

Naumovia gen. n. for *Plumularia microtheca* Naumov, 1960, a deepwater North Pacific species, with remarks on other genera and species of the family Kirchenpaueriidae (Cnidaria, Hydrozoa)

S.D. Stepanjants, A.L. Peña Cantero, O.V. Sheiko & A. Svoboda

Stepanjants, S.D., Peña Cantero, A.L., Sheiko, O.V. & Svoboda, A. 1997. *Naumovia* gen. n. for *Plumularia microtheca* Naumov, 1960, a deepwater North Pacific species, with remarks on other genera and species of the family Kirchenpaueriidae (Cnidaria, Hydrozoa). *Zoosystematica Rossica*, 6(1/2): 9-20.

A re-description of *Plumularia microtheca* Naumov, 1960 (originally placed in Plumulariidae) is given. This species is referred to the new genus *Naumovia* and to the family Kirchenpaueriidae. Some comments on other genera and species of this family are given.

S.D. Stepanjants, Zoological Institute, Russian Academy of Sciences, Universitetskaya nab. 1, St. Petersburg 199034, Russia.

A.L. Peña Cantero, Departamento de Biología Animal, Facultad de Ciencias Biológicas, E-46100 Burjassot, Valencia, Spain.

O.V. Sheiko, Kamchatka Institute of Ecology, Partizanskaya 6, Petropavlovsk-Kamchatsky 683000, Russia.

A. Svoboda, Ruhr-Universität, Universitätsstr., 150, Bochum D-4468, Germany.

Introduction

A joint investigation of bipolarity problems (Stepanjants, Svoboda & Vervoort, 1996, 1997) raised questions on taxonomic position of certain species of hydroids discovered earlier in seas of the Northern and Southern hemispheres. In particular, representatives of the family Kirchenpaueriidae have not been recorded from Eurasian Arctic Seas, the North Pacific bordering Asia and the Black Sea, whereas species of this family are common in the North Atlantic, the eastern part of the North Pacific and the Southern Ocean. This prompted us to revise the taxonomic position of certain species from the Arctic Seas, the North Pacific and the Black Sea. For example, the taxonomic status of *Plumularia microtheca* Naumov, 1960, *P. magellanica* Moneroni Naumov, 1960, *P. fragilis* Hamman, 1882, *P. linkoi* Naumov, 1960, *Schizotricha divergens* Naumov, 1960 (cf. Naumov, 1960), *Halcium linkoi* Ant-

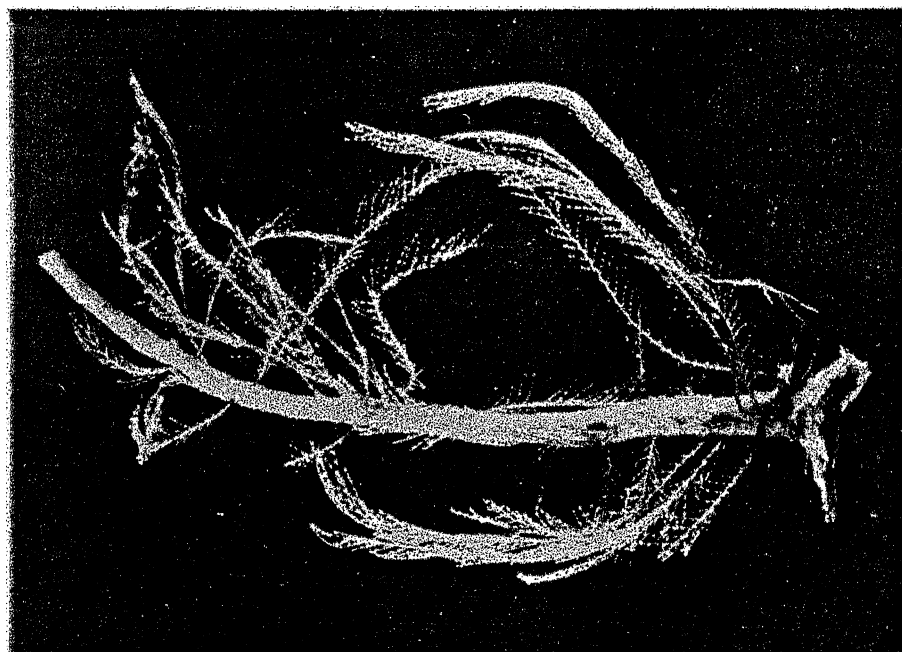
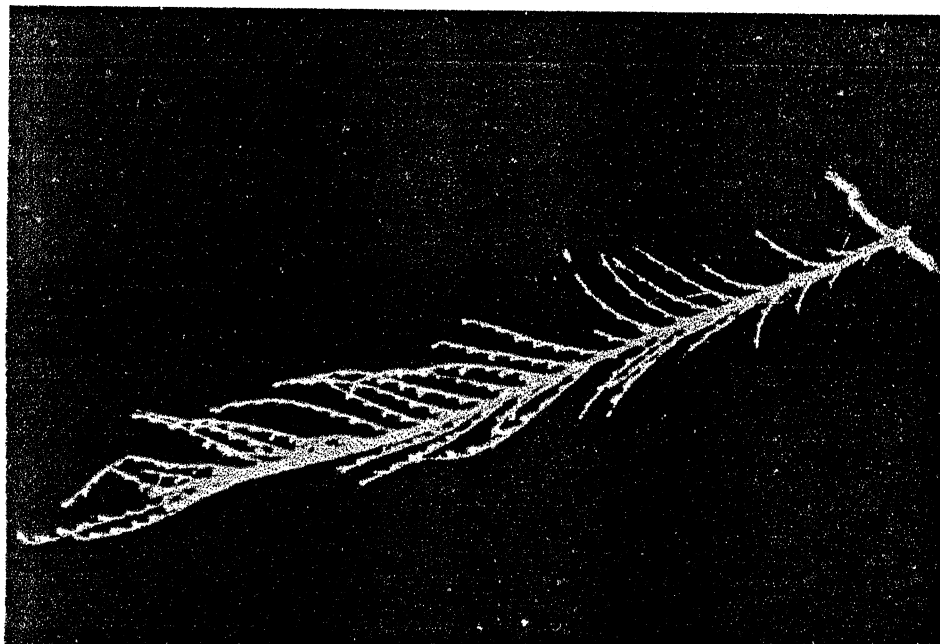
sulevitch, 1980, *H. plumularioides* (Clark, 1877), *Hydrodendron gracilis* (Fraser, 1914) (cf. Antsulevitch, 1987) must be revised.

This publication concerns *Plumularia microtheca* Naumov, 1960, which is placed here in a new genus *Naumovia* (the description of the genus is given after redescription of the type species).

***Naumovia microtheca* (Naumov, 1960), comb. n. (Figs 1-9)**

Plumularia microtheca Naumov, 1960: 462.

Lectotype (designated here). Colony composed c. 40 small stems, rising from a filiform hydrorhizum, growing on the polysiphonic stem of another hydroid colony. Sea of Okhotsk, depth 2300 m, "Vityaz", St. 143, 3.10.1949. Deposited in collection of the Zoological Institute of the Russian Academy of Sciences (ZIN RAS), No. 10294/1. Fragments in Kamchatka Institute of Ecology (KOOP, No. KIE 1/1547) and in National Museum of Natural History, Leiden, The Netherlands (slide No. 3572).



Figs 1-2. 1, lectotype colony of *Naumovia microthecha* drifted along the other hydroid stem; 2, stem of the lectotype colony of *N. microthecha*.

Paralectotypes. (No. 1). Six stems attached to small stones by thin hydrorhiza from the Bering Sea, Commander Islands, Medny Isl., depth 110 m, "Vityaz", St. 529, 19.08.1950; in collection of ZIN RAS (No. 10295/2), fragments in KOOP (No. KIE 2/1548). (No. 2). Four stems and two colony fragments from the Kuril Islands, Paramushir Isl., depth 296 m, "Lebed", St. 132, 3.08.1954; in collection of ZIN RAS (No. 10296/3) and in KOOP (No. KIE 3/1549). (No. 3). Colonies from the Sea of Okhotsk, depth 506 m, "Vityaz", St. 2758, 21.05.1954, also considered by Naumov as *P. microtheca* (No. 4 in ZIN collection), belong to another species.

Description of lectotype. Hydrorhizum (stolon) filiform, developing on polysiphonic stem of unidentifiable hydroid of which the stem, composed of c. 20 closely adnate tubes, cut off at the top and expanded into a plate at the base, without apophyses, branches, hydrothecae or zooids (Figs 1-5). One tube growing on the surface of the supporting stem not parallel to remaining tubes but forming loops around them (Fig. 6); it may be treated as filiform hydrorhizum of the examined species.

Stems of lectotype colony irregularly arranged around the stem of the supporting colony (Fig. 6). Cnidome of substrate colony and these stems showing distinct differences (see below).

Stems of the investigated colony broken up into internodes (about 30 per stem), without hydrothecae and nematophores. Each cauline internode with 1-5 apophyses supporting hydrocladia. Apophyses alternately arranged either in one plane or in slightly different planes (Fig. 7, A). Each stem bearing 20-90 hydrocladia. Sometimes hydrocladium connected with apophysis through an intermediate ahydrothecate internode (Fig. 7, A, B). Each apophysis with two nematophores: one on upper part of apophysis and sometimes provided with bithalamic nematotheca, the other, sometimes obscure, at axil between apophysis and cauline internode and without nematotheca (Fig. 7, B-D).

Hydrocladia unbranched and divided into 5-15 internodes per hydrocladium. Each hydrocladial internode with hydrotheca placed on middle of internode (4-15 hydrothecae per hydrocladium); sometimes 1-2 ahydrothecate internodes present (Fig. 7, D). Hydrocladial walls with thick perisarc (Fig. 7, B, D, F). Hydrotheca low; adcauline wall entirely adnate, slightly shorter than the abcauline one; hydrothecal aperture slightly tilted adcaudally. Hydrothecal rim even and smooth. Perisarc of abcauline hydrothecal wall and hydrothecal base thickened (Fig. 3, E, F).

Hydrothecal internodes with only mesial superior nematophore placed in front of hydrothecal rim and sometimes closed by a thin theca, without nematophore below hydrotheca (Fig. 7, C, D, E, F). It is remarkable that there are no nematocysts in the zooids (gastrozooids and nematophores). Only one type of nematocyst could be found in stem tissue (see below). In colonies from lesser depths (see below), two types of nematocysts have been observed; this seems to indicate a linkage between the cnidome and the bathymetric distribution of this species.

Gonothecae situated on cauline apophyses (Fig. 7, A); one gonotheca per apophysis. In lectotype colony, all gonothecae are immature, therefore the sex cannot be distinguished.

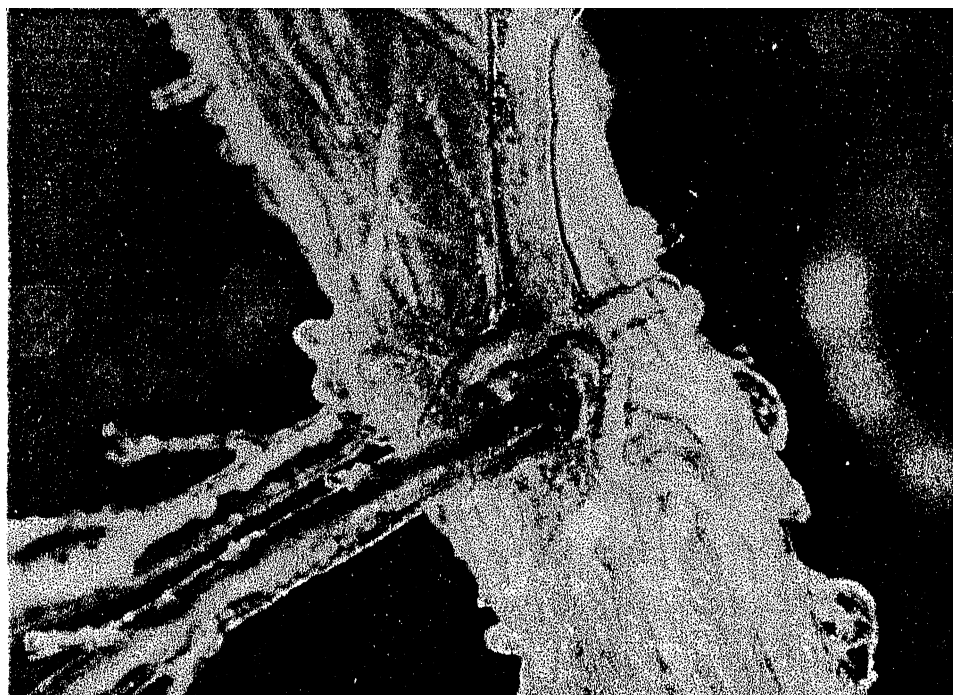
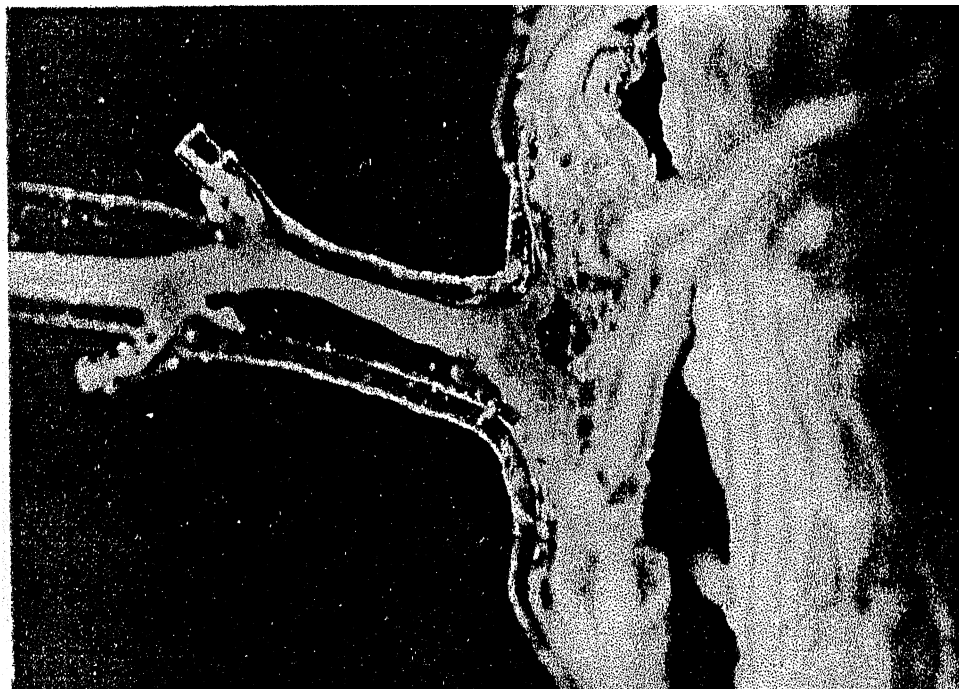
Measurements (in mm): Substrate colony: length of stem c. 140; basal diameter of stem 4.5; distal diameter of stem 1.5. *Naumovia microtheca*: length of stems up to 80; diameter of stems 1.04-2.60; hydrocladial length 4-10; hydrocladial diameter 0.7-0.9; number of hydrothecae per hydrocladium 5-14; number of ahydrothecate internodes per hydrocladium 1 (occasionally more); length of hydrothecate internodes 0.52-0.72; diameter of hydrothecate internodes 0.09-0.12; length of ahydrothecate internodes 0.15-0.19; diameter of ahydrothecate internodes 0.07-0.09; hydrothecae: length of abcauline wall 0.10-0.13, length of adcauline wall 0.10-0.12, diameter of aperture 0.13-0.17; gonothecae: length c. 0.6, diameter 0.26-0.45.

Nematocysts (in μm): microbasic mastigophores (rhabdoids sensu Boshenova, 1988) $9-10 \times 2.5-2.6$ and $6-6.5 \times 2$. Capsulae of substrate-colony stem belonging to another type haplonemes: $15-16 \times 5$ (Fig 7, G, H).

Description of paralectotypes. No. 1. All 6 stems most probably are fragments of the same colony, whose filiform hydrorhiza weaves the black stones druse. Stems emerging from filiform hydrorhiza and divided into illegible internodes bearing 3-5 apophyses per internode.

Hydrocladium divided into 7-15 hydrothecate and 1-3 ahydrothecate internodes (Fig. 8, A, B). Shape and distribution of hydrothecae and nematophores as in the lectotype colony (Fig 8, A-D).

Measurements (in mm): length of stems 60-130; diameter of stems 0.39-0.46; length of hydrocladia 6-19; length of hydrothecate internodes 0.39-0.49; diameter of internodes 0.10-0.13; length of ahydrothecate inter-



Figs 3-4. *Naumovia microthecha*, lectotype colony. 3, hydrorhiza drifted along the polysiphonic stem of the other species of hydroid; 4, fragment of the stem off the substrate colony.

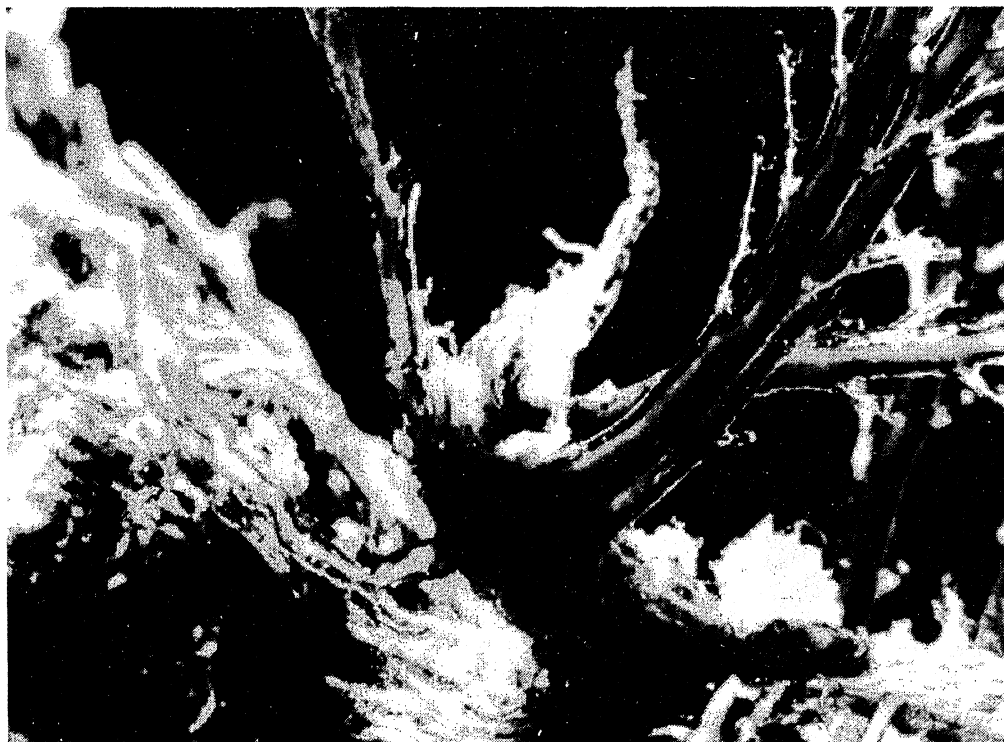


Fig. 5. *Naumovia microtheca*, lectotype colony, hydrorhiza drifted along a fragment of the polysiphonic stem of the substrate colony.

nodes 0.07-0.09; hydrothecae: length of abcauline wall 0.13-0.16, length of adcauline wall 0.11-0.13, diameter of aperture 0.11-0.13; gonothecae (Fig. 8, E): length 1.6-1.9, diameter 0.43-0.49.

Nematocysts (in μm): microbasic mastigophores (rhabdoids) in two dimensional groups: $9.5-10.5 \times 3$ and $6-6.5 \times 2$ (Fig. 8, F).

No. 2. These colonies belong probably to *Naumovia microtheca* (Fig. 9, A-F). They differ from the lectotype colony in having 2 apophyses per cauline internode and slightly smaller hydrothecae. Colonies are sterile.

Measurements (in mm): length of stems 6-250; number of internodes per stem up to 20; length of cauline internodes 0.39-1.7; diameter of cauline internodes 0.13-0.23; number of hydrocladia per stem up to 46; length of hydrocladia 1.5-7; diameter of hydrocladia 0.07-0.08; number of hydrothecae (one on each internode) per hydrocladium 4-11;

length of hydrocladial internodes 0.52-0.59; hydrothecae: length of abcauline wall 0.09-0.11, length of adcauline wall 0.09-0.10; diameter of aperture 0.13-0.14.

Nematocysts (in μm): microbasic mastigophores (rhabdoids) $5.2-6 \times 1.8-2$ (Fig. 9, F).

No. 3. This material was identified by D.V. Naumov as *P. microtheca* too (see above).

One colony with monosiphonic stem and divided into 38 internodes, each one with one apophysis connected with unbranched hydrocladium through a short ahydrothecate internode (Fig. 10, A, B). Up to 4 hydrothecate internodes per hydrocladium. Between hydrothecate internodes there are regularly arranged, elongated ahydrothecate internodes (Fig. 10, A, B). Two unpaired nematophores present: one below hydrothecal base (provided with bithalamic nematotheca), the other naked and situated in front of hydrothecal aperture (Fig. 10, B-E).

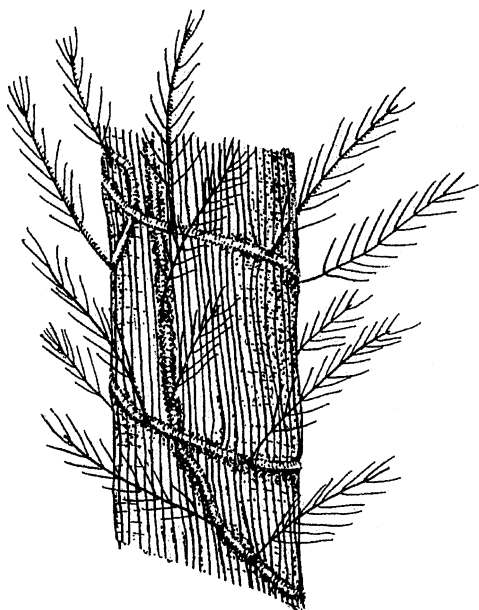


Fig. 6. *Naumovia microtheca*, lectotype colony, scheme of arrangement on polysiphonic stem of another hydroid colony.

There is a single nematophore on apophysis. Immature horn-shaped gonothecae present below hydrothecae on hydrocladia (Figs. 10, A, C).

Measurements (in mm): length of stem 310; diameter of stem 0.27-0.32; number of internodes per stem 38; number of hydrocladia per stem 37; length of hydrocladia 1.24-4.29; diameter of hydrocladia 0.10-0.13; length of hydrothecate internodes 0.65-0.78; length of ahydrothecate internodes 0.39-0.52; length of first ahydrothecate internode following cauline apophysis 0.12-0.13; length of abcauline hydrothecal wall 0.13-0.17; diameter of hydrothecal aperture 0.13-0.14; length of gonothecae 0.39-0.46; diameter of apical part of gonothecae 0.22-0.26.

Nematocysts (in μm): microbasic mastigophores (rhabdoids) (Fig. 10, H) 6×1.8 ; microbasic eurithelae (Fig. 10, G) $12-13 \times 6-7.5$.

As it is possible to see from the description, this colony differs considerably from colonies of *Naumovia microtheca*. The main differences are the presence of mesial inferior nematophore; the presence of a single nematophore on the cauline apophyses; the presence of gonothecae on the hydrocladia instead of on the cauline apophyses; the

regular presence of a short ahydrothecate internode following the cauline apophysis and, finally, the regular alternation of hydrothecate and ahydrothecate hydrocladial internodes.

The described colony is allied to *Plumularia fragilis* Hamman, 1882, described from the Barents Sea. The only difference is the presence of gonothecae on the stem in *P. fragilis*. Olga Sheiko found colonies from the Commander Islands area that she assigned to *Plumularia fragilis* (Fig. 11). She examined its nematocysts and found microbasic mastigophores (rhabdoids) of $6.2 \times 2 \mu\text{m}$ and microbasic eurithelae of $12.5-13 \times 5.5-6 \mu\text{m}$ (Fig 11, C-E).

We consider this material as not belonging to *Naumovia microtheca*. An in-depth study is necessary to reconsider its systematic position.

Diagnosis of the species. Colonies composed of small, monosiphonic and unbranched feather-like stems arising from fili-form hydrorhiza growing on other hydroids, stones or other objects. Stem consisting of internodes of different lengths. Each internode with 1-5 apophyses supporting hydrocladia. These usually divided into hydrothecate internodes with ahydrothecate internodes at base of some hydrocladia and, occasionally, between hydrothecate internodes. Perisarc of internodes thick. Hydrothecate internodes with a single hydrotheca. Hydrotheca low, rim even and smooth. Hydrothecal walls thickened, especially at base and at abcauline side, where perisarc thickening resembles intrathecal cusp. Abcauline wall straight or flexed, slightly longer than adcauline wall and, as a result, tilted adcaudally. Mesial superior nematophore present in front of hydrothecal aperture, emerging through a single perisarc hole. Sometimes nematophore provided with a thin theca. Cauline apophysis with two nematophores: one at axil between apophysis and stem, and the other on the upper dorsal side, sometimes provided with a thin nematotheca. Cauline internodes without nematophores. Elongate gonotheca arising from cauline apophysis. Mature gonotheca with 4 longitudinal ribs and, accordingly, square at section (Fig. 8, E).

Measurements (in mm): length of abcauline hydrothecal wall 0.09-0.16; length of adcauline hydrothecal wall 0.09-0.13; diameter of hydrothecal aperture 0.11-0.17; length of gonotheca 1.6-1.9; diameter of gonotheca 0.43-0.49.

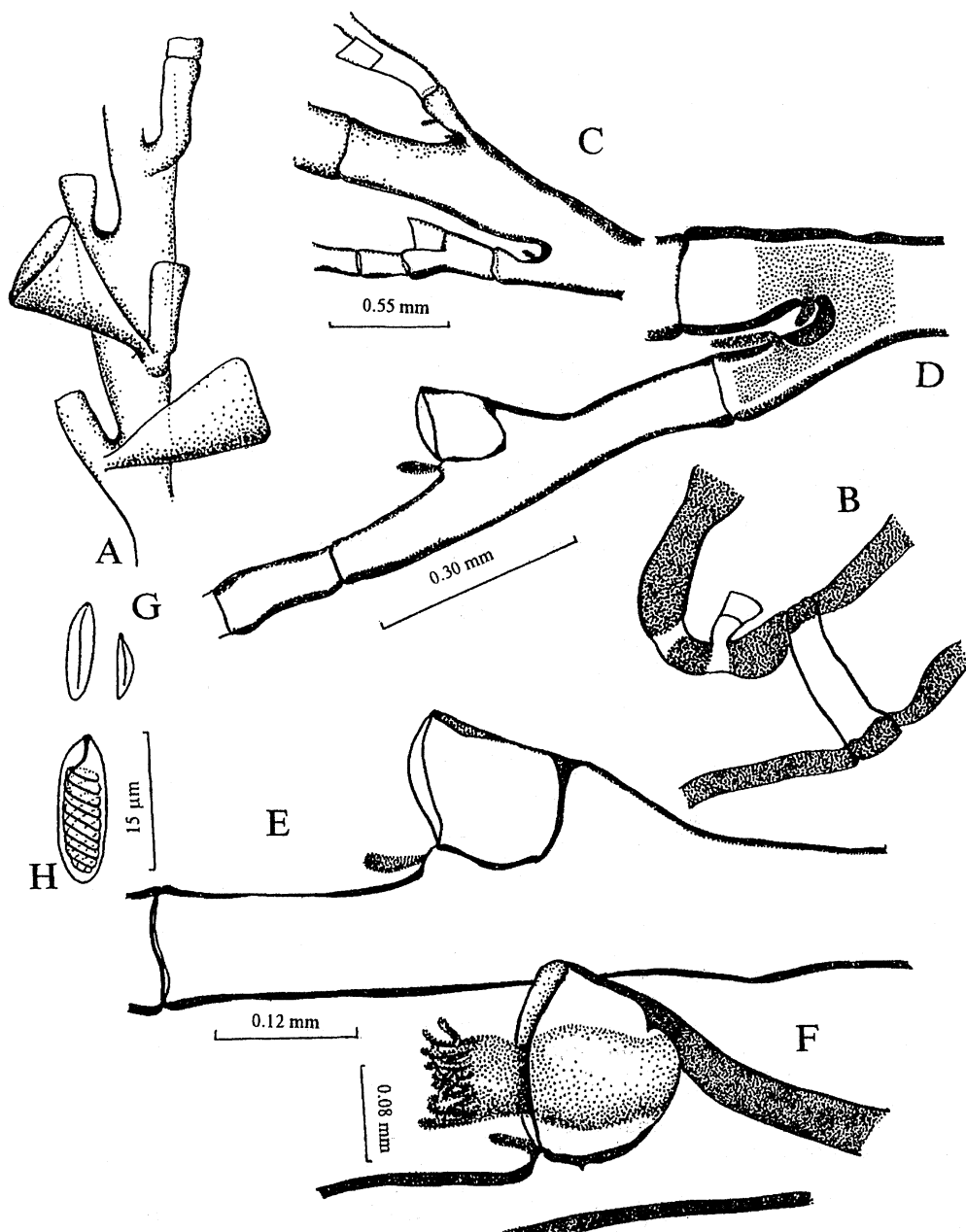


Fig. 7. *Naumovia microtheca*, lectotype colony: A, scheme of arrangement of cauline apophyses and gonothecae on the stem; B, scheme of arrangement of nematophores on cauline apophysis; C, D, fragments of colony; E, F, hydrothecal internodes of hydrocladia; G, microbasic mastigophores, uncharged capsulae of two sizes; H, haplonemes uncharged capsula of substrate colony.

Nematocysts. Microbasic mastigophores (rhabdoids) in two dimensional classes.

Comparison. Colonies of *Naumovia microtheca* are similar to those of other mem-

bers of the family Kirchenpaueriidae. It allows us to place it in this family.

This species differs from the other species of the family in: (1) the absence of infrathe-

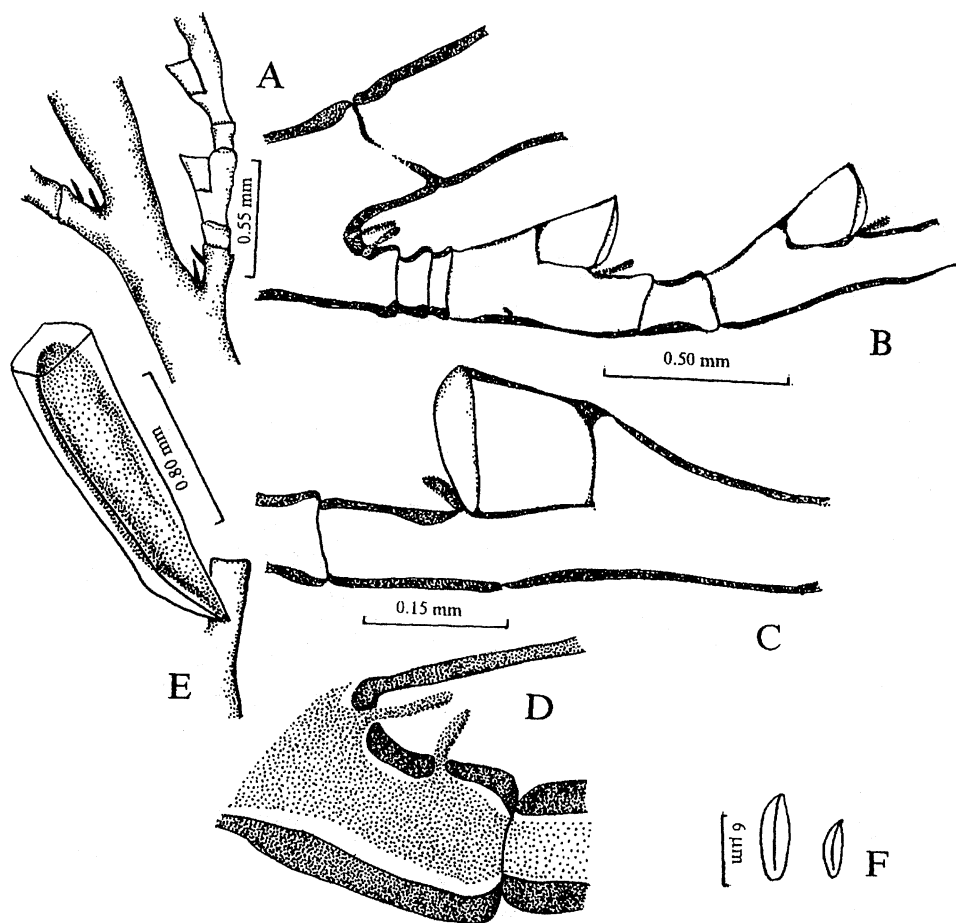


Fig. 8. *Naumovia microtheca*, paralectotype No. 1 colony: A, fragment of stem; B, fragment of hydrocladium; C, hydrotheca; D, scheme of arrangement of nematophores on cauline apophysis; E, gonotheca; F, microbasic mastigophores, uncharged capsulae of two sizes.

cal nematophore; (2) the presence of two nematophores on apophysis: one on upper part and the other at axil between apophysis and cauline internode; (3) the presence of a thin perisarc theca on some nematophores ahead of hydrothecal aperture and on the cauline apophyses.

From some characteristics it is impossible to place this species in any of the known genera of Kirchenpaueriidae. This allows us to establish a new genus *Naumovia* named in memory of the famous Russian cnidarian investigator Donat Naumov.

Genus *Naumovia* gen. n.

Type species *Plumularia microtheca* Naumov, 1960.

Diagnosis. Colonies composed of monosiphonic, unbranched stems broken up into

internodes. Each internode bearing 1-5 apophyses alternately arranged either in one plane or in slightly different planes. Cauline internodes without nematophores. Cauline apophyses with two nematophores: one at axil between apophysis and stem, the other on upper dorsal part. Apophyses supporting unforked hydrocladia. Each hydrocladium divided into hydrothecate internodes (occasionally with ahydrothecate internodes also) bearing one hydrotheca and a single nematophore in front of hydrothecal aperture. Gonothecae elongate and square at cross-section arising from cauline apophyses.

As no detailed description of Kirchenpaueriidae was published originally (Stechow, 1921, 1923) or later (Millard, 1975; Bouillon, 1985; Cornelius, 1995) we propose below its diagno-

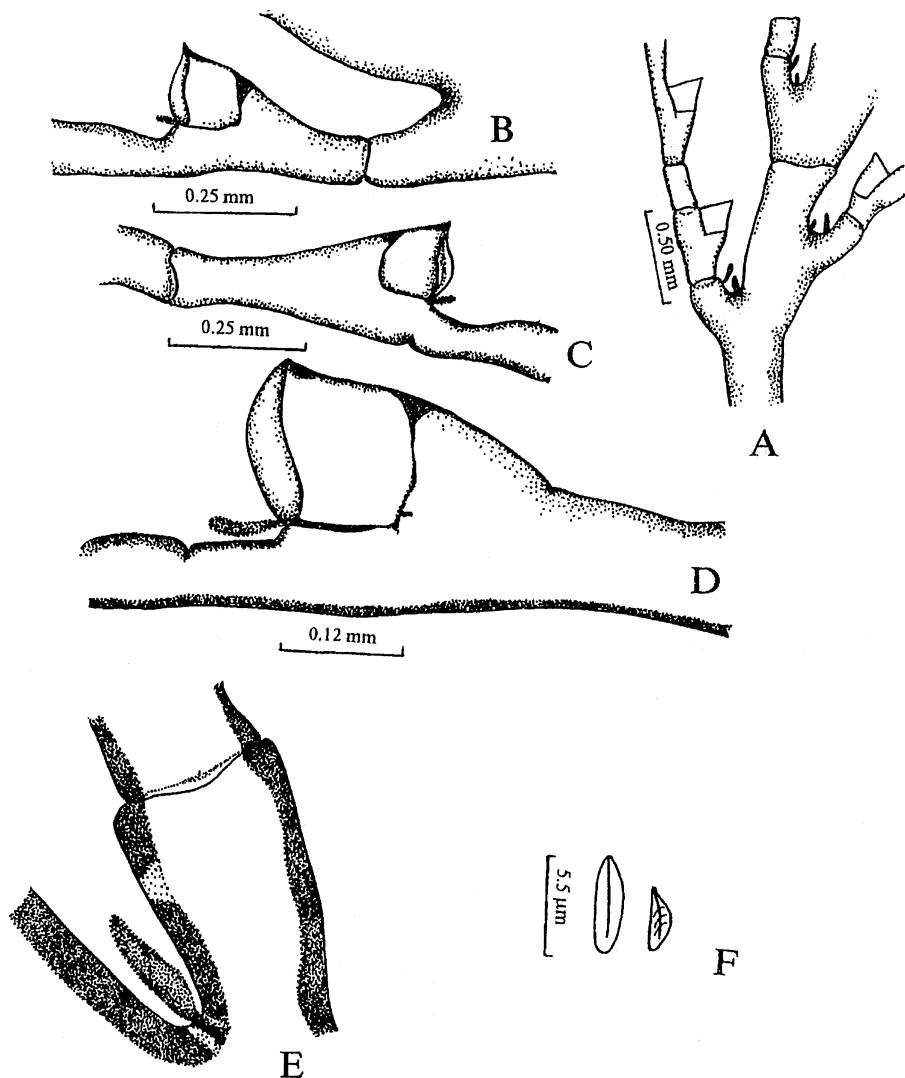


Fig. 9. *Naumovia microtheca*, paralectotype No. 2 colony: A, fragment of stem; B-D, fragments of hydrocladia with hydrothecae; E, scheme of arrangement of nematophores on cauline apophysis; F, microbasic mastigophores, uncharged capsulae of two sizes.

sis (unlike some authors, we consider it as a family).

Family **KIRCHENPAUERIIDAE** Stechow, 1921

Diagnosis. Colonies with monosiphonic or polysiphonic distinct stem (with the exception of *Ophinella*). Hydrocauli branched or unbranched, with or without internodes and provided with apophyses supporting hydrocladia; one or more apophyses per internode. Stem without hydrothecae, with or without nematophores. Cauline apophyses

with or without nematophores. Hydrocladia divided into hydrothecate (in some species also ahydrothecate) internodes without vertical septa. Hydrothecate hydrocladial internodes provided with a hydrotheca and usually two nematophores (only one in *Naumovia*): a mesial inferior one placed below hydrothecal base, and a mesial superior one situated in front of hydrothecal aperture. Nematophores emerging through a simple perisarcular hole, a mamelon-shaped structure, or through either monothalamic or bithalamic nematotheca. Hydrothecae usually

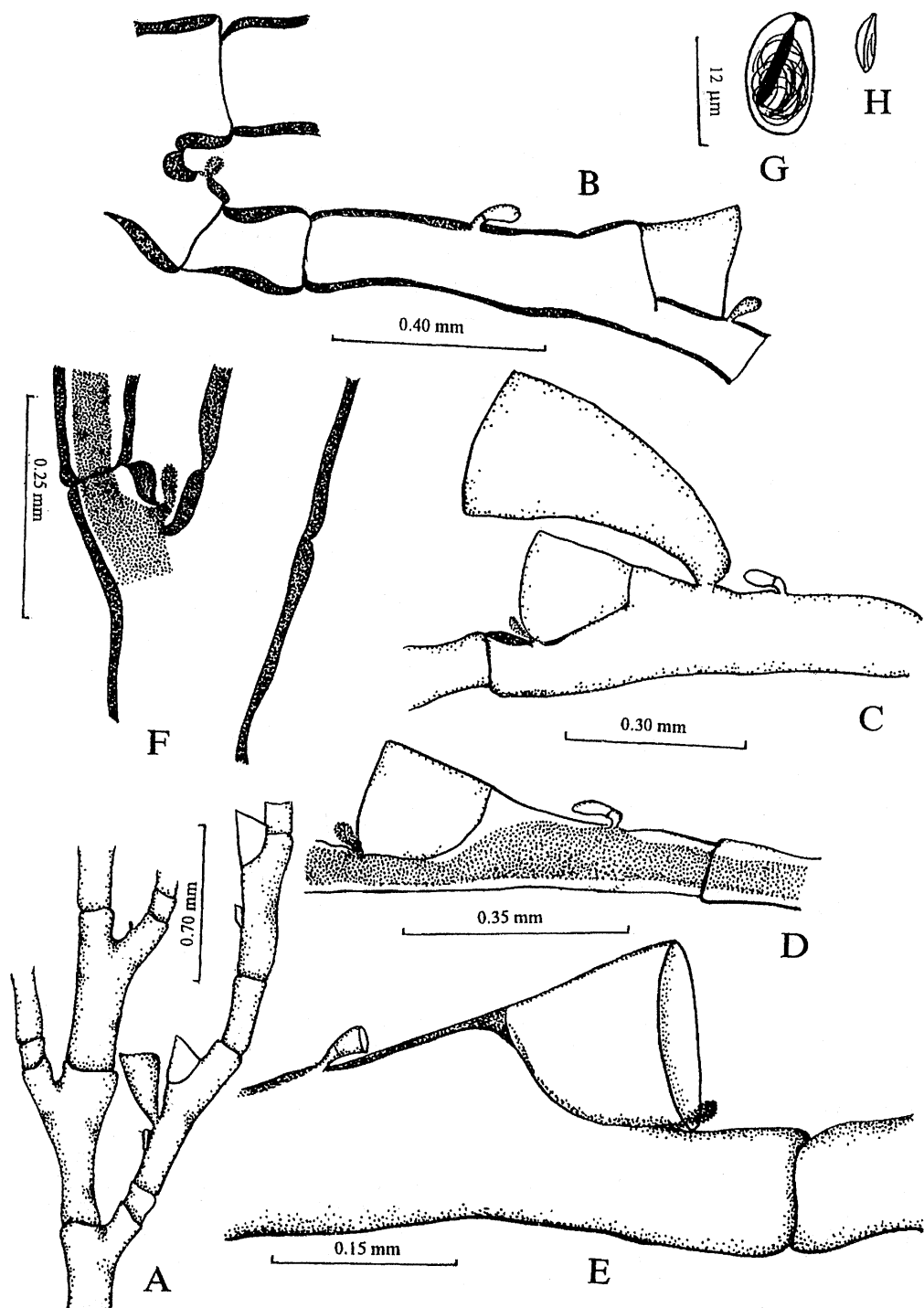


Fig. 10. Paralectotype No. 3 (of *Plumularia microtheca*), colony belonging to another species: A, fragment of stem; B-E, fragments of hydrocladia with hydrothecae and gonothecae; F, scheme of arrangement of nematophore on cauline apophysis; G, microbasic eurithelae uncharged capsula; H, microbasic mastigophore uncharged capsula.

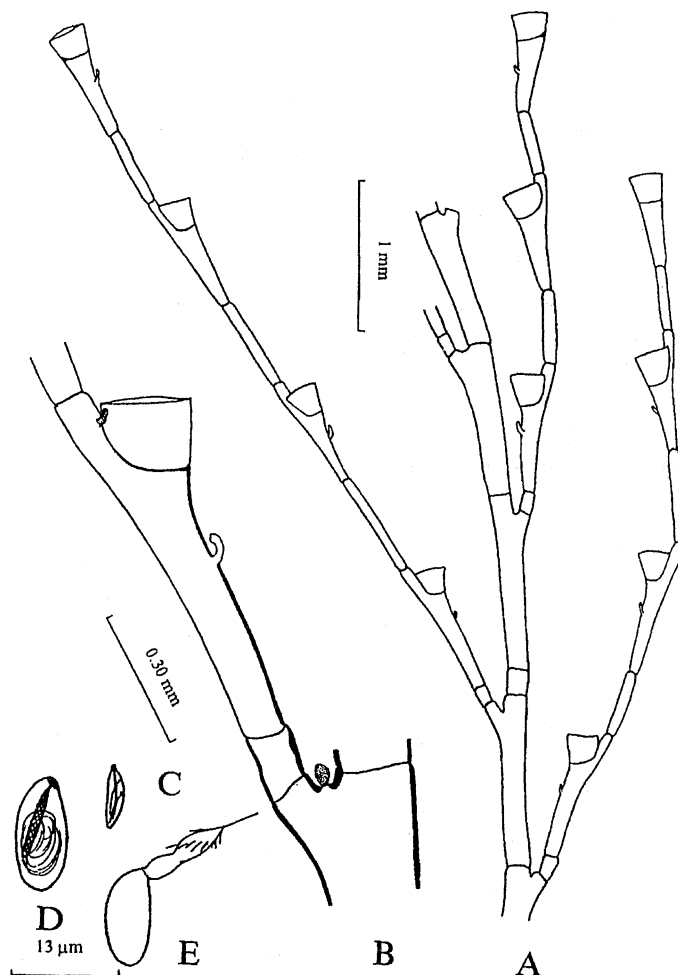


Fig. 11. Fragments of colony from the Commander Islands conditionally attributed to *Plumularia fragilis* by O. Sheiko: A, stem fragment; B, hydrocladium fragment; C, microbasic mastigophore uncharged capsula; D, E, microbasic eurihelae uncharged (D) and charged (E) capsulae.

low; rim of hydrothecal aperture without cusps (with the exception of *Halicornopsis*); without internal septa (with the exception of *Pycnotheca*). Gonothecae borne on stem, cauline apophyses, or hydrocladial internodes, never on hydrorhiza. Gonothecae fusiform, oval or square at cross section, without nematothecae. Cnidome composed of microbasic mastigophores of two different sizes and possibly of microbasic eurihelae.

Cornelius in his two-volume monograph (1995) included in Kirchenpaueriinae (subfamily in his opinion) 5 genera, but did not name them. As he considered *Ventromma* as belonging to Plumulariinae, we may suppose that he included in Kirchenpaueriinae

Kirchenpaueria, *Oswaldella*, *Ophinella*, *Halicornopsis* and *Pycnotheca*. Concerning *Ventromma*, we are unanimous in opinion that this genus must be placed in Kirchenpaueriidae, because colonies of *V. halecioides* have the typical characters of this family: slight branching, cauline apophyses with nematophores, nematothecae on cauline internodes and both mesial superior and mesial inferior nematophores in hydrothecate hydrocladial internodes (Medel & Vervoort, 1995), and absence of cauline hydrothecae. The investigation of cnidome also shows relationship of *Ventromma* with other members of Kirchenpaueriidae: it has microbasic mastigophores (rhabdoids) in two dimensional classes: $9-10 \times 4-4.5 \mu\text{m}$ and $5-5.5 \times 1.8 \mu\text{m}$.

As to *Halicornopsis* and *Pycnotheca*, their placement in Kirchenpaueriidae is doubtful. *Pycnotheca mirabilis* differs from other members of the family in the presence of an intrathecal septum in the hydrotheca, position of the medial nematotheca, and position of the gonothecae on hydrorhiza. *Halicornopsis elegans* differs in the presence of marginal cusps in the hydrotheca. It is necessary to know the cnidome of these genera before re-considering their systematic position. For the moment we keep these two genera in the family Kirchenpaueriidae, though with doubts. They are placed in brackets in the key below.

Identification key to the genera included in Kirchenpaueriidae by previous authors, supplemented with *Ventromma* and *Naumovia*

- 1(2). [Hydrothecal aperture with cusps. **Halicornopsis**]
- 2(1). Hydrothecal aperture without cusps.
- 3(4). [Hydrotheca with internal septum. **Pycnotheca**]
- 4(3). Hydrotheca without internal septum.
- 5(6). Colony without distinct stem. **Ophinella**
- 6(5). Colony with well defined stem.
- 7(10). Stem with nematophores.
- 8(9). Nematophores provided with bithalamic nematothecae; no naked cauline nematophores. Gonothecae ringed **Ventromma**
- 9(8). Nematophores without bithalamic nematothecae; cauline nematophores frequently naked. Gonothecae not ringed **Kirchenpaueria**
- 10(7). Stem without nematophores.
- 11(12). Hydrothecate hydrocladial internodes with mesial inferior nematophores **Oswaldella**
- 12(11). Hydrothecate hydrocladial internodes without mesial inferior nematophores **Naumovia**

As to the distribution of the Kirchenpaueriidae, we have no doubt now that it is a bipolar family. Most probably all the genera belonging to this family have tendency to cold-water and temperate distribution areas. This put extra doubts on if the tropical genera *Halicornopsis* and *Pycnotheca* belong to Kirchenpaueriidae.

Acknowledgements

The authors are grateful to Professor W. Vervoort for many advices and the detailed and patient correc-

tion of English. The work was fulfilled using scientific collections of the Zoological Institute, Russian Academy of Sciences, which obtain financial support from the Science and Technology State Committee of Russian Federation (Reg. No. 97-03-16).

References

- Antsulevich, A.E.** 1987. *Gidroidy shel'fa Kuril'skikh ostrovov* [Hydroids from the shelf waters of Kurile Islands]: 1-166. Zool. Inst. St.Petersburg. (In Russian).
- Boshenova, O.V.** 1988. Present views on the classification of the nematocysts of Cnidaria. In: V.M. Koltun & S.D. Stepanjants (eds). *Gubki i knidarii: sovremennoe sostoyanie i perspektivy issledovaniy* [Porifera and Cnidaria. Modern and perspective investigations]: 57-71. St.Petersburg. (In Russian).
- Bouillon, J.** 1985. Essai de classification des Hydro-polypes-Hydromeduses (Hydrozoa-Cnidaria). *Indo-Malayan Zoology*, 2: 29-244.
- Cornelius, P.F.S.** 1995. North-West European thecate hydroids and their medusae. *Synopses of British Fauna* (N.S.), 50(2): 1-386.
- Medel, M.D. & Vervoort, W.** 1995. Plumularian hydroids (Cnidaria: Hydrozoa) from the Strait of Gibraltar and nearby areas. *Zool. Verhand.*, 300: 1-72.
- Millard, N.A.H.** 1975. Monograph on the Hydroida of Southern Africa. *Ann. South Afr. Mus.*, 68: 1-513.
- Naumov, D.V.** 1960. Hydroids and Hydromeduses of the marine, brackish- and fresh-water basins of the USSR. *Opredeliteli po faune SSSR*, 70: 1-586. (In Russian).
- Stechow, E.** 1921. Neue Genera und Species von Hydrozoen und anderer Everttebraten. *Arch. Naturgesch.*, 87: 248-265.
- Stechow, E.** 1923. Zur Kenntniss der Hydroiden-fauna des Mittelmeeres, Amerikas und anderer Gebiete. II. *Zool. Jahrb., Abt. Syst., Geogr., Biol. Tiere*, 47: 29-270.
- Stepanjants, S.D., Svoboda, A. & Vervoort, W.** 1996. The problem of bipolarity, with emphasis on the Hydroidea (Cnidaria, Hydrozoa). *Russk. Gidrobiol. Zhurn.*, special issue: 5-34. (In Russian).
- Stepanjants, S.D., Svoboda, A. & Vervoort, W.** 1997. The problem of bipolarity, with emphasis on the Medusozoa (Cnidaria: Anthozoa excepted). *Proc. 6th Intern. Conf. Coelenterate Biology* (ed. J.C. den Hartog): 455-464. Nat. Natuurhist. Mus. Leiden.

Received 6 May 1997