

NEW ADDITIONS TO THE FAUNA OF BRYOZOA CHEILOSTOMATA OF THE BLACK SEA.

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Abstract

*Investigation of the fauna and flora in the Black Sea has started during the eighteenth century earlier than in other marine and freshwater basins this part of the World. Literature data were analyzed together with new data obtained and it permitted to revise the bryozoan fauna. New genus *Miravitrea* and new species *Miravitrea reingardtae* for the fauna were described. The sea inhabits sixteen species and one variety cheilostomate bryozoa which are mainly autochthonic elements.*

Key words: *Bryozoa, Cheilostomata, new species, fauna, ecology*

1. INTRODUCTION

Some papers about Bryozoa of the southern Russian Seas have published in the second part of the XX century. We follow Gontar (2012) in the present paper and offer new data about the bryozoan fauna of the Black Sea according to current status.

2. HISTORY OF INVESTIGATION

It is strange but there were not publication until 1960 which could serve as a key for an identification of Bryozoa of the southern Russian seas.

Paper of Braiko (1968) was devoted to Bryozoa of the Black Sea and she described from the order Cheilostomata the following species (names of species as they were described by Braiko): *Membranipora aurita*, *Membranipora denticulata*, *Membranipora crustulenta*, *Membranipora pilosa*, *Membranipora zostericola*, *Lepralia turgenewi*, *Lepralia Pallasiana*, *Lepralia pallasiana* f. *Bifoliata*, *Schizoporella linearis*, *Schizoporella auriculata*, *Schizoporella dolgopolsky*, *Scrupocellaria berthollettii* var. *capreolis*. Descriptions of species given by Braiko were short, although her figures of species were more detailed.

Tyana Gryncharova (1977) has published a paper about Bryozoa of the Bay of Ropotamo' the Gulf of Burgas and reported to *Electra pilosa* (L., 1767), *Electra crustulenta* (Pallas, 1766), *Conopeum reticulum* (L., 1767), *Conopeum seurati* (Canu, 1928).

Tyana Gryncharova (1980) has published other paper with description of new species *Electra pontica* Gryncharova of the Bay of Ropotamo' the Gulf of Burgas.

Monograph of Braiko (1983) in Ukrainian language in the «Fauna of Ukraine» was devoted to Bryozoa of the Black Sea. She mentioned in it the following species from Cheilostomata order: *Aetea erecta* Hincks, *Conopeum seurati* (Canu) (according to Braiko it had as synonyms *M.denticulata*, *C.reticulum*, *C.seurati* Зевиной), *Electra crustulenta* Borg, *Electra monostachys* (Busk), *Electra pilosa* (L.) (synonym *M. Repiachowi*), *Electra zostericola* (Nordmann), *Callopora aurita* (Hincks), *Scrupocellaria berthollettii* Aud var. *capreolus* Heller, *Schizoporella linearis* (Hassall), *Schizoporella auriculata* (Hassall) (synonym *Sch. Dolgopolsky*), *Lepralia turgenewi* (Ostroumov), *Lepralia pallasiana* (Moll, 1803).

Gontar (2013) revised the collection of the Cheilostomata order in the Zoological Institute RAS (Saint Petersburg) and described some new species for the fauna in the Black Sea. The last mentioned species were found near the Bosphor Strait and, probably, as has described by Ostroumov, have invaded from the Mediterranean Sea. New genus described for the endemic Black Sea species *Braikovia turgenewi*. New species *Tendra pontica* (Gryncharova) was described by Gryncharova and included in the full list of species of the Black Sea. For all species was given current systematic position. Thus, according to literature data it is known 16 species and 1 subspecies of Cheilostomata in the Black Sea.

It is necessary to quote in detail in the present article all reports in literature about representatives of the genus *Conopeum* in the Black Sea to illustrate the difficult situation which has developed so far with definition of species of the genus *Conopeum* in our southern seas. According to Ostroumov «the fauna of the sea consists from: 1) from Mediterranean immigrants; 2) from the remains of the fauna which were directly preceding till

penetration of the Mediterranean forms, i.e. before communication of the Black Sea with the Mediterranean Sea; 3) from the remains of more ancient fauna, Sarmatian (*Membranipora reticulum*). Immigrants, depending on relative flexibility of their organization, anyway have changed under the influence of conditions of a new habitat». In the work on Bryozoa of the Sevastopol bay he has defined this species as *Membranipora denticulata* Busk. In the description of *M. denticulata* he nevertheless, has written: « Note: Perhaps, the history of development will show us that under the name *M. denticulata* two species connects. Data for such assumption consist in distinction of their habitat, a way of growth of colonies. Colonies of this Bryozoa species on piles and coastal stones in desalinated water, such as, in the Gulf of Odessa and the Kerch Bay and near Sevastopol in the top of the Quarantine bay, remind *Flustra* in a mode of vegetation, rising in the form of the curved plates consisting of two colonies, put together by the basal sides. The colonies which met on rather deep water (in Sevastopol, Feodosiya, Sukhumi) on shells of big mussels, oysters, always closely adjoin to a substrate by one layer in the form of a plate or even narrow tapes...». From Ostroumov's statements it is possible to draw a conclusion that the colonies was probably represented by two different species

Braiko mentioned for the Black Sea *Conopeum reticulum* (L.), describing its colonies as a crust on underwater subjects and *M. denticulata* was referred to a synonym. Afterward Braiko described for fauna of the Black Sea and the Sea of Azov two species: *M. denticulata*, having noted that it is very similar to *Conopeum seurati* (Canu), and *M. crustulenta*. Further in the work about the Bryozoa of Ukraine Braiko has refer to a synonym with *Conopeum seurati* the species of *Conopeum reticulum* which she described in the work, and wrote: «In the Black Sea and Azov basins one species of this genus was marked», having complicated the situation even more. Figures of *Conopeum seurati* from the Black Sea were not enough detailed also and have not permitted to draw an unambiguous conclusion. Braiko also written about three forms of species.

Zevina has noted *C. seurati* as the first find in the Black Sea. She mentioned that earlier this species was mixed with *Electra crustulenta* and *Conopeum reticulum*.

It is necessary to emphasize that *C. reticulum* lives mainly in marine conditions, in the Black Sea up to 30 %. *C. seurati* meets more often in the estuarine and the brackish water conditions; it was marked even in fresh waters.

Some new species in the fauna of the Black Sea are identified by us in A.A.Ostroumov and A.I. Alexandrov's collections. These are those species which were found near the Bosphorus Strait and probably as written by Ostroumov, they invaded from the Mediterranean Sea.

3. SYSTEMATIC PART

Suborder MALACOSTEGINA Levinsen, 1902

Superfamily Membraniporoidea Busk, 1854

Family Electridae Stach, 1937

Genus *Conopeum* Gray, 1848

Conopeum seurati (Canu) (Fig.1)

Conopeum seurati Prenant et Bobin, 1966:127-131, fig. 33,34; Braiko, 1983:77-80, fig. 17; Gruncharova, 1977:88-91.

Membranipora denticulata? Braiko, 1968:410, Table.I, fig.2.

Material: The Black Sea, 6°6'W, 45°52'S, St.24, depth 53,3–68,3m, On *Mytilus* shells, 19.05.1891, «Donets», Coll. A.A.Ostroumov

The Black Sea, The Sunny Beach Bay, 06.06.2013, intertidal zone, on the shells of living *Rapana* sp., Coll. V.I.Gontar.

To the description of the species of Bobin и Prenant, 1966 we added own observations for colonies from the Black Sea.

C. seurati – very variable species; although (with the exception of some characteristic of organization, which will be defined more exactly later) these modifications have not geographical significance and can exist in the same colony. Thus we can give general description.

Colonies have very changeable shape, – incrustated, flat or uneven, sometimes as irregular blades. Colony shape can influence autozooids shape. On the wide substrata autozooids are arranged by regular mode (in the beginning of colony development), as in Fig. 1 B, C. Their opesia is typical oval then, and the relation of their length to

their width can change from 1,5 to 2. On narrow or cylindrical substrata autozooids are more stretched. Their opesia has a shape of in the form of a rectangle with the rounded corners which length can exceed width considerably; while on outstanding parts of a colony autozooids renew a common shape. There are all transitions between these various forms. Numerous underdeveloped autozooids can be of deformed and the reduced size. New autozooids are situated on the colony margin. (Fig.1 D)

Operculum of *C. seurati* has a shape which is typical for genus *Conopeum*: opercular plane is bordered by complicate wide and flexible membranous formation, which occupies the entire free circumference. This membrane is stretched by two thin arches, and is colourless in youth and then brown.

When operculum closes an opening, it is enclosed with distant edge of the opening which is equipped of narrow and thinner colourless membrane. Flatness of operculum is not calcareous.

Cryptocyst of *C. seurati* can be visible from frontal side as notches inside of opesia. Very changeable notches can vary from simple festoons to very sharp spinules, which are located in some lines sometimes in some plans (Fig.1, E). Very submerged proximal cryptocyst well differs from a basal surface. Gymnocyst is very reduced.

Autozoid margin is prominent and quite strongly calcified but remains however thin, surrounding a basal wall, and it isn't visible there neither immersions, nor the distal outgrowths as at *C. reticulum*. There are not in corners of autozooids also of three-angle spaces as in *C. reticulum*, nor of very small underdeveloped autozooids scattered in irregular areas of a colony, nor of three-sided regions of the calcified gymnocyst which are situated always between oval opesia. This mishmash between *C. reticulum* and *C.seurati* meets very often.

Quite often there is pair of distal spines, chitinous or more or less calcified. The margin can bear also calcareous spinules which aren't the real spines, but rather outstanding, sometimes long crystals: it occurs, mainly, in case of unusual contacts between colonies or parts of colonies. Presence or lack of spines and spinules the most unimportant characters among elements of modifications in a colony that gave a reason of Canu and Bassler to describe different species, although in the same zoarium can find of various autozooids with different degree of developments of these characters.

Ancestrula (115-340 micron in width and 285-300 in length) smaller (Fig.1A), than regular autozooids (215 - 370 micron in width and 360 - 650 in length). It differs from them also by presence of uniform and corrugated on edge of gymnocyst surrounding opesia. On the one side and on the other side of operculum are situated of a pair distal spines typical for the species similar to that existing sometimes in normal autozooids. In our colony of spines weren't found, probably, didn't preserve.

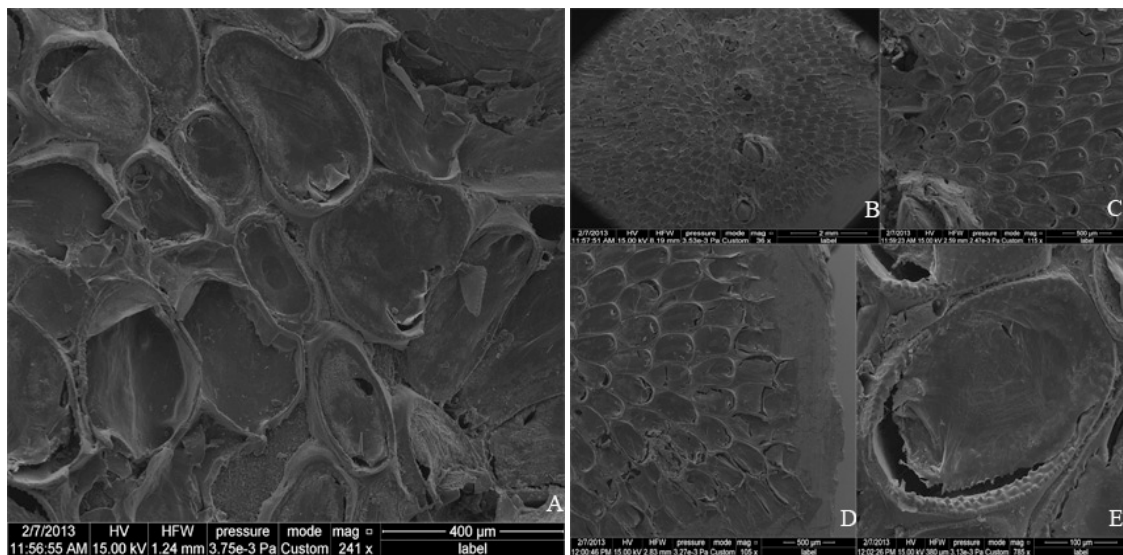


Fig.1. *Conopeum seurati* (Canu) A- ancestrula and two periancestrular zooids at distal and proximal ends of ancestrula; B-colony; C-arrangement of autozooids in the colony; D-colony margin; E-autozooids with denticulate cryptocyst.

Superfamily Membraniporoidea Busk, 1854

Family Electridae Stach, 1937

Genus *Miravitrea* Gontar

Diagnosis of genus: Colony small, delicate, autozooids are arranged fan likely. Autozooids transparent or semitransparent, of Irregular Square or hexagonal oblong shape. On colony margin are situated not fully developed young autozooids. Opesia occupies whole frontal and coincides with shape of autozooids. Cryptocyst is absent. Opening and operculum of autozooid are in horseshoe-shaped. Colonies were covered by diatoms.

Miravitrea reingardtae Gontar (Fig.2)

MATERIAL

Holotype № 1/19-2014: The Black Sea, near Feodosia opposite Meteor, near swimming bath of the city, St. 43, depth. 8,5m, *Zostera*, 05.07.1913, dredge, Coll.A.I.Aleksandrov.

Paratypes №2/20-2014: The Sea of Azov, the Utlyukskiy estuary, near Atmanay river, St. 93, depth. 6,5m, 17.08.1913, ground: *Zostera* sp., algae, trawl Sigsbee, Coll.A.I.Aleksandrov;

№ 3/21-2014: The Sea of Azov, the Utlyukskiy estuary, St. 96, depth. 8,5m, 17.08.1913, ground: silt, some *Zostera* sp., Coll.A.I.Aleksandrov.

Description: Colony small (1,9 X 1,87 mm), delicate (Fig.2A), Number of autozooids in colony do not reaches more twenty. Autozooids transparent or semitransparent, of Irregular Square or hexagonal oblong shape (Fig.2 B, D, E). Autozooids small (length: 0,5-0,6 mm, width: 0,5-0,6 mm), are arranged in chess order (Fig.2A), are divided by raised margins (Fig.2E). Frontal is tightened by transparent frontal membrane (Fig.2F). Opesia occupies whole frontal and coincides with shape of autozooids (Fig.2F). Cryptocyst is absent. On colony margin are situated not fully developed young autozooids (Fig. 2F). Opening and operculum of autozooid are in horseshoe-shaped (Fig. 2D, F). Height of opening: 0,16 mm, width of opening:0,14 mm. Almost whole surface of autozooids was covered by diatoms (Fig.2B,E).

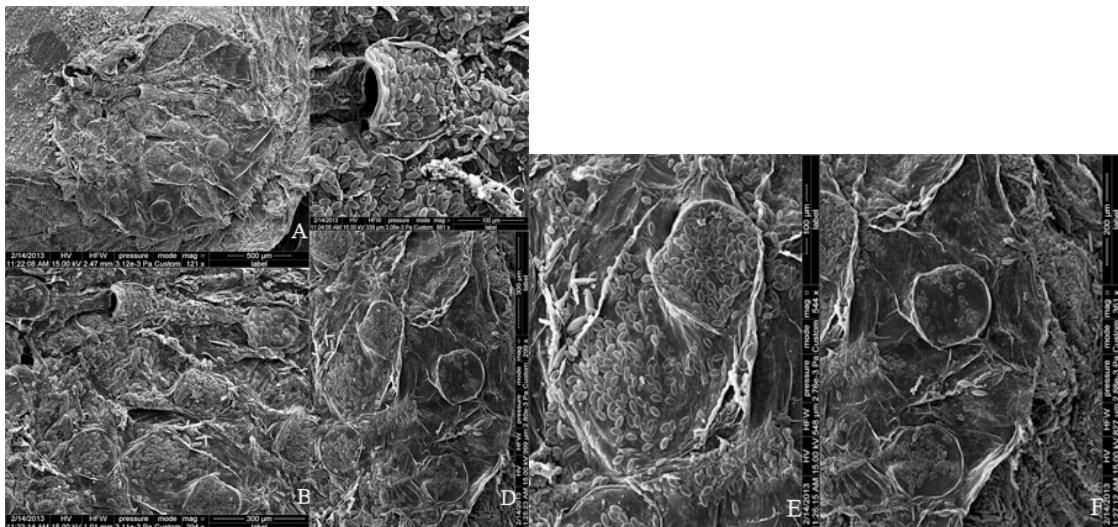


Fig.2. *Miravitrea reingardtae* Gontar A-colony; B-autozooids; D-colony margin; E-autozooid with diatoms; F-transparent autozooids and new autozooids at colony margin

Etymology: The species is named after V.V. Reingardt, who studied Bryozoa in the Black Sea.

Incertae sedis

Family Tendridae Vigneaux, 1949

Genus *Tendra* Nordman, 1839

Tendra zostericola Nordmann, 1839 (Fig.3)

Membranipora zostericola Braiko, 1968:411, Table.I, fig.5; *Electra zostericola* Braiko, 1983:87-90, fig.23.

Material: The Black Sea, to the north of Tendra estuary, St.14, bank 52, depth. 262,4m, 05.05.1913, «Nadir of baron V.A.Mass», Sigsbee trawl, Coll.A.I.Aleksandrov; the Black Sea, near Skadovsk, near Krasnoye village, the Jarylgach Bay, St. 33, depth. 4,26-8,52m, 16.05.1913, dredge, «Nadir of baron V.A.Mass», Coll.A.I.Aleksandrov; the Gulf of Tendra, near Belye Kuchugury, St. 21, Cup 80, depth. 6,5-19,5m, 10.05.1913, ground: *Zostera* sp. и *Ulva* sp., dredge, Coll.A.I.Aleksandrov; The Sevastopol Biological Station, the Big Raid near the Black river, Cup 196, 1913, ground *Zostera* sp., Coll.A.I.Aleksandrov.

The Black Sea, The Gulf of Burgas 08.06.2013, organic matter washed up on the shore, Coll. V.I.Gontar

Colonies often in ribbon shape, because ancestrula forms two buds on the its opposite ends or one bud on the distal end and other bud a little lower at the side. Therefore colony grows as a ribbon, using *running* strategy (Fig.3B). Well developed colonies as a crusts found on *Zostera* sp covered *Zostera* from both sides. It is often possible to see how the colony could create the second layer on already existing single-layer colony. This second layer develops as a chain autozooids. Sometimes the adjacent rows of autozooids are created so that autozooids are directed in an opposite direction. Sometimes there is an accretion of the basal surfaces of zooids. Autozooids of the extended oval shape (Fig.3 B,C, E) with the rounded distal edge and slightly concave proximal edge, of average size (length: 0,525–0,67mm, for new zooids on the colony margin: length: 0,25–0,375mm, width: 0,6–0,625mm, for new zooids on the colony margin 0,25-0,325mm). The aperture occupies two thirds or nearly all of frontal surface, an oval shape, is slightly expanded closer to proximal part (length: 0,5–0,575 mm, for new zooids on the colony margin 0,25–0,275mm, width 0,525–0,575mm, for new zooids on the colony margin 0,25–0,3mm). Operculum semicircular (Fig.3F,I). Gymnocyst smooth, semitransparent, shiny, weakly calcified, is developed in proximal part and can occupy to one third of frontal surface. Frontal membrane transparent, chitinous, under it appears through polypide with 12 tentacles (Reingardt, 1875). Between autozooids sometimes are situated small irregular-shaped zooids, possibly remained undeveloped. Often autozooids have irregular oval shape – they narrower and are bent in one or other side. Sometimes autozooid of almost equal length and width and gives rise of two new zooids at distal end. Zooidal aperture on edge bears from three to seven hollow spines which can vary in size (Fig.3 C). Three spines are existed almost always: two in distal part, sometimes they are very long, one in proximal part of zooids. Often two proximal spines are very weakly developed and almost inconspicuous (Fig. 3 I), and the proximal spine in general is absent. On each side of aperture there are additional spines. During reproduction are formed modified zooids of smaller length and width (length: 0,35–0,40mm, width 0,175–0,225mm) (Fig.3 B,D,E,F). Between last mentioned and regular zooids exist few zooids with gradual increase in quantity of spines (from 4, further 8, etc.) (Fig.3B, C, F).

Orifice has a semioval shape at these zooids, with proximal edge slightly concave in space of orifice. Height of orifice of them is 0,125–0,175mm, width 0,125mm. At the following zooid the greater number of spines is formed (14–24), which merge over aperture and form a translucent lattice cell which serves as analog of ovicell. Basal wall is transparent. Four pores are situated in the lateral wall of zooid, sometimes they are three or five (according to Reingardt, 1875).

Distribution. Common species in the Black Sea near sea shore of Russia, Ukraine, as well as Bulgaria – in the Bay of Ropotamo, the Gulf of Burgas, the Sunny Beach Bay, and near northern coast of Bulgaria, near Tuylenevo village.

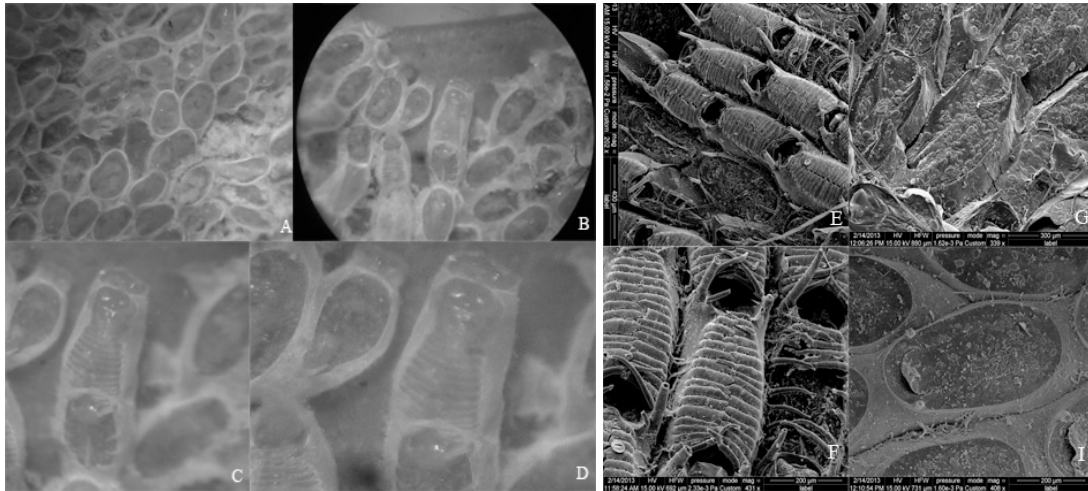


Fig.3. A,E– fragments of colonies of *Tendra zostericola* Nordmann; B–colony margin of *T.zostericola*; C,D,F– formation of new zooid for larvae; D,E,F–autozooids with merged spines over frontal; G –autozooids with two distal spines, I–autozooids with underdeveloped distal spines.

Suborder Neocheilostomina d'Hondt, 1985

Infraorder Flustrina Smitt, 1868

Superfamily Calloporoidea Norman, 1903

Family Calloporidae Norman, 1903

Genus *Crassimarginatella* Canu, 1900

Colony incrusting or vertical, bilayer or horizontal from incrusting base. Autozooidal cryptocyst is moderately developed, or very narrow, opesia occupies major part of frontal surface. Gymnocyst is conspicuous or much reduced. Vicarious avicularia with- or without pivot bar. Ovicells generally with crescent frontal area or small cap-like and can be closed by autozooidal operculum. *Mural* septula or basal pore chambers are present.

Crassimarginatella crassimarginata (Hincks, 1880) (Fig.4)

Material: The Black Sea, near the Bosphorus Strait, 41°15′-0°57′, St. 53, depth. 59,7m, 05.06.1891, «Donets», Coll.A.A.Ostroumov.

Colony incrusting light. Autozooids are well divided from each other, elliptical or oval in a shape, more or less elongated. Gymnocyst is often very weakly developed. Opesia is elliptical. Cryptocyst is sufficiently wide with smooth inner boundary. Setting of opesia is prominent, curved, and finely granular, expanded proximally and narrowed distally. Spines are absent commonly, although some unusual spines were found including a pair closely situated small spines at distal end. Two septula are in lateral wall and one in distal wall. The most remarkable feature is a presence of vicarious avicularia which can almost reach of size of autozooid. Their frame is thickened and rounded mandibula is situated in central calcified and avicularian chamber has a shape of Arabic figure 6. Mandibula can vary from elongated narrow to semicircular in a shape or even wider. Mandibula can bear mucro at the end often. Ovicells are inflating, prominent, wide, deeply embedded and isolated from autozooids. During its development primary ectooecium on frontal of ovicell has noncalcified frontal area and subsequently extend through this area. Median narrowing subdivides it in two, but membrane area can disappear and ovicell becomes uniformly calcified with costa or without transverse costa. Ancestrula is small and common shape. Near with it there are sometimes closed zooids with median round pore.

Sizes:

Zooecial length: 450 -680 micron;

Zooecial width: 380- 500 micron;

Length of: 300-480 micron;

Width of opesia: 250- 400 micron;

Length of avicularium : 150- 300 micron (more often 250 micron).

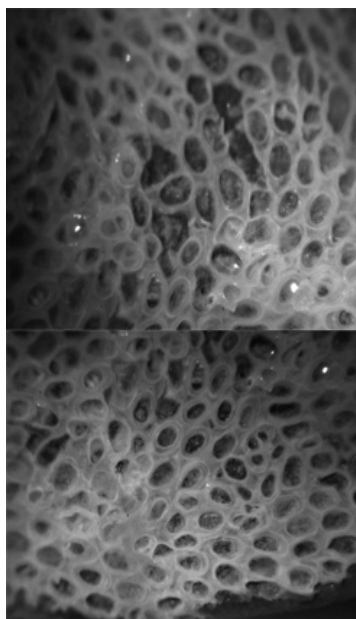


Fig.4. *Crassimarginatella crassimarginata* (Hincks)

Species meets commonly in warm water, but Hastings (1945) has demonstrated that species has mixed with other species often and its distribution seemingly is limited by some relatively warm water regions in the Northern Atlantic (Madeira and probably Cape Verde) and Mediterranean Sea. It often meets on fragments of corals, shells or limestone, on calcareous seaweed and so on; it is especially frequent from 40 to 80m. At Naples it was noted in shallower waters, but probably some specimens were mixed up with *Corbulella maderensis*. In the Mediterranean Sea ovicells were registered from March to December, embryos from June to September. As fossil were registered in Eocene of Florida and Carolina (Canu et Bassler).

“Grade” Lepraliomorpha Gordon, 1989

Superfamily Smittinoidea Levinsen, 1909

Family Bitectiporidae MacGillivray, 1895

Genus *Schizomavella* Canu et Bassler, 1917

Schizomavella auriculata (Hassall, 1842) (Fig.5)

Schizoporella auriculata Braiko, 1968:412; 1983:96-98, fig. 29, 30.

Schizoporella dolgopolsky Braiko, 1968:412.

Material: The Black Sea, 1°9′W, 41°17′–41°16′S, St.54, depth.62–96m, 05.06.1891, «Donets», Coll. A.A.Ostroumov; St. 27, on shells; 45°2′–6°5′, St. 25, depth. 15m, 24.05.1891, «Donets», Coll. A.A.Ostroumov.

The Black Sea, the Kara-Dag Mountain, between Otuz (Shchebetovka) to the Kosy village, St. 68, 8,5–10,7m, ground: *Cystoseira* and *Phyllophora*, 17.07.1913, Cup 311, Coll. A.I.Aleksandrov; the Yarylgach Bay, the Karkinit Bay, St.37, depth. 21,33m, ground: *Phyllophora*, *Cystoseira*, sand, 18.05.1913, trawl, «Nadir», Coll. A.I.Aleksandrov; St. 4, depth. 10,7m, 30.04.1913, dredge, «Nadir», Coll. A.I.Aleksandrov.

Colony incrusting, consisting of autozooids, Colony incrusting, consisting of autozooids which are situated in short straight rows and slanting rows, in the fixed condition of white color (Fig. 5A, C). Autozooids small (length 0.375mm–0.5mm, width 0.3mm–0.375mm), short, wide, almost rectangular, in young age with raised margin, along which and on frontal surface are situated pores. Between pores frontal convex wall is irregularly calcified thanks to its surface become tuberos and raised margins become less observable. Frontal of young autozooids is vitreous, semitransparent. At distal margin is situated rounded primary orifice with small sinus with rounded end which is situated in the centre of orifice (Fig.5B, E, G) and thanks to flanked condyles becomes deeper. Directly at a sinus is situated the outstanding conic avicularian camera with steeply or nearly steeply inclined to an opening зооида very small avicularium approximately on width is equal to sinus on its end (Fig.5G,I). Avicularium has a semicircular upper mandible. Avicularium can be absent. Ovicella hiperstomial, round, convex (height 0.25–0.275mm, width 0.25–0.325mm) with incompleteness a calcified external layer and a calcified frontal wall of the inside layer covered with a small pores (Fig.5E,F). In lateral and distal walls on six simple pores situated along a basal wall.

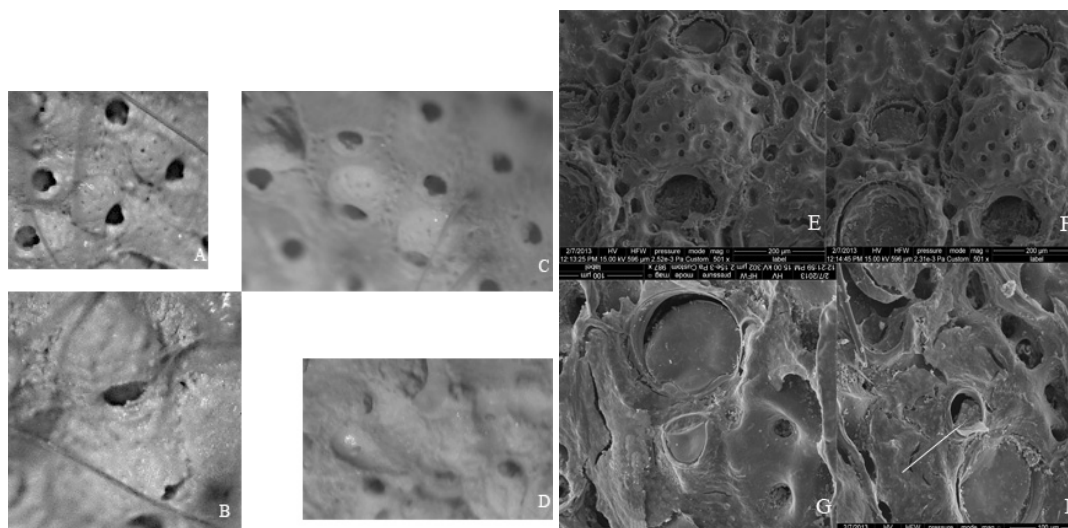


Fig 5. *Schizomavella auriculata* Hassall A, B, C. Some autozooids with ovicells; B. Autozooid with ovicell and avicularium; E,F. Autozooids with ovicells. D. *Hippothoa* sp. на *Schizomavella auriculata*; G,I- autozooid with avicularium.

Reproduction occurs in the Black Sea during whole year. Larvae have orange colour.

Ecology. It was found on algae, ascidians, hydroids, shells and stones, at depths of 5 to some hundred meters.

Distribution: Near the Britain Islands, near Woods Hole, near California, northern part of the Japan Sea, the Mediterranean Sea, the Adriatic Sea and the Black Sea.

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