

Marine Algae of Amchitka Island (Aleutian Islands). II. Bonnemaisoniaceae¹

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ABSTRACT: *Pleuroblepharis stichidophora* gen. et sp. nov., from Amchitka Island in the Aleutian Islands, is described as new to science. This taxon is the only representative of the Bonnemaisoniaceae (Nemaliales, Rhodophyta) collected at Amchitka. It is distinguished from other members of the family by the presence of macroscopic tetrasporophytes with compound tetrasporangial stichidia arising along the margins of laminate axes. These tetrasporic branchlets are homologous to indeterminate branches. Gland cells with brownish contents are present over the surface of the laminate axes and also on the stichidia. Although numerous specimens have been collected, tetrasporic plants are the only fertile stages observed so far.

THE FAMILY BONNEMAISONIACEAE (Nemaliales, Rhodophyta) is represented at Amchitka Island in the Aleutian Archipelago by a single species of an undescribed genus. The first paper in this series (Wynne, 1970) has furnished the historical background of phycological activity in the Aleutians and environs, and has also reported on the location of Amchitka Island and of the various collection sites mentioned in the present account.

Pleuroblepharis stichidophora gen. et sp. nov.

Figs. 1-12

Thalli ex axibus ramosis applanatis vittaformibus, 5-10 (-15) cm long., usque ad 4 mm lat. constantes; crescentia per singulam cellulam apicalem duas superficiales ad exsectionendum quae segmenta oblique alterneque exsectiunt habentem effecta; omne segmentum duas cellulas pericentrales oppositas exsectiens, quarum una ramulum (1 mm long.) determinatum subulatum efficit, altera primordium rami indeterminati potentis fingit; plurimi rami indeterminati possibiles in axibus processuum determinantum aborti manent. Superficies cellulis corticalibus cum glandicellulis conspicuis subbruneis intermixtis tecta. Plantae tetrasporicae solus status fertilis adhuc notae; tetrasporangia in ramulis usque ad 3 mm long. effecta; ramuli tetrasporici ramis indeterminatis homologi, itaque in

axibus processuum determinantum nascuntur; filamentum primum ramulorum tetrasporicorum uniseriatum, e cellulis trapezoideis quae duos ordines stichidiorum alternantium efficiunt compositum. Tetrasporangia cruciate divisa 50-55 μ diam., 2 (interdum 3) ad omnem altitudinem stichidii nisi segmentis infimis superioribusque reperta. Glandicellulae nemcon in stichidio repertae.

Thalli consisting of branched, flattened, ribbon-like axes, 5 to 10 (to 15) cm long, to 4 mm broad; growth by means of a single apical cell with two cutting surfaces which cut off segments obliquely and alternately, each segment cutting off two opposite pericentral cells, one of which gives rise to a determinate subulate branchlet (1 mm long) and the other represents the primordium of a potential indeterminate branch; most of the possible indeterminate branches remain undeveloped in the axils of the determinate processes. Surface (Fig. 4) is covered by cortical cells intermingled with conspicuous brownish gland cells. Cortical cells (Figs. 5, 6) with 12 to 20 platelike parietal chromatophores. Tetrasporic plants are the only fertile stages known so far; tetrasporangia develop in branchlets, or "compound stichidia," which are to 3 mm in length; tetrasporic branchlets are homologous to indeterminate branches and thus arise in the axils (Figs. 2, 9, 10) of the determinate processes; tetrasporic branchlets with a uniseriate main filament composed of trapezoidal cells, giving rise to two rows of al-

¹ Manuscript received April 24, 1970.

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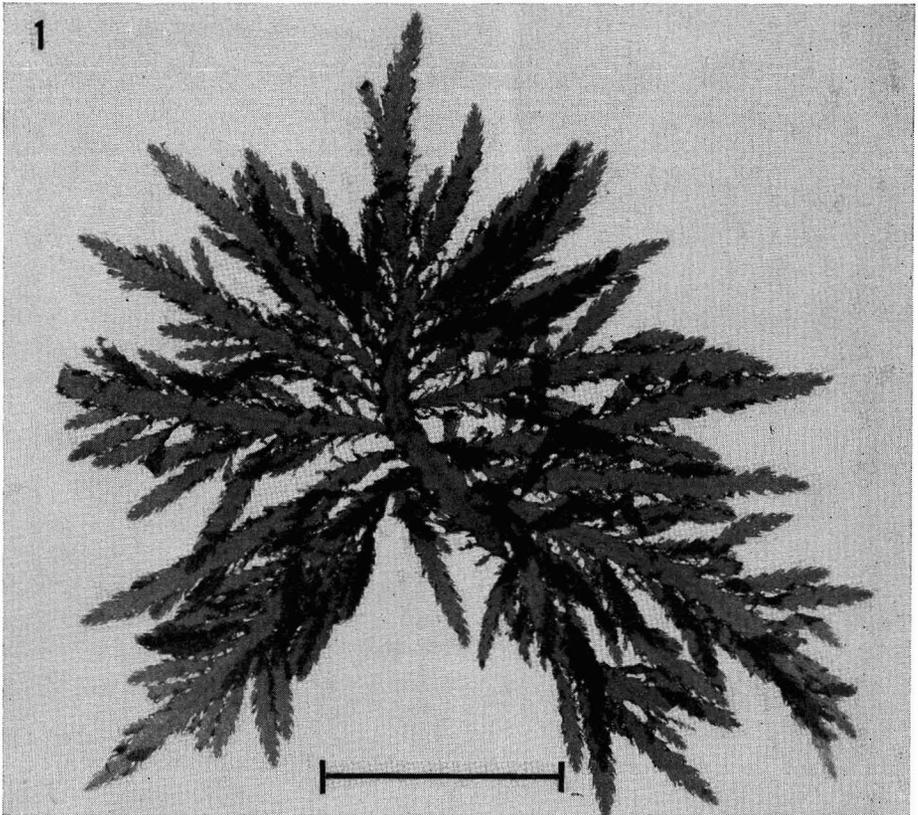


FIG. 1. *Pleuroblepharis stichidophora*. Holotype specimen (WTU 242770). Scale = 3 cm.

ternating stichidia (Figs. 11, 12). Tetrasporangia cruciately divided, 50 to 55 μ in diameter, with 2 (at times 3) tetrasporangia occurring at each level of the stichidium (Figs. 3, 7, 8), except for the lowermost and the upper segments. Gland cells also present on the stichidium.

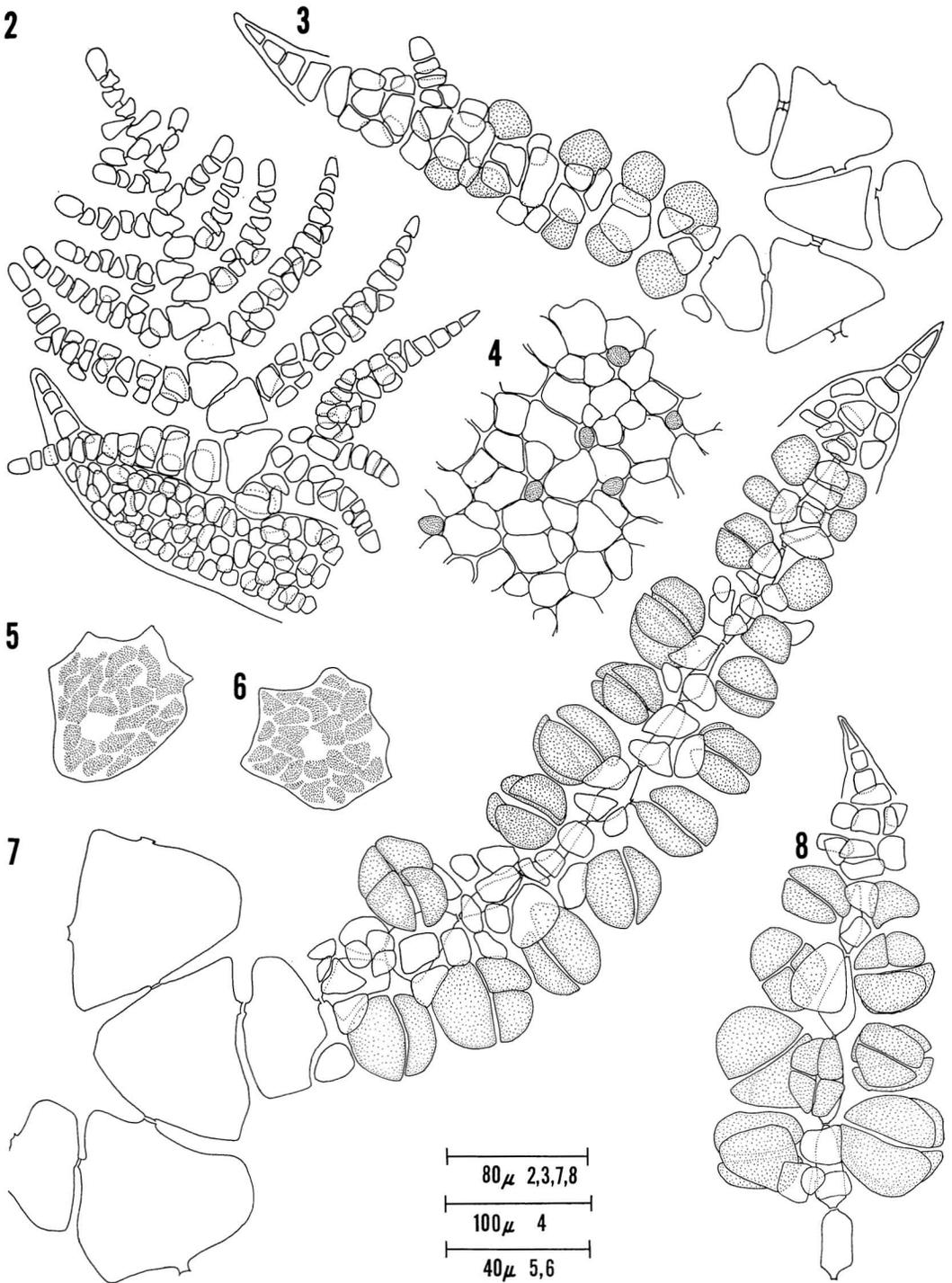
HOLOTYPE: A tetrasporic specimen (*Wynne* 1357) (Fig. 1), collected at St. Makarius Bay, Amchitka Island, March 16, 1968; deposited in the University of Washington Herbarium (WTU 242770). Isotypes deposited in the herbaria of the University of British Columbia, the University of California, and the University of Texas.

ADDITIONAL AMCHITKA COLLECTIONS: Constantine Harbor: iii.1968, *Wynne* 1348 (tetrasporic), *Wynne* 1510 (tetrasporic); iv.1969, *Lebednik* 312 (tetrasporic). Constantine Harbor dock: iv.1969, *Lebednik* 256 (tetrasporic);

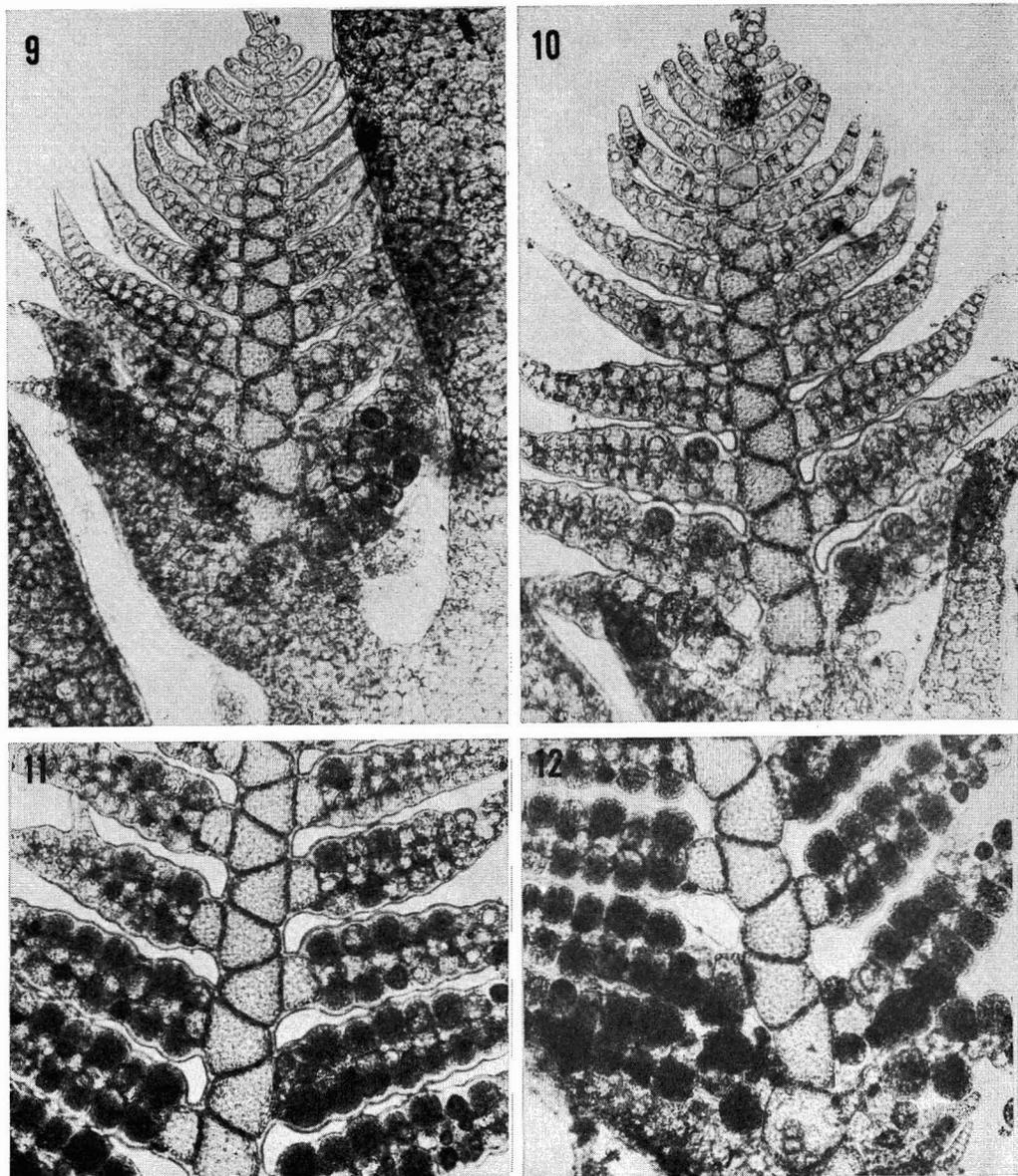
3–10 m). Square Bay: ix.1967, *Weinmann* 33, *Weinmann* 263 (on *Ptilota*); viii.1968, *Weinmann* 703A. Sea Otter Pen Cove: vi.1969, *Lebednik* 372 (on *Odonthalia*; 7–8 m). South Bight: xii.1968, *Lebednik* 125A. St. Makarius Bay: iii.1968, *Wynne* 1287 (tetrasporic); *Wynne* 1529 (tetrasporic). Rifle Range Point: iii.1968, *Wynne* 1490 (tetrasporic).

Specimens of *Pleuroblepharis stichidophora* are invariably epiphytic on the red algal genera *Ptilota* and *Odonthalia* and are collected either on the shore where the host has been cast up or in the sublittoral by diving. Although this alga has been collected during most of the year, fertile plants were encountered only in March and April, and all of the numerous specimens collected during these two months were tetrasporic.

The distinctive gland cells, which are characteristic of most members of the *Bonnemaisoniales*



FIGS. 2-8. *Pleuroblepharis stichidophora*. 2, Young tetrasporic branchlet. 3, Individual stichidium with immature tetrasporangia (shaded). 4, Surface of laminate axis (gland cells are shaded). 5, 6, Cortical cells of laminate axis with chromatophores (shaded). 7, Individual stichidium of mature tetrasporic branchlet, arising from uniseriate axis. 8, Portion of stichidium.



FIGS. 9-12. *Pleuroblepharis stichidophora*. 9, Young tetrasporic branchlet arising in axil of determinate branch; a sterile determinate branch has been developed at the lower left portion of the branchlet; $\times 128$. 10, Young tetrasporic branchlet with some tetrasporangia being differentiated; $\times 120$. 11, Mid-region of mature tetrasporic branchlet; $\times 114$. 12, Same as 11; $\times 110$.

iaceae, indicated the affinity of the new genus for that family. The brownish color of their contents is like that of the iodine cells is *Asparagopsis* (Feldmann and Feldmann, 1942) rather than that of the colorless glandular cells in *Bonnemaisonia*.

Preliminary Culturing Studies

Both foliar axes and tetrasporic branchlets were excised and placed in a culture medium of supplemented natural seawater. The foliar axes continued to grow as broad leafy thalli and maintained their normal structure. The uniseri-

ate axes, on the other hand, grew indefinitely as filamentous tufts, often reaching 2 cm in length, as contrasted with a length of about 3 mm on the naturally occurring plants. These tufts eventually ceased producing tetrasporangia but grew as vegetative uniseriate axes. Iodine cells continued to be cut off alternately between adjacent cells, resembling the pattern in the "Trailliella-stage" of *Bonnemaisonia hamifera* (see Chihara, 1961; Taylor, 1957). In culture the iodine cells become colorless and refractile. The mature vegetative cells of the axes are highly vacuolate and have numerous parietal chromatophores. Eventually the cultures died. At no time were sexual stages observed in nature or in culture.

Discussion

This remarkable new genus of the Bonnemaisoniaceae is distinguished from other genera of the family by the compound tetrasporangial stichidia, which arise along the margins of the flat axes. Until now the family has consisted of five genera (Kylin, 1956): *Bonnemaisonia* C. Agardh, *Asparagopsis* Montagne, *Ptilonia* J. Agardh, *Delisea* Lamouroux, and *Leptophyllis* J. Agardh.

Attention has been focused on this family since an alternation of heteromorphic phases was demonstrated in certain members. The tetrasporophyte of *Asparagopsis* is a polysiphonous filamentous phase referred to as the "Falkenbergia-stage" (Feldmann and Feldmann, 1939, 1942, 1952; Feldmann, 1965; Chihara, 1961). *Bonnemaisonia hamifera* and *B. nootkana* have dissimilar filamentous tetrasporophytes known as the "Trailliella-stage" (Harder and Koch, 1949; Chihara, 1961, 1965); however, the type species of the genus, *B. asparagoides*, apparently lacks a tetrasporic stage (Feldmann and Feldmann, 1942, 1946; Feldmann, 1966). This latter type of life history was also demonstrated in *Ptilonia okadai* by Chihara (1962). By culturing carpospores he obtained a "Hymenoclonium-stage" as the basal disc which returned the apparent gametophyte. The single report (Lucas and Perrin, 1947) of a tetrasporic specimen of *Ptilonia australasica* must be regarded as a dubious record.

An alternation of isomorphic phases has been reported in *Leptophyllis* and *Delisea*. In both *Leptophyllis conferta* (Levring, 1953, figs. 55 C

and G) and *Delisea fimbriata*³ (Levring 1953, fig. 55 B), which are the type species of these genera, tetrasporangia occur in sori located directly on the flattened axes (see also Kylin, 1956). Thus, *Pleuroblepharis*, with tetrasporangia developing in lateral filaments which arise from the margins of laminate axes, is strikingly different from the other members of this family.

Feldmann and Feldmann (1942) established the Bonnemaisoniales as a distinct order to emphasize the heteromorphic nature of the gametophytic and sporophytic phases of *Bonnemaisonia* and *Asparagopsis*. However, as has been pointed out above, this trait does not occur in all members of the family. Papenfuss (1966) argued against the family's separation from the Nemaliales despite Fan's (1961) supplemental information concerning the origin of the gonimoblast. The reports of heteromorphic life histories in other families of the Nemaliales (see Martin, 1969; Ramus, 1969; West, 1968) have provided additional support for the retention of Bonnemaisoniaceae within the Nemaliales. The presence of macroscopic tetrasporophytes in *Pleuroblepharis stichidophora* would at least suggest that it is another example of a species in the Bonnemaisoniaceae which does not have a heteromorphic life history. It will be of great interest to learn the nature of the sexual stages in this new genus.

ACKNOWLEDGMENTS

I am grateful to my colleagues Dr. R. E. Norris, Mr. P. A. Lebednik, and Mr. F. C. Weinmann for making available their Amchitka collections, made under US-AEC Contract No. AT (26-1)-171. I also wish to thank the US-AEC-Nevada Operations Office, which provided air transportation and field support enabling me to visit Amchitka to collect specimens. This study was begun during the tenure of a National Science Foundation postdoctoral fellowship at the University of Washington. Dr. R. E. Norris kindly gave me access to the culturing facilities

³ Contrary to Levring's observations of tetrasporophytes among Australian specimens of this species, Chihara (1962) reported that this species in Japan has a haplobiontic life history.

in his laboratory. I think Dr. H. Croasdale for providing the Latin diagnosis.

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