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## NEW SPECIES AND NEW RECORDS OF RARE CTENOSTOME BRYOZOANS OF THE GENUS *ALCYONIDIUM* IN THE RUSSIAN ARCTIC SEAS

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### ABSTRACT

New species of ctenostome bryozoan *Alcyonidium pseudodisciforme* sp. nov. is described. Subspecies *Alcyonidium gelatinosum pachydermatum* Denisenko, 1996 is raised to a species range and redescribed as *A. pachydermatum* Denisenko, 1996. New records of *A. radicellatum* Kluge, 1946 and *A. proboscideum* Kluge, 1962 are added to the list of bryozoan fauna of the Russian Arctic sector.

**Key words:** Arctic seas, bryozoans, *Alcyonidium*, taxonomy, distribution.

## НОВЫЕ ВИДЫ И НОВЫЕ НАХОДКИ РЕДКИХ КТЕНОСТОМНЫХ МШАНОК РОДА *ALCYONIDIUM* В РОССИЙСКИХ АРКТИЧЕСКИХ МОРЯХ

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### РЕЗЮМЕ

Дано описание нового вида ктеностомных мшанок *Alcyonidium pseudodisciforme* sp. nov. Подвид *Alcyonidium gelatinosum pachydermatum* Denisenko, 1996 возведен в статус вида и переописан. Приводятся сведения о новых находках *A. radicellatum* Kluge, 1946 и *A. proboscideum* Kluge, 1962 в морях российского сектора Арктики.

**Ключевые слова:** Арктические моря, мшанки, *Alcyonidium*, таксономия, распределение.

## INTRODUCTION

Despite of numerous studies of zoobenthos in the Arctic seas, the bryozoan fauna still requires considerable investigation. Even in the Barents, Kara, Laptev and Chukchi seas, which are the most thoroughly investigated, new records of abundant and new species of Bryozoa have recently been reported (Denisenko 1990, 1996, 2000; Gontar 1996, 2004; Gontar et al. 2001; Denisenko and Kuklinski 2008). The new data substantially add to the diversity of the Arctic bryozoan fauna and the biogeographic status of its species.

## MATERIAL AND METHODS

Material for this publication was collected during several expeditions of the Zoological Institute of the Russian Academy of Sciences (ZIN) and the Murmansk Marine Biological Institute of the Russian Academy of Sciences (MMBI) between 1976 and 1994. Sampling was also fulfilled in the frames of the international programs (Russian-Norwegian "BASICC", "CABANERA" and Russian-American "RUSALCA") carried out between 2003 and 2005. In addition, author's archive data and collections of

ZIN and MMBI were used. Holotype and paratype specimens are deposited in ZIN. Research vessel is abbreviated as R/V and station as St.

## SYSTEMATICS

**CLASS Gymnolaemata Allman, 1856**

**Order Ctenostomata Busk, 1852**

**Family Alcyonidiidae Johnston, 1837**

**Genus *Alcyonidium* Lamouroux, 1813**

***Alcyonidium pseudodisciforme* Denisenko sp. nov.**  
(Figs. 1, 2)

**Type material.** Holotype – ZIN 1/52904; north-western part of the Barents Sea, “CABANERA”, R/V “Jan-Mayen”, St. 3R-9, 79°01.2′N, 25°46.3′E, depth 198 m, sediments – sandy silt, multi-core (0.03 m<sup>2</sup>), 16.07.2003, coll. M. Carroll. Paratypes – 20 specimens (ZIN 2/52905); northwestern part of the Barents Sea, “CABANERA”, R/V “Jan-Mayen”, St. 6 (76°21.6′N 18°21.3′E), depth 226 m, sediments – sandy silt, van Veen grab (0.1 m<sup>2</sup>), 20.07.2003, coll. M. Carroll.

**Additional material.** In addition to the type material abundant material on a new species was collected in the northern and western parts of the Barents Sea during the Russian-Norwegian program “BASICC”, R/V “Ivan Petrov”. St. 3 (74°23.40′N 26°11.34′E), depth 391 m, sediments – sandy silt, bottom temperature 0.6 °C, van Veen grab (0.1 m<sup>2</sup>), 10.08.2003; St. 8 (77°58.64′N 26°49.52′E), depth 35 m, sediments – sandy silt, bottom temperature (-1.3) °C, van Veen grab (0.1 m<sup>2</sup>), 12.08.03; St. 9 (78°11.24′N 33°52.61′E), depth 163 m, sediments – sandy mud, bottom temperature (-0.7) °C, van Veen grab (0.1 m<sup>2</sup>), 12.08.2003; St. 10 (77°28.75′N 33°23.63′E), depth 145 m, sediments – fine silty mud, bottom temperature (-0.6) °C, van Veen grab (0.1 m<sup>2</sup>), 12.08.2003; St. 16 (73°1.57′N 30°57.58′E), depth 273 m, sediments – sandy silt, bottom temperature 0.8 °C, van Veen grab (0.1 m<sup>2</sup>), 14.08.2003; St. 23 (77°29.14′N 39°25.31′E), depth 217 m, sediments – sandy mud, bottom temperature (-0.8) °C, van Veen grab (0.1 m<sup>2</sup>), 16.08.2003; St. 24 (78°15.05′N 42°32.29′E), depth 221 m, sediments – silty sand with clay, bottom temperature 0.6 °C, van Veen grab (0.1 m<sup>2</sup>), 16.08.2003; St. 25 (78°16.57′N 46°39.66′E), depth 244 m, sediments – silty sand with clay, bottom temperature (-0.4) °C, van Veen grab (0.1 m<sup>2</sup>), 17.08.2003; St. 28 (76°10.91′N 43°27.89′E), sediments – silty sand with clay, depth 42 m, bot-

tom temperature (-0.6) °C, van Veen grab (0.1 m<sup>2</sup>), 17.08.2003; St. 39 (77°43.74′N 51°0.15′E), depth 225 m, sediments – silty sand with clay, bottom temperature (-0.4) °C, van Veen grab (0.1 m<sup>2</sup>), 20.08.2003; St. 40 (78°14.06′N 53°7.18′E), depth 300 m, sediments – silty sand with clay, bottom temperature (-0.8) °C, van Veen grab (0.1 m<sup>2</sup>), 21.08.2003; St. 41 (78°53.98′N 53°55.75′E), depth 234 m, sediments – silty sand with clay, bottom temperature (-0.7) °C, van Veen grab (0.1 m<sup>2</sup>), 21.08.2003; St. 42 (78°58.04′N 47°45.37′E), depth 261 m, sediments – silty sand with clay, bottom temperature (-0.6) °C, van Veen grab (0.1 m<sup>2</sup>), 21.08.2003, coll. S. Denisenko, S. Cochrane, A. Voronkov and V. Potin.

**Etymology.** The species epithet “*pseudodisciforme*” refers to its resemblance to *Alcyonidium disciforme* Smitt, 1872.

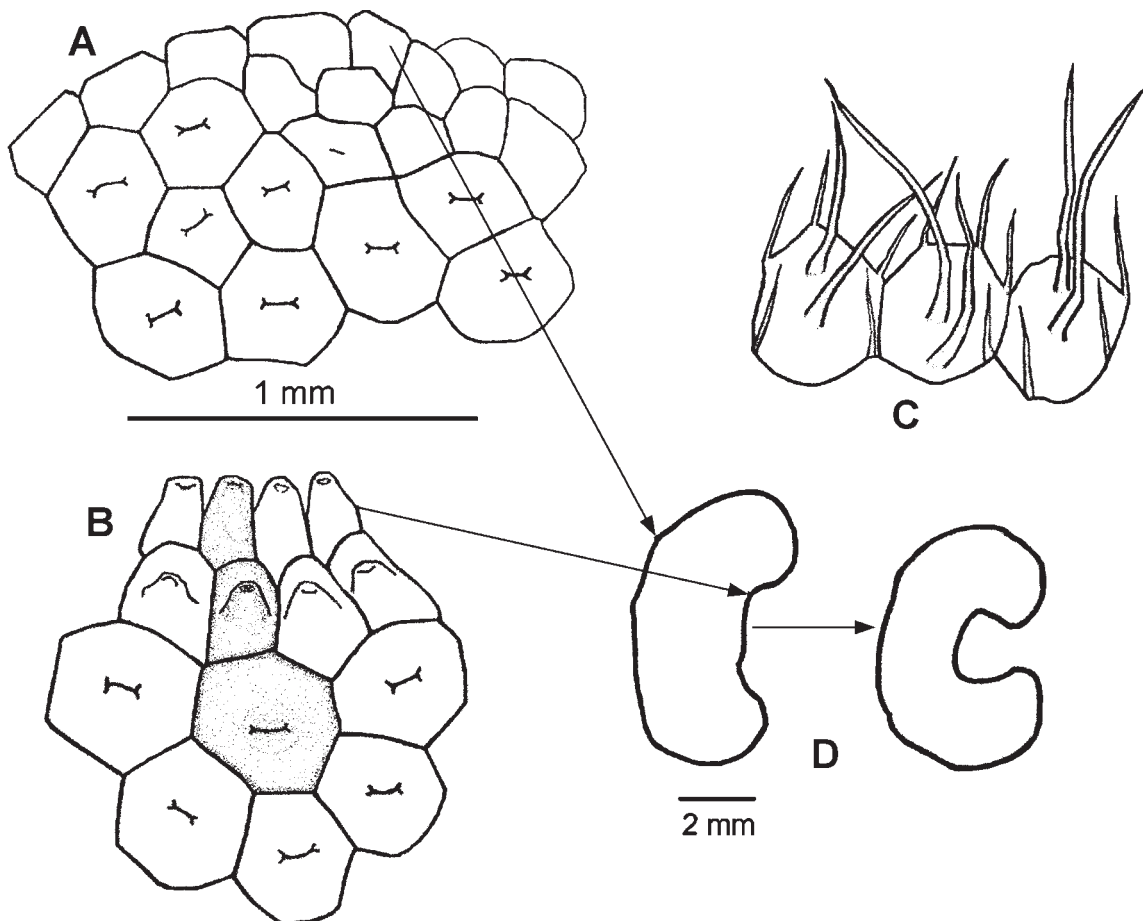
**Description.** Colonies gelatinous, unilaminar, roundish, half-ring or bean-shaped, laying freely on the bottom and superficially rooting in the soft sediment by short rhizoids. Maximum colony length – 8.2 mm. Coloration is light-brown or yellowish, with polypides visible through the semi-transparent frontal wall. Colonies are flat or slightly convex at the beginning of their formation. Colony growth is irregular owing to non-uniform zooids budding (Fig. 1A). Zooids are basically hexagonal (Fig. 1B, Fig. 2A); their sizes are given in Table 1. Zooidal boundaries marked by distinct lines (Fig. 2A). During its growth (Fig. 1A), the roundish colony becomes, at first, bean-shaped, and then gets half-ring shape. Zooids located in the concave part of colony, are compressed from sides by neighboring zooids that changes their form to rectangular (Fig. 1B, Fig. 2B). Sometimes, zooids located on internal edge of the colony are situated perpendicular to the colony surface due to the strong compression. In that case the polypide stomach becomes visible through the transparent zooidal wall, although it is usually hardly distinguished through the frontal wall (Fig. 2C).

The slit-shaped orifice positioned centrally, often at the tip of small papilla (partially everted) (Figs. 1B, 2B, C). Lophophor with 14–16 tentacles.

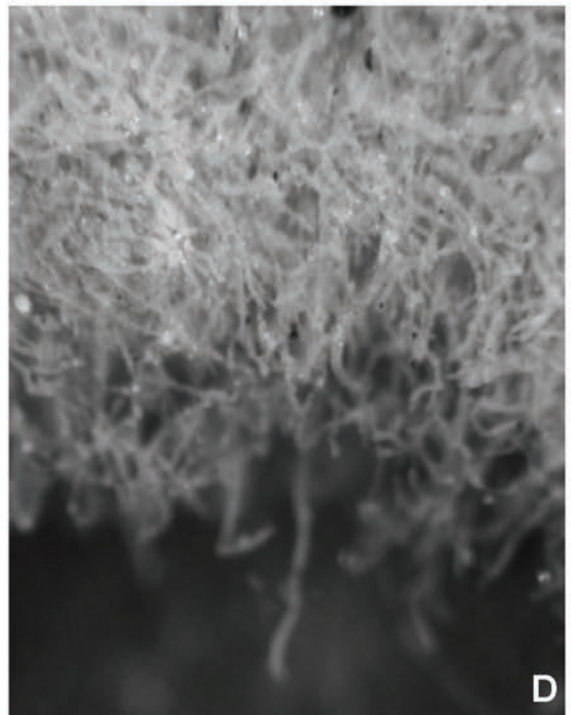
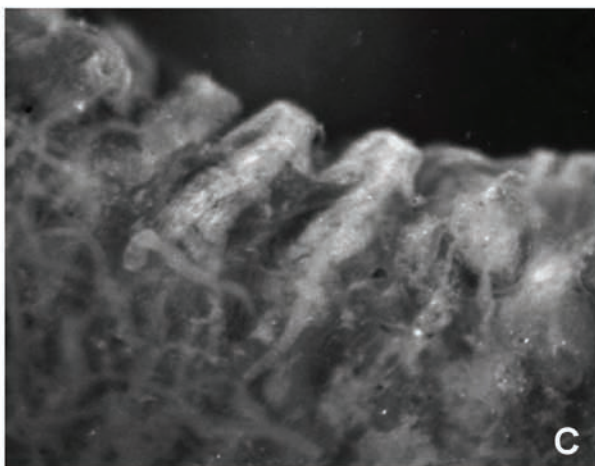
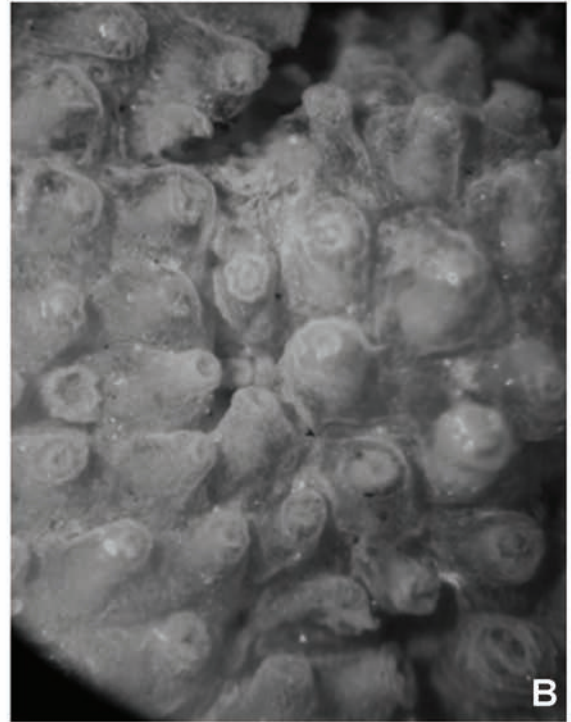
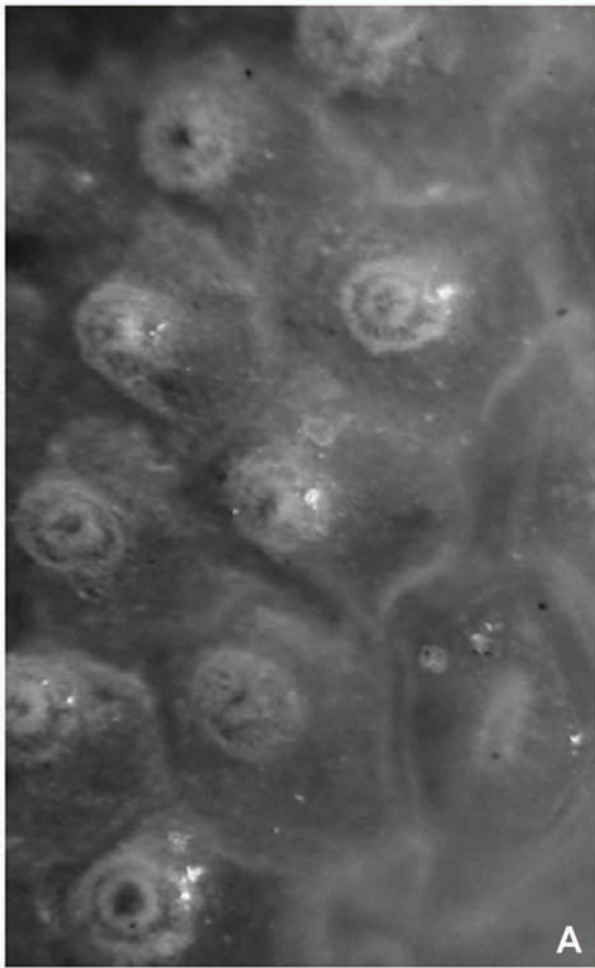
Basal side of autozooids bears curved rhizoids which serve to anchor the colony in sediment (Fig. 2D). They are of two types: longer ‘filaments’ are located in the center of the autozooidal basal wall, whereas shorter and thinner ones are located in its ‘corners’. Longer rhizoids (1–3) are located along the central axis of the zooidal wall, and the central

**Table 1.** Morphological and size comparison of *Alcyonidium pseudodisciforme* sp. nov. and *Alcyonidium disciforme* (Smitt, 1872).

	<i>A. disciforme</i>	<i>A. pseudodisciforme</i>
Morphology of colony	Roundish or ring-shaped with rings of kenozooids, up to 60 mm	Roundish, bean-shaped, half-ring-shaped, 5–15 mm
Zooid shape	Hexagonal or rectangular	Hexagonal or rectangular
Mean size of zooids (mm)	0.559	0.406
Standard error	0.015	0.009
Standard deviation	0.079	0.049
Minimum size (mm)	0.425	0.31
Maximum size (mm)	0.875	0.495
P-value		0.00001



**Fig. 1.** *Alcyonidium pseudodisciforme* sp. nov., ZIN 2/52905, paratype, Barents Sea, northwestern part: A – growing edge of the colony; B – portion of the colony showing the differences in zooidal shape in different parts of the colony; C – basal side of zooids with rhizoids; D – diagram of the colony shape, showing its change with growth (shown by an arrow).



A \_\_\_\_\_  
B \_\_\_\_\_  
C, D \_\_\_\_\_

one is always thicker than the others. Their length exceeds the length of autozooid (Fig. 1 C). Rhizoids are entangled (Fig. 2D).

**Differential diagnosis.** The new species can be confused with *A. disciforme* but differs in its maximum size (up to 15 mm in *A. pseudodisciforme* and up to 60 mm in *A. disciforme*), colony shape, zooid size and some other characters (Tabl. 1, Figs. 1B and 3A). Colonies of *A. pseudodisciforme* are roundish or bean-shaped, not ring-shaped as in *A. disciforme* (the latter species possesses the ring-like colony shape from the beginning of its development). Additionally, the colonies of *A. pseudodisciforme* have less dense consistence in comparison to *A. disciforme*, which has thicker frontal walls. In *A. pseudodisciforme* zones of budding are located mostly on the same side of the colony, whereas it is encircle the colony periphery in *A. disciforme*. Kenozooids do not occur in *A. pseudodisciforme*, whereas they form one-row rings between the annual growth zones in *A. disciforme*.

In *A. pseudodisciforme* basal wall of zooids is indiscernible due to the curved long root filaments (rhizoids) located in the center and the corners of the zooid basal wall. In contrast, in *A. disciforme* colony basal side has clearly visible parallel banding due to a presence of one row of short median papillae which number varies from 6 up to 9 (usually 7) (Fig. 3B).

### *Alcyonidium pachydermatum* Denisenko, 1996

*Alcyonidium gelatinosum*: Waters, 1904: 179 (part).

*Alcyonidium gelatinosum* var. *pachydermatum* Kluge, 1962: 190, fig. 97; 1975: 224, fig. 97.

*Alcyonidium gelatinosum pachydermatum* Denisenko, 1996: 236.

*Alcyonidium gelatinosum pachydermatum*: Gontar, 2004:152.

**Type material.** Neotype (designated here) – 2 specimens (ZIN 1/2969); southeastern part of the Barents Sea, R/V “Malygin”, St. 55 (69°30′N 46°55′E), depth 74 m, trawl, 24.09.1921.

**Additional material.** Additional specimens were collected in the Chukchi, Barents and Kara seas.

Chukchi Sea. Near Cape Lisburn in coastal waters. “RUSALCA” program, R/V “Professor Khromov”, St. 17 (68°17.81′N 16°703.06′W), depth 39 m, trawl,

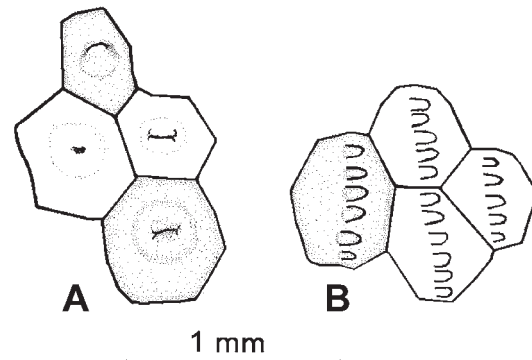


Fig. 3. *Alcyonidium disciforme* Smitt, 1872, ZIN collection specimen 67/39601: A – frontal surface of autozooids; B – basal side of zooids.

14.08.2004; Mouth of the Rogers Bay, Wrangle Island, expedition of ZIN, St. 10 (70°58′N 178°28′W), depth 3 – 9 m, SCUBA (1 m<sup>2</sup>), 17.08.1976; St. 20 (70°58′N 178°28′W), depth 3 – 9 m, SCUBA (0.1 m<sup>2</sup>), 22.08.1976.

Barents Sea. South-eastern part of the sea, to the west from Kolguev Island, expedition of PlayMorIn (Floating Marine Research Institute), R/V “Malygin”, St. 55 (69°30′N 46°44′E), depth 74 m, 24.09.1921. The Pechora Sea, expedition of MMBI, R/V “Dalniye Zelentzy”, cruise 67, St. 12 (70°14′N 55°04′E), depth 175 m, sediments – silty mud, grab “Ocean” (0.25 m<sup>2</sup>), 15.07.1992. Hope trench, “CABANERA” program, R/V “Jan Mayen”, St. 1 (75°67′N 30°10′E), depth 345 m, sediments – sandy mud, bottom temperature 2.6°C, van Veen grab (0.1 m<sup>2</sup>), 11.07.2003. To the north from Spitsbergen, “CABANERA” program, R/V “Jan Mayen”, St. 8R (81°28′N 26°51.08′E), depth 503 m, sediments – sandy mud, bottom temperature 0.4°C, multi-core (0.03 m<sup>2</sup>), 25.07.2004.

Kara Sea. Southern part of the sea, expedition of MMBI, R/V “Dalnie Zelentzy”, Cruise 74, St. 1 (70°00.09′N 61°04.56′E), depth 195 m, sediments – mud with silt, van Veen grab (0.1 m<sup>2</sup>), 12.09.1993; St. 12 (80°35.6′N 73°35.6′E), depth 43–48 m, sediments – sandy mud, van Veen grab (0.1 m<sup>2</sup>), 19.09.1993. Central part of the sea, expedition of Shirshov Institute of Oceanology, RAS and Alfred Wegener Institute of Marine and Polar Research, Bremerhaven, Germany, R/V “Dmitry Mende-

Fig. 2. *Alcyonidium pseudodisciforme* sp. nov., ZIN 2/52905, paratype, Barents Sea, northwestern part: A – autozooids, located in the central part of the colony; B – autozooids located closer to the concave side of the colony; C – autozooids at the edge of concave side of the colony, view from basal side; D – rhizoids on the basal side. Scale bar=1 mm.

leev", St. 4398 (76°02'N 79°57,88'E), depth 55 m, sediments – sandy mud with gravel, grab "Ocean" (0.25 m<sup>2</sup>), 12.09.1993. Eastern part of the sea, expedition of MMBI, R/V "Pomor", St. 28 (76°30.33'N 82°09.47'E), depth 58 m, sediments – sandy mud, van Veen grab (0.1 m<sup>2</sup>), 06.09.1994; the Kara Gate, expedition of MMBI, R/V "Pomor", St. 49 (70°34.85'N 58°54.74'E), depth 178 m, sediments – muddy sand, van Veen grab (0.1 m<sup>2</sup>), 12.09.1994.

**Description.** Colony erect, cylindrical, non-branching, with typically white or yellowish coloration. Maximal length is 48 cm, diameter up to 12 mm. Colony attached to substratum by small encrusting base of kenozooids. Erect part of the colony is subdivided into two parts. Slender and short proximal part consists of elongated kenozooids. Widening distal part consists of autozooids, which have thick frontal walls. Autozooids are small (0.22–0.4 mm in diameter), hexagonal, with central orifice. Polypide is oriented perpendicularly to the colony surface. Probably, much of the surface area consists of frontally budded zooids: polygonal plates with smaller size (0.05–0.1 mm) are located between autozooids. On cross-section the inner part of the colony has a cellular structure.

**Remarks.** This species was introduced as variety *Alcyonidium gelatinosum* var. *pachydermatum* in 1962 (Kluge 1962). However, since that time and until now way of writing of name of this bryozoa has not finally established. The subspecies range can be regarded as available after its publication in 1996 (Denisenko 1996). Later V.I. Gontar also marks the variety described by G. A. Kluge as subspecies (Gontar 2004).

G. A. Kluge (1962) described *A. gelatinosum* var. *pachydermatum* as a variety of *Alcyonidium gelatinosum* (L., 1767), which is referred by P. Hayward (1985) as *A. diaphanum* (Hudson, 1762). The latter species differs from *A. pachydermatum* by colony form (*A. diaphanum* has lobed or digitate colonies) and by absence of papillae form of orifice.

*A. pachydermatum* strongly differs from *A. gelatinosum* L., 1761 too. According to the Hayward's description (1985) the colonies of *A. gelatinosum* are thin smooth colorless sheets encrusting algae, with small autozooids (0.44–0.62 × 0.32–0.36 mm); kenozooids do not occur; autozooids with oval or irregularly angular form, separated by indistinct grooves, subterminal orifice is puckered when closed but is not distinctly papillate. At present time *A. gelatinosum* is regarded as a species complex (Porter et

al. 2008), with characters differing from those of *A. pachydermatum*.

**Distribution.** This species was earlier reported only from the northern part of the Kara Sea (Kluge 1962), from the coastal waters to the north from Franz Josef Land archipelago (Waters 1904, Denisenko 1990), in the Pechora Sea (Denisenko 1996), and the Laptev Sea (Gontar 2004). With a new data recently obtained distributional range is widened with new records in the Chukchi Sea: in coastal waters of Alaska, near the cape Lisburn and in the coastal waters of the Wrangler Island. In the Kara Sea the species was found in its eastern and southern parts and in the Kara Gate strait. We also found *A. pachydermatum* in south-eastern and in the north-western parts of the Barents Sea and to the north of Spitsbergen. Depth range is 43–505 m.

#### *Alcyonidium proboscideum* Kluge, 1962

*Alcyonidium proboscideum* Kluge 1962: 199, fig. 105; 1975: 234–235, fig. 105.

**Material.** Barents Sea. North-western part of a shelf zone of the sea. "BASICC" program, R/V "Ivan Petrov", St. 9 (78°11'4N 33°53'4E), depth 164 m, sediments – silty mud with clay, bottom temperature (-0.7) °C, van Veen grab (0.1 m<sup>2</sup>), 12.08.2003.

**Remarks.** Morphology of this specimen well corresponds to descriptions of Kluge (1962, 1975).

**Distribution.** Earlier findings of this species were mentioned only from the south-eastern part of the Barents Sea: to north-west from the Kolguev Island (Kluge 1962) and in the Cheshskaya Bay (Denisenko 2000).

#### *Alcyonidium radicellatum* Kluge, 1946

*Alcyonidium radicellatum* Kluge, 1946: 215, tab. III, figs. 6; 1975: 225–227, fig. 98

**Material.** Barents Sea. The central and north-eastern part of a shelf zone of the sea, "BASICC" program, R/V "Ivan Petrov", St. 10 (77°28.75'N 33°23.63'E), depth 144 m, sediments – silty sand, bottom temperature (-0.6) °C, van Veen grab (0.1 m<sup>2</sup>), 12.08.2003; St. 11 (76°43.11'N 32°45.02'E), depth 190 m, sediments – silty sand, bottom temperature 1.1 °C, 13.08.2003; St. 14. (74°22.63'N 31°28.87'E), depth 260 m, sediments – silty sand, bottom temperature (-0.8) °C, van Veen grab (0.1 m<sup>2</sup>), 13.08.2003; St. 24 (78°15.05'N 42°32.29'E), depth 221 m, sedi-

ments – silty sand with clay, bottom temperature (-0.4) °C, van Veen grab (0.1 m<sup>2</sup>), 16.08.2003; St. 25 (78°16.57'N 46°35.86'E), depth 244 m, sediments – silty sand with clay, bottom temperature (-0.4) °C, van Veen grab (0.1 m<sup>2</sup>), 17.08.2003; St. 40 (78°14.6'N 53°7.18'E), depth 241 m, sediments silty sand with clay, bottom temperature (-0.7) °C, 21.08.2003; St. 41 (78°53.98'N 53°55.50'E), depth 254 m, sediments silty sand with clay, bottom temperature (-0.7) °C, van Veen grab (0.1 m<sup>2</sup>), 21.08.2003; St. 42 (78°58.12'N 47°45.18'E), depth 268 m, sediments – silty sand with clay, bottom temperature (-0.6) °C, van Veen grab (0.1 m<sup>2</sup>), 21.08.2003; “CABANERA” program, R/V “Jan Mayen”, St. 17R (77°25.64'N 40°18.31'E), depth 208 m, sediments – sandy silt, bottom temperature 0.1 °C, van Veen grab (0.1 m<sup>2</sup>), 29.05.2005.

**Remarks.** The studied specimen fits well to descriptions of Kluge (1946). The distinct character of the species is the subdivision of the yellowish colony onto three parts: 1 – proximal part or basis of the colony, with kenozooids covered by numerous thin rhizoids; 2 – thinner middle part of the colony with irregular polygonal kenozooids; 3 – distal part consisting of autozooids and including budding zone. The third zone is slightly thicker than others. Autozooids are directed obliquely in relation to the colony surface. Orifice subterminal, small and roundish.

**Distribution.** The species has been previously recorded from the northern part of the Kara sea, northern part of the Barents Sea (coastal waters of Franz Josef Land, between Franz Josef Land and Spitsbergen); Laptev Sea, East Siberian Sea (to a southeast from Henrietta Island) (Kluge 1946, 1962). As a result of recent studies *Alcyonidium radicellatum* was found in the central and north-eastern parts of the Barents Sea. It inhabits mixed sediments: silty and sandy gravels at the depths 47–680 m.

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