

## *Philine malaquiasi* (Mollusca: Gastropoda: Heterobranchia), a new species for the Russian fauna, with a discussion of its taxonomic position

## *Philine malaquiasi* (Mollusca: Gastropoda: Heterobranchia) – новый вид в фауне России, с обсуждением его таксономического положения

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**Abstract.** *Philine malaquiasi* Valdés, Cadien et Gosliner, 2016 is recorded from the Chukchi and Bering seas and from the southeastern coast of the Kamchatka Peninsula. This is the first record of the species for the Russian fauna. This species was initially considered as a member of the genus *Philine* Ascanius, 1772 (family Philinidae). In the present article, we transfer it to the genus *Retusophilina* Nordsieck, 1972 (family Laonidae) under the name *Retusophilina malaquiasi* (Valdés, Cadien et Gosliner, 2016), **comb. nov.**, based on the morphology of the headshield, gizzard and copulatory system.

**Резюме.** *Philine malaquiasi* Valdés, Cadien et Gosliner, 2016 найден в Чукотском и Беринговом морях, а также у юго-восточного берега Камчатки. Вид впервые отмечается для фауны морей России. Он был описан в составе рода *Philine* Ascanius, 1772 семейства Philinidae. Мы переносим этот вид в род *Retusophilina* Nordsieck, 1972 семейства Laonidae под названием *Retusophilina malaquiasi* (Valdés, Cadien et Gosliner, 2016), **comb. nov.** на основании морфологии головного щита, копулятивного аппарата и гиззарда.

**Key words:** morphology, taxonomy, Chukchi Sea, Bering Sea, Kamchatka, Cephalaspidea, Laonidae, *Retusophilina*, new record, new combination

**Ключевые слова:** морфология, таксономия, Чукотское море, Берингово море, Камчатка, Cephalaspidea, Laonidae, *Retusophilina*, новая находка, новая комбинация

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## Introduction

The genus *Philine* Ascanius, 1772 (family Philinidae) is one of the largest groups within the order Cephalaspidea. It includes more than 80 species (Gofas & Bouchet, 2022) and is char-

acterised by a high degree of variability in the morphology of the digestive and genital systems (Rudman, 1972; Price et al., 2011; Malaquias et al., 2016; etc.). Species of this genus are widely distributed in the World Ocean, excluding Antarctic waters (Valdés, 2008; Ohnheiser & Malaquias,

2013; Gonzales & Gosliner, 2014; Malaquias et al., 2016; Valdés et al., 2016; Moles et al., 2019), from intertidal to hadal depths (Chaban & Chernyshev, 2014; Chaban et al., 2019). The diagnosis of the genus *Philine* was clarified in the recent taxonomic revisions of the superfamily Philinoidea (Oskars et al., 2015; Moles et al., 2019; Chaban et al., 2019). As a result, a list of *Philine* species is constantly updated.

During the investigation of the cephalaspidean collection from the Chukchi and Bering Seas, deposited at the Zoological Institute of the Russian Academy of Sciences, St Petersburg, a new species for the fauna of the Russian seas was found. Additional specimens of this species were collected recently near the southeastern Kamchatka Peninsula (Pacific coast). These specimens were identified as *Philine malaquiasi* Valdés, Cadien et Gosliner, 2016, a species described from the Beaufort Sea (Valdés et al., 2016). However, preliminary study indicates that the morphology of this species does not match the current diagnosis of the genus *Philine*. The aim of the present article is to clarify the taxonomical position of *P. malaquiasi*.

## Material and methods

The specimens were collected: (1) in the Bering Sea, 1933, by A.V. Kondakov; (2) in the Chukchi Sea, 1976, during the expedition of the Laboratory of the Marine Research, Zoological Institute, Russian Academy of Sciences; (3) near the southeastern coast of the Kamchatka Peninsula, 2009, by D.D. Danilin (Fig. 1). All the specimens examined are stored at the Zoological Institute, Russian Academy of Sciences (ZIN) for a long time, being fixed with 70% ethanol, and therefore they were studied without molecular analysis.

The penial apparatus of two specimens was mounted in glycerol and examined under a Leica DME light microscope. The specimens, shell and penial apparatus were photographed using a DCM-130 digital camera with Scope Photo 3.0 software. A scanning electron microscope (SEM; Quanta-250) was used to examine the morphology of the shell and radula. To separate the radula, the buccal mass was dissolved in 10% lactic acid. The radula and shell were mounted on stubs using carbon discs and covered with platinum for examination under SEM.

## Results

Order **Cephalaspidea** P. Fischer, 1883

Superfamily **Philinoidea** Gray, 1850 (1815)

Family **Laonidae** Pruvot-Fol, 1954

Type genus: *Laona* A. Adams, 1865.

*Diagnosis.* Shell internal or external, rounded to quadrangular in profile, smooth or with chain-like or net-like sculpture. Radula present or absent. Gizzard without gizzard plates. Head copulatory system with short prostate, penial papilla simple, conical.

*Composition.* The family includes the genera *Laona* A. Adams, 1865 and *Retusophilina* Nordsieck, 1972.

Genus ***Retusophilina*** Nordsieck, 1972

Type species: *Bulla lima* T. Brown, 1827, by original designation; recent.

*Diagnosis.* Head shield with a pair of posterior appendages. Shell internal, oval cylindrical, with spiral sculpture of punctured lines and obtuse apex. Radula 2:1:0:1:2. Lateral teeth hook-shaped, without denticles on inner margin.

*Composition.* The genus includes *Retusophilina lima* (T. Brown, 1827) and *R. malaquiasi* (Valdés, Cadien et Gosliner, 2016), **comb. nov.**

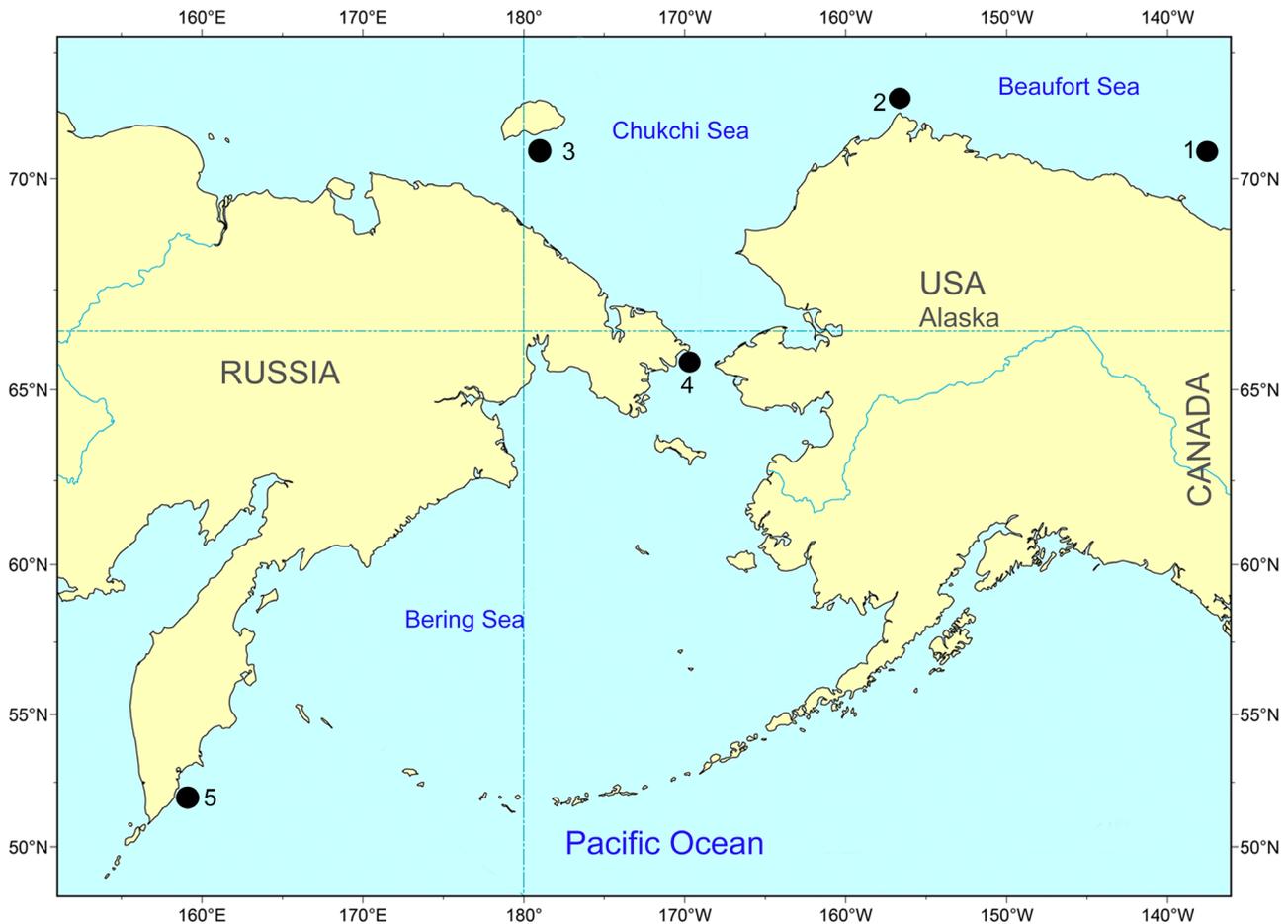
***Retusophilina malaquiasi*** (Valdés, Cadien et Gosliner, 2016), **comb. nov.**  
(Fig. 2)

*Philine malaquiasi* Valdés, Cadien et Gosliner, 2016: 528–530, figs 18–19.

*Retusophilina polaris* sensu Chaban, 2008, non Aurivilius, 1887.

*Type material.* Holotype, 7 mm preserved length, Natural History Museum of Los Angeles County, LACM 3436 – not examined.

*Material examined.* **Russia:** *Chukchi Sea*, Wrangel I., expedition of Laboratory of Marine Research ZIN in 1976, coll. A.N. Golikov and A.M. Sheremetevsky: 70°58'N, 178°28'W, depth 22 m, 13.VIII.1976, station 17, 1 specimen (ZIN 63343), 71°00'N, 178°00'W, depth 20 m, 15.VIII.1976, station 25, 1 specimen (ZIN 63344), 70°58'N, 178°28'W, depth 16 m, 17.VIII.1976, station 32, 7 specimens (ZIN 63345), 70°58'N, 178°28'W, depth 6 m, 20.VIII.1976, station 37, 1 speci-



**Fig. 1.** Distribution of *Retusophilina malaquias*, **comb. nov.** in Arctic and North-West Pacific. **1**, type locality; **2**, westernmost collection locality in Beaufort Sea (according to Valdés et al., 2016); **3**, localities of material collected by Laboratory of Marine Research (ZIN) in Chukchi Sea in 1976; **4**, locality of specimens collected by A.V. Kondakov in Bering Sea; **5**, locality of material collected by D.D. Danilin in Avacha Bay.

men (ZIN 63348); *Bering Sea*, Bering Strait, depth 37 m, sand, stones, 10.VIII.1933, R/V “Krasnoarmeets”, station 33, 1 specimen, coll. A.V. Kondakov (ZIN 63341); *Northwest Pacific*, Kamchatka Peninsula, Avacha Bay, 52°56'N, 159°41'E, depth 129 m, gray mud, 13.V.2009, 2 specimens, coll. D.D. Danilin (ZIN 63349).

Type locality: Beaufort Sea (70°10.3'N, 144°35.5'W), 27 m depth.

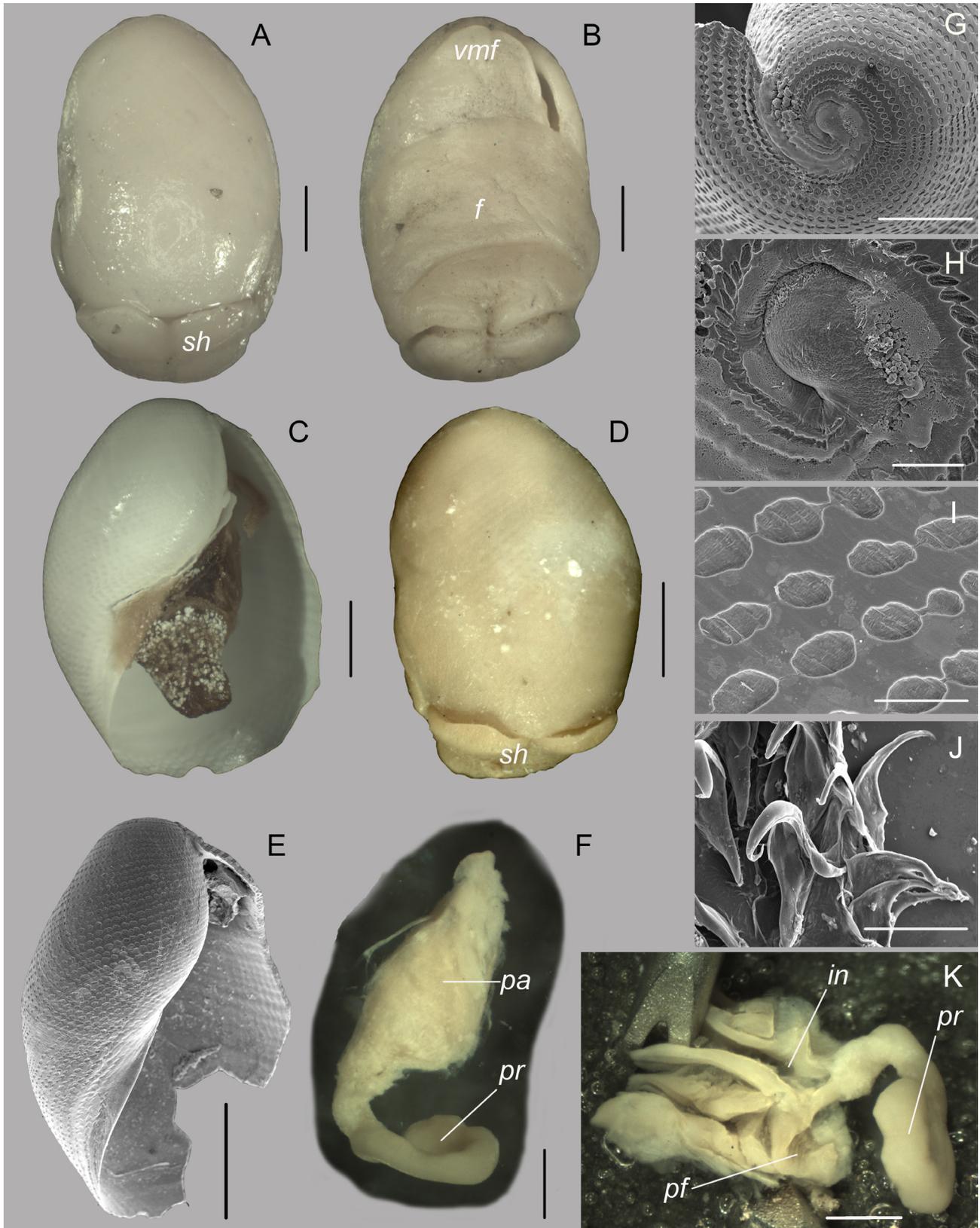
**Diagnosis** (updated from Valdés et al., 2016). Shell white, oval cylindrical, with obtuse apex, spire consisting of drop-shaped protoconch and 1.50 definitive whorls. Shell width to height ratio 0.71–0.75. Aperture slightly shorter than shell. Sculpture consisting of spiral lines formed by

closely located oval pits. Inner surface of penial sac covered with longitudinal folds and several small tubercles. Short triangle penial fold located at base of penial sac.

**Description.** Fixed specimens up to 5.30 mm in length, pale gray, almost entirely retracted into shell. Short cephalic shield with two posterior lobes. Foot short and wide; parapodia small. Posterior mantle shield without dorsal lobes; suprapallial lobe shallow, with oval end, not protruding over shell apex.

Shell white, fragile, oval cylindrical, up to 3.70 mm in length, covered with relatively thick mantle layer, spiral sculpture not visible through it.

**Fig. 2.** Morphology of *Retusophilina malaquias*, **comb. nov.** **A–C**, specimen ZIN 63349; **D, F, K**, specimen ZIN 63345; **E, G–J**, specimen ZIN 63348. Fixed specimen, dorsal view (A, D), ventral view (B). Shell, ventral view (C, E),



apex (G), protoconch (H), shell sculpture (I). Radula (J). Head copulatory system (F), dissected penial atrium (K). Abbreviations: *f* – foot; *in* – incurrent duct; *pa* – penial atrium; *pf* – penial fold; *pr* – prostate; *sh* – head shield; *vmf* – ventral mantle fold. Scale bars: 1 mm (A–E), 500  $\mu$ m (G), 200  $\mu$ m (F, K), 100  $\mu$ m (H–J).

Apex obtuse, spire consisting of drop-shaped protoconch 170 µm in diameter and 1.50 teleoconch whorls. Protoconch surface uneven, consisting of small dimples and elevations. Shell width to height ratio 0.71–0.75. Aperture length slightly shorter than shell length. Sculpture consisting of spiral lines formed by closely located oval pits. Outer lip thin, not rising to apex, forming acute angle with parietal wall. Parietal wall slightly convex, almost equal in length to columellar part of inner lip. Thin ribbon-like callus covering parietal wall and upper part of aperture columellar region.

**Anatomy.** Gizzard plates absent. Radular formula 11 × 2:1:0:1:2. Teeth hook-shaped, without denticles on inner margin. Head copulatory system consisting of large penial sac and short prostate. Length of prostate almost equal to length of penial sac. Prostate of brownish colour, convoluted. Penial sac white, covered with shiny white connective tissue fibers. Inner surface of penial sac bearing longitudinal folds and small tubercles. One of folds serving as inner seminal groove. Short triangle penial fold located at base of penial sac.

**Ecology.** In the Avacha Bay, this species was found in the biocoenosis of *Macoma calcarea* (Gmelin, 1791), where the highest abundance of *Retusophilina malaquiasii* was 12 individuals/m<sup>2</sup>.

**Distribution.** Beaufort Sea, Chukchi Sea, Bering Strait, North-West Pacific, southeastern coast of Kamchatka Peninsula, Avacha Bay, 4–360 m depth.

**Note.** *Retusophilina malaquiasii*, **comb. nov.** is recorded for the fauna of the Russian seas for the first time. This is the only species of the family Laonidae in the studied region from the southeastern Kamchatka to the Chukchi Sea. The species is easily distinguished from other Philinoidea by three characters: (1) a pair of posterior appendages of the head shield; (2) the gizzard without plates; (3) the short, simple prostate and unarmed penis. In the South-Western Chukchi Sea, *R. malaquiasii* neighbors with Arctic *R. lima*, which was recorded from the East Siberian Sea (Chaban, 2010). The latter species has the more narrow and elongated shell with a large (more than 200 µm) protruding protoconch and the much shorter prostate than in *R. malaquiasii* (Ohnheiser & Malaquias, 2013; Valdés et al., 2016). *Philina polaris* Aurivillius, 1887 from the East Siberian Sea is another Arctic

species morphologically similar to *R. malaquiasii*. *Philina polaris* was placed in synonymy with *Laona quadrata* (Wood, 1839) (Ohnheiser & Malaquias, 2013; Cuvelier et al., 2022), which is distributed from the North Atlantic to the Barents Sea (Ohnheiser & Malaquias, 2013). Obviously, the taxonomic position of *P. polaris* needs to be clarified (Chaban & Nekhaev, in prep.). Anyway, *R. malaquiasii* differs from it in the shape of the shell [obtuse apex in *R. malaquiasii* vs. truncated in *P. polaris*; see Lemche, (1948)].

## Discussion

*Philina malaquiasii* is morphologically similar to the type species of the genus *Retusophilina* Nordsieck, 1972, *R. lima*. This similarity was noted by Valdés et al. (2016): the gizzard plates absent, the shell is oval cylindrical, the inner lip with a ribbon-like callus, a spiral sculpture consists of chains of oval pits, the head shield with two posterior lobes, the head copulatory system with simple conical penial fold and short prostate. These characters correspond to the diagnosis of the genus *Retusophilina*; see Chaban et al. (2019). For this reason, *P. malaquiasii* is here transferred to this genus as *R. malaquiasii* (Valdés, Cadien et Gosliner, 2016), **comb. nov.** (family Laonidae). Specimens of *R. malaquiasii* show some variability in the shell shape (Valdés et al., 2016, figs 18C, E, G) ranging from conical to more oval. Our specimens also have conical (Fig. 2E) and more oval shells (Fig. 2C). Further studies of this species, including the molecular analysis, are necessary to clarify the boundaries of intraspecific variability in the shape and sculpture of the shell.

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## References

- Aurivillius C.W.S.** 1887. Öfversigt öfver de af Vega-Expeditionen insamlade Arktiska Hafsmollusker. II. Placophora och Gastropoda. In: **Nordenskiöld A.E.** *Vega-Expeditionen Vetenskapliga Iakttagelser*, 4: 313–383. Stockholm: F. & G. Beijers förlag. (In Swedish).
- Chaban E.M.** 2008. Chapter VIII. Opisthobranchiate mollusca of the orders Cephalaspidea, Thecosomata and Gymnosomata (Mollusca, Opisthobranchia) of the Chukchi Sea and the Bering Strait. *Explorations of the Fauna of the Seas*, 61: 149–162. (In Russian).
- Chaban E.M.** 2010. Cephalaspidean molluscs of (Gastropoda, Opisthobranchia) of the East Siberian Sea. *Explorations of the Fauna of the Seas*, 66: 71–88. (In Russian).
- Chaban E. M. & Chernyshev A.V.** 2014. Opisthobranch cephalaspidean mollusks (Gastropoda: Opisthobranchia) of Vostok Bay, Sea of Japan. Part 1. *The Bulletin of the Russian Far East Malacological Society*, 18: 41–62. (In Russian).
- Chaban E.V., Ekimova I.A., Schepetov D.M., Kohnert P.C., Schrödl M. & Chernyshev A.V.** 2019. Euopisthobranch mollusks of the order Cephalaspidea (Gastropoda: Heterobranchia) of the Kuril–Kamchatka Trench and the adjacent Pacific abyssal plain with descriptions of three new species of the genus *Spiraphiline* (Philinidae). *Progress in Oceanography*, 178: 102185. <https://doi.org/10.1016/j.pcean.2019.102185>
- Cuvelier D., Rosenberg G. & Bouchet Ph.** 2022. *Philine polaris* Aurivillius, 1887. *WoRMS. World Register of Marine Species*. <https://www.marinespecies.org/aphia.php?p=taxdetails&id=156347> [viewed 17 May 2022].
- Gofas S. & Bouchet Ph.** 2022. *Philine Ascanius*, 1772. *WoRMS. World Register of Marine Species*. <http://www.marinespecies.org/aphia.php?p=taxdetails&id=138339> [viewed 17 February 2022].
- Gonzales C. & Gosliner T.** 2014. Six new species of *Philine* (Opisthobranchia: Philinidae) from the tropical Indo-Pacific. In: **Williams G.C. & Gosliner T.M.** (Eds). *The Coral Triangle. The 2011 Hearst Philippine Biodiversity Expedition*: 351–383. San Francisco: California Academy of Sciences. <https://doi.org/10.5962/bhl.title.154474>
- Lemche H.** 1948. Northern and Arctic tectibranch gastropods. *Det Kongelige Danske videnskabernes selskab. Biologiske skrifter*, 5(3): 1–136.
- Malaquias M.A.E., Ohnheiser L.T., Oskars T.R. & Willassen E.** 2016. Diversity and systematics of philinid snails (Gastropoda: Cephalaspidea) in West Africa with remarks on the biogeography of the region. *Zoological Journal of the Linnean Society*, 180(1): 1–35. <https://doi.org/10.1111/zoj.12478>
- Moles J., Avila C. & Malaquias M.A.** 2019. Unmasking Antarctic mollusk lineages: novel evidence from philinoid snails (Gastropoda: Cephalaspidea). *Cladistics*, 35(5): 1–27. <https://doi.org/10.1111/cla.12364>
- Ohnheiser L.T. & Malaquias M.A.** 2013. Systematic revision of the gastropod family Philinidae (Mollusca: Cephalaspidea) in the north-east Atlantic Ocean with emphasis on the Scandinavian Peninsula. *Zoological Journal of the Linnean Society*, 167: 273–326. <https://doi.org/10.1111/zoj.12000>
- Oskars T.R., Bouchet Ph. & Malaquias M.A.** 2015. A new phylogeny of the Cephalaspidea (Gastropoda: Heterobranchia) based on expanded taxon sampling and gene markers. *Molecular Phylogenetics and Evolution*, 89: 130–150. <https://doi.org/10.1016/j.ympev.2015.04.011>
- Price R.M., Gosliner T.M. & Valdés Á.** 2011. Systematics and phylogeny of *Philine* (Gastropoda: Opisthobranchia), with emphasis on the *Philine aperta* species complex. *The Veliger*, 51(2): 1–58.
- Rudman W.** 1972. The genus *Philine* (Opisthobranchia, Gastropoda). *Proceedings of the Malacological Society of London*, 40(3): 171–187.
- Valdés Á.** 2008. Deep-sea “cephalaspidean” heterobranchs (Gastropoda) from the tropical southwest Pacific. Tropical Deep-Sea Benthos 25. *Mémoires du Muséum national d’Histoire naturelle*, 196: 587–792.
- Valdés Á., Cadien D.B. & Gosliner T.M.** 2016. Philinidae, Laonidae and Philinorbidae (Gastropoda: Cephalaspidea: Philinoidea) from the northeastern Pacific Ocean and the Beaufort Sea (Arctic Ocean). *Zootaxa*, 4147(5): 501–537. <https://doi.org/10.11646/zootaxa.4147.5.1>

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