Norio SAHASHI*: **Morphological and taxonomical studies on Ophioglossales in Japan and the adjacent regions (9)****

Additional notes on *Sceptridium* in Isl. Oshima, Izu Islands

佐橋紀男*: 日本および近隣産ハナヤスリ目の形態学的分類学的研究 (9)

伊豆大島産オオハナワラビ属新知見への追加

Six new taxa of *Sceptridium* collected in Isl. Oshima, the Izu Islands, were reported by the author in this journal**. They were *S. triangularifolium*, *S. japonicum* var. *silvicola*, *S. ternatum* var. *pseudoternatum*, *S.* ×*argutum*, *S.* ×*elegans* and *S.* ×*pulchrum*. Morphological and cytological records of their spores will be given in this paper.

Spore morphology

1) Spores of *S. triangularifolium* are scattered during the season almost overlapping with those of *S. nipponicum* var. *n.*, but a little earlier.

Tetrahedral, trilete (Fig. 1. A), rarely irregular to shape monolete-like, amb ST to RT often TQ, PP flatly pyramidal to convex, DP hemispherical or often heavily arched; size 24(23-26)×27(24.5-31) μm; laesura arms 12-17 μm, thin ridge up to 2 μm tall at the proximal pole; exine light-yellow, semitransparent, ca 1.5 μm, thick, with somewhat fine rugulo-reticulate, lumina up to 3 μm in diameter on DF (Fig. 1. B), finely foveo-reticulate on PF; roughly fine granules scattering on the projected muri.

2) Spores of *S. japonicum* var. *silvicola* are very similar to those of *S. japonicum* var. *j.* and *S. atrovirens*, but a little larger.

Tetrahedral, trilete (Fig. 1. C), often somewhat irregular in shape to monolete-like, amb ST to RT or TQ, PP convex to nearly flat, DP hemispherical or often convex, 26(23-31)×31(28-35) μm in size; laesura arms 12-17 μm long, with somewhat prominent ridge, ca 2-3 μm tall at the proximal pole; exine

* School of Pharmaceutical Science, Toho University, Funabashi, Chiba Pref., Japan. 東邦大学 薬学部.
** Continued from Journ. Jap. Bot. 58: 240-247, 1983.

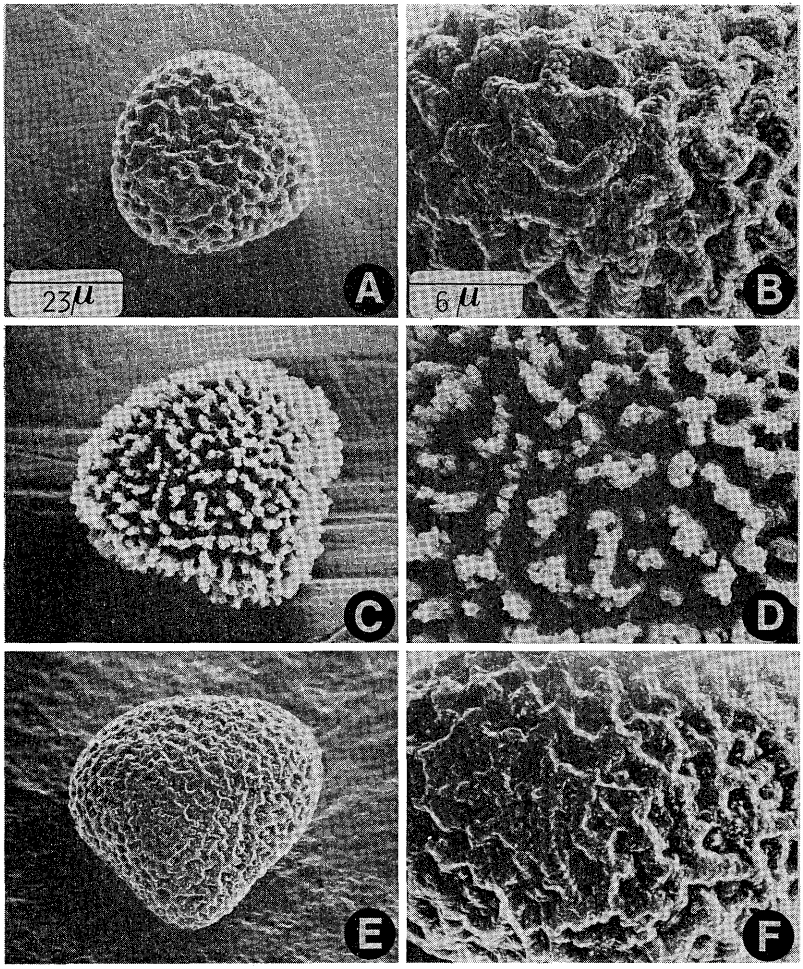

Fig. 1. SEM photomicrographs of spores (from holotype specimen). A-B. *S. triangularifolium.* A. Polar view, distal face, showing typical rugulo-reticulate ornamentation. B. A part of magnified distal face, showing dense granules on the muri. C-D. *S. japonicum* var. *silvicola.* C. Polar view, distal face, showing distinctly dense papillae. D. A part of magnified distal face, with irregular shaped muri, which have no reticulate ornamentation. E-F. *S. ternatum* var. *pseudoternatum.* E. Polar view, distal face, showing small rugulo-reticulate ornamentation. F. A part of magnified distal face, showing rugulo-reticulate ornamentation.

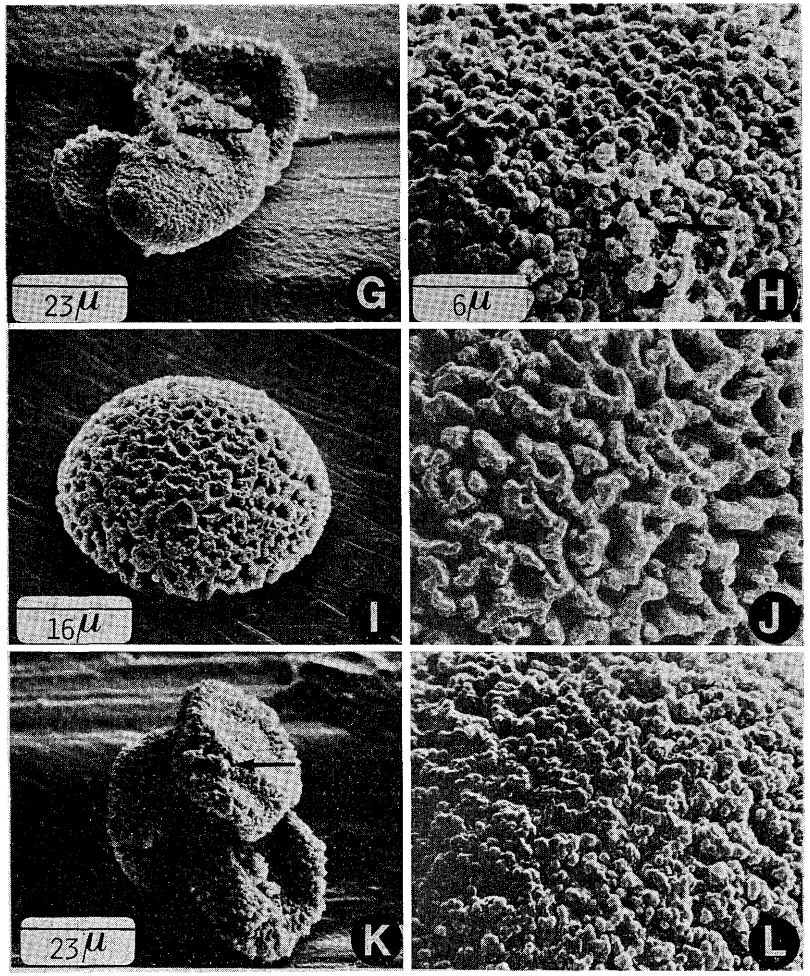

Fig. 2. SEM photomicrographs of spores (from holotype specimen). G-H. *S.* ×*argutum*. G. Abortive grains, showing tapetum deposit (arrow). H. A part of the magnification of spore shown in Fig. G, showing dense granules and tapetum deposit (arrow). I-J. *S.* ×*elegans*. I. Alete spore, without laesurae. J. A part of the magnification of spore shown in Fig. I, showing reticulum-like pattern. K-L. *S.* ×*pulchrum*. K. Abortive grains, showing tapetum deposit (arrow). L. A part of the magnification of spore shown in Fig. K, showing small and dense granules.

light-yellow, semitransparent, ca 1.5 μm thick, with irregular papillae or spinule-like projections as in the var. *japonicum*, 1.5–2.5 μm high, 0.5–1.5 μm in diameter at the base, papillae forming more or less interrupted ridges and sometimes forming a reticulum-like pattern (Fig. 1. D).

3) Spores of *S. ternatum* var. *pseudoternatum* are closely allied to those of *S. ternatum* var. *t.* and also *S. nipponicum* var. *n.*

Tetrahedral, trilete (Fig. 1. E), amb ST to often TQ or rarely RT, PP plano-convex, DP hemispherical or often heavily arched, 23 (21–25) × 28 (26–30) μm in size; laesura arms 10–15 μm long, with slender ridge, being up to 1.5 μm tall at the proximal pole; exine light-yellow, semitransparent, ca 1.5 μm thick, with small rugulo-reticulate on DF (Fig. 1. F), fine reticulum-like or foveo-fossulate patterns on PF, sparsely fine granules decorating on the muri.

4) *S.* ×*argutum*, *S.* ×*elegans* and *S.* ×*pulchrum* have abortive spores and none of mature spores was observed (Fig. 3. A, B, D) as those of *S.* ×*longistipitatum* (Fig. 3. C). Sometimes large alete spores (without laesurae) were found in all these hybrids. According to SEM observations, the abortive spores are deposited with tapetum residue (Fig. 2. G, H, K, indicated by arrows) which was derived from tapetum cell. These alete spores have thick exine (up to 3 μm in diam.), and are variable in size (35–60 μm in diam.). At high magnification under SEM, fine and dense granules (Fig. 2. H, L) or irregular murus-like lists or often bacula-like projections (Fig. 2. I, J) were seen on the whole surface of the spores. These patterns seems to be the basic sculptures of the spores of their parents (Fig. 1. B. D).

Cytological observations For the study of meiosis, young fertile fronds were fixed in the field in Newcomer's fluid and observed by squashed method. For the study of somatic chromosomes, root tips were fixed in 0.002 M 8-hydroxy-quinoline solution for 4 hours. They were fixed in 45% acetic acid for 20 min., and stocked in 70% alcohol solution for 4 days. Then the root tips were refixed in 45% acetic acid for 10 min., hydrolyzed in a mixture of 1 N HCl and 45% acetic acid (2 : 1) at 60°C for 5 min., and squashed on slides.

Chromosome numbers in meiosis of *S. triangularifolium* were counted n=45 (Fig. 4. A). None of irregular meiosis was observed. On the contrary, in *S.* ×*pulchrum* irregular meiotic division was observed and 90 univalents and 45 bivalents were counted (Fig. 4. B). Incidentally, the somatic chromosomes of *S.* ×*longistipitatum* were clearly observed during this study. It showed 2n=180

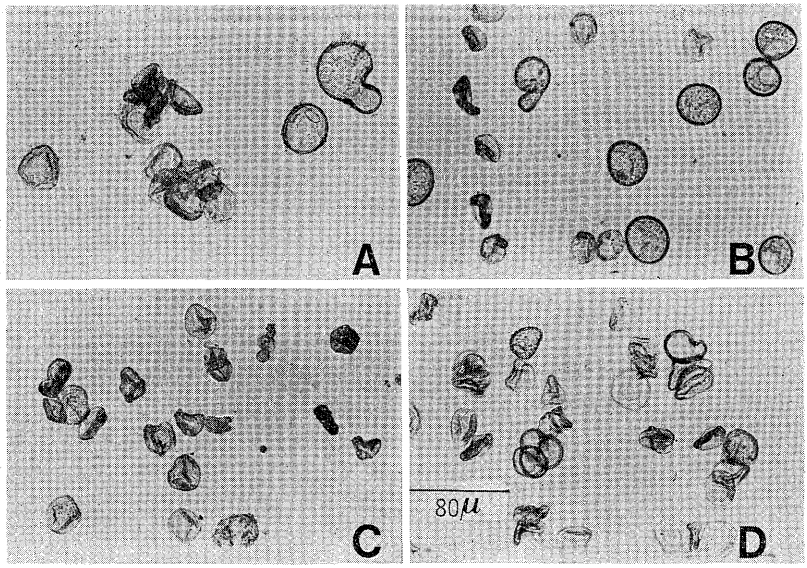

Fig. 3. Abortive spores of hybrid (from holotype specimen). A. *S.* ×*argutum*. B. *S.* ×*elegans*. C. *S.* ×*longistipitatum*. D. *S.* ×*pulchrum*.

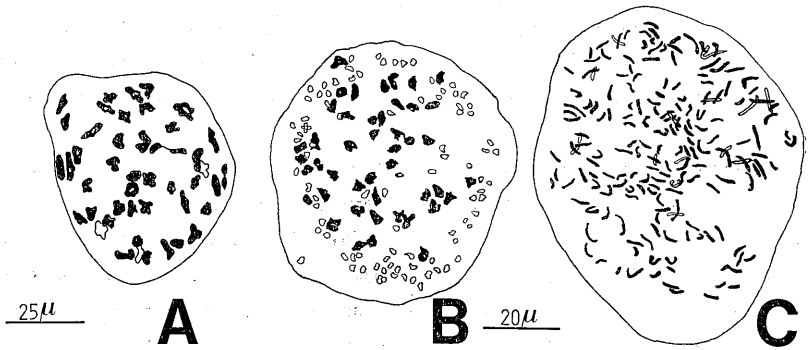

Fig. 4. Chromosomes of three species of *Sceptridium*. A. *S. triangularifolium*, showing n=45 chromosomes in meiosis. B. *S.* ×*pulchrum*, showing 90 univalents and 45 bivalents in meiosis. C. *S.* ×*longistipitatum*, showing somatic chromosome number 2n=180.

in root tip cells (Fig. 4. C).

The measured values of the stomata size (Fig. 5) allow a speculation that the chromosome numbers of *S. japonicum* var. *silvicola* may be n=135 and *S.*

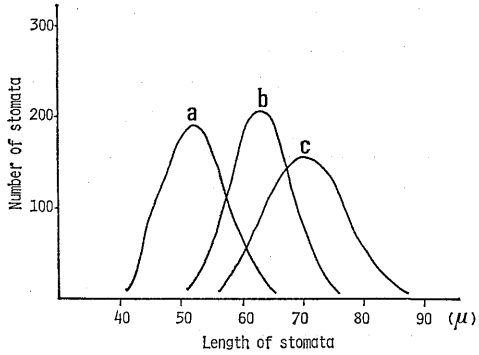

Fig. 5. Comparison of the length of stomata among the three chromosome races in *Sceptridium* from Isl. Oshima. a. n=45 (*S. ternatum* var. *t.* and var. *pseudoternatum**, *S. nipponicum* var. *n.* and *S. triangularifolium*). b. 2n=180, meiosis irregular (*S.* ×*argutum**, *S.* ×*elegans**, *S.* ×*longistipitatum* and *S.* ×*pulchrum*). c. n=135 (*S. japonicum* var. *j.* and var. *silvicola** and *S. atrovirens*). *This species is probably inserted here, though chromosome number is unknown.

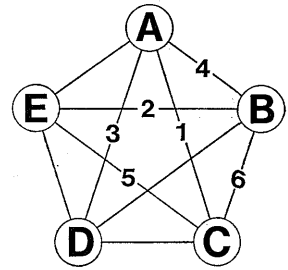

Fig. 6. Putative hybrids and their possible parent species of *Sceptridium* in Isl. Oshima. A. *S. japonicum* var. *j.* B. *S. nipponicum* var. *n.* C. *S. atrovirens.* D. *S. triangularifolium.* E. *S. ternatum* var. *t.* 1. *S. japonicum* var. *silvicola.* 2. *S. ternatum* var. *pseudoteratum.* 3. *S.* × *argutum.* 4. *S.* ×*elegans.* 5. *S.* ×*longistipitatum.* 6. *S.* ×*pulchrum.*

ternatum var. *pseudoternatum* may be n=45, whereas two hybrids, *S.* ×*argutum* and *S.* ×*elegans* may be 2n=180.

There are five species in Isl. Oshima. They are *S. japonicum* (n=135), *S. nipponicum* (n=45), *S. atrovirens* (n=135), *S. triangularifolium* (n=45) and *S. ternatum* (n=45) (Fig. 6. A-E). Ten putative hybrids are expected between each two of them theoretically, but only six hybrids are found at present (Fig. 6. 1-6). Two of the six hybrids were described as a variety of one of two parent species, respectively, in my previous paper. They are *S. japonicum* var. *silvicola* (putatively A×C) and *S. ternatum* var. *pseudoternatum* (B×E). Further discussions will appear afterward.

A key to the taxa of *Sceptridium* in Isl. Oshima

1. Spores normal, tetrahedral, trilete; plants rather lax or stout, 15-60 cm high.
   2. Spores with spinule-like pattern; fertile stalks stand even after spore scattering.
      3. Sterile blades deep-green and grossy; segments oblong to ovate, somewhat acute or obtuse, with crenulate or roughly serrate margins .... *S. atrovirens*

3. Sterile blades green to dark-green, without shiny; segments elongate, acute, with sharply serrate margins..... *S. japonicum* var. *j.*
3. Sterile blades dark-green, more or less glossy; segments somewhat elongate, acutish, with irregularly serrate or crenulate margins..... ..... *S. japonicum* var. *silvicola*

2. Spores with rugulo-reticulate pattern; fertile stalks fall down after spore scattering.
3. Blades latericious in midwinter, and lime-green in autumn and spring.
4. Segments more or less elongate, acute or acutish, with mostly minutely serrate..... *S. nipponicum* var. *n.*
4. Segments not elongate, obtuse or somewhat acute, with entire or crenulate margins..... *S. ternatum* var. *pseudoternatum*
3. Blades mostly green even in midwinter.
4. Segments not elongate, obtuse or more or less acute, with entire or crenulate margins..... *S. ternatum* var. *t.*
4. Segments more or less elongate, acute, with mostly minutely serrate margins ..... *S. triangularifolium*

1. Spores abnormal, abortive; plants large and rather lax, 35–65 cm high.
2. Blades latericious in midwinter, and lime-green in autumn and spring.
3. Blades membranous to herbaceous; segments lanceolate to oblong, acute, with finely and sharply serrate margins..... *S.* ×*elegans*
3. Blades thick-herbaceous; segments elongate, acutish, with minutely serrate to crenulate margins..... *S.* ×*pulchrum*
2. Blades mostly green even in midwinter.
3. Blades membranous; segments lanceolate to oblong, acute, with finely and sharply serrate margins..... *S.* ×*argutum*
3. Blades thick-herbaceous; segments more or less elongate, acutish or often obtuse, with minutely serrate to crenulate margins .... *S.* ×*longistipitatum*

* * * *

前報で記載した伊豆大島産オオハナワラビ属の新種1，新変種2および新雑種3の胞子の形態および染色体数について報告した。また同島産11分類群間の関係を論じ，さらにそれらについて検索表を与えた。