

The genus *Sinularia* (Octocorallia: Alcyonacea) at Palau, Micronesia

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A collection of *Sinularia* specimens from Palau has been studied, which represents 38 different species. Of these, 15 are new to science, which are described and figured: *S. babeldaobensis*; *S. bisulca*; *S. crebra*; *S. digitata*; *S. finitima*; *S. flaccida*; *S. foliata*; *S. humilis*; *S. luxuriosa*; *S. siaesensis*; *S. sublimis*; *S. tumulosa*; *S. ultima*; *S. uniformis*; *S. verruca*. *S. larsonae* Verseveldt, in Verseveldt & Alderslade, 1982, is synonymized with *S. sobolifera* Verseveldt & Tursch, 1979.

Introduction

The *Sinularia* fauna of Palau is still poorly known. Utinomi (1956) was the first to publish about this fauna. He mentioned only three species: *S. flexibilis* (Quoy & Gaimard, 1833), *S. gardineri* (Pratt, 1903), and *S. polydactyla* (Ehrenberg, 1834). Verseveldt (1978) listed *S. dura* (= *S. brassica* May, 1898), *S. polydactyla*, and ?*S. scabra* Tixier-Durivault, 1970. Almost 50 years after Utinomi's findings Fabricius & Alderslade (2001) showed pictures from Palau of *S. brassica* and *S. lamellata* Verseveldt & Tursch, 1979. Fabricius et al. (2007) mentioned more than 20 species of *Sinularia* to occur around Palau, eight of them identified to species level: *S. abrupta* Tixier-Durivault, 1970, *S. flexibilis* (Quoy & Gaimard, 1833), *S. fungoides* Thomson & Henderson, 1906, *S. grandilobata* Verseveldt, 1980, *S. heterospiculata* Verseveldt, 1970, *S. lamellata* Verseveldt & Tursch, 1979, *S. peculiaris* Tixier-Durivault, 1970, and *S. polydactyla* (Ehrenberg, 1834).

Of these 11 identified species, only *S. gardineri* and *S. polydactyla* were not found in the present study; ?*S. scabra* was re-examined and included in *S. luxuriosa* spec. nov. Verseveldt (1980) regarded Utinomi's identification of *S. gardineri* for Palau as incorrect, though he did not mention why. Utinomi described his two specimens as flat colonies with short digitate lobes, 4-12 mm long; lobes bluntly tipped and not subdivided. His schematic drawings of sclerites suggest *leptocladus*-type clubs. Therefore, his specimens could have been *S. gaveshaniae* Alderslade & Shirwaiker, 1991, or *S. digitata* spec. nov., but it is not sure whether they are still available for re-examination to get certainty about this matter. The precise characters of *S. polydactyla* are unknown, but I consider it doubtful that this species occurs in Palau (see discussion).

A two-week survey (May, 2005) around the island of Koror, using Scuba, accumulated a considerably number of *Sinularia* specimens from 15 different stations (see station list). Each specimen encountered was photographed under water, part of it was deposited in the NNM (Nationaal Natuurhistorisch Museum Naturalis), another part in the collection of the CRRF (Coral Reef Research Foundation). In total 56 specimens

were collected, representing 38 different species (see species list), 15 of which are new to science and which are described and figured in the present publication.

Of the 56 specimens collected, 27 were used in the construction of a phylogenetic tree of *Sinularia* (McFadden et al., in prep); these specimens are also discussed below.

Abbreviations

- CSIRO = Commonwealth Scientific and Industrial Research Organisation, Australia.
 NTM = Museum and Art Gallery of the Northern Territory, Darwin, Australia.
 PIRC-CN = Coral Reef Research Foundation, Palau.
 RMNH = National Museum of Natural History (NNM), formerly Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands.

Station list

- KOR.01: Palau, Koror, "Ngederrak Reef", E of Ngeruktabel Island, 07°17'05.0"N 134°29'20.0"E; 12.v.2005, depth 20 m.
 KOR.02: Palau, Koror, Ngerikuul Pass, E. of Ngeteklou Island, pass between Ngeteklou and Ngermeuangel Islands, 07°19'13.4"N 134°31'26.8"E; 12/21.v.2005, depth -25 m.
 KOR.03: Palau, Koror, Mutremdiu, west side Uchelbeluu Reef, barrier reef south-east of town of Koror, 07°16'25.2"N 134°31'26.8"E; 13/21.v.2005, depth -20 m.
 KOR.04: Palau, Koror, Toachel Mid (KB Channel between Koror and Babeldaob), SW side of channel near Itelblong Island, 07°20'21.9"N 134°31'03.8"E; 13.v.2005, depth -20 m.
 KOR.05: Palau, Koror, Wonder Channel (Rock Islands), NW side of Mercherchar Island, 07°10'53.3"N 134°21'38.6"E; 16.v.2005, depth -20 m.
 KOR.06: Palau, Koror, Wonder Channel (Rock Islands), NW side of Mercherchar Island, 07°10'56.5"N 134°21'38.7"E; 16.v.2005, depth 25 m.
 KOR.07: Palau, Koror, Siaes Reef, western barrier reef, 07°18'41.8"N 134°13'36.5"E; 17.v.2005, depth -30 m.
 KOR.08: Palau, Koror, Ngerumekaul Channel, channel in western barrier reef W of Ulong Island, 07°16'54.7"N 134°14'43.5"E; 17.v.2005, depth -25 m.
 KOR.09: Palau, "Toagel Mlungi Channel", channel in western barrier reef off Babeldaob, 07°32'33.0"N 134°28'06.6"E; 18.v.2005, depth -25 m.
 KOR.10: Palau, "Ngaregabab Reef", lagoon patch reef southwest of Babeldaob, 07°24'50.4"N 134° 26'38.2"E; 18.v.2005, depth -6.5 m.
 KOR.11: Palau, Airai, Toachel Mid (KB Channel between Koror and Babeldaob), E side off Babeldaob, 07°21'28.1"N 134°30'31.0"E; 19.v.2005, depth 15 m.
 KOR.12: Palau, Koror, cove in Rock islands, N side of Ulebsechel Island, 07°19'04.8"N 134°29'18.7"E; 19.v.2005.
 KOR.13: Palau, Koror, Uchelbeluu Reef, E side, barrier reef south-east of town of Koror, 07°16'25.2"N 134°31'27.0"E; 20.v.2005; depth -30 m.
 KOR.14: Palau, Peleliu, drop-off, Ngermokat, SW side of Peleliu Island, 06°58'36.9"N 134°13'20.0"E; 23.v.2005, depth -30 m.
 KOR.15: Palau, Koror, Big Drop Off, E side of Ngemelis reef adjacent to island, 07°06'48.8"N 134°15'36.4"E; 23.v.2005, depth -25 m.

***Simularia* species list of Palau (previously recorded species in bold)**

1. *S. abhishiktae* Ofwegen & Vennam, 1991: KOR.03 (RMNH Coel. 38720)
2. ***S. abrupta*** Tixier-Durivault, 1970: KOR.13 (RMNH Coel. 34314; RMNH Coel. 34315, PIRC-CNI149) (Fabricius et al., 2007)
3. *S. acuta* Manuputty & Ofwegen, 2007: KOR.05 (RMNH Coel. 38721, PIRC-CNI147); KOR.06 (RMNH Coel. 38722)
4. *S. babeldaobensis* spec. nov.: KOR.09 (RMNH Coel. 38723, PIRC-CNI132)
5. *S. bisulca* spec. nov.: KOR.05 (RMNH Coel. 38724, PIRC-CNI148)
6. ***S. brassica*** May, 1898: KOR.02 (RMNH Coel. 34301); KOR.03 (RMNH Coel. 34302, PIRC-CNI137; RMNH Coel. 34303, PIRC-CNI108); KOR.05 (RMNH Coel. 34304, PIRC-CNI144); KOR.06 (RMNH Coel. 34305, PIRC-CNI150) (Fabricius & Alderslade, 2001)
7. *S. corpulentissima* Manuputty & Ofwegen, 2007: KOR.08 (RMNH Coel. 38725, PIRC-CNI118)
8. *S. crebra* spec. nov.: KOR.13 (RMNH Coel. 38726)
9. *S. cruciata* Tixier-Durivault, 1970: KOR.03 (RMNH Coel. 34320, PIRC-CNI131)
10. *S. densa* (Whitelegge, 1897): KOR.07 (RMNH Coel. 34310, PIRC-CNI125); KOR.09 (RMNH Coel. 34311, PIRC-CNI116)
11. *S. digitata* spec. nov.: KOR.09 (RMNH Coel. 38727, PIRC-CNI114)
12. *S. finitima* spec. nov.: KOR.10 (RMNH Coel. 38728, PIRC-CNI112); KOR.04 (RMNH Coel. 38729, PIRC-CNI100); KOR.05 (RMNH Coel. 38730)
13. *S. flaccida* spec. nov.: KOR.15 (RMNH Coel. 38731)
14. ***S. flexibilis*** (Quoy & Gaimard, 1833): KOR.08 (RMNH Coel. 34312, PIRC-CNI151); KOR.13 (RMNH Coel. 34313) (Utinomi, 1956; Fabricius et al., 2007)
15. *S. foliata* spec. nov.: KOR.03 (RMNH Coel. 38732)
16. ***S. fungoides*** Thomson & Henderson, 1906: KOR.14 (RMNH Coel. 34321, PIRC-CNI123) (Fabricius et al., 2007)
17. *S. gaveshaniae* Alderslade & Shirwaiker, 1991: KOR.01 (RMNH Coel. 38733, PIRC-CNI138)
18. *S. gaweli* Verseveldt, 1978: KOR.15 (RMNH Coel. 38734, PIRC-CNI106)
19. ***S. grandilobata*** Verseveldt, 1980: KOR.15 (RMNH Coel. 38735, PIRC-CNI117) (Fabricius et al., 2007)
20. *S. gravis* Tixier-Durivault, 1970: KOR.14 (RMNH Coel. 38736)
21. ***S. heterospiculata*** Verseveldt, 1970: KOR.07 (RMNH Coel. 34316, PIRC-CNI122); KOR.08 (RMNH Coel. 34317) (Fabricius et al., 2007)
22. *S. hirta* (Pratt, 1903): KOR.03 (RMNH Coel. 34306, PIRC-CNI156); KOR.11 (RMNH Coel. 34307)
23. *S. humilis* spec. nov.: KOR.05 (RMNH Coel. 38737, PIRC-CNI154)
24. ***S. lamellata*** Verseveldt & Tursch, 1979: KOR.11 (RMNH Coel. 34318, PIRC-CNI145) (Fabricius & Alderslade, 2001; Fabricius et al., 2007)
25. *S. aff. leptocladus*: KOR.01 (RMNH Coel. 38738, PIRC-CNI139); KOR.08 (RMNH Coel. 38739, PIRC-CNI111); KOR.14 (RMNH Coel. 38740); KOR.15. (RMNH Coel. 38741)
26. *S. luxuriosa* spec. nov.: KOR.04 (RMNH Coel. 38742, PIRC-CNI101)
27. *S. macrodactyla* Kolonko, 1926: KOR.13 (RMNH Coel. 38743)

28. *S. notanda* Tixier-Durivault, 1966; KOR.13 (RMNH Coel. 34319)
29. *S. pavida* Tixier-Durivault, 1970; KOR.13 (RMNH Coel. 38744)
30. *S. peculiaris* Tixier-Durivault, 1970; KOR.13 (RMNH Coel. 38745) (Fabricius et al., 2007)
31. *S. querciformis* (Pratt, 1903); KOR.03 (RMNH Coel. 34308); KOR.11 (RMNH Coel. 34309, PIRC-CNI110)
32. *S. siaesensis* spec. nov.: KOR.07 (RMNH Coel. 38746); KOR.07 (RMNH Coel. 38747)
33. *S. sobolifera* Verseveldt & Tursch, 1979; KOR.06 (RMNH Coel. 38748, PIRC-CNI155); KOR.15 (RMNH Coel. 38749)
34. *S. sublimis* spec. nov.: KOR.07 (RMNH Coel. 38750)
35. *S. tumulosa* spec. nov.: KOR.14 (RMNH Coel. 38751)
36. *S. ultima* spec. nov.: KOR.13 (RMNH Coel. 38752)
37. *S. uniformis* spec. nov.: KOR.09 (RMNH Coel. 38753, PIRC-CNI115)
38. *S. verruca* spec. nov.: KOR.07 (RMNH Coel. 38754, PIRC-CNI127)

***Sinularia* species included in comparisons but not recorded from Palau**

- S. acetabulata* Verseveldt & Tursch, 1979
- S. anomala* Verseveldt & Benayahu, 1983
- S. arborea* Verseveldt 1970
- S. bremerensis* Ofwegen, 2008
- S. capitalis* (Pratt, 1903)
- S. crassa* Tixier-Durivault, 1945
- S. compacta* Tixier-Durivault, 1970
- S. compressa* Tixier-Durivault, 1945
- S. conferta* Dana, 1846
- S. conferta* var. *gracilis* Macfadyen, 1936
- S. confusa* Ofwegen, 2008
- S. crispa* Tixier-Durivault, 1970
- S. dactyloclados* Verseveldt & Benayahu, 1983
- S. deformis* Tixier-Durivault, 1969
- S. densa* (Whitelegge, 1897)
- S. discrepans* Tixier-Durivault, 1970
- S. fishelsoni* Verseveldt, 1970
- S. flabelliclavata* Verseveldt & Benayahu, 1983
- S. frondosa* Verseveldt, 1978
- S. gardineri* (Pratt, 1903)
- S. gaveshaniaea* Alderslade & Shirwaiker, 1991
- S. gibberosa* Tixier-Durivault, 1970
- S. higai* Benayahu, 2002
- S. hirta* (Pratt, 1903)
- S. kotanianensis* Manuputty & Ofwegen, 2007
- S. larsonae* Verseveldt, 1982
- S. leptoclados* (Ehrenberg, 1834)
- S. licroclados* Verseveldt & Benayahu, 1983
- S. linnei* Ofwegen, 2008

- S. lochmodes* Kolonko, 1926
- S. longula* Manuputty & Ofwegen, 2007
- S. loyai* Verseveldt & Benayahu, 1983
- S. maxima* Verseveldt, 1971
- S. molesta* Tixier-Durivault, 1970
- S. numerosa* Tixier-Durivault, 1970
- S. nanolobata* Verseveldt, 1977
- S. ornata* Tixier-Durivault, 1970
- S. ovispiculata* Tixier-Durivault, 1970
- S. papula* Ofwegen, 2008
- S. polydactyla* (Ehrenberg, 1834)
- S. schumacheri* Verseveldt & Benayahu, 1983
- S. verseveldti* Ofwegen, 1996
- S. vrijmoethi* Verseveldt, 1971
- S. woodyensis* Ofwegen, 2008

Descriptive part

S. abhishiktae Ofwegen & Vennam, 1991
(figs 1a, 75a)

S. abhishiktae Ofwegen & Vennam, 1991: 148; Ofwegen & Benayahu, 1992: 140.

Material examined.— RMNH Coel. 38720, colony fragment and microscope slide, KOR.03.

Molecular study.— Specimen RMNH Coel. 38720 showed the same DNA sequence as the holotype of *S. foliata* spec. nov. and *S. gravis* (RMNH Coel. 38736). For a comparison of these species see the remarks of *S. foliata*.

Remarks.— The species was originally described from the Laccadives, and later found in Tanzania as well (Ofwegen & Benayahu, 1992: 140). The present specimen shows the same colony shape and corrugated colony surface (figs 1a, 75a), but the sclerites are slightly different. For now, I consider these differences intraspecific variation.

Sinularia acuta Manuputty & Ofwegen, 2007
(figs 1b-c, 2, 75b)

Sinularia acuta Manuputty & Ofwegen, 2007: 193.

Material examined.— RMNH Coel. 38721, colony fragment and microscope slide, KOR.05; RMNH Coel. 38722, colony fragment and microscope slide, KOR.06.

Molecular study.— Specimen RMNH Coel. 38721 showed the same DNA sequence as the holotype of *S. acuta* (RMNH Coel. 38432), *S. longula* (RMNH Coel. 38439), *S. molesta* (RMNH Coel. 38440) and *S. lochmodes* (RMNH Coel. 38404). *S. acuta* specimen RMNH Coel. 38722 could not be amplified.

Remarks.— This species was recently described from Ambon by Manuputty & Ofwegen (2007). Based on preserved material it was characterized as having an arbo-

rescent colony form, however, live colony photographs of the present material (fig. 75b) show that it is an encrusting species. For comparison, the Palau preserved colony fragments (fig. 1b-c), anthocodial sclerites, and clubs of the surface layer of the top of these colonies are presented (fig. 2).

Sinularia babeldaobensis spec. nov.
(figs 3a-b, 4-7, 75c)

Material examined.— RMNH Coel. 38723, holotype and 2 microscope slides, KOR.09.

Description.— The holotype is part of an encrusting colony, with a maximum cross-section of 6×10 cm (figs 3a-b). The height of the fragment is 6 cm. The primary lobes have knob- to finger-shaped lobules, but undivided finger-like lobes also are present; several lobes and lobules are slightly flattened.

The surface layer of the lobes contains clubs with a central wart (figs 4-5a). This wart and the three tubercles below it can be foliaceous. The clubs are up to 0.25 mm long. Furthermore, small spindles are present, that have the same length as the clubs, and mostly with prominent simple tubercles (fig. 5b). Sclerites intermediate between small spindles and clubs are also common. There are no sclerites in the polyps.

The clubs of the surface layer of the base resemble those of the lobules but are shorter and wider (fig. 6a). The small spindles do not differ much from those of the top of the colony (fig. 6b).

The interior of the lobules has unbranched and branched spindles (fig. 7a), up to 2 mm long, with simple or complex tubercles (fig. 7b). In the base of the colony similar shaped and sized spindles occur (fig. 7c), with slightly more complex tubercles (fig. 7d).

Colour.— The preserved specimen is white.

Etymology.— The species is named after the island Babeldaob; the holotype was collected in a channel in the western barrier reef off this island.

Molecular study.— The holotype of *S. babeldaobensis* showed an unique sequence.

Remarks.— The holotype of *S. babeldaobensis* spec. nov. mostly resembles that of *S. tumulosa* spec. nov., both species have somewhat similar lobes and branched spindles in the interior of the colony. However, *S. tumulosa* has smaller clubs (up to 0.20 mm long) which have less foliaceous central warts. Moreover, the live colony shapes are distinctly different, *S. tumulosa* have many small knobs (fig. 78e), whereas *S. babeldaobensis* has mostly subdivided primary lobes (fig. 75c). The resemblance between both holotypes is purely an effect of collecting small fragments not showing the proper colony shape.

Sinularia bisulca spec. nov.
(figs 1d, 8-11, 75d)

Material examined.— RMNH Coel. 38724, holotype and 1 microscope slide, KOR.05.

Description.— The holotype is part of an encrusting colony, 7 cm high and 4 cm wide (fig. 1d). It has long, slender lobes, up to 4 cm long, which split at the end or have several small lobules; these lobules are up to about 1 cm long.

The polyps have a collaret and eight points. Collaret with bent spindles, up to 0.20 mm long (fig. 8a), points with poorly developed clubs, up to 0.15 mm long (fig. 8b). Tentacles have small rods, up to 0.10 mm long.

The surface layer of the lobes has *leptoclados*-type clubs, the smallest are 0.06 mm long, most are around 0.10 mm, but some reach even a length of 0.15 mm (fig. 8c); in addition longer wart clubs are present, up to 0.25 mm long (fig. 9a). Furthermore, the surface layer of the lobes has spindles, up to 0.35 mm long, with simple tubercles (fig. 9b-c).

The sclerites of the surface layer of the base of the colony resemble those of the lobes, but are wider and shorter than those of the lobules (fig. 10a-b).

The interior of the colony has unbranched spindles, up to 2 mm long (fig. 11a, c-d). Most of them have complex tubercles (fig. 11b-e).

Colour.— The preserved specimen is whitish.

Etymology.— The Latin “*bisulca*”, split in two parts, forked, refers to the split primary lobes of this species.

Molecular study.— The holotype of *S. bisulca* falls in the clade with other species with *leptoclados*-type clubs, but it has a unique sequence. In the group of species with this type of club, the live colony shape of the present species (fig. 75d) resembles that of *S. densa* (fig. 75g) and probably also *S. fishelsoni*, and to a lesser content that of *S. digitata* spec. nov.

Remarks.— *S. densa* differs from *S. bisulca* in having a different type of *leptoclados*-type clubs (see Ofwegen & Vennam, 1991: fig. 2). *S. fishelsoni* differs in having numerous branched spindles in the interior of the lobes. *S. digitata* differs in having finger-like lobes only (figs 12c, 75h), much longer point and collaret sclerites, overall more tuberculate small spindles in the surface layer of the lobes, and much longer interior spindles.

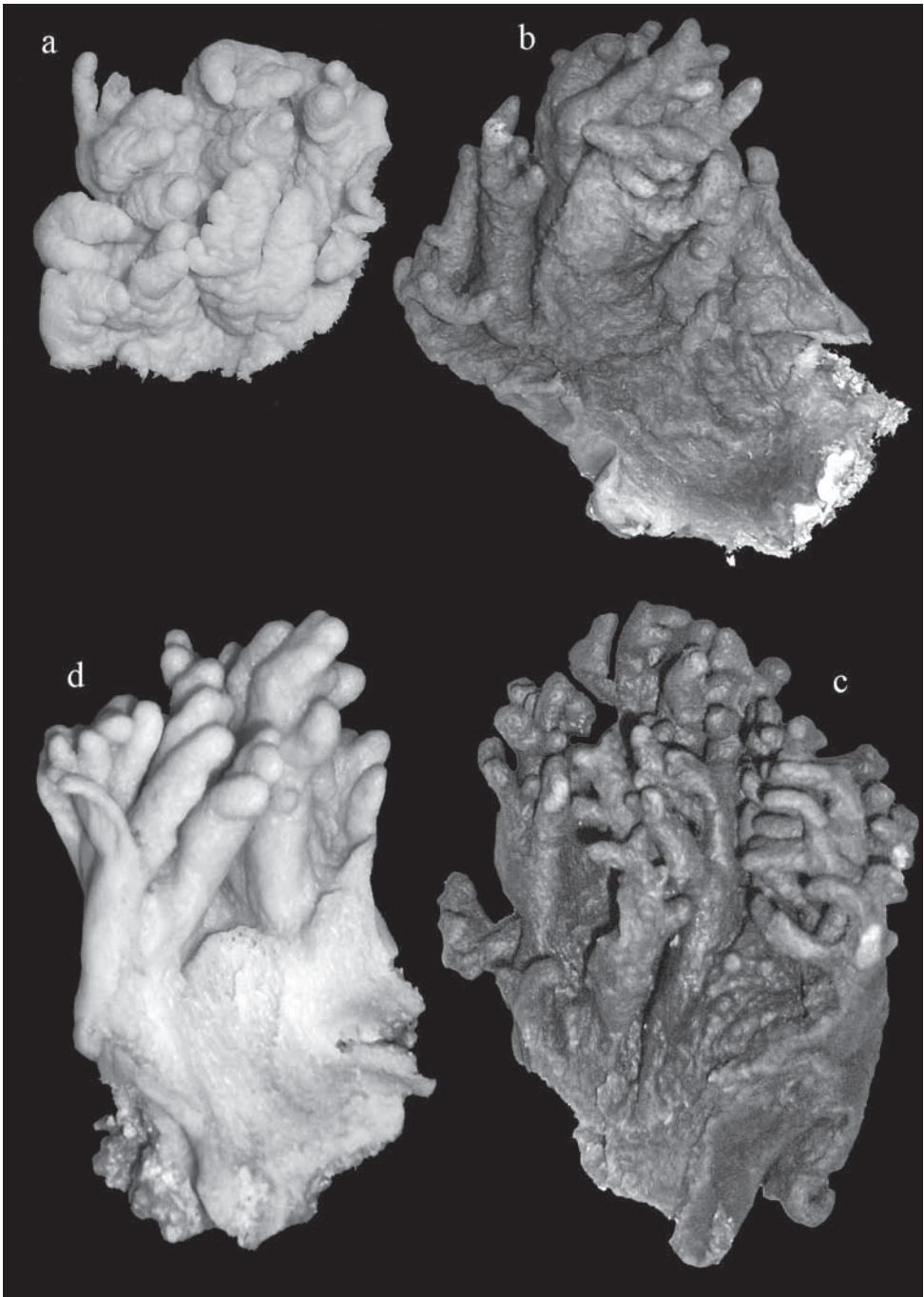


Fig. 1a. *Simularia abhishiktae*, RMNH Coel. 38720, view from above; b-c, *S. acuta*, lateral views, b, RMNH Coel. 38721, c, RMNH Coel. 38722; d, *S. bisulca* spec. nov., holotype RMNH Coel. 38724, lateral view. All natural size.

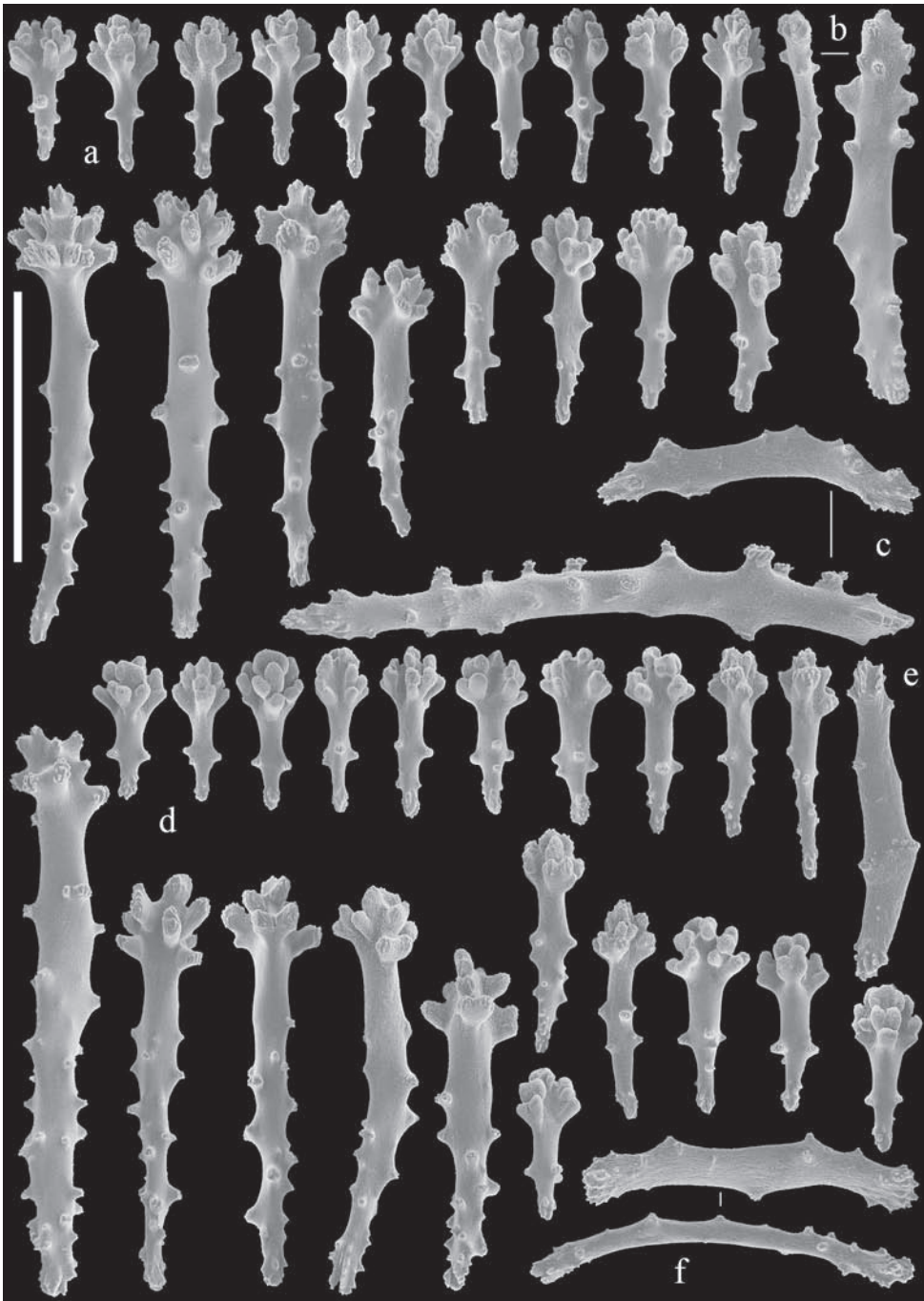


Fig. 2. *Simularia acuta*; a-c, RMNH Coel. 38721; d-f, RMNH Coel. 38722; a, clubs of surface layer of the top of colony; b, point clubs; c, collaret spindles; d, clubs of surface layer of the top of colony; e, point club; f, collaret spindles. Scale 0.10 mm.

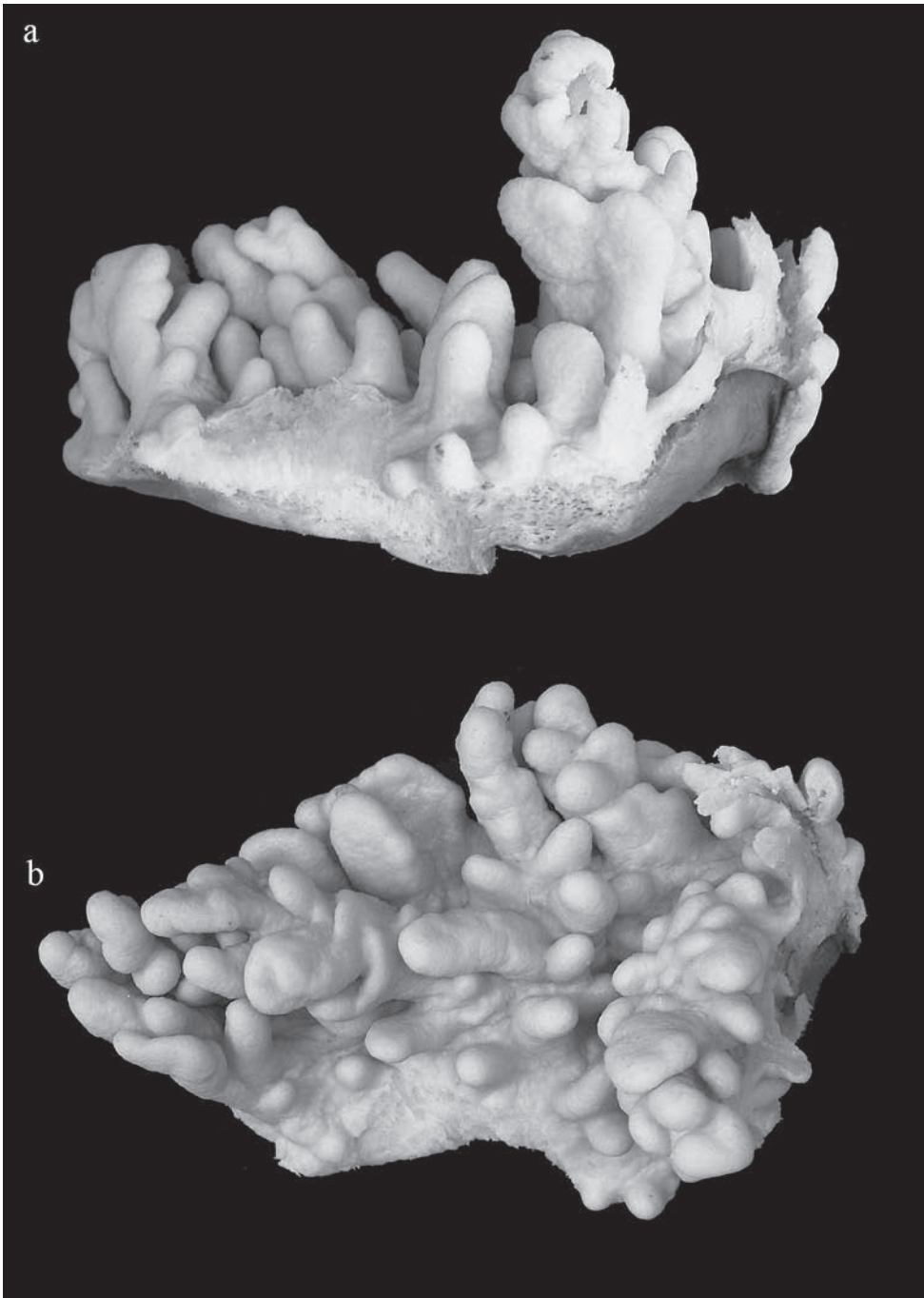


Fig. 3a-b. *Sinularia babeldaobensis* spec. nov., holotype RMNH Coel. 38723, a, lateral view, b, view from above. Both natural size.

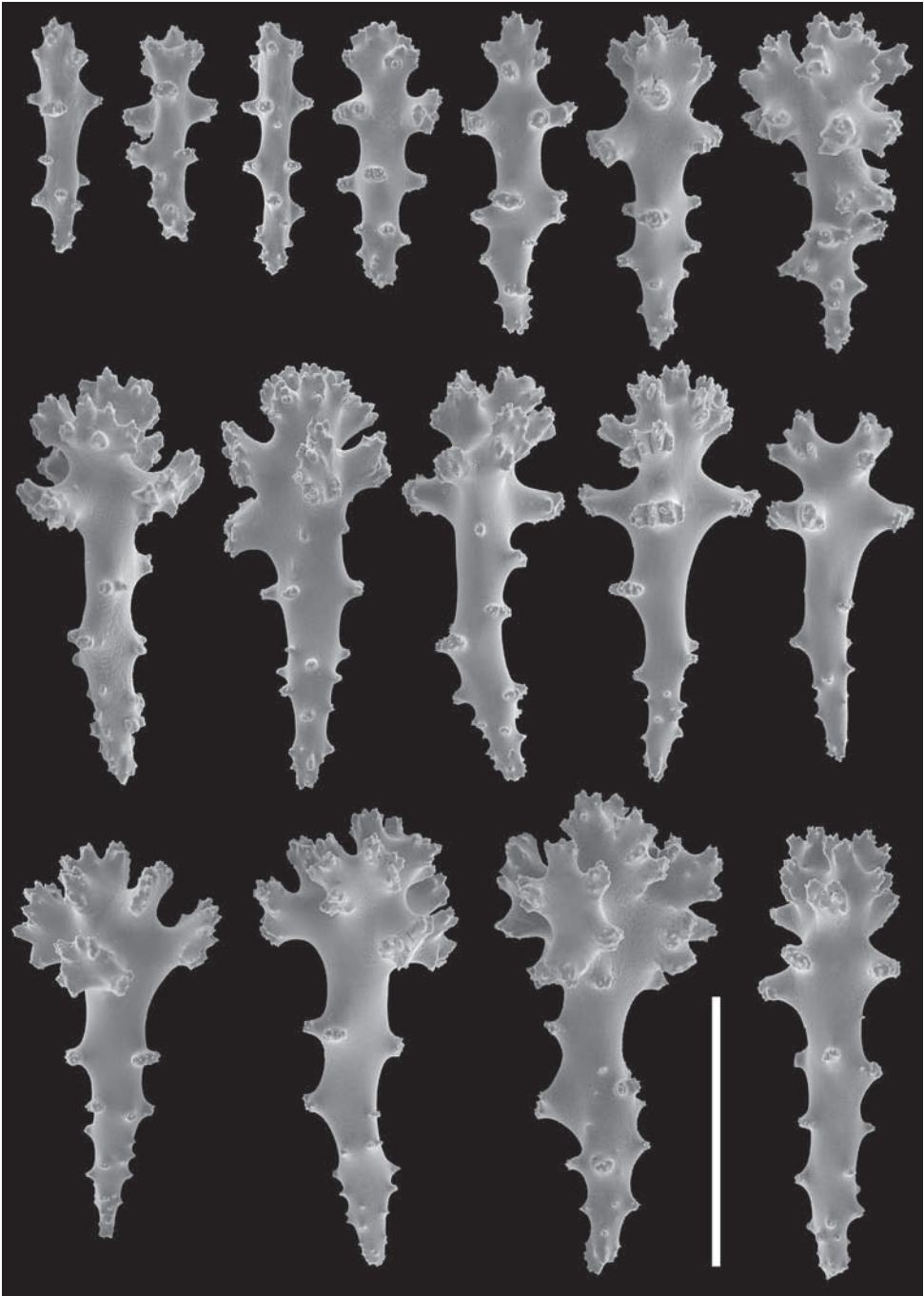


Fig. 4. *Simularia babeldaobensis* spec. nov., holotype RMNH Coel. 38723; clubs of surface layer of the top of the colony. Scale 0.10 mm.

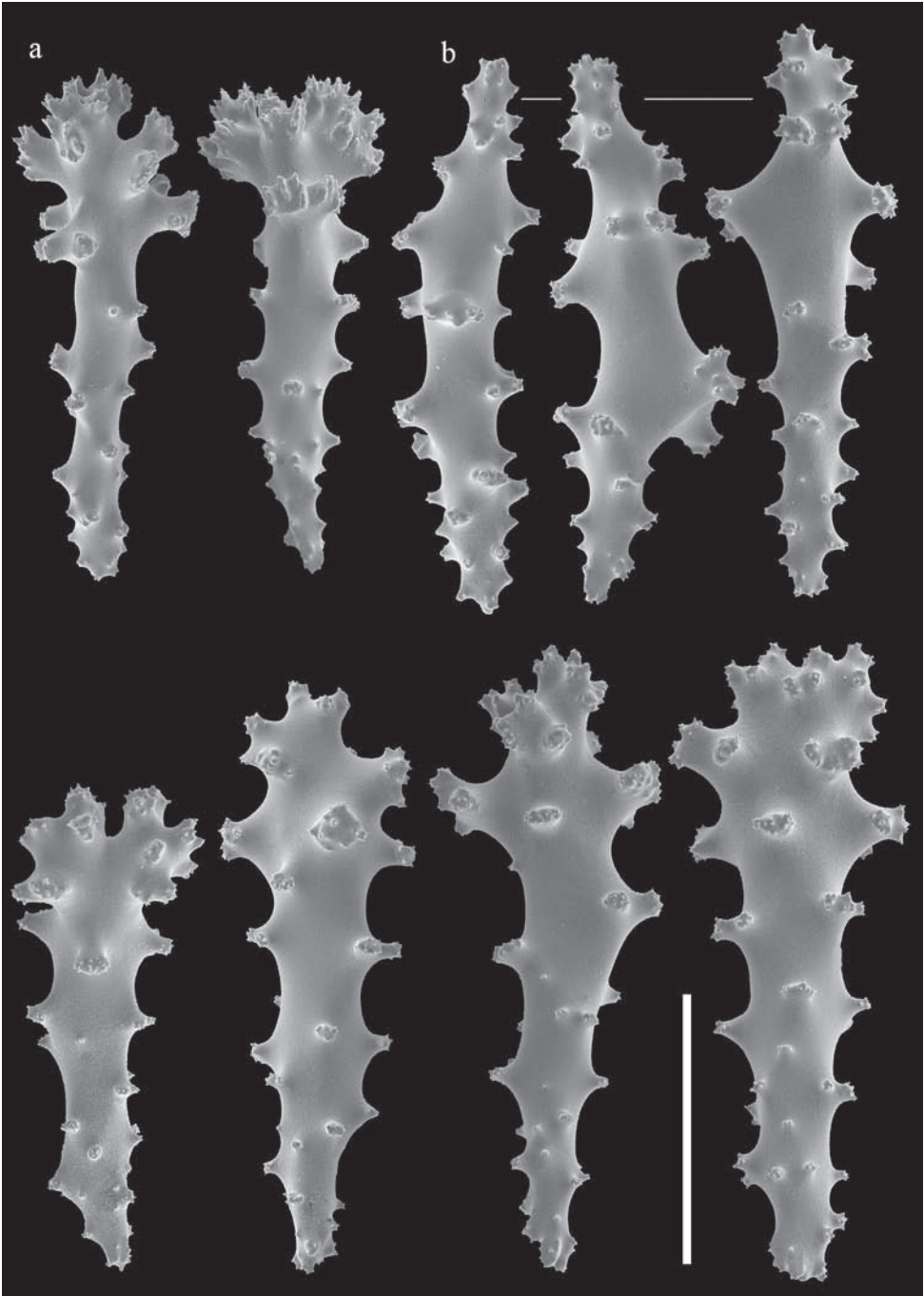


Fig. 5. *Simularia babeldaobensis* spec. nov., holotype RMNH Coel. 38723; sclerites of surface layer of the top of the colony; a, clubs; b, spindles. Scale 0.10 mm.

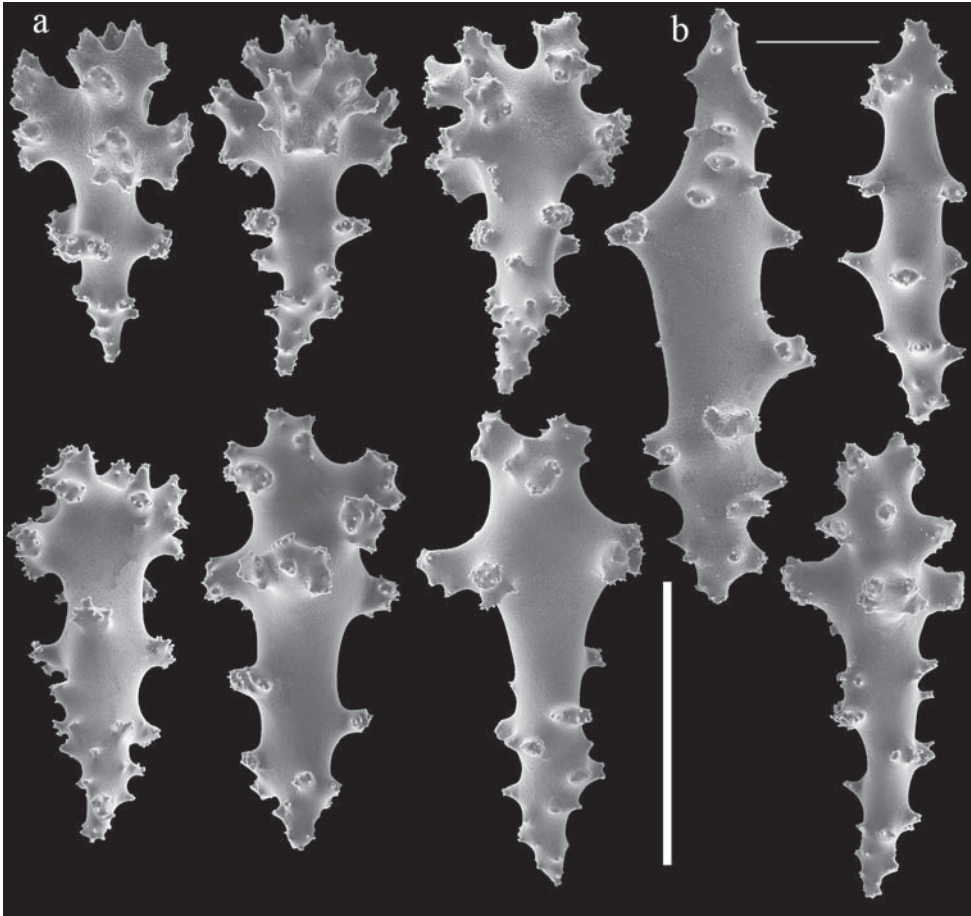


Fig. 6. *Simularia babeldaobensis* spec. nov., holotype RMNH Coel. 38723; sclerites of surface layer of the base of the colony; a, clubs; b, spindles. Scale 0.10 mm.

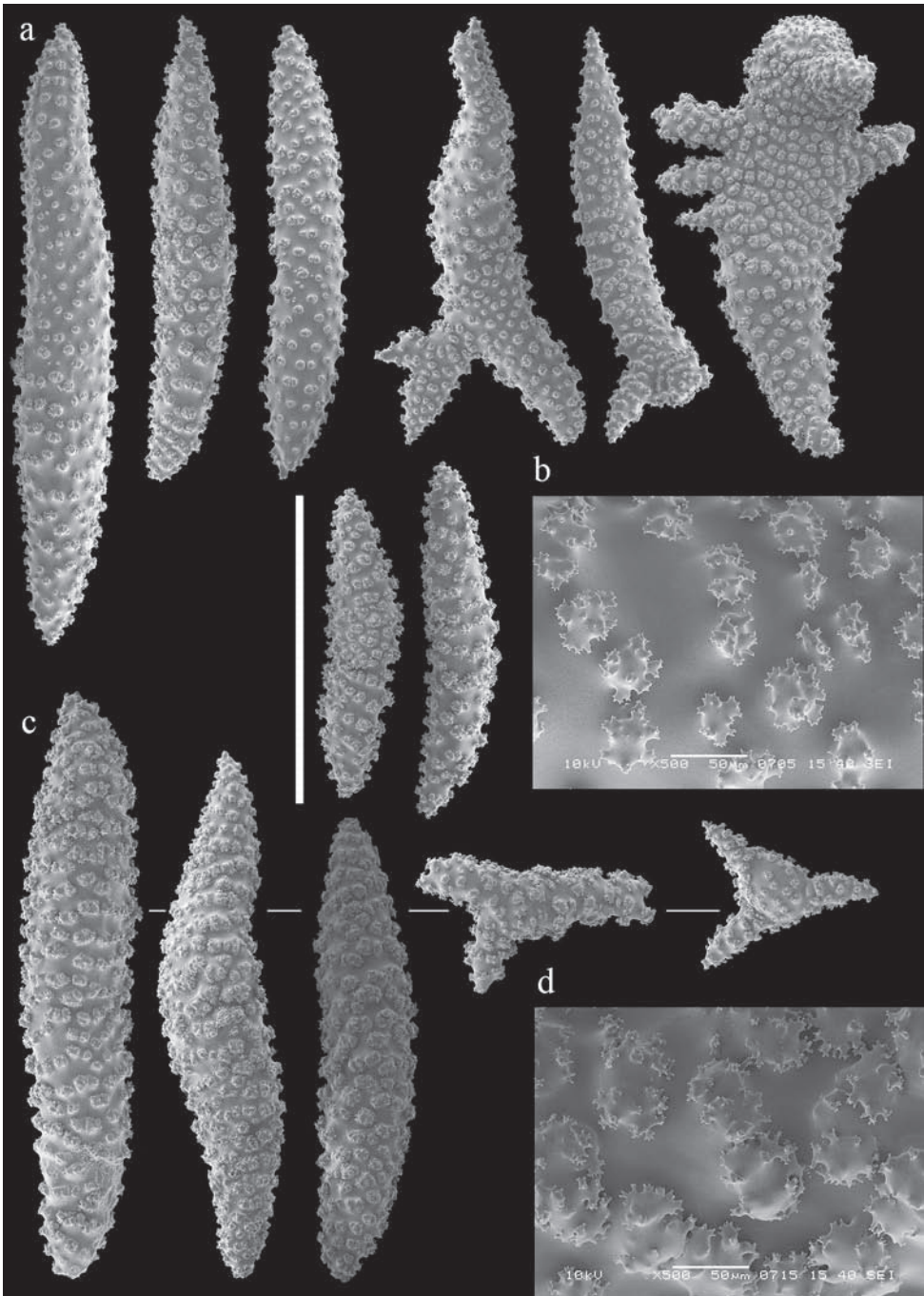


Fig. 7. *Sinularia babeldaobensis* spec. nov., holotype RMNH Coel. 38723; a, c, spindles of interior of colony; b, d, tubercles on spindles; a-b, top of colony; c-d, base of colony. Scale 1 mm.

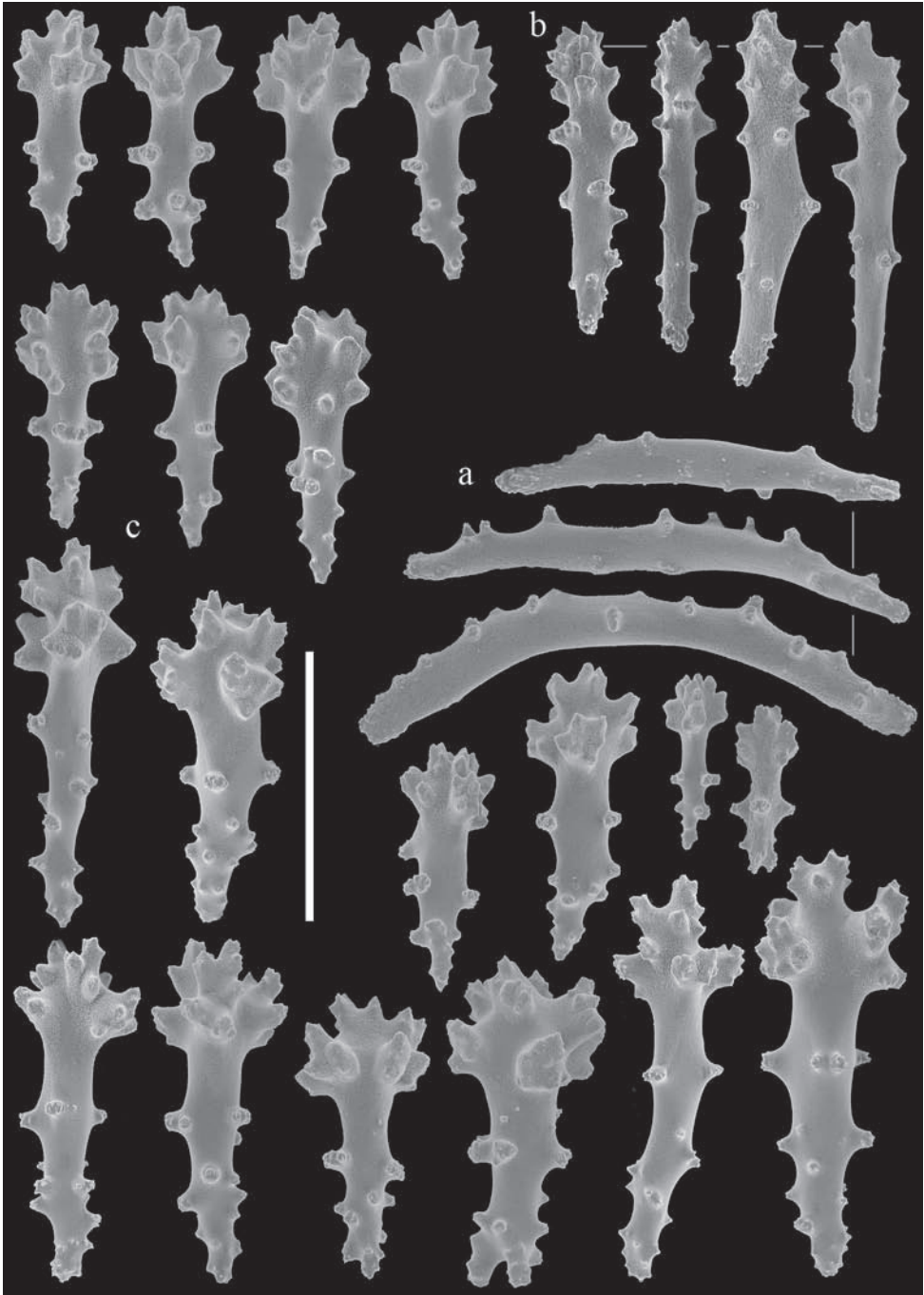


Fig. 8. *Simularia bisulca* spec. nov., holotype RMNH Coel. 38724; a, collaret spindles; b, point clubs; c, clubs of surface layer of the top of the colony. Scale 0.10 mm.



Fig. 9. *Sinularia bisulca* spec. nov., holotype RMNH Coel. 38724; sclerites of surface layer of the top of the colony; a, clubs; b-c, spindles. Scales 0.10 mm, that at c only applies to c.

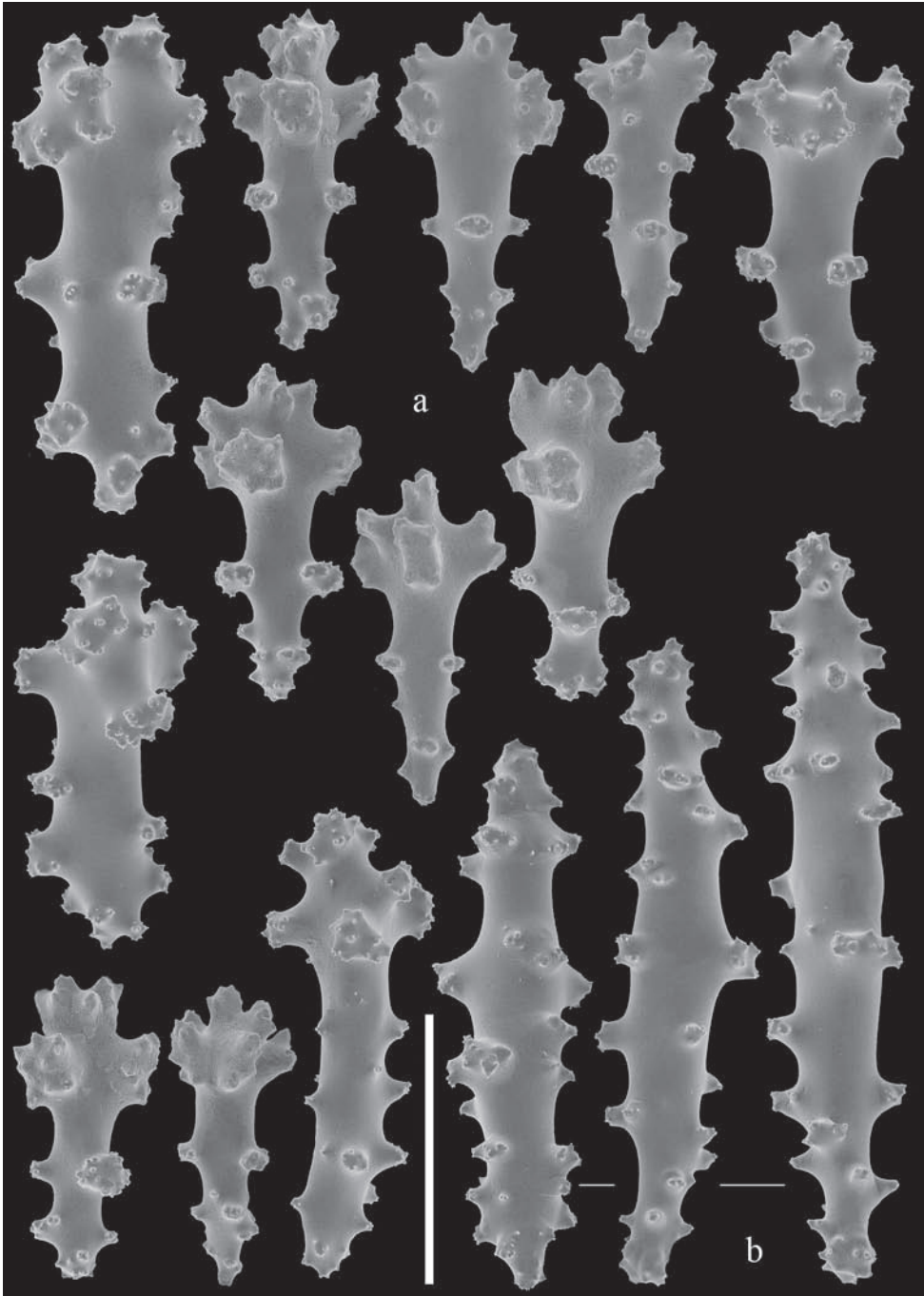


Fig. 10. *Simularia bisulca* spec. nov., holotype RMNH Coel. 38724; sclerites of surface layer of the base of the colony; a, clubs; b, spindles. Scale 0.10 mm.

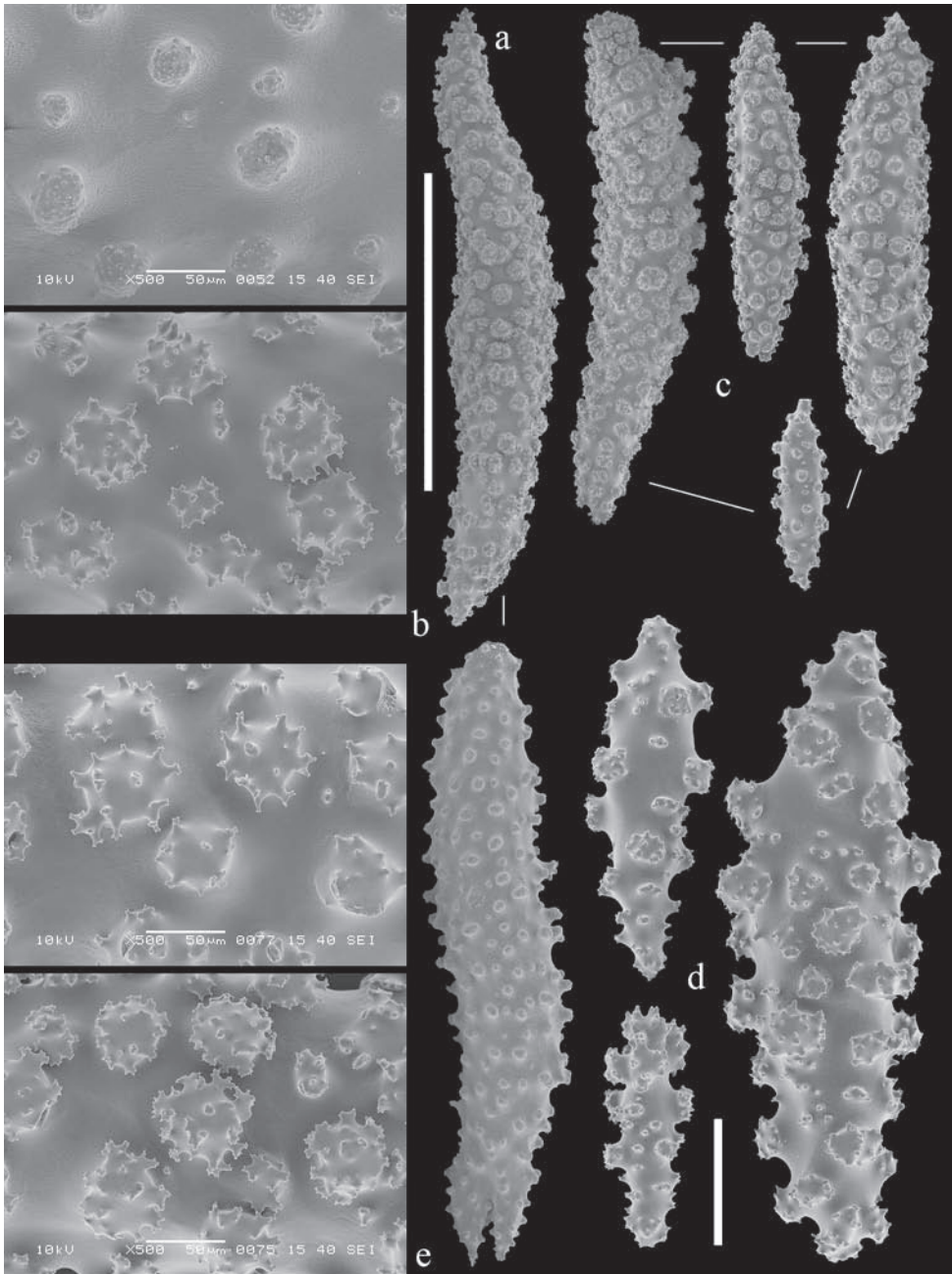


Fig. 11. *Simularia bisulca* spec. nov., holotype RMNH Coel. 38724; ; a, c-d, spindles of interior of colony; b, e, tubercles on spindles; a-b, top of colony; c-e, base of colony. Scale at a 1 mm, applies to a, c; that at d 0.10 mm, only applies to d.

Sinularia corpuentissima Manuputty & Ofwegen, 2007
(figs 12a, 75e)

Sinularia corpuentissima Manuputty & Ofwegen, 2007: 193.

Material examined. — RMNH Coel. 38725, colony fragment and 1 microscope slide, KOR.08.

Remarks. — Like the above mentioned *S. acuta*, this species was also recently described from Ambon by Manuputty & Ofwegen (2007). The live colony photograph of *S. corpuentissima* (fig. 75e) shows that it is an encrusting species. However, like with the original description, the preserved colony fragment suggests an arborescent colony form (fig. 12a).

Sinularia crebra spec. nov.
(figs 12b, 13-15, 75f)

Material examined. — RMNH Coel. 38726, holotype and 1 microscope slide, KOR.13.

Description. — The holotype is part of an encrusting colony with a maximum cross-section of the polyparium being 5 × 5.5 cm (fig. 12b). The colony fragment is 3 cm high. The polyparium consists of a number of densely placed primary lobes, several of which bear lobules; lobes and lobules vary in size and shape, from tiny knobs to small ridges.

The surface layer of the lobules contains clubs with a central wart (figs 13, 14a), which can be foliaceous. These clubs are 0.08-0.25 mm long. Furthermore, spindles are present, up to 0.30 mm long, with prominent simple tubercles (fig. 14b). A few sclerites intermediate between small spindles and clubs (fig. 14c) and a few shuttles (fig. 14d) are also present. There are no sclerites in the polyps.

The clubs and spindles of the surface layer of the stalk resemble those of the lobules but are shorter and wider (fig. 15a).

The interior of the lobules has unbranched spindles, up to 2 mm long (fig. 14f), with simple or complex tubercles. Some of the smaller spindles can be club-like (fig. 14e). In the base of the colony they are slightly longer, up to 2.5 mm long (fig. 15b), with tubercles similar to those of the spindles of the top of the colony (fig. 15c).

Colour. — The preserved specimen is cream.

Etymology. — The Latin “*crebra*”, thick, crowded together, close, numerous, refers to the crowded lobules of the holotype.

Molecular study. — The holotype showed a unique sequence.

Remarks. — Although the preserved specimen shows densely placed lobes the live colony shows many spaced small knobs in a large part of the colony (fig. 75f).

The colony form and sclerites resemble several other species: *Sinularia crassa*, *S. compressa*, *S. gaweli* (only live colonies are alike), *S. linnei*, *S. ornata*, *S. ovispiculata*, *S. peculiaris*, and *S. woodyensis* (presumably only live colonies are alike).

Although the microscope slides of the type of *S. crassa* in my possession show many disintegrated sclerites, it is still possible to see the club characters. The species differs from *S. crebra* in having many clubs with the tubercles below the central wart

directed towards that central wart; in *S. crebra* they mostly make an angle of 90 degrees with the central wart. The clubs of the surface layer of the lobules are also slightly longer in *S. crassa*, up to 0.35 mm long. *S. compressa* differs in having much shorter clubs, up to 0.16 mm long. *S. gaweli* has clubs with overall simpler central warts (fig. 37). *S. linnei* differs in having clubs with overall wider handles and smaller spindles in the surface layer of the lobules. *S. linnei* also has much wider internal spindles. *S. ornata* also has clubs with overall wider handles and the warts below the central wart are not as well developed as in *S. crebra*. *S. ovispiculata* differs in having smaller clubs in the surface layer of the lobules (up to 0.20 mm long) and many small ovals in the interior of the colony. *S. peculiaris* has many small branched spindles in the interior of the base. *S. woodyensis* differs from *S. crebra* in having the same type of clubs as *S. crassa*. Moreover, *S. compressa*, *S. crassa*, *S. gaweli*, *S. linnei*, *S. ornata*, *S. peculiaris* and *S. woodyensis* were all included in the molecular study and had sequences different from *S. crebra*.

At the same station (KOR.13) a specimen was collected which I identified as belonging to *Sinularia peculiaris*; it has a live colony shape (fig. 77h) similar to *S. crebra*. It differs from the latter in having clubs with much more ornamented heads, as described for *S. peculiaris*, and having several small branched spindles in the interior of the base of the stalk; although not as many as in the type of *S. peculiaris*.

Sinularia digitata spec. nov.
(figs 12c, 16-20, 75h)

Material examined. — RMNH Coel. 38727, holotype and 1 microscope slide, KOR.09.

Description. — The holotype is part of an encrusting colony with a maximum cross-section of 4 x 5 cm (fig. 12c). It has only finger-like lobes, the smallest only a few mm high, but most are about 1 cm long.

The polyps have a collaret and eight points. Collaret with bent spindles, up to 0.40 mm long (fig. 16c-d), points with poorly developed clubs, which are mostly about 0.15 mm long, but a few are up to 0.25 mm long (fig. 16b). Tentacles have small rods, up to 0.10 mm long (fig. 16a).

The surface layer of the lobes has *leptocladus*-type clubs, the smallest are 0.07 mm long, most are around 0.10 mm, but some reach even a length of 0.15 mm; in addition longer wart clubs are present, up to 0.25 mm long (fig. 17). Furthermore, the surface layer of the lobes has spindles, up to 0.50 mm long, with simple tubercles (figs 16e, 18a); some of these spindles can be club-like (fig. 16f).

The sclerites of the surface layer of the base of the colony resemble those of the lobes but are less *leptocladus*-like, wider, and more tuberculate (figs 19, 20a). Here also club-like spindles are found (fig. 20b).

The interior of the colony has unbranched spindles, up to 3.5 mm long (figs 18b, 20c). Those of the base being more tuberculate (fig. 20d).

Colour. — The preserved specimen is whitish.

Etymology. — The Latin “*digitata*”, having fingers, refers to the finger-like lobes of this species.

Molecular study.— The holotype of *S. digitata* showed the same DNA sequence as *S. compacta* (RMNH Coel. 38433), *S. gaveshaniana* (RMNH Coel. 38733), and *S. leptoclados* (ZMTAU CO34095).

Remarks.— Of these *S. gaveshaniana* is most similar to *S. digitata*. It also has an encrusting colony shape with finger-like lobes (see fig. 26c). However, *S. gaveshaniana* additionally has lobes with lobules. The sclerites also differ in many aspects. Both colaret and point spindles are much longer in *S. digitata*. The *leptoclados*-type clubs are different, overall with wider heads and handles, and less *leptoclados*-like in *S. digitata* (compare fig. 17 with fig. 34d). Finally, the small spindles of the surface layer are less tuberculate in the present species (compare fig. 16e with fig. 35b-c).

Sinularia densa also can have a similar live colony shape (compare fig. 75g with fig. 75h). However, that species has clearly differently shaped *leptoclados*-type clubs (see Ofwegen & Vennam, 1991: fig. 2). Superficially, the colony shape of *Sinularia bisulca* spec. nov. resembles that of *S. digitata*, but in *S. bisulca* the lobes have lobules (fig. 75d).

Sinularia finitima spec. nov.
(figs 12d-f, 21-25, 76a)

Material examined.— RMNH Coel. 38728, holotype and 1 microscope slide, KOR.10; RMNH Coel. 38729, paratype and 1 microscope slide, KOR.04; RMNH Coel. 38730, paratype and 1 microscope slide, KOR.05.

Description.— The holotype is part of an arborescent colony, 7 cm high and wide (fig. 12d). Lobes are subdivided having small finger-like lobules; the latter are only a few mm wide and up to 1 cm long.

The surface layer of the lobules has clubs, 0.10-0.25 mm long (fig. 21a-b), mostly with a central wart; both this wart and the tubercles below it can be foliaceous. In addition, the surface layer of the lobes has spindles, up to 0.35 mm long, with rather prominent sparse, simple tubercles (fig. 21c). There are no sclerites in the polyps.

The clubs of the surface layer of the base of the colony resemble those of the lobes, but have wider handles and are shorter than those of the lobules (fig. 22a-b). The small spindles of the surface layer of the base are also smaller and wider than those of the top (fig. 22b).

The interior of the lobules has spindles, up to 3 mm long, several of them are bent, and others have side branches (fig. 23a-b); all with rather small tubercles (fig. 23c). In the interior of the base the spindles are shorter, up to 2 mm long (fig. 22c-d), but more tuberculate than those of the lobules (fig. 22e).

Colour.— The holotype is white with yellowish lobules.

Etymology.— The Latin “finitimus”, neighbouring, adjacent to, related to, resembling, similar, refers to the resemblance with *S. bremerensis*, described from the Gulf of Carpentaria, *S. foliata* spec. nov. and *S. luxuriosa* spec. nov.

Molecular study.— The holotype and two paratypes all showed the same DNA sequence.

Remarks.— The clubs of the lobules of the paratypes differ slightly from those of the holotype, in the bigger clubs the central wart is less obvious. In paratype RMNH

Coel. 38729 the spindles of the interior of the lobes are also bigger, up to 4.5 mm long. In paratype RMNH Coel. 38730 many of the smaller spindles of the interior of the lobules are almost smooth. For comparison the sclerites of paratype RMNH Coel. 38729 are also presented (figs 23d-25).

Also *S. linnei* (NTM C14480), *S. woodyensis* (NTM C14577), *S. papula* (NTM C14527) and *S. crassa* (RMNH Coel 38430) had the same DNA sequence as the three *S. finitima* specimens. However, these four species all show knob-like lobules, quite different from the finger-like lobules in *S. finitima*. The differences between *S. bremerensis*, *S. finitima*, *S. foliata* and *S. luxuriosa* are discussed under *S. luxuriosa*.

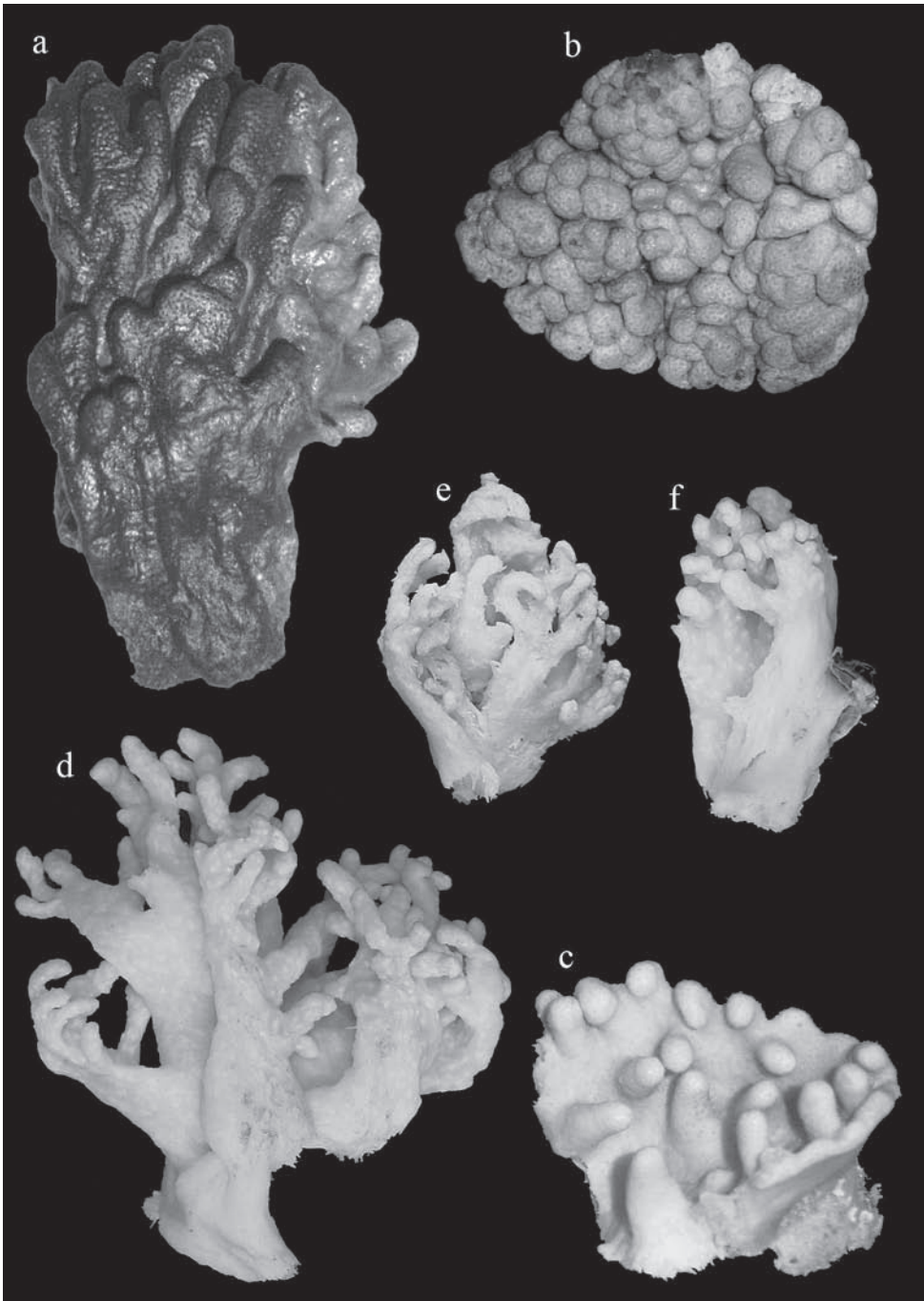


Fig. 12a. *Sinularia corpulentissima*, RMNH Coel. 38725, lateral view; b, *Sinularia crebra* spec. nov., holotype RMNH Coel. 38726, view from above; c, *S. digitata* spec. nov., holotype RMNH Coel. 38727, view from above; d-f, *S. finitima* spec. nov., lateral views; d, holotype RMNH Coel. 38728; e, paratype RMNH Coel. 38729; f, paratype RMNH Coel. 38730. All natural size.

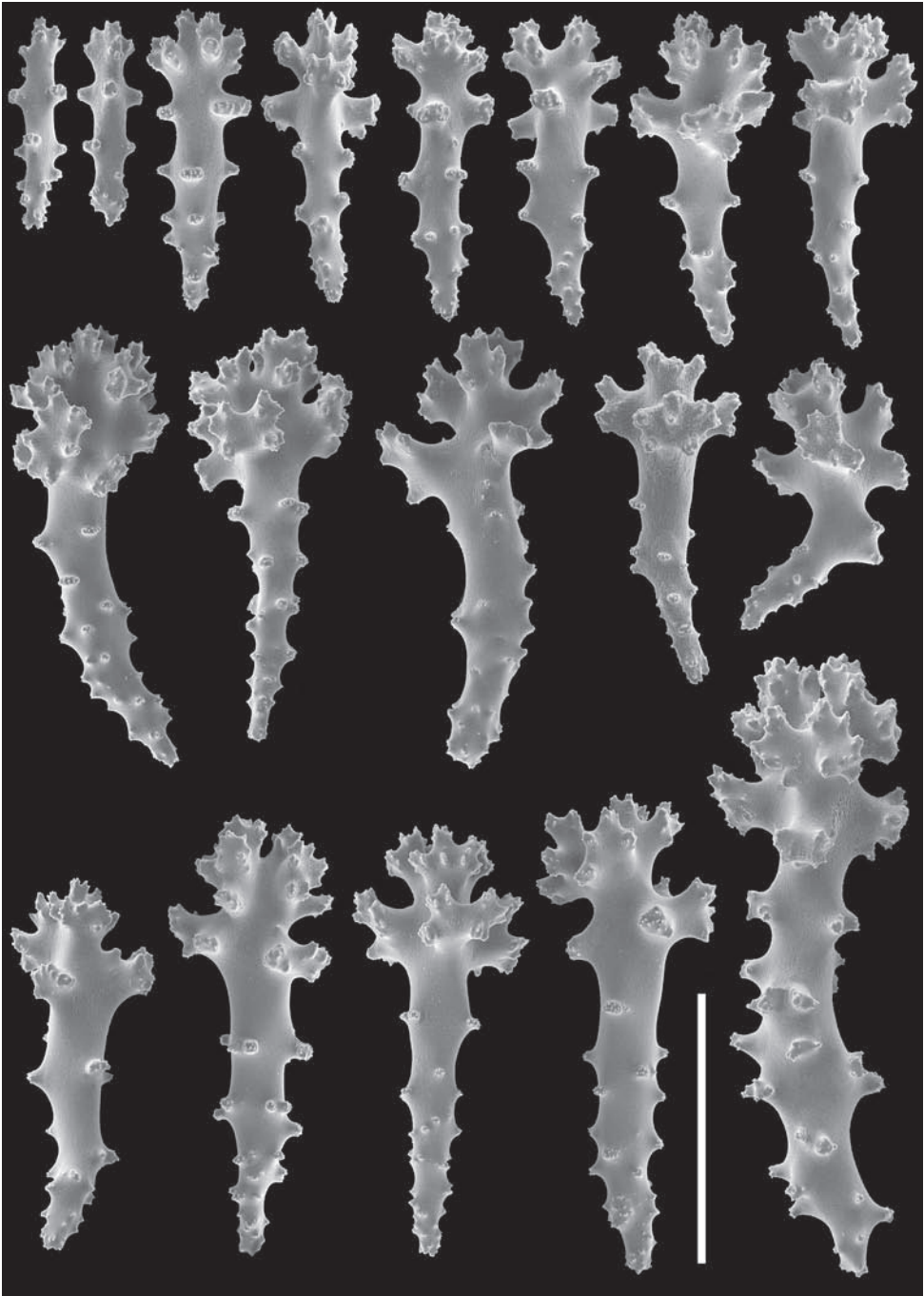


Fig. 13. *Sinularia crebra* spec. nov., holotype RMNH Coel. 38726; clubs of surface layer of the top of the colony. Scale 0.10 mm.

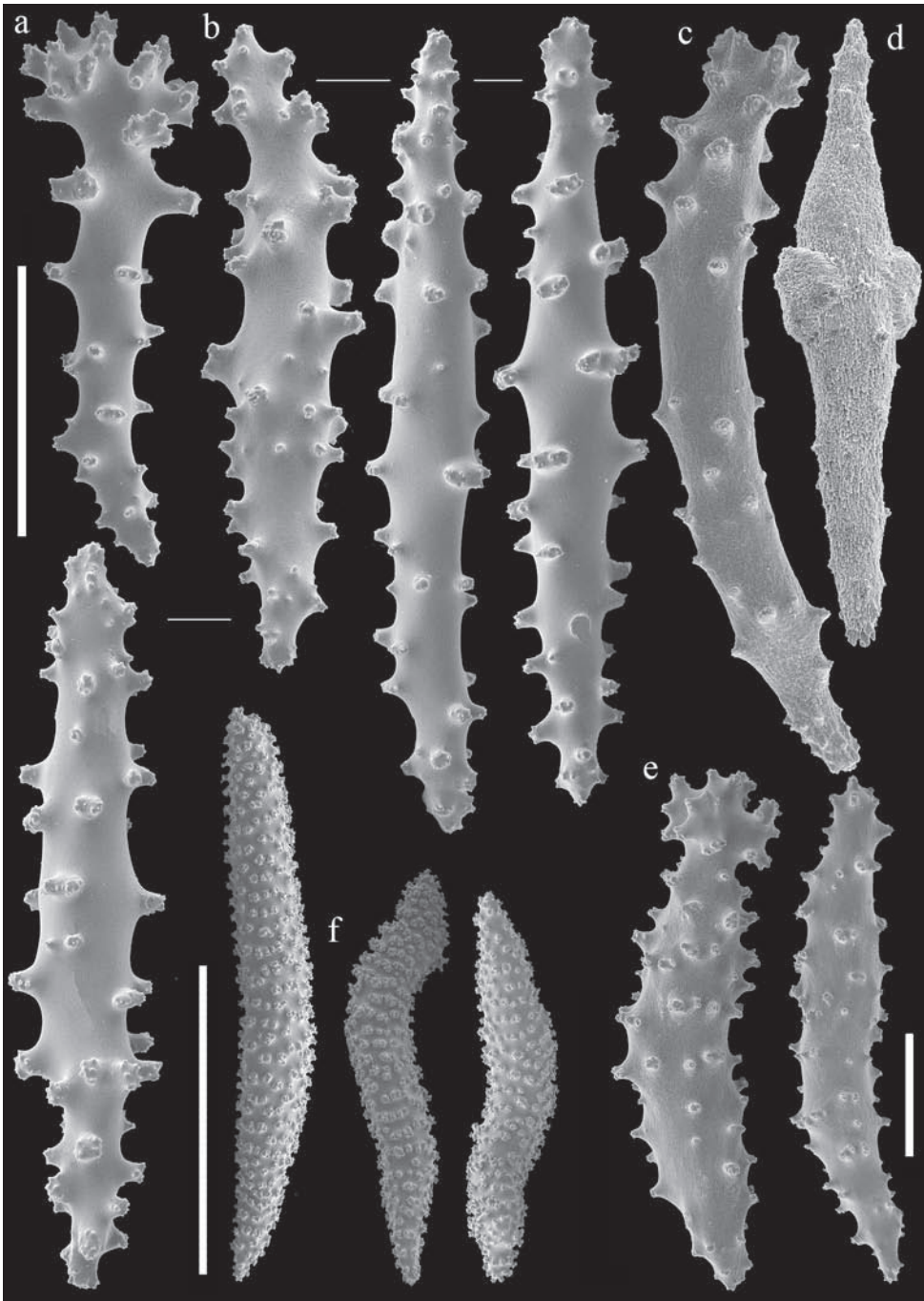


Fig. 14. *Simularia crebra* spec. nov., holotype RMNH Coel. 38726; sclerites of top of colony; a, club of surface layer; b, spindles of surface layer; c, intermediate of surface layer; d, shuttle of surface layer; e-f, spindles of interior. Scale at a 0.10 mm, also applies to b-d; scale at e 0.10 mm, at f 1 mm.

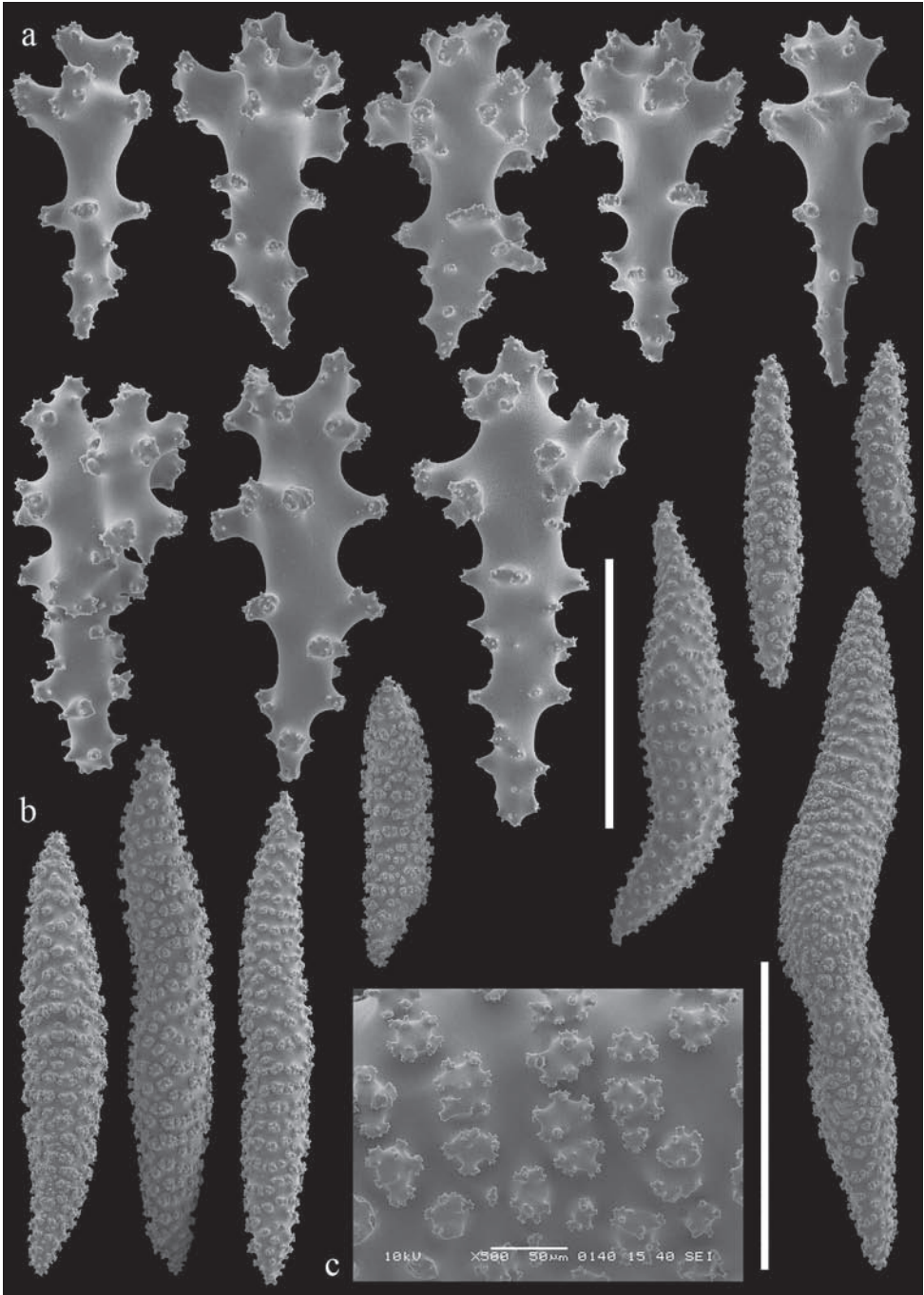


Fig. 15. *Simularia crebra* spec. nov., holotype RMNH Coel. 38726; sclerites of the base of the colony; a, clubs of surface layer; b, spindles of interior; c, tubercles on spindle. Scale at a 0.10 m, at b 1 mm.

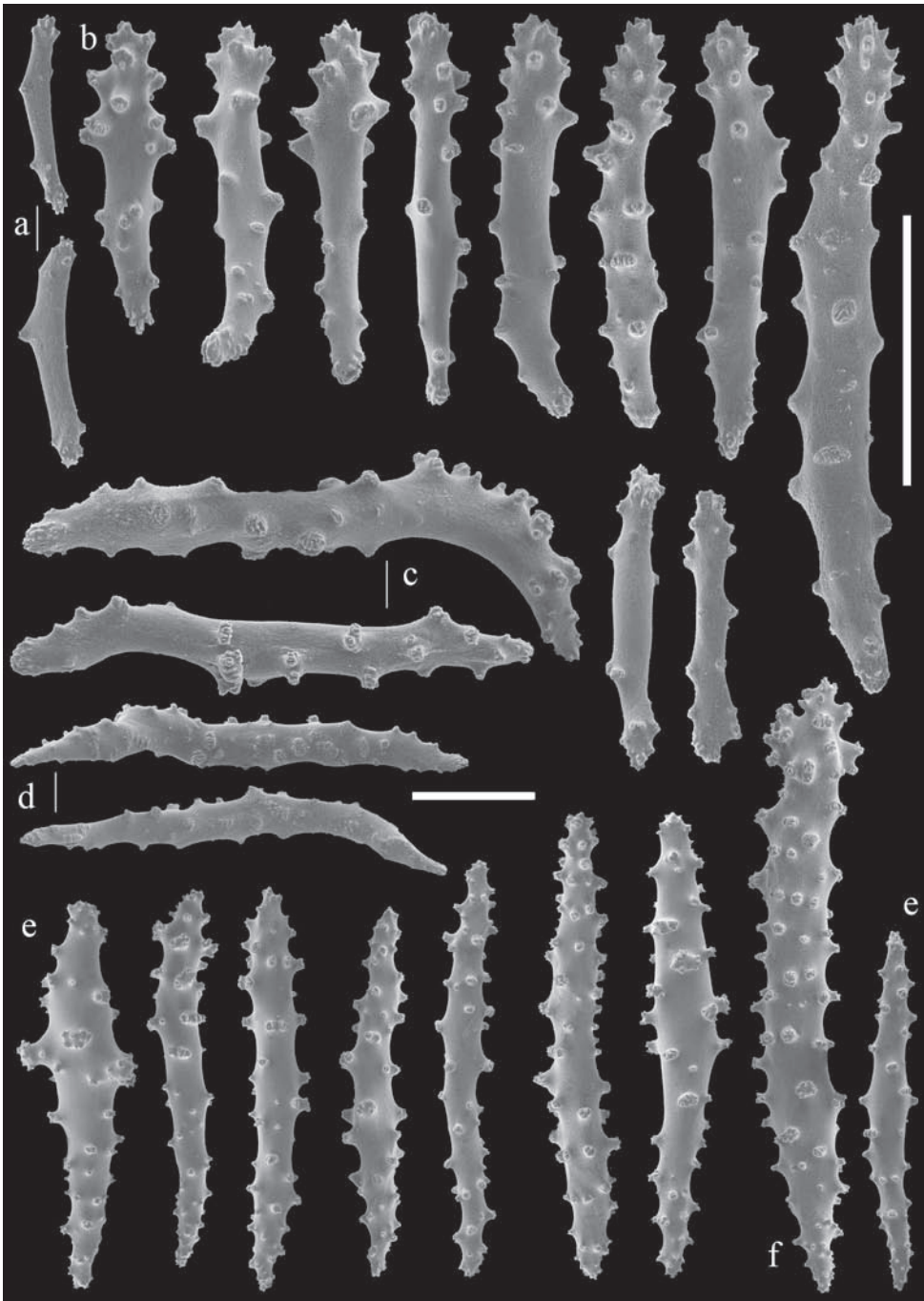


Fig. 16. *Simularia digitata* spec. nov., holotype RMNH Coel, 38727; a, tentacle rods; b, point clubs; c-d, collarlet spindles; e-f, sclerites of surface layer of the top of the colony; e, spindles; f, club-like spindle. Scales 0.10 mm, that at d also applies to e-f.

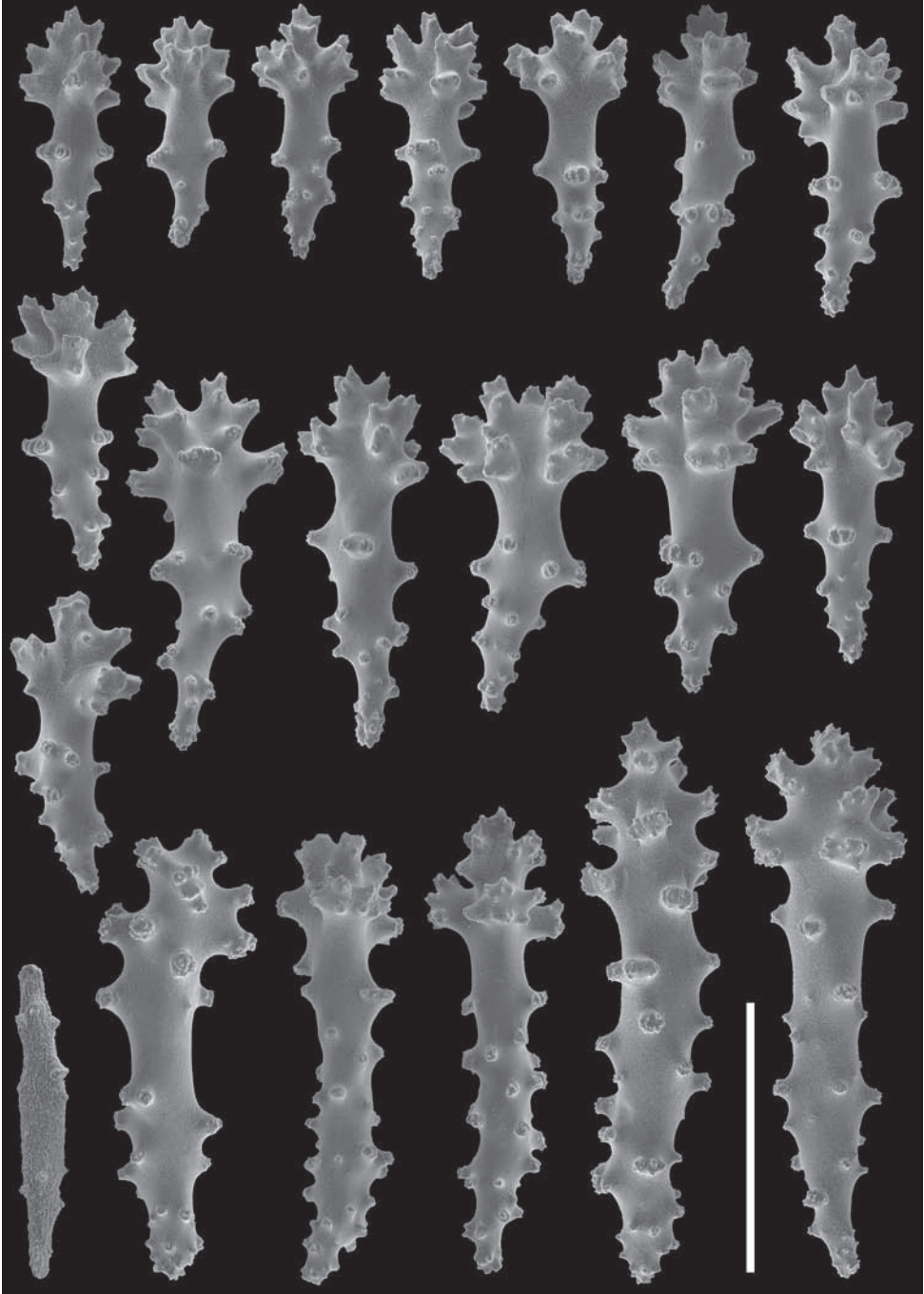


Fig. 17. *Sinularia digitata* spec. nov., holotype RMNH Coel, 38727; clubs and shuttle of surface layer of the top of the colony. Scale 0.10 mm.

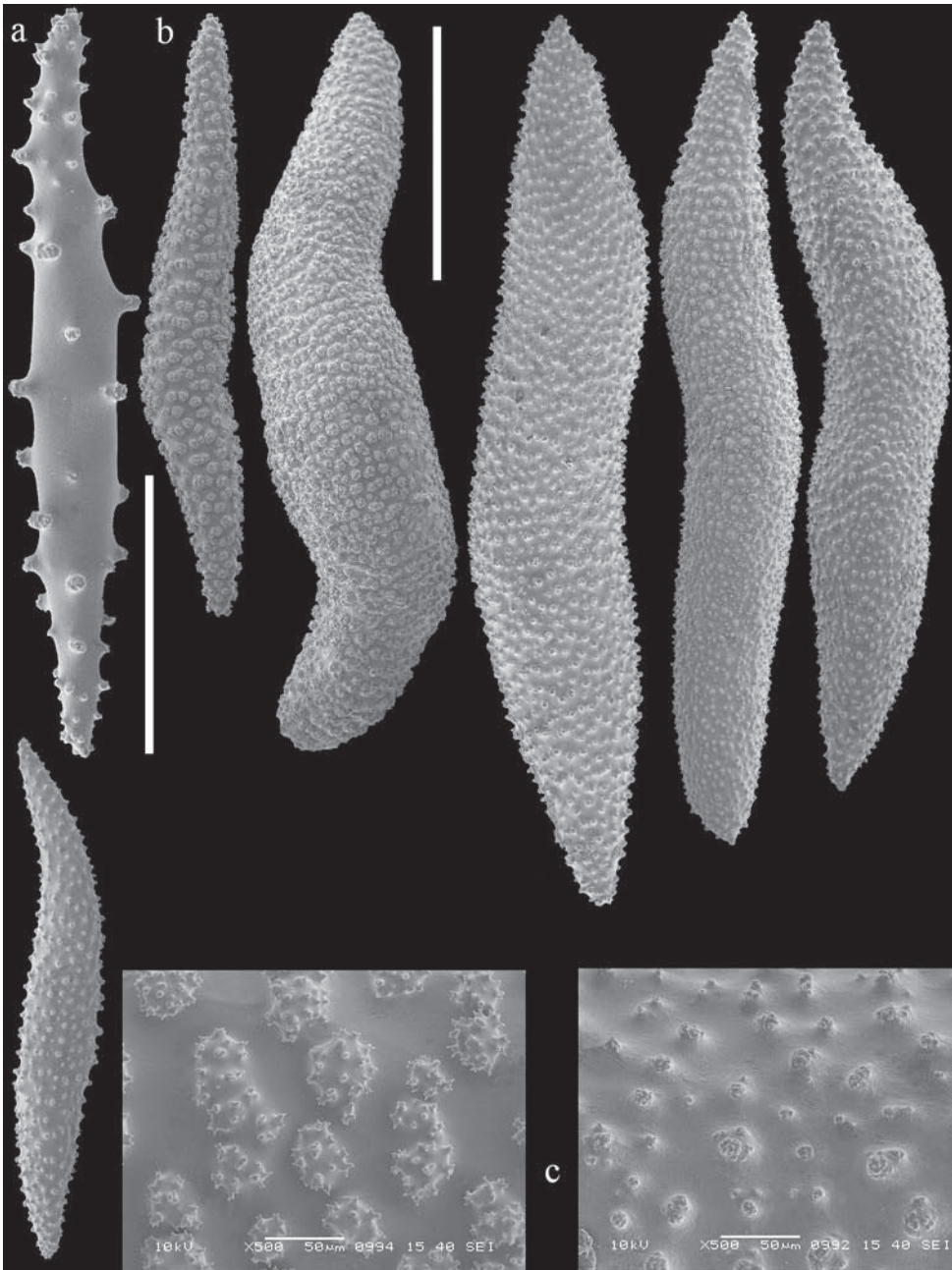


Fig. 18. *Simularia digitata* spec. nov., holotype RMNH Coel, 38727; a, spindle of surface layer of the top of the colony; b, spindles of interior of top of the colony; c, tubercles on spindles. Scale at a 0.10 mm, at b 1 mm.

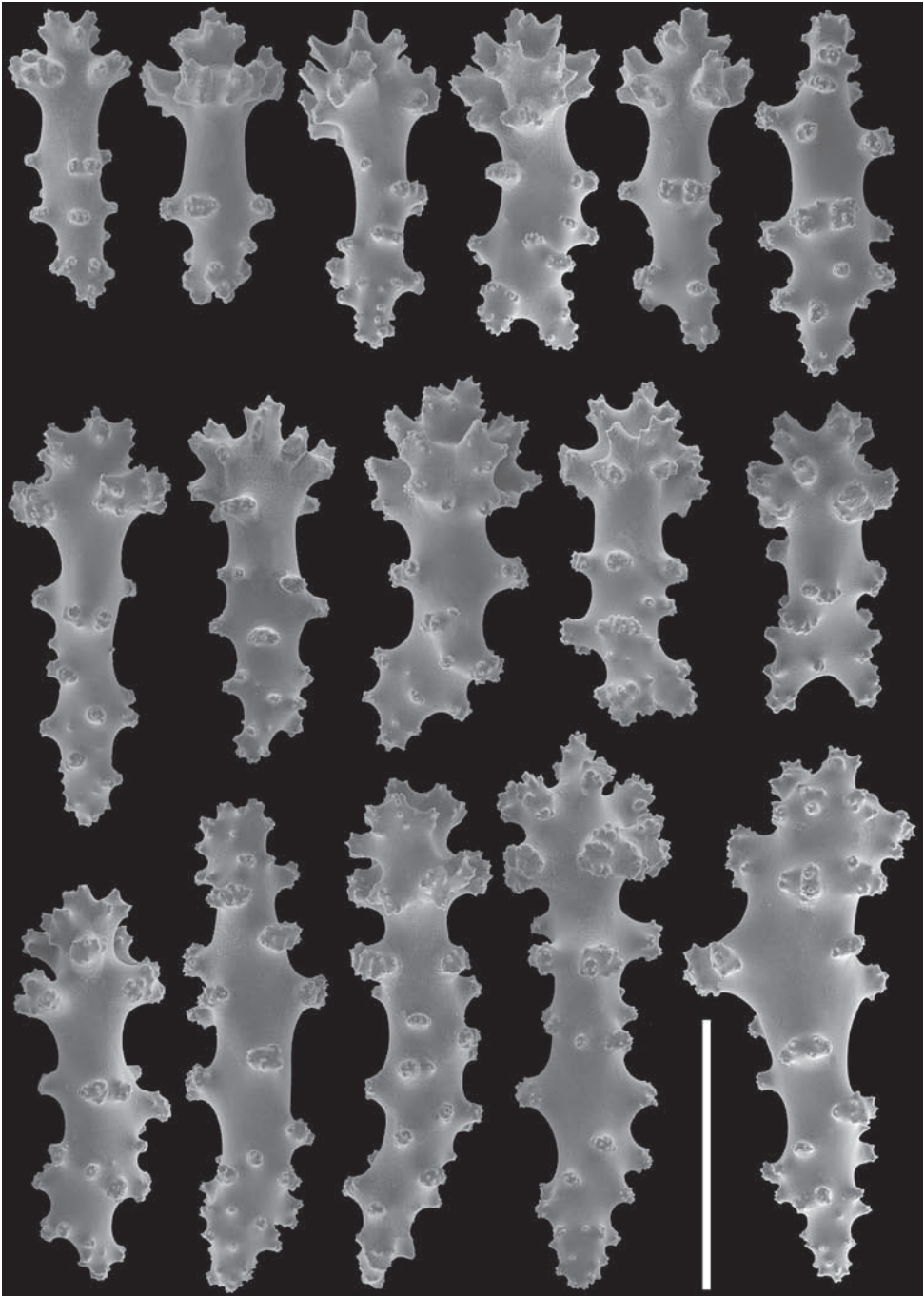


Fig. 19. *Simularia digitata* spec. nov., holotype RMNH Coel, 38727; sclerites of surface layer of the base of the colony. Scale 0.10 mm.

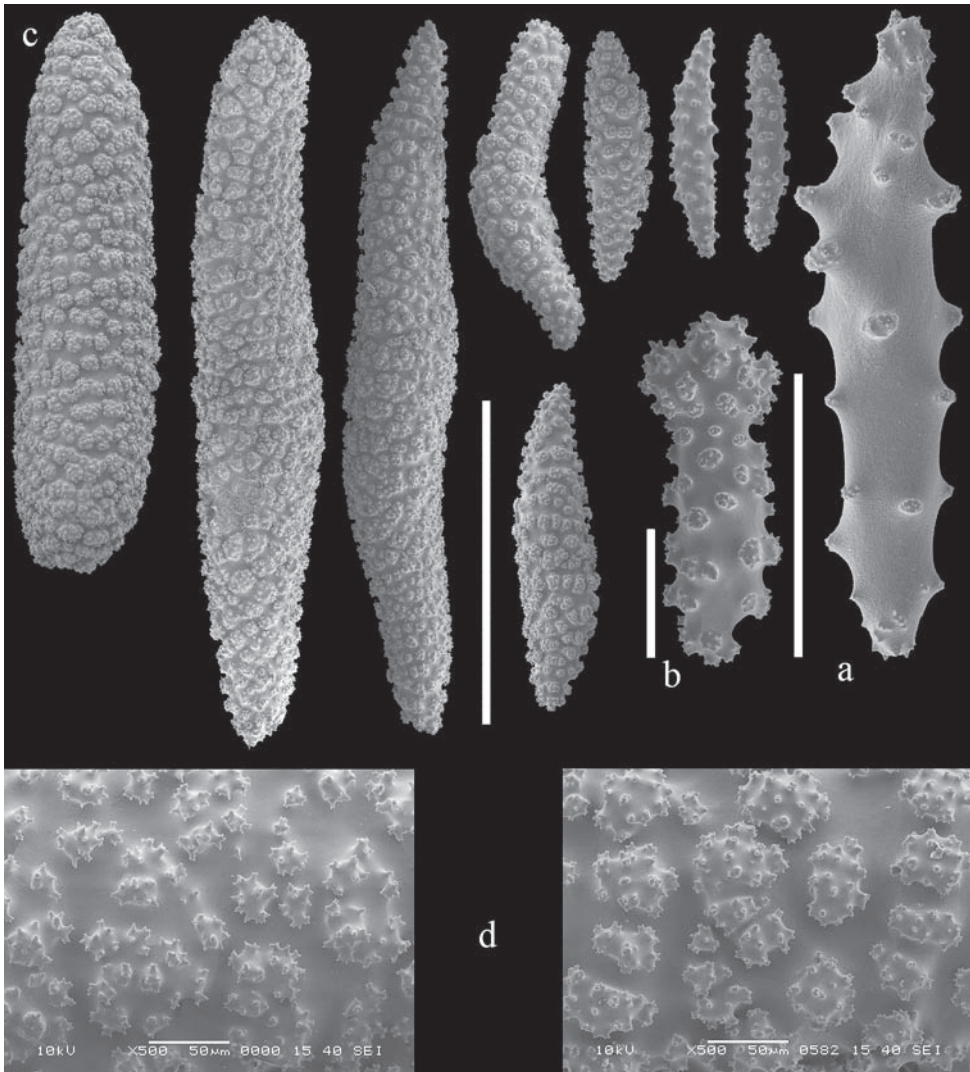


Fig. 20. *Simularia digitata* spec. nov., holotype RMNH Coel, 38727; a-b, sclerites of surface layer of the base of the colony; a, spindle, b, club-like spindle; c, spindles of interior of the base of the colony; d, tubercles on spindles. Scale at a and b 0.10 mm, scale at c 1 mm.

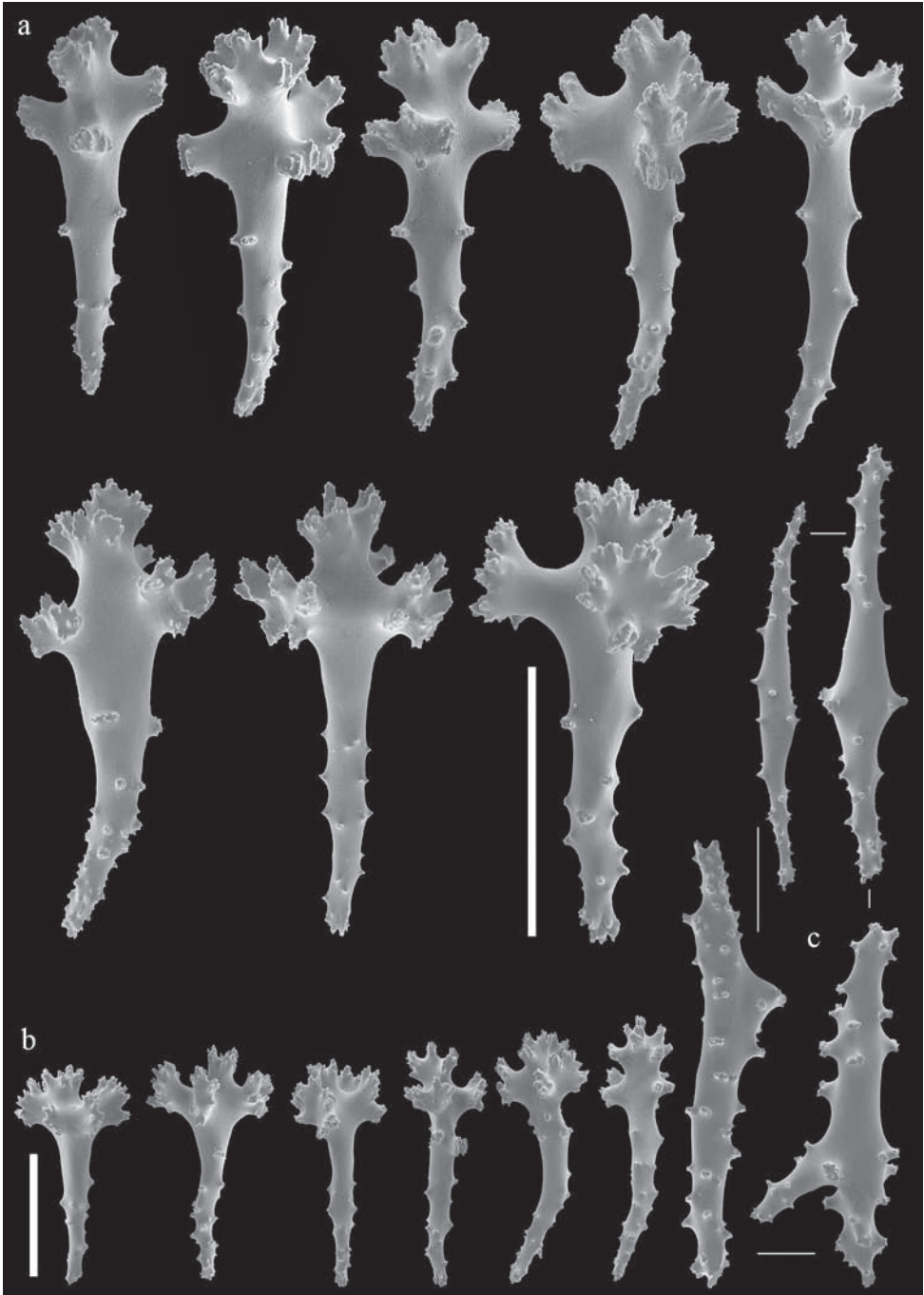


Fig. 21. *Sinularia finitima* spec. nov., holotype RMNH Coel. 38728; sclerites of surface layer of the top of the colony; a-b, clubs; c, spindles. Scales 0.10 mm, that at a only applies to a.

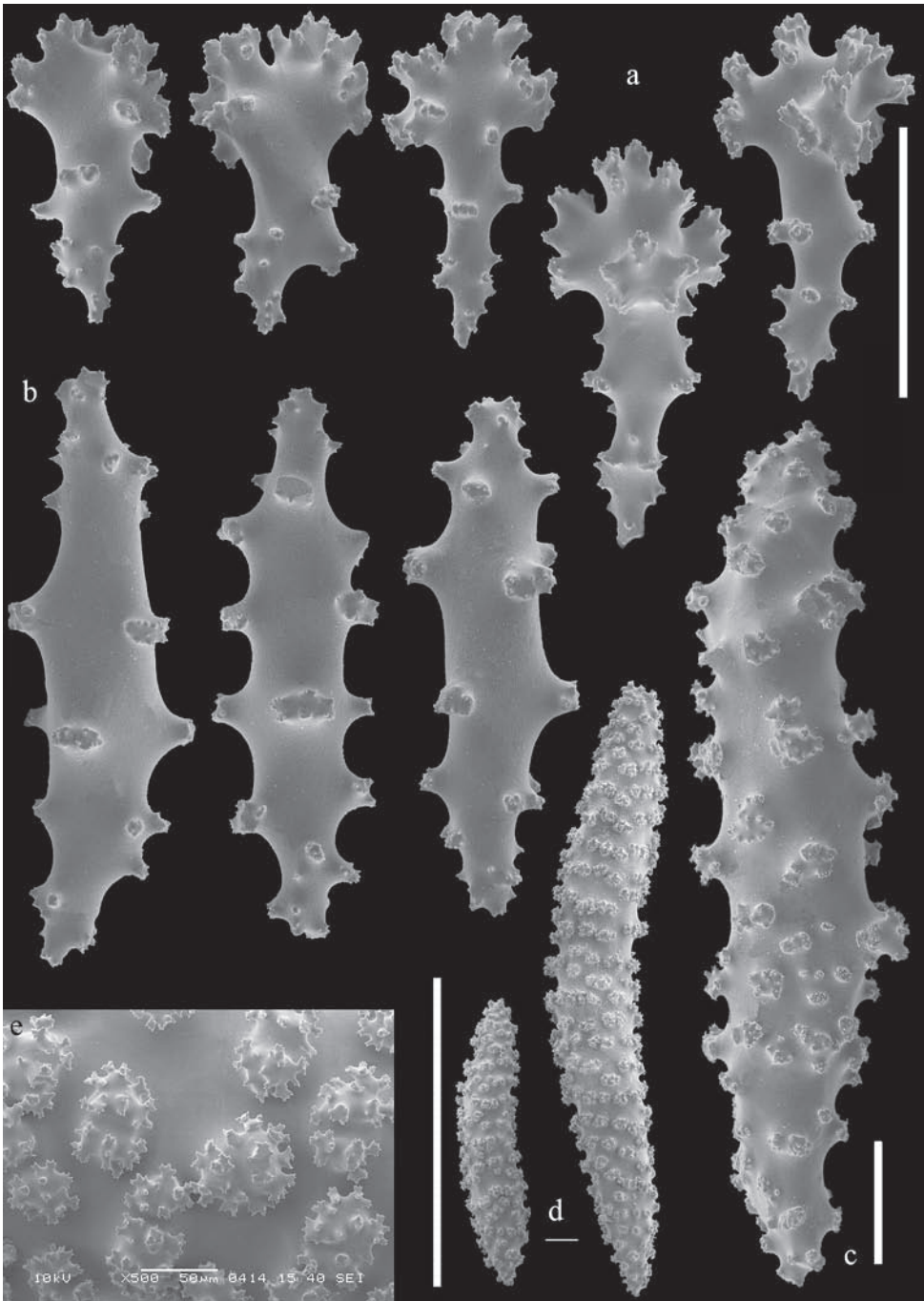


Fig. 22. *Simularia finitima* spec. nov., holotype RMNH Coel. 38728; sclerites of the base of the colony; a, clubs of surface layer; b, spindles of surface layer; c-d, spindles of interior; e, tubercles on spindle. Scale at a 0.10 mm, also applies to b; scale at c 0.10 mm, at d 1 mm.

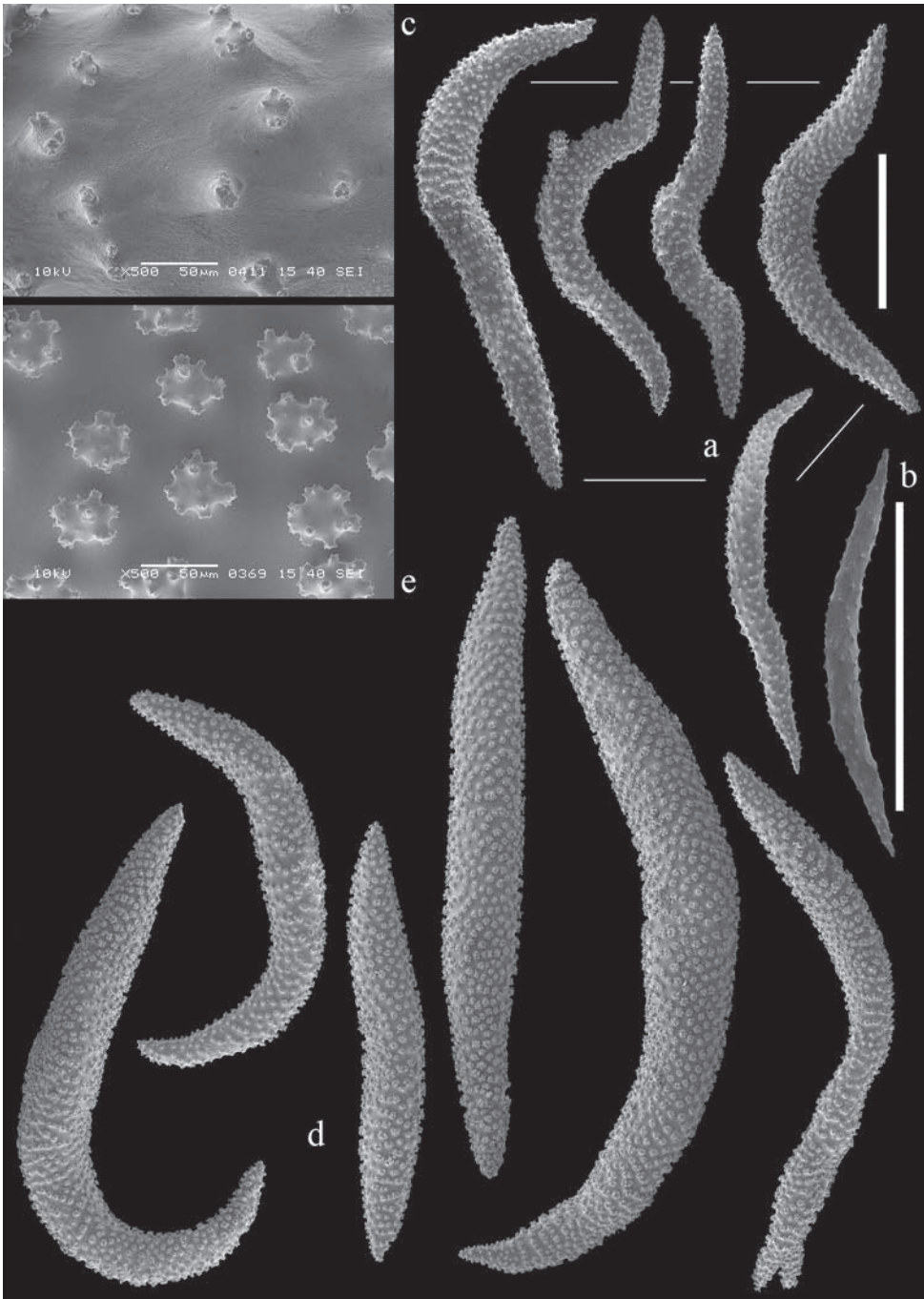


Fig. 23. *Sinularia finitima* spec. nov.; a-c, holotype RMNH Coel. 38728; d-e, paratype RMNH Coel. 38729; a-b, d, spindles of interior of the top of the colony; c, e, tubercles on spindles. Scales 1 mm, that at b only applies to b.

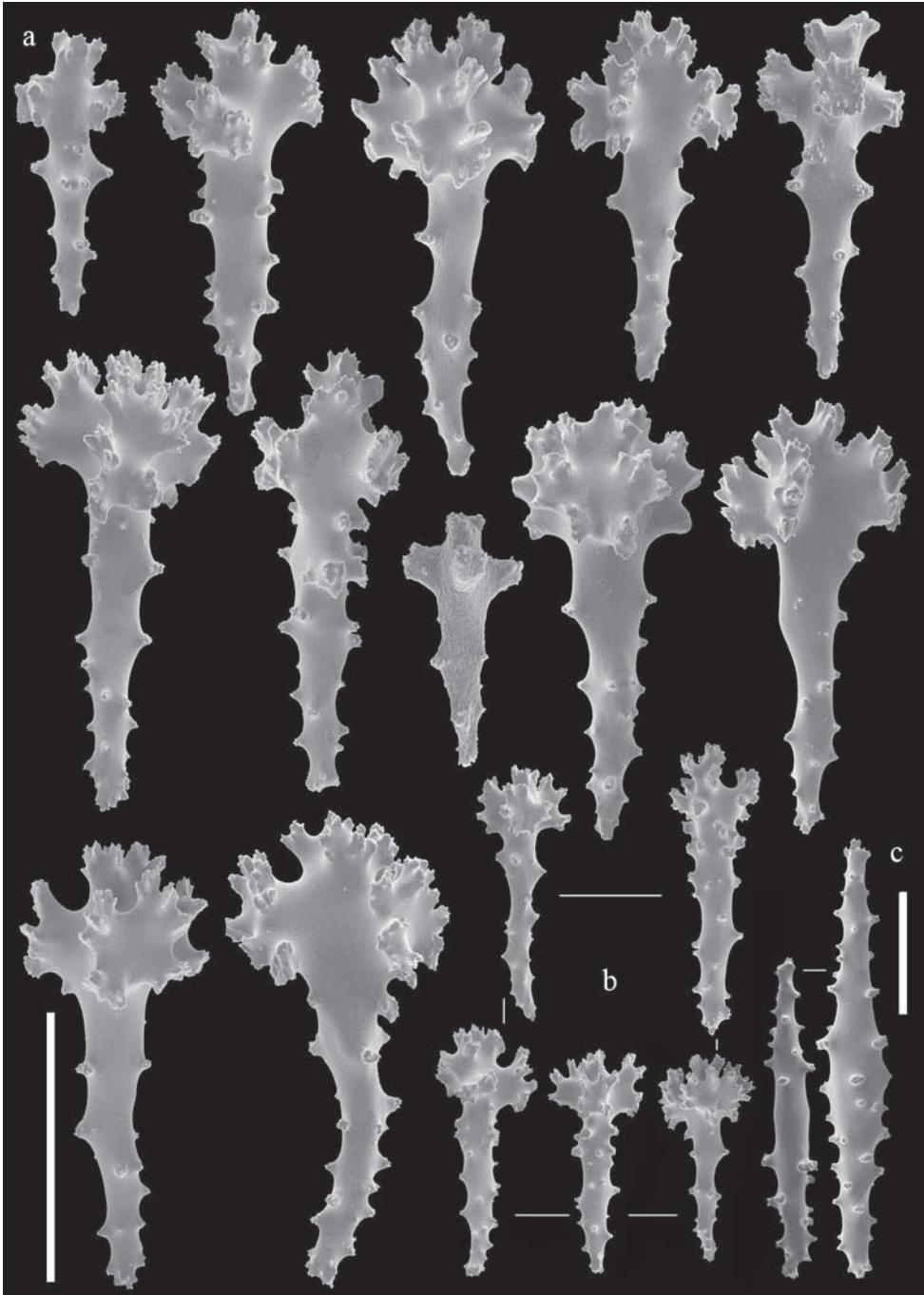


Fig. 24. *Simularia finitima* spec. nov., paratype RMNH Coel. 38729; sclerites of surface layer of the top of the colony; a-b, clubs; c, spindles. Scales 0.10 mm, that at a only applies to a.

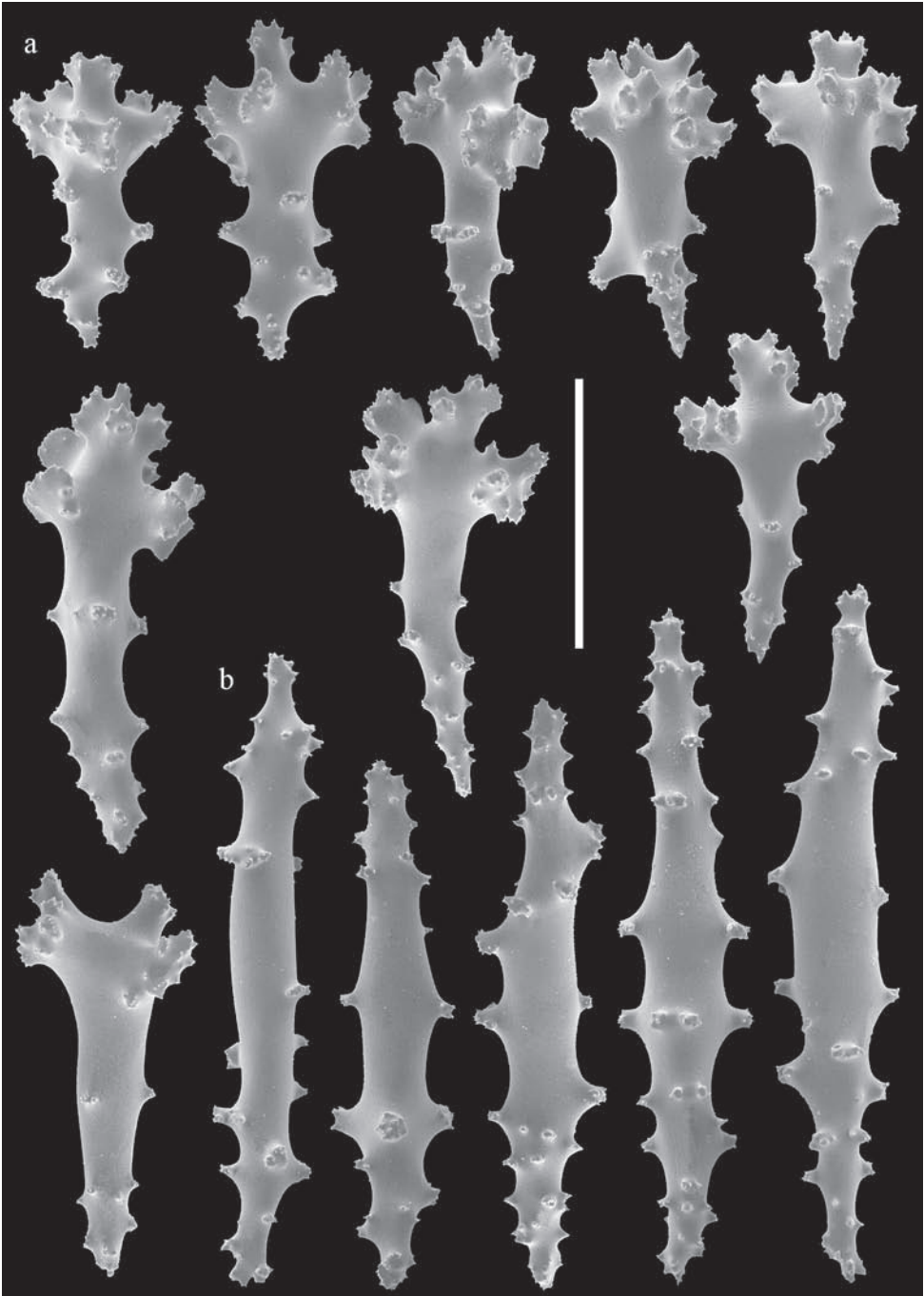


Fig. 25. *Sinularia finitima* spec. nov., paratype RMNH Coel. 38729; sclerites of surface layer of the base of the colony; a, clubs; b, spindles. Scale 0.10 mm.

Simularia flaccida spec. nov.
(figs 26a, 27-30, 76b)

Material examined.— RMNH Coel. 38731, holotype and 1 microscope slide, KOR.15.

Description.— The holotype is an arborescent colony, 7 cm high and 3.5 cm wide (fig. 26a). The stalk is 3 cm high, it gives off a number of primary lobes, which branch once or twice; the lobules are only a few mm wide.

The polyps have a collaret and eight points. Collaret with bent spindles, up to 0.50 mm long, with higher tubercles on the convex side (fig. 27a-b). The points with poorly developed clubs, up to 0.25 mm long (fig. 27c). The tentacles have flattened rods, up to 0.10 mm long.

The surface layer of the lobules contains clubs, 0.10-0.30 mm long (figs 27d, 28a-b). Most of the clubs have a central wart, which often is obscured by the tubercles below it. Additionally, a few spindles are present, up to 0.30 mm long, with simple tubercles (fig. 28c), and some shuttles (fig. 28d).

The clubs of the surface layer of the base of the colony have wider handles and are shorter than those of the lobules (fig. 29a-b); a few look like capstans (fig. 29d). The small spindles of the surface layer of the base are also smaller and wider than those of the top (fig. 29c).

The interior of the lobules has hardly any spindles, the four present in the microscope slide were up to 1 mm long, all with rather simple tubercles. In the interior of the base more and longer spindles are present than in the lobules, up to 2.5 mm long (fig. 30a), and they are more tuberculate (fig. 30b).

Etymology.— The Latin “flaccidus”, flabby, weak, refers to the very soft lobules of the species.

Molecular study.— The holotype of *S. flaccida* showed the same DNA sequence as *S. vrijmoethi* (NTM C14095).

Remarks.— Live colonies were found grouped and hanging down (fig. 76b), much like colonies of *S. querciformis*, also found around Palau.

S. vrijmoethi, originally described from Madagascar, also has an arborescent colony shape, but differs in having longer and wider lobules (Verseveldt, 1971: pl. 10 fig. 2). Moreover, it has shorter crown and point sclerites, and although it has the same type of clubs in the surface layer of the lobules as *S. flaccida*, they are shorter (a few up to 0.26 mm long). Verseveldt (1974: 20) reported *S. vrijmoethi* also from the Gulf of Elat, Red Sea. For the five specimens examined he reported “Clubs in surface layer of lobes and sterile part may be larger than previously stated, up to 0.4 mm long (Figs 14 & 15)”. I have re-examined the five microscope slides of sclerites of RMNH Coel. 8899, the specimen used by Verseveldt for his drawings of figs 14-15. As Verseveldt’s drawings already suggested, this specimen has sclerites that differ from those in the type of *S. vrijmoethi*. Actually, the sclerites resemble those depicted by Verseveldt & Benayahu (1983: fig. 6) for specimens they identified as *S. gardineri*. Specimens of *S. vrijmoethi* and *S. gardineri* sensu Verseveldt & Benayahu look quite similar and both species have collaret and point sclerites. In my opinion the main difference between these two species is that *S. gardineri* sensu Verseveldt & Benayahu has many small clubs which show a

clear central wart (fig 14a-g in Verseveldt 1974) that are missing in *S. vrijmoethi*. It is noteworthy the type specimen of *S. gardineri* does not resemble the specimens identified by Verseveldt & Benayahu as *S. gardineri*.

The colony shape of *S. loyai*, *S. licroclados*, *S. dactyloclados*, and *S. schumacheri* all also resemble *S. flaccida*. Of these four species *S. licroclados* and *S. schumacheri* have the smallest lobules, most resembling those of *S. flaccida*. However, in these two species the overall length of the clubs of the surface layer is smaller, the club handles are wider, and the club heads less spiny.

Finally, the largest clubs of the lobules of *S. flaccida* have a striking resemblance with the largest clubs of *S. hirta* (Verseveldt, 1980: fig. 33i) and the colony shape of both species can also be quite similar (Ofwegen & Vennam, 1994: fig. 10b). However, *S. hirta* has many more small clubs with distinct central wart (Ofwegen & Vennam, 1994: fig. 11).

Sinularia foliata spec. nov.
(figs 26b, 31-33, 76c)

Material examined. — RMNH Coel. 38732, holotype and 1 microscope slide, KOR.03.

Description. — The holotype is part of an arborescent colony, 6.5 cm high and 6 cm wide (fig. 26b). Lobes are subdivided having small finger-like lobules; the latter are only a few mm wide and up to 1 cm long.

The surface layer of the lobules has clubs, 0.10-0.30 mm long (fig. 31a-b), mostly with a central wart; both this wart and the tubercles below it can be foliaceous. In addition, the surface layer of the lobes has spindles, up to 0.50 mm long, with rather prominent simple tubercles (fig. 31c). There are no sclerites in the polyps.

The clubs of the surface layer of the base of the colony resemble those of the lobes, but have wider handles and are shorter; up to 0.20 mm long (fig. 32a-b). The small spindles of the surface layer of the base are also smaller and wider than those of the top (fig. 32c-d).

The interior of the lobules has spindles, up to 2.5 mm long, several of them have side branches (fig. 33a), all with rather small tubercles (fig. 33c). Some of the smaller ones have one end with foliaceous tubercles, so resembling big clubs. In the interior of the base the spindles are slightly longer, up to 3 mm long (fig. 33b, d).

Colour. — The preserved specimen is white.

Etymology. — The Latin “*foliatus*”, leafy, refers to the leaf-like central wart so common in the clubs of this species.

Molecular study. — The holotype specimen of *S. foliata* showed the same sequence as *S. abhishiktae* (RMNH Coel. 38720) and *S. gravis* (RMNH Coel. 38736). The colony shapes of *S. gravis* and *S. abhishiktae* are quite different; *S. gravis* has ridges (Verseveldt, 1977: pl. 4 fig. 1) and *S. abhishiktae* stout lobes with small knob-like lobules (Ofwegen & Vennam, 1991: fig. 1A-B; fig. 1a).

Remarks. — This species mostly resembles *S. bremerensis* described from the Gulf of Carpentaria, *S. finitima* spec. nov., and *S. luxuriosa* spec. nov. The differences between these species are discussed under *S. luxuriosa*.

Sinularia gaveshaniae Alderslade & Shirwaiker, 1991
(figs 26c, 34-36, 76e)

S. gaveshaniae Alderslade & Shirwaiker, 1991: 225.

Material examined.— RMNH Coel. 38733, colony fragment and 1 microscope slide, KOR.01.

Molecular study.— The specimen from KOR.01 showed the same DNA sequence as *S. compacta* (RMNH Coel. 38433), *S. digitata* spec. nov., and *S. leptocladus* (ZMTAU CO34095). Of these *S. digitata* is most similar to *S. gaveshaniae*, it also has an encrusting colony shape with finger-like lobes (see fig. 12c). However, the sclerites of *S. digitata* are different (see remarks of *S. digitata*).

Remarks.— The species was described from the Laccadive Archipelago by Alderslade & Shirwaiker (1991). The present material is very similar regarding sclerites and colony shape. For comparison a live colony (fig. 76e), preserved fragment (fig. 26c) and sclerites of the surface layer are given (figs 34-36).

Sinularia gaweli Verseveldt, 1978
(figs 37, 76f)

Sinularia gaweli Verseveldt, 1978: 55, fig. 3, pl. 3 fig. 2 (Guam); Benayahu, 1997: 221, figs 7-8 (Guam);

Ofwegen, 2002: 168 (overview *Sinularia* species).

Not *Sinularia gaweli*; Ofwegen & Vennam, 1991: 143 (Laccadives).

Material.— RMNH Coel. 38734, colony fragment and 1 microscope slide, KOR.15.

Molecular study.— The specimen of *S. gaweli* appeared to be the same or very similar to two *S. gaweli* specimens from Guam.

Remarks.— This is one of the few *Sinularia* species with very variable lobe shape within a colony. For the holotype fragment it was already reported both small round knobs and big lobes bearing lobules occurred (Verseveldt, 1978: pl. 3 fig. 3). Later Benayahu reported similar colonies from Guam but also a colony with only small finger-like lobes (1997: fig. 7a). The present colony from Palau resembles the holotype, especially the underwater image (fig. 76f) shows the two types of lobes very well. *S. kotanianensis* (Ambon), *S. woodyensis* (Gulf of Carpentaria, Australia), and *S. babeldaobensis* spec. nov. (Palau) have similar colony shapes. The clubs in the surface layer of the top of the colony of *S. kotanianensis* have more slender handles and less leafy central wart (Manuputty & Ofwegen, 2007: fig. 15) than those of *S. gaweli* (fig. 37). The clubs of *S. woodyensis* are overall less ornamented (Ofwegen, 2008: fig. 25). *S. babeldaobensis* differs from *S. gaweli* in having much bigger clubs in the surface layer of the top of the colony (figs 4, 5a).

There is a striking resemblance between the live colonies of *S. gaweli* (fig. 76f) and *S. crebra* spec. nov. (fig. 75f). For differences between the two species see the remarks of *S. crebra*.

Ofwegen & Vennam (1991) wrongly identified a specimen from the Laccadives as *S. gaweli*; it will be the subject of another publication.

Sinularia gravis Tixier-Durivault, 1970
(fig. 76h)

For references, see Vennam & Ofwegen, 1996: 439.

Material. — RMNH Coel. 38736, colony fragment and 1 microscope slide, KOR.14.

Molecular study. — *S. gravis* (RMNH Coel. 38736) came out identical to *S. abhishiktae* and *S. foliata* spec. nov. For a comparison of these species see the remarks of *S. foliata*.

Sinularia humilis spec. nov.
(figs 26d, 38-40, 77c)

Material examined. — RMNH Coel. 38737, holotype and 1 microscope slide, KOR.05.

Description. — The holotype is part of an encrusting colony, with a maximum cross-section of 4 × 6 cm (fig. 26d). The height of the fragment is 3 cm. The lobes are very diverse, finger like, having small lobules which form hillock-like rosettes, or they are crest-like.

The polyps have eight points with poorly developed clubs, up to 0.20 mm long (fig. 38a). The tentacles have flattened rods, up to 0.10 mm long (fig. 38b).

The surface layer of the lobules contains clubs, up to 0.25 mm long (figs 38c, 39a-b). Most of these clubs have a central wart, a few are intermediate between small spindles and clubs (fig. 39b). Additionally, spindles are present, up to 0.35 mm long, many with prominent simple tubercles (fig. 39c-d), but quite a few have low spines.

The clubs of the surface layer of the base of the colony resemble those of the lobes, but are slightly wider and shorter; up to 0.20 mm long; a few small ones are capstan-like (fig. 40a). The small spindles of the surface layer of the base are more tuberculate than those of the top of the colony (fig. 40b-c).

The interior of the lobules has spindles, up to 2.5 mm long (fig. 39e), several of them are bent, and all with rather small tubercles (fig. 39f). In the interior of the base these spindles are up to 2 mm long (fig. 40d). Most have simple tubercles; some have a short side branch.

Colour. — The preserved specimen is light brown.

Etymology. — The Latin “*humilis*”, on or near the ground, low, shallow, refers to the small lobes in comparison with the related species *S. subtilis* spec. nov. and *S. ultima* spec. nov.

Molecular study. — The holotype of *S. humilis* spec. nov. showed the same DNA sequence as that of *S. subtilis* spec. nov. and as a specimen (NTM C13790) identified by Dr Alderslade (CSIRO) as *S. numerosa*. For a discussion of these three species see *S. ultima* spec. nov.

Sinularia lamellata Verseveldt & Tursch, 1979

S. lamellata Verseveldt & Tursch, 1979: 142; Fabricius & Alderslade, 2001: 81 fig. 15; Fabricius et al., 2007: 90.

Material examined. — RMNH Coel. 34318, colony fragment and 1 microscope slide, KOR.11.

Remarks.—This species was described from Mililat Bay, Madang Harbour, Papua-New Guinea by Verseveldt & Tursch (1979), and mentioned later on by Fabricius & Alderslade (2001) and Fabricius et al. (2007) to occur in Palau. Verseveldt & Tursch (1979) mentioned that no polyps were present in the holotype fragment. The polyps of the present material have a collaret and point arrangement. The point sclerites are club-like, up to 0.15 mm long, the collaret has short bent spindles, up to 0.10 mm long. The tentacles contain many rods.

Verseveldt & Tursch did not compare *S. lamellata* with *S. frondosa* and *S. brassica*, the only two other *Sinularia* species that can have flattened lobes. *S. brassica* has completely different sclerites, but those of *S. frondosa* are very similar to the ones of *S. lamellata*, and at present the difference between these two species is not clear to me. I identify the present material as *S. lamellata* because of the previous records; my under water photograph resembles that of Fabricius & Alderslade (2001: 81, fig. 15).

So far *S. frondosa* has only been reported from the type locality, Ponape, Micronesia.

Sinularia aff. *leptoclados*

Material examined.—RMNH Coel. 38738, fragment and 1 microscope slide, KOR.01; RMNH Coel. 38739, 1 colony and 1 microscope slide, KOR.08; RMNH Coel. 38740, 3 colonies and 1 microscope slide, KOR.14; RMNH Coel. 38741, 1 colony and 1 microscope slide, KOR.15.

Molecular study.—Molecular data and re-examination of museum material indicate specimens previously identified as *S. leptoclados* could belong to a complex of related species rather than one widespread species, as reported by Verseveldt (1980: 80).

Remarks.—The present specimens from Palau are very similar to specimens identified by Manuputty & Ofwegen (2007) from Ambon as *S. leptoclados*; that identification is now considered incorrect. *S. verseveldti* described from the Bismarck Sea, Papua New Guinea, also shows sclerites similar to the present material.

The re-examination of the RMNH specimens previously identified as *S. leptoclados*, together with the present material, *S. leptoclados* from Bremer island (see Ofwegen, 2008), and re-examination of *S. verseveldti* will be the subject of a separate publication.

Sinularia luxuriosa spec. nov.
(figs 26e, 41-44, 77d)

?*Sinularia scabra*; Verseveldt, 1978: 50.

Not *Sinularia scabra* Tixier Durivault, 1970: 212.

Material examined.—RMNH Coel. 38742, holotype and 1 microscope slide, KOR.04; RMNH Coel. 12821, paratype and 4 microscope slides, material identified by Verseveldt as ?*S. scabra*, Palau, Koror, Malakal isl., reef front, 15 ft deep, coll. C. Birkeland, 10.i.1976.

Description.—The holotype is part of an arborescent colony, 6.5 cm high and 4 cm wide (fig. 26e). Lobes are undivided, finger-like, or subdivided having small finger-like lobules; the latter are only a few mm wide.

The surface layer of the lobes and lobules has clubs, 0.10-0.20 mm long, mostly

with a central wart (figs 41a, 42a). The heads of the clubs show much variation, the central wart and warts below it can be simple or subdivided; several clubs totally lack a central wart. In addition, the surface layer of the lobes has spindles, up to 0.35 mm long, with sparse, simple tubercles (figs 41b, 42b). Some sclerites, intermediate between clubs and spindles, are also present (fig. 42a, left from spindle). There are no sclerites in the polyps.

The clubs of the surface layer of the base of the colony resemble those of the lobes, but have somewhat wider handles and are shorter (fig. 43a). The small spindles of the surface layer of the base have the same size as those of the top but are wider (fig. 43b).

The interior of the lobes and lobules has spindles, up to 3.5 mm long, several are bent or have side branches (fig. 44a), all with rather small tubercles (fig. 44c). In the interior of the base these spindles (fig. 44b) are even longer, up to 4.5 mm long, with larger tubercles (fig. 44d).

Colour.—The preserved specimen is white.

Etymology.— The Latin “luxuriosus”, luxurious, refers to the excessively shaped heads of the clubs of the surface layer of the lobes.

Molecular study.— The holotype showed the same sequence as two specimens identified as *S. peculiaris* (NTM C13959 and NTM C14092). *S. peculiaris* has a totally different colony shape, with small spherical lobules, and different sclerites, viz. clubs with more regular heads, and many small branched spindles in the base of the colony.

Remarks.— The clubs of the present material resemble those found in *S. capitalis*, *S. deformis*, and to a lesser extent *S. brassica*. *S. capitalis* colonies have overall much wider lobes (Verseveldt 1980: pl. 5 figs 1-2; Ofwegen & Vennam, 1994: fig. 2). Additionally, in *S. capitalis* the surface layer clubs have less developed heads.

S. deformis also shows a different colony shape with much wider lobes (Verseveldt 1980: pl. 12 fig. 2) but it should be considered that species was described on a dry specimen. However, the base of the colony of *S. deformis* shows rather bizarre clubs and aberrant forms (Verseveldt 1980: fig. 14), not present in *S. luxuriosa*. Additionally, the small surface spindles and the club handles of the clubs of the top of the colony are much wider in *S. deformis*.

S. brassica has polyp sclerites which easily differentiates it from the present material.

The colony shape and sclerites of *S. luxuriosa* resemble those of *S. foliata* spec. nov., *S. finitima* spec. nov., and *S. bremerensis*, described from the Gulf of Carpentaria. Of these four similar looking species *S. bremerensis* and *S. luxuriosa* have the shortest clubs in the lobules, both up to 0.20 mm long (*S. finitima* up to 0.25 mm, *S. foliata* up to 0.30 mm long). Regarding the small spindles of the surface layer *S. luxuriosa* and *S. finitima* are alike in both having spindles with sparse, simple tubercles, while *S. bremerensis* and *S. foliata* both have spindles with more closely set tubercles. Also DNA-wise *S. bremerensis* and *S. foliata* are most similar to each other.

RMNH Coel. 12821, previously identified as ?*S. scabra* by Verseveldt (1978), was re-examined and included in *S. luxuriosa*. The specimen is larger, 10 cm high, but has similar sclerites and colony shape as the holotype of *S. luxuriosa*.

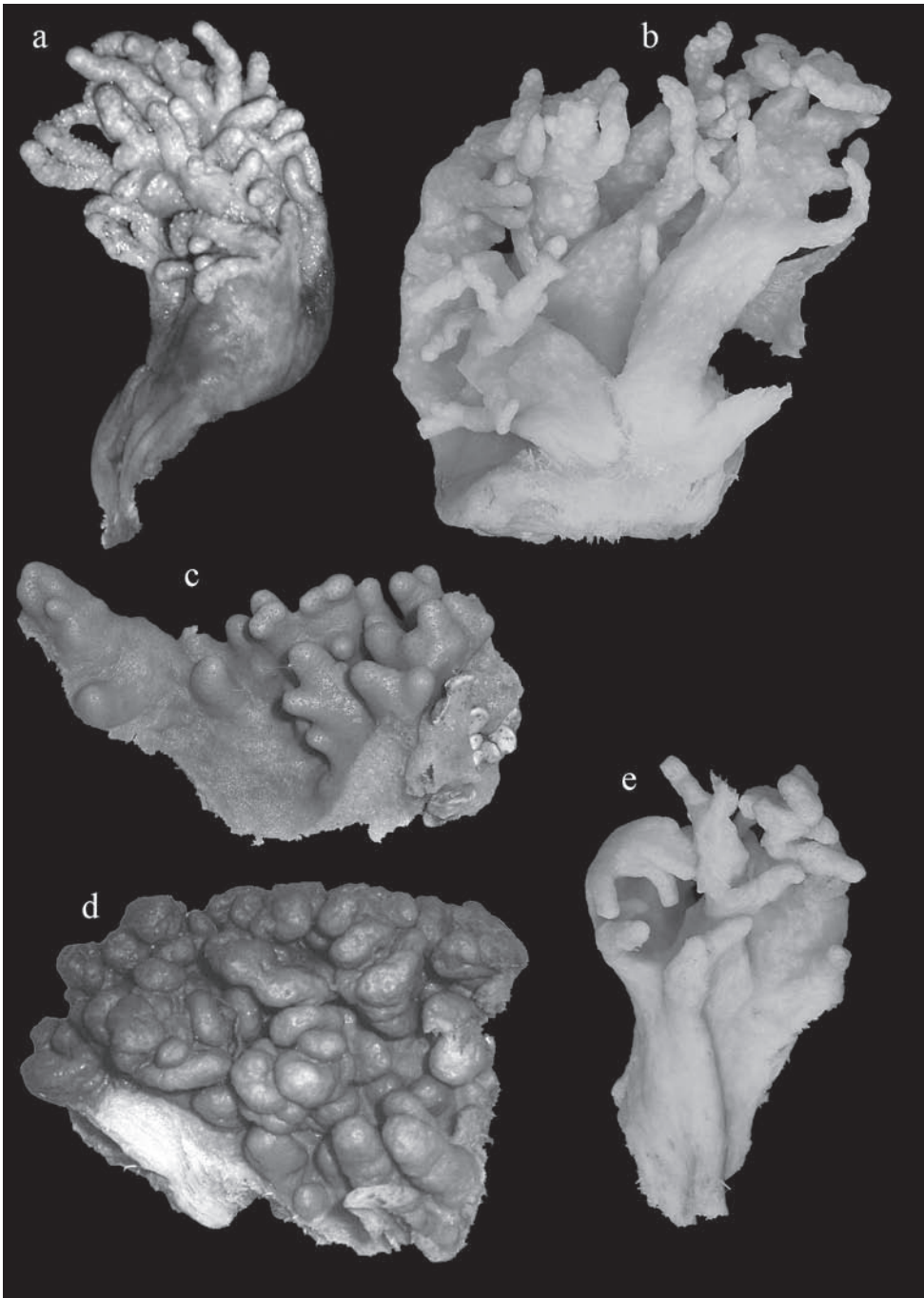


Fig. 26a. *Sinularia flaccida* spec. nov., holotype RMNH Coel. 38731; b, *S. foliata* spec. nov., holotype RMNH Coel. 38732; c, *S. gaveshaniae*, RMNH Coel. 38733; d, *S. humilis* spec. nov., holotype RMNH Coel. 38737; e, *S. luxuriosa* spec. nov., holotype RMNH Coel. 38742. All natural size; c-d views from above, others lateral views.



Fig. 27. *Sinularia flaccida* spec. nov., holotype RMNH Coel. 38731; a-b, collaret spindles; c, point clubs; d, clubs of surface layer of the top of the colony. Scales 0.10 mm, that at b only applies to b.



Fig. 28. *Simularia flaccida* spec. nov., holotype RMNH Coel. 38731; sclerites of surface layer of the top of the colony; a-b, clubs; c, spindles; d, shuttles. Scales 0.10 mm, that at b applies to b-c.

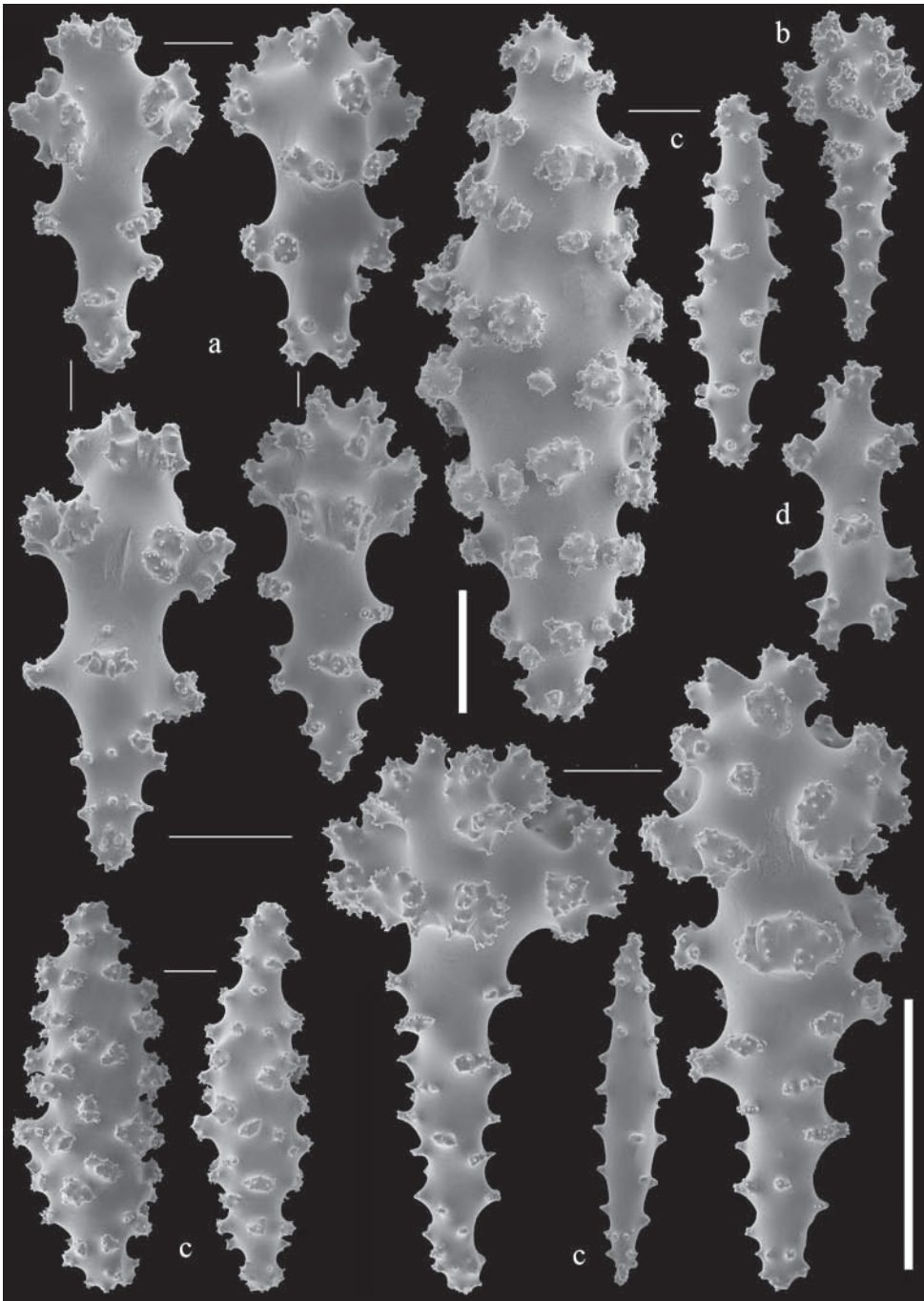


Fig. 29. *Sinularia flaccida* spec. nov., holotype RMNH Coel. 38731; sclerites of surface layer of the base of the colony; a-b, clubs; c, spindles; d, capstan. Scales 0.10 mm, that at c applies to b-c.

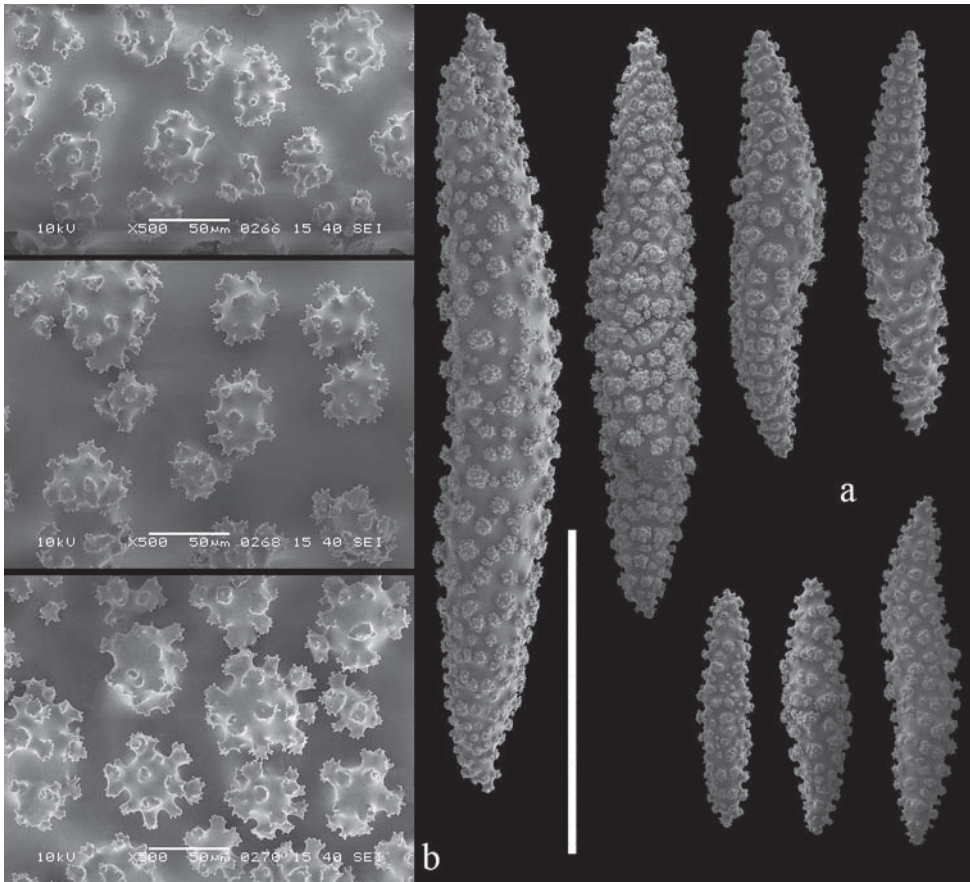


Fig. 30. *Simularia flaccida* spec. nov., holotype RMNH Coel. 38731; a, spindles of the interior of the base of the colony; b, tubercles on spindles. Scale 1 mm.

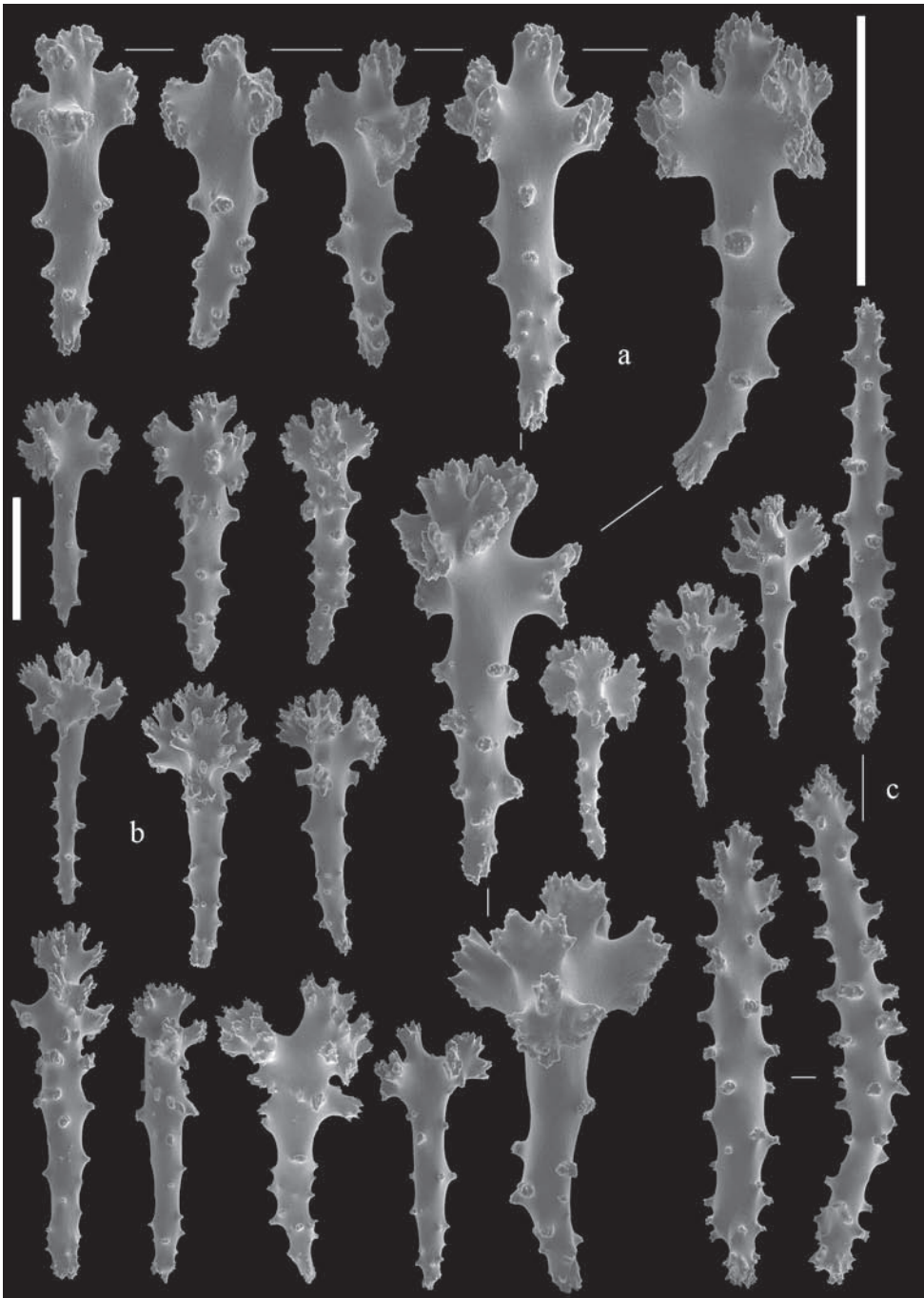


Fig. 31. *Sinularia foliata* spec. nov., holotype RMNH Coel. 38732; sclerites of surface layer of the top of the colony; a-b, clubs; c, spindles. Scales 0.10 mm, that at a only applies to a.

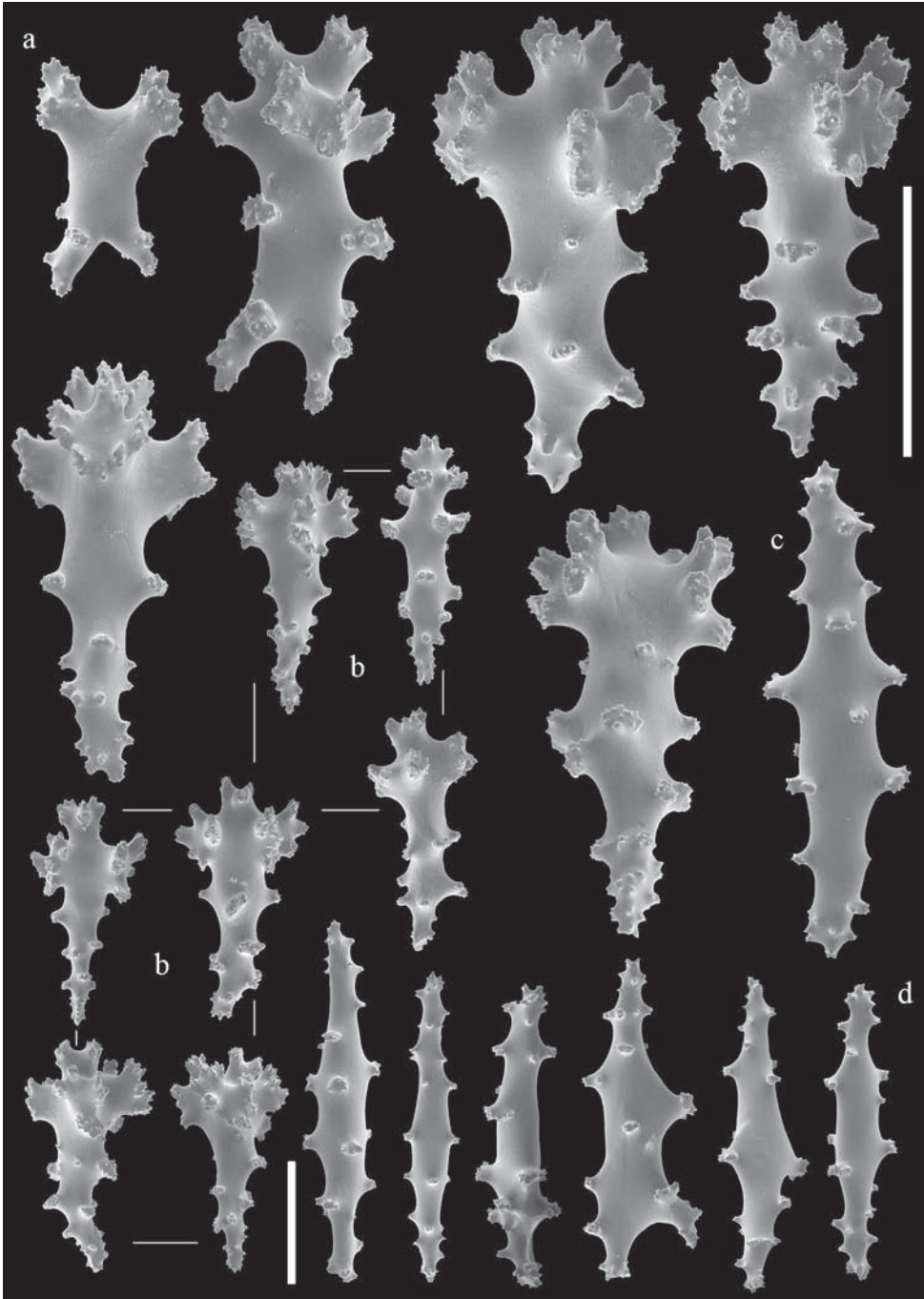


Fig. 32. *Simularia foliata* spec. nov., holotype RMNH Coel. 38732; sclerites of surface layer of the base of the colony; a-b, clubs; c-d, spindles. Scales 0.10 mm, that at a applies to a, c.

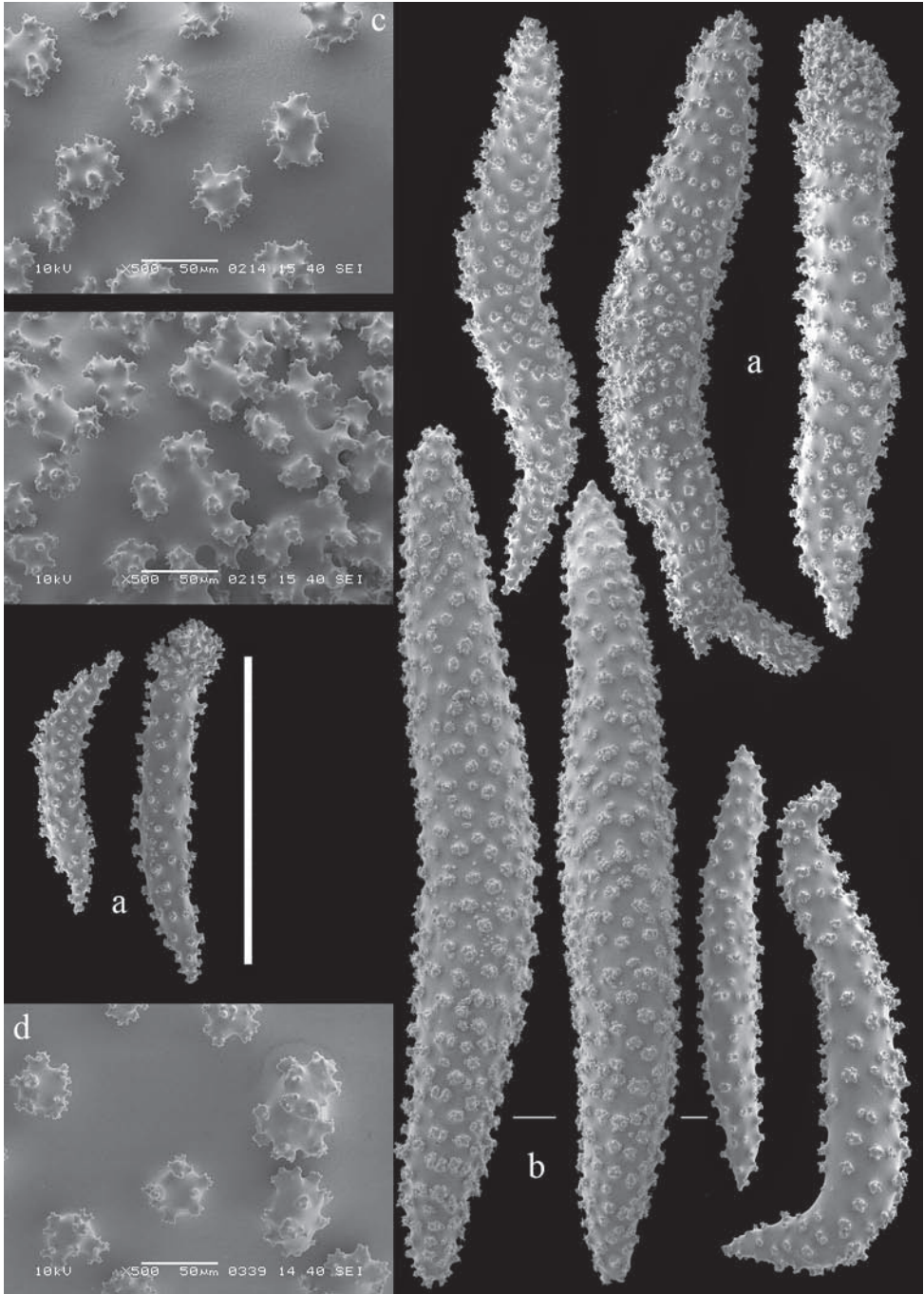


Fig. 33. *Sinularia foliata* spec. nov., holotype RMNH Coel. 38732; a-b, spindles of the interior; c-d, tubercles on spindles; a, c, top of colony; b, d, base of colony. Scale 1 mm.



Fig. 34. *Simularia gaveshaniae*, RMNH Coel. 38733; a, collaret spindles; b, point clubs; c, tentacle rod; d, clubs of surface layer of the top of the colony. Scale 0.10 mm.

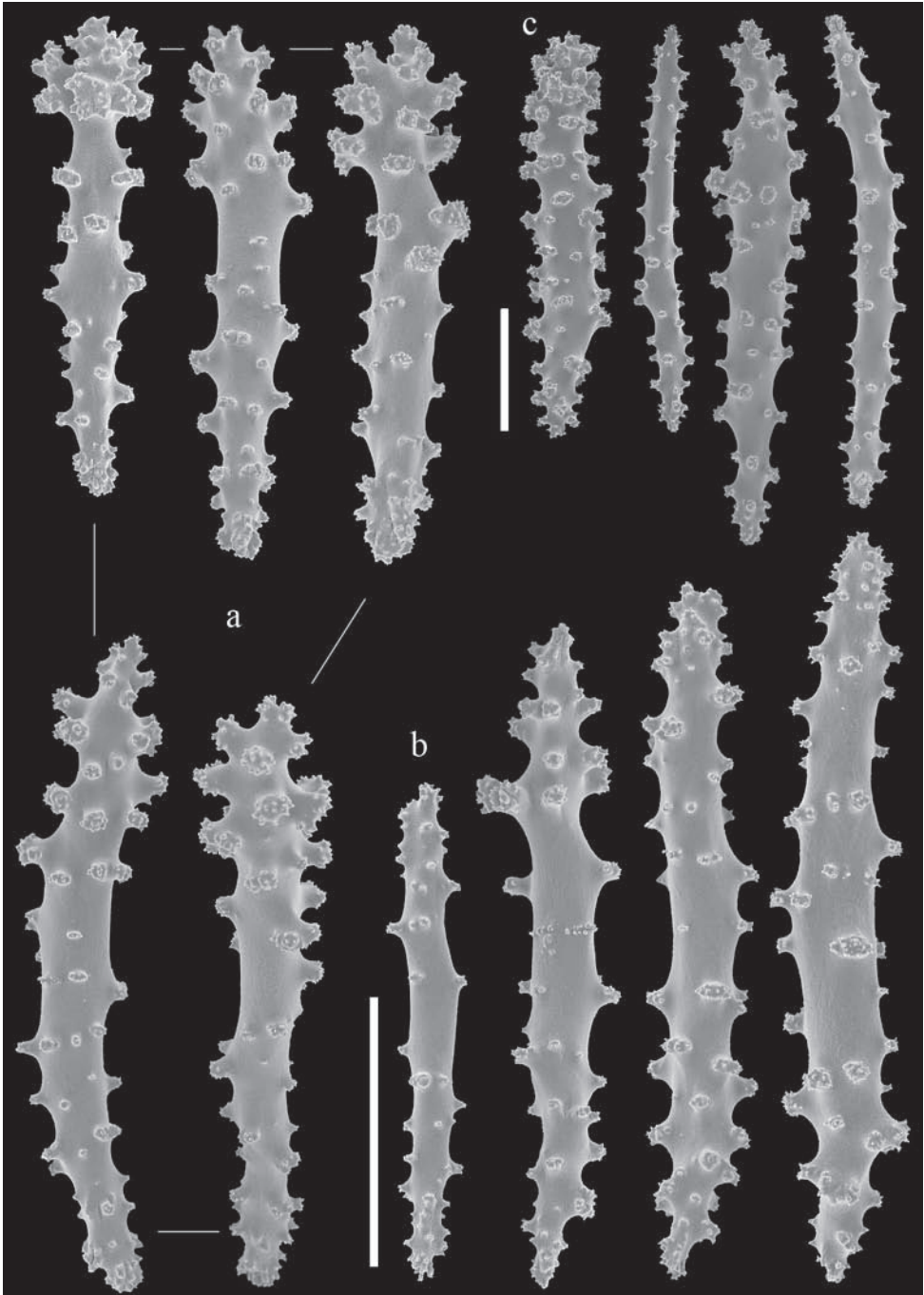


Fig. 35. *Simularia gaveshaniae*, RMNH Coel. 38733; sclerites of surface layer of the top of the colony; a, clubs, b-c, spindles. Scales 0.10 mm, that at c only applies to c.

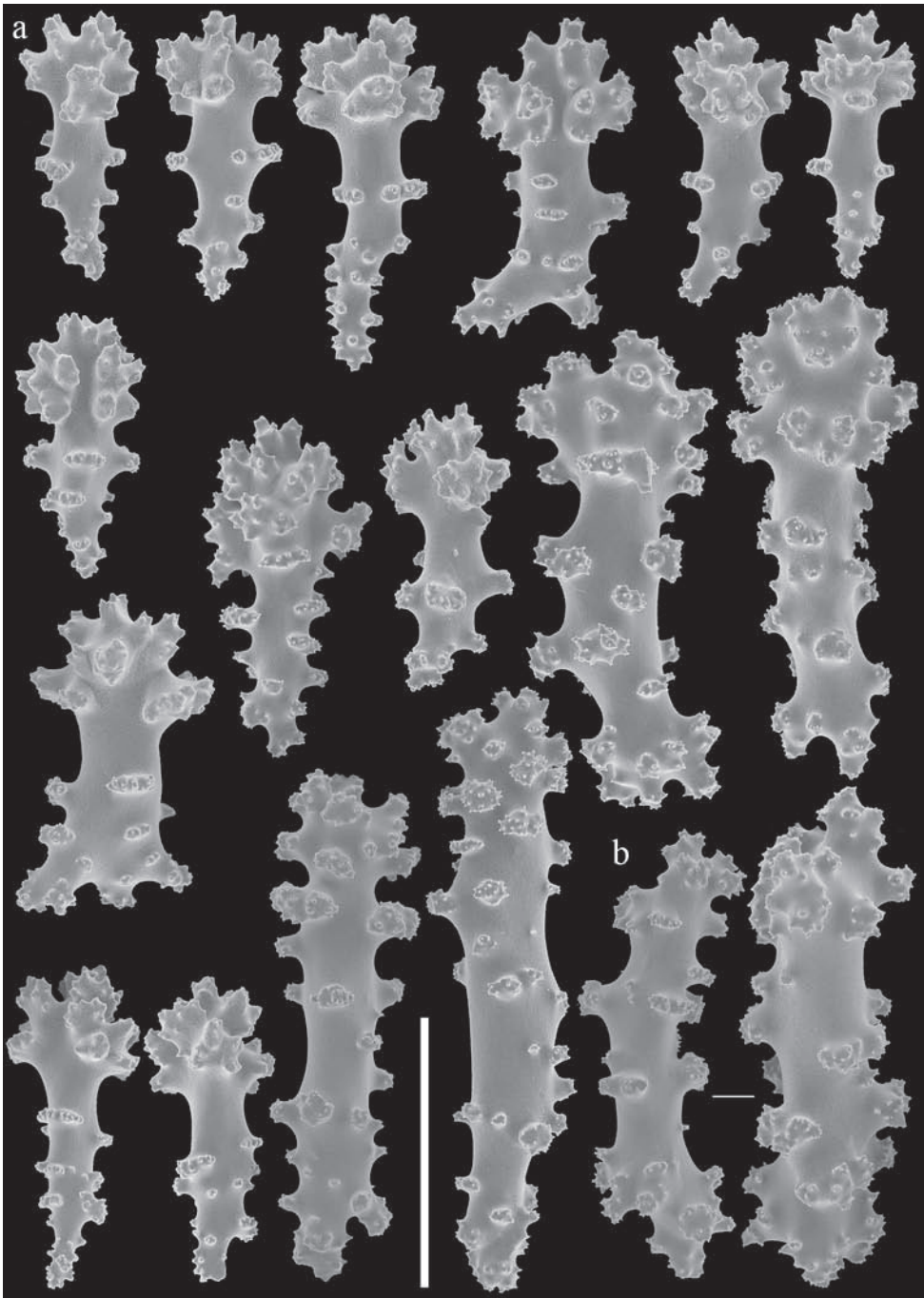


Fig. 36. *Simularia gaveshaniae*, RMNH Coel. 38733; sclerites of surface layer of the base of the colony; a, clubs, b, spindles. Scale 0.10 mm.

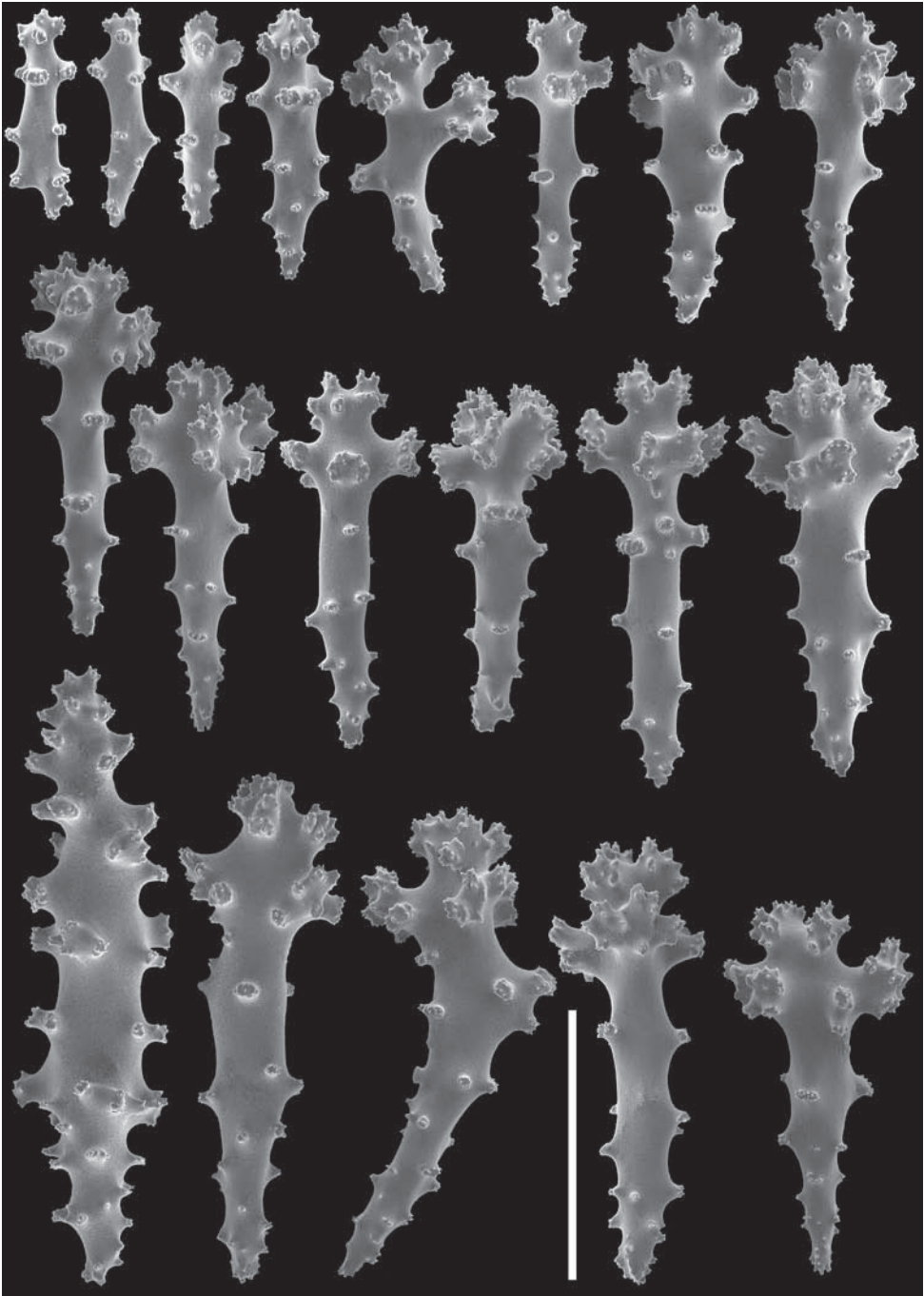


Fig. 37. *Sinularia gaweli*, RMNH Coel. 38734; sclerites of surface layer of the top of the colony. Scale 0.10 mm.

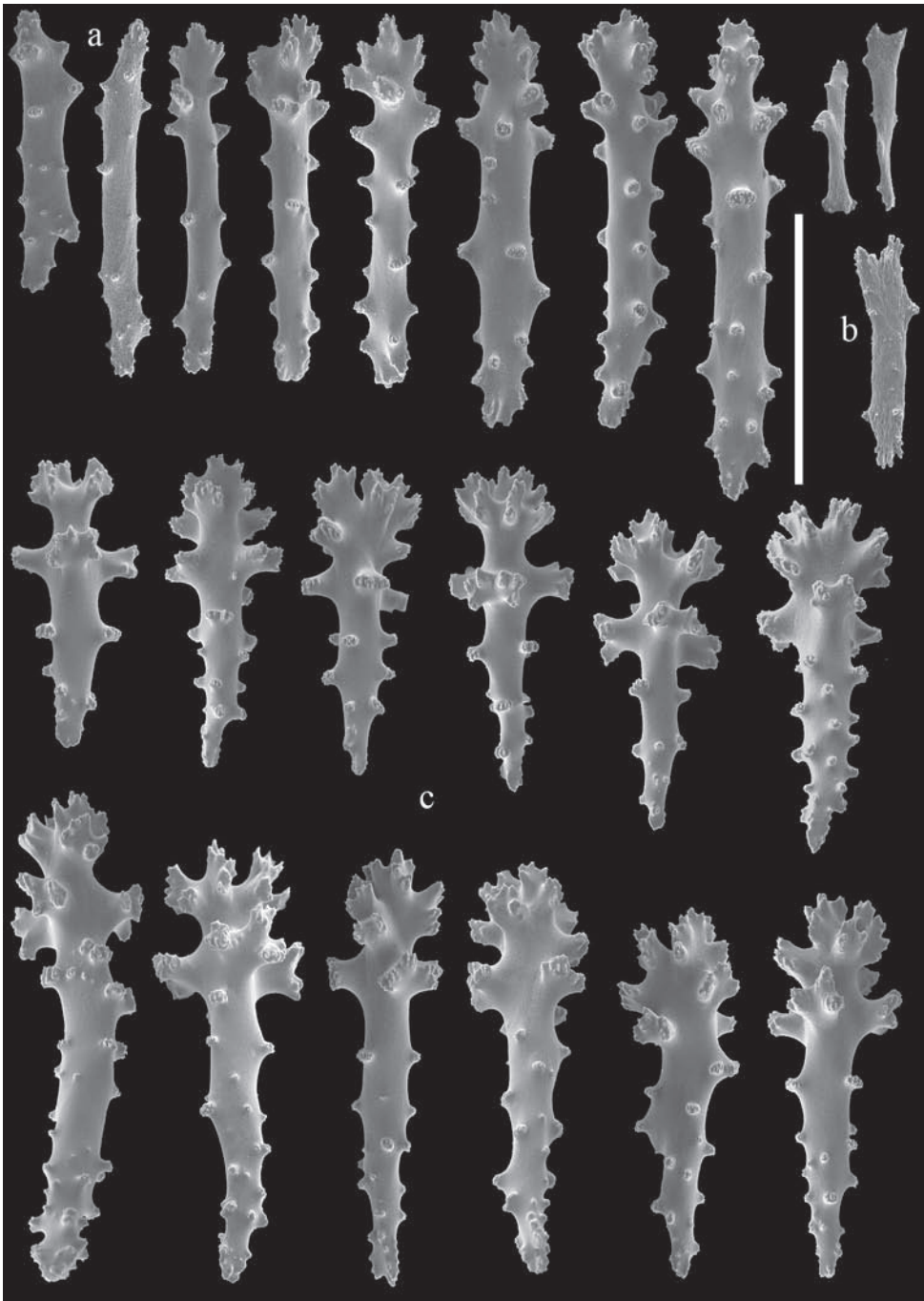


Fig. 38. *Simularia humilis* spec. nov., holotype RMNH Coel. 38737; a, point clubs; b, tentacle rods; c, clubs of surface layer of the top of the colony. Scale 0.10 mm.

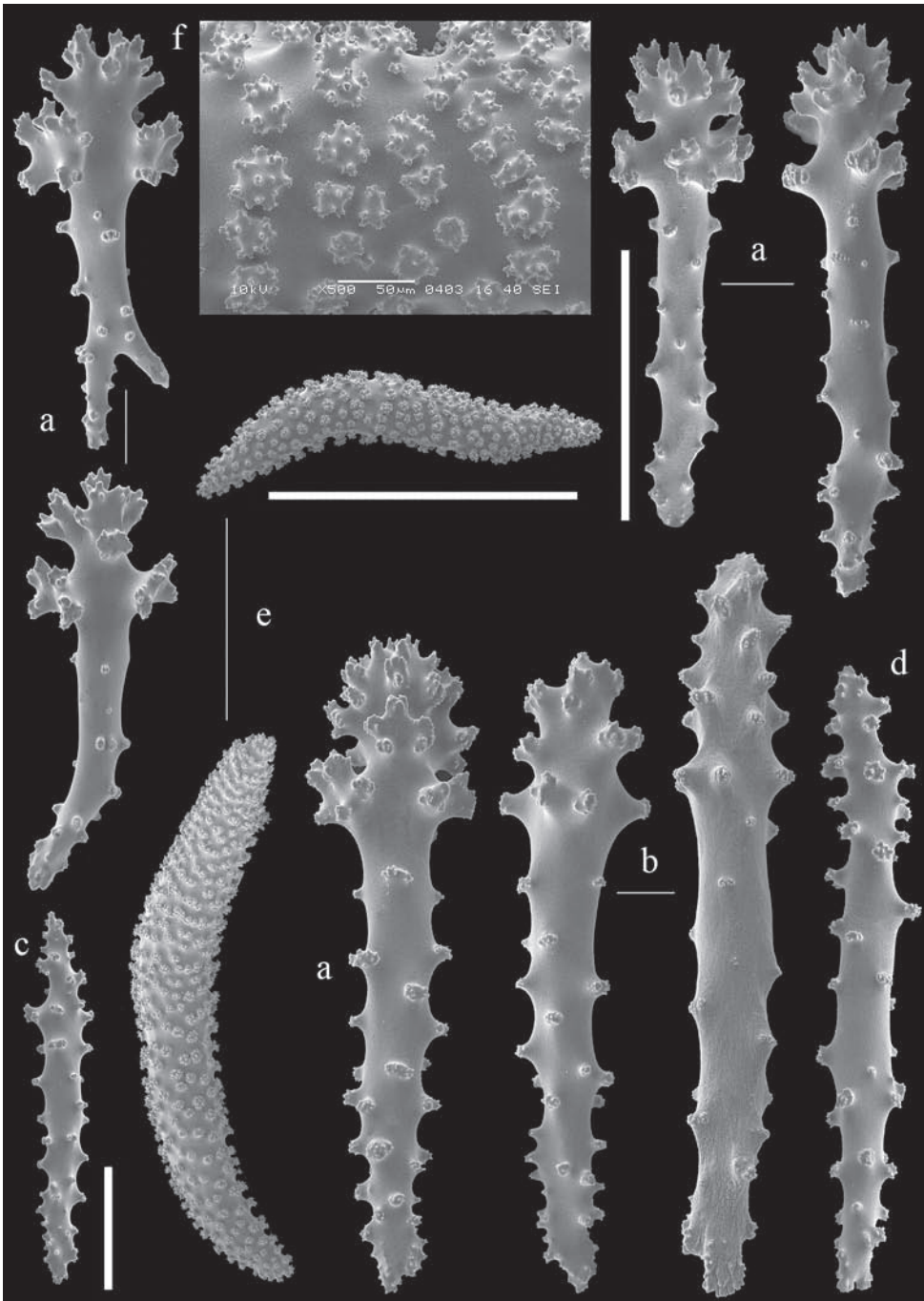


Fig. 39. *Simularia humilis* spec. nov., holotype RMNH Coel. 38737; a-b, clubs of surface layer of the top of the colony; c-d, spindles of surface layer of the top of the colony; e, spindles of the interior of the top of the colony; f, tubercles on spindle of the interior of the top of the colony. Scales at a and c 0.10 mm, that at c only applies to c; scale at e 1 mm, only applies to e.

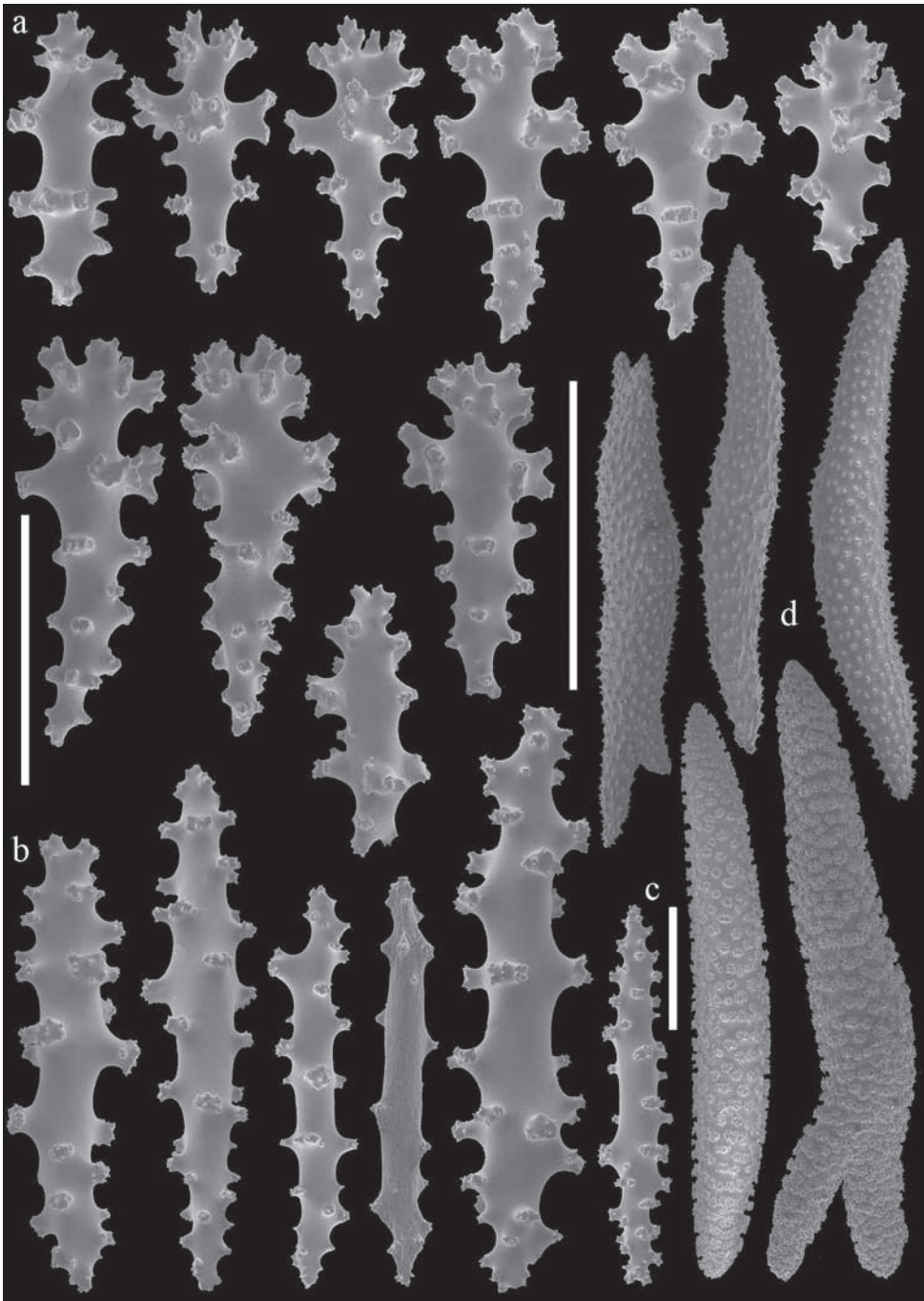


Fig. 40. *Simularia humilis* spec. nov., holotype RMNH Coel. 38737; sclerites of the base of the colony; a, clubs of the surface layer; b-c, spindles of the surface layer; d, spindles of the interior. Scales at a and c 0.10 mm, that at c only applies to c; scale at d 1 mm, only applies to d.



Fig. 41. *Sinularia luxuriosa* spec. nov., holotype RMNH Coel. 38742; sclerites of surface layer of the top of the colony; a, clubs, b, spindle. Scale 0.10 mm.



Fig. 42. *Sinularia luxuriosa* spec. nov., holotype RMNH Coel. 38742; sclerites of surface layer of the top of the colony; a, clubs, b, spindle. Scale 0.10 mm.

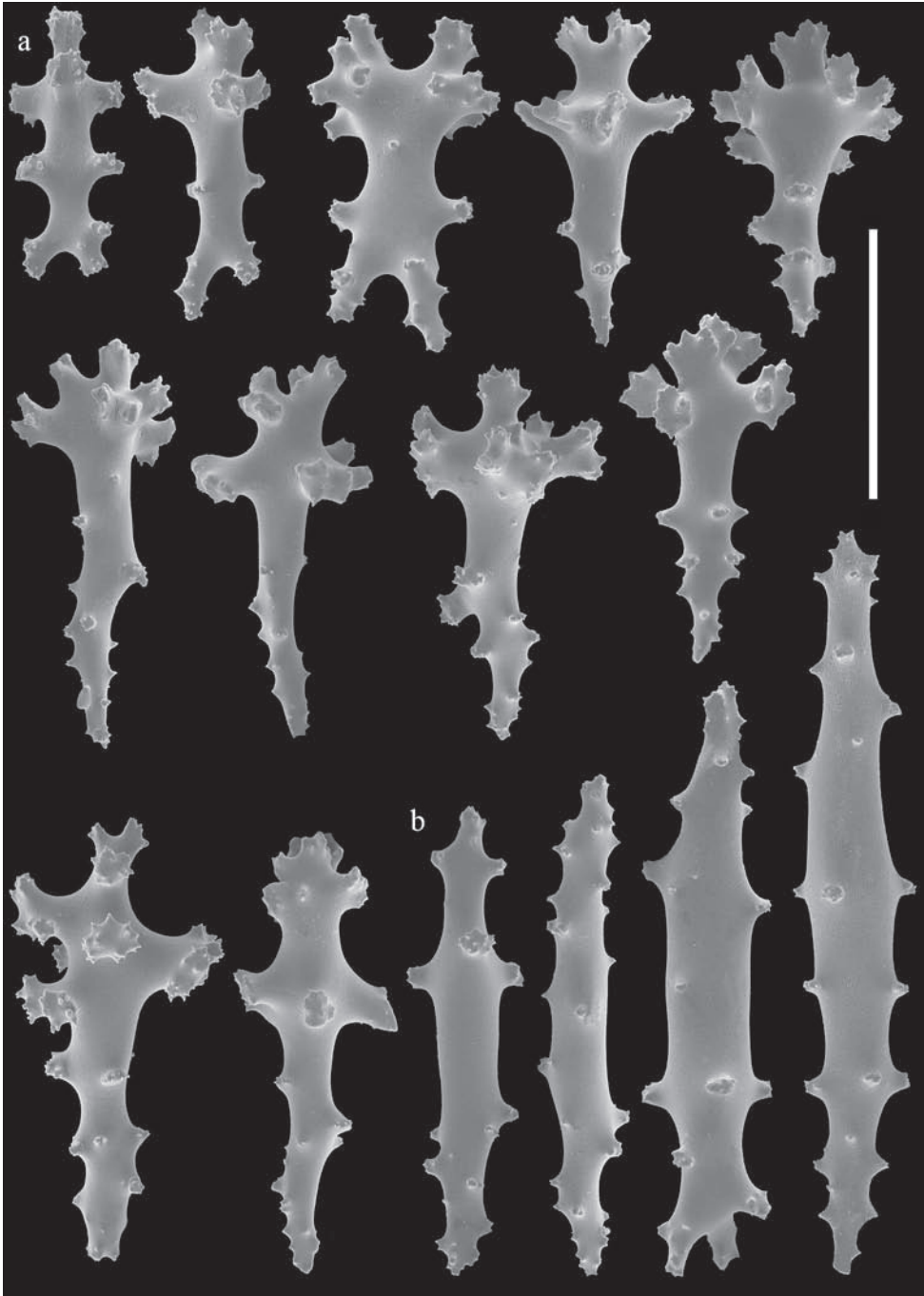


Fig. 43. *Sinularia luxuriosa* spec. nov., holotype RMNH Coel. 38742; sclerites of surface layer of the base of the colony; a, clubs, b, spindles. Scale 0.10 mm.

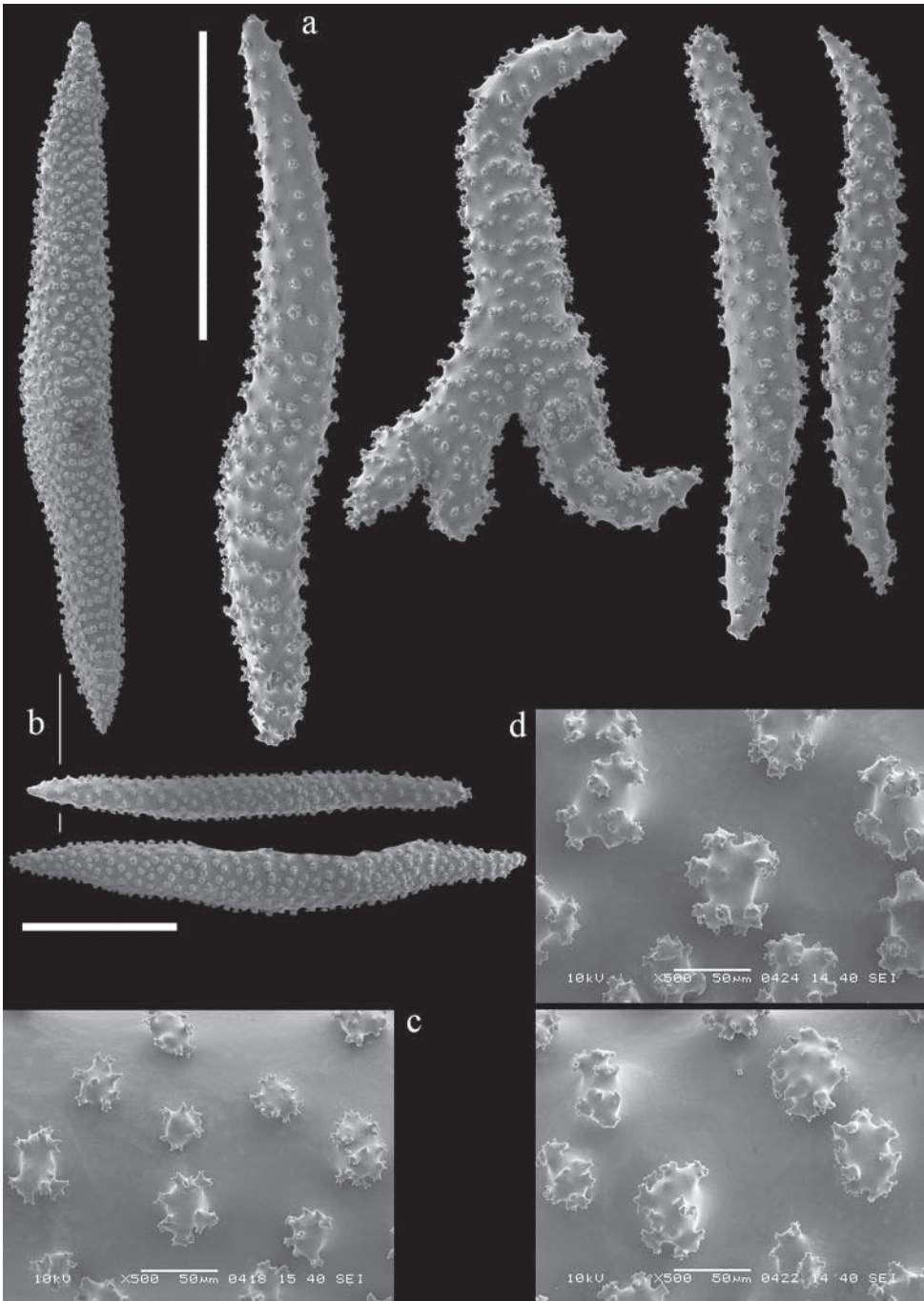


Fig. 44. *Simularia luxuriosa* spec. nov., holotype RMNH Coel. 38742; a-b, spindles of the interior of the colony; a, top of colony; b, base of colony; c-d, tubercles on spindles; c, top of colony; d, base of colony. Scales of spindles 1 mm.

Sinularia macrodactyla Kolonko, 1926
(fig. 77e)

For references see Verseveldt, 1980: 83.

Material examined.— RMNH Coel. 38743, fragment of colony and 1 microscope slide, KOR.13.

Molecular study.— The DNA from fragment RMNH Coel. 38743 was impossible to amplify, it appeared to be very degraded.

Remarks.— Undoubtedly the species is related to *S. flaccida* spec. nov., it has similarly shaped clubs and big polyp sclerites. The microscope slides of the sclerites of the type specimen Verseveldt made show slightly different sclerites. The present material has more tuberculated polyp sclerites and somewhat longer clubs in the surface layer of the lobes (up to 0.15 mm long versus up to 0.11 mm long for the type specimen). As Verseveldt's slides show some disintegrated polyp sclerites next to almost smooth polyp sclerites I assume the type specimen was kept in formalin for some time. The smaller club size could be the result of Verseveldt's rather rigid slide making procedure, often resulting in loss of the larger clubs and small spindles of the surface layer. The live picture of the present *S. macrodactyla* specimen (fig. 77e) shows an encrusting specimen, unlike the picture of the type specimen (Kolonko, 1926: pl. 3 fig. 4), which suggests an arborescent colony shape.

Sinularia pavidata Tixier-Durivault, 1970
(fig. 77g)

For references see Verseveldt, 1980: 104.

Material examined.— RMNH Coel. 38744, fragment of colony and 1 microscope slide, KOR.13

Molecular study.— Fragment RMNH Coel. 38744 had an unique sequence.

Sinularia siaesensis spec. nov.
(figs 45a-b, 46-53, 78b)

Material examined.— RMNH Coel. 38746, holotype and 1 microscope slide, KOR.07; RMNH Coel. 38747, paratype and 1 microscope slide, KOR.07.

Description.— The holotype is part of an encrusting colony, with a maximum cross-section of 5 × 9.5 cm (fig. 45a). The height of the fragment is 3 cm. The lobes are very diverse, knob-shaped, finger like, and larger ones with knob-shaped lobules; a few lobes and lobules are slightly flattened.

The surface layer of the lobes contains clubs with a central wart (figs 46a, 47a), this wart and the three tubercles below it can be foliaceous. The clubs are up to 0.20 mm long. Furthermore, many small spindles are present, up to 0.30 mm long, mostly with prominent simple tubercles (figs 46b, 47b, d). A few shuttles are also present (fig. 47c). There are no sclerites in the polyps.

The clubs of the surface layer of the base resemble those of the lobules but are shorter and wider (fig. 48a). The small spindles of this layer have complex tubercles (fig. 48b)

The interior of the lobules has unbranched spindles (fig. 49a), up to 3 mm long, with simple or complex tubercles (fig. 49c); some spindles have a short side branch. In the base of the colony similar spindles occur (fig. 49b), with the tubercles being the same as those of the spindles of the lobules (fig. 49d).

Colour.—The preserved specimen is cream.

Etymology.—The species is named after the type locality, Siaes Reef.

Molecular study.—The holotype showed an unique sequence, most similar but also an unique sequence is the one of the paratype.

Remarks.—The paratype is smaller, but has a similar colony shape (fig. 45b) and sclerites (figs 50-53) as the holotype.

S. siaesensis spec. nov. is most similar to *S. confusa* and *S. tumulosa* spec. nov. *S. confusa* differs in having clubs with less developed heads (Ofwegen 2008: figs 6, 7a). *S. tumulosa* also has less developed club heads, but differs more from *S. siaesensis* in having small multiradiate bodies in the interior of the base of the colony.

Sinularia sobolifera Verseveldt & Tursch, 1979

Sinularia sobolifera Verseveldt & Tursch, 1979: 144; Ofwegen, 1996: 208.

Sinularia larsonae Verseveldt, in Verseveldt & Alderslade, 1982: 627; Ofwegen, 1996: 208.

Material examined.—RMNH Coel. 38748, colony fragment and 1 microscope slide, KOR.06; RMNH Coel. 38749, colony fragment and 1 microscope slide, KOR.15.

Molecular study.—One of the specimens of *S. sobolifera* (RMNH Coel. 38748) showed the same DNA sequence as the holotype of *S. ultima* spec. nov. For differences between the two species see the remarks of *S. ultima*.

Remarks.—There are hardly any differences between *S. sobolifera* and *S. larsonae*. Both species have the same arborescent colony shape and similar looking sclerites. I consider these two species synonymous and therefore *S. sobolifera* is here selected as the valid name.

Sinularia sublimis spec. nov. (figs 45c, 54-57, 78d)

Material examined.—RMNH Coel. 38750, holotype and 1 microscope slide, KOR.07.

Description.—The holotype is part of an encrusting colony, with a maximum cross-section of 3.5 x 9 cm (fig. 45c). The height of the fragment is 3 cm. The lobes are finger-like, most having a few small lobules or are split at the top; a few lobes are slightly crest-like.

The polyps have eight points with poorly developed clubs, up to 0.13 mm long (fig. 54a). The tentacles have no sclerites.

The surface layer of the lobules contains clubs, up to 0.25 mm long (figs 54b, 55a). The smaller clubs have a distinct central wart, in larger clubs it becomes less obvious.

Additionally, small spindles are present, up to 0.30 mm long, which are very diverse in shape (fig. 55b). Several shuttles, immature sclerites, were also present (fig. 54c).

The clubs of the surface layer of the base of the colony resemble those of the lobes, but are slightly wider and shorter; up to 0.20 mm long (fig. 56a). The small spindles of the surface layer of the base are slightly shorter than those of the top and many of them have the middle part less tuberculate than the two ends (fig. 56b).

The interior of the lobules has spindles, up to 2.5 mm long (fig. 57a), some have a few side branches, and all with rather small tubercles (fig. 57b). In the interior of the base these spindles are up to 3 mm long (fig. 57c); most have complex tubercles (fig. 57d).

Colour. — The preserved holotype is brownish.

Etymology. — The Latin “*sublimis*”, high, raised, lofty; elevated, sublime, refers to the height of the lobes in comparison with the related species *S. humilis* spec. nov. and *S. ultima* spec. nov.

Molecular study. — The holotype of *S. sublimis* spec. nov showed the same DNA sequence as that of *S. humilis* spec. nov. and as a specimen (NTM C13790) identified by Dr Alderslade (CSIRO) as *S. numerosa*. For a discussion about these three species see *S. ultima* spec. nov.

Remarks. — The small spindles with middle part less tuberculate seem to be characteristic for this species, although these spindles are not recognized easily in the top of the colony.

Sinularia tumulosa spec. nov.
(figs 45d, 58-61, 78e)

Material examined. — RMNH Coel. 38751, holotype and 1 microscope slide, KOR.14.

Description. — The holotype is part of an encrusting colony, with a maximum cross-section of 3 x 6.5 cm (fig. 45d). The height of the fragment is 3 cm. The lobes are knob-shaped, some larger ones having small knob-shaped lobules which form hillock-like rosettes; a few lobes are slightly crest-like.

The surface layer of the lobes contains clubs with a central wart (figs 58, 59b), this wart and the three tubercles below it can be foliaceous. The clubs are up to 0.20 mm long. Furthermore, many small spindles are present, up to 0.30 mm long, with simple tubercles (fig. 59c). A few sclerites intermediate between clubs and spindles are also present (fig. 59a). There are no sclerites in the polyps.

The clubs and spindles of the surface layer of the stalk resemble those of the lobules but are shorter and wider (fig. 60a-b).

The interior of the lobules has branched and unbranched spindles (fig. 61a), up to 2.5 mm long, with simple or complex tubercles (fig. 61b). In the base of the colony similar spindles occur (fig. 61c), but with slightly stronger tubercles (fig. 61f). Additionally, small multiradiate bodies are present, up to 0.50 mm long (fig. 61d-e).

Colour. — The preserved specimen is white.

Etymology. — The Latin “*tumulosus*”, full of mounds, hilly, refers to the colony shape.

Molecular study. — The holotype showed a unique sequence.

Remarks. — The only other *Sinularia* species with similar clubs and small multiradiate bodies in the interior of the stalk is *S. peculiaris*. The latter species differs in having overall shorter clubs, with wider handles, and a colony shape with more crowded lobes (fig. 77h).

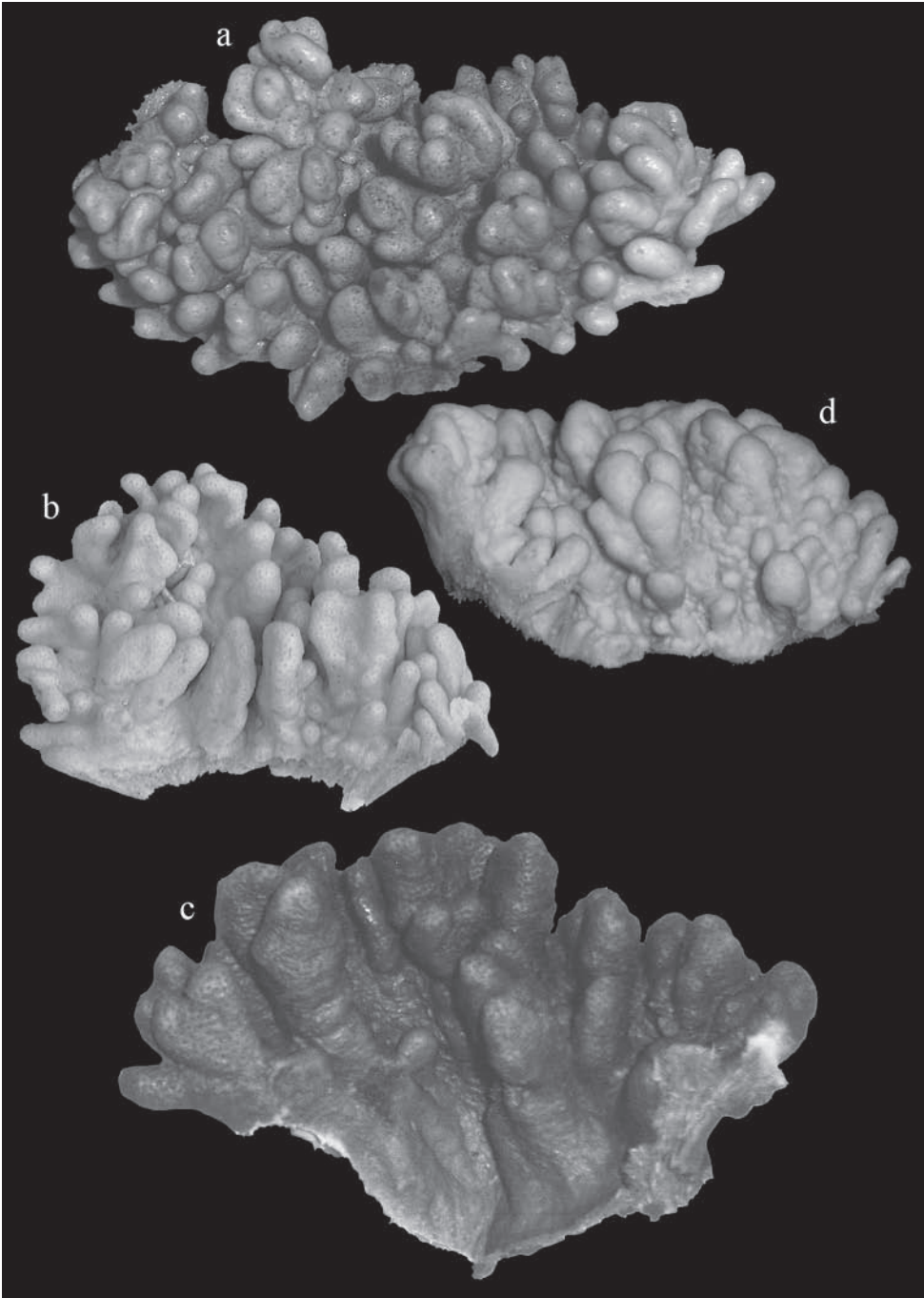


Fig. 45a. *Sinularia siaesensis* spec. nov., holotype RMNH Coel. 38746, b, paratype RMNH Coel. 38747; c, *S. sublimis* spec. nov., holotype RMNH Coel. 38750; d, *S. tumulosa* spec. nov., holotype RMNH Coel. 38751. All natural size and views from above.

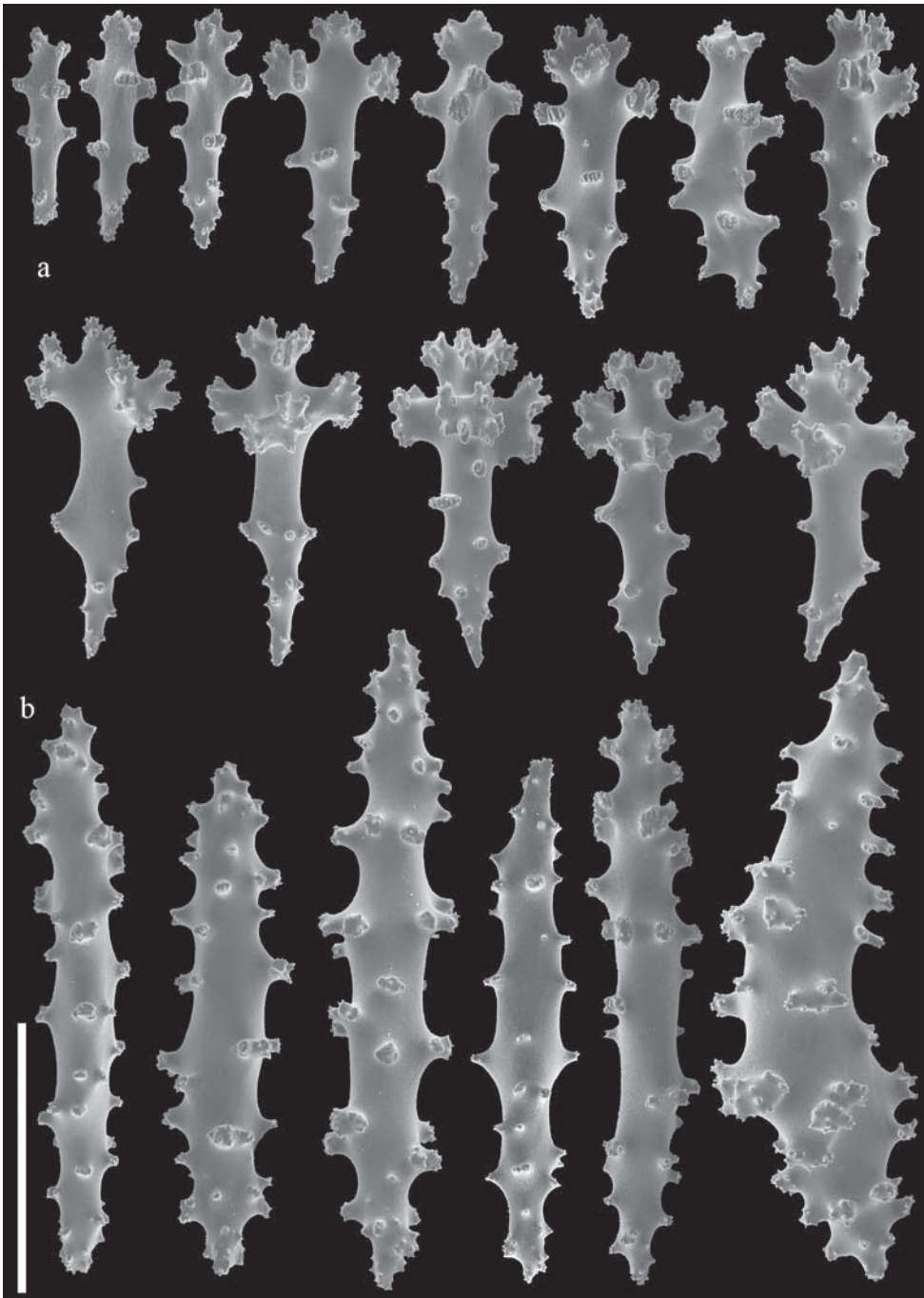


Fig. 46. *Simularia siaesensis* spec. nov., holotype RMNH Coel. 38746; sclerites of surface layer of the top of the colony; a, clubs, b, spindles. Scale 0.10 mm.

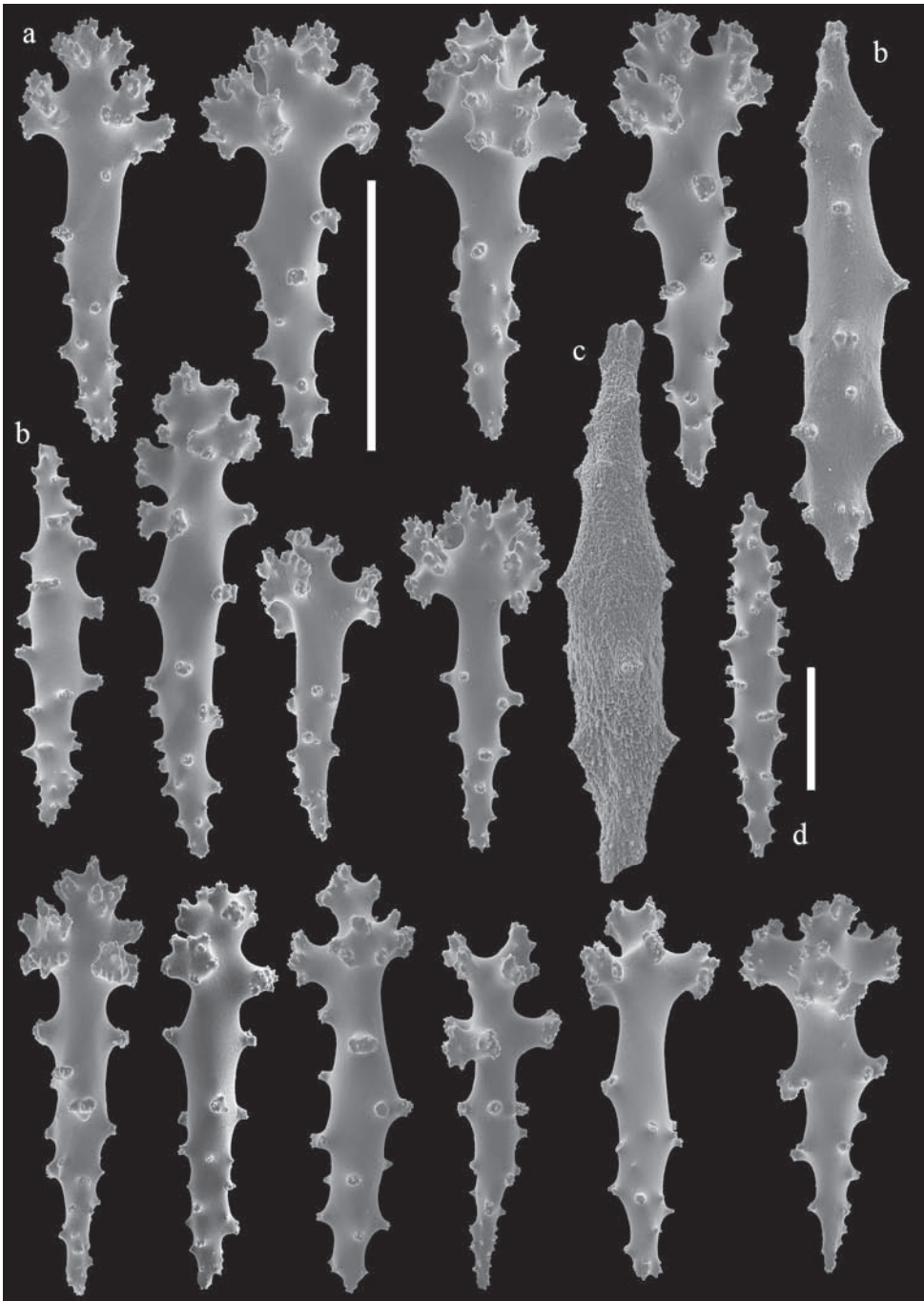


Fig. 47. *Sinularia siaesensis* spec. nov., holotype RMNH Coel. 38746; sclerites of surface layer of the top of the colony; a, clubs, b, d, spindles; c, shuttle. Scales 0.10 mm, that at d only applies to d.

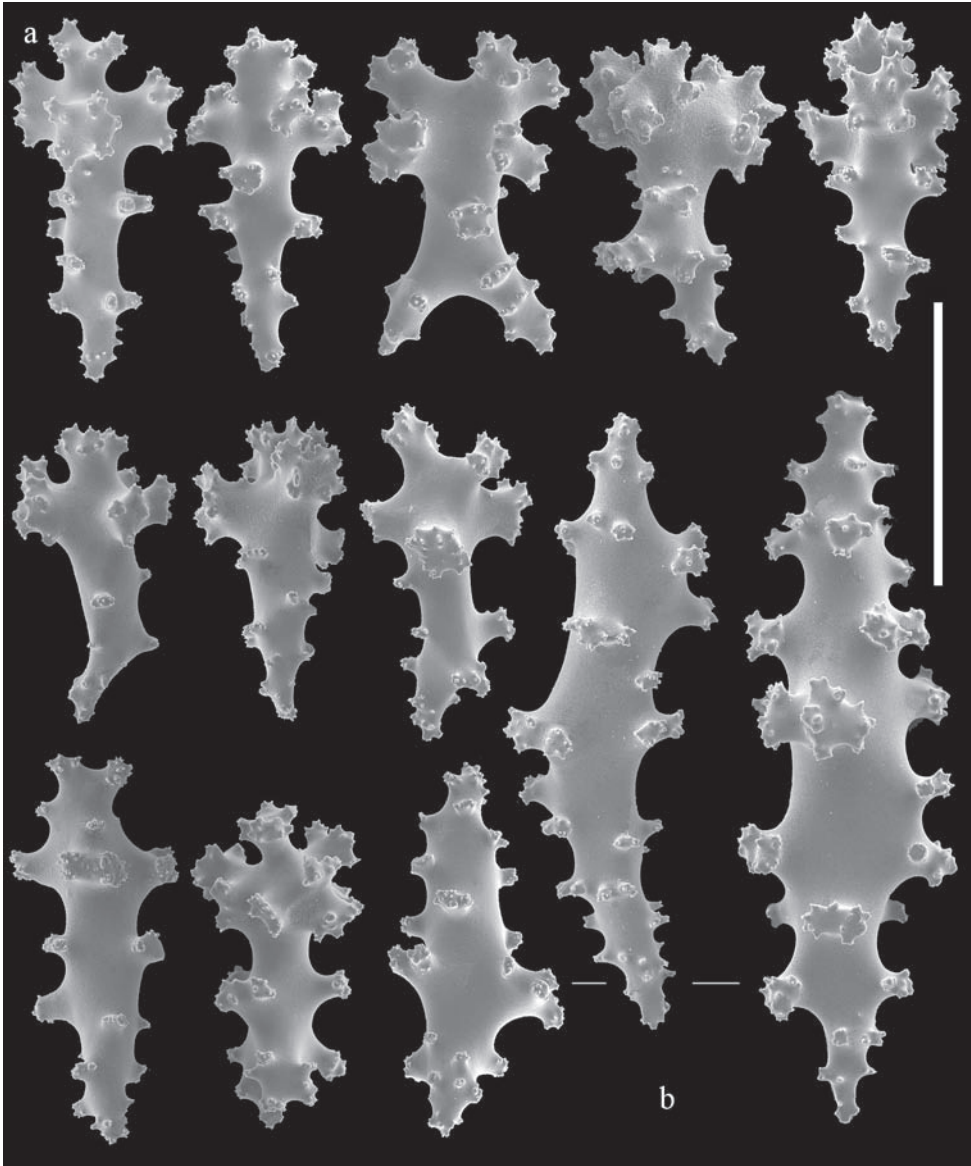


Fig. 48. *Sinularia siaesensis* spec. nov., holotype RMNH Coel. 38746; sclerites of surface layer of the base of the colony; a, clubs, b, spindles. Scale 0.10 mm.

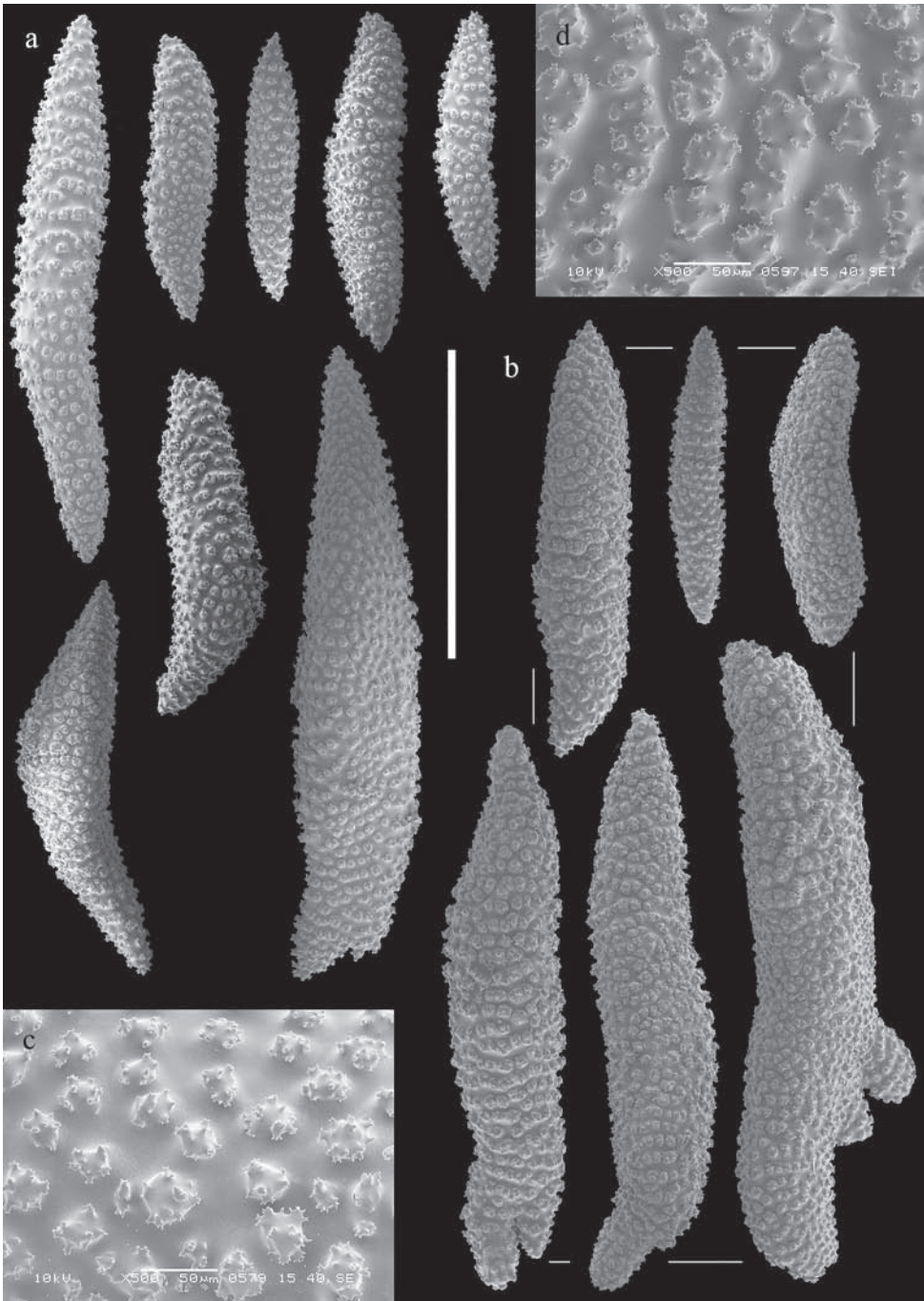


Fig. 49. *Sinularia siaesensis* spec. nov., holotype RMNH Coel. 38746; spindles of the interior of the colony; a, top of colony; b, base of colony; c-d, tubercles on spindles; c, top of colony; d, base of colony. Scales of spindles 1 mm.

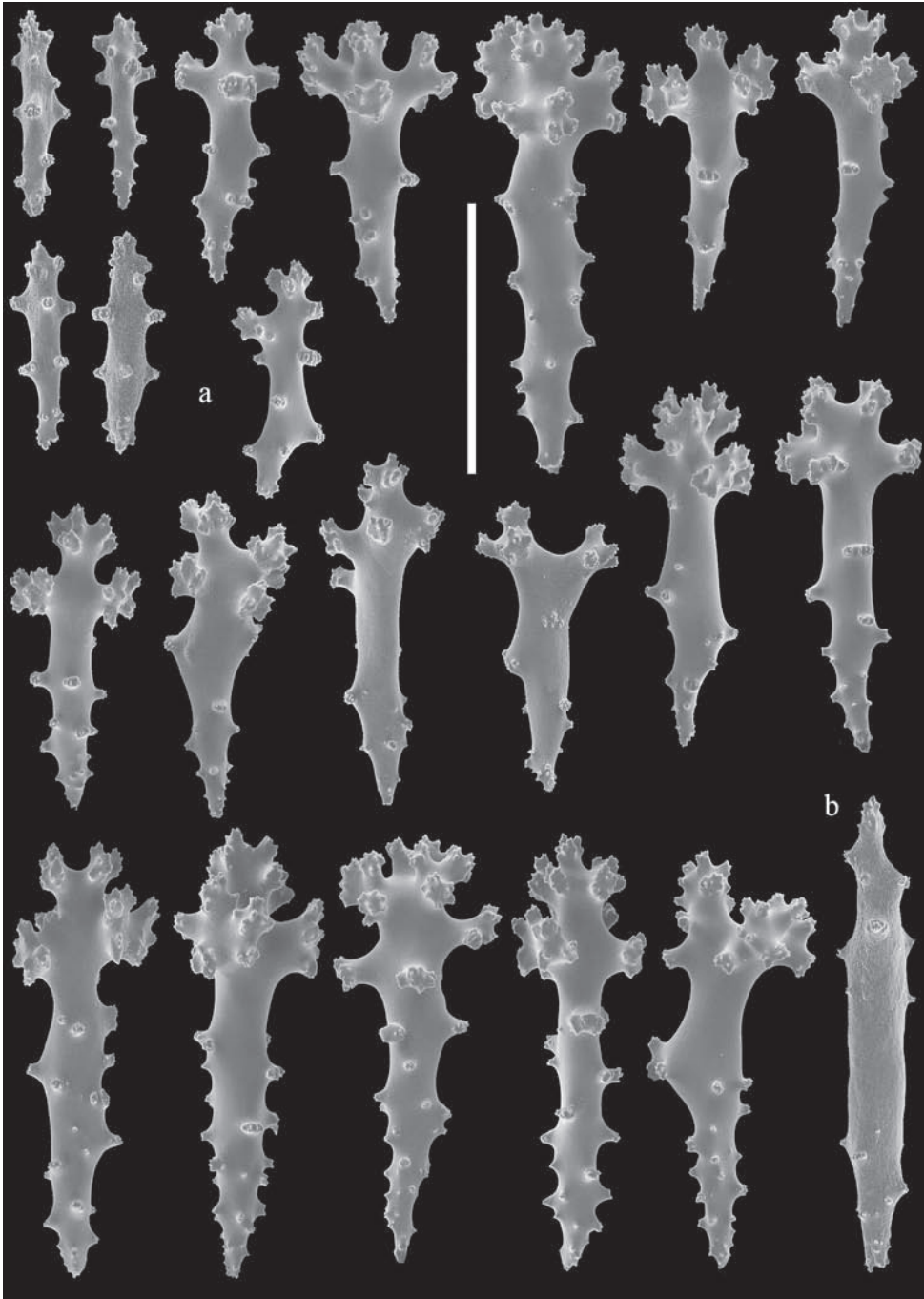


Fig. 50. *Simularia siaesensis* spec. nov., paratype RMNH Coel. 38747; sclerites of surface layer of the top of the colony; a, clubs, b, shuttle. Scale 0.10 mm.

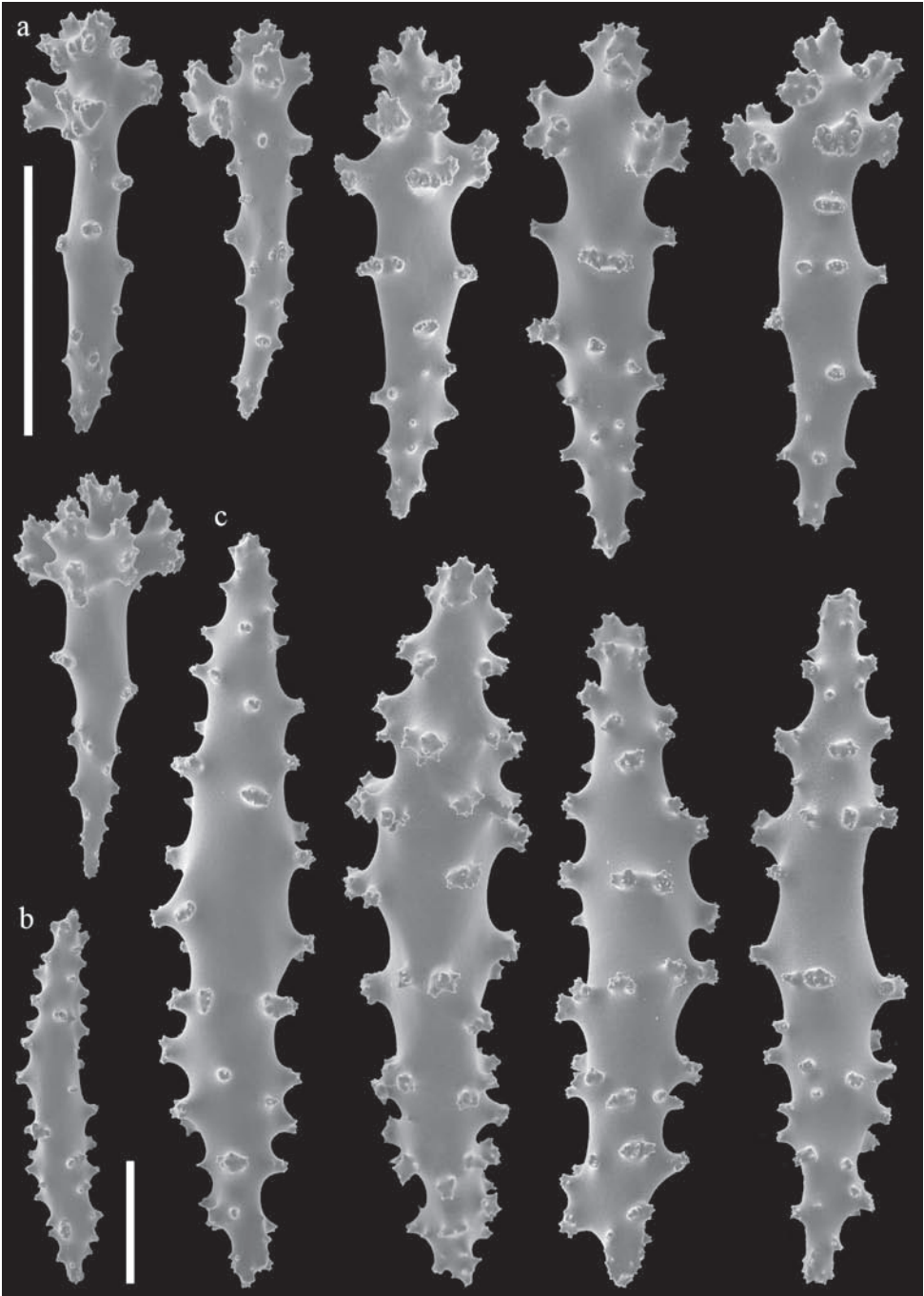


Fig. 51. *Sinularia siaesensis* spec. nov., paratype RMNH Coel. 38747; sclerites of surface layer of the top of the colony; a, clubs, b-c, spindles. Scales 0.10 mm, that at b only applies to b.

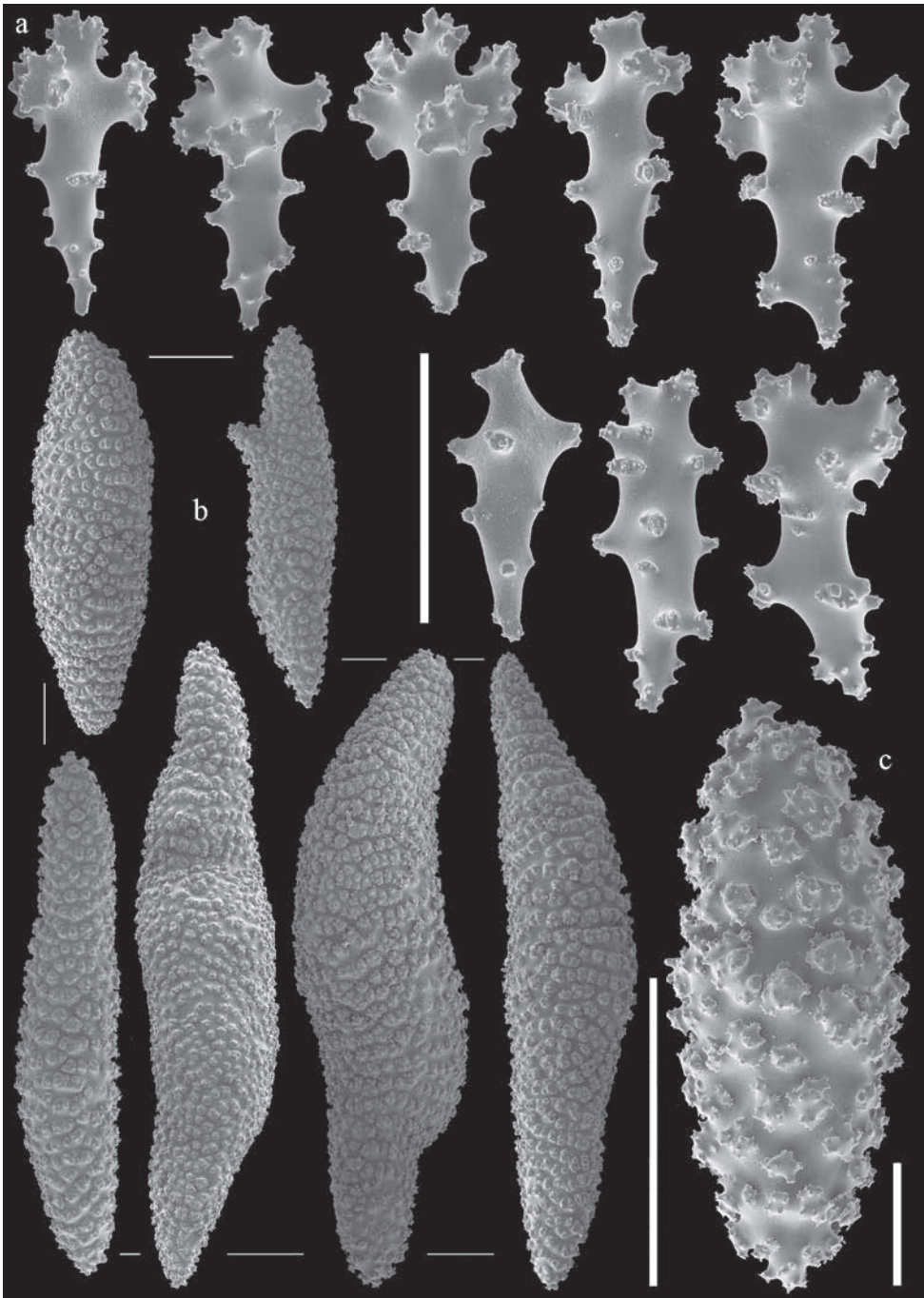


Fig. 52. *Simularia siaesensis* spec. nov., paratype RMNH Coel. 38747; sclerites of the base of the colony; a, clubs of surface layer; b-c, spindles of interior. Scale at a, c is 0.10 mm, at b 1 mm.

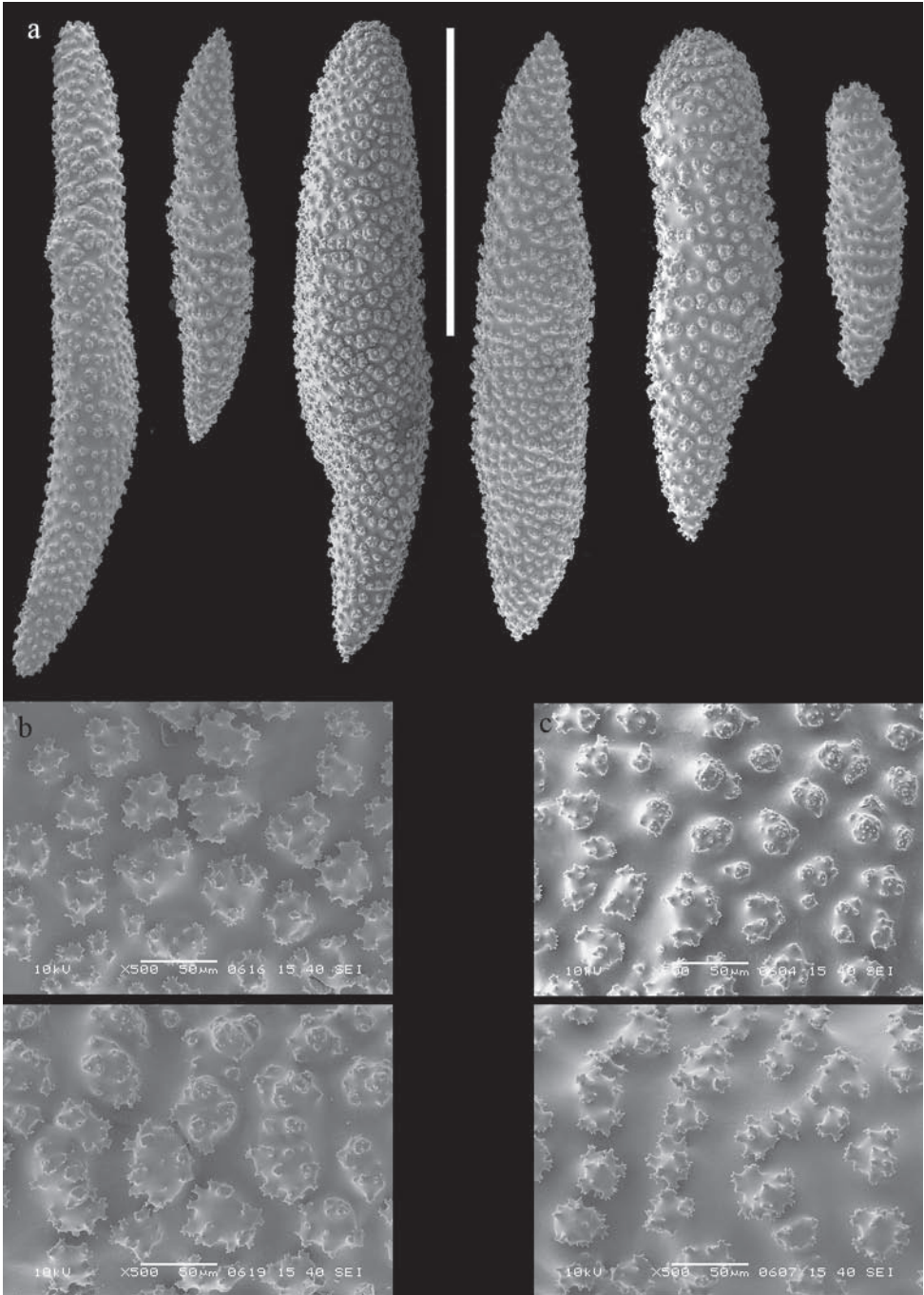


Fig. 53. *Sinularia siaesensis* spec. nov., paratype RMNH Coel. 38747; a, spindles of the interior of the top of colony; b-c, tubercles on spindles; b, base of colony; c, top of colony. Scale of spindles 1 mm.

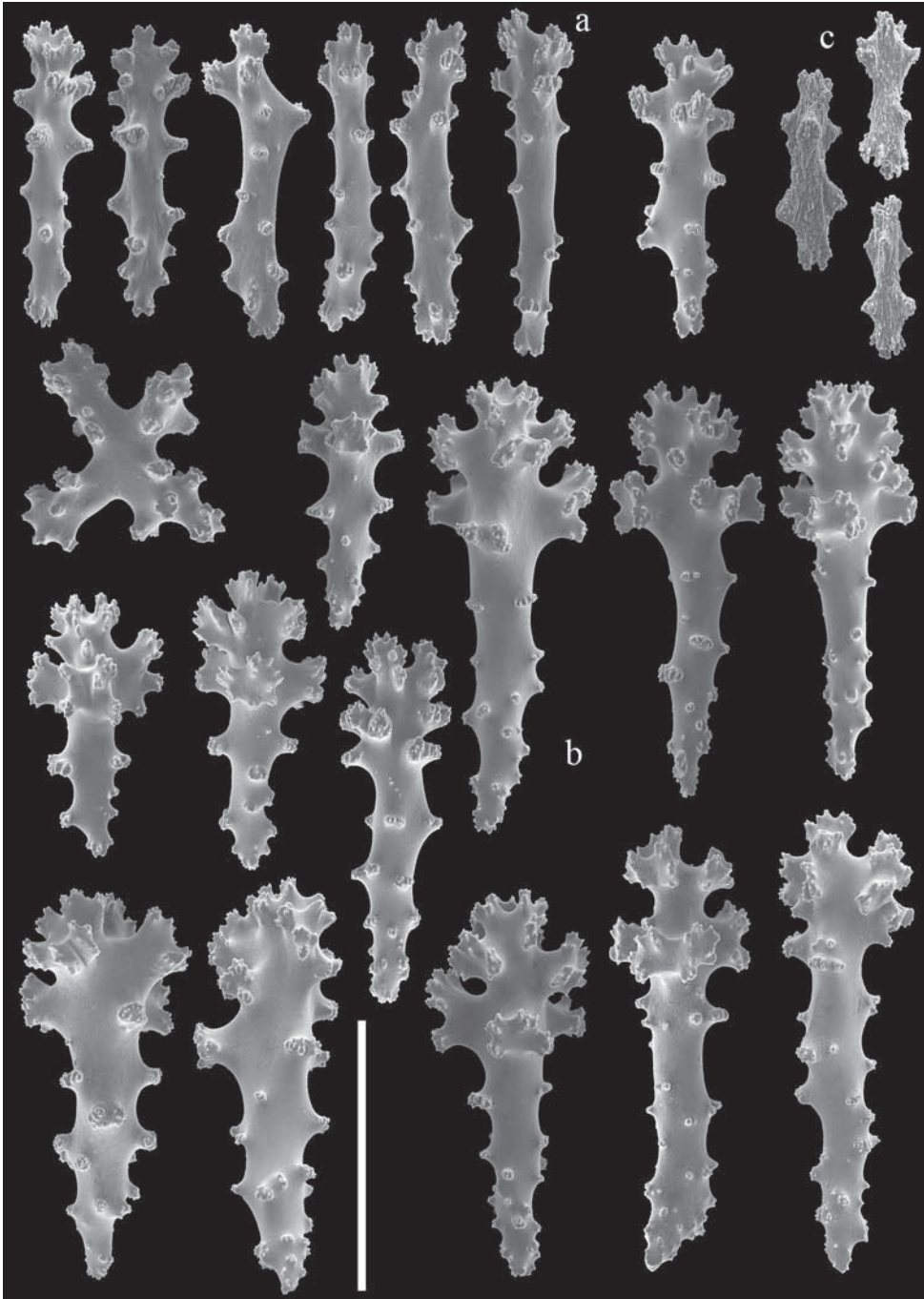


Fig. 54. *Sinularia sublimis* spec. nov., holotype RMNH Coel. 38750; a, point clubs; b, clubs of surface layer of the top of the colony; c, shuttles of surface layer of the top of the colony. Scale 0.10 mm.



Fig. 55. *Sinularia sublimis* spec. nov., holotype RMNH Coel. 38750; sclerites of surface layer of the top of the colony; a, clubs, b, spindles. Scale 0.10 mm.

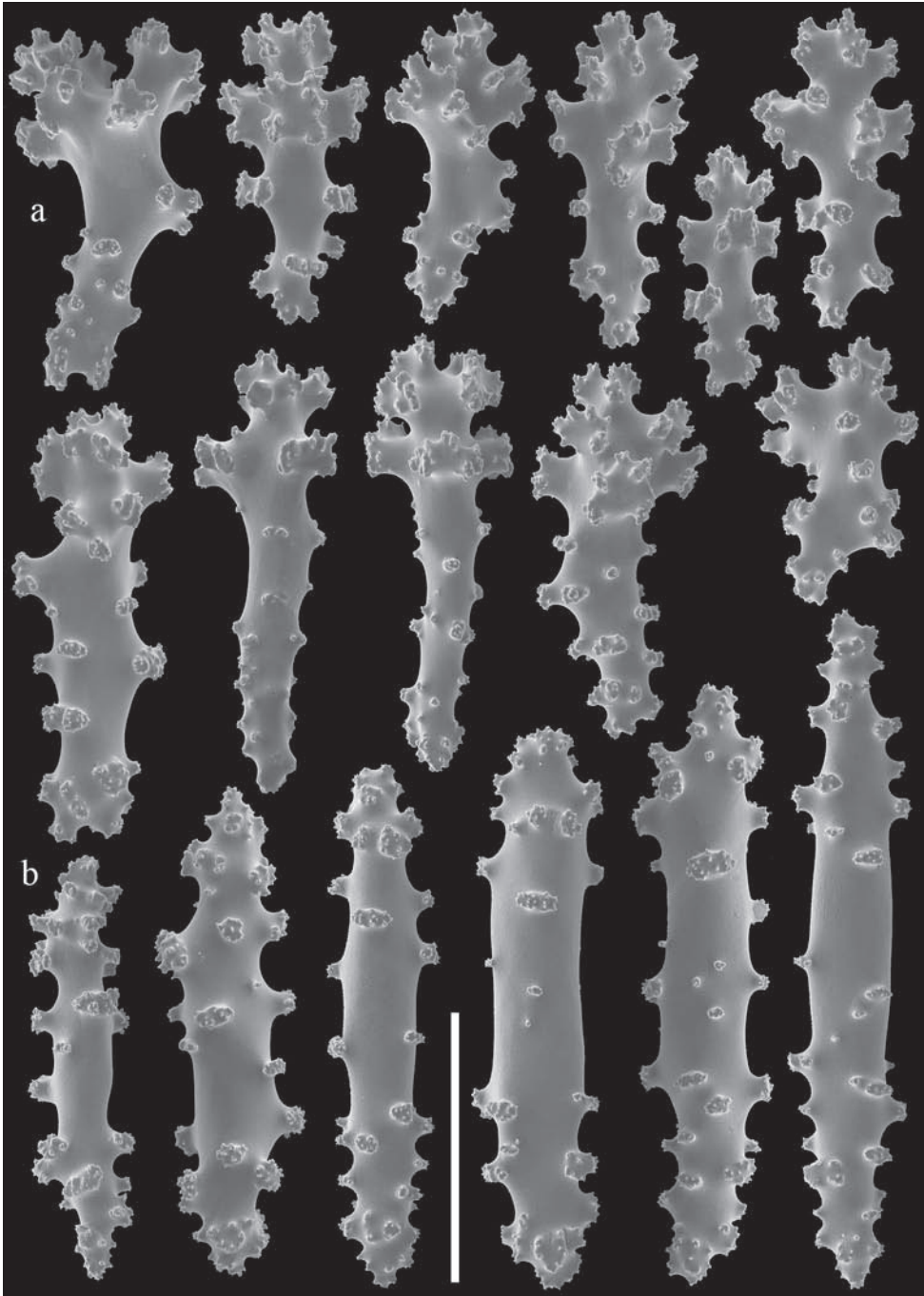


Fig. 56. *Simularia sublimis* spec. nov., holotype RMNH Coel. 38750; sclerites of the base of the colony; a, clubs; b, spindles. Scale 0.10 mm.



Fig. 57. *Simularia sublimis* spec. nov., holotype RMNH Coel. 38750; a, c, spindles of the interior of the colony; a, top of colony; c, base of colony; b, d, tubercles on spindles; b, top of colony; d, base of colony. Scale of spindles 1 mm.

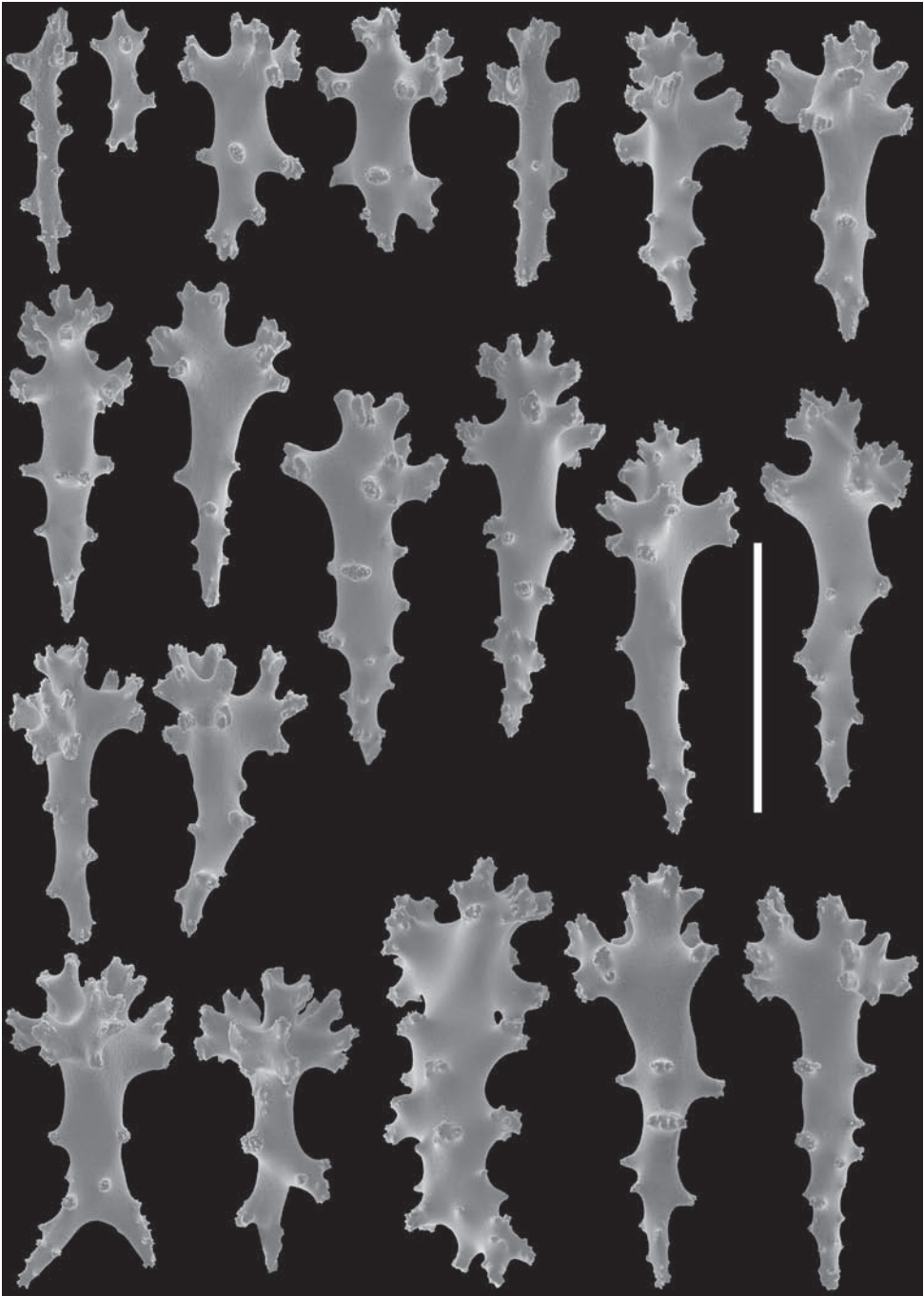


Fig. 58. *Simularia tumulosa* spec. nov., holotype RMNH Coel. 38751; clubs of surface layer of the top of the colony. Scale 0.10 mm.

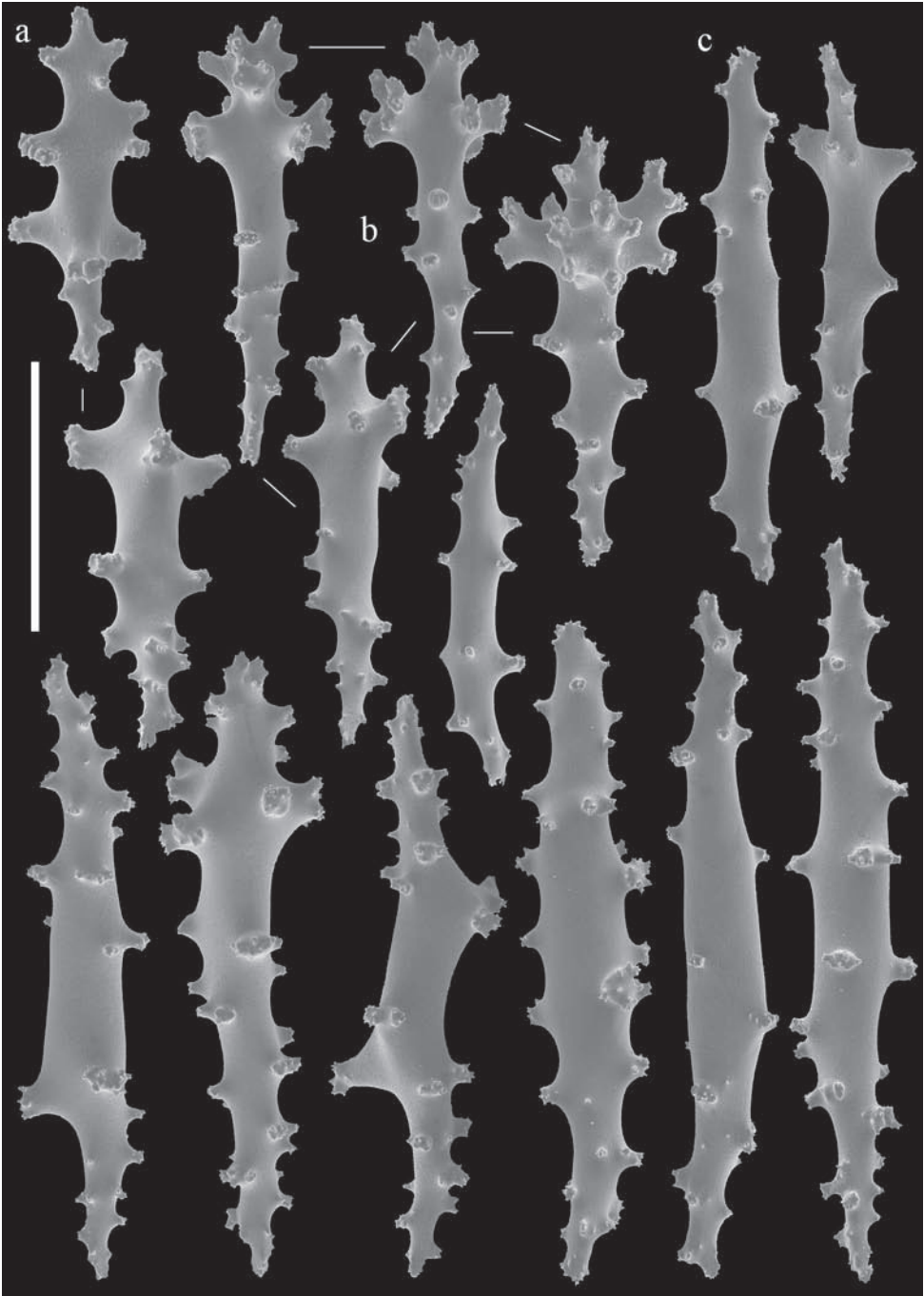


Fig. 59. *Sinularia tumulosa* spec. nov., holotype RMNH Coel. 38751; sclerites of surface layer of the top of the colony; a, intermediate forms; b, clubs; c, spindles. Scale 0.10 mm.

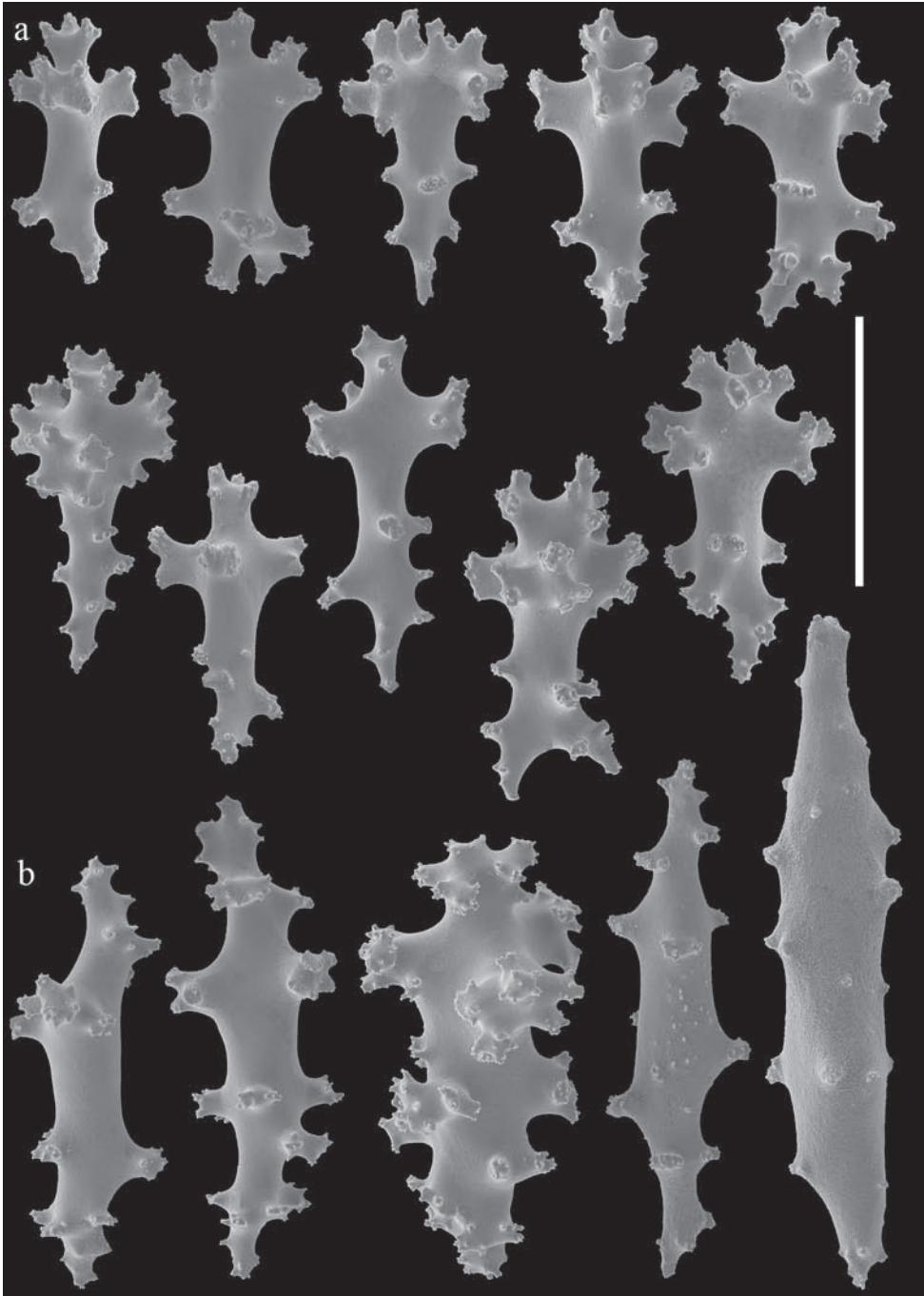


Fig. 60. *Sinularia tumulosa* spec. nov., holotype RMNH Coel. 38751; sclerites of surface layer of the base of the colony; a, clubs; b, spindles. Scale 0.10 mm.

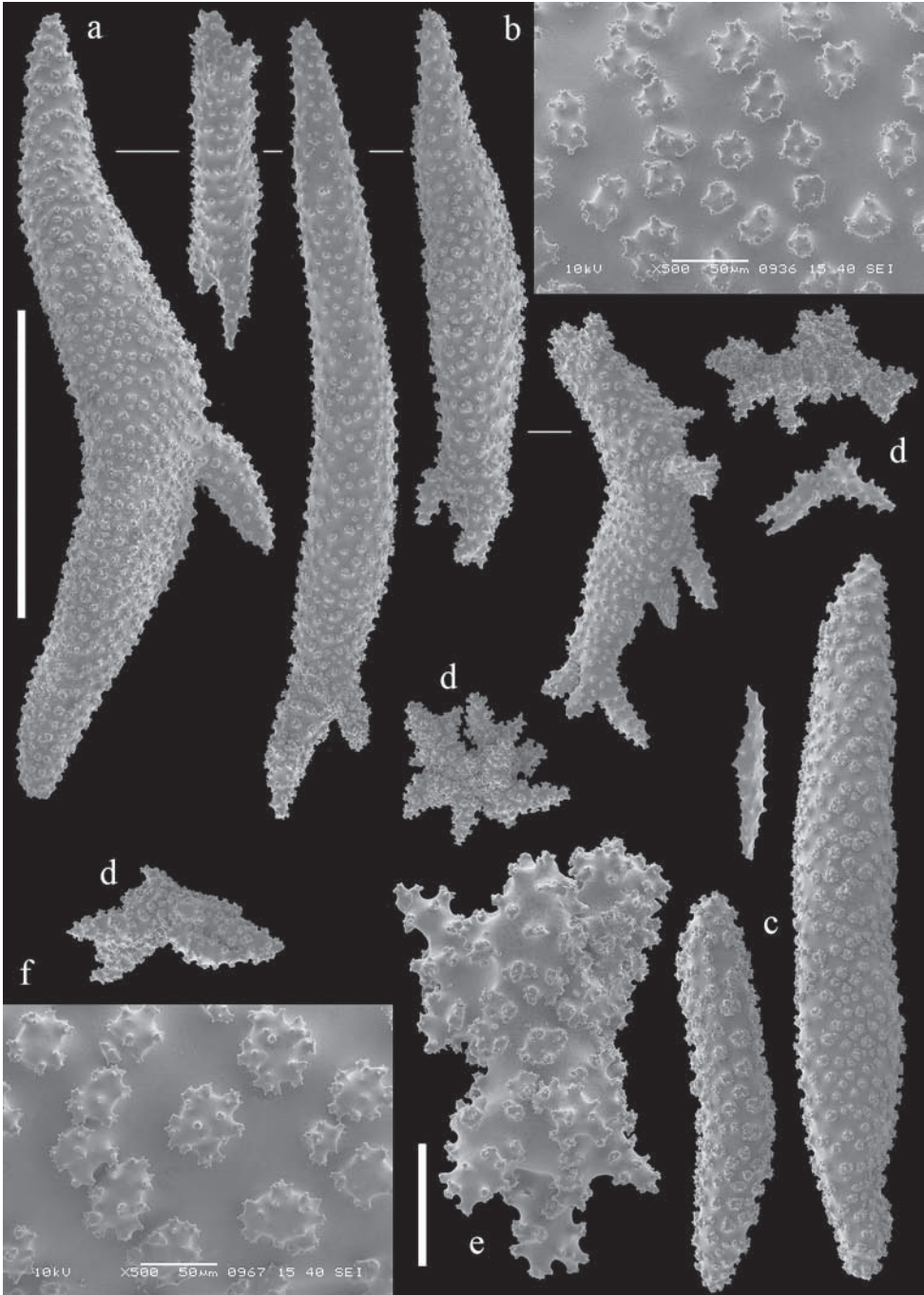


Fig. 61. *Sinularia tumulosa* spec. nov., holotype RMNH Coel. 38751; spindles of the interior of the colony; a, top of colony; c-e, base of colony; b, f, tubercles on spindles; b, top of colony; f, base of colony. Scale at a 1 mm, also applies to c-d; scale at e 0.10 mm, only applies to e.

Sinularia ultima spec. nov.
(figs 62a, 63-66, 78f)

Material examined. — RMNH Coel. 38752, holotype and 1 microscope slide, KOR.13.

Description. — The holotype is an encrusting colony, with a maximum cross-section of 5 x 8 cm (fig. 62a). The height of the colony is 7 cm, the lower 1.5 cm without polyps. A few lobes are finger like, but most primary lobes branch once or twice; the lobules being knob-shaped to finger like.

The polyps have eight points with poorly developed clubs, up to 0.15 mm long (fig. 63a). The tentacles have many small, flattened rods, about 0.05 mm long (fig. 63b).

The surface layer of the lobules contains clubs, up to 0.25 mm long (figs 63c, 64a). The smaller clubs have a distinct central wart, in larger clubs it becomes less obvious. Additionally, small spindles are present, up to 0.30 mm long, with simple tubercles (fig. 64b). Several shuttles, immature sclerites, were also present (fig. 63d).

The clubs and spindles of the surface layer of the base of the colony resemble those of the lobes, but are slightly wider and shorter (fig. 65a-b).

The interior of the lobules has spindles, up to 2.5 mm long (fig. 66a), some have a few side branches, many are bent, and all have rather small tubercles (fig. 66b). In the interior of the base these spindles are up to 3 mm long (fig. 66c-d); with more complex tubercles (fig. 66e).

Colour. — The preserved holotype is partly brown, partly cream.

Etymology. — The Latin “ultimus”, most distant, farthest, extreme, refers to the higher lobes in comparison with the related species *S. humilis* spec. nov. and *S. sublimis* spec. nov.

Molecular study. — The holotype of *S. ultima* spec. nov. showed the same DNA sequence as a specimen (RMNH Coel. 38748) identified as *S. sobolifera*. The latter species is easily differentiated from *S. ultima* in having an arborescent colony shape (compare fig. 78c with fig. 78f) and clubs and spindles of the surface layer of the top of the colony with very weak ornamentation.

Remarks. — The sclerites of *S. ultima* spec. nov. are similar to those of *S. numerosa*, *S. humilis* spec. nov. and *S. sublimis* spec. nov. All four species have poorly developed clubs in the polyps and clubs with a distinct central wart in the surface layer of the colonies. Moreover, all four species have an encrusting colony shape.

S. numerosa differs from the other three species in having a colony shape with mostly flattened crest-shaped lobes, though some finger-like lobes also can be present (Verseveldt, 1980: pl. 33 fig. 2). The brown specimen described by Whitelegge (1897) as *S. conferta* is here considered to belong to *S. numerosa* (Verseveldt, 1980: pl. 7 fig 1; not the grey specimen, pl. 7 fig. 2). Regarding sclerites, *S. numerosa* mostly differs in having many small spindles in the surface layer, 0.25-0.30 mm long, many of them with rather blunt ends. In this aspect *S. sublimis* is most like *S. numerosa*, in having similar small spindles in the surface layer of the base of the colony (fig. 56b); *S. sublimis* differs in having larger clubs, (up to 0.20 mm long in *S. numerosa* versus up to 0.25 mm in *S. sublimis*).

S. humilis differs from all three other species in having much smaller lobes, a character best seen in live specimens (fig. 77c); and in having the longest clubs in which the central wart is still distinctly visible (fig. 39a).

S. sublimis and *S. ultima* are very similar to each other and without having both species together it will not be easy to distinguish them from each other. *S. sublimis* differs in having clubs with more developed heads, small spindles with middle part less tuberculate, and smaller point clubs.

Verseveldt (1980) synonymized *S. crispa* with *S. numerosa*. However, the drawings of the sclerites of *S. crispa* given by Verseveldt (1980: fig. 50) are quite different from those of *S. numerosa* (Verseveldt, 1980: fig. 49). Moreover, a specimen from Gambier island identified by Verseveldt as *S. numerosa* (1977: 28, fig. 21) also shows sclerites rather different from the type of that species. According to me, Verseveldt allowed too much variation in sclerites of *S. numerosa*. My own identifications of *S. numerosa* from the Laccadives (Ofwegen & Vennam, 1991: 144) and from Ambon (Manuputty & Ofwegen, 2007: 192) need verification as those identifications also allowed a lot of variation in the sclerites of *S. numerosa*.

Sinularia uniformis spec. nov.
(figs 62b, 67-70, 78g)

Material examined.— RMNH Coel. 38753, holotype and 2 microscope slides, KOR.09.

Description.— The holotype is part of an encrusting colony, with a maximum cross-section of 9 × 10 cm (fig. 62b). The height of the colony is 6 cm; the colony fragment is laterally compressed. The lobes are undivided, knob shaped to finger-like, some are laterally flattened. The live colony shape is flat with knob shaped lobes (fig. 78g).

The surface layer of the lobules contains clubs with a central wart, 0.07-0.20 mm long (figs 67, 68a); in most clubs the central wart is rather simple. Additionally, a few small spindles are present, up to 0.30 mm long, with prominent simple tubercles (fig. 68b-c). Sclerites intermediate between small spindles and clubs are common (fig. 67, third row, first sclerite). There are no sclerites in the polyps.

The clubs and spindles of the surface layer of the base of the colony resemble those of the lobes, but are wider and shorter (fig. 69a-b).

The interior of the lobes has spindles, up to 2.5 mm long (fig. 70a), most have simple tubercles (fig. 70c). Additionally, several smaller, almost smooth spindles are present (fig. 70b). The interior of the base has similarly sized spindles as those of the top of the lobes (fig. 70d), but with more complex tubercles (fig. 68d).

Colour.— The preserved holotype is white.

Etymology.— The Latin “uniformis”, having one form, simple, refers to the very uniformly shaped clubs of the surface layer.

Molecular study.— The holotype of *S. uniformis* had the same sequence as the holotype of *S. verruca* spec. nov. For a discussion of the differences see *S. verruca* below.

Remarks.— The sclerites and preserved colony shape of *S. uniformis* are also somewhat similar to those of *S. acetabulata*, but the latter species has many clubs with almost smooth handles, not present at all in *S. uniformis*.

Sinularia verruca spec. nov.
(figs 62c, 71-74, 78h)

Material examined.— RMNH Coel. 38754, holotype and 1 microscope slide, KOR.07.

Description.— The holotype is part of an encrusting colony, with a maximum cross-section of 3.5 × 6.5 cm (fig. 62c). The height of the colony is 3 cm. A few primary lobes are subdivided with knob-shaped lobules, but most are undivided, finger-like, knob shaped, or flattened forming low ridges.

The surface layer of the lobules contains warty clubs, 0.05-0.20 mm long (figs 71, 72c). The smaller clubs have a distinct central wart, in larger clubs it becomes less obvious. Additionally, small spindles are present, up to 0.30 mm long, with prominent simple tubercles (fig. 72b). Sclerites intermediate between small spindles and clubs are also common (fig. 72a). There are no sclerites in the polyps.

The clubs and spindles of the surface layer of the base of the colony resemble those of the lobes, but are wider and shorter (fig. 73a-b).

The interior of the lobules has spindles, up to 2.5 mm long (fig. 74f), some have a few side branches, most have rather complex tubercles (fig. 74a). In the interior of the base these spindles are up to 2 mm long (fig. 74c-e); also with rather complex tubercles (fig. 74b).

Colour.— The preserved holotype is white.

Etymology.— The Latin “verruca”, a wart, refers to the wart clubs of the surface layer.

Molecular study.— In the molecular study the holotype of *S. verruca* spec. nov. had the same sequence as the holotype of *S. uniformis* spec. nov.

Remarks.— The live colony shape of *S. verruca* spec. nov. and *S. uniformis* spec. nov. is also rather similar (fig. 78g-h). However, the two species have completely different clubs. The very warty clubs of *S. verruca* are very distinctive in the genus *Sinularia*, only those of *S. macrodactyla*, are somewhat similar, but that species has collaret and points arrangement in the polyps. *S. deformis* has clubs in the base of the colony which resemble those of *S. verruca* spec. nov. However, *S. deformis* has no warty clubs in the top of the colony.

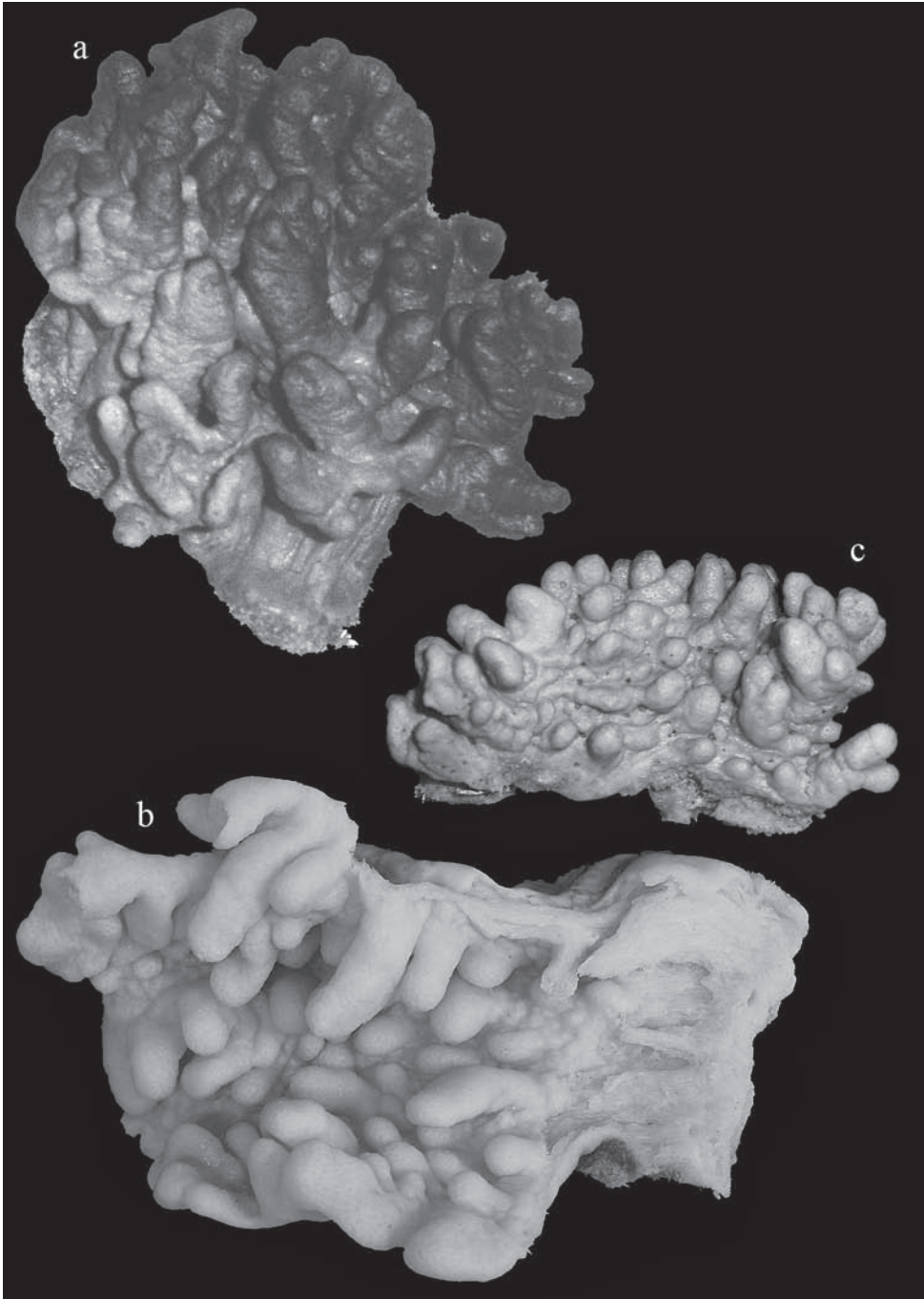


Fig. 62a. *Sinularia ultima* spec. nov., holotype RMNH Coel. 38752; b, *S. uniformis* spec. nov., holotype RMNH Coel. 38753; c, *S. verruca* spec. nov., holotype RMNH Coel. 38754. All natural size; a, lateral view; b-c, views from above.



Fig. 63. *Simularia ultima* spec. nov., holotype RMNH Coel. 38752; a, point clubs; b, tentacle rods; c, clubs of surface layer of the top of the colony; d, shuttles of surface layer of the top of the colony. Scale at c 0.10 mm; at b 0.05 mm, only applies to b.



Fig. 64. *Sinularia ultima* spec. nov., holotype RMNH Coel. 38752; sclerites of surface layer of the top of the colony; a, clubs; b, spindles. Scale 0.10 mm.

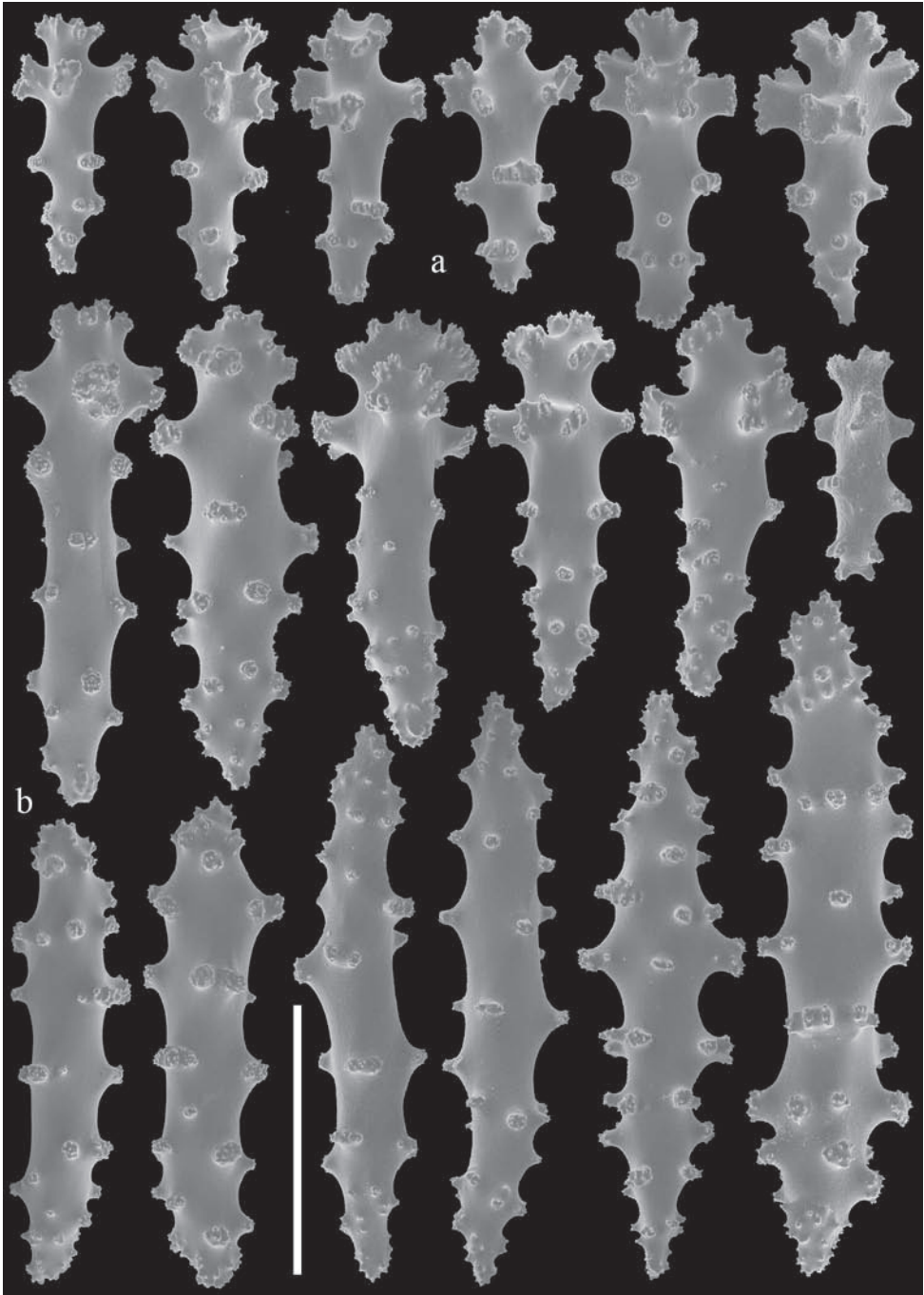


Fig. 65. *Simularia ultima* spec. nov., holotype RMNH Coel. 38752; sclerites of surface layer of the base of the colony; a, clubs; b, spindles. Scale 0.10 mm.



Fig. 66. *Sinularia ultima* spec. nov., holotype RMNH Coel. 38752; spindles of the interior of the colony; a, top of colony; c-d, base of colony; b, e, tubercles on spindles; b, top of colony; e, base of colony. Scales of spindles 1 mm, that at c only applies to c.

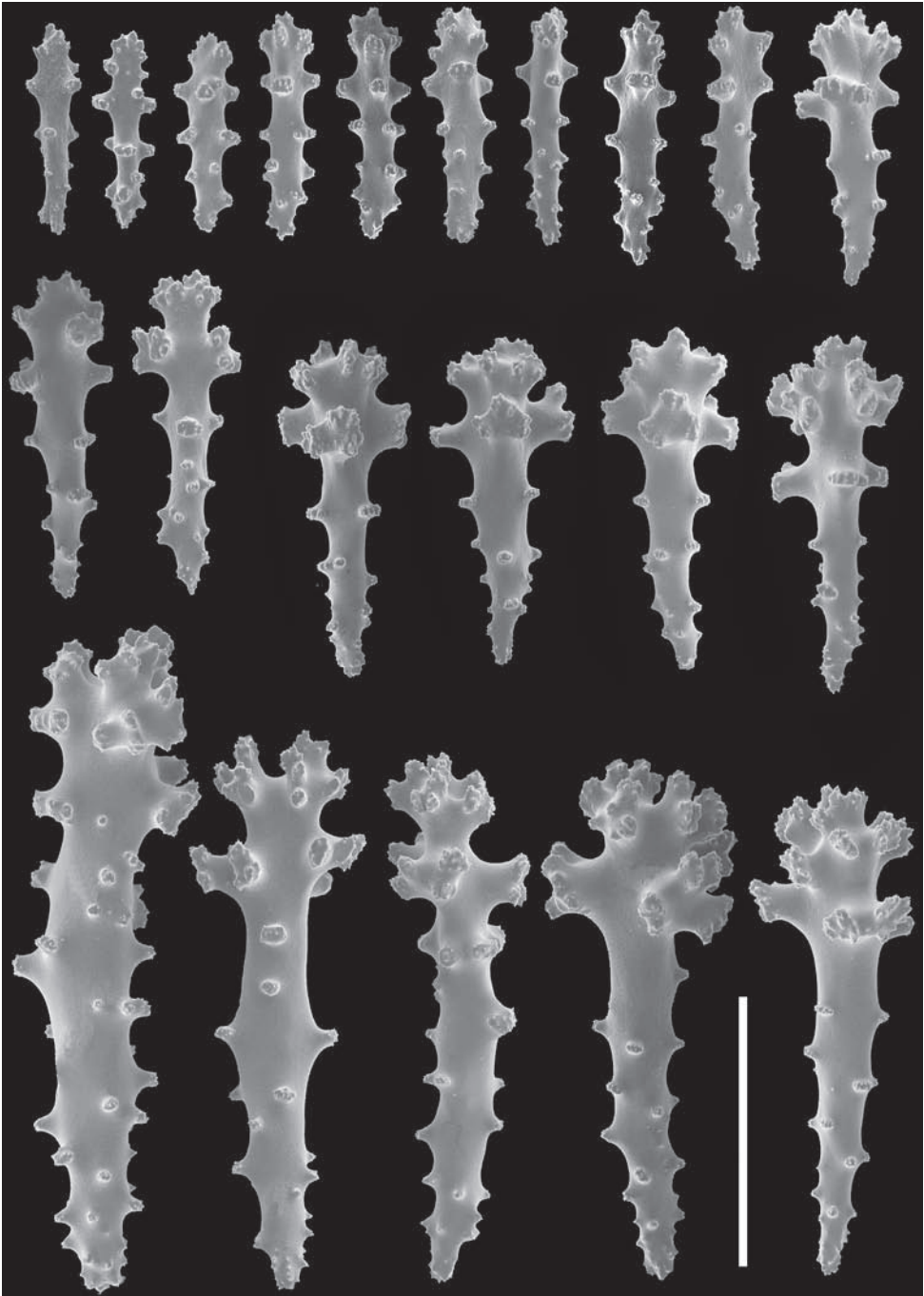


Fig. 67. *Simularia uniformis* spec. nov., holotype RMNH Coel. 38753; clubs of surface layer of the top of the colony. Scale 0.10 mm.

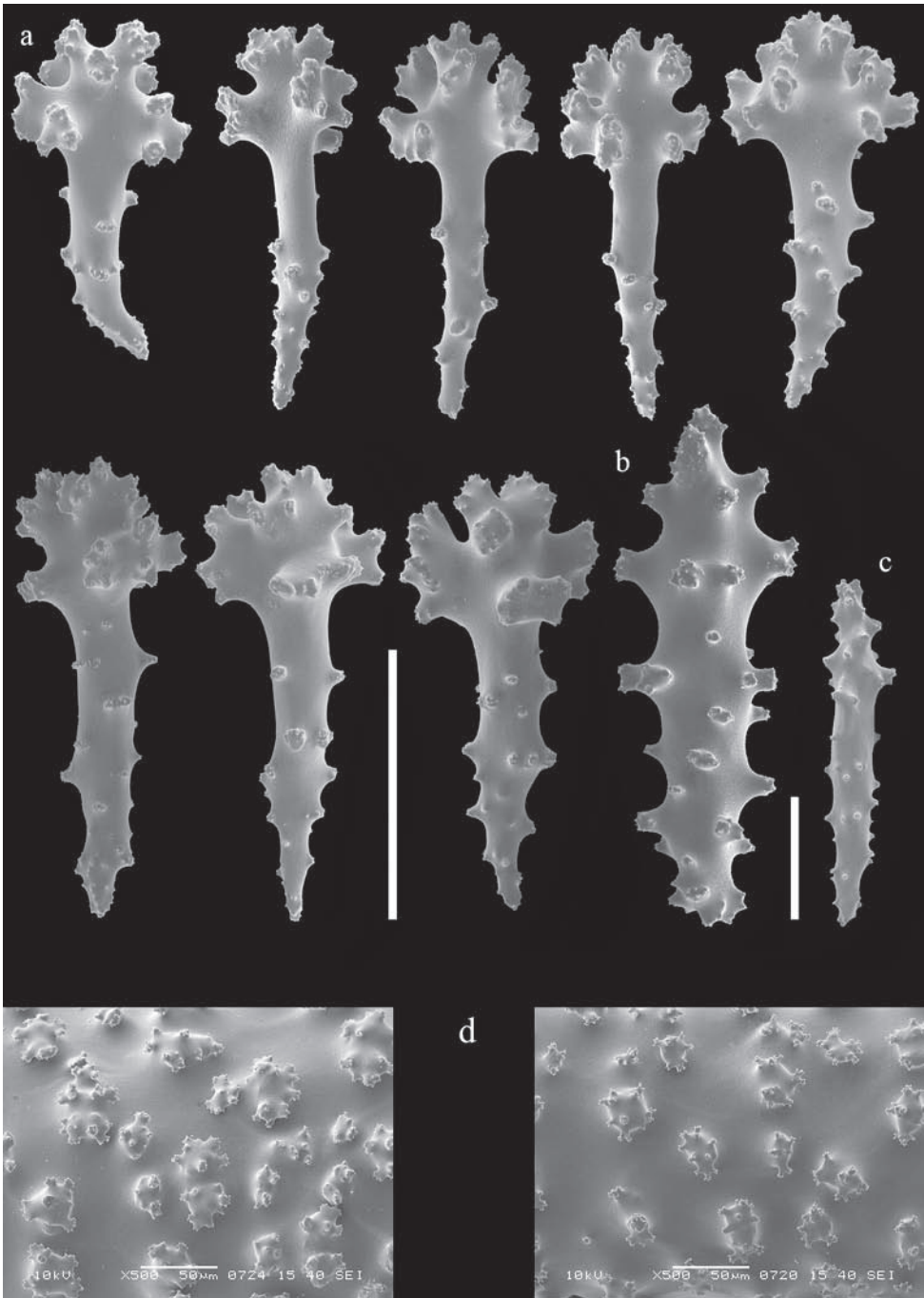


Fig. 68. *Sinularia uniformis* spec. nov., holotype RMNH Coel. 38753; a-c, sclerites of surface layer of the top of the colony; a, clubs; b-c, spindles; d, tubercles on spindles of interior of the base of the colony. Scales 0.10 mm, that at c only applies to c.

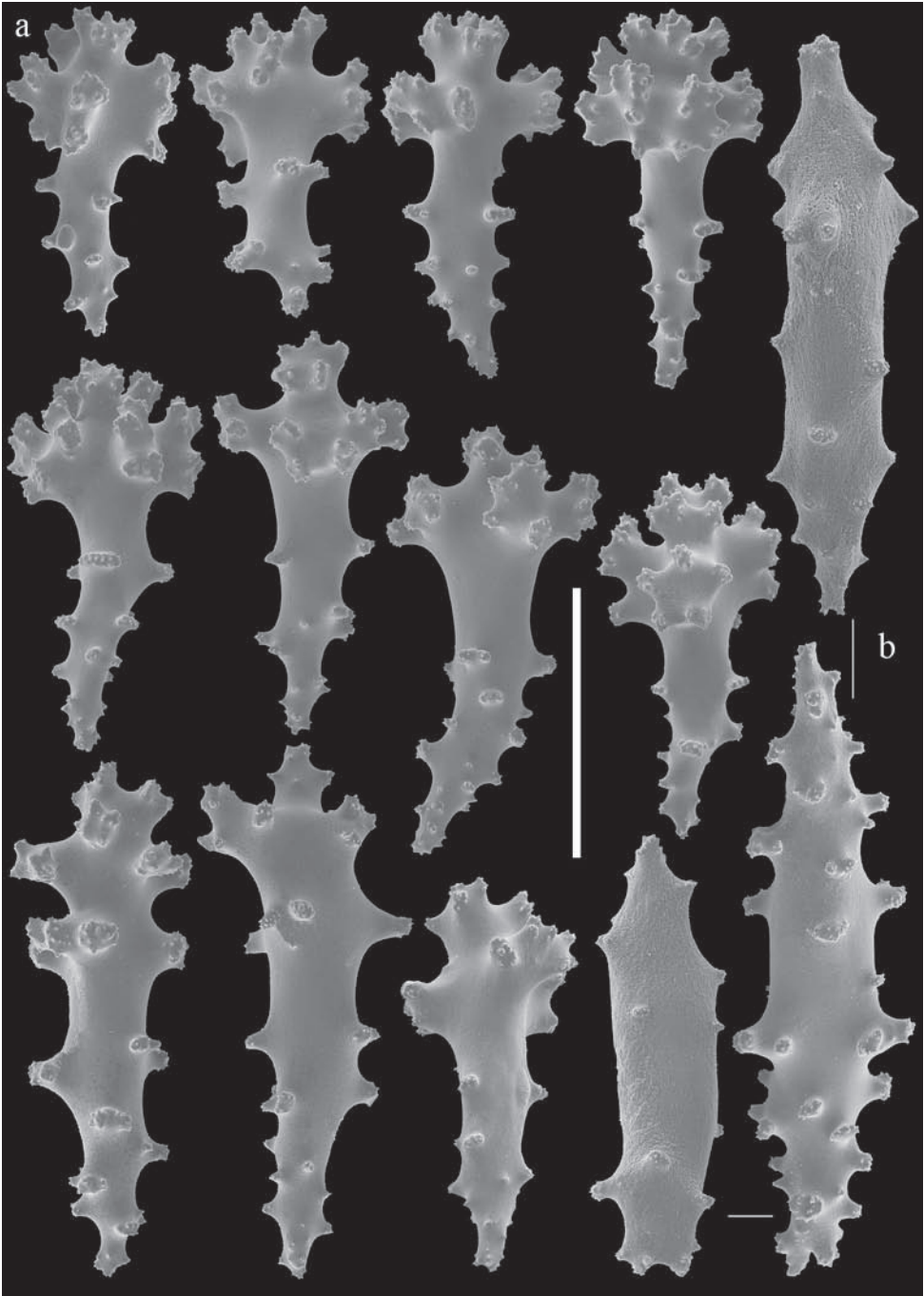


Fig. 69. *Simularia uniformis* spec. nov., holotype RMNH Coel. 38753; sclerites of surface layer of the base of the colony; a, clubs; b, spindles. Scale 0.10 mm.

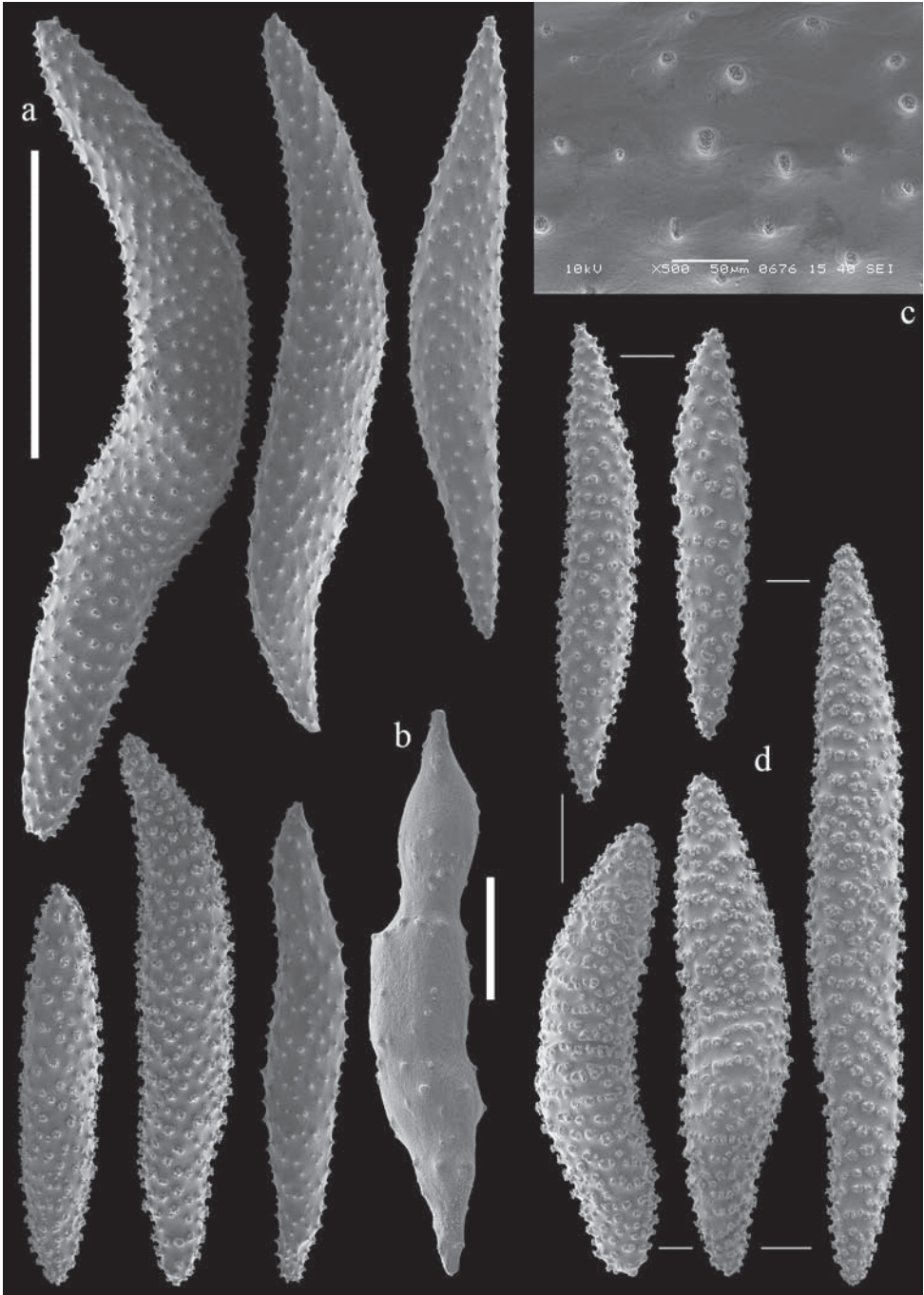


Fig. 70. *Sinularia uniformis* spec. nov., holotype RMNH Coel. 38753; spindles of the interior of the colony; a-b, top of colony; d, base of colony; c, tubercles on spindle of interior of the top of the colony. Scale at a 1 mm, that at b 0.10 mm, only applies to b.

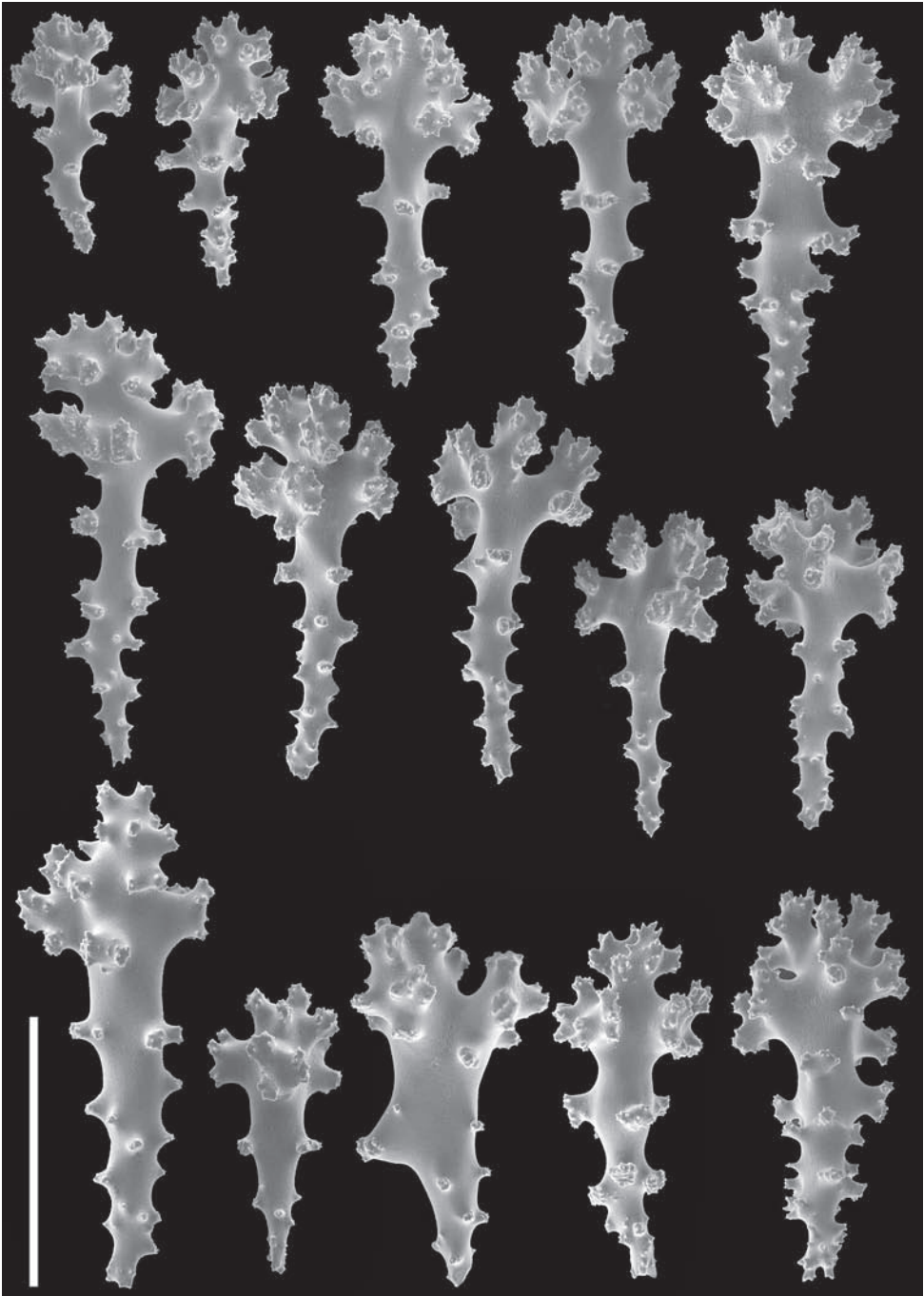


Fig. 71. *Simularia verruca* spec. nov., holotype RMNH Coel. 38754; clubs of surface layer of the top of the colony. Scale 0.10 mm.

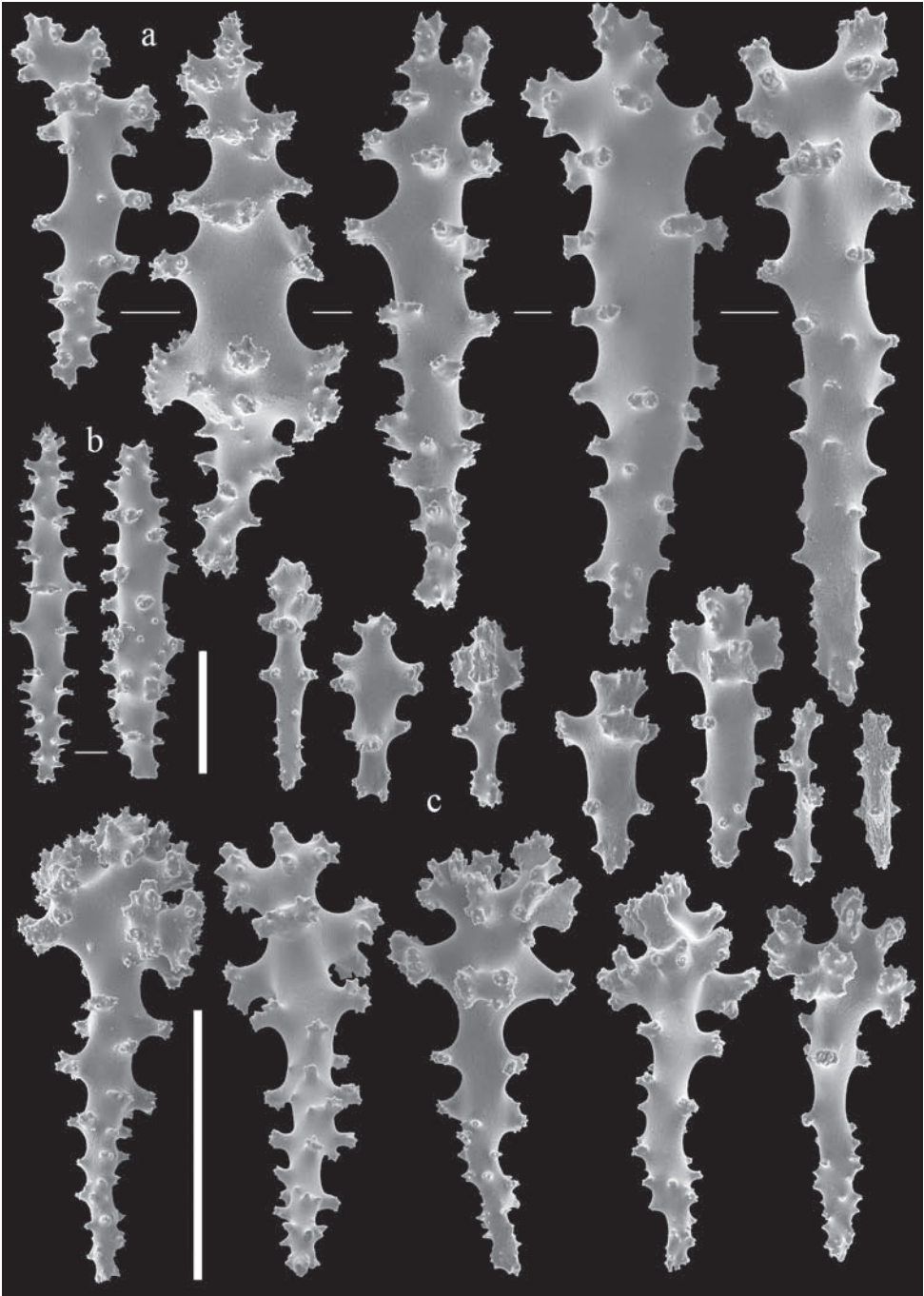


Fig. 72. *Sinularia verruca* spec. nov., holotype RMNH Coel. 38754; sclerites of surface layer of the top of the colony; a, intermediates between spindles and clubs; b, spindles; c, clubs. Scales 0.10 mm, that at b only applies to b.

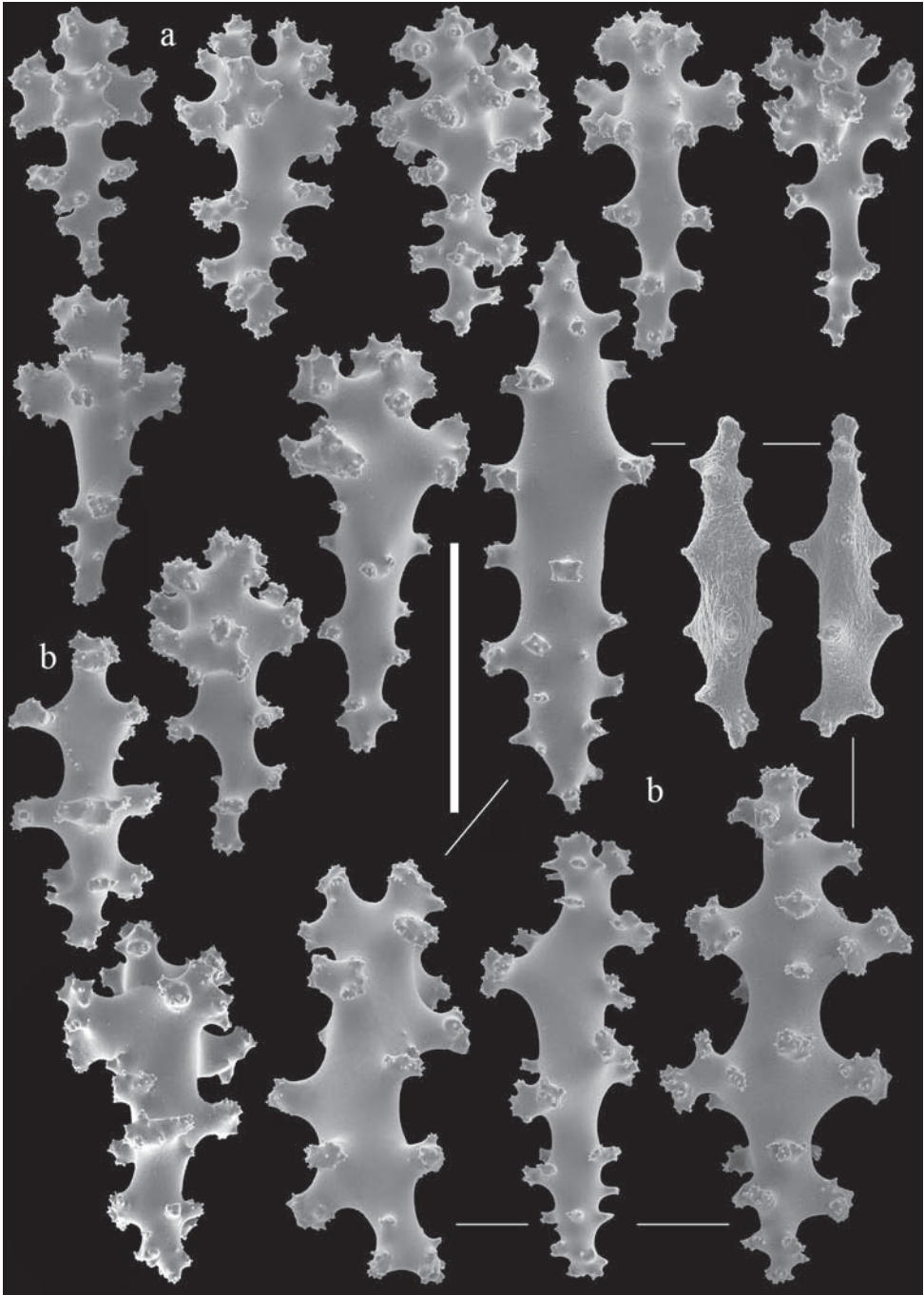


Fig. 73. *Simularia verruca* spec. nov., holotype RMNH Coel. 38754; sclerites of surface layer of the base of the colony; a, clubs; b, spindles and shuttles. Scale 0.10 mm.

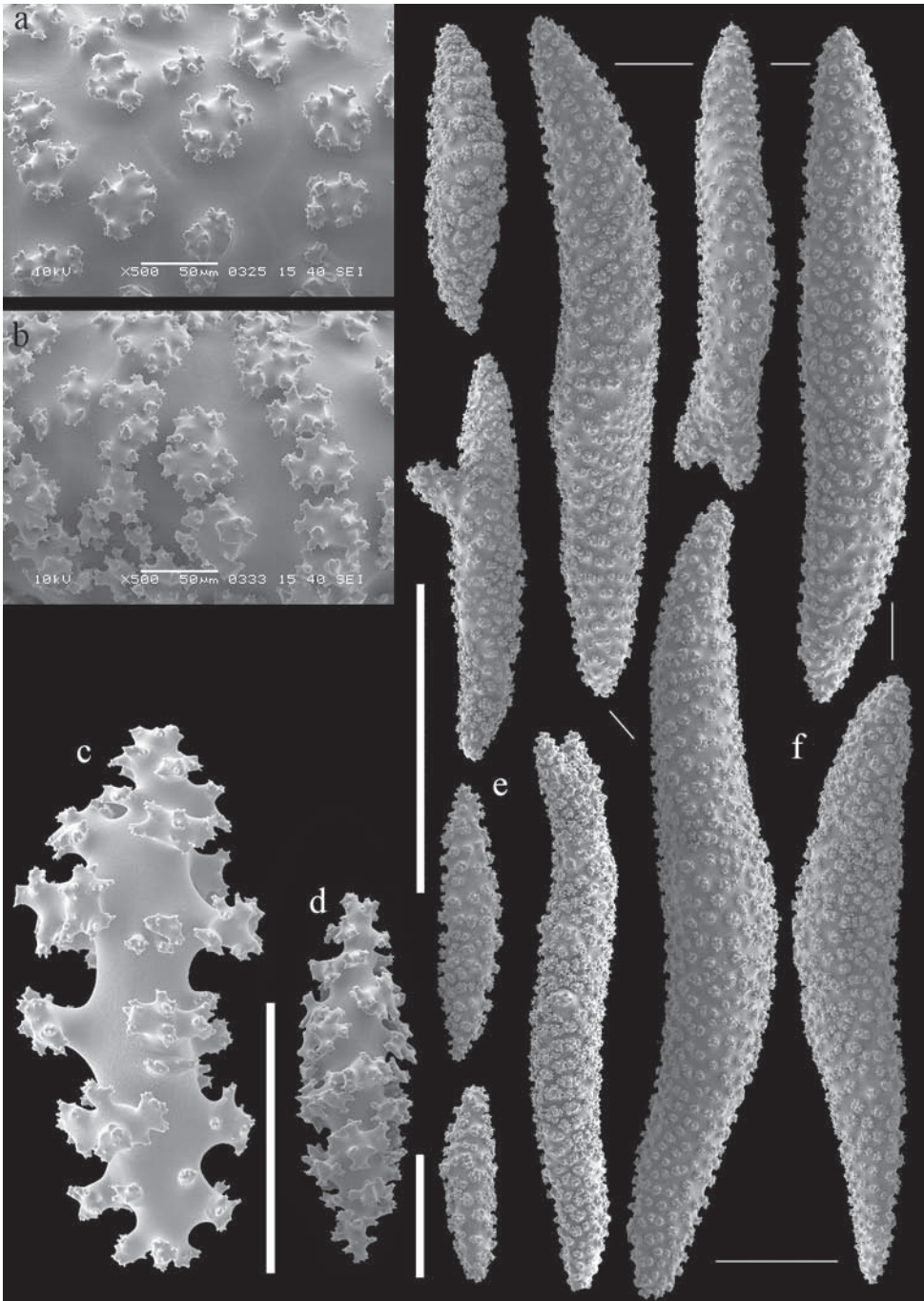


Fig. 74. *Sinularia verruca* spec. nov., holotype RMNH Coel. 38754; spindles of the interior of the colony; f, top of colony; c-e, base of colony; a-b, tubercles on spindles of interior of colony; a, top of colony; b, base of colony. Scale at e 1 mm, also applies to f; scales at c and d 0.10 mm.

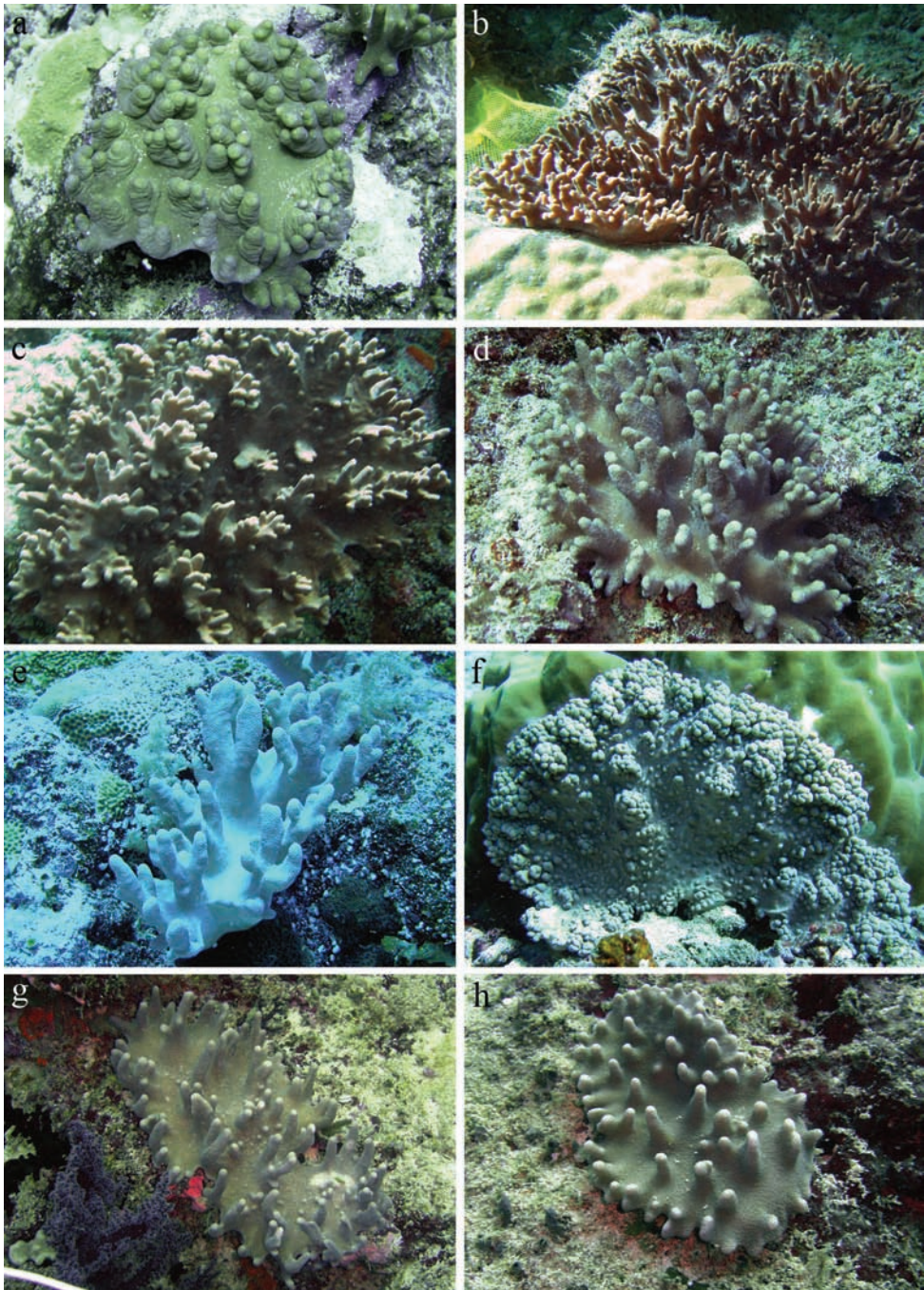


Fig. 75. Live colonies; a, *Simularia abhishiktae*; b, *S. acuta*; c, *S. babeldaobensis*; d, *S. bisulca*; e, *S. corpulentissima*; f, *S. crebra*; g, *S. densa* (RMNH Coel. 34311); h, *S. digitata*.

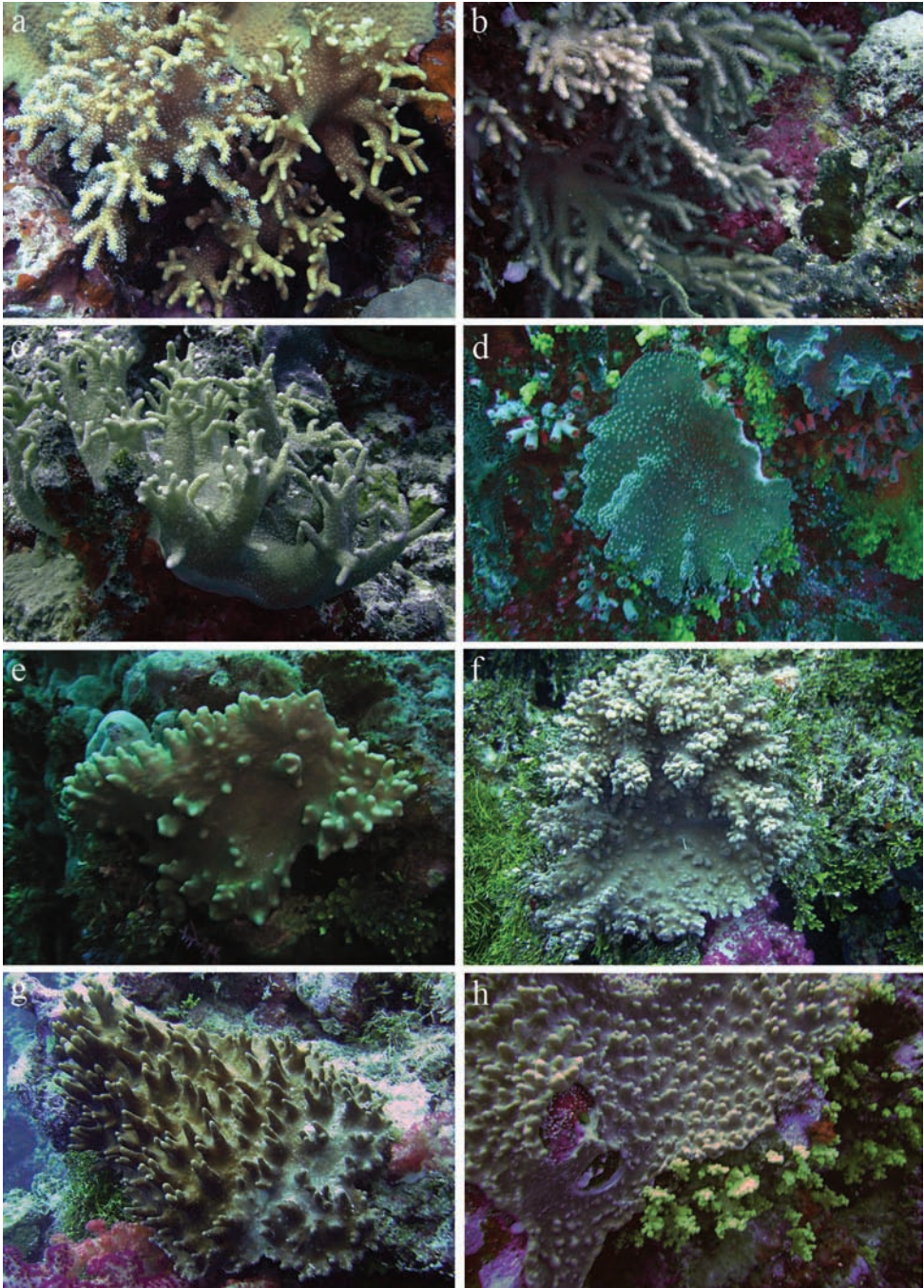


Fig. 76. Live colonies: a, *Sinularia finitima*; b, *S. flaccida*; c, *S. foliata*; d, *S. fungoides*; e, *S. gaveshaniae*; f, *S. gaweli*; g, *S. grandilobata*; h, *S. gravis*.

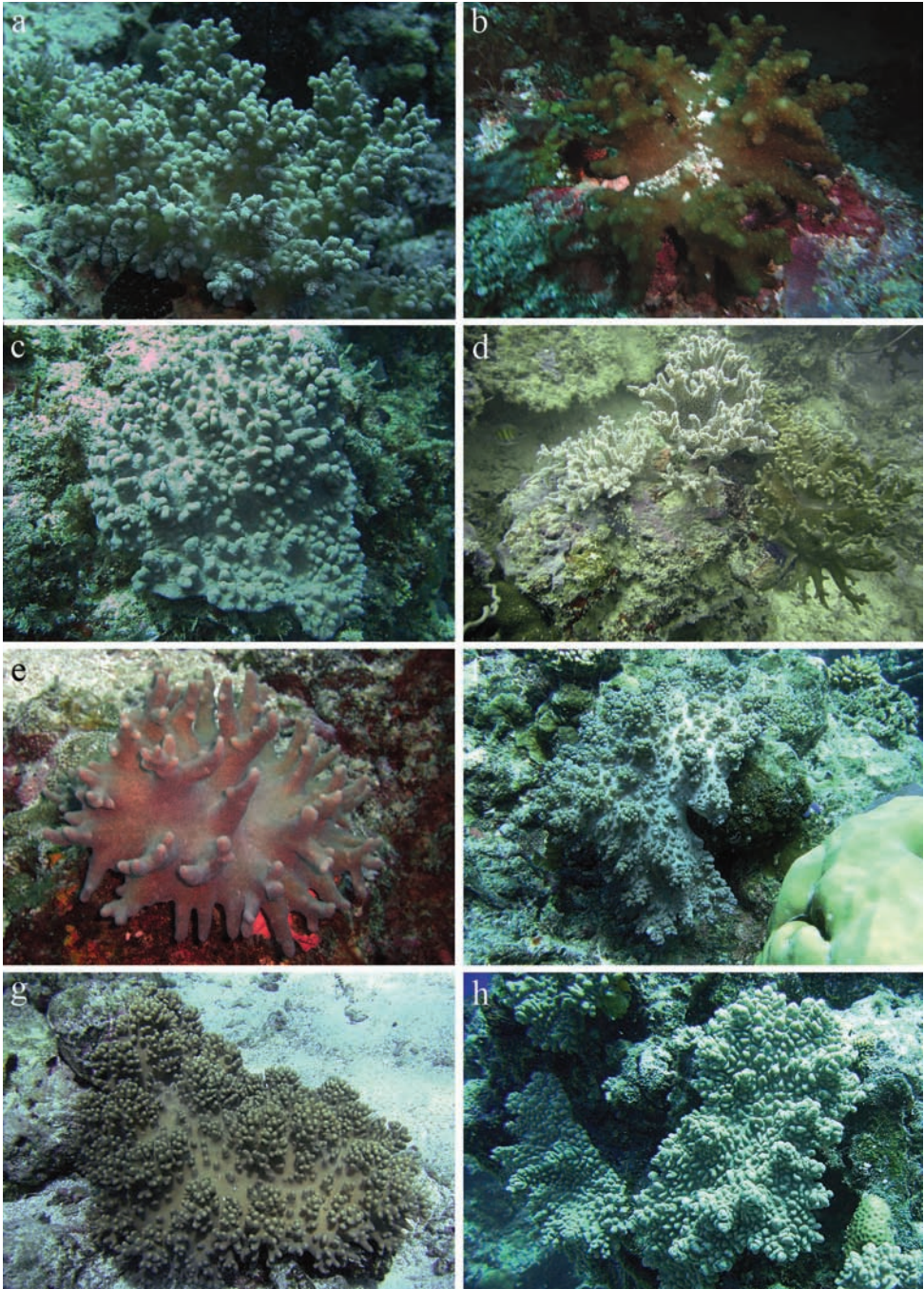


Fig. 77. Live colonies: a, *Simularia heterospiculata*; b, *S. hirta*; c, *S. humilis*; d, *S. luxuriosa*; e, *S. macrodactyla*; f, *S. notanda*; g, *S. pavidia*; h, *S. peculiaris*.

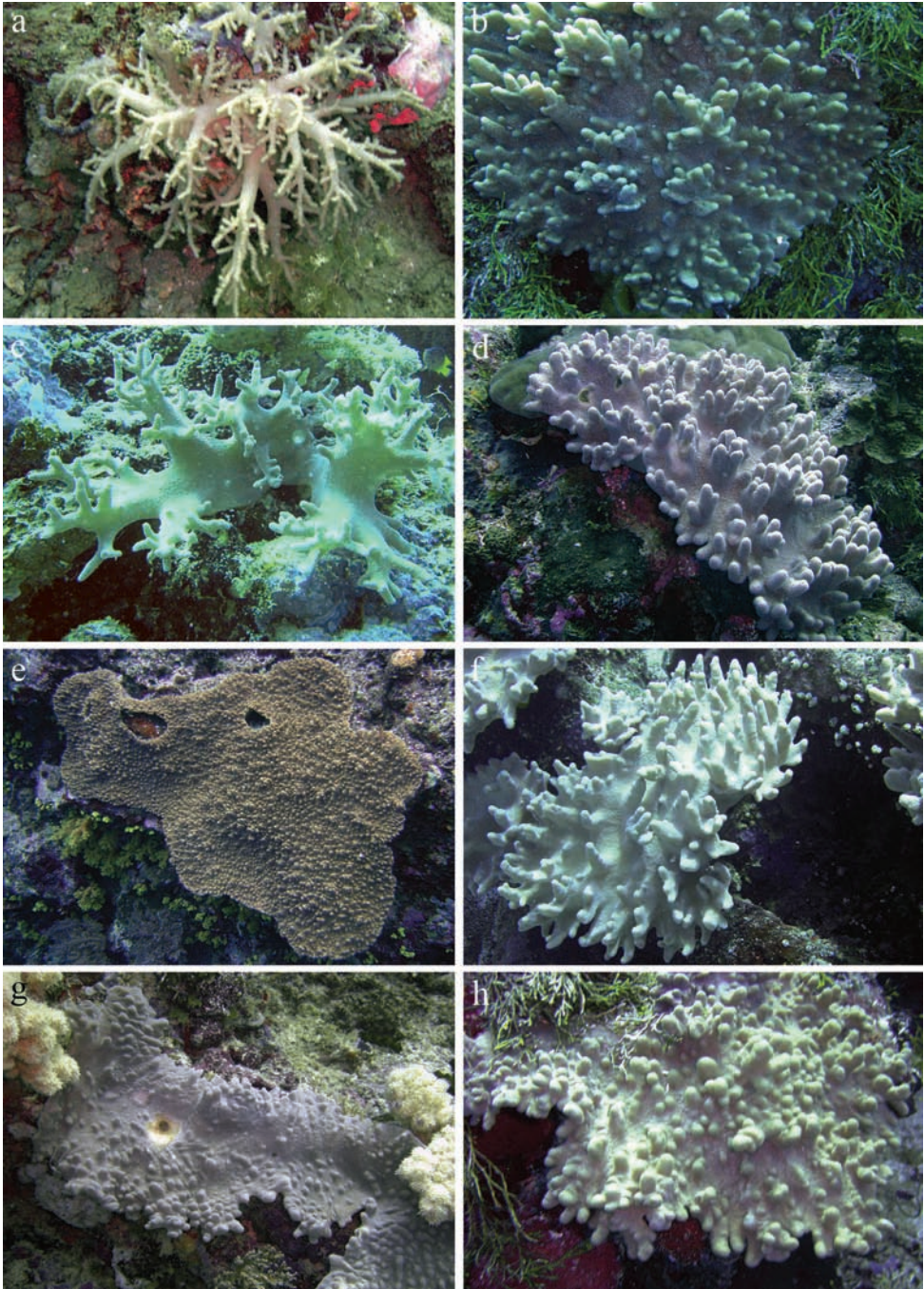


Fig. 78. Live colonies: a, *Sinularia querciformis*; b, *S. siaesensis*; c, *S. sobolifera*; d, *S. sublimis*; e, *S. tumulosa*; f, *S. ultima*; g, *S. uniformis*; h, *S. verruca*.

Discussion

The present study is the first one in which *Sinularia* species are identified by combining the usual preserved colony and sclerite characters together with molecular findings and live colony shape.

Regarding the molecular data, one of the outcomes was that *S. polydactyla* from Ambon (RMNH Coel. 38442; Manuputty & Ofwegen, 2007), two specimens identified as *S. polydactyla* from Australia by Dr Phil Alderslade and one from the Red Sea by Dr Yehuda Benayahu (Tel Aviv University, Israel) showed a totally different DNA sequence than those of other specimens from the Red Sea also identified by Dr Yehuda Benayahu. As the species originally was described from the Red Sea, I now consider only part of Benayahu's identifications of Red Sea material correct and I doubt the Indo-Pacific distribution mentioned by Verseveldt (1980) and others. For *S. leptoclados* a similar inconsistency was found (see remarks *S. aff. leptoclados*). Both these species will be dealt with in separate papers.

The new subgeneric classification resulting from the molecular data (McFadden et al., in prep) facilitated recognizing different species and this is one of the reasons why so many new species are described from the Palau collection. However, on species level the molecular data were several times contradicting the morphological data. The two specimens I described as *S. siaesensis* spec. nov. had different sequences but based on a morphological similarity, I consider them to represent one and the same species. For comparison, both specimens and their sclerites are depicted. Many species with the same sequence are regarded by me as different because sclerites and/or colony shape indicate so. They are discussed in the remarks of the species described.

Compared with stony corals, very few images of live colonies have been published in scientific publications about soft corals; regarding *Sinularia* only eight publications are known to me: Macfadyen, 1936 (*S. polydactyla*, *S. conferta* var. *gracilis*, *S. lochmodes*); Verseveldt & Benayahu, 1983 (*S. anomala*, *S. flabelliclavata*); Benayahu, 1995 (*S. yamazatoi*, *S. gibberosa*); Benayahu, 1997 (*S. abrupta*, *S. arborea*, *S. discrepans*, *S. gaweli*, *S. gibberosa*, *S. maxima*, *S. numerosa*, *S. polydactyla*, *S. querciformis*; in colour); Benayahu et al., 1997 (*S. brassica*; in colour); Benayahu, 1998 (*S. nanolobata*); Fabricius & Alderslade, 2001 (*S. brassica*, *S. lamellata*; in colour); Benayahu et al., 2004 (*S. leptoclados*, *S. polydactyla*, *S. higai*; in colour). If popular literature is included, *S. flexibilis* can be added without too much doubt, because of its characteristic shape. All together, only 20 of the estimated 150 *Sinularia* species are presented with live images so far. If the doubtful identity of *S. leptoclados* and *S. polydactyla*, as indicated by molecular data, is considered, then only 18 species remain. In the present report, I add another 30 species to that list (*S. gaweli* and *S. querciformis* are here shown once again. Six species identified are not shown: *S. abrupta*, *S. brassica*, *S. cruciata*; *S. flexibilis*, *S. lamellata*, and *S. aff. leptoclados*).

The *in situ* pictures also greatly helped recognizing species. For a long time already it has been recognized that the identification of *Sinularia* species based on small collected fragments has its drawbacks. Many species, especially the large encrusting species, show different lobe morphology in different parts of the colony (*S. gaweli* is a good example of this; fig. 76f) and many collected fragments do not show that variability. Moreover, samples often shrink after collecting. For instance the preserved colony

fragments of *S. babeldaobensis* (fig. 3a-b), *S. tumulosa* (fig. 45d), and *S. uniformis* (fig. 62b) are very similar to each other while the live colonies (figs 75c, 78e, 78g) are quite different. Several species described or depicted as being arborescent (*S. acuta*, *S. corpulentsima*, *S. grandilobata* and *S. macrodactyla*) based on preserved specimens are actually shown to be encrusting species *in situ*.

Benayahu et al. (1997) showed the huge colony shape variation in specimens of *S. brassica* and the Palau specimens showed a similar variation. However, in all other species examined in this publication that were represented by more than one specimen, such variation was not observed in underwater pictures. Therefore I conclude that live colony shape can be a valuable character to identify *Sinularia* species, and therefore pictures of live specimens should be presented more often.

In conclusion, the present unusual large number of new species is in my opinion caused by a more precise manner of identification, using both molecular data and live colony shape next to the traditional morphological characters. Additionally, the selective sampling of *Sinularia* in the two weeks survey has resulted in more species than by my normal procedure of collecting all soft coral species indiscriminately. Finally, Palau has never before been studied extensively regarding *Sinularia*, and as already shown in my publication about the Bremer and West Woody islands (Ofwegen, 2008), in newly explored regions of the Indo-Pacific still many undescribed *Sinularia* species can be found.

Acknowledgements

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