STUDIES ON THE MELOBESIOIDEAE OF JAPAN. VI

Tomitarô MASAKI and Jun TOKIDA
Faculty of Fisheries, Hokkaido University

10. **Lithophyllum okamurai** Foslie

Foslie, 1900, p. 4; 1904*a*, p. 59, pl. 11, figs. 11–19; 1909, p. 30 (as *Lithophyllum Okamurae*); 1929, p. 36, pl. 64, figs. 1–9; Yendo, 1902, p. 187; 1916, *in* Okamura, 1916, p. 128; 1936, *in* Okamura, 1936, p. 512, fig. 241; De Toni, 1905, p. 1783; 1924, p. 684; Dawson, 1954, p. 427, fig. 39a; Segawa, 1956, p. 71, pl. 40, fig. 317; Saito, 1956, p. 102; Tokida & Masaki, 1959, p. 185; Segawa & Ichiki, 1959, p. 109; Chihara & Numata, 1960, p. 168.

Lithophyllum okamurai Foslie f. **japonicum** Foslie

Pl. I–III

Foslie, 1901, p. 18 (as f. *japonica*); 1904, p. 59, pl. 11, figs. 13–19; Yendo, 1902, p. 187; 1916, *in* Okamura, 1916, pl. 129; 1936, *in* Okamura, 1936, p. 512, fig. 241; De Toni, 1905, p. 1783.

Syn. *Lithophyllum cephaloides* Heydrich, 1901, p. 271 (according to Foslie, 1909, p. 30).

Japanese name. Hira-ibo (Yendo).

Habit and distribution, in literature. Species—On stones or other hard objects at 3–30 ft. below tide mark. Honshu, Hokkaido, Kyushu, Japan; Indonesia; Viet Nam; Philippines; New Guinea; Polynesia; Ceylon.

Specimens collected. On stones. Moheji, near Hakodate, Hokkaido, 20 July 1959, 22 September 1960, T. Masaki; 24 April 1960, H. Yamamoto.

The specimens from Moheji are described as follows.

Thallus in the form of crusts firmly adherent to small stones, shells, and algae (*Sargassum*), crust up to 600 μ thick, in advanced stages surrounding completely the substratum and becoming free spherical or subspherical balls, 3–6 cm diam. and 1.5–3.0 cm thick, producing on surface more or less crowded wart-like short branches, the branches simple or subdichotomously divided, 3–10 mm long, 2–3 mm diam., subterete, somewhat elliptical in cross section, often anastomosing with each other even towards the apex, more or less attenuate upwards, flat or depressed at the apex; tissue of branches consisting of three parts, viz., central (corresponding to hypothallium in the crusts), peripheral (perithallium in the crusts) portions, and epithallium; cells of the central portion are not clearly distinguishable from those

of the peripheral, roundish and 4–10 μ diam. or elliptical and 5–10 μ long by 4–7 μ diam. in both transverse and longitudinal sections, intermixed here and there with groups of large oval or ellipsoidal cells, 12 μ diam. or 12 μ long by 9 μ diam. respectively, in longitudinal sections; cells of the peripheral tissue in branches subquadrate and 7 μ diam. or elongated rectangular and 12–19 μ long by 7–9 μ diam. in longitudinal section, 7–15 μ long by 7–9 μ diam. in transverse section; hypothallium of the crust well developed, up to 200 μ thick, cells rectangular, 12–20(–34) μ long by 6–10 μ diam.; cells of perithallium of the crust subquadrate and 9–12 μ diam. or elongated rectangular and 9–19 μ long by 9–15 μ diam.; epithallium one to three cell-layered, cells rectangular or tiangular, 2–4 μ high by 6–8 μ diam.; secondary pits between adjacent cell-rows present; conceptacles formed mainly in the upper parts of branches; tetrasporangial conceptacles flat or convex on surface, 126–190 μ high, 190–252 μ diam., tetrasporangia 55–80 μ long by 21–42 μ diam., standing on the periphery of conceptacle floor, central part of floor upheaved and crowned with hairy cells, roof of conceptacle 34–63 μ thick, orifice with poorly developed papillae; procarpic conceptacles immersed, 84–126 μ high, 105–168 μ diam., roof 42–84 μ thick, one to two carpogonial branches standing on each auxiliary cell; cystocarpic conceptacles submerged, 126 μ high, 200–252 μ diam., roof 70 μ thick, carpospores arising from the periphery of fusion-cell which is thin and continuous in section, orifice with well developed papillae; spermatangial conceptacles crowded, slightly convex, sometimes embedded deeply in the tissue without openings, (31–)42–84(–105) μ high, 84–122 μ diam., roof 21–42 μ thick, spermatangia numerous, small, narrowly cylindrical, 5 μ long by 2 μ diam.

The present species was established by Foslie in 1900 on the basis of the material collected by Yendo at Misaki, Kanagawa Pref., Japan. In this Japanese species Foslie distinguished two forms, viz., f. *japonica* and f. *angularis* in 1901, and later added two forms,* viz., f. *contigua* in 1904 and f. *trincomaliensis* in 1906 from South Australia and Ceylon respectively. The type specimen of the species is shown by Foslie in the Corallinaceae of the Siboga Expedition (1904), Pl. XI, Fig. 11. His Fig. 11 and Fig. 12 in Pl. XI are explained by Foslie (1904, p. 59) to show the habit of f. *angularis* Foslie, and Fig. 12 as the type specimen of f. *angularis*. Then, f. *angularis* Foslie should be treated as *Lithophyllum okamurai* f. *okamurai* in accordance with Article 26 of the International Code of Botanical Nomenclature (1960). On the other hand, Foslie (1909, p. 30) proposed to treat f. *japonica* Foslie as f. *typica* Foslie on the ground, no doubt, that this form was considered to be typical of the species occurring most commonly. However,

* F. *valida* Foslie (1906, p. 7) from Ceylon and f. *ptychoides* Foslie (1907, p. 29) from the Indian Ocean were treated later as independent species respectively (Foslie, 1909, p. 32).

the type of the present species had already been indicated otherwise by Foslie himself as mentioned above. So, the most typical and common form of the species should retain its original name, f. *japonicum* Foslie.

The writers could examine two specimens of this species from Yendo's collection preserved in the Foslie Algae Herbarium in Trondheim, through the kindness of Dr. Olaf I. Rønning of the Royal Norwegian Society of Sciences, Botanical Department, Trondheim. They agree quite well with the writers' specimens from Moheji in the structures of the vegetative tissues and of the tetrasporangial conceptacle. Tetrasporangial and cystocarpic conceptacles were already observed by Foslie, but procarpic conceptacles and spermatangial ones are described herein for the first time.

11. **Lithothamnium intermedium** Kjellman

Pl. IV, Figs. 1–4, Pl. V, Figs. 1–3, Pls. VI–VIII

Kjellman, 1883*a*, p. 127, pl. 4, figs. 1–10; Foslie, 1890, p. 7; 1891, p. 6, pl. 3, fig. 5; 1905, p. 36; 1929, p. 42, pl. 22, figs. 1–5, Rosenvinge, 1893, p. 774.

Syn. *Lithothamnium fruticulosum* (Kuetzing) Foslie f. *intermedia* (Kjellman) Foslie, 1895, p. 18. *Lithothamnium ungeri* Kjellman f. *intermedia* (Kjellman) Foslie, 1900, p. 11; 1905, p. 36.

Japanese name. Ibo-ishimo (n. n.).

Habit and distribution, in literature. On sandy or clayish bottom at a depth of 4.5–22.5 meters. Norway and Iceland.

Specimens collected. On calcareous animal body remains including Foraminifera shells on the *Laminaria* beds at a depth of about 20 meters. Imabetsu, Aomori Pref., 5 November 1960, T. Masaki, 9 July & 5 November 1961, T. Masaki.

Thallus in the form of crusts, 300–1500 μ thick, 6–8 cm in diam., firmly adherent to subglobose, sometimes hollow, substratum composed of calcareous animal body remains, crust bearing numerous flat-topped excrescenses on the whole surface, excrescenses simple or subdichotomously divided, up to 4–5 mm long, 2 mm diam., marginal portion of crust lobate and sometimes free from substratum; hypothallium consisting of about 5–6 layers of cells which are elongated, 10–27 μ long by 5–10 μ diam.; perithallium abruptly arising from hypothallium, consisting of vertically elongated cells which are 7–17 μ long by 5–8 μ diam., cells sometimes subspherical or ovoid and 5–9 μ diam., cell-fusion frequently occurring between adjacent cell-rows; epithallium consisting of 1–3 layers of cells which are subquadrate and 4–5 μ diam. by 3 μ high; sporangial conceptacles scattered all over the thallus surface, convex, (168–)210–380 μ diam., 110–180 μ high, roof (12–)21–23(–28) μ thick, perforated by

65–80 or even up to 110 muciferous canals, sporangia tetrasporic, (59–)80–134 μ high, 29–62 μ diam.; procarpic conceptacles hemispherical, 70–84 μ high, 42–50 μ diam.; conceptacle cavity surrounded by a thick wall of cells, auxiliary cells not always distinctly differentiated, procarps few in number; cystocarpic conceptacles hemispherical, (210–)252–290(–320) μ high, 190–312(–340) μ diam., carpospores arising from the whole surface of conceptacle floor, fusion-cell discontinuous in section, conceptacle cavity flask-shaped, surrounded by a tissue which stains well with haematoxylin and anilin-blue; spermatangial plant unknown.

The writers' specimens agree well in general characters with the descriptions of the present species given by Kjellman and Foslie except in having greater number of muciferous canals in each sporangial conceptacle. Foslie (1905) gives 30–60 for that number in his description of the species. Besides the sporangial plant hitherto known to the species, the writers could observe procarpic and cystocarpic, but not spermatangial plants among the specimens described here. *Lithothamnium intermedium* Kjellman is one of the main components of the *Lithothamnia* banks developed along the coasts of the northern part of Honshu.

The writers are indebted to Dr. K. Iwamoto of Tokyo University of Fisheries for a copy of Kjellman's paper (1883).

12. **Melobesia sargassi** Foslie

Pl. IV, Fig. 5, Pl. V, Figs. 4–9, Pls. IX–X

Foslie, 1908, p. 6 (as *Melobesia* (*Pliostroma*) *Sargassi*).

Syn. *Melobesia marginata* f. *Sargassi* Foslie, 1904, (*fide* Foslie, 1906, p. 26). *Lithophyllum* (*Carpolithon*) *sargassi* Foslie, 1906, p. 26. *Heteroderma Sargassi* Foslie, 1909, p. 57; Yendo, *in* Okamura, 1916, p. 125, 1936, p. 507; De Toni, 1924, p. 654; Yamada, *in* Okamura, 1936, fig. 237.

Japanese name. Moku-goromo (n. n.).

Habit and distribution, in literature. Epiphytic on the vesicles of *Sargassum serratifolium* and *S. fulvellum*: Misaki, Kanagawa Pref., Pacific coast of middle Honshu, Japan. Epiphytic on the thallus of *Sargassum confusum*: locality unknown (cf. Yamada, loc. cit.).

Specimens collected. On *Laurencia intermedium*. Nou, Niigata Pref., Japan Sea coast of middle Honshu, 31 August 1960, Y. Saito. On the stems, branches, and vesicles of *Sargassum serratifolium* and *S. fulvellum*. Shimoda, Shizuoka Pref., Pacific coast of middle Honshu, 11 April 1961, J. Tokida.

Thallus firmly adherent to the host, at first forming small irregular patches, 0.5–1.0 cm diam., later becoming confluent or overlapping, attaining to 2–3 cm in

maximum diam., monostromatic only in narrow marginal portion which is composed of oblong cells, 12–20 μ long by 5–8 μ diam. in surface view, each cell except those at the extreme margin cutting off a cover cell; trichocyst absent; thallus polystromatic in inner portion which is 97–126 μ thick consisting of up to 13 layers of cells, basal layer of cells quadrate to elongated in section, 5–7 μ high by 9–12 μ diam. in plants growing on vesicles of the host, or 5–10 μ high by 9–17 μ diam. in those on stems and branches of the host; cells of perithallium quadrate to elongate, 7–11 μ high by 9–21 μ diam., cell-fusion frequent; epithallium one to three cell-layered, cells oblong, subtriangular or roundish, 5–7 μ high by 9 μ diam. in section, 12–20 μ long by 5–8 μ diam. in surface view; sporangial conceptacles convex or subconical, 55–105 μ high, 140–210 μ diam., roof two to three cell-layered, 21–25 μ thick, sporangia tetrasporic, 46–63 μ long, 30–42 μ diam., standing on the periphery of conceptacle floor which is flat and surmounted at the central part by a columella; procarpic conceptacles nearly flat or subconvex, 42–63 μ high, 42–63 μ diam., one or two carpogonial branches standing on each auxiliary cell; cystocarpic conceptacles usually convex but sometimes nearly flat, 50–80 μ high, (42–)84–134(–172) μ diam., roof 12–21 μ thick, carpospores arising from periphery of fusion-cell; spermatangial conceptacles convex or nearly flat, 25–84 μ high, 60–92 μ diam., roof 13–34 μ thick, often provided with a spout, sometimes embedded deeply in the tissue with or without an opening, spermatangia narrowly cylindrical, 4 μ long, 1.7 μ diam.; conceptacle floor in the specimens growing on stems and branches of the host three to eight cell-layered while that in specimens on vesicles of the host is one to several cell-layered.

The above description is based on specimens from Shimoda. It agrees well with Foslie's diagnosis of the present species except in the dimensions of the basal cells. Sexual conceptacles are described in the present paper for the first time.

The writers could examine some specimens from the type collection of the present species in Foslie's Herbarium through the kindness of Dr. Olaf I. Rønning of Botanical Department, Royal Norwegian Society of Sciences, Trondheim. They are attached to the vesicles of *Sargassum fulvellum* (Pl. IV, Fig. 6). However, these specimens are unfortunately found to be different from *Melobesia sargassi* in having a monostromatic thallus which attains a thickness of several cell layers only in the neighborhood of conceptacles; the specimens are referable to *Melobesia farinosa* Lamouroux. (Cf. Pl. V, Fig. 10).

Summary

1. *Lithophyllum okamurai* Fosl. f. *japonicum* Fosl., a rather widely spread alga, is described on the basis of specimens from Hokkaido. Besides the previously

known tetrasporangial and cystocarpic conceptacles, both procarpic and spermatangial conceptacles were also observed and described.

2. *Lithothamnium intermedium* Kjellm., a species previously known only from Norway and Iceland, is reported herein to be new to Japan on the basis of specimens collected from the *Lithothamnia* banks in the northermost part of Honshu. Besides the previously known sporangial plant, the female plant was also observed and described. Male plant is left unknown yet.

3. *Melobesia sargassi* Fosl., a species previously known only from the Pacific coast of middle Honshu, is reported herein to be found also on the Japan Sea coast of middle Honshu. Besides the previously known asexual plant, the female and male plants were also observed and described herein.

References

Chihara, M. & Numata, M. (1960). Algal flora and communities at Choshi (preliminary report). Coastal and littoral vegetation at Choshi, Chiba Prefecture II. *Jour Coll. Arts & Sci., Chiba Univ.* **3**(2), 163-171, pls. 1-3.

Dawson, E. Y. (1954). Marine plants in the vicinity of the Institute Oceanographique de Nha Trang, Viêt Nam. *Pacific Science* **8**(4), 373-481, figs. 1-62.

Foslie, M. (1890). Contribution to knowledge of the marine algae of Norway I. East-Finmarken. *Trφmso Mus. Aarshefter.* **13**, 1-186, pls. 1-3.

——— (1891). Ditto II. Species from different tracts. *Ibid.* **14**, 1-23, pls. 1-3.

——— (1904*a*). Lithothamnioneae, Melobesieae, Mastophoreae, *in* Weber-van Bosse. A. & Foslie, M. *The Corallinaceae of the Siboga-expedition. Siboga-Expeditie, Monographie LXI.* 110p., 16 pls., 34 textfigs. Leyden.

——— (1906*a*). Algologiske Notiser III. *K. Norske Vid. Selsk. Skr.* 1906 (8), 1-34.

——— (1906*b*). Den botaniske samling. *K. Norske Vid. Aarsber.* 1905, 1-8.

——— (1908*a*). *Plistroma* a new subgenus of *Melobesia*. *K. Norske Vid. Selsk. Skr.* 1908 (11), 1-7.

Kjellman, F. R. (1883*a*). Norra Ishafvets Algflora. *Vega-exped. vetenskapl. arbeten* **3**, 1-430, pls. 1-30.

Rosenvinge, L. K. (1893). Grφnlands Havalgea. *Meddelelser om Grφnland* **3**, 765-981, pls. 1-2.

Saito, Y. (1956). List of the marine algae from Nou, Echigo Province, and its vicinity. *Bull. Fac. Fish., Hokk. Univ.* **7**(2), 96-108, figs. 1-7.

Segawa, S. & Ichiki, M. (1959). A list of seaweeds in the vicinity of the Aizu Marine Biological Station of Kumamoto University. *Kumamoto Jour. Sci., Ser. B, Sec. 2,* **4**(2), 103-112.

Tokida, J. & Masaki, T. (1959). A list of marine algae collected in the vicinity of Oshoro Marine Biological Station, at Oshoro, Hokkaido, Japan. *Bull. Fac. Fish., Hokk. Univ.* **10**(3), 173-195.

(For further references: see the preceding reports, I-V)

Explanation of Plates

PLATE I

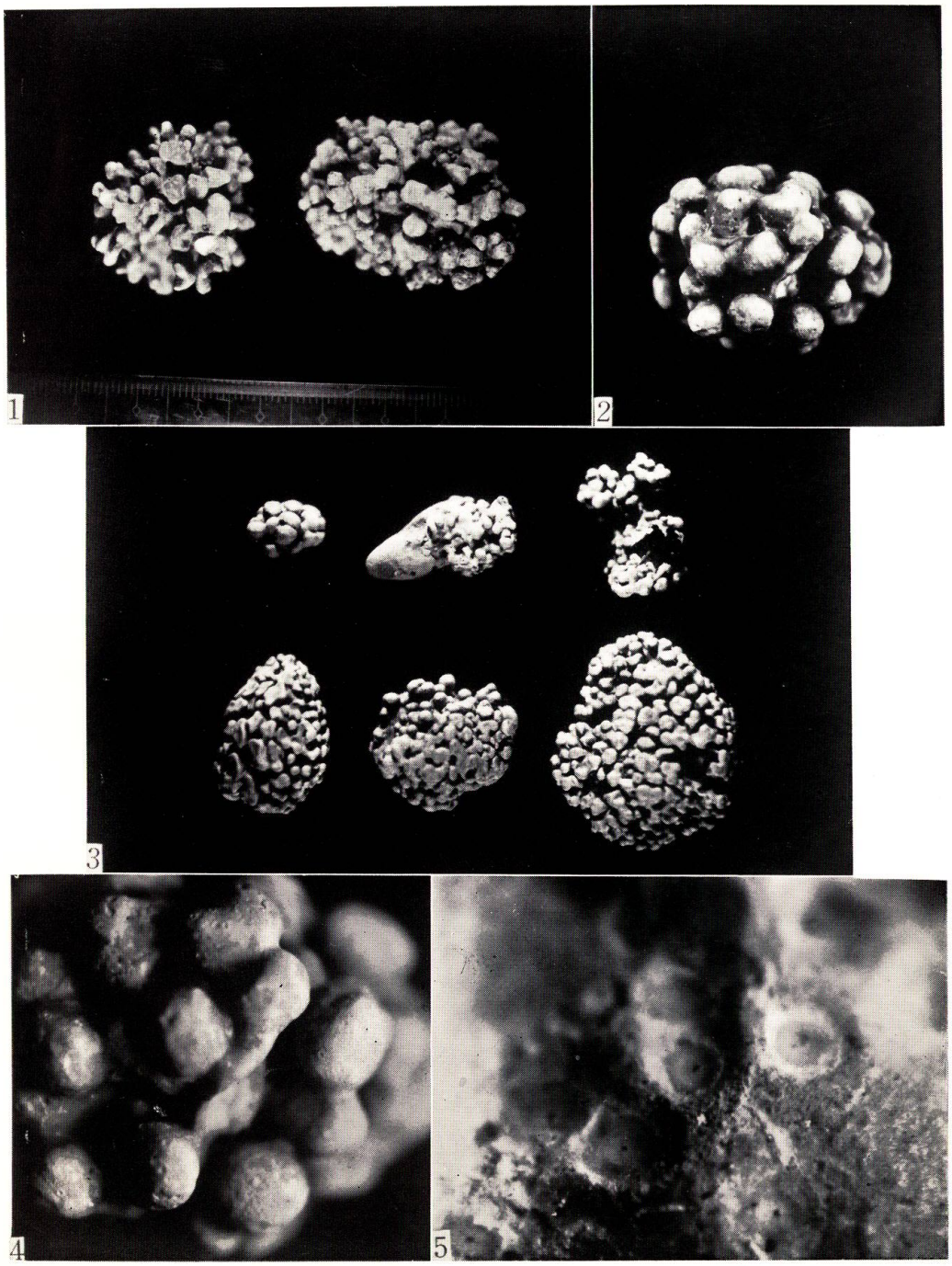
Lithophyllum okamurai Foslie f. *japonicum* Foslie

Fig. 1. Two specimens from Yendo's collection preserved in the Foslie Algae Herbarium in Trondheim, Norway

Fig. 2 & 3. Specimens from Moheji, near Hakodate, Hokkaido, collected by T. Masaki, 22 September 1960. Fig. 2, ×1.6; Fig. 3, ×0.6

Fig. 4. Surface detail of branches ×3.2

Fig. 5. Surface detail of a branch, showing conceptacle ×40



T. Masaki & J. Tokida: Studies on the Melobesioideae of Japan. VI

PLATE II

Lithophyllum okamurai Foslie f. *japonicum* Foslie

Photomicrographs of sections of plant

Fig. 1. Vertical section of crust ×72

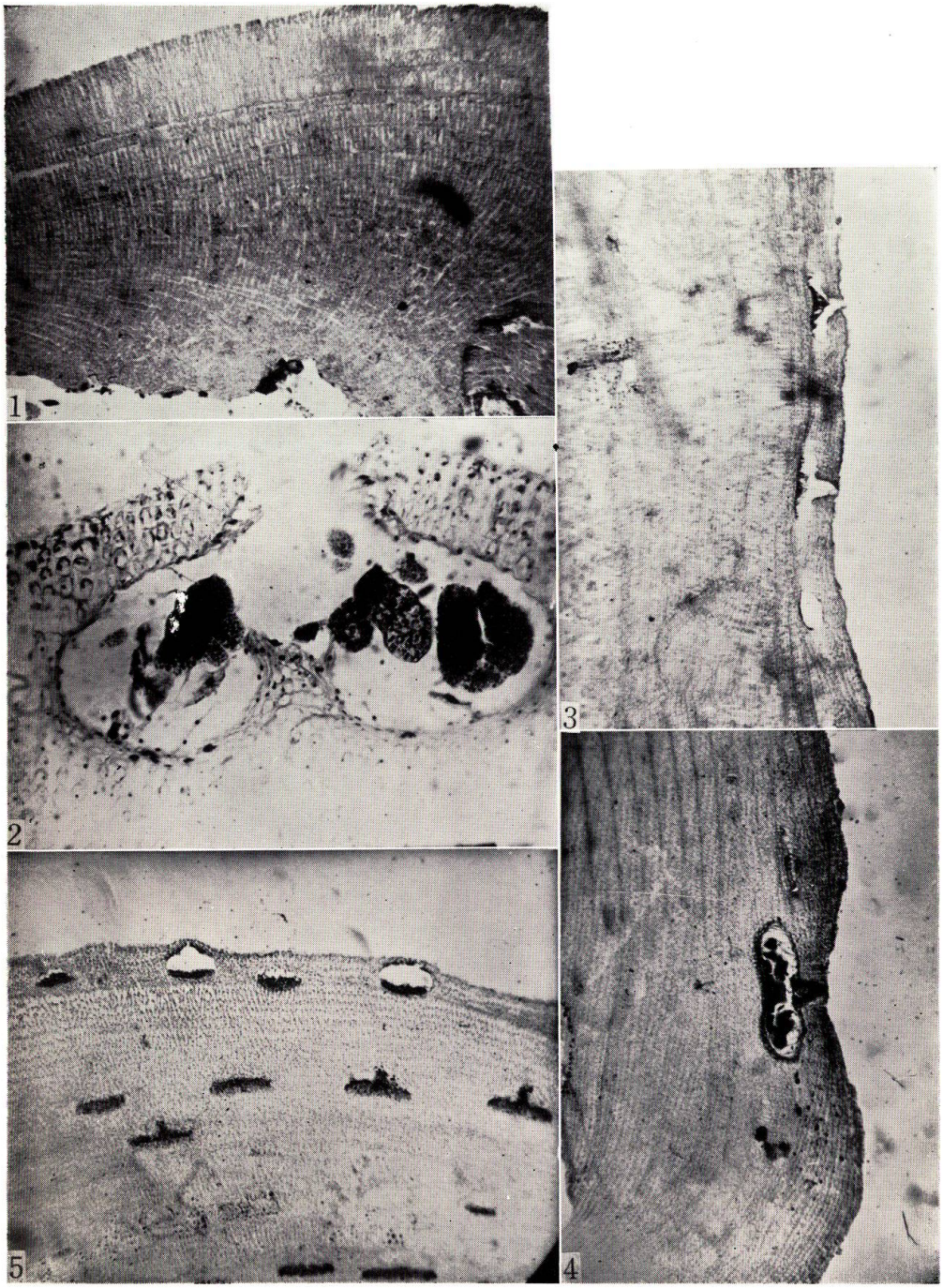
Figs. 2–5. Longitudinal section of branch

Fig. 2. Tetrasporangial conceptacle ×260

Fig. 3. Procarpic conceptacles ×72

Fig. 4. Cystocarpic conceptacle ×72

Fig. 5. Spermatangial conceptacle ×72



T. Masaki & J. Tokida: Studies on the Melobesioideae of Japan. VI

PLATE III

Lithophyllum okamurai f. *japonicum* Foslie

Fig. 1. Vertical section of the marginal portion of a crust

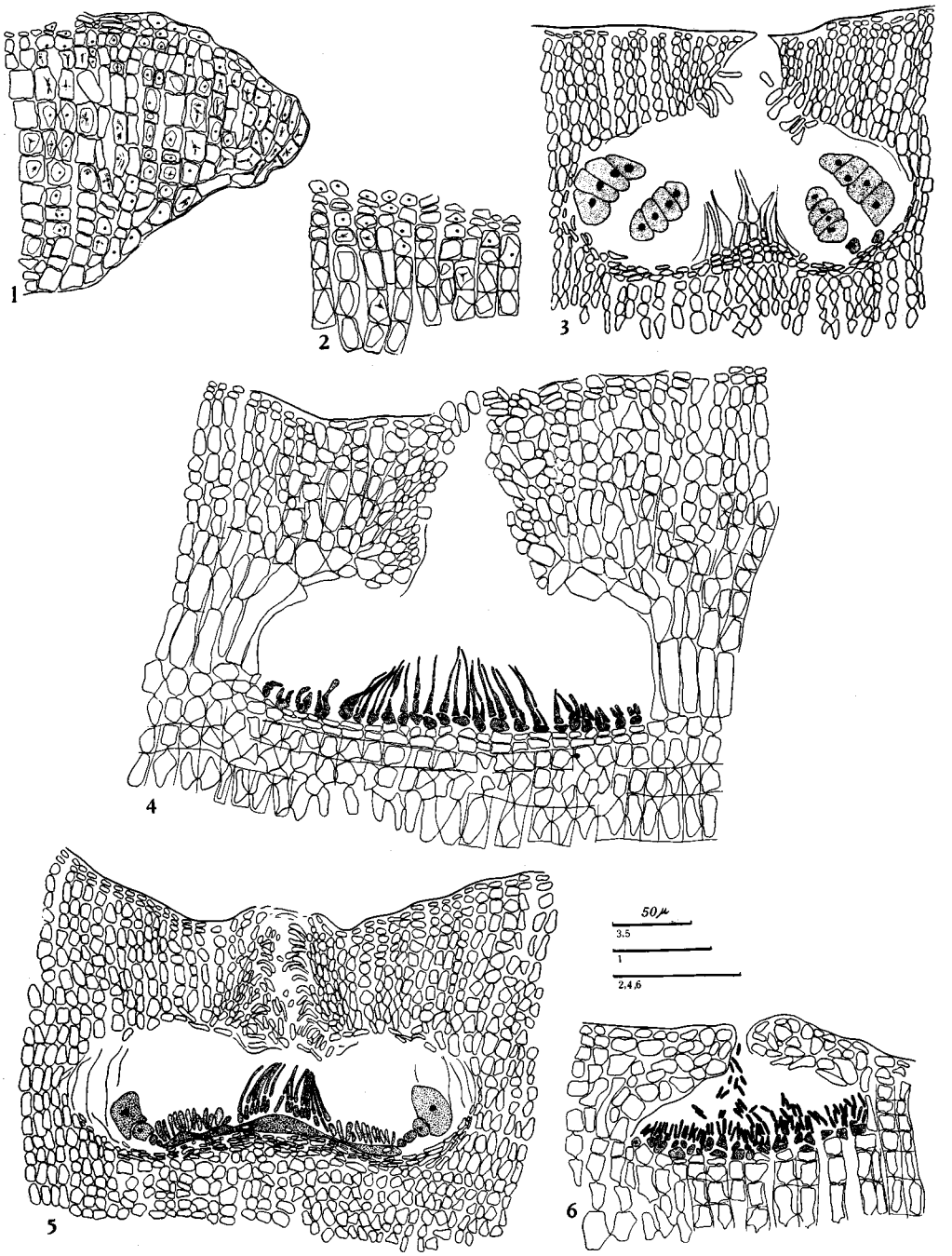
Fig. 2. Part of vertical section of a crust showing perithallium

Fig. 3. Tetrasporangial conceptacle

Fig. 4. Procarpic conceptacle

Fig. 5. Cystocarpic conceptacle

Fig. 6. Spermatangial conceptacle



T. Masaki & J. Tokida: Studies on the Melobesioideae of Japan. VI

PLATE IV

Lithothamnium intermedium Kjellman

Fig. 1 & 2. Habit of plant ×1.5

Fig. 3. Surface detail of plant showing two excrescences ×20

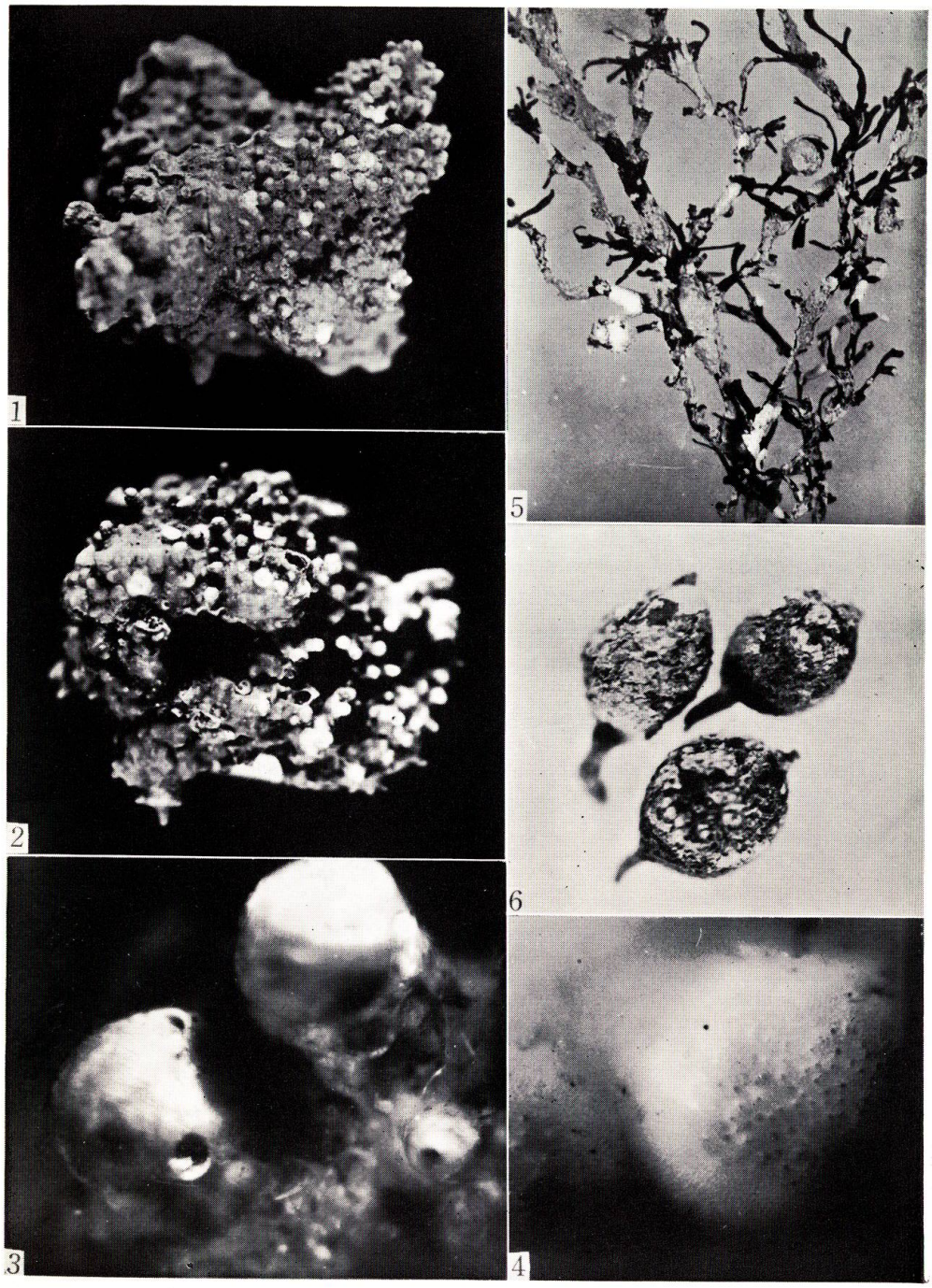
Fig. 4. Surface view of sporangial conceptacle showing pores perforating its roof ×120

Melobesia sargassi Foslie

Fig. 5. Habit of plant growing on the thallus of a specimen of *Sargassum serratifolium* from Shimoda, Shizuoka Pref., Pacific ocast of middle Honshu (11 April 1958, J. Tokida) ×2.7

Melobesia farinosa Lamouroux

Fig. 6. Habit of plant growing on three vesicles of *Sargassum fulvellum* sent from Foslie's Herbarium in Norway under the name of *Melobesia sargassi* ×28



T. Masaki & J. Tokida: Studies on the Melobesioideae of Japan. VI

PLATE V

Lithothamnium intermedium Kjellman

Photomicrographs of vertical sections of plants

Fig. 1. Tetrasporangial conceptacle ×55

Fig. 2. Procarpic conceptacle ×210

Fig. 3. Cystocarpic conceptacle ×55

Melobesia sargassi Foslie

Photomicrographs of vertical sections of plants

Fig. 4. Tetrasporangial crust on a branch of the host ×84

Fig. 5. Procarpic crust on a branch of the host ×224

Fig. 6. Cystocarpic crust on a branch of the host ×84

Fig. 7. Spermatangial crust on a branch of the host ×84

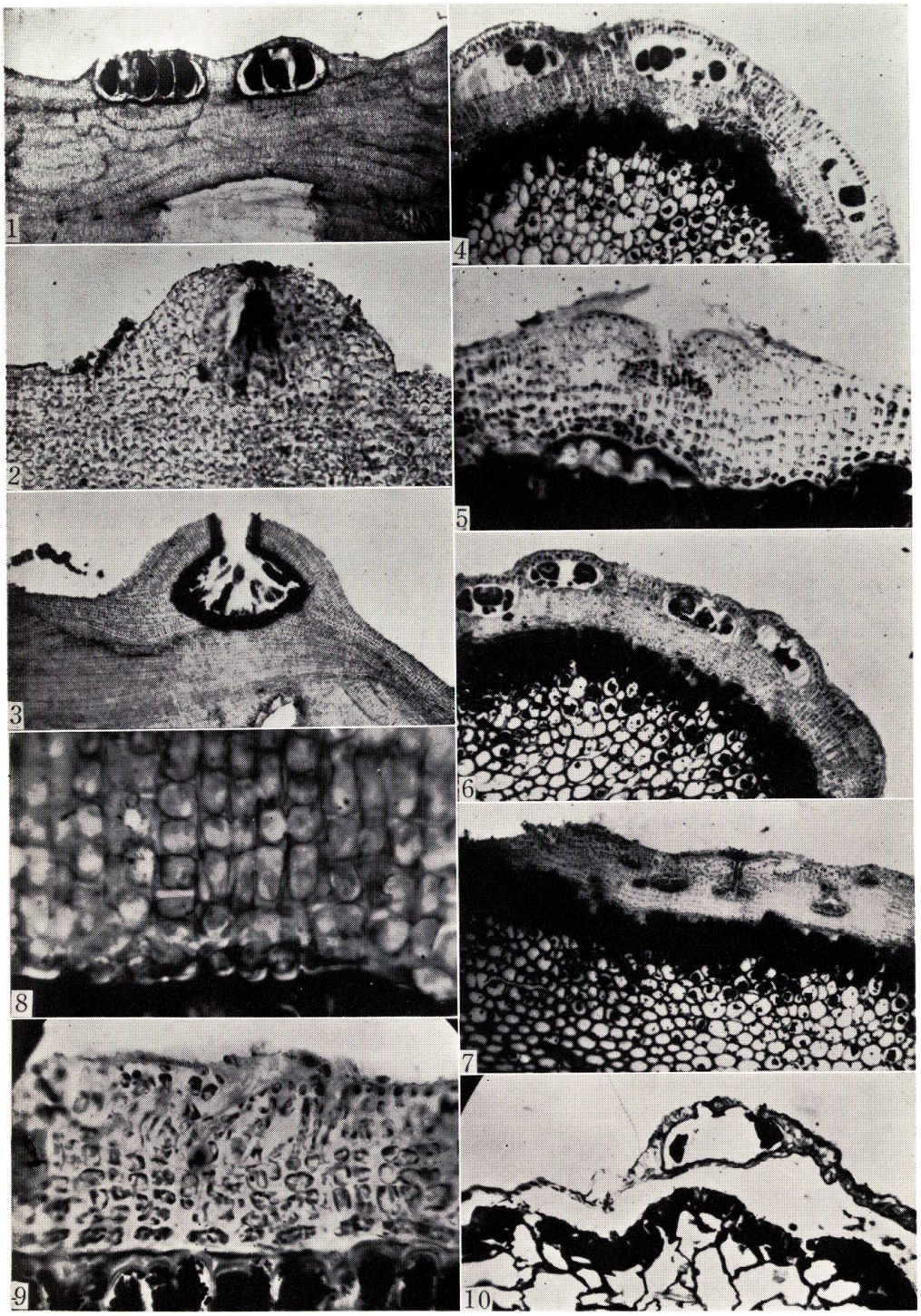
Fig. 8. Part of vegetative portion of a crust on a vesicle of the host, showing lateral coalescence of cells ×525

Fig. 9. Ditto, showing single cell-layered hypothallium ×315

Melobesia farinosa Lamouroux

Photomicrograph of vertical section of one of the specimens shown in Pl. IV, Fig. 6

Fig. 10. Tetrasporangial crust growing on a vesicle of the host showing the monostromatic nature of the vegetative portion of the crust ×133



T. Masaki & J. Tokida: Studies on the Melobesioideae of Japan. VI

PLATE VI

Lithothamnium intermedium Kjellman

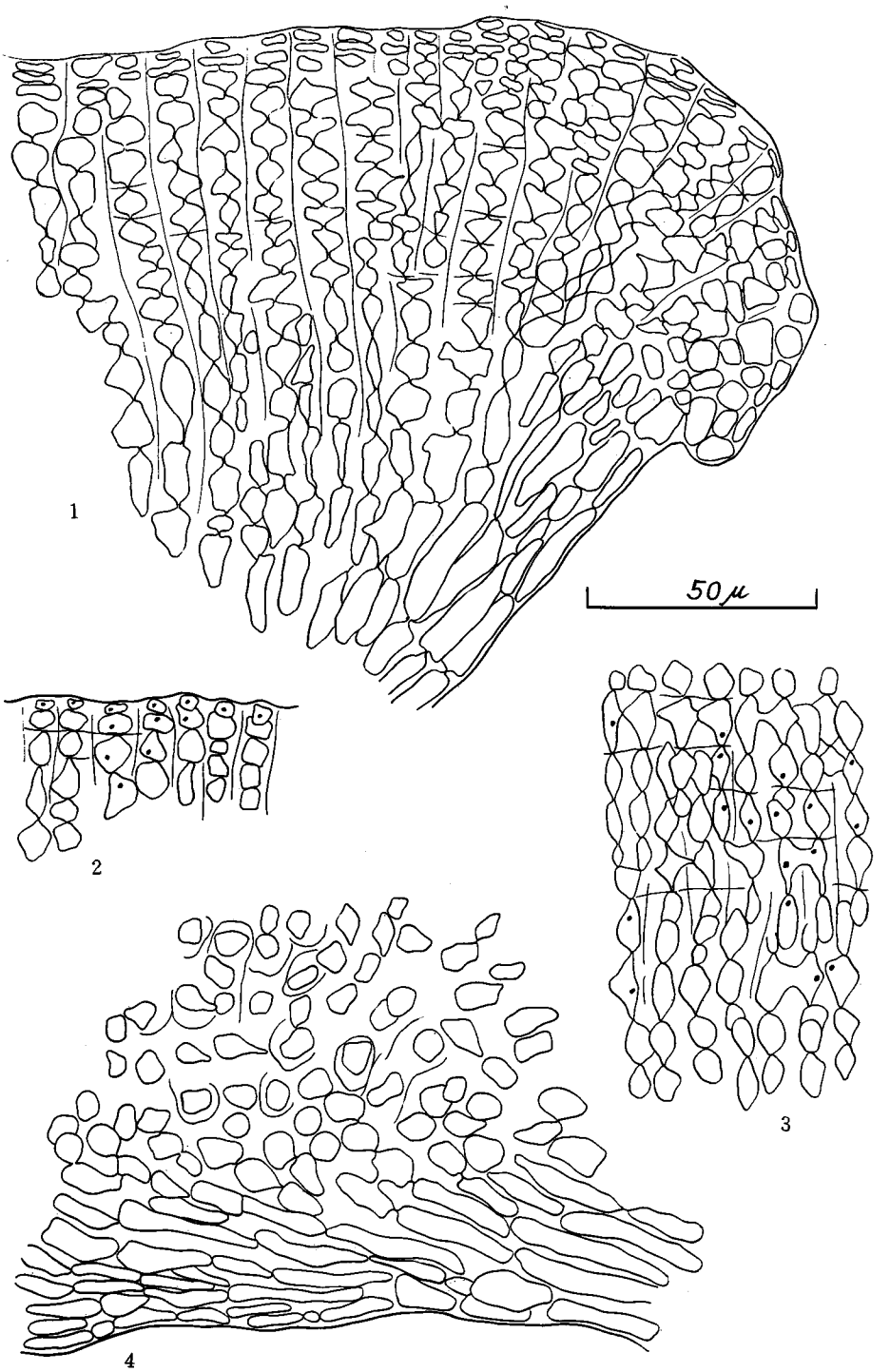
Vertical sections of crust

Fig. 1. Marginal portion

Fig. 2. Epithallium

Fig. 3. Perithallium

Fig. 4. Hypothallium



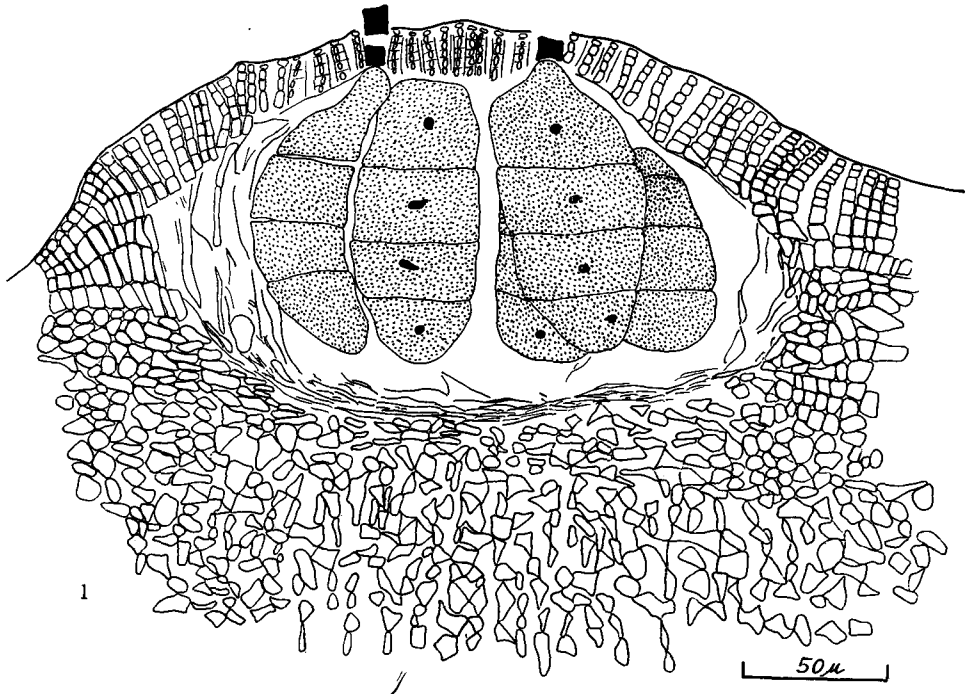
T. Masaki & J. Tokida: Studies on the Melobesioideae of Japan. VI

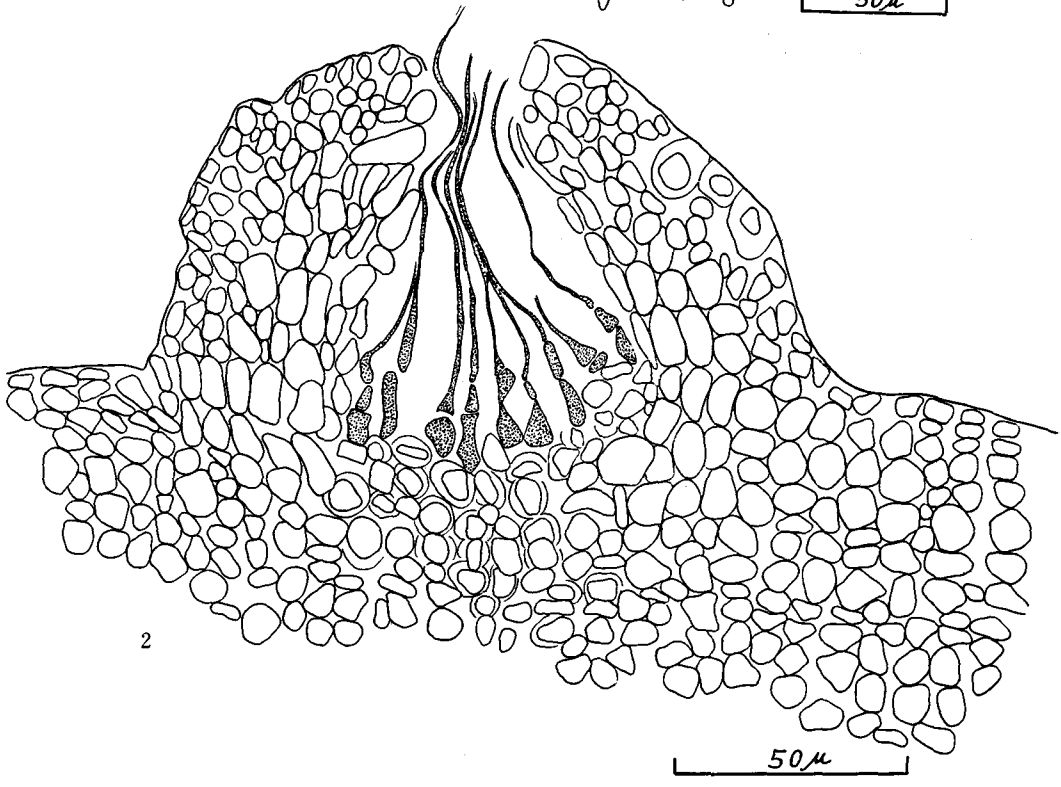
PLATE VII

Lithothamium intermedium Kjellman

Fig. 1. Vertical section through tetrasporangial conceptacle

Fig. 2. Vertical section through procarpic conceptacle





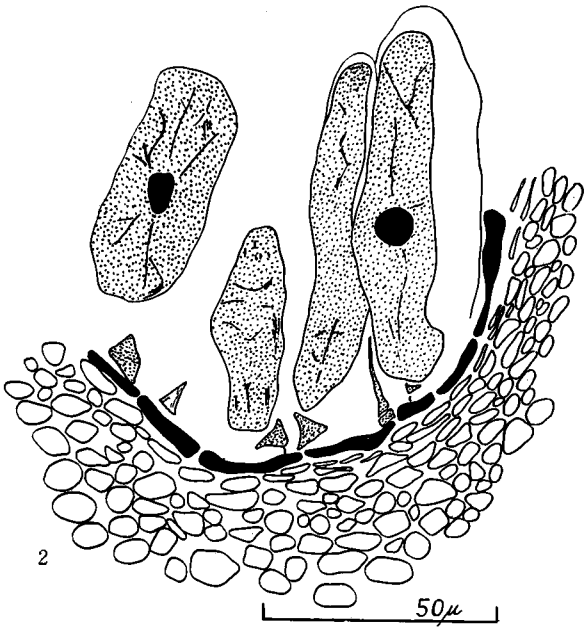
T. Masaki & J. Tokida: Studies on the Melobesioideae of Japan. VI

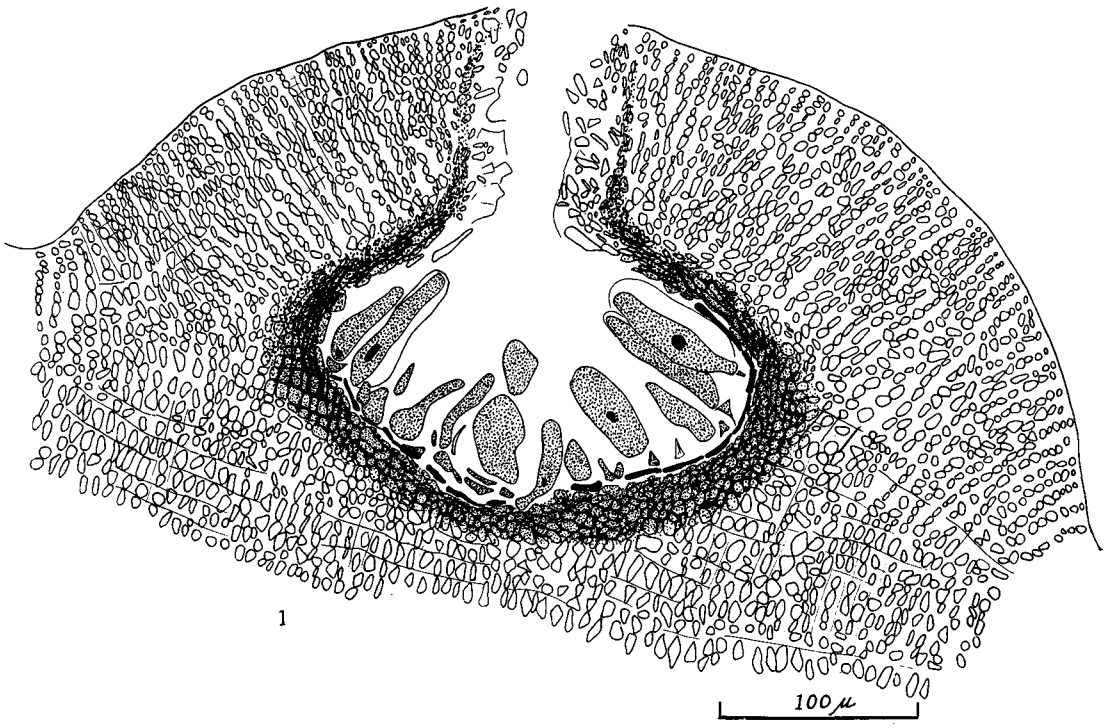
PLATE VIII

Lithothamnium intermedium Kjellman

Fig. 1. Vertical section through cystocarpic conceptacle

Fig. 2. Detail of a part of cystocarpic conceptacle floor





T. Masaki & J. Tokida: Studies on the Melobesioideae of Japan. VI

PLATE IX

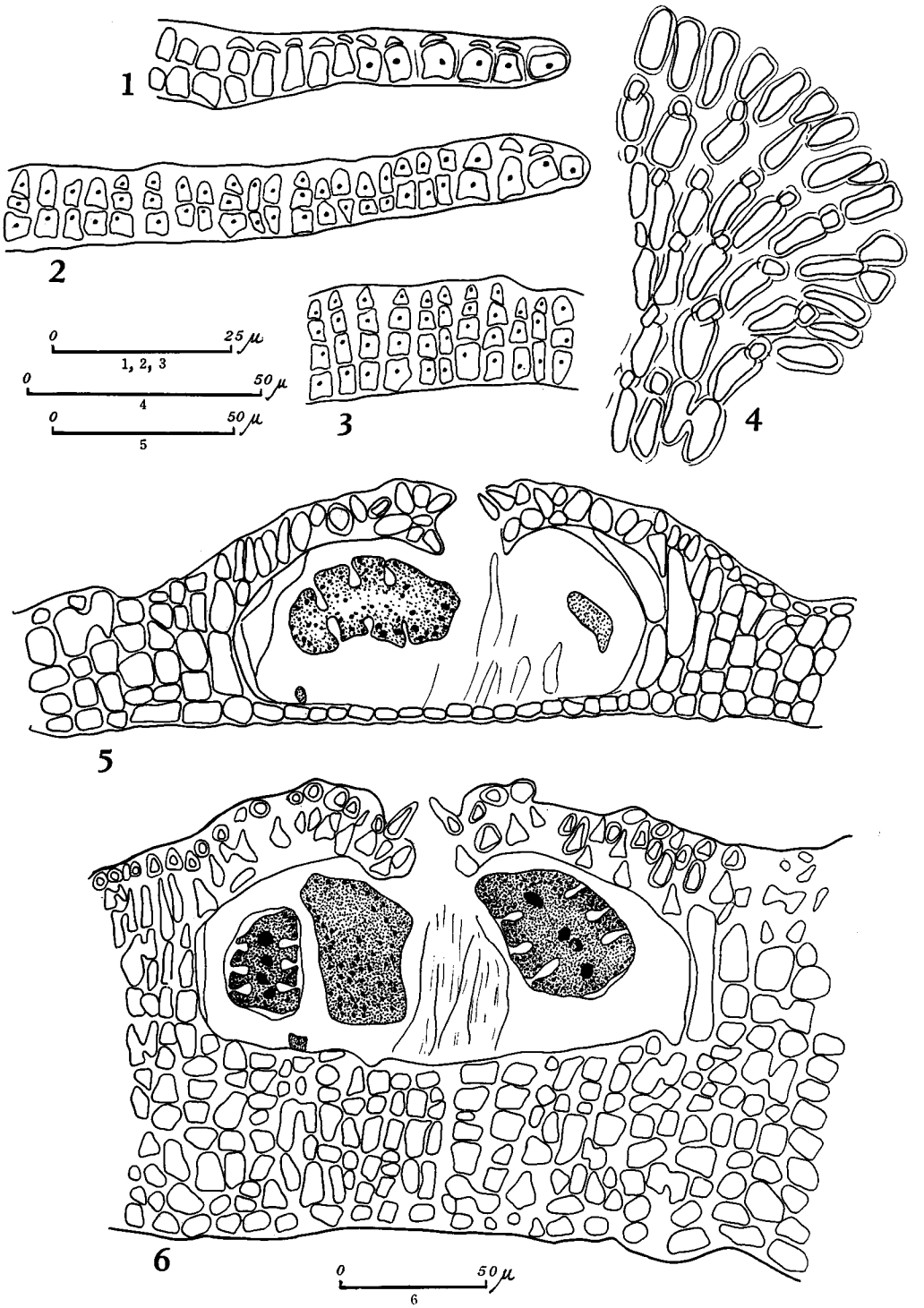
Melobesia sargassi Foslie

Fig. 1-3. Vertical section through the marginal portion of the thallus attached to a branch of the host

Fig. 4. Surface view of the marginal portion of a crust on a vesicle of the host

Fig. 5. Tetrasporangial conceptacle of a crust attached to a vesicle of the host showing the single-cell-layered base of the conceptacle

Fig. 6. Tetrasporangial conceptacle of a crust attached to a branch of the host showing the many-cell-layered base of the conceptacle



T. Masaki & J. Tokida: Studies on the Melobesioideae of Japan. VI

PLATE X

Melobesia sargassi Foslie

Vertical sections of fertile portions of plant

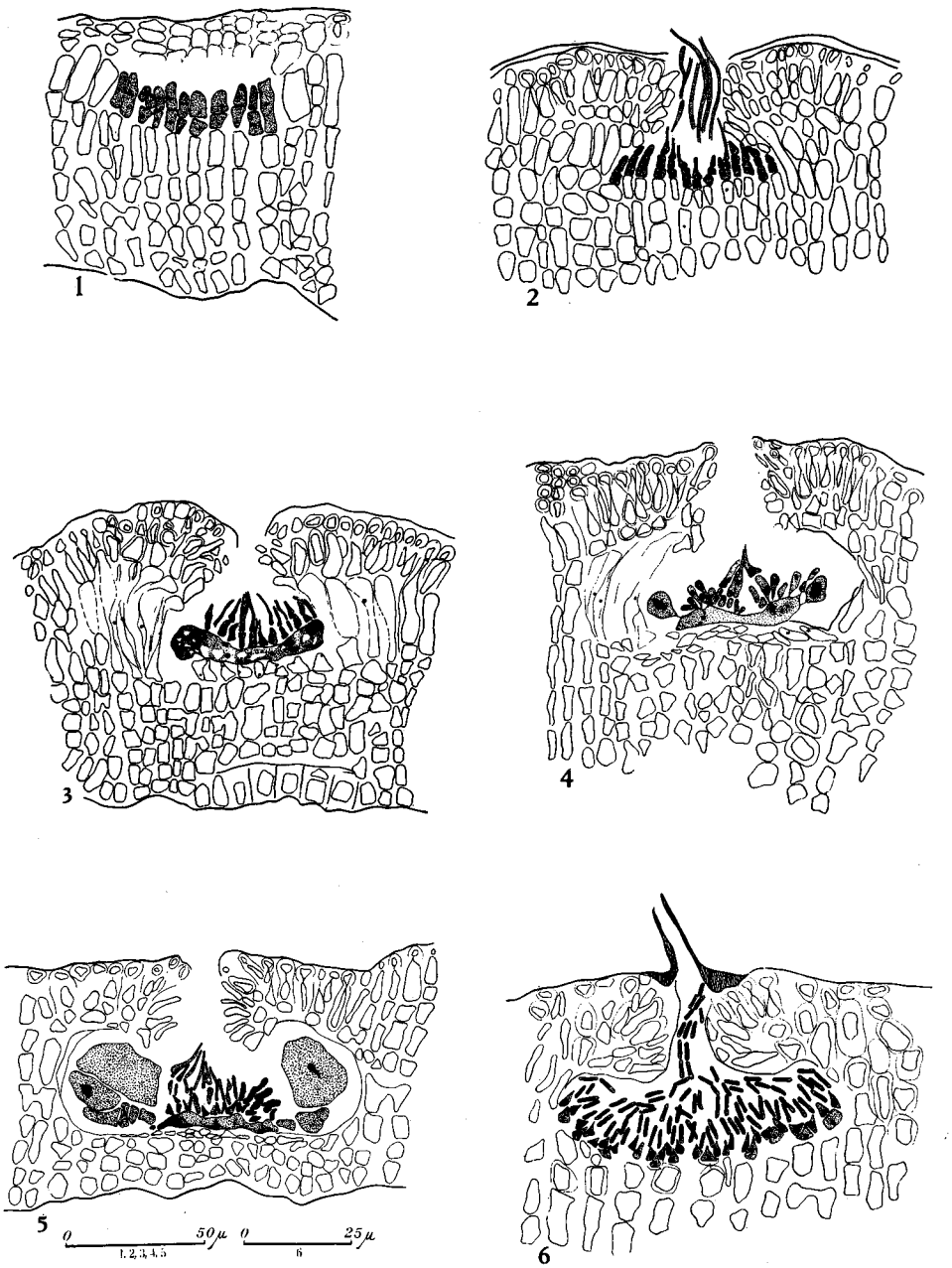
Fig. 1. Young procarpic conceptacle

Fig. 2. Procarpic conceptacle, matured but unfertilized yet

Fig. 3. Procarpic conceptacle, after the formation of a large fusion-cell

Fig. 4 & 5. Cystocarpic conceptacle

Fig. 6. Spermatangial conceptacle



T. Masaki & J. Tokida: Studies on the Melobesioideae of Japan. VI