

## SEAWEEDES OF THE SNELLIUS-II EXPEDITION. CHLOROPHYTA: DASYCLADALES

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### ABSTRACT

A survey is given of algae collected during the Snellius-II Expedition (1984) in the Banda, Sawu and Flores Seas, in particular the genera *Acetabularia*, *Bornetella*, *Cymopolia*, *Neomeris* and *Polyphysa* (Dasycladales). Their morphology and anatomy are discussed, biogeographical data are added and a comparison is made with the material from the earlier Siboga Expedition (1899-1900).

### 1. DESCRIPTIONS

#### *Acetabularia* Lamouroux

##### *Acetabularia dentata* Solms-Laubach (Figs 1-11).

Thallus up to 1 cm tall, heavily calcified; cap flat to slightly cupuliform, 2-3.5 mm in diameter, made up of 33-35 gametangial rays which are joined by the calcification (Figs 1, 2); apices of the rays either blunt with a distinct sharp apiculum (Figs 4-6) or tapering towards the apiculum (Fig. 3). Segments of the corona superior (Figs 7-9) 100-125  $\mu\text{m}$  long, longish-ovate, with rounded-truncate, sometimes slightly emarginate upper margin, each with 3 trichoblast scars on one longitudinal row. Corona inferior (Figs 10, 11) slightly smaller, with deeply bilobed upper margin. No fertile material collected.

Specimens examined. SN 10975: Komodo, on reef flat; SN 11145: Sumbawa, N coast, in shallow littoral; SN 11414: Salayer, on hard substrates in sheltered sandflat with seagrasses; SN 11562: Salayer, between large seagrasses.

Geographic distribution. Tropical and subtropical Indo-Pacific; already recorded for Indonesia.

Discussion. According to VALET (1969: 614) the specimens of *A. caraiatica* Kützinger, as recorded by WEBER-VAN BOSSE (1913: 91) belong to *A. dentata*.

##### *Acetabularia ryukyuensis* Okamura & Yamada var. *philippinensis* (Gilbert) Valet (Figs 15-21)

Thallus 2-3 cm tall, stipe smooth, cap infundibuliform (Fig. 15), dark green, up to 9 mm in diameter, composed of 51-55 gametangial rays which are joined by the calcification; apices of the rays obtuse to slightly emarginate (Fig. 16). Segments of the corona superior (Figs 17-19) longish obovate, 100-150  $\mu\text{m}$  long, each with 5-6 trichoblasts or scars, more or less on two longitudinal rows. Segments of the corona inferior (Figs 20, 21) 80-125  $\mu\text{m}$  long, emarginate to slightly bilobate. Our specimens are sterile.

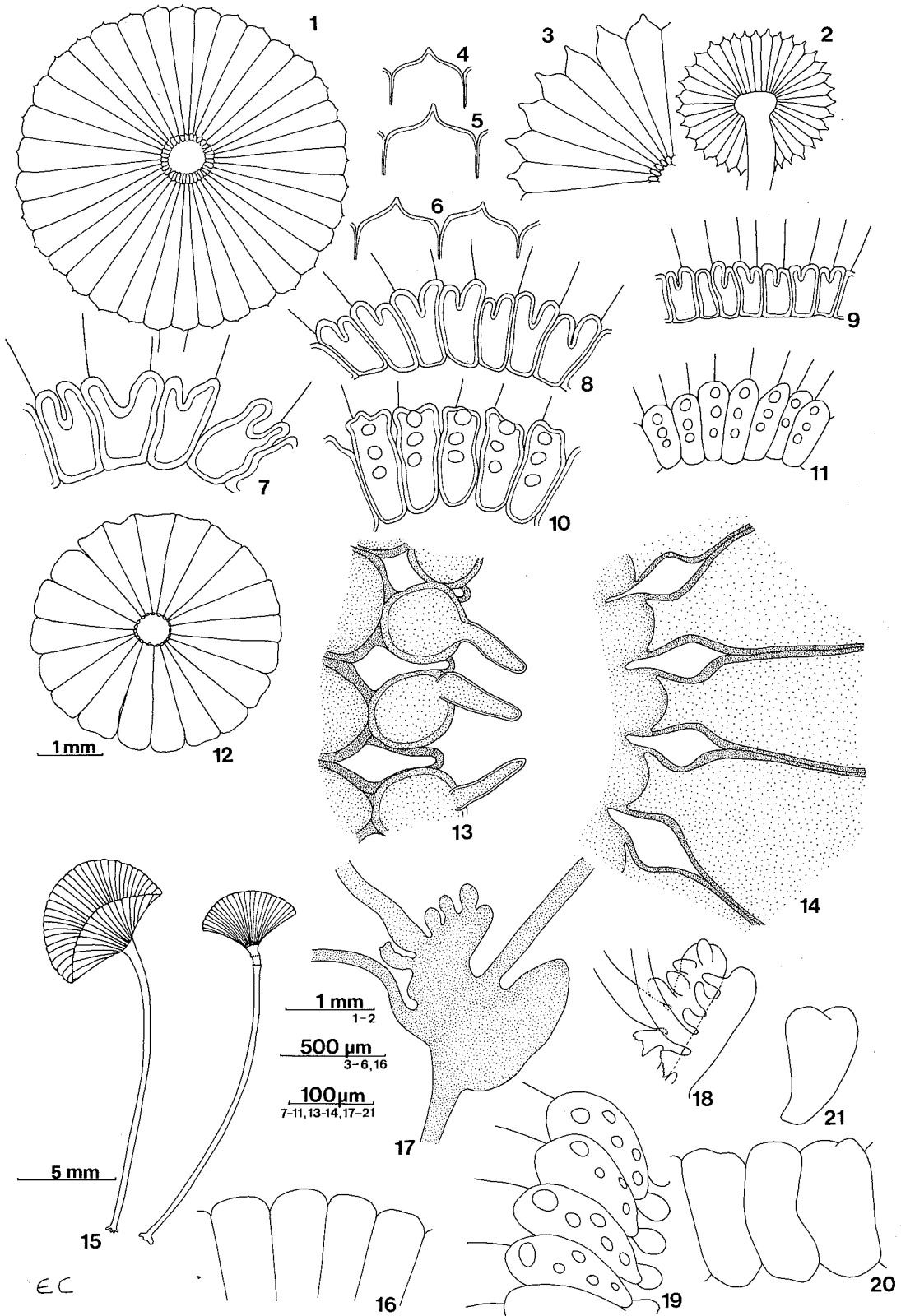
Specimens examined. SN 11500: Salayer, in sandy and silty subtidal seagrass meadows.

Geographic distribution. Only known from the type material: Philippines, Pacific Ocean.

Discussion. These specimens correspond with the descriptions of this taxon by GILBERT (1942: 31) (as *A. philippinensis* Gilbert) and by VALET (1969: 613) except for the shape of the cap (flat) and the slightly larger sizes of corona superior and inferior (150-200  $\mu\text{m}$ ). Those of *A. ryukyuensis* are even larger (200-250  $\mu\text{m}$ ) and the margin of the segments of the corona inferior is obtuse. *A. calyculus* Quoy & Gaimard, which is characterized by the infundibuliform cap, differs by the number of gametangial segments (20-30) and the number of trichoblasts on each corona superior segment (2-4). *A. roxasii* Trono *et al.* differs because of the larger sizes of the cap (11-14 mm), of the corona superior (150-225  $\mu\text{m}$ ) and inferior (107-232  $\mu\text{m}$ ), which segments are deeply constricted into 2-3 parts.

#### *Polyphysa*

##### *Polyphysa parvula* (Solms-Laubach) Schnetter & Bula Meyer (Figs 12-14).



A single sterile specimen. Stipe 5 mm long, transversely wrinkled, cap flat, 4 mm in diameter, made up of 20 gametangial rays which are joined by the calcification; apices of the rays slightly emarginate (Fig. 12). Segments of the corona superior roundish (Fig. 13), 90  $\mu\text{m}$  in diameter, bearing no or only one young trichoblast. Corona inferior absent (Fig. 14).

Specimen examined. SN 10917: Komodo, on steep reef slope.

Geographic distribution. In all oceans along tropical or subtropical coasts; already recorded for Indonesia.

Discussion. According to VALET (1969: 622) and EGEROD (1975: 63) (both as *Acetabularia parvula* Solms-Laubach) the segments of the corona superior bear (3-) 4-5 (-6) trichoblasts. TRONO *et al.* (1978: 87) mention (under *A. moebii* Solms-Laubach) "the number of hair scars not clearly seen" but they only figure a single one per segment (see their fig. 4a).

### **Bornetella Munier-Chalmas**

Both collected species are morphologically very similar: thallus not ramified, clubshaped, dark green, surface built up by rows of small hexagones. They differ in their reproductive structures, which are produced laterally on the branches of first order (see identification key).

**Bornetella nitida** (Harvey) Munier-Chalmas (Figs 22-26).

Fully grown and fertile specimens from this expedition up to 4 cm high, clubshaped and strongly curved with a total length of 5 (-6) cm (Fig. 22). Width of the cortical cells (in surface view and measured between parallel sides of the hexagones) generally 250 (-300)  $\mu\text{m}$  (Figs 23, 24). Only 1 (or 2) gametangium on each branch of first order, containing a large number (> 20) of cysts (Figs 25, 26).

Specimens examined. SN 10527: Sumba, NE coast, on sandy reef flat; SN 11494 and SN 11561: Salayer, in sandy and silty subtidal seagrass meadows; SN 11601: Salayer, in dense intertidal seagrass beds.

Geographic distribution. Tropical Indo-Pacific; already recorded for Indonesia.

**Bornetella oligospora** Solms-Laubach (Figs 27-40).

Fully grown and fertile specimens of this collection up to 2 cm high, clubshaped and straight or only slightly curved (Fig. 27). Width of the cortical cells (measured as for *B. nitida*) generally 180 (-200)  $\mu\text{m}$  (Figs 28, 29). More than 4 gametangia on each primary branch (Figs 30, 31), containing a small number (4-8) of cysts (Figs 32-38).

Specimens examined. SN 10358: Tukang Besi Islands, in mixed seagrass meadow; SN 10467: Sumba, NE coast, on reef flat, depth 10-15 m; SN 10907: Komodo, on offshore reef flat, depth 1-3 m; SN 11041 and SN 11062: Sumbawa, N coast, in subtidal seagrass beds; SN 11096: Sumbawa, N coast, on lagoon side of reef, depth 20 m; SN 11148: Sumbawa, N coast, in shallow sublittoral; SN 11168: Tukang Besi Islands, in muddy and sandy seagrass area; SN 11260: Taka Bone Rate Islands, in shallow seagrass meadow; SN 11406: Salayer, in sheltered sandy seagrass meadow.

Geographic distribution. Tropical Pacific and Indian Oceans; already recorded for Indonesia.

Discussion. The specimens preserved as SN 10358 and SN 10907 bear only 3-4 (-5) young gametangia on each primary branch. It can be supposed that a larger number of gametangia would be formed by maturation. The other morphological and anatomical characters agree with *B. oligospora*. The same applies for the sterile SN 11406.

### **Cymopolia Lamouroux**

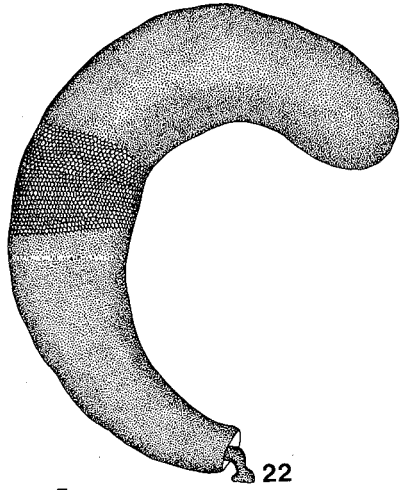
**Cymopolia vanbosseae** Solms-Laubach (Figs 41-43).

Thallus up to 5 mm high, not ramified, clubshaped, segmented (up to 6 superposed segments), apical segment up to 1.5 mm in diameter, bearing a tuft of green filaments (Fig. 41). Gametangia (Fig. 42) shortly stipitate on the top of the primary branch, oval, 200 x 150  $\mu\text{m}$ , surrounded by 5-8 secondary peltate branches which form a continuous cortex (Fig. 43).

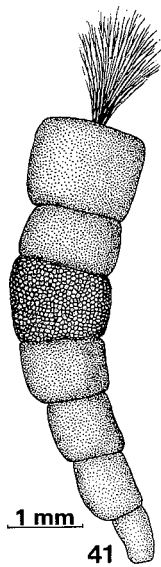
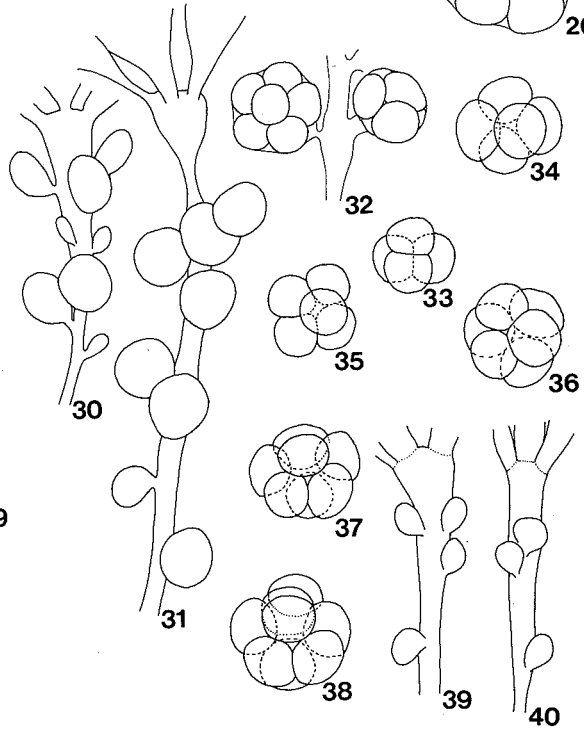
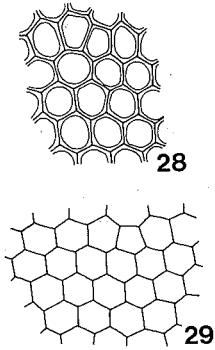
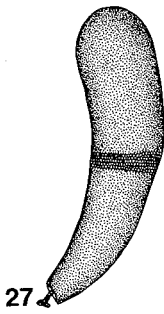
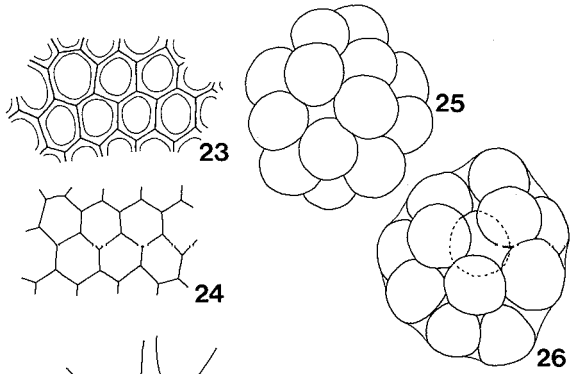
Specimens examined. SN 11033 and SN 11143: Sumbawa, N coast, on shallow sandy stretches.

Geographic distribution. Tropical and subtropical Indo-Pacific; already recorded for Indonesia.

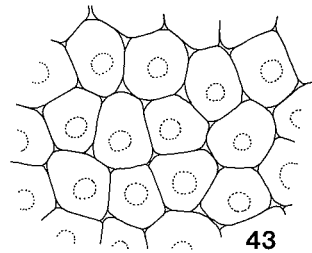
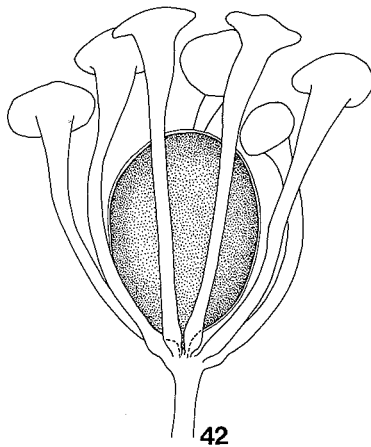
Figs 1-11. *Acetabularia dentata* Solms-Laubach. 1. Surface view of a cap (SN 10975); 2. Lower view of a cap (SN 11414); 3. Detail of 2 (surface view); 4. Margin of the rays (SN 10975); 5, 6 Idem (SN 11562); 7. Corona superior (SN 11145); 8. Idem (SN 11562); 9. Idem (SN 11414); 10. Corona inferior (SN 10975); 11. Idem (SN 11414). Figs 12-14. *Polyphysa parvula* (Solms-Laubach) Schnetter & Bula Meyer (SN 10917). 12. Surface view of a cap; 13. Corona superior; 14. Lower view of the cap: no corona inferior. Figs 15-21. *Acetabularia ryukyuensis* Okamura & Yamada var. *philippinensis* (Gilbert) Valet (SN 11500). 15. Side view of 2 specimens; 16. Margin of the rays; 17. Longitudinal section through the apical part of the thallus: corona inferior, ray, corona superior with trichoblasts, apex of the stipe; 18. Detail of corona superior with trichoblasts; 19. Idem, only trichoblast scars; 20, 21. Corona inferior lobes, sometimes emarginate or bilobate.



5 mm  
22, 27



1 mm



500 μm  
23-24, 28-29

100 μm  
42-43

150 μm  
25-26, 30-40

**Neomeris Lamouroux**

The three species collected are morphologically very similar: thallus not ramified, clubshaped, whitish by the strong calcification (except for the outer surface of the secondary branchlets and of the apical trichoblasts), surface built up by rows of small hexagones. The discriminative characters are: the dimensions of the primary branches, of the gametangia, form of the cellulosic plugs between the top of the primary branch and the pedicel of the gametangium.

**Neomeris annulata** Dickie (Figs 44-48).

Gametangia strongly calcified and cohering in discontinuous rows within a calcareous sheath, markedly elongate after decalcification: 100-150 (-180) x 65-90  $\mu\text{m}$  (Figs 44-46). Cellulosic plug as a cylinder in the pedicel of the gametangium, combined with a cone in the primary branch (Figs 47, 48).

Specimens examined. SN 10957: Komodo, on narrow coastal reef flat; SN 11442 (partim): Salayer, in dense intertidal seagrass beds; SN 11570: Salayer, in sandy and silty subtidal seagrass meadows.

Geographic distribution. All tropical oceans; already recorded for Indonesia.

**Neomeris bilimbata** Koster (Figs 49-62).

Gametangia strongly calcified but free from each other; after decalcification oval: (110-) 140 x (90-) 100  $\mu\text{m}$  (Fig. 49) to subspherical: 130 x 120  $\mu\text{m}$  (Figs 50 and 51). Primary branches 350-400 (-450)  $\mu\text{m}$  long, 50  $\mu\text{m}$  in diameter, the basal ones claviform, 100  $\mu\text{m}$  in diameter, sometimes curved and with rough tips (Figs 58-62), all strongly calcified but free from each other. Cellulosic plug as a cylinder in the pedicel of the gametangium, emarginate to hollowed at the top (Figs 52-54). After release of the gametangium the plug remains on the primary branch, together with the extreme base of the pedicel, thus forming a more complex structure (Figs 55-57) which corresponds with KOSTER's fig. 5 (1937: 221).

Specimens examined. SN 10212: Tukang Besi Islands, on reef flat; SN 11336: Taka Bone Rate Islands, at atoll entrance; SN 11656: Salayer, on reef flat.

Geographic distribution. W. Pacific Ocean.

Discussion. In SN 11656 the tips of the fertile primary branches are typically clavate (Fig. 56) or with flattened sides (Fig. 52), but in SN 10212 and SN 11336 they frequently become trifurcate as in *N. vanbosseae* (Figs 49, 53). The other characters still point to *N. bilimbata*.

**Neomeris vanbosseae** Howe (Figs 63-71).

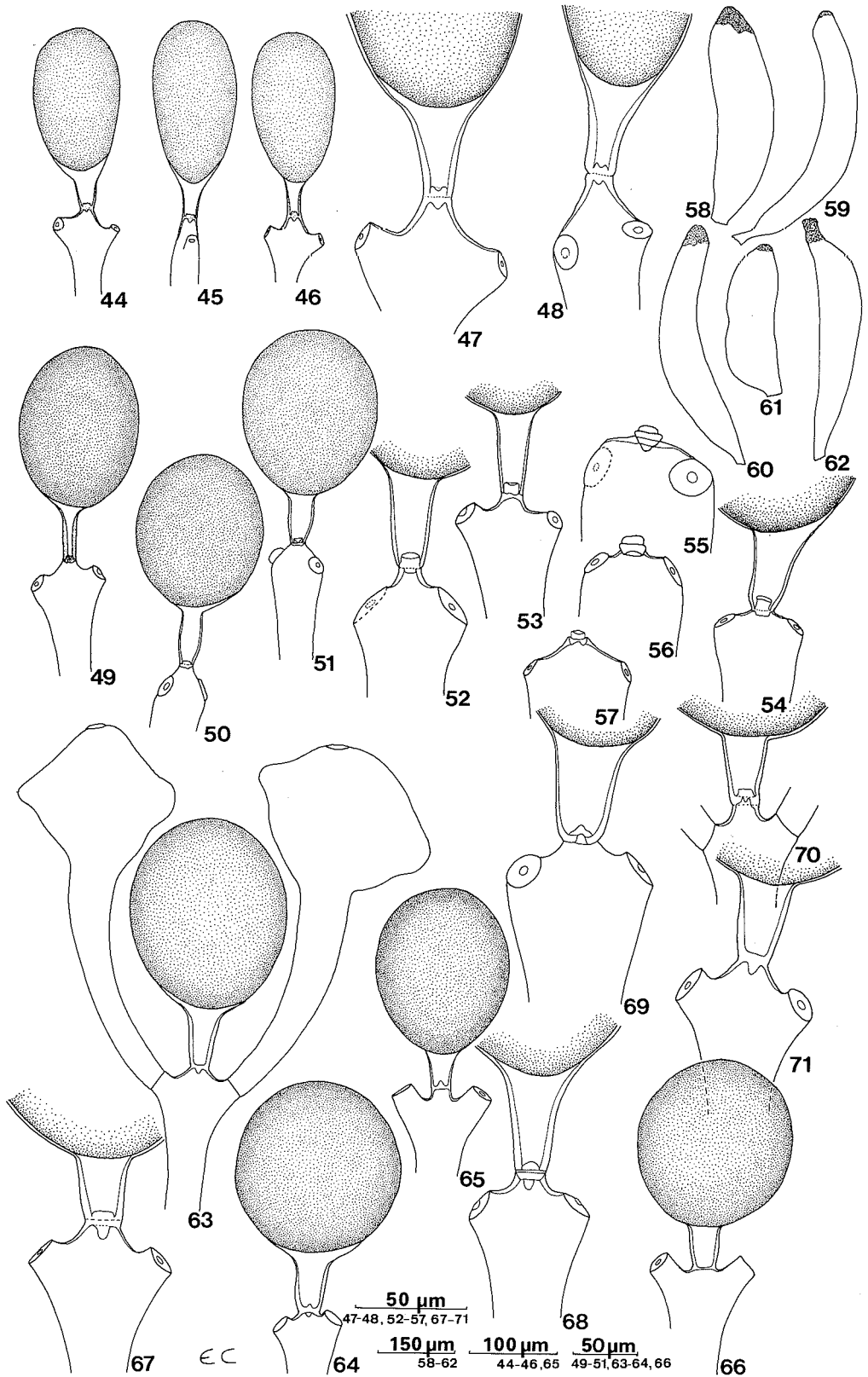
Gametangia strongly calcified but free from each other. After decalcification spherical (120-140  $\mu\text{m}$  in diameter, Figs 64, 66), obovoid (Fig. 65) or oval (160 x 120  $\mu\text{m}$ , Fig. 63). Primary branches (450-) 560-640 (-770)  $\mu\text{m}$  long, 24  $\mu\text{m}$  in diameter, strongly calcified but free from each other (exceptionally short flabelliform scales at the base of some branches). Cellulosic plug very variable from one collection to another and even within one specimen: sometimes absent (Fig. 66) or restricted to an inconspicuous swelling, sometimes a cone (Figs 65, 69) or a cylinder in the pedicel of the gametangium, sometimes the latter combined with a spiny outgrowth in the primary branch (Figs 64, 67, 68, 70), or exclusively an appendage downwards (Fig. 71).

Specimens examined. SN 10470: Sumba, NE coast, on extensive, gently sloping reef flat, depth 10-15 m; SN 10525: Sumba, NE coast, on sandy, gradually sloping reef, depth 5-12 m; SN 10655: Sumba, NE coast, in stony littoral; SN 11021: Sumbawa, N coast, in shallow sandy bay; SN 11040: Sumbawa, N coast, in seagrass meadows; SN 11097: Sumbawa, N coast, on lagoon side of reef; SN 11144: Sumbawa, N coast, in shallow sublittoral; SN 11213 and SN 11244: Taka Bone Rate Islands, on edge of reef flat; SN 11442 (partim): Salayer, in dense intertidal seagrass beds.

Geographic distribution. Indo-Pacific; already recorded for Indonesia.

Discussion. Some specimens are typically *N. van-*

Figs 22-26. *Bornetella nitida* (Harvey) Munier-Chalmas. 22. Habit of a large specimen (the surface texture only partly represented) (SN 11494); 23. Surface view of cortical cells (without decalcification) (SN 11494); 24. Idem after decalcification (SN 11156); 25. Gametangium with cysts (SN 11156); 26. Idem (11601). Figs 27-40. *Bornetella oligospora* Solms-Laubach. 27. Habit (the surface texture has only partly been represented) (SN 11062); 28. Surface view of cortical cells (without decalcification) (SN 10907) 29. Idem after decalcification (SN 11041); 30. Primary branch with young (undivided) gametangia (SN 11148); 31. Idem (SN 11041); 32. Ripe gametangia with cysts on the primary branch (SN 11062); Stages in division of the gametangium: 33. (SN 11096); 34. (SN 11168); 35. (SN 11096); 36, 37, 38. (SN 11168); 39, 40. Primary branches with only 3 or 4 young (undivided) gametangia (SN 10907). Figs 41-43. *Cymopolia vanbosseae* Solms-Laubach (SN 11033). 41. Habit (surface texture only represented in one segment); 42. Shortly stipitate gametangium, terminal on a primary branch, surrounded by secondary branches; 43. Surface view of the cortical layer (dotted lines: cylindrical part of secondary branches).



*bosseae* in all characters: long primary branches: 500-770  $\mu\text{m}$ , with trifurcate apices, spherical gametangia, cellulosic plug with an appendage in the primary branch. But others are aberrant in one or more characters: e.g. SN 10470: gametangia obovoid (160 x 120  $\mu\text{m}$ ), plug as a cone in the pedicel. These characters rather correspond with *N. mucosa* Howe, but the length (450-640  $\mu\text{m}$ ), the width (30  $\mu\text{m}$ ) and the trifurcate apex of the primary branches as well as the uncalcified outer wall of the secondary branches agree with *N. vanbosseae*.

## 2. IDENTIFICATION

Identification key for the Dasycladales from the Snellius-II expedition

- 1 a. Thallus composed of a stipe bearing one cap 2
- b. Thallus cylindrical-clubshaped ..... 4
- 2 a. Corona inferior absent ..... *Polyphysa parvula*
- b. Corona inferior present ..... 3
- 3 a. Corona superior segments with 3 trichoblasts; corona inferior segments deeply bilobed .....  
*Acetabularia dentata*
- b. Corona superior segments with 5-6 trichoblasts; corona inferior segments emarginate to slightly bilobed .....  
*A. ruyukyuensis* var. *philippinensis*
- 4 a. Thallus composed of superposed cylindrical segments ..... *Cymopolia vanbosseae*
- b. Thallus without constrictions (no segments).. 5
- 5 a. Thallus whitish; fertile cysts terminal on the primary branches ..... *Neomeris* 6
- b. Thallus greenish; fertile cysts lateral on the primary branches ..... *Bornetella* 8
- 6 a. Basis of the thallus showing discontinuous annular rows; gametangia oblong .... *N. annulata*
- b. No annular rows ..... 7
- 7 a. Apices of the primary branches markedly trifurcate; gametangia spherical; cellulosic plug variable but mostly with a downward pointed spine or cone ..... *N. vanbosseae*
- b. Apices of the primary branches clavate or with flattened sides; gametangia oval to subspherical; cellulosic plug composed of a ring in the pedicel of the gametangium .....  
*N. bilimbata*
- 8 a. Thallus strongly curved 1(2) reproductive structures on each primary branch, containing nume-

- rous cysts (> 15) ..... *B. nitida*
- b. Thallus straight or slightly curved; more than 4 reproductive structures on each primary branch, containing 4-8 cysts ..... *B. oligospora*

## 3. DISCUSSION

Several species belonging to the Dasycladales which were recorded during the Siboga Expedition 1899-1900 (WEBER-VAN BOSSE, 1913) were not collected again during the Snellius II-expedition (*Acetabularia exigua* Solms-Laubach, *Bornetella capitata* (Harvey) J. Agardh f. *brevistylis* Arnoldi, *B. sphaerica* (Zanardini) Solms-Laubach, *Halicoryne spicata* (Kützinger) Solms-Laubach). TAYLOR (1966) recorded *Halicoryne wrightii* Harvey from Bali. On the other hand only *Acetabularia ruyukyuensis* var. *philippinensis* and *Neomeris bilimbata* are new records for Indonesia. This relative paucity is probably due to the fact that we only collected for four weeks (compared to one year in the Siboga Expedition), inventories of each site being made only partly and roughly for one or two days. Moreover, the collecting sites were situated in clear water (best development of corals) and not in mangrove areas or estuaries, which are more favoured by algae. Therefore it would be premature to conclude that the Dasycladales flora of the area studied is poorer than at the end of last century.

## 4. REFERENCES

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Figs 44-48. *Neomeris annulata* Dickie (SN 11570). 44-46. Apical part of primary branches with gametangium and cellulosic plug; 47, 48. Details. Figs 49-62. *Neomeris bilimbata* Koster. 49-51. Apical part of primary branches with gametangium and cellulosic plug (SN 10212); Details: 52. (SN 11656); 53, 54. (SN 10212); Apices of primary branches, the gametangia having fallen off: 55, 56. (SN 11656), 57. (SN 10212) 58-62. Clavate primary branches from the base of the thallus (SN 11656). Figs 63-71. *Neomeris vanbosseae* Howe. 63. Apical part of primary branch with gametangium and 2 secondary branches (SN 11021); Idem but without secondary branches: 64. (SN 11144), 65. (SN 10655), 66. (SN 11213); Details of the cellulose plug: 67. (SN 11021), 68. (SN 10525), 69. (SN 10470), 70. (SN 11040), 71. (SN 11021).

