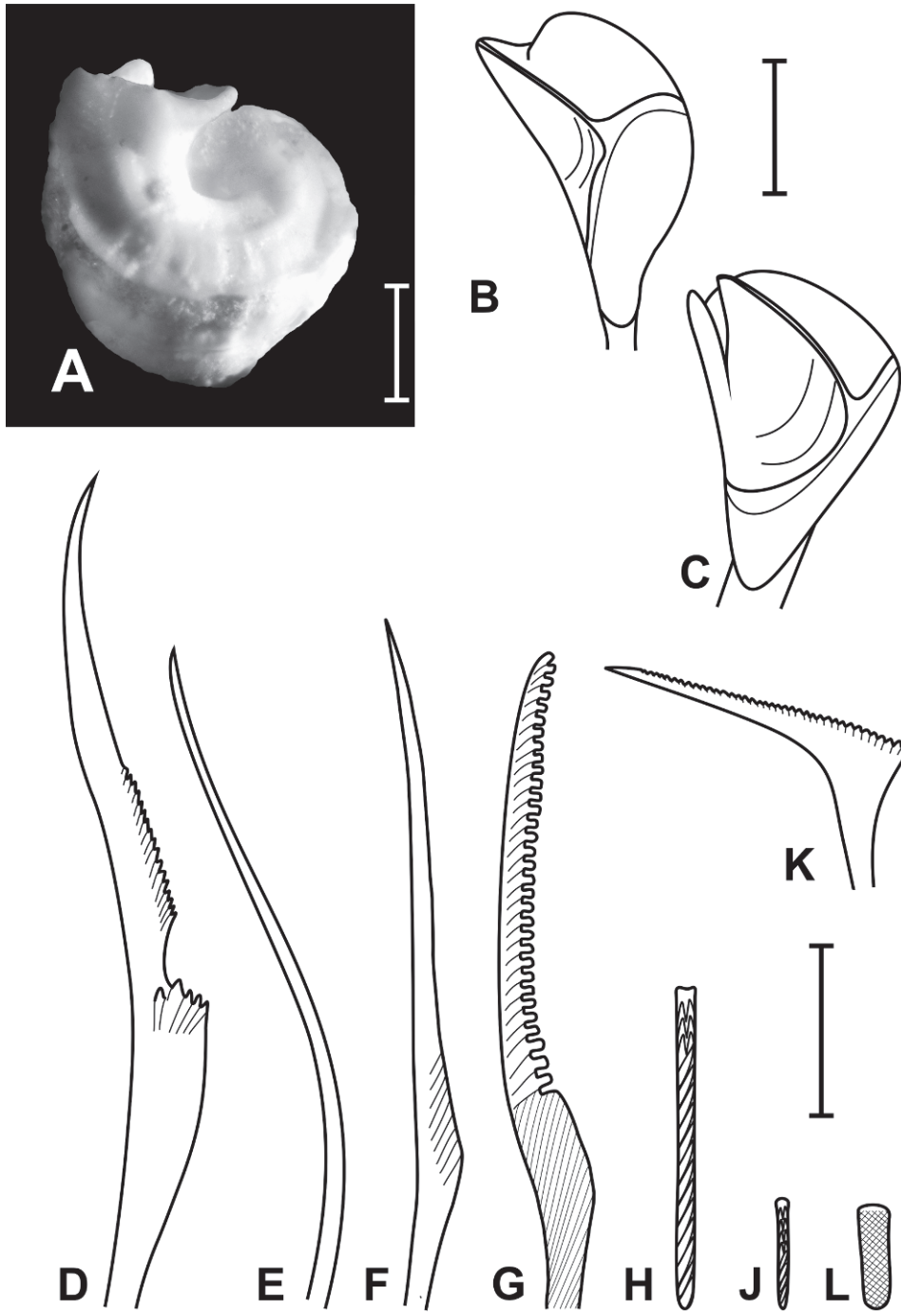

Fig. 1. *Pileolaria aurita*. A. Tube, paratype, scanning electron micrograph (paratype series IEE 1/2748). B, C. Brood chamber without embryos, lateral and dorso-lateral views, paratype (paratype series IEE 1/2748). D–H, J, L. Chaetae, holotype. D. Fin-and-blade collar chaeta. E. Companion capillary chaeta from first chaetiger. F. Simple chaeta from second and third chaetigers. G. Sickle chaeta from third chaetiger. H. Largest thoracic uncinus chaetae. J. Smallest thoracic uncinus. K. Flat geniculate abdominal chaeta. L. Abdominal uncinus. Scales: A = 0.5 mm; B, C = 0.3 mm; D–H, J, L = 0.02 mm.

of the brood chamber, but these projections are either in the shape of numerous spines, as, for example, in *Pileolaria spinifer* Knight-Jones, 1978, *Pileolaria tiarata* Knight-Jones, 1978 (Knight-Jones 1978: Figs. 9D, E, 10D–G), or only one spine like in *Pileolaria heteropoma* (Zibrowius 1968) (Zibrowius 1968: pl. 11, Figs. 20, 21; Bianchi 1981: Fig. 58C). Projections of brood chamber in *Pileolaria lateralis* Knight-Jones, 1978 are in the form of 1–5 randomly placed spines (Knight-Jones 1978: Figs. 7E–G). Projections of the shape similar to those of *P. aurita* may be present in *Pileolaria* ex gr. *berkeleyana* (Rioja 1942) but these, if present, are arranged in lateral rows (Knight-Jones et al. 1979: Fig. 5A (d)). Lateral seams on the calcified zone of the brood chamber are unknown for any other Pileolariinae.

Many *Pileolaria* have large crystalline patches (one, two, or numerous) on the dorsal side of the achaetous zone separating the thorax and the abdomen, usually of different shades of red and sometimes species-specific. As a rule, these patches are well visible in preserved material even after a long storage, though sometimes they may change their color, as in, for example, *Pileolaria militaris* Claparède, 1868 (Knight-Jones et al. 1979). Sometimes color may disappear as a result of preservation, which has been noted by Knight-Jones & Knight-Jones (1977) for *P. heteropoma* and occasionally for *P.* ex gr. *berkeleyana* (pers. obs.). So it is not clear whether the lack of crystalline patches is a characteristic feature of the new species or a result of color fading after a long preservation.

Absence of cross-striation in collar chaetae is atypical for the genus, which clearly distinguishes the new species from all other *Pileolaria.* The cross-striation has not been described for *P. heteropoma* by Zibrowius (1968) and is absent in his figures, but Harris (1968) and Bailey (1969) suggest that cross-striation is distinct in *P. heteropoma*. Nevertheless, Knight-Jones & Knight-Jones (1977) reported that *P. heteropoma* has a weak cross-striation of the collar chaetae blades.

Only two other species of *Pileolaria, P. militaris* and *P.* ex gr. *berkeleyana* (as *Laeospira rosepigmentata* Uchida 1971) are known from Japanese waters (Uchida 1971, 1978). These species clearly differ from *P. aurita* by the morphology of brood chambers, distinct cross-striation of collar chaetae, and, probably, by the presence of the crystalline patches. *Pileolaria* ex gr. *berkeleyana* is one of the widely distributed species (or likely species-complexes) known world-wide from the Arctic to the Antarctic. Some authors (e.g., Knight-Jones et al. 1975, Zibrowius & Bianchi 1981, Thorp et a1. 1986) suggest that this species invaded in the northeastern Atlantic from Japan and established dense populations in the Mediterranean Sea and off the British coasts only in the 1970s of the last century. The species is found at the depths down to 256 m on various substrata such as stones, shells, serpulid tubes, Sargassum, and coralline algae. *Pileolaria militaris* is a widely distributed species on the shoals in the warm and temperate waters where it settles on various algae, stones, and shells.

Another Japanese species of the genus *Simplaria* that is morphologically similar to *Pileolaria* also differs from *P. aurita* by its brood chamber morphology, distinct cross-striation of collar chaetae, and, additionally, by absence of sickle chaetae in the third thoracic chaetiger. Similar to *P. militaris,* this species also is widespread in shallow waters of (sub)tropical and temperate seas and attaches to stones and shells.

Etymology.—The species name originated from the *Latin* word "*aurita,*" which means "eared," because of the two characteristic projections of the brood chamber similar to cat ears.

Ecology.—Worms were found at depths of 20–22 m on empty oyster shells and sometimes on bryozoans covering those shells. The shells were collected from sandy bottoms below artificial reefs constructed for recreational scuba diving. Most likely the oyster shells had fallen to the bottom from these artificial constructions. No other spirorbid species were observed in the association with this species.

Distribution.—off Iwa, Manazuru Peninsula, Sagami Bay, Honshu, Japan. Not known elsewhere.

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