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Arachnoidea dhondti, a new species of bryozoan from the North Atlantic (Bryozoa, Ctenostomata).

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Abstract: A new species of the ctenostomatous bryozoan genus Arachnoidea, *Arachnoidea dhondti*, is described. The species is epizooic on the hermit crab *Parapagurus pilosimanus* collected in the North Atlantic off the coast of North Carolina, USA at a depth of 550 m. The colonies are encrusting, forming linear chains or small patches on the anterior appendages of the hermit crab. The zooids consist of a short, proximal part, an oval middle part, together forming a broad basal plate, and a distal part forming an erect tube-shaped peristomium. The species is distinguishable from other members of the genus by a row of crystalline structures along the lateral margin of the basal plate. The crystalline structures are considered to be homologous with the crenellations in other species in the genus.

Résumé : Arachnoidea dhondti *une nouvelle espèce de Bryozoaire de l'Atlantique Nord (Bryozoa: Ctenostomata)*. Une nouvelle espèce de Bryozoaire Cténostome du genre Arachnoidea, *Arachnoidea dhondti*, est décrite. L'espèce, épibionte sur le bernard l'hermite *Parapagurus pilosimanus*, a été collectée dans l'Atlantique Nord au large de la côte de la Caroline du Nord, USA, à une profondeur de 550 m. Les colonies sont encroûtrantes, formant des chaînes linéaires ou de petites taches sur les appendices antérieurs du pagure. Les zoïdes sont constitués de trois parties: une partie proximale courte, une partie intermédiaire ovale, et une partie distale constituant un péristome en forme de tube érigé. L'espèce se distingue des autres espèces du genre par des structures cristallines présentes le long de la marge latérale de la partie intermédiaire. Ces structures cristallines sont considérées comme homologues des crénelures des autres espèces du genre.

Keywords: Bryozoa, Ctenostomata, new species, North Atlantic fauna, stained crystalline structures.

Introduction

The genus *Arachnoidea* includes ten marine species (d'Hondt, 1983; d'Hondt & Mawatari, 1987), five of which belong to the North Atlantic fauna: *A. barentsia* was described by Kluge 1962, (Kluge, 1975) from the Barents Sea, 44 m depth, and *A. annosciae* d'Hondt & Geraci, 1976, was described from the Mediterranean but recorded also from the English Channel, near Brest. *A. dubia* d'Hondt, 1974 was collected from 2095 to 2223 m depth, *A. prenanti* d'Hondt, 1975 between the Azores and the Bay of Biscay at 1810 and 4270 m depth and *A. thalassae* d'Hondt, 1978 (redescribed by d'Hondt & Hayward, 1981) from 860 to 910 m depth. These three species, *A. dubia, A. prenanti* and *A. thalassae*, have bathyal or abyssal distributions.

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On examining a sample of the hermit-crab *Parapagurus pilosimanus* Smith, collected in the North Atlantic off the coast of North Carolina, USA, at a depth of 550 m, a bryozoan belonging to the genus *Arachnoidea* was identified on the anterior part of the body. *Arachnoidea dhondti* sp. nov. is the first species of the genus *Arachnoidea* that has been reported to live epizooically on a crustacean. Bryozoans are sometimes found on crustaceans which have not moulted for some time (Ryland, 1970). Species of the ctenostome genus *Triticella* are often found on the carapace and appendages of decapods, e.g. *Calocaris* (Hayward, 1985). The genus *Platypolyzoon*, that has been found on the S.W. coast of Arabia, at a depth of ca. 200 m, lives epizooically on the crustacean *Squilla.*

Material and methods

Hermit crabs, *Parapagurus pilosimanus*, with attached bryozoan colonies were collected off the coast of North Carolina, USA, in August 1975. They were offered to the Swedish Museum of Natural History by the United States National Museum. The hermit crabs had also zoanthid cnidarians on the shells in which they lived. The different animals were preserved in 80% ethanol. For light microscopical studies (LM), the bryozoan colonies were mounted on microscope slides in polyvinyl-lactophenol with aniline blue added. For LM studies of the position of the crystalline structures some sections were stained with methylene blue (Fig. 6). In addition to conventional light microscopy, confocal laser scanning microscopy (Leica TSC-SP) was used on the mounted specimens stained with aniline blue, for analysis of the crystalline structures along the periphery of the animals. Two excitation wavelengths (488 nm and 568 nm) were used. Unstained portions of the specimens emitted light in the green range (500-540 nm) whereas the stained parts emitted in the yellow-red range (580-630 nm). Forty sections were cut at 1.2 and 2.0 µm thickness and the images were displayed as a maximum projection of all the sections (Fig. 3).

For scanning electron microscopy (SEM) the bryozoan colonies attached to pieces of the host cuticle were postfixed in phosphate-buffered 1 % osmium tetroxide, thoroughly rinsed, dehydrated in a graded series of ethanol, and then critical-point dried using CO2. The dried specimens were mounted on Cambridge stubs, sputter-coated with gold in an ion sputter, examined and photographed using a Philips XL 30 scanning electron microscope operated at 10 kV.

Drawings were made by means of a light microscope equipped with a camera lucida. Morphological measurements were made with the microscope on specimens mounted on microscope slides.

Results

Arachnoidea dhondti sp. nov.

Type locality: 34°03.2´N - 34°05.2´N, 75°52.0´W - 75° 52.3´W, depth 550 m. On the carapace, antennae and anterior appendages of the hermit crab *Parapagurus pilosimanus* Smith. Leg. R7V Estvard, E -1-73, sta. 73, 29 April 1973. Det. R. Lemaitre.

Type material. Holotype: a colony consisting of ten fullgrown zooids mounted on a slide. Swedish Museum of Natural History: SMNH nr 5136. Paratypes: five colonies from the same locality, attached to pieces of appendages from the host animal. SMNH nr 5137 - 5141.

Etymology. the species is named in honour of Dr. Jean-Loup d´Hondt, Muséum National d´Histoire Naturelle, Paris.

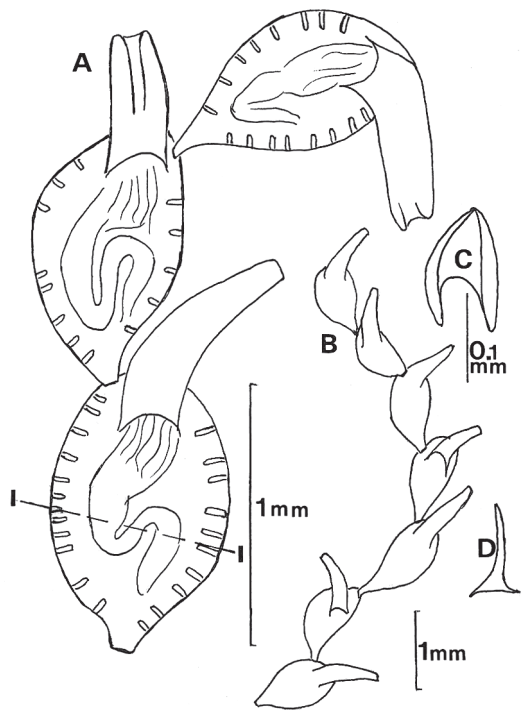

Figure 1. *Arachnoidea dhondti* sp. nov.. **A.** Three zooids in the holotype colony. **B.** Part of a colony (seven zooids). **C., D.** Crystalline structures. The line I - I indicates the approximate level of the section shown in Figure 6.

Figure 1. *Arachnoidea dhondti*. sp. nov., **A.** Trois zoécies de la colonie holotype. **B.** Une partie d'une colonie. **C., D** Structures cristallines. La ligne I - I indique le niveau approximatif de la coupe représentée Figure 6.

Diagnosis

Epizoic on the hermit crab *Parapagurus pilosimanus*. Zooids consist of a basal plate, measuring about 1 mm in length and 0.6 mm in width and an erect tube-shaped peristomium. The basal plate consists of a short proximal

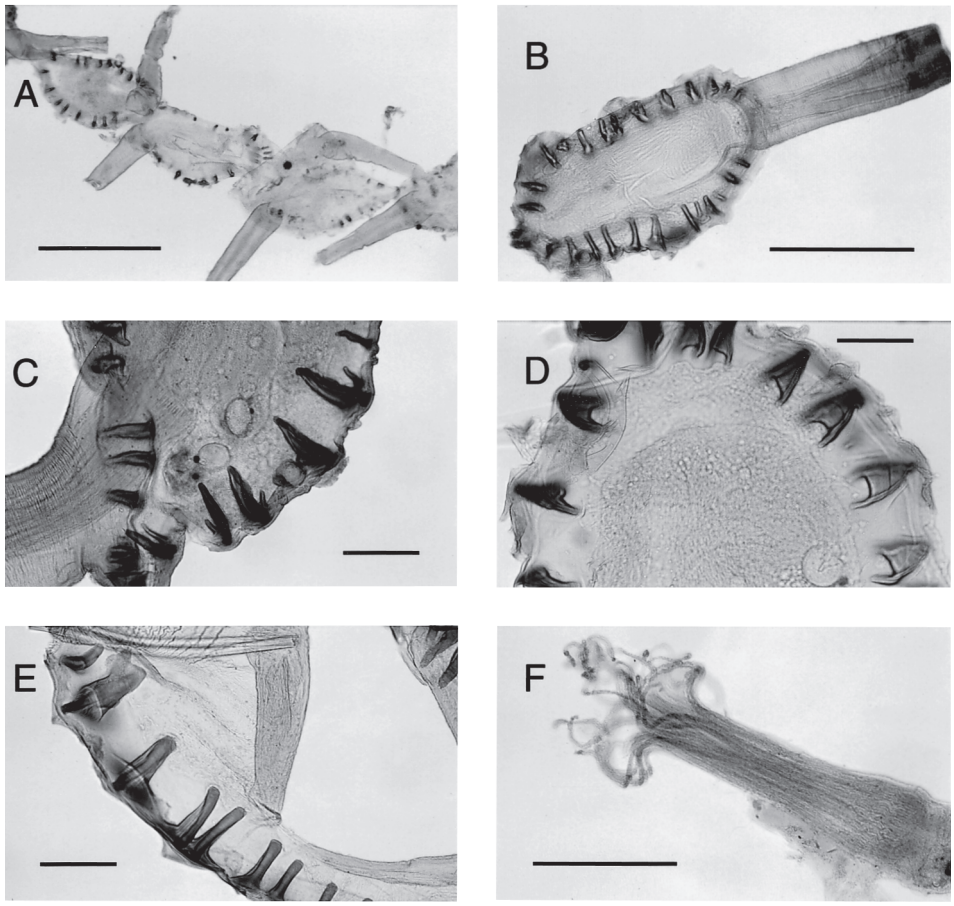

Figure 2. *Arachnoidea dhondti*, sp. nov.. Light microscopy. Whole mounts of zooids in polyvinyl-lactophenol with aniline blue. **A. P**art of a colony. **B.** One zooid. **C.-E.** Parts of zooids showing variation in morphology of the stained crystalline structures. **F.** Partly extended tentacles. scale bars A: 1mm; B,F: 0.5 mm; C-E: 100 µm.

Figure 2. *Arachnoidea dhondti.* sp. nov.. Microphotographies de zoécies montées dans du polyvinyl-lactophénol avec bleu d'aniline. **A.** Partie d'une colonie. **B.** Une zoécie. **C.-E.** Parties de zoécies montrant les variations morphologiques des structures cristallines colorées. **F.** Tentacules partiellement étendus. Echelles A : 1 mm ; B,F : 0,5 mm ; C-E : 100 µm.

part and a broad middle part. The distal part of the zooid is the peristomium, up to 1.8 mm long in everted condition. Zooids arranged in short, simple chains, linked to each other by the short cylindrical portion of the proximal part. Distinguishable from other members of the genus by a row of crystalline structures along the lateral margin of the basal plate, structures easily stained by aniline or methylene blue.

Description

The colonies are encrusting, forming linear chains or small patches on the anterior appendages of the hermit crab *Parapagurus pilosimanus*. Small colonies were also found on the eyes of the crab. In young colonies the zooids are arranged in short, simple chains, linked to each other by the cylindrical proximal part and the posterior end of the middle part (Figs 1, 2 A). In larger colonies, the zooids sometimes form flat irregular patches (Fig. 4 C). The zooids consist of a short, proximal part, and an oval middle part, together forming a broad basal plate. A distal portion has the shape of an erect tube-shaped peristomium. Each zooid is linked to neighbouring zooid by the short proximal part of the basal plate. Number of tentacles per zooid is up to 25 (Fig. 2 F).

The basal parts of a fullgrown, feeding zooid measure from 930 µm up to 1120 µm in length and about 500 up to 840 µm in width at its broadest part (Figs 1-5, Table 1). The length of the everted peristome is up to 1800 µm. Most animals in the sample have a retracted peristome, 490 to 710 µm in length.

Crystalline structures are present; lateral crenellations, typical of this genus, are absent, but the row of crystal-like structures on each side of the basal plate are considered to be homologous with the crenellations.

On whole mounts of animals embedded in polyvinyl-lactophenol with aniline blue, the crystalline structures stain deep blue. On LM sections (Fig. 6) coloured with methylene blue these structures stain deep blue whereas the cuticle of the cystid stains pale blue. Transverse LM sections of zooids show that the stained crystalline structures are situated betwen the dorsal and the ventral cystid wall (Fig. 6). They are often more or less flattened and approximately parallel to the frontal plane. The number of stained crystalline structures varies between four and 15 on each side. In young zooids, these structures are few or may be absent. Their shapes vary (Figs 1 C-D, 2 C-E, 3). In the conventional light microscope they often appear as an open cylinder or a narrow pointed cone, with a flat basal portion. Sometimes they resemble scales with the margins bent inwards (Figs. 1 and 2) and this is also the picture one gets with confocal microscopy (Fig. 3). Occasionally, a small body, a "daughter

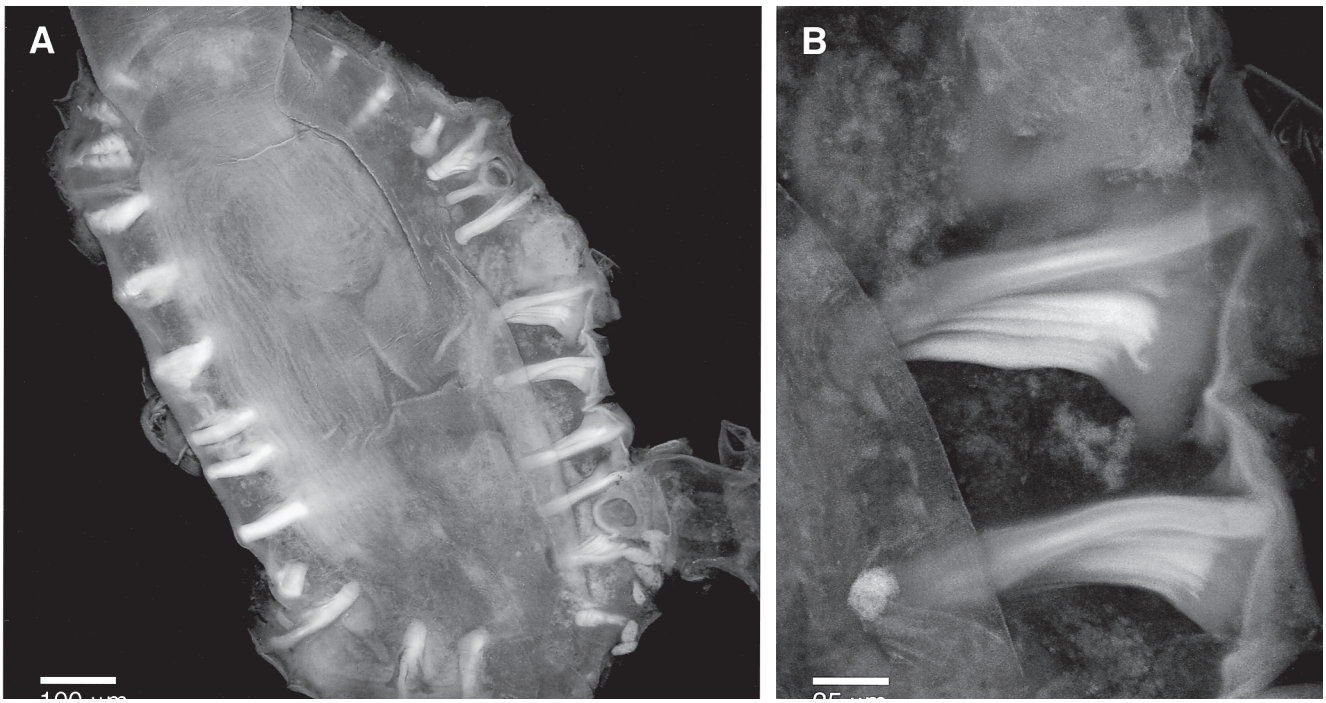

Figure 3. *Arachnoidea dhondti*, sp. nov. **A.** Confocal laser scanning microscopy of the zooid shown in figure 2B, revealing the stained crystalline structures. **B.** Detail of two stained crystalline structures.

Figure 3. *Arachnoidea dhondti*, sp. nov.. **A.** Photographie en microscopie confocale de la zoécie de la figure 2B révélant les structures cristallines colorées. **B.** Détail de deux structures cristallines colorées.

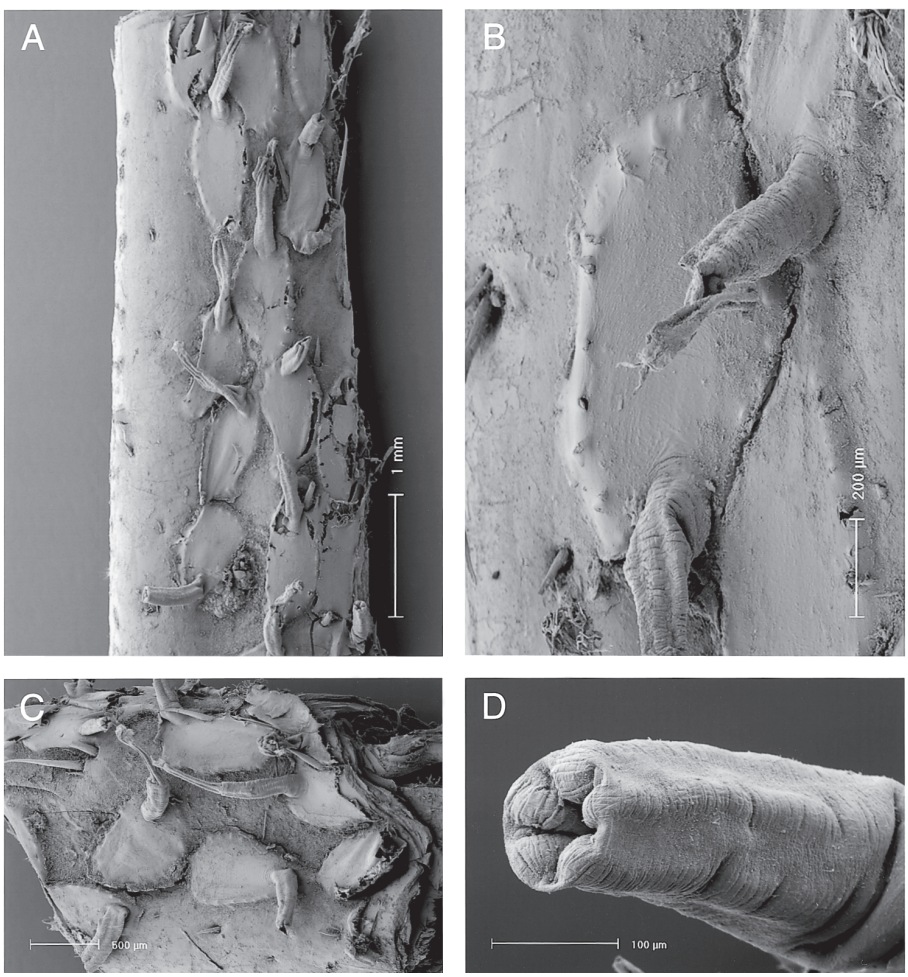

Figure 4. *Arachnoidea dhondti,* sp. nov.. SEM. Colonies attached to anterior appendages of the host animal, *Parapagurus pilosimanus*. **A.** Colony in linear chains. **B** Zooid in which the crystalline structures have burst. **C.** Zooids in a patch-like colony. **D.** The distal part of a peristome.

Figure 4. *Arachnoidea dhondti,* sp. nov.. MEB. Colonie attachée à un appendice antérieur de l'animal hôte. **A.** Une colonie en chaînes linéaires. **B.** Zoécie dans laquelle les structures cristallines sont cassées. **C.** Zoécie dans une colonie en forme de tache. **D.** Partie distale d'un péristome.

Table 1. Body dimensions of *Arachnoidea dhondti* sp. nov.
Table 1. Dimensions du corps d'*Arachnoidea dhondti* sp. nov

Measurements µm	$\bar{x}$	S	Range	n
Zooid				
length	1043	57.94	930 - 1120	10
width	582	113.31	500 - 840	10
Retracted peristome				
length	585	81.27	490 - 710	10
width	229	25.58	200 - 270	10
Everted peristome	1320	241.23	1050 - 1800	12

$\bar{x}$, mean;
S, standard deviation;
n, number of measurements.

crystalline stucture", is seen at the base of the normal crystalline structure (Fig. 2 C). Using confocal laser scanning microscopy the stained structures emitted light in the yellow-red range (580-630 nm) whereas unstained portions of the body, e.g. the stomach, the muscular system and the coelom, emitted in the green range (500-540 nm). However, part of the crystalline structures, mainly the centrally situated part, emitted light in the green range. This indicates that the structures are composed of materials of two different kinds. During preparation for scanning microscopy, they often burst, leaving a gap in the zooid wall (Fig. 4 B). The crystalline structures appear as specialized cuticular areas and probably have a supporting function.

The tube-shaped distal peristome is contractile and has a faint wrinkled structure. Usually it extends anteriorly at an angle of about 45 degrees in relation to the basal plate. The orifice is terminal on the peristome and is surrounded by a collar, about 120 µm long. Each zooid possesses a polypide bearing about 25 tentacles (Fig. 2 F) and a typical U-shaped digestive tract. The muscular system consists of the retractor muscle group and scattered parietal muscle fibers.

Discussion

According to d'Hondt (1983), the genus *Arachnoidea* Moore, 1903 could be split up into two subgenera *Arachnoidea s.s*. and *Arachnoidella* (d'Hondt, 1983).

The diagnosis for *Arachnoidea s. s*. d'Hondt (1983) was: Arachnidiidae with very long tubular peristome; encrusting part of zooid composed of a narrow and often long proximal portion, and with a broad basal plate generally bearing lateral crenellations. The frontal surface is not membranous. The zooid series are united by anastomosing filaments. *Arachnoidea s.s*. includes only the freshwater species, *A. raylankesteri* Moore, 1903, found in Lake Tanganyika.

In the subgenus *Arachnoidella* the zooid series were not connected by anastomosing filaments. D'Hondt & Mawatari (1987) have later stated that it was not necessary to split the genus *Arachnoidea* in two subgenera.

The following characters are of significance for the description and identification of the species within the genus *Arachnoidea* (see d'Hondt, 1983):

1. Proportion: length of proximal part / broad middle part of zooid.
2. Approximate number of lateral crenellations around the zooid.
3. Morphology of the lateral crenellations.
4. Proportion: peristomial length / basal plate length.
5. Peristome: either contractile, always wrinkled, or not contractile, never wrinkled.
6. Bathymetry and geographical occurrence: coastal species, or bathyal species, or abyssal species.

The three species *Arachnoidea protecta* Harmer,1915, *A. evelina* Marcus, 1937 and *A. barentsia* are all coastal species and differ from *A. dhondti* sp.nov. also in morphological characters. In *A. protecta*, the proximal part is slender and very elongated, the middle part is nearly as broad as long. There are few crenellations. The distribution is tropical Pacific Ocean, Celebes, 0-32 m (Harmer, 1915) and the Mediterranean, Sicily, (Chimenz Gusso et. al 1998). In *A. evelinae* the proximal part is long and thread-shaped and the lateral crenellations are few (3-5); the species is known from tropical Atlantic, Bahia de Santos, 20 m (Marcus, 1937). In *A. barentsia* the proximal part of the zooid is very reduced; the zooids are almost completely tightly packed together and are provided with numerous digitiform lateral processes. This is a coastal cold-water species.

The four species *Arachnoidea annosciae, A. dubia, A. prenanti* and *A. thalassae* are found in deeper water in the North Atlantic, like *A. dhondti* that however is morphologically distinct from them. *A. annosciae* is recorded from the Mediterranean (Genova Gulf) and from the Atlantic (English Channel, near Brest). The proximal part is elongated and the middle part oval, tapering distally. Both parts have numerous (up to about 45) rectangular lateral crenellations. This species is described from the Mediterranean, 200-250 m depth. *A. dubia* has a very small zooid and the proximal part is elongated, thread-shaped; there are no clear lateral crenellations. *A. dubia* was described from the Atlantic, between the Azores and the Bay of Biscay, 2095-2223 m depth. In *A. prenanti* the proximal part, the middle part and the peristome are of about the same length. This species has no clear lateral crenellations and the proximal part of the zooid is very elongated (750 µm). *A. thalassae* has a long proximal part, no crenellations and the peristome is cylindrical to sausage-shaped, not transparent, with numerous tight, ring-shaped grooves.

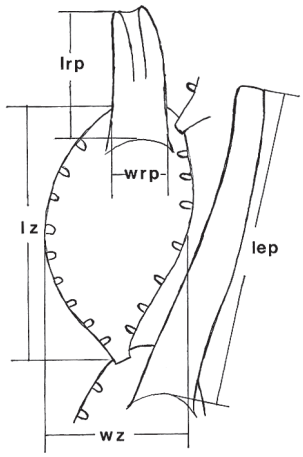

Figure 5. Measurements on zooids of *Arachnoidea dhondti*, sp. nov.. (*lep*) length of everted peristome, (*lrp*) length of retracted peristome, (*lz*) length of zooid (basal plate), (*wrp*) width of retracted peristome, (*wz*) width of zooid (basal plate).

Figure 5. Mesures prises sur les zoécies de *Arachnoidea dhondti*. sp. nov.. (*lep*) longeur du péristome étendu, (*lrp*) longeur du péristome rétracté, (*lz*) longeur de la zoécie (plaque basale), (*wrp*) largeur du péristome rétracté, (*wz*) largeur de la zoécie (plaque basale).

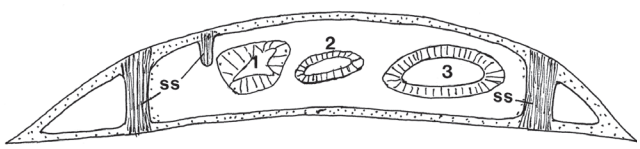

Figure 6. Transverse section of a cystid of *Arachnoidea dhondti*, sp. nov.. (*ss*) stained crystalline structures, (*1, 2, 3*) gut.

Figure 6. Coupe transversale de la zoécie de *Arachnoidea dhondti*.. (*ss*) structures cristallines colorées, (*1, 2, 3*) tractus digestif.

Two species of the genus *Archnoidea*, *A. brevicaudata* d'Hondt & Mawatari, 1987 and *A. ophidiomorpha* d'Hondt & Mawatari, 1987 are found in very deep water (3835 m) at oceanic hydrothermal vents (Japan) and do not have close morphological similarity with *A. dhonti*. In *A. brevicaudata* the proximal part is not well differentiated. The lateral crenellations are connected with crenellations from adjacent zooids forming parallel connections. *A. ophidiomorpha* has no sharp boundary between the elongated proximal part and the middle part o the zooid, and there are no crenellations. Finally, *Arachnoidea sp*. d'Hondt & Geraci, 1976 is poorly known. The zooids alternate with parts that may be stolons. If there are stolons, this species is not a typical *Arachnoidea*.

Arachnoidea dhondti sp. nov does not have typical lateral crenellations. These have been replaced by crystalline structures, bent upwards, along the lateral margins of the proximal and the middle portions of the zooids. These structures are presumably homologous with crenellations in other species of the genus. Generally there are about twelve of these structures on each side in a full-grown zooid. They are twice as many as the crenellations in *A. protecta*.

The proximal portion is rather well-differentiated but short, as in *A. brevicaudata* and *A. barentsia*. *A. brevicaudata* differs from *A. dhondti* in the fusion of crenellations, and A. *barentsia* differs in the presence of numerous digitiform processes.

The peristome generally is about the same length as the broad basal plate. In this character *Arachnoidea dhondti* resembles *A protecta, A. prenanti*, *A annosciae* and *Arachnoidea. sp*.. However, *A protecta* and *A. prenanti* both have a long proximal portion and *A. annosciae* has a large number of rectangular crenellations. *Arachnoidea. sp*. does not have crenellations. (d'Hondt & Geraci, 1976).

The colonies of *Arachnoidea dhondti* are present on the anterior part of the body, particularly on the appendages of the hermit crab *Parapagurus pilosimanus*. As filter feeding animal the bryozoan presumably can catch and utilize particles which are suspended in the water when the hermit crab is eating.

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References

Chimenz Gusso C., d'Hondt J.-L., Nicoletti L. & Galluzzo Cusciano G. **1998**. Finding *of Arachnoidea (Arachnoidella) protecta* Harmer, 1915 (Bryozoa, Ctenostomida, Arachnidiidae) in the Mediterranean Sea. *Italian Journal of Zoology*, **65**: 235-238.

Harmer S. F. 1915. The Polyzoa of the Siboga Expedition, Part 1. Entoprocta, Ctenostomata, Cyclostomata. *Siboga Expeditie*, **28 a**, pp. 1-180, pl.1-12.

Hayward P. J. 1985. Ctenostome Bryozoans. *Synopses of the British Fauna*. (*New Series*.), **33** (D.M. Kermack & R.S.K. Barnes eds). Brill / W. Backhuys, London. 169 pp.

d'Hondt J.-L. 1975. Bryozoaires Cténostomes bathyaux et abyssaux de l'Atlantique Nord. Documents des Labobratoires de Géologie de la Faculté des Sciences de Lyon, HS **3.** In: *Bryozoa 1974*, *Proceedings of the Third Conference, International bryozoology association* (S. Pouyet ed), pp. 311-333, 8 figs. Villeurbanne, Impr. du Département des sciences de la terre : Lyon.

d'Hondt J.-L. 1978. Nouveaux Bryozoaires bathyaux et abyssaux. *Bulletin de la Société zoologique de France*, **103** (3): 325-333.

d'Hondt J.-L. 1983. Tabular keys for identification of Recent Ctenostomatous Bryozoa. *Mémoires de l´Institut Océanographique Monaco*, **14**: 1-134.

d'Hondt J.-L. & Geraci S. 1976. *Arachnoidea annosciae* n. sp., nouveau Bryozoaire Cténostome Arachnidiidae du Golfe de Gênes. *Annali del Museo Civico di Storia Naturale di Genova*, **81:** 139-152.

d'Hondt J.-L. & Hayward P.L. 1981. Nouvelles récoltes de Bryozoaires Cténostomes bathyaux et abyssaux. *Cahiers de Biologie Marine*, **22**: 267-283.

d'Hondt J.-L. & Mawatari S.F. 1987. Description de deux nouvelles espèces d´*Arachnoidea* (Bryozoa, Ctenostomida) provenant de la campagne océanographique KAIKO I (Japon). *Cahiers de Biologie Marine*, **28**: 373-380.

Kluge G. A. 1962. Mshanki Severnykh Morei SSSR. *Opred. Faune SSSR*. **76:** 1-584.

Kluge G. A. 1975. *Bryozoa of the northern seas of the USSR*. - Amerind Publishing Co., New Delhi, 711 pp., 404 figs. (Translated from Russian.)

Marcus E. 1937. Briozoarios marinhos brasileiros. 1 **.** *Boletim de Faculdade de filosofia, ciencias e letras Universidade de Sao Paulo serie Zoologia*, :1-234.

Ryland, J. S. 1970. *Bryozoans*. Hutchinson University Library. London, 175 pp.