

## A redescription of *Paragotoea bathybia* Kramp 1942 (Hydroidomedusae: Corymorphidae) with a new diagnosis for the genus *Paragotoea*

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**SUMMARY:** A redescription is given for the 1-tentacled Anthomedusa *Paragotoea bathybia* from new specimens collected in the Weddell Sea. The comparative study of the previous descriptions of this species permitted to define a new diagnosis for the genus which has been ascribed to the family Corymorphidae. The family Paragotoeidae Ralph, where *P. bathybia* was formerly included, is suppressed. The 4-tentacled reconstructed stage considered by Ralph (1959) as the adult stage of *P. bathybia* is a new species placed in a new genus: *Tetraralphia hypothetica*, (*Capitata incertae sedis*).

**Key words:** *Paragotoea bathybia*, systematic position, *Tetraralphia hypothetica* n. gen. n. sp., Anthomedusae.

**RESUMEN:** REDESCRIPCIÓN DE *PARAGOTEA BATHYBIA* KRAMP 1942 (HYDROIDOMEDUSAE CORYMORPHIDAE) Y UNA NUEVA DIAGNOSIS DEL GÉNERO *PARAGOTEA*. – Se redescrive la antomedusa unitentaculada *Paragotoea bathybia* a partir de nuevos ejemplares recolectados en el mar de Weddell. El estudio comparativo de las descripciones previas de esta especie nos ha permitido establecer una nueva diagnosis del género que es emplazado dentro de la familia Corymorphidae. Se suprime la familia Paragotoeidae Ralph, donde *P. bathybia* estaba situada anteriormente. El estadio de 4 tentáculos reconstruido por Ralph (1959) y considerado como el estadio adulto de *P. bathybia*, es una especie nueva para la que se erige un género nuevo: *Tetraralphia hypothetica*, (*Capitata incertae sedis*).

**Palabras clave:** *Paragotoea bathybia*, posición sistemática, *Tetraralphia hypothetica* gen. n. sp. n., Antomedusa.

### INTRODUCTION

The genus *Paragotoea* was erected by Kramp (1942) for a single specimen collected in the Greenland Sea, *P. bathybia*, characterized by the presence of prominent marginal bulbs and a single stiff marginal tentacle armed with a conspicuous terminal knob of cnidocysts (Fig. 1A).

In successive years, a few more specimens were collected in the Bay of Biscay (Ralph 1959) and Mediterranean (Brinckmann-Voss 1970, Goy 1972). The two latter authors described specimens quite similar to the holotype. However, Ralph (1959), put forward the hypothesis that the one-tentacle *Paragotoea bathybia* described by Kramp (1942) was the juvenile stage of a four-tentacled medusa that she reconstructed by assembling three incomplete specimens (Fig. 1B). She concluded by making a new diagnosis for this genus and placed it in the

\*Received March 25, 1997. Accepted July 9, 1997.

new family Paragotoeidae which has not been unanimously recognized by subsequent authors. Brinckmann-Voss (1970) considered that the establishment of a separate family for *Paragotoea* was not justified and kept this genus in the Corymorphidae. She was followed by Bouillon (1985, 1995) and Calder (1988).

Petersen (1990, p.133), in his cladistic revision of the capitates considered the Paragotoeidae as valid and included it in the superfamily Sphaerocorynoidea. He gave the following definition of the family: Medusae with evenly rounded umbrella and with numerous, scattered exumbrellar nematocysts; four stiff tentacles with chordal endoderm, terminating in a disk-shaped nematocyst knob; nematocyst pad surrounds the base of each tentacle bulb and continues around the umbrellar margin as prominent triangular clasp; ocelli absent; manubrium wide, quadrate with cruciform base and square mouth, not extending below umbrella margin; interradial gonads which may be continuous over perradii, with deep interradial groove. Hydroids unknown.

A new one-tentacle species *Paragotoea elegans* (Fig. 1C) was described by Margulis (1989) from material collected in the Arctic and the Southern Ocean. However, she included *P. elegans* in the family Tubulariidae following Kramp (1961) who joined all one-tentacle anthomedusae into this family. Pagès and Kurbjeweit (1994) and Pagès and

Schnack-Schiel (1996) cited this species in the Weddell Sea. Nonetheless, re-examination of their specimens (Fig. 2) and of additional material collected later in the same area cast some doubt about the validity of this latter species and encouraged the authors to review all the published information on the genus *Paragotoea*. The result of this survey brought us to different conclusions than those of Ralph (1959), Margulis (1989) and Petersen (1990).

#### MATERIAL EXAMINED

##### *Paragotoea bathybia* Krany 1942:

- Antarktis V/3 cruise, FS Polarstern :  
20-11-1986; 72° 43,8' S 19° 53, 7' W. Sta. 611, 700-500 m depth: 1 specimen.
- Antarktis IX/2 cruise, FS Polarstern :  
1-12-1990; 66° 07,3' S 31° 47,0' W. Sta. 63, 500-200 m depth: 1 specimen.
- 2-12-1990; 66° 28,1' S 28° 45,4' W. Sta. 67, 500-200 m depth: 1 specimen.
- Antarktis X/3 cruise, FS Polarstern :  
13-4-1992; 68° 31,6' S 07° 16,8' W. Sta. 369, 1000-340 m depth: 1 specimen.
- 23-4-1992; 70° 25,1' S 11° 05,9' W. Sta. 435, 500-0 m depth: 1 specimen.
- 1-5-1992; 70° 19,3' S 12° 12,9' W. Sta. 467, 500-0 m depth: 1 specimen.
- Antarktis X/4 cruise, FS Polarstern.:  
9-6-1992; 56° 00,1' S 00° 00,1' E. Sta. 577, 500-200 m depth: 1 specimen.
- 15-6-1992; 66° 00,1' S 00° 00,8' E. Sta. 595, 500-250 m depth: 1 specimen.
- 16-6-1992, 67° 30,2 S 00° 00,4' E. Sta. 598, 500-200 m depth: 1 specimen.

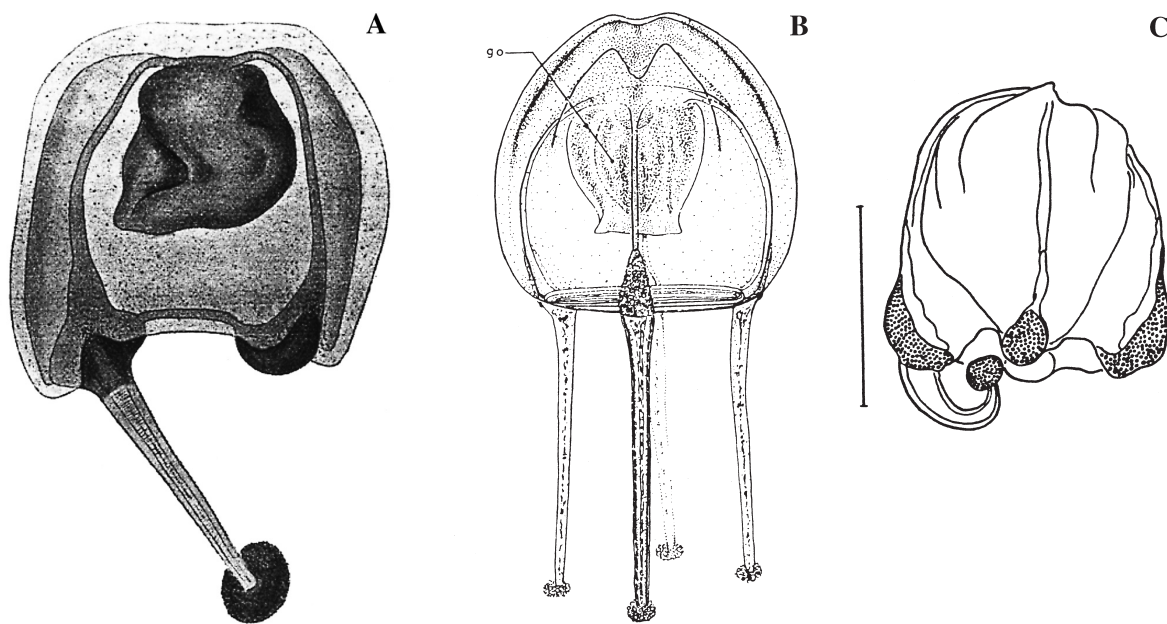


FIG. 1. – A, *Paragotoea bathybia* after Kramp (1942). B, *Paragotoea bathybia* after Ralph (1959). C, *Paragotoea elegans* after Margulis (1989). Scale bar: 0.5 mm.

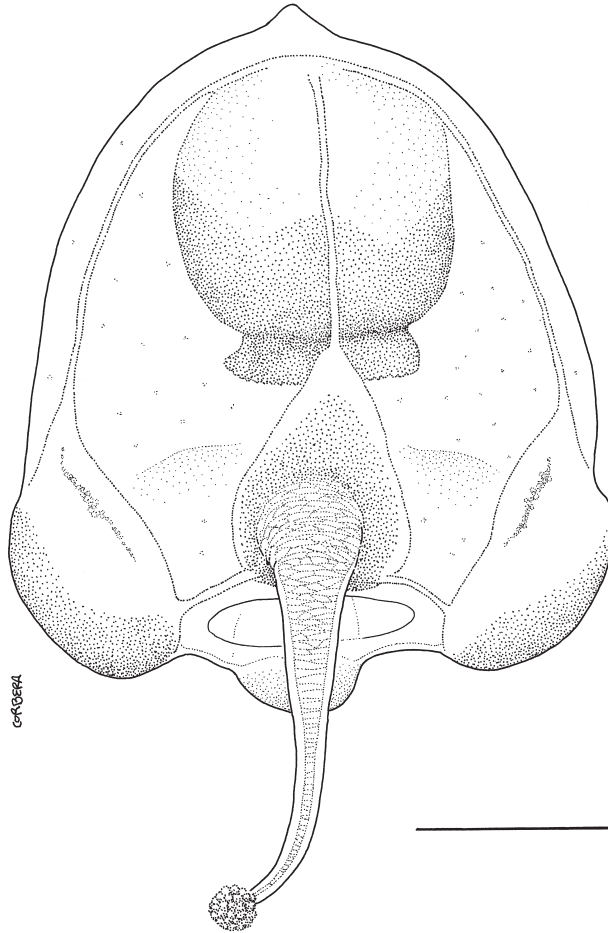


FIG. 2. – *Paragotoea bathybia*. Specimen collected at Sta. 435 during ANT X/3 cruise in the Weddell Sea. Scale bar: 0.5 mm.

All the above-mentioned material is deposited in the collection of cnidarians of the I.C.M. (CSIC). Unfortunately the reference material, including the holotype (Kramp 1942, Ralph 1959) has disappeared after having been loaned. Brinckmann-Voss' specimen deposited at the British Museum is in such a bad state of preservation that it is useless for comparative examination. Goy' specimens are also missing (Goy, pers. comm).

**Gotoea similis Kramp 1959:**

Zoologisk Museum Copenhagen; holotype and 3 specimens; Dana Expedition; St. Helena, Bali, Madagascar, Mozambique Channel.

Institut Royal des Sciences naturelles de Belgique; I.G. 27838; 1 specimen; Papua New Guinea.

**RESULTS AND DISCUSSION**

The main morphological features described by previous authors and those of the new specimens examined by us are shown in Table 1. The comparative study brought us to conclude that the one-tentacled specimen described by Kramp (1942) is a valid species (*Paragotoea bathybia*) and that the 4-tentacled specimen of Ralph (1959) belongs to another genus and species.

Our preserved material shows very slight longitudinal exumbrellar ridges. They actually correspond to folds linked to the contraction of the mesoglea due to preservation, because this character was not evident on a living specimen examined on board of the FS Polarstern. In our opinion, the ribs described in *P. elegans* by Margulis (1989) are arti-

TABLE 1. – Morphological characteristics of *Paragotoea bathybia* given by different authors, including also *P. elegans* Margulis,

Author	Number of specimens s	Bell height x width (mm)	Umbrella	Manubrium	Mouth
Kramp, 1942	1	1.3 x 1.6	Square, flat top, with scattered cnidocysts	Short, thick, 1/2 bell cavity, no gastric pouches	Simple opening
Ralph, 1959	3	2.0-3.85 x 2.0-3.99	Square, with scattered cnidocysts, with four subumbrellar apical projections	Quadrate, 2/3 of bell cavity, possibly small peduncle; well developed gastric pouches	Simple, quadrate
Brinckmann-Voss, 1970	1	0.5 x 0.4	Rectangular, no scattered cnidocysts described	Broad peduncle, no gastric pouches	Circular or rounded-square
Goy, 1972	3 (only 1 described, 2 badly preserved)	1.0 x 1.3	Rounded with scattered cnidocysts	Long, square, extending beyond the umbrellar margin, with gastric peduncle, with interradial vacuolated dark zones, no gastric pouches	-
Margulis 1989	≥6	1.5 x 1.25	Oval, with conical apex, with scattered cnidocysts, with 4 ribs extending from bulbs to apex and several short vertical ribs in the lower third of the umbrella	Large, 2/3 of the bell cavity but can extend beyond the umbrella opening, no gastric pouches, no gastric peduncle	Cnidocysts in the rim, shape undescribed
Pagès & Bouillon, present study	9	0.8-2.0 x 0.6-1.6	Square rectangular, apex slightly conical, with scattered cnidocysts, without ridges or ribs.	Globular, extending from half bell cavity to the umbrella margin, depending on the umbrella contraction, proximal part vacuolated, distal part sexual, no gastric pouches, no peduncle	Circular, sometimes tubular, rim with cnidocysts

facts due to preservation and the absence of other important characters differentiating both species led us believe that the two species are conspecific and that the only valid species is *P. bathybia* Kramp, 1942 because of priority' law. The specimens described by Brinckmann-Voss (1970) and Goy (1970) fit well with the original description and although collected in warmer waters certainly belong to this species. The peduncle described by Brinckmann-Voss (1970) and Goy (1972) presumi-

bly corresponds to the vacuolated zone of the manubrium observed in our specimens.

Typically the tentacles of Hydroidomedusae (Bouillon et al 1992) are formed by a narrow ectoderm separated from the hollow or solid endodermal axis by a thin layer of mesoglea. In *Paragotoea* this mesoglea lamella remains thin in the proximal third of the tentacles where it surrounds a pluristratified endoderm (hollow tentacle), then it progressively thicken to attain its maximum development in the

here considered as identical with *P. bathybia*. See text for explanation.

Radial canals	Gonads	Tentacles	Marginal bulbs	Cnidocysts	Geographic area and depth (m)
Simple, narrow, enlarged distally	Encircling manubrium	1, stiff, solid, with one large terminal cnidocysts knob, mesoglea distally very large	4, unequal size, tentacular one is the largest, all with umbrellar spurs,	Type unknown, 17 x 13.5 $\mu$	Greenland Sea. 1000-0
Simple, enlarged distally	Incomplete, apparently encircling the manubrium and covering the manubrial pouches	4, stiff, tapering, with terminal disk-shaped cnidocysts	4, triangular, bluntly pads of cnidocysts of uniform size	Stenoteles and atrichous, size unknown	Bay of Biscay. 1800-800
-	Not clear if encircling the -manubrium, apparently two masses on each manubrium side	1, large terminal, globular cnidocyst cluster divided in sector-like pouches	4, flat, triangular with spurs	Type unknown, size unknown	Naples, Mediterranean. 350-0
Enlarged distally	Not described	1, stiff, solid, with one terminal cnidocyst knob	4, with long spurs of cnidocysts extending almost to the umbrella apex	Stenoteles, size unknown	Offshore Nice, Mediterranean. 600-0
Enlarged distally	Not described	1, smooth and rigid, ball-shaped dilation in the distal end	Large, with cells like fat cells	Unknown	Arctic and Antarctic. 2000-100
Quite large, with very large endodermal cells, canal light very narrow	Developing interradial masses at the distal half of the manubrium, encircling slowly the manubrium with age	1, stiff, with proximal part hollow, distal part solid and with very thick mesoglea. 1 terminal globular knob of cnidocysts	4, similar, very prominent, with spurs of cnidocysts and with very large vacuolated endoderm cells	Stenoteles, two sizes: 17.5 $\mu$ m and 8.0 $\mu$ m	Weddell Sea (Antartic) 1000-200

distal tentacular third. In the meantime the endoderm becomes reduced in diameter and unistratified (solid tentacle). In an extended tentacle the mesoglea ends up occupying 2/3 of the tentacular diameter. Such a structure reinforces the solidity and rigidity of the tentacles, it can be found also in *Gotoea similis* and, several taxa of the Calycopsidae in (Bouillon et al 1989) which also have very stiff tentacles. And although very characteristic his disposition can thus not been used as a family diagnostic character.

#### **New description of *Paragotoea bathybia*:**

Umbrella 0.5-2.0 mm high, 0.4-1.6 mm wide, square or rectangular with a slightly conical apex containing refractile droplets, exumbrella with scattered cnidocysts (Fig. 2). Vertical exumbrellar walls and mesoglea with uniform thickness. Manubrium broadly flask-shaped, sometimes globular, extending from half of the subumbrellar cavity to the umbrella margin depending on umbrella contrac-

tion, proximal part built up by large vacuolated endodermal cells (cf. *Rhabdoon singulare*), distal part sexual; mouth simple, circular, sometimes tubular, month rim with cnidocysts; 4 conspicuous radial canals, enlarged distally with large endodermal cells, light very narrow; evident circular canal; gonads developing interradially in the distal half of the manubrium and encircling manubrium slowly with age; 1 stiff, tapering marginal tentacle with a basal thickening, proximal part hollow, distal part solid with very thick mesoglea, one terminal and globular knob of cnidocysts; 4 very large and prominent marginal bulbs -1 tentacular, 3 non-tentacular-similar, with cnidocyst spurs; cnidome: stenoteles of two sizes. 17.5  $\mu$  and 8.0  $\mu$  long. Color: transparent when alive, with green-yellow vacuolated cells in the inner part of the marginal bulbs.

#### New diagnosis of the genus *Paragotoea* :

Umbrella with scattered cnidocysts, with simple circular mouth, with one developed tentacle terminating in a globular cnidocyst knob, with 4 very large and prominent marginal bulbs with cnidocyst spurs. Cylindrical or globular manubrium.

Geographical distribution: Arctic (Margulis 1989); Greenland Sea (Kramp 1942); Mediterranean, offshore Nice (Goy 1972) and Naples (Brinckmann-Voss 1970); South Africa (Kramp 1959); Southern Ocean (Margulis 1989, Pagès and Kurbjewit 1994, Pagès and Schnack-Schiel 1996).

Depth distribution: taken between 2000 m and surface, although the samples collected in discrete depth ranges in the Southern Ocean suggest a mesopelagic vertical distribution, mainly between 700 and 200 m depth.

#### CONCLUSIONS

*Paragotoea bathybia* has no cnidocyst tracks or ribs in the exumbrella and fits the diagnosis of the family Corymorphidae given by Bouillon (1985):

Les méduses possèdent ou non un processus apical, elles sont dépourvues de tractus exombrellaires de cnidocystes; leur bouche est simple, circulaire; il y a de un à quatre tentacules marginaux capités ou moniliformes, exceptionnellement des tentacules ramifiés ou rudimentaires. Les gonades entourent complètement le manubrium, il n'y a pas d'ocelles.

As the 4-tentacled species described by Ralph cannot belong to the genus *Paragotoea* because it

has subumbrellar projections, a quadrate manubrium, gastric pouches, gonads on the gastric pouches and manubrium walls, the family Paragotoeidae as defined by Ralph has no meaning anymore. The 4-tentacled species is here ascribed to a new genus and species dedicated to Ralph as *Tetraralphia hypothetica*. Ralph (1959) did not provide a diagnosis for Paragotoea and we utilize her definition of the family Paragotoeidae as a model for the diagnosis of the genus *Tetraralphia*:

Umbrella with scattered cnidocysts, with 4 stiff marginal tentacles terminating in a disc-shaped cnidocyst cluster, with 4 marginal bulbs with cnidocyst pads. Manubrium quadrate, with 4 stomach pouches and simple circular mouth.

This new genus would be included into the superfamily Sphaerocorynoidea according Petersen (1990). However, awaiting the rediscovery of new specimens that would increase the information on this genus, we position it in the Capitata as *incertae sedis*.

#### ACKNOWLEDGEMENTS

We greatly thank the valuable comments made by Ferdinando Boero and Claudia Mills. This study was supported by the Spanish Ministry of Education and Science (EX92-46331867). J.B. gratefully acknowledges the support from the "Fonds National de la Recherche scientifique" Belgium.

#### REFERENCES

- Bouillon, J. – 1985. Essai de classification des Hydropolypes-Hydroméduses (Hydrozoa-Cnidaria). *Indo-Malayan Zool.*, 2: 29-243.
- Bouillon, J. – 1995. Classe des Hydrozoaires. In: P.P. Grassé and D. Doumenc (eds.). *Traité de Zoologie*, 3(2), Masson, Paris, pp. 29-416.
- Bouillon, J., F. Boero and G. Seghers. – 1988. Notes additionnelles sur les Hydroméduses de la mer de Bismarck (Hydrozoa-Cnidaria) II. *Indo-Malayan Zool.*, 5: 87-99.
- Bouillon, J., F. Boero, F. Cicogna, J.M. Gili and R.G. Hughes. – 1992. Non-Siphonophoran Hydrozoa: what are we talking about?. *Sci. Mar.*, 56: 279-284.
- Brinckmann-Voss, A. – 1970. Anthomedusae/Athecatae (Hydrozoa, Cnidaria) of the Mediterranean. *Fauna e Flora del Golfo di Napoli*, 39: 1-96.
- Calder, D. – 1988. Shallow water hydroids of Bermuda. The Athecatae. *Life Sci. Contr. R. Ontario Mus.*, 148: 1-107.
- Goy, J. – 1972. Les Hydroméduses de la mer Ligure. *Bull. Mus. nat. Hist. nat.*, 3e sér., 83, Zool 62: 965-1009.
- Kramp, P.L. – 1942. Medusae -The Godthaab Expedition 1928. *Medd. Grønland*, 81: 1-168.
- Kramp, P.L. – 1959. The Hydromedusae of the Atlantic Ocean and adjacent waters. *Dana Report*, 46: 1-283.
- Kramp, P.L. – 1961. Synopsis of the medusae of the world. *J. mar. biol. Ass. U.K.*, 40: 1-469.

- Margulis, R.Y. – 1989. New hydroid jelly-fishes of the family Tubulariidae (Coelenterata, Hydrozoa). *Zool. Zh.*, 68: 126-130.
- Pagès, F. and F. Kurbjeweit. – 1994. Vertical distribution and abundance of mesoplanktonic medusae and siphonophores from the Weddell Sea, Antarctica. *Polar. Biol.*, 14: 243-251.
- Pagès, F. and S.B. Schnack-Schiel. – 1996. Distribution patterns of the mesozooplankton, principally siphonophores and medusae, in the vicinity of the Antarctic Slope Front (eastern Weddell Sea). *J. Mar. Syst.*, 9: 231-248.
- Petersen, K. – 1990. Evolution and taxonomy in capitate hydroids and medusae (Cnidaria; Hydrozoa). *Zool. J. Linn. Soc.*, 100: 101-231.
- Ralph, P. – 1959. The status and affinities of the anthomedusan *Paragotoea bathybia* Kramp, 1942. *Proc. Zool. Soc. Lond.*, 133: 171-177.

Scient. ed.: J.M. Gili.