

THE DISCOVERY OF *MONOSOLENIUM TENERUM* IN TAIWAN

by

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It was in 1960 the writer found large patches of *Monosolenium tenerum* Griffith growing widely on the floor of a diffused greenhouse designed for raising pot flowers in the south of our main glass-house of the Botany Department, National Taiwan University. Because of its peculiar combination of characters, its position has remained a puzzle to her for several years. Then in June 1965, Dr. Margaret Fulford of the University of Cincinnati, after having seen a specimen of the plant which the writer sent to her and after reading her manuscript, suggested that she send it to Dr. J. Proskauer of the University of California, a well-known authority on Marchantiales, for identification. Immediately, the writer was favored with Dr. Proskauer's kind reply which reads as follows:

"I am not surprised that the plant puzzled you. Its combination of characters is indeed so peculiar that for many decades after its original description in 1849 people believed that the original author, Griffith, had largely imagined it! And even today few people are aware of its existence. Only 30 years ago it was unnecessarily redescribed in Japan. The plant is *Monosolenium tenerum* Griffith.

syn. *Dumortieropsis liukiensis* Horikawa.

Originally collected in the Himalayas, its range extends all the way to Japan....."

Since the discovery of its growing on the campus of the National Taiwan University, we know its range extends south of Japan to Taiwan and reaches to Canton, for Goebel discovered this plant on the soil of tea plants imported from Canton 1915-1918⁽⁵⁾. Numerous illustrations were given in his "Organographie de Pflanzen"⁽⁴⁾. Tatuno collected *Monosolenium tenerum* Griffith from Liukiu and also from southern Japan in 1941⁽¹³⁾ and reported its chromosome number in gametophytes, $N=9$, 1957⁽¹⁴⁾.

Since *Monosolenium tenerum* Griffith is a rare and noteworthy liverwort and this is the first record of it in Taiwan, a proper presentation of the plant seems necessary, especially to those who are not aware of its existence here before. The original description from Griffith's hand-written manuscript deposited in Kew, England, is quoted as follows:

"No. 2. *Monosolenium*.—Iconogr. Assam, t. 39, t. 2.

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Aggregata, caespites densos informes formans. Frondes depressae, amoene virescentes, tenerae, membranaceae, spathulatae, simplices vel divisae, subrepandae, apice bilobae, infra radicanter praesertim secus venam unicam centralem crassam purpurascens. Anatomia cellulosa, cellulis¹⁾ laxis rotundatis oblongisve, paginae inferioris in radículas saepe elongatis. Cuticula²⁾ prorsus nulla. Radiculae longae, simplices saepe undulatae, hyalinae, teniores vacuae granulas numerosas continentes, his receptaculi intra involucra ortis et in pedunculi sulcum decurrentibus. Receptaculum peltatum, breviter pedunculatum, lobatum, supra concavum et punctis³⁾ multis albis opacis notatum, marginibus erectis undulatis inflexis-infra plicato-convexum. Pedunculus linealis, supra vel postice sulcatus, sulco radículas receptaculi foventes. Thecae globosae, tot quot lobi receptaculi et iis alternantes, brevissime stipitatae sitae (et reconditae) in fundo cavitatis eduplicatione frondis ortae, extrorsum hiantes, oris margine supero truncato, stylo theca duplo brevior apice dilatato, medio space-lato coronata, e membrana cellulosa.

Theca interna membranacea, tenuissima, e cellulis lineari-angulatis, cellularum vestigiis hinc illinc adhaerentibus. Sporula junior fluido mucilaginoso immersa, filis irregularibus grumosis immixta, constantia e cellulis ovatis massam grumosam continentibus.

Involucrum e duplicatura frondis ortum—supra planum, infra plicato-convexum—extrorsum hians oris margine supero truncato. In receptaculi pagina inferiore insidentes vidi corpora bina approximata theciformia, e cellulis irregularibus superimpositis singulis seriebus. Juncturis seriei elevatis et plicam quasi referentibus, apice planiusculo e cellulis radiantibus, his disci minimis obovatis. Dehiscunt lapsu hujus membranae tumque theca apice multidentata. Cellularum serie quaque cellulam unicam fibre spirali donatam referente—Nuda tantum vidi.

Legit Wallichius primo in agris arenosis Cheikwar cum *Antheroceroti* arctissime mixtum. Postremum reperi in sylvis Theae in humidis copiose vigentem.

Sporula maturiora e nucleo 3-nato rarius 4-nato grumoso in cellula contenta mixta cum cellularum vestigiis quam maxime irregularibus.”

A Description of *Monosolenium tenerum* Griffith based on the Taiwan plants.

Thallus monoicous, 2–3 cm. long, 5–7 mm. broad (Fig. 1), growing in extended dark green patches, appressed to moist rocks and on shaded ground in green-houses. Stems prostrate, creeping, furcate, slightly ascending at apical ends, with filamentous, evanescent underleaves (Figs. 6, 7), numerous rhizoids of both smooth and tuberculate types, triangular in cross section (Fig. 7), and a midrib without a central strand. Margins of the thallus more or less undulate, and the transverse section (Figs. 3, 4, 5) being 13–16 cells high in the middle, 1–5 cells on the wings; dorsal epidermal cells 5–6 angled (Figs. 2, 5), having numerous starch grains and

chloroplasts, as shown by iodine test, in each cell, brown cells with distinct oil bodies (Fig. 2) and other products scattered here and there in the epidermis.

Antheridia and archegonia are borne on respective receptacles on the upper surface near the apical regions of the thallus. The female receptacle always arising from a notch near the apex of the thallus, and the male receptacle situated slightly posterior to the former. The female receptacle supported by a short, bi-furrowed peduncle (Fig. 13), appearing sessile at first, and slightly raised at maturity (Fig. 14) is covered with a somewhat circular receptacle-sheath on the top, protecting the archegonia below. Its transverse section resembles the indusia of ferns, protecting the sori beneath (Figs. 8, 9). Ventral scales (Goebel⁽⁴⁾ P. 55, Fig. 6) in various stages have been frequently found from the ventral side of female receptacles (Fig. 18). They look like protonema of *Schiffneria viridis*. The presence of oil cells in the epidermis and marginal mucous papillae on these structures is very evident.

The male receptacle is also sessile and somewhat circular in gross outline, the antheridia are borne in groups arising from the cells near the upper epidermis of the thallus, partially raised above the surface.

Sporophytes in young stages appear sometime from November to December (Figs. 8, 9) and mature in March. Two to four sporophytes often mature in each cavity of the receptacle (Figs. 14, 15), but only two were described by Griffith. The globose capsule with a roughened surface is slightly stipitate (Fig. 16), about 1 mm. in diameter it is light green to dark-brown, and dehisces irregularly into fragments; the seta is white and fragile, less than 1 mm. high. Young spore mother cells are yellowish-green, full of sap granules, immersed in a mucilaginous substance, and the tetrads become black, and are angular and reticulate to coarsely papillose on the margins at maturity, measuring 38–45 μ in diameter (Figs. 11, 11.1), and often remaining together a longer period than those in other hepatics. Elaters are few, about 70 μ long and 20 μ wide, spiral single, but some are shorter and lobed without spirals (Figs. 12, 12.1). Involucre and perianth are lacking in all the specimens examined.

Monosolenium belongs to the order *Marchantiales*, according to Griffith⁽⁶⁾; two other genera of this order lack air chambers in the thallus, these are: *Dumortiera* and *Monoclea*, the former is common in Taiwan and the latter occurs in North and South America and New Zealand. The thallus tissue of both *Monosolenium* and *Monoclea* contains distinct idioblasts but in the former, they are restricted to the epidermis only. A transverse section of *Monosolenium tenerum* Griffith of Taiwan further reveals a resemblance to *Moerckia stotowiana* (Nees) Schiffn. in its lack of a central strand in the midrib, in addition to the undulate margins of the thallus.

Dr. H. Inoue of the National Science Museum of Japan, however, has proposed a new family, the *Monosoleniaceae*, segregating *Monosolenium* from the *Marchantiaceae*, based on the following four distinct characters:

1. Thallus possessing no air chambers

2. Dark oil bodies limited to the epidermal cells
3. Presence of primitive lobed elaters containing chloroplasts
4. Having no trace of involucre and perianth

As it was indicated in the original description, *Monosolenium tenerum* Griffith was found growing mixed with *Anthoceros*. It is also true here in Taiwan that these two liverworts are always closely associated in the same habitat. In comparing the elaters of *Anthoceros*, with those of *Monosolenium*, it is evident that the inner walls of the former are largely smooth or irregularly thickened, and two or more cells may be joined end to end (Fig. 12.2) in simple or branched chains⁽²⁾, while those of the latter are sometimes smooth and lobed, others are thickened in a single spiral as in Figs. 12 and 12.1. The young elaters of these two liverworts are very similar and they are apparently different from those with long and coiled spiral thickenings in other liverworts. Furthermore, in the ontogeny of their sporogenous cells, both *Anthoceros* and *Monosolenium* contain definite chloroplasts⁽¹⁾⁽⁹⁾.

In the light of the above comparisons, both *Anthoceros* and *Monosolenium* have short and lobed elaters and both contain chloroplasts in their sporogenous cells. We can interpret this to mean that during the course of evolution there was a relationship between the two liverworts, in spite of their extreme differences in sporophytic and gametophytic developments. The sporophytic phase in *Monosolenium* of Taiwan is very ephemeral and the gametophytic phase is essential to maintain the existence of the plant by vegetative growth. Moreover, the thalli with sex organs are usually found in dry areas while those without reproductive structures often grow in wet and more favorable places. This may indicate that sexual reproduction in *Monosolenium* only serves to bridge over certain unfavorable conditions, and not to multiply new individuals.

We may conclude that the simplicity in the sporophyte of *Monosolenium* is probably due to the overshadowing of the vegetative growth of the gametophyte; and likewise, the similarity revealed in the elaters of *Anthoceros* and *Monosolenium* and the chloroplasts contained in their respective sporogenous cells, may also indicate a phylogenetic relationship between these two hepaticae.

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Explanation of Figures

- Fig. 1. Thallus $\times 7$
- Fig. 2. Upper epidermal cells showing one cell with brown oil bodies $\times 616$
- Fig. 3. Cross section of thallus $\times 30$
- Fig. 4. Portion of wing enlarged $\times 660$
- Fig. 5. Cells from midrib $\times 660$
- Fig. 6. Filamentous underleaves $\times 150$
- Fig. 7. Rhizoids and underleaves enlarged $\times 660$
- Fig. 8. Cross section of thallus showing female receptacle and archegonia $\times 30$
- Fig. 9. Young sporophyte $\times 30$
- Fig. 10. Cross section of male receptacle $\times 150$
- Fig. 11. A mature spore $\times 720$
- Fig. 11.1 Tetrads $\times 240$
- Fig. 12. Elater $\times 720$
- Fig. 12.1 Young elaters $\times 240$
- Fig. 12.2 Young elaters of *Anothoceros* $\times 240$
- Fig. 13. Portion of bi-furrowed peduncle of a female receptacle $\times 33$
- Fig. 14. Portion of thallus showing peduncle slightly raised, ventral view $\times 10$
- Fig. 15. Mature sporophytes arising from each cavity $\times 10$
- Fig. 16. A detached sporophyte $\times 33$
- Fig. 17. Sporophyte in cavity, side view $\times 14$
- Fig. 18. A ventral scale with mucous papillae on its edge $\times 140$

