SCIENT. MAR., 53(1): 53-57 1989

Siphonophores (Cnidaria, Hydrozoa) collected during the "Magga Dan" Expedition (1966-67) from Africa to Antarctica*

FRANCESC PAGÈS & JOSEP-MARIA GILI

Institut de Ciències del Mar, Passeig Nacional s/n, 08003 Barcelona. Spain.

SUMMARY: Nine species of siphonophores were collected during the Belgian "Magga Dan" Expedition in a transect from South Africa to Antarctic waters between December 1966 and February 1967. Two species were recorded for the first time in Antarctic waters: *Bargmannia elongata* and *Nanomia bijuga*. The bracts of *Thalassophyes crystallina* were found and described from material collected during this expedition. Two substantial colonies of *Mica micula* allowed a redescription of species and its systematic position is discussed.

Key words: Siphonophora, *Mica micula, Thalassophyes crystallina,* Antarctic waters.

RESUMEN: SIFONÓFOROS (CNIDARIA, HYDROZOA) RECOLECTADOS DURANTE LA CAMPAÑA «MAGGA DAN» (1966-67) DESDE SUDÁFRICA HASTA LA ANTÁRTIDA. En la campaña «Magga Dan», se muestreó un transecto de estaciones desde Sudáfrica hasta la Antártida entre diciembre de 1966 y febrero de 1967. Se recolectaron nueve especies de sifonóforos de las cuales dos se dan a conocer por primera vez en aguas antárticas y se describe también la bráctea de *Thalassophyes crystallina.* La recolección de dos colonias de *Mica micula* ha permitido redescribir esta especie con mayor detalle y comentar su posición sistemática.

Palabras clave: Sifonóforos, *Mica micula, Thalassophyes crystallina,* Antártida.

INTRODUCTION

In most published studies of zooplankton in Antarctic waters there is a marked interest in the biology of certain species because of their greater abundance and economic interest, such as Euphausiacea *(Euphausia superba).* With regard to other taxonomic groups, the most abundant species are: *Sagitta gazellae* (Chaetognatha), *Salpa thompsoni* (Salpidae), *Themisto gaudichaudi* (Amphipoda) and *Calanoides acutus* and *Calanus propinquus* (Copepoda) (e.g. EL-SAYED, 1985; PIATKOWSKI, 1987).

The siphonophores have not been widely studied in the Antarctic, and most information refers to *Dimophyes arctica* and *Diphyes antarctica* (KRAMP, 1947; IKEDA & BRUCE, 1987), although the fauna in Antarctic waters consists of approximately 15 species, which constitute only 10 % of all known species of Siphonophora. The studies by MARGULIS (1977, 1982a, b), ALVARIÑO & FRANKWICK (1983) and ALVARIÑO & WOJTAN (1984), in which new species were described, are proof of our scant knowledge of Siphonophora in polar waters. On the other hand, the Siphonophora, together with other gelatinous zooplankton, seem to play a prominent role in the trophic chain in Antarctic waters, particularly as components in the diet of fish (HOSHIAI, 1979; DUHAMEL & HUREAU, 1985). In this article, the samples of siphonophores collected by the Belgian vessel "Magga Dan" (1966-67) in the Antarctic sector situated off the southern tip of Africa are analyzed.

* Recibido el 1 de junio de 1988. Aceptado el 19 de marzo de 1989.

MATERIALS AND METHODS

The hauls were carried out using Indian Ocean standard nets (CURRIE, 1963) with vertical depth ranges between 4500-0 and 250-0 metres. The mesh size was 300 μ. The characteristics of the hauls are described in some prior studies carried out on Euphausiacea (CASANOVA, 1980) and Chaetognatha (DUCRET, 1973). Of the 33 hauls (at 17 stations) along a transect between the southern tip of the African Continent and the Antarctic (fig. 1), siphonophores were found in 15 (9 stations).

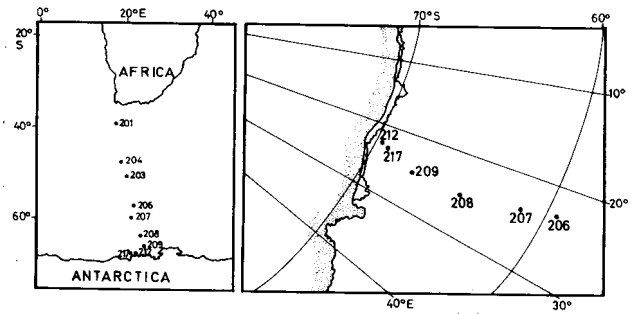

FIG. 1. — Stations in the survey area where specimens of siphonophores were collected.

RESULTS AND DISCUSSION

Bargmannia elongata Totton, 1954

Specimen collected: E-208, one nectophore.

Remarks: This physonectid, despite having been collected on few occasions, has a wide geographical distribution (ALVARIÑO, 1971). The nectophore collected conforms to the characteristics described by KIRKPATRICK and PUGH (1984). The "Magga Dan" nectophore is small, 4.6 mm in length, with a projection at the apex where the pallial canal penetrates. The nectosac, like the nectophore, is long and narrow and extends to the base of the apical prolongation. It has four straight radial canals which originate on the lower adaxial face. The pedicular or pallial canal unites with the ventral canal just below this point and runs towards the apex of the central process.

This is a deep-water species and its biological characteristics are unknown. This is the first time it has been recorded in Antarctic waters. The systematic position of *Bargmannia* is uncertain. TOTTON (1965) included it in the Pyrostephidae while MARGULIS (1982,a) related it to Physophorae. KIRKPATRICK and PUGH (1984) included it in the Agalmidae but the latest general publication on siphonophores (MACKIE *et al.*, 1987) assigned it to the Pyrostephidae although, it is probably incorrect (PUGH, per. com.).

Nanomia bijuga (Chiaje, 1841)

Specimens collected: E-201, four pneumatophores and 88 nectophores; E-206, two nectophores.

Remarks: A cosmopolitan species widely distributed throughout all the oceans of the world (ALVARIÑO, 1971), although not previously been found in Antarctic waters. The specimens collected belonged to juvenile colonies, with nectophores relatively small (1.5 mm) in comparison with those collected in the Mediterranean (GILI, 1986) or in the Indian Ocean (TOTTON, 1954).

(?) *Mica micula* Margulis, 1982

Specimens collected: E-209, two colonies (fig. 2).

Remarks: This is the first time that this species has been found in the Atlantic sector of the Antarctic. MARGULIS (1982a) described it from sub-Antarctic waters of the Indian Ocean. The colonies collected by the Magga Dan expedition were more complete than the holotype, thereby allowing a more comprehensive description.

The colony is small (2 mm, in length), hence the meaning of the genus *Mica* given by the author. The pneumatophore is extremely small (0.2 mm) and is found at the top end of a short stem, which bears traces of secondary nectophores at its base. The principal nectophore has a circular base, with a velum. It is long and with a rounded apex. The nectophore is joined to the side of the stem and extends above the pneumatophore, which is placed at the same level as the upper limit of the nectosac. A radial canal runs along the ventral face of the nectosac from where it joins to other radial canals, close to the pedicular canal, and then joins the ostial ring canal. There is a dorsal radial canal on the opposite side. Two lateral canals depart from the ostium lengthwise, and curve and join the top part of the ventral canal. The pedicular canal is slightly different in the two colonies. It is more visible on the smaller specimen (1.5 mm length) where it arises just above the gastrozooid. It runs up, parallel with the main stem, until it reaches a level close to the top of the nectosac. The canal then branches, one branches continuing upward in the hydroecial groove as a pallial canal, and the other bending down towards the nectosac. The pedicular canal joins the ventral radial canal below the common junction of the lateral radial canals.

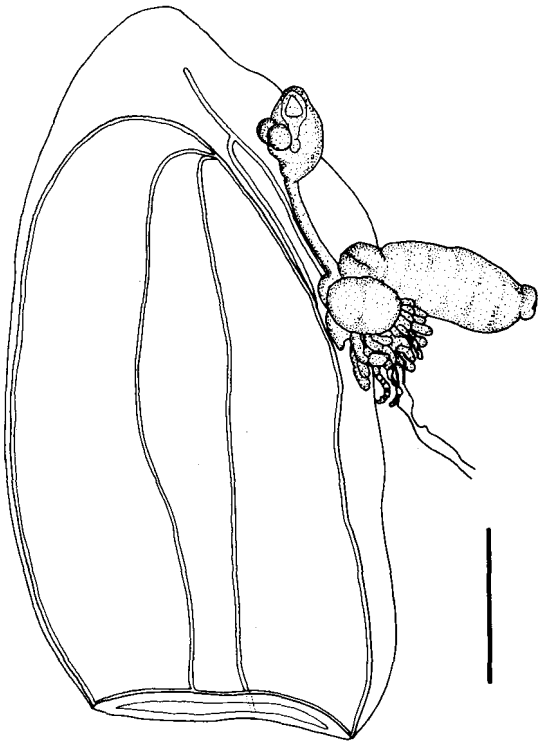

FIG. 2. — Colony of (?) *Mica micula*. Scale 0.5 mm.

At the base of the stem is an obvious gastrozooid, with a basigaster, that must correspond to the small part observed by MARGULIS (1982a). The tentacle is contracted and tentilla are not visible. The components of the incipient siphosome are not distinguishable.

The few colonies collected so far indicate that this species is limited to Antarctic waters. The present colonies were collected between different depth intervals (3000-0 m and 280-0 m), but the depth intervals at which the holotype and its paratype were sampled (51-0 m, 52-0 m and 110-60 m), seem to indicate that his species is epipelagic.

There are reasons for thinking these specimens are the post-larval or siphonula stage of some physonect because of the ill-defined nature of the pneumatophore, suggesting it is still being developed; the simple structure of the nectophore and its singularity, since its relative size would lead one to expect there to be several if it was an adult form; the presence of a single gastrozooid without any other distinguishable siphosomal structures.

The problem is to ascertain the identity of this siphonula. The first point of interest is that during their development most physonect species (e.g. *Agalma elegans* (TOTTON, 1956), *Nanomia bijuga* (CARRÉ, 1969), *Cordagalma cordiformis* (CARRÉ, 1973), produce a larval bract, or bracts, of varying size, before any nectophores are developed. However, one species, *Halistemma rubrum,* is know to produce a larval nectophore first (CARRÉ, 1971). But the general aspect and description of the larva of *H. rubrum* do not coincide with the present siphonula. MARGULIS (1982a) related *Mica micula* to the Apolemiidae and drew attention to the lack of tentacles. This inaccuracy is due to the diminutive size of the colonies, particularly the tentacles, which are contracted after preservation.

Among the other physonect collected during Magga Dan expedition, only *Bargmannia elongata,* has a certain resemblance with the siphonula. This resemblance was noted by Margulis (1982a). The junction of pedicular canal with the radial canals may be a relevant anatomical feature. In most physonect species, the four radial canals arise at the intersection with the pedicular canal, but this is not the case in *Bargmannia,* where the pedicular canal joins the ventral radial canal just below the points of origin of the lateral canals. The 1.5 mm long specimen shows this feature, but it is not visible in the colony of 2 mm perhaps because it is at an earlier stage of development. We conclude that *Mica micula* is not a valid species but represents a siphonula/post-larval stage of a physonect species, perhaps *Bargmannia elongata.*

Dimophyes arctica (Chun, 1897)

Specimens collected: E-201, one anterior nectophore; E-203, two anterior nectophores; E-206, eight anterior nectophores, five posterior nectophores and one eudoxid; E-207, four anterior nectophores; E-208, four anterior nectophores, five posterior nectophores and one eudoxid; E-209, one anterior nectophore, one posterior nectophore and one eudoxid; E-212, two anterior nectophores.

Remarks: A detailed description of this species was given by TOTTON (1965). It is a cosmopolitan species with a bipolar distribution in the epipelagic layers (MOSER, 1925; LELOUP, 1938; KRAMP, 1949), and abundant in meso and bathypelagic waters of the South Atlantic (ALVARIÑO, 1981) and North Atlantic (KIRKPATRICK & PUGH, 1984). In the present samples it appears both in deep and surface hauls.

Lensia lelouveteau Totton, 1941

Specimen collected: E-208, one anterior nectophore.

Remarks: The species was originally named *Len-*

sia multicristata var. grimaldi by LELOUP (1934), but it was redescribed and named by TOTTON (1941). Subsequently ALVARIÑO & WOJTAN (1984) described its sexual stage. It has been captured sporadically in the North Atlantic (FRASER, 1967) and in the south Atlantic (TOTTON, 1941) and it is not uncommon in the Pacific (ALVARIÑO, 1971). It is abundant in the Antarctic and Sub-Antarctic waters (ALVARIÑO & WOJTAN, 1924.).

Muggiaea bargmannae Totton, 1954

Specimens collected: E-206, two nectophores; E-207, two nectophores; E-208, twenty nectophores; E-209, two nectophores; E-212, two nectophores.

Remarks: The characteristics of the specimens collected coincide with those described by TOTTON (1941) and ALVARIÑO (1981). The somatocyst, of variable diameter, extends to a little over half-way along the nectophore, and contains an obvious drop of oil.

Eudoxoides spiralis (Bigelow, 1911)

Specimens collected: E-201, two eudoxids.

Remarks: A very well-known species (BIGELOW, 1911; TOTTON, 1965), widely distributed in the tropical, subtropical and circumboreal areas and predominantly epipelagic. There are references to specimens captured in the South Atlantic (ALVARIÑO, 1971) and near station 201 (MOSER, 1925).

Thalassophyes crystallina Moser, 1925

Specimens collected: E-206, three anterior nectophores; E-207, two anterior nectophores; E-208, five anterior nectophores and five bracts; E-209, one anterior nectophore.

Remarks: The specimens collected are similar to those described by MOSER (1925), ALVARIÑO (1981), and KIRKPATRICK & PUGH (1984), except that the somatocyst is more extensive and there are certain other peculiarities (fig. 3). The anterior nectophore is pyramidal with five ridges. The dorsal and the two lateral ridges join at the apex while the two ventral ones unite just below the apex but do not reach it. The ridges are very visible and extend along their length like very fine sheets. The nectosac occupies only the lower half of the nectophore and is overlain by the hydroecium and the somatocyst. The pallial canal follows the curve described by the hydroecium, from which a short stem emerges with a large gastrozooid hanging from it. The huge somatocyst rests on the nectosac, the somatocyst is kidney-shaped and its surface forms a mosaic of polygonal shapes. At its upper ventral end it becomes a short, thin filament that runs towards the apex of the nectophore.

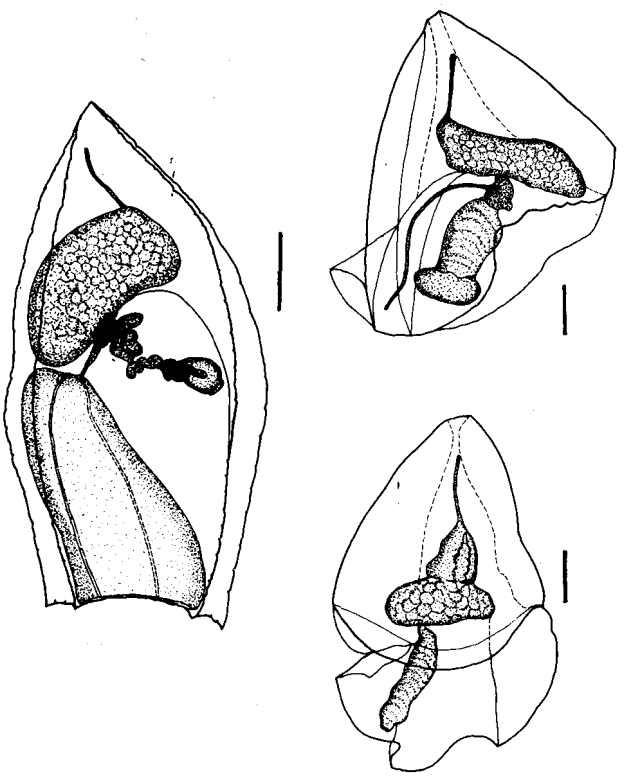

FIG. 3. — Nectophore and bracts of *Thalassophyes crystallina*. Scale 0.5 mm.

The eudoxid is very similar to that of *Heteropyramis maculata* except that it lacks opaque areas. The bract is pyramidal (fig. 3), with four ridges, the two dorsal ones longer than the two ventral ones, giving the bract the shape of a hood. In the apical region the dorsal and ventral ridges are joined together in pairs, with a small apical ridge at each join. The hydroecium is furrowed with two phyllocyst canals leading towards the lower end of the long dorsal ridges.

It is a meso and bathypelagic species found in the southern Indian Ocean (MOSER, 1925) and the Atlantic (LELOUP & HENTSCHEL, 1938; TOTTON, 1965, KIRKPATRICK & PUGH, 1984). It has been recorded in sub-Antartic waters by some of these authors.

Crystallophyes amygdalina Moser, 1925

Specimens collected: E-209, four anterior nectophores and one posterior nectophore.

ACKNOWLEDGEMENTS

During the «Magga Dan» expedition the specimens of zooplankton were collected by Drs J. M. San Feliu and A. Ballester, to whom we express our thanks both for their painstaking field notes and the preservation of the samples. Thanks are also due to Dr. E. Macpherson, as Director of the program «The Study of the Austral African Fisheries», which support this work. We wish to thank Dr. P. R. Pugh for the revision of the «*Mica micula*» specimens and for his comments that greatly contributed to the ideas reflected in this paper. Also thanks to Dr. C. Carré and Dr. A. Alvariño for making useful suggestions that improved the manuscript.

REFERENCES

ALVARIÑO, A. — 1971. Siphonophores of the Pacific with a review of the world distribution. *Bull. Scripps inst. Oceanogr.*, 6: 1-432.

— 1981. Siphonophorae. In: *Atlas del zooplancton del Atlántico sudoccidental y métodos de trabajo con zooplacton marino*, D. Boltovskoy, ed.; 383-441, INIDEP, Buenos Aires.

ALVARIÑO, A. & K. R. FRANKWICK. — 1983. *Heteropyramis alcala* and *Thalassophyes ferrarii*, new species of Clausophyidae (Calycophorae: Siphonophorae) from the South Pacific. *Proc. Biol. Soc. Wash.*, 96: 686-692.

ALVARIÑO, A. & J. M. WOJTAN. — 1984. Three new species of *Lensia* and description of the eudoxia stages of *Lensia reticulata* and *Lensia lelouveteau* (Calycophorae, Siphonophorae). *Proc. Biol. Soc. Wash.*, 97: 49-59.

BIGELOW, H. B. — 1911. Reports on the scientific results of the Expedition to the Eastern tropical Pacific. XIII. The Siphonophorae. *Mem. Mus. Comp. Zool. Harv. Coll.*, 38: 171-401.

CARRÉ, D. — 1969. Étude histologique du développement de *Nanomia bijuga* (Chiaje, 1841), Siphonophore Physonecte, Agalmidae. *Cah. biol. mar.*, 10: 325-341.

— 1971. Étude du développement d'*Halistemma rubrum* (Vogt, 1852), Siphonophore Physonecte, Agalmidae. *Cah. biol. mar.*, 12: 77-93.

— 1973. Étude du développement de *Cordagalma cordiformis*, Totton 1932, Siphonophore, Physonecte, Agalmidae. *Bijd. t. d Dierk.*, 43: 113-118.

CASANOVA, B. — 1980. Evolution spetiale et structurale des peuplements d'euphausiaces de l'Antartique au golfe d'Aden. *Inv. Pesq.*, 44: 377-394.

CURRIE, R. I. — 1963. The Indian Ocean Standard Net. *Deep-Sea Res.*, 10: 27-32.

DUCRET, F. — 1973. Les Chaetognates du «Magga Dan» (de la zona subtropicale, africaine à l'Antartique). *Inv. Pesq.* 37: 577-592.

DUHAMEL, G. & J. C. HUREAU — 1985. The role of Zooplankton in the diets of certain Sub-Antarctic marine fish. In: *Antarctic Nutrient Cycles and food webs*, W. R. Siegfrid & P. R. Condy, edts.; 421-429, Springer-Verlag, Berlin.

EL-SAYED, S. L. — 1985. Plankton of the Antarctic Seas. In: *Key Environments, Antarctica*, W. N. Bonner & D. W. H., edts.; 135-153, Pergamon Press, Oxford.

FRASER, J. N. — 1967. Siphonophora in the plankton of the north and west of the British Islands. *Proc. R. S. Edinburgh Sec. B.*, 70: 1-30.

GILI, J. M. — 1986. *Estudio sistemático y faunístico de los cnidarios de la costa catalana*. Ph. D. Univ. Autónoma de Barcelona, 565 pp.

HOSHIAI, T. — 1979. Feeding behaviour of juvenile *Nothotenia rossi marmorata*, Fischer at South Georgia Station. *Antarctic Record*, 66: 25-36.

IKEDA, T. & BRUCE, B. — 1987. Metabolic activity and elemental composition of krill and other zooplankton from Prydz Bay, Antarctica, during early summer (November-December). *Max. Biol.*, 92: 545-555.

KIRKPATRICK, P. A. & P. R. PUGH. — 1984. Siphonophores and Velellids. *Synopses of the British Fauna*, 29, 154 pp.

KRAMP, P. L. — 1949. Medusae and Siphonophora. *Sci. Rep. Norvegican Antarctic Exped.*, 30: 5-8.

LELOUP, E. — 1934. Siphonophores calycophorides de l'Océan Atlantique tropical et austral. *Bull. Mus. Hist. Nat. Belg.*, 10(6): 1-87.

— 1938. Siphonophores et ctenophores. Résultats du voyage de la BELGICA, 1897-99. *Expedition Antartique Belge. Zool.*: 1-12.

LELOUP, E. & E. HENTSCHEL, — 1938. Die Verbreitung der Calycophoren Siphonophoren im Südatlantische Ozean. *Wiss. Ergb. Deuts. Atlant. Exp. Meteor.*, 12(2): 1-31.

MACKIE, G.O., P.R. PUGH & J. E. PURCELL — 1987. Siphonophore biology. *Advances in marine biology*, 24: 97-262.

MARGULIS, R. Y. — 1977. A new species of Siphonophores *Moseria similis* sp. n. (Physophorae). *Zool. Zh.* 56: 1100-1103.

— 1982a. Two new Siphonophores from Antarctic (Hydrozoa, Siphonophora). *Ibídem*, 61: 777-780.

— 1982b. A new genus and species of the Siphonophora (Coelenterata, Hydrozoa) from the Polar basin, with some notes on other Siphonophora. *Ibídem*, 61: 440-444.

MOSER, F. — 1925. Die Siphonophoren der Deutschen Südpolar Expedition. *Deutsche Sudpolar-Exped.* 17 *Zool.*, 9: 1-541.

PIATKOWSKI, U. — 1987. Zoogeographische Untersuchungen und Gemeinschaftsanalysen an antarktischem Makroplankton. *Ber. Polarforsch.*, 34: 1-150.

TOTTON, A. K. — 1941. New species of the siphonophoran genus *Lensia*. *Ann. Mag. Nat. Hist. London*, 8: 145-168.

— 1954. Siphonophora of the Indian Ocean together with systematic and biological notes on related specimens from other oceans. *Discovery Rep.*, 27: 1-162.

— 1956. Development and metamorphosis of the larva of *Agalma elegans* (Sars) (Siphonophora Physonectae). In: Papers in Marine Biology and Oceanography. *Deep-Sea Res.* 3 (Suppl), 239-241.

— 1965. *A synopsis of Siphonophora*. Brit. Mus. (Nat. Hist.), London.

Ed. Cient. J. Lleonart.