

Contribution to the *Bazzania* flora of the Philippines. 1. *Bazzania subtilis* and similar species

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Abstract: UWE SCHWARZ, ALFONS SCHÄFER-VERWIMP, JAMES R. SHEVOCK (2023): Contribution to the *Bazzania* flora of the Philippines. 1. *Bazzania subtilis* and similar species. *Frahmia* 33:1-84¹.

Bazzania species that look similar to *B. subtilis* which were collected by the first and third author in the Philippines are described and illustrated. Amongst these specimens *B. acanonista* and *B. globuliformis* were described as new to science. Furthermore *B. herzogiana*, *B. sikkimensis*, *B. vittata*, and *B. wiltensii*, mentioned by other authors for their similarity with *B. subtilis* are also included. The critical comparison with herbarium specimens stored under, named or synonymized with *B. subtilis* resulted in the separation of the newly described *B. acanoserrata*, *B. helgana*, *B. helgana* var. *minor*, *B. palmatifidoides*, and *B. reicheliana*. In addition, *B. indigenarum*, *B. palmatifida*, and *B. pulchella* were studied and found to be species worthy of recognition.

1. Introduction

First records of *Bazzania* species from the Philippines date back to 1836. C. GAUDICHAUD-BEAUPRÉ collected plants in or near Manila which were later named as *Mastigobryum manillanum* GOTTSCHKE EX STEPH. Further collections of *Bazzania* species were made by C.G. SEMPER during his exploration of the Philippines in 1860 (*Mastigobryum semperi* STEPH.), by G. WALLIS 1870 (*Mastigobryum philippinense* STEPH.), W. MICHOLITZ 1884/85 (*Mastigobryum minutidens* STEPH.) and A. SCHADENBERG in 1889 (*Mastigobryum schadenbergii* STEPH.).

At the beginning of the 20th century botanical exploration of the Philippines was intensified. *Bazzania* records were obtained for example from H.M. CURRAN, E.B. COPELAND, A.D.E. ELMER, W. MACGREGOR, E.D. MERRILL, C.B. ROBINSON, and H.N. WHITFORD.

After World War II these studies continued by local botanists or visitors from abroad, e.g. G.E. EDAÑO during the late 1940s, J.V. PANCHO in mid 1960s or H.A. MILLER around the same time.

DEL ROSARIO (1975) critically evaluated and summarized the available information about *Bazzania* in the Philippines. His work remains one of the most valuable sources for studying this genus in this area. *Bazzania* records in the checklist of Philippine Hepaticae (TAN & ENGEL [1986]) are based to a major degree on his findings. There is unfortunately no modern treatment of the genus in the Philippines currently available.

As the first author holds a major collection of *Bazzania* specimens from the Philippines and the third author collected intensively in this area it was obvious to look into the samples more closely. The specimens by the first author origin from collections between 1999 and 2001 in the central and southern part of the Philippines, partially together with DR. FELIX SCHUMM. The third author visited locations on Mindanao, Negros and Camiguin Island between 2017 and 2022. Figure

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1 shows the locations where *Bazzania* specimens were collected, including also those from species that are not addressed in this article.

One of the challenges the authors faced during the identification were specimens that could be identified as *Bazzania subtilis* (SANDE LAC.) SCHIFFN. Already the material from the Philippines showed a wide range of variation. Therefore, the authors decided to include material from South East Asia, Australia and the Pacific Islands as well to refine the species concept.

Species that were mentioned by different authors in showing a resemblance to *Bazzania subtilis* were also studied and treated in this article.

Observations about selected characters, like papillosity or stem characters have been added, even though a more comprehensive overview about the morphology of *Bazzania* is needed.

2. Historical account of species around *Bazzania subtilis*

Bazzania subtilis was described as *Mastigobryum subtile* by SANDE LACOSTE (1864) based on plants collected by Teysmann in Java (Gunung Gede and Gunung Salak). He also mentions a specimen by Korthals from Sumatra. His drawing (tab. VII) shows leaves that are predominantly trilobate even though the description states “apices truncates 2 – 3 dentatis”. Other main characters were the 2 – 3 rows of enlarged cells and the small, distant underleaf with 4 lobes. He refers to similarities to *Mastigobryum vittatum* GOTTSCHKE in GOTTSCHKE, LINDENB. & NEES with a denser foliation and unlobed underleaf.

Plants which were later synonymized with or mentioned as similar to *B. subtilis* by KITAGAWA (1979) were described by STEPHANI 1908 and 1924 as *Mastigobryum palmatifidum* STEPH. and *Mastigobryum indigenarum* STEPH. respectively.

Drawings by STEPHANI (1985) (Icones no. 7431 and 7432) of *Mastigobryum subtile* are based on material from Amboina collected by TEYSMAN. They show 2 different forms, one that is mostly bilobate with crenulate leaf margin (no. 7341) and one that is mostly trilobate with a rather weak crenulation. STEPHANI (1908) described *Mastigobryum subtile* as a plant with crenulate leaf margin. MEIJER (1960) already rose doubts that the species from Amboina belongs to *Bazzania subtilis*.

HERZOG (1950) described *Bazzania remotifolia* nom. ill. (= *Bazzania herzogiana* MEIJER) based on material from Borneo. He compared the plants with *B. vittata* but states as a distinguishing character the underleaf with 4 truncate lobes and the small size.

DEL ROSARIO (1975) followed the approach STEPHANI used in naming bilobate (partially trilobate) species with vitta and respective underleaves as *B. subtilis* because DEL ROSARIO studied *Bazzania* material from Geneva as indicated by notes he made on the specimen.

KITAGAWA (1977) and KITAGAWA (1979) dealt with members of this group. His excellent descriptions and drawings allow a good judgment on the species he had on hand. His treatment of *Bazzania subtilis* based on material from Borneo shows plants with predominantly trilobate leaves with a rather smooth apical margin. The Bornean plants look very similar to the ones from the original description (SANDE LACOSTE [1864]). Unfortunately, his understanding of *B. palmatifida* did not match the original description. STEPHANI (1908) described *M. palmatifidum* as a member of the section *Fissistipulae* which is supported by the leaf shape (STEPHANI [1985] Icones no. 7213) and the large trigones. KITAGAWA (1979) already mentioned the relation to *Bazzania indigenarum*. The type collection of *B. indigenarum* in G includes a handwritten note by MITZUTANI from 1976 who synonymized this species with *B. palmatifida*.

GROLLE (1980) synonymized *Mastigobryum pulchellum* (STEPH.) H. A. MILL. and *M. palmatifidum* with *Bazzania subtilis* in his work about liverworts from Samoa based on the examination of the lectotype of *B. subtilis* (L), the holotype of *M. palmatifidum* (G) and material of *M. pulchellum* from Samoa. The review of material stored under *B. subtilis* in JE

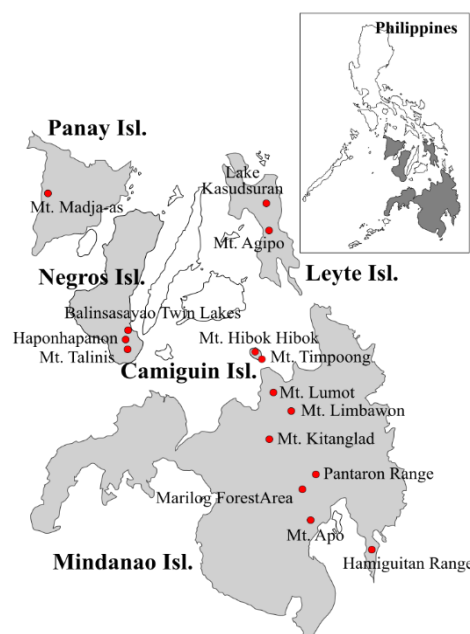


Figure 1: Collection Areas

indicates that GROLLE had a rather broad concept of *B. subtilis* which is not followed in this article. The judgement of the different forms will be handled under the respective species.

MEAGHER (2019) mentions a collection of *B. subtilis* from Australia. His drawings and the description however, indicate the identity of the plants are a different species than *B. subtilis*.

Mastigobryum repandistipulum STEPH. was synonymized under *Bazzania tridens* by KITAGAWA (1972:451). It was erroneously filed under *Bazzania subtilis* by LEE ET AL. (2022).

Based on the sources mentioned and the specimens studied by the authors, we came to the conclusion that the following forms should be handled as separate species:

- Predominantly trilobate forms with rather smooth upper leaf margin
Bazzania subtilis sensu: SANDE LACOSTE (1864), KITAGAWA (1977)
➤ treated as ***Bazzania subtilis*** in this paper
- Predominantly bilobate forms with crenulated upper leaf margin
Bazzania subtilis sensu: STEPHANI (1908), DEL ROSARIO (1975), and most of the other authors from the region
➤ treated as ***Bazzania acanonista* sp. nov.** in this paper
- Forms with truncated underleaf lobes
Bazzania herzogiana sensu: HERZOG (1950), MEIJER (1960)
➤ treated as ***Bazzania herzogiana*** in this paper
- Medium sized trilobate forms with serrate, hooked leaf lobes and long underleaf lobes
Bazzania subtilis sensu: MEAGHER (2019), *Bazzania palmatifida* sensu: KITAGAWA (1979, except his drawing from the type of *B. palmatifida*)
➤ treated as ***Bazzania helgana* spec. nov.** in this paper
- Small trilobate forms with short leaves, serrate leaf lobes and short underleaf lobes
Bazzania pulchella sensu: STEPHANI (1908) and other authors prior its synonymization with *B. subtilis*
➤ treated as ***Bazzania pulchella*** in this paper
- Trilobate forms with constricted leaves below the apex, divergent leaf lobes, broad non-vittate lamina and enlarged trigones
Bazzania palmatifida sensu: STEPHANI (1908)
➤ treated as ***Bazzania palmatifida*** in this paper
- Trilobate forms with slightly constricted leaves below the apex, fragile underleaf lobes, broad non-vittate lamina and enlarged trigones
Bazzania indigenarum sensu: STEPHANI (1924)
➤ treated as ***Bazzania indigenarum*** in this paper

In addition to these forms four new species and one new variety were discovered in the specimens from Australia, Philippines, New Caledonia, New Guinea, and Malaysia, here described as ***B. acanoserrata* sp. nov.**, ***Bazzania globuliformis* sp. nov.**, ***Bazzania palmatifidoides* sp. nov.**, ***B. reicheliana* sp. nov.**, and ***Bazzania helgana* var. minor** var. nov.

3. Remarks on selected characters

Papillosity

The cell walls of a number of *Bazzania* species are described as verrucous, papillose or striolate by various authors. While studying older herbarium material, hot potassium hydroxide (KOH) was used to reproduce the original shape of cells. This process also led to the disappearance of the verrucous structures on the cell wall (see Figure 2 A, B). Depending on the species these structures might be more durable, e.g., in *Bazzania manillana* (GOTTSCHE EX STEPH.) S. HATT. (see Figure 2 C, D).

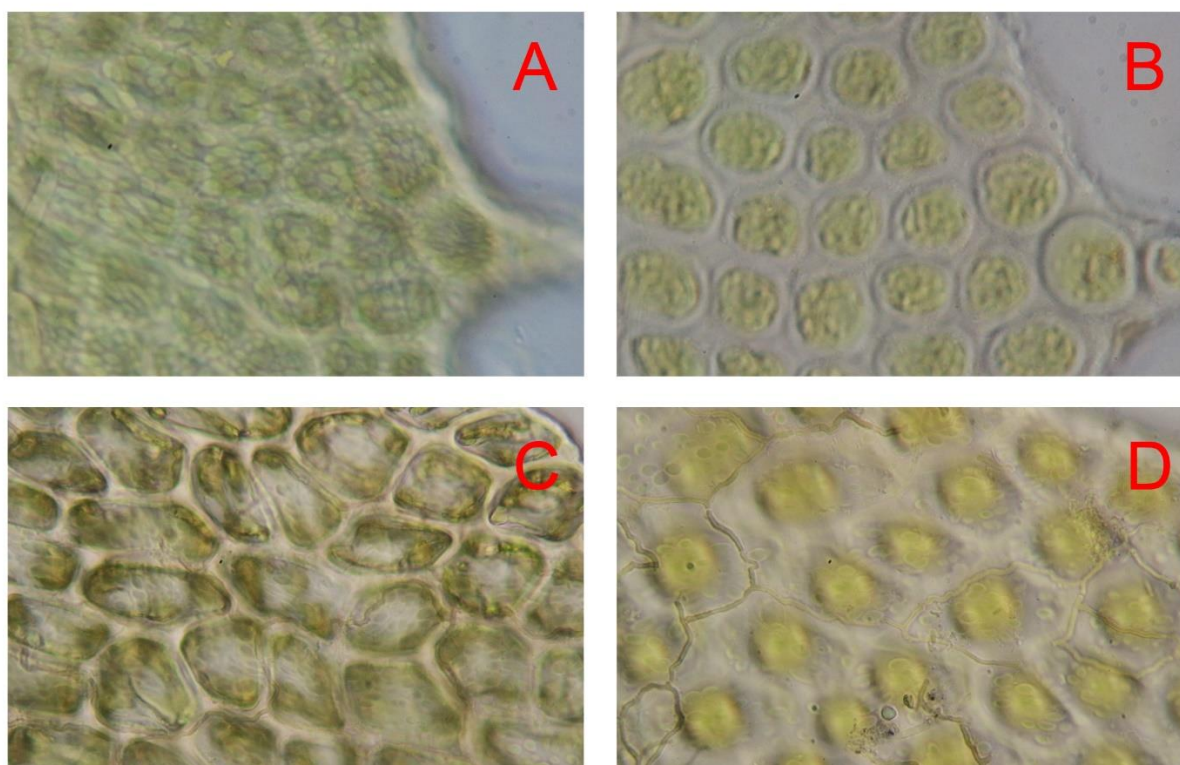


Figure 2: A, C – Apical leaf cells in water; B, D – Apical leaf cells after potassium hydroxide treatment – Scales: A – D – 50 μm – A, B: *Bazzania subtilis* (SANDE LAC.) SCHIFFN. (from UWE SCHWARZ 4775); C, D *Bazzania manillana* (GOTTSCHE EX STEPH.) S. HATT. (from UWE SCHWARZ 6014)



Figure 3 – *Bazzania horridula* Schiffn.: Leaf cross section – Scale: 50 μm (from UWE SCHWARZ 6185)

It was also observed that these structures were not evenly developed on the leaves or on the leaves of the same stem. Even though the ornamentation might differ amongst the species (e.g., very finely granular in *B. vittata* [Plate 47: D – F] vs. more coarse in *B. subtilis* [Figure 2: A]), this character has to be used very carefully in distinguishing taxa.

True papillae were only observed in *Bazzania horridula* SCHIFFN. out of the *Bazzania* specimen available from the Philippines (Figure 3).

Further systematic studies are recommended to identify the origin and composition of those papillae like structures.

Stem Characters

So far, a variation in the stem cross section was observed in different *Bazzania* species which relates to the development of an outer layer of larger cells and the thickening of the walls of the inner cells.

There are species with evenly sized cells in the cross section. The inner cell walls are more or less evenly thickened, whereas only the outermost cell walls are more thickened (Figure 4 A). In other cases, there is the tendency to develop a larger layer of outer cells of the stem (Figure 4 B). Those cells are usually short rectangular. To distinguish a different size compared to the inner cells is not always possible. There are finally species with strongly thickened inner cell walls (Figure 4 C). So far it was only observed in species with strongly thickened walls of the leaf cells.

The cell wall thickening and cell shape even differs in a surface view. It ranges from elongated surface cells with strongly thickened longitudinal wall and weaker lateral walls (Figure 4 D), hexagonal to short rectangular cells with evenly thickened walls (Figure 4 E) to almost quadrate cells (Figure 4 F). The cells can be slightly prorate (Figure 4 D), smooth or develop a verrucous surface (Figure 4 G) similar the “papillosity” of the leaf cells.

Since the stem morphology hasn't been studied for all the available specimens it is yet too early to decide how useful this character is to distinguish taxa.

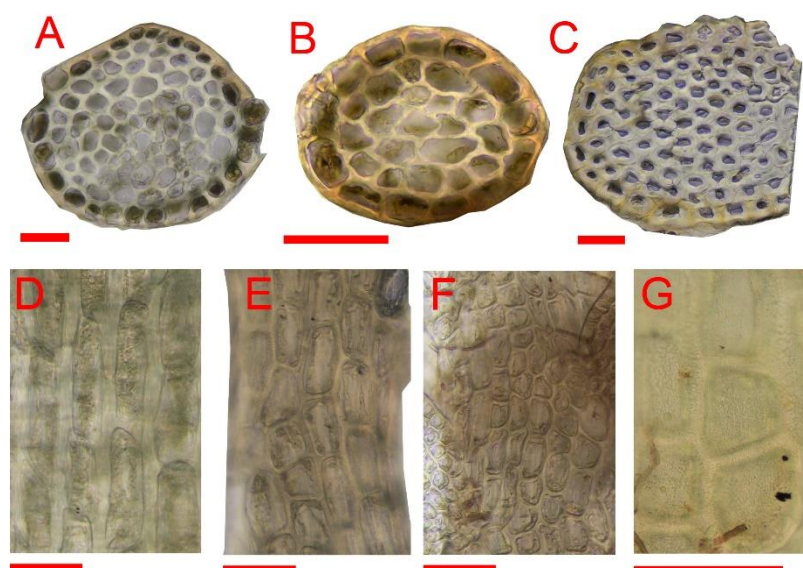


Figure 4: A – C Stem cross section (A *Bazzania helgana* [SCHÄFER-VERWIMP 4040], B *Bazzania acanonista* [SHEVOCK 56240], C *Bazzania uncigera* [SHEVOCK 54897], D – G Dorsal stem surface (D *Bazzania longicaulis* [SCHWARZ 5951], E, G *Bazzania vittata* [SCHWARZ 6369], F *Bazzania acanonista* [SHEVOCK 56240])

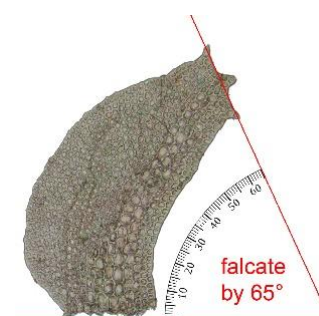


Figure 5: Measurement of leaf curvature

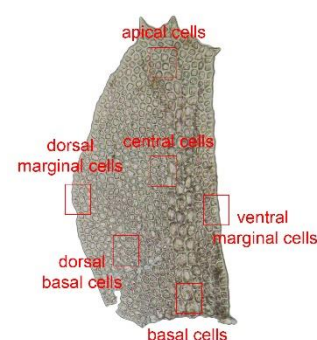


Figure 6: Measurement of leaf cells

Leaf curvature:

Bazzania leaves can bent in two ways. On the one hand side, the leaves are ventrally curved, which means that the apex is bent downwards to the ventral side of the stem. This can be observed in a minor degree in *B. globuliformis* but in particular in species like *B. harpago* (DE NOT.) SCHIFFN. or *B. merillana* (STEPH.) INOUE. The curvature is clearly visible in dry but also wet condition.

On the other hand, the leaf itself can be curved where the plant is ±flat but the fictive line of the leaf base and the one at the leaf apex are not parallel, here called "falcate by 65°" (Figure 5).

Within the descriptions we mention both kinds of leaf curvature.

Leaf cells:

Cells within a *Bazzania* leaf differ to a major degree in shape, size, wall thickening, enlargement of trigones as well as in the structure of the cuticula. Therefore, the cell characters of the areas marked in Figure 6 are provided in the description.

Characters of central cells were only given if a vitta is not present. Otherwise, one finds the characters of the vitta cells.

In those cases where the vitta reaches to the leaf apex and no other cells can be observe the information about apical cells was omitted.

4. Key to species similar to *Bazzania subtilis*

Remark: In addition to the following key it is advisable to consult the comparison plate of leaves (Plate 51) and underleaves (Plate 52) for better understanding of the mentioned characters.

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- 1 Lobes of the underleaves blunt, not uniseriate (Borneo) *Bazzania herzogiana* MEIJER (p. 13)
- 1* Lobes of the underleaves uniseriate, (1-) 2-6 (-7) cells long 2
- 2 Leaves less than twice as long as wide 3
- 3 Dorsal leaf margin strongly arched; underleaf lobes at base with two elongate cells side by side (Australia, New Zealand, East Africa) *Bazzania nitida* (F. WEBER) GROLLE
(not treated in this article, for treatment see ENGEL & GLENNY [2008] or MEAGHER [2019])
- 3* Dorsal leaf margin moderately arched; underleaf lobes uniseriate or with two $\pm$ isodiametric cells at base 4
- 4 Leaf lobes weakly developed, mostly consisting of just a few cells (Australia) *Bazzania zonulata* MEAGHER
(not treated in this article, treated by MEAGHER [2019])
- 4* Leaf lobes well developed 5
- 5 Leaves bidentate or tridentate, leaf margin serrate down to the leaf middle, underleaves $\pm$ irregular in outline, 3-5 cells high (Malaysia, New Guinea) *Bazzania acanoserrata* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK sp. nov. (p. 9)
- 5* Leaves predominantly tridentate, leaf margin only crenulate at the apex or upper part of leaf, underleaves $\pm$ regular cross-rectangular, 5-7(-8) cells high 6
- 6 Underleaves completely chlorophyllous, cells mostly quadrate, with moderately thickened trigones; underleaf lobes up to 3 cells long (Pacific Islands) *Bazzania pulchella* (STEPH.) H. A. MILL. (p. 18)
- 6* Underleaves partially hyaline, cells often rectangular, with strongly thickened walls and no further enlarged trigones; underleaf lobes up to 5 cells long (Australia, New Guinea) *Bazzania helgana* var. *minor* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK var. nov. (p. 12)
- 2* Leaves at least twice as long as wide 7
- 7 Leaves predominantly trilobate 8
- 8 Dorsal leaf base crossing stem midline, underleaf lobes very irregular, sometimes curved, fragile, often broken in the lower part of the stem, leaves more than 0.9 mm long (New Caledonia) *Bazzania reicheliana* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK sp. nov. (p. 19)
- 8* Dorsal leaf base not crossing stem midline, underleaf lobes straight, rarely curved and fragile 9
- 9 Underleaves 6-lobed, with 1-2 additional lateral teeth, largest leaves up to 1 mm long, leaf lobes rather broad and strongly serrate (Philippines to Australia) *Bazzania helgana* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK sp. nov. (p. 11)
- 9* Underleaves 4-lobed, sometimes with 1 blunt lateral tooth, largest leaves up to 0.8 mm long, leaf lobes rather narrow, entire to moderately serrate 10
- 10 Vitta reaching to the leaf apex, leaf cells thin-walled, trigones $\pm$ enlarged, discus of the underleaves quadrate to rhombic 11
- 11* Leaf lobes serrulate; ventral leaf margin $\pm$ falcate, cells forming 7 – 10 rows between the vitta and the dorsal margin (New Guinea) *Bazzania palmatifida* (STEPH.) GROLLE (p. 16)
- 11 Leaf lobes entire; ventral leaf margin $\pm$ straight, cells forming 4 – 6 rows between the vitta and the dorsal margin (New Guinea) *Bazzania palmatifidoides* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK sp. nov. (p. 17)
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- 10 Vitta reaching 4/5 of the leaf length, leaf cells thick walled, trigones not enlarged, discus of the underleaves ovate 12
- 12 Leaf lobes short (mostly 2 cells long), Vitta up to 4 cells wide at the base, lobes of the underleaves not fragile, straight, up to 3 cells long (South East Asia) *Bazzania subtilis* (SANDE LAC.) SCHIFFNER (p. 22)
- 12* Leaf lobes longer (mostly 4 cells long), Vitta up to 6 cells wide at the base, lobes of the underleaves $\pm$ fragile and curved, up to 5 cells long (Vanuatu) *Bazzania indigenarum* (STEPH.) N. KITAG. (p. 15)
- 7* Leaves predominantly bilobate, underleaf lobes mostly 2-3 or 3-5 cells long 11
- 13 Leaf lobes flat, not curved ventrally, underleaf lobes mostly 2-3 cells long and 1(-2) cells wide at base, cells of the dorsal basal leaf area up to 13 μ m wide, forming (9-)10 – 12(-13) cell rows between the vitta and the dorsal margin (South East Asia) *Bazzania acanonista* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK sp. nov. (p. 7)
- 13* Leaf lobes hooked, curved ventrally, underleaf lobes (2-) 3-5 cells long and often 2 cells wide at base, cells of the dorsal basal leaf area usually 15 μ m wide, forming 6 – 8 cell rows between the vitta and the dorsal margin (Philippines) *Bazzania globuliformis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK sp. nov. (p. 10)

5. Treatment of Taxa

Bazzania acanonista U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK sp. nov.

Figures:

Plate 1, Plate 2 – DEL ROSARIO (1975) fig. 36, STEPHANI (1985) Icones no. 7341.

Holotype:

Philippines: Negros Island, Province Negros Oriental, Cuernos de Negros (Mt. Talinis), Along the ridge trail well above the village of Naubok toward the summit slopes about Hapon-Haponon and Mt. Talinis. Mixed hardwood evergreen tropical rain forest with fern understory, 9° 14' 42.6" N, 123° 7' 4.5" E, on base of hardwood trunk in filtered light, 1475 m, JAMES R. SHEVOCK 56240, with DARYL S. SALAS, 17 December 2019 (holotype: CAS, isotypes BRIT, CMUH, MO, Herbarium SCHÄFER-VERWIMP, herbarium UWE SCHWARZ).

Description:

Plants pale green, small, ca. 1 cm long, with leaves 1.0-1.2 (-1.3) mm wide, dichotomously to irregularly branched, rhizoids occasional to rare, arising in small bundles from base of underleaves.

Stem in cross section 125-140 μ m and 8 cells wide, 110-115 μ m and 7-8 cells high, medullary cells irregular in outline, $\pm$ isodiametrical to 1.6x longer than wide, 10-18 x 12.5-22 μ m, walls uneven thick-walled, marginal cells subquadrate to rectangular, outer wall thicker, 14-18 x (14-)16-22 μ m, dorsal cortical cells $\pm$ quadrate to (short) rectangular, sometimes elongate-polygonal, 15-20 x 17-35 μ m, walls moderately thick-walled, trigones small, cuticula smooth.

Flagelliform branches few, 0.6-0.9 mm long, 75 μ m in diameter, leaves of flagelliform branches distant, scale-like, $\pm$ triangular to subquadrate, shortly bilobed, cells thin-walled, trigones slightly enlarged.

Leaves spreading at an angle of (60°-) 70°-80° (-90°) with the stem, bilobed, only rarely with an additional third tooth-like lobe, asymmetric, ovate-oblong, falcate by 12°-42°, dorsal margin arched, ventral margin $\pm$ straight to usually slightly falcate, contiguous to subimbricate in lower part of plant, imbricate in upper part, flat, dorsal base not crossing stem midline leaving a leaf-free strip of mostly 2-3 cells (except at apex of shoot), widest 0.25-0.35 of the leaf length above base, 500-650 μ m long, 200-230 μ m wide at the base, 220-300 μ m wide at the widest part, 100-140 μ m wide at apex (at base of lobes), margin irregular in outline.

Leaf lobes sharp, the lobes small, (1-)2-3(-6) cells wide at base, (1-)2-3(-7) cells long, $\pm$ straight to divaricate, irregular.

Vitta well developed, ventrally sharply, dorsally less sharply delimited, reaching near the leaf apex, 2 (-3) rows wide at the base, (1-)2(-3) rows wide at the upper end of the vitta, 2-3 cell rows from vitta to ventral margin, 10-13 cells from vitta to dorsal margin at widest part of leaf lobe, cells subquadrate to rectangular, 25 x 25 µm and 20-22 x 35-40 µm, walls thin, trigones triangular to sometimes slightly knot-like, cuticula slightly roughened to papillose-striate.

Leaf cells similar from base to apex, getting smaller from vitta to margins, upper lamina cells subquadrate to irregularly polygonal, 14-17 x 18-22 µm, walls thin-walled, trigones small or lacking, cuticula rough-verrucose, cells of the dorsal, basal lamina subquadrate to short rectangular, 10-12.5 x 12-18 µm, walls thin-walled, trigones very small or lacking, cuticula rough, dorsal marginal cells subquadrate, 10-12 x 8-12 µm, walls thin-walled, trigones small or lacking, cuticula rough, ventral marginal cells subquadrate to short rectangular, 10-12 x 12-16 µm, walls thin-walled, trigones small, moderate sized along vitta, cuticula rough.

Underleaves distant to approximate (rarely ±contiguous), slightly to strongly spreading from the stem, 1.0-1.4 times as wide as the stem, transversely attached, often narrowly connate by a single cell with the leaf on one side, chlorophyllous, generally with four sharp lobes, occasionally an additional small tooth may be present on one or both sides, 140-180 µm wide, 150-160 µm long, discus wider than long, 140-180 µm, (10-)11-13 cells wide, 100-120 µm, 5-7 cells long, cells similar as in leaves, subquadrate to short rectangular, 10-15 x 10-25 µm, walls thin, trigones small, cuticula verrucose, lobes spreading to recurved/reflexed, lobes 40-50 µm, 2-3 cells long, 1 (-2) cells wide at base, apical cell triangular, 1.2-2.4 time as long as wide, 10-12 x 14-25(-28) µm, apically narrowly obtuse and strongly thickened.

Distinguishing characters:

The new species is distinguished from similar species by the combination of the following characters: (1) small size, stem with leaves 1-1.2 mm wide; (2) flat, bidentate to bilobed leaves; (3) irregular leaf margin; (4) small underleaves with 4 sharp, and 2-3 cells long teeth. It can only be confused with *B. globuliformis* which can already be distinguished in the field by its pearl necklace like appearance. Furthermore, the hooked leaf apices and the larger cells in the basal dorsal leaf area will separate the two species.

Etymology:

The name is based on ακανόνιστος (greek: irregular) due to the irregular leaf margin.

Distribution:

Amboina, Borneo, Java, Malaysian Peninsula, New Guinea, Philippines.

Further specimen examined:

Indonesia: Borneo Island, Province Kalimantan Timur, East of Kutai, Peak of Bukit Papan, 1000 m, leg. WILLEM MEIJER B1686b, 1952, det. MEIJER, conf. RICLÉF GROLLE, 1969 + 1974, as *Bazzania subtilis* (JE, Duplicate ex L).

Indonesia: Java Island, Province Java Barat, Tjibodas, 6° 29' 0" S, 106° 40' 0" E, on *Dysoxylum excelsum*, leg. O. REIMERS 3459, February 1931, det. THEODOR HERZOG, conf. RICLÉF GROLLE 1974, as *Bazzania subtilis* (JE).

Indonesia: New Guinea Island, Province Papua, District Hollandia, Cycloop Mountains (Gunung Dafonsoro), 2° 30' 46.2" S, 140° 29' 58.1" E, 1220 m, on tree trunc in primary forest, leg. PIETER VAN ROYEN & HERMAN O. SLEUMER 5919, 1961, det. RICLÉF GROLLE, 1974, conf. NAOFUMI KITAGAWA, 27 November 1978, as *Bazzania subtilis* (JE, Duplicate ex L).

Malaysia: State Pahang, Frasers Hill, Parklandschaft im Ort am Rande des Golfplatzes, 3° 42' 48.5" N, 101° 43' 58.6" E, in der Kronenregion eines umgefallenen Baumes, 1300 m, leg. A. SCHÄFER-VERWIMP & I. VERWIMP, 20 Mai 1997 (Herbarium SCHÄFER-VERWIMP no. 18622).

Papua New Guinea: New Guinea Island, Province Morobe, Koke [Kokea] Village, 3 km SE of Aseki. Advanced regrowth forest beside stream, 7° 21' 55" S, 146° 13' 25" E, 1500 m, on *Syzygium trunc*, leg. HEINAR STREIMANN 11714, with E. TAMBA, 20 January 1981, det. RICLÉF GROLLE, 1982, as *Bazzania subtilis* (JE, Duplicate ex CBG no. 8105806).

Philippines: Negros Island, Province Negros Oriental, Cuernos de Negros (Mt. Talinis), Lunga Nature Trail from Camp Vendiola to Lake Nailig, 9° 15' 34.88" N, 123° 10' 56.99" E, ca. 1300 m, on bark, leg. FELIX SCHUMM & UWE SCHWARZ, 10 August 2000 (Herbarium UWE SCHWARZ no. 5798, mixed with *B. vittata*).

Remarks:

B. acanonista has long been known from the region. Records based on figures, keys, as well as our own collections indicate that the species is widely distributed. Due to the misinterpretation of *B. subtilis* by earlier authors the species was not adequately distinguished in the past.

***Bazzania acanoserrata* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK sp. nov.**

Figures:

Plate 3, Plate 4, Plate 5.

Holotype:

Malaysia: State Selangor, 20th mile from Kuala Lumpur on the Ulu Gombak road, ecotone between hill Dipterocarp and lower montane forest, 650 m, leg. G. EEN 12, 21 April 1972, det. RICLEF GROLLE, 1974, as *Bazzania pulchella* (Holotype: JE).

Description:

Plants dull green, small, up to 0.8 cm long, with leaves 0.7-0.9 mm wide, irregularly branched, rhizoids rare, in bundles from base of underleaves.

Stem in cross section 80-100 µm and 7 cells wide, 80 µm and 6 cells high, medullary cells irregular in outline, oval to polygonal, 11-20 x 10-18 µm, walls thickened, marginal cells quadrate to irregular polygonal, outer walls thickened, 13-23 x 12-20 µm, dorsal cortical cells quadrate to polygonal, 15-25 x 23-32 µm, walls evenly thickened, trigones not enlarged, cuticula smooth.

Flagelliform branches sparse, up to 2 mm long, 60 µm in diameter, leaves of flagelliform branches distant, triangular to ovate, short bilobate, 45-60 µm wide, 60-75 µm long, cells thick walled, trigones slightly enlarged.

Leaves spreading at an angle of 75°-85° with the stem, bilobate or trilobate, symmetric to asymmetric, rectangular to ovate, falcate by 0°-20°, dorsal margin arched to almost straight, ventral margin straight, loosely imbricate, apically curved ventrally, dorsal base not crossing the middle of the stem, widest 0.25-0.4 of the leaf length above the base, 380-440 µm long, 130-170 µm wide at the base, 220-270 µm wide at the widest part, 120-170 µm wide at apex (at base of lobes), margin irregular serrulate in the upper half of the leaf.

Leaf lobes sharp, hooked ventrally, 1-4 cells wide at base, 1-4 cells long, straight, serrate.

Vitta well developed, rather sharply delimited, reaching 4/5 of the leaf length, 3-6 rows wide at the base, 3-5 rows wide at the upper end of the vitta, 2-4 cell rows from vitta to ventral margin, 6-10 cells from vitta to dorsal margin at widest part of leaf lobe, cells ovate to rectangular, 17-20 x 20-35 µm, walls thin, trigones moderately thickened, cuticula smooth.

Leaf cells rather regular, getting smaller towards the dorsal margin, upper lamina cells quadrate to polygonal, 13-18 x 11-15 µm, walls moderately thickened, trigones slightly enlarged, cuticula almost smooth to verrucose, cells of the dorsal, basal lamina quadrate to polygonal, 12-15 x 12-18 µm, walls moderately thickened, trigones slightly enlarged, cuticula almost smooth to verrucose, dorsal marginal cells quadrate to polygonal, 10-18 x 11-15 µm, walls moderately thickened, trigones slightly enlarged, cuticula almost smooth to verrucose, ventral marginal cells quadrate to polygonal, 15-18 x 8-12 µm, walls moderately thickened, trigones slightly enlarged, cuticula almost smooth to verrucose.

Underleaves distant, patent, 1.8-2.2 times as wide as the stem, transversely attached, connate on one side with the lateral leaves, chlorophyllous, divided to 1/2-2/3 into 4 irregular lobes, sometimes with 1-2 small, lateral teeth, 160-210 µm wide, 100-130 µm long, discus wider than long, 115-140 µm, 8-10 cells wide, 40-70 µm, 2-5 cells long, cells quadrate to irregular polygonal, 11-16 x 10-20 µm, walls thickened, trigones slightly enlarged, cuticula smooth, straight, lobes 45-75 µm, 2-4 cells long, 1-2 cells wide at base, apical cell oval to narrowly triangular, 1.3-2.1 times as long as wide, 12-15 x 16-32 µm, apically obtuse, slime papillae occasionally at the base of the underleaf lobes.

Distinguishing characters:

The new species is distinguished from similar species by the following characters: (1) leaves less than twice as long as wide, (2) leaf serrate from apex down to the middle of the leaf, (3) underleaves ±irregular in outline and divided at least to ½ of their length, (4) hooked leaf lobes and (5) frequent appearance of trilobate leaves. It can only be confused with *B. globuliformis* which has more narrow leaves and an almost entire leaf margin.

Etymology:

The species resembles to a certain degree *B. acanonista* but develops a much stronger serrate leaf margin.

Distribution:

Malaysian Peninsula, New Guinea.

Further specimen examined:

Papua New Guinea: New Guinea Island, Province Morobe, District Hube Rural, Kulungtufu, 6° 23' 53" S, 147° 27' 59" E, 1650 m, leg. JOSEPH CLEMENS 6537c, 1937, det. RICLÉF GROLLE, 1969 as *Bazzania subtilis*, rev. NAOFUMI KITAGAWA, 27 November 1978, as *Bazzania palmatifida* (JE).

***Bazzania globuliformis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK spec. nov.**

Figures:

Plate 6, Plate 7, Plate 8.

Holotype:

Philippines: Leyte Island, Province Leyte, Area around Lake Kasudsuran, Ormoc-City, Barangay Liberty, 11° 1' 32.33" N, 124° 44' 55.86" E, on bark, 720 m, leg. FELIX SCHUMM & UWE SCHWARZ, 23 August 2000 (Holotype herbarium UWE SCHWARZ no. 6231, Isotype Herbarium SCHÄFER-VERWIMP).

Description:

Plants pale green, small, 1-1.5 cm long, with leaves (0.55-) 0.73-0.93 mm wide, dichotomously branched, rhizoids not seen.

Stem in cross section 130-150 µm and 8 cells wide, 95 µm and 8 cells high, medullary cells irregular in outline, oval to polygonal, 12-20 x 7-16 µm, walls evenly thickened, marginal cells quadrate to rectangular, outer walls as thick as the walls of the medullary cells, 12-25 x 10-18 µm, dorsal cortical cells rectangular, 13-16 x 25-30 µm, walls evenly thickened, trigones slightly enlarged, cuticula smooth.

Flagelliform branches sparse to scattered, up to 3 mm long, 70 µm in diameter, leaves of flagelliform branches distant, triangular, very short bilobate, 80-110 µm wide, 70-110 µm long, cells thick-walled, trigones slightly enlarged.

Leaves spreading at an angle of 75°-85° with the stem, bilobate, very rarely trilobate, asymmetric, oblong-ovate, falcate by 34°-58°, dorsal margin arched, ventral margin concave, loosely imbricate, leaves strongly curved ventrally, giving an impression of a pearl necklace, dorsal base not crossing the middle of the stem, widest 0.25 of the leaf length above the base, 450-500 µm long, 150-180 µm wide at the base, 220-250 µm wide at the widest part, 120-150 µm wide at apex (at base of lobes), margin entire, towards the apex irregular crenulate to serrate.

Leaf lobes sharp, hooked ventrally, 2-3 cells wide at base, 3-5 cells long, straight forward to slightly divaricate, weakly serrulate.

Vitta well developed, sharply delimited, reaching near the leaf apex, 3-4 rows wide at the base, 3-4 rows wide at the upper end of the vitta, 2-3 cell rows from vitta to ventral margin, 6-8 cells from vitta to dorsal margin at widest part of leaf lobe, cells quadrate to rectangular, 19-21 x 30-37 µm, walls thin, trigones moderately thickened, cuticula verrucose by elliptical to slightly striolate papillae.

Leaf cells rather regular, getting smaller towards the dorsal margin, upper lamina cells quadrate to irregularly hexagonal, 13-17 x 13-19 µm, walls moderately thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae, cells of the dorsal, basal lamina round to oval, 14-17 x 13-23 µm, walls moderately thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae, dorsal marginal cells quadrate to round, 12-14 x 13-18 µm, walls moderately thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae, ventral marginal cells round to irregular hexagonal, 11-13 x 10-15 µm, walls moderately thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae.

Underleaves distant, reflexed, 1.3-1.6 times as wide as the stem, transversely attached, connate on one side with the lateral leaves, chlorophyllous, divided to 1/3-1/2 into 4 lobes, sometimes with 1-2 smaller, lateral teeth, 190-250 µm wide, 160-170 µm long, discus wider than long, 130-190 µm, 9-10 cells wide, 90-120 µm, 4-5 cells long, cells similar to leaf cells, elongated oval to short rectangular, 13-24 x 18-40 µm, walls thickened, trigones slightly enlarged, cuticula weakly

verrucous, reflexed, lobes 45-75 µm, 3-4 cells long, 1-2 cells wide at base, apical cell oval to narrowly triangular, 1.2-2 times as long as wide, 14-15 x 18-30 µm, apically obtuse.

Dioecious ?, only female branches seen.

Female branches origin from the stem ventrally intercalary, bracts and bracteoles distinctive reddish but cells hyaline, slightly thick walled, elongated rectangular, bracts in 3 pairs, irregular lobed, margin denticulate to laciniate. Perianth not found.

Distinguishing characters:

Bazzania globuliformis is closely related to *Bazzania acanonista* but differs in the (1) leaves curved ventrally in dry condition, (2) ventrally hooked leaf lobes, (3) the reflexed underleaf and (4) the larger leaf cells in the dorsal, basal part of the leaf. From the other, partially bilobate species, *B. acanoserrata* it can be readily distinguished by (1) the leaves that are more narrowed towards the apex, (2) wider lamina between the vitta and the dorsal leaf margin, and (3) the larger underleaves.

Etymology:

The leaves of this species look rather spherical in dry condition.

Distribution:

Philippines (only known from the type collection).

***Bazzania helgana* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK spec. nov.**

Figures:

Plate 13, Plate 14, Plate 15 – KITAGAWA (1979) fig. 1 (as *B. palmatifida*, except his drawing from the type of *B. palmatifida*), MEAGHER (2019) fig. 30 (as *B. subtilis*).

Holotype:

Australia: State Queensland, Region Tablelands, Atherton Tablelands südwestlich Cairns, Regenwald am Lake Barrine, 17° 14' 53" S, 145° 38' 12" E, auf morschem Holz, leg. A. SCHÄFER-VERWIMP, 8 August 1983 (holotype herbarium SCHÄFER-VERWIMP no. 4040, isotype herbarium UWE SCHWARZ).

Description:

Plants pale green, small to medium sized, 1.5-2.5(-3) cm long, with leaves 2 mm wide, dichotomously to irregularly branched, rhizoids rare, in bundles from base of underleaves.

Stem in cross section 250-275 µm and 12-13 cells wide, 200-230 µm and 11 cells high, medullary cells irregular in outline, ±isodiametrical to often (slightly) longer than wide, 14-22 x 16-35 µm, walls uneven thick-walled, marginal cells quadrate to rectangular, outer wall thicker, 14-18 x 16-33 µm, dorsal cortical cells mostly subquadrate to rectangular, 20-22 x 20-40 µm, walls moderately thick-walled, trigones trigones lacking or very small, cuticula smooth.

Flagelliform branches few, 1.4-2.1 mm long, 150 µm in diameter, leaves of flagelliform branches distant, scale-like, broadly triangular, apically slightly incised (less than one cell), 150 µm wide, 125 µm long, cells thick-walled, trigones slightly enlarged.

Leaves spreading at an angle of 70°-80° in moist and dry condition with the stem, generally 3-lobed, well developed leaves often with a fourth tooth-like lobe on ventral side, longitudinally somewhat convex (if seen from dorsal), asymmetrically ovate-lingulate, falcate by 28°-45°, dorsal margin ±strongly arched, ventral margin straight to slightly falcate, imbricate, widely spreading from the stem, dorsal base not crossing middle of stem leaving a leaf-free strip of 1-2(-3) cells, widest 0.35-0.4 of the leaf length above base, 870-950(-980) µm long, 350-380 µm wide at the base, 500-550 µm wide at the widest part, 250-380 µm wide at apex (at base of lobes), margin strongly but irregularly crenulate-denticulate in the upper part, ±entire in lower half.

Leaf lobes sharp, the lobes small, often hooked ventrally, 1-2(-6) cells wide at base, 2-4(-6) cells long, ±straight to slightly divaricate, strongly serrulate-denticulate.

Vitta well developed, not sharply delimited on both ventral and dorsal side, reaching near the leaf apex, 5 (-6) rows wide at the base, (1-)2(-3) rows wide at the upper end of the vitta, 3-5 cell rows from vitta to ventral margin, 14-22 cells from

vitta to dorsal margin at widest part of leaf lobe, cells short to long rectangular, sometimes $\pm$ irregular pentagonal, 16-24 x 25-50 μ m, walls thin, trigones triangular, cuticula rough-verrucose.

Leaf cells dorsally cells gradually decreasing in size to margin, upper lamina cells subquadrate or short rectangular to irregularly polygonal with rounded corners, 10-15 x 10-18 μ m, walls thin-walled, trigones small to medium-sized, cuticula roughened, cells of the dorsal, basal lamina rounded-subquadrate to short rectangular, 10-14 x 10-25 μ m, walls thick-walled, trigones slightly enlarged, cuticula rough-verrucose, dorsal marginal cells quadrate to short rectangular, 8-12 x 8-15 μ m, walls thick-walled, trigones $\pm$ enlarged, cuticula rough-verrucose, ventral marginal cells rounded-quadrate to elongate, 10-12 x 10-15 μ m, walls moderately thick-walled, trigones moderate sized, cuticula Rough-verrucose.

Underleaves approximate, obliquely spreading from the stem, 1.0-1.5 times as wide as the stem, transversely attached, connate with the leaf on one or both sides, chlorophyllous, usually with 6 lobes, the lateral ones occasionally shorter and $\pm$ half as long as the central lobes, 1-2 additional small teeth may be present at both lateral margins, 300-350 μ m wide, 380-420 μ m long, discus wider than long, 300-350 μ m, 18-22 cells wide, 150-180 μ m, 6-7 (-8) cells long, cells $\pm$ similar to leaf cells, often in longitudinal rows, $\pm$ irregular in outline, triangular, quadrate, short to long rectangular to polygonal, 15-20 x 15-35 μ m, walls conspicuously thickened, trigones small, cuticula verrucose-rough, lobes recurved to reflexed, lobes 80-110 (-120) μ m, (2-)3-5(-6) cells long, 1 (-2) cells wide at base, apical cell narrowly triangular, $\pm$ 3 x as long as wide as long as wide, reaching 17-18 x 50 μ m, apically narrowly obtuse and strongly thickened, the thickening 12-15 μ m.

Distinguishing characters:

This species is distinguished from similar species by the following characters: (1) rather large plants with leaves more than 0.6 mm long, (2) trilobate leaves with hooked and serrate leaf lobes, and (3) the (4-) 6 lobed underleaves (well-developed underleaves always with 6 lobes), with lobes are 4-6(-7) cells long.

Etymology:

The species is named after DR. HELGA OTTO (Claußnitz, Germany) an active German bryologist who supported the first author during his first steps into bryology in the mid 1980s.

Distribution:

Australia, Borneo, New Guinea, New Hebrides, Philippines (new country record).

Specimen examined:

Australia: State Queensland, District Upper Barron, Hugh Nelson Range, Crater State Forest, 19 km S of Atherton. Logged rain forest, 17° 26' 0" S, 145° 29' 0" E, 1000 m, in large tree crown, leg. HEINAR STREIMANN 27063, 1 March 1983, det. DAVID MEAGHER, February 2011, as *Bazzania subtilis* (JE, duplicate from CBG 8302814).

Papua New Guinea: Central Province, South East New Guinea, small island in Sirinumu Lake east of Port Moresby, mixed Castanopsis forest, 9° 29' 50" S, 147° 29' 28" E, 540 m, on rotten log in shade, leg. B.O. VAN ZANTEN 68-110, 1968, det. NAOFUMI KITAGAWA, 3 December 1978, as *Bazzania palmatifida* (JE).

Papua New Guinea: Central Province, South East New Guinea, small island in Sirinumu Lake east of Port Moresby, mixed Castanopsis forest, 9° 29' 50" S, 147° 29' 28" E, 540 m, on rotten log in shade, leg. B.O. VAN ZANTEN 68-116, 1968, det. NAOFUMI KITAGAWA, as *Bazzania palmatifida* (JE).

Philippines: Luzon Island, 840 m, leg. ELMER D. MERRILL (s.n.), det. FRANZ STEPHANI, conf. RICLEF GROLLE 1974, as *Bazzania subtilis* (JE H1355, duplicate ex FH, the label inside the specimen also shows a determination as *Bazzania pulchella*, which was later changed to *B. subtilis* by GROLLE).

***Bazzania helgana* var. *minor* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK var. nov.**

Figures:

Plate 16, Plate 17, Plate 18.

Holotype:

Australia: Queensland, District Kuranda, Little Surprise Creek, track to Barron Falls, 2 km SE of Kuranda. Tropical forest near creek surrounded by wetter *Eucalyptus* forest, 16° 51' 20.2" S, 145° 38' 31.2" E, 360 m, on boulder of creek,

leg. HEINAR STREIMANN 54114, 9 July 1994, det. DAVID MEAGHER, February 2011, as *Bazzania subtilis* (JE). (JE, duplicate from CBG s.n.).

Description:

Plants pale green, small, up to 2 cm long, with leaves 0.8-1.0 mm wide, dichotomously branched, rhizoids not seen.

Stem in cross section 180-200 µm and 9-10 cells wide, 130 µm and 9 cells high, medullary cells round to irregular polygonal, 11-22 x 10-19 µm, walls thick walled, marginal cells oval to rectangular, thick walled, 10-22 x 9-14 µm, dorsal cortical cells quadrate to oval, 13-20 x 13-32 µm, walls strongly thickened, trigones not enlarged, cuticula smooth.

Flagelliform branches few, up to 5 mm long, 80 µm in diameter, leaves of flagelliform branches distant, triangular to ovate, shortly multilobate, 60-80 µm wide, 60-80 µm long, cells thin-walled, trigones not enlarged.

Leaves spreading at an angle of 70°-90° with the stem, trilobate, asymmetric, rectangular to ovate, falcate by 30°-45°, dorsal margin arched, ventral margin straight, imbricate, flat, dorsal base not crossing middle of stem leaving a leaf-free strip of 4 cells, widest 0.25-0.3 of the leaf length above the base, 630-750 µm long, 240-250 µm wide at the base, 380-400 µm wide at the widest part, 250-310 µm wide at apex (at base of lobes), margin apically crenulate or serrulate.

Leaf lobes sharp, hooked ventrally, 2-5 cells wide at base, 2-5 cells long, the lateral lobes divaricate, strongly serrulate-denticulate.

Vitta well developed, not sharply delimited, reaching 4/5 of the leaf length, 5-6 rows wide at the base, 3-4 rows wide at the upper end of the vitta, 3-4 cell rows from vitta to ventral margin, 12-14 cells from vitta to dorsal margin at widest part of leaf lobe, cells ovate to rectangular, 25-30 x 27-45 µm, walls thin, trigones triangular, cuticula verrucose through striolate papillae.

Leaf cells rather regular, upper lamina cells quadrate to ovate, 14-22 x 14-20 µm, walls thick walled, trigones lacking, cuticula verrucose through ovate papillae, cells of the dorsal, basal lamina quadrate to irregular polygonal, 12-17 x 14-20 µm, walls thick walled, trigones lacking, cuticula verrucose through ovate papillae, dorsal marginal cells quadrate, 13-18 x 12-18 µm, walls thick walled, trigones lacking, cuticula verrucose through ovate papillae, ventral marginal cells quadrate to rectangular, 12-20 x 10-17 µm, walls thick walled, trigones lacking, cuticula verrucose through ovate papillae.

Underleaves distant, loosely appressed, 1.3-1.6 times as wide as the stem, transversely attached, connate on one side with the lateral leaves, chlorophyllous or hyaline in the upper half of the underleaf, divided to 1/3-1/2 into 4 lobes, sometimes with 1-2 small, lateral teeth, 240-340 µm wide, 180-230 µm long, discus wider than long, 220-260 µm, 14-17 cells wide, 120-140 µm, 5-7 cells long, cells rectangular to irregular polygonal, 14-28 x 12-27 µm, walls thickened, trigones not enlarged, cuticula almost smooth, straight, lobes 50-80 µm, 2-5 cells long, 2-3 cells wide at base, apical cell triangular to narrowly triangular, 1.4-2.4 times as long as wide, 17-20 x 28-40 µm, evenly thickened.

Distinguishing characters:

Even though the variety shows a lot of similarity to *B. helgana* it is characterized by (1) its smaller size (leaves only reaching up to 750 µm), (2) the underleaves that develops hyaline areas in the upper part, (3) the narrower underleaf discus, and (4) the shorter lobes of the underleaves.

Distribution:

Australia, New Guinea.

Specimen examined:

Australia: Queensland, District Wallaman, Blue Water Creek, Old Mill Road, 39 km WSW of Ingham. Rainforest fringing stream, 18° 39' 18" S, 145° 50' 28" E, 600 m, on shaded boulder beside stream, leg. HEINAR STREIMANN 28394, 19 June 1984, det. DAVID MEAGHER, 15 February 2011, as *Bazzania subtilis* (JE). (JE, duplicate from CBR 8406200).

Papua New Guinea: New Britain Island, Province East New Britain, Nakanai Mountains, 48 km SE of Hoskins. Ridge forest dominated by *Castanopsis*, *Elaeocarpus* and *Garcinia*, 5° 45' 0" S, 150° 46' 0" E, 520 m, on buttress of large tree, leg. HEINAR STREIMANN 40444, 19 February 1989, det. RICHEL GROLLE, 1992, as *Bazzania subtilis* (JE).

Bazzania herzogiana MEIJER. *Blumea*. 10:371. 1960.

= *Bazzania remotifolia* HERZOG non HORIK. *Transactions of the British Bryological Society*. 1:304. 1950.

Figures:

Plate 9, Plate 10, Plate 11, Plate 12 – HERZOG (1950) fig. 22 a-f (as *B. remotifolia*).

Description:

Plants dull pale green, medium, up to 5 cm long, with leaves 1.2-1.4 mm wide, irregular branched, rhizoids rare, at the base of the underleaves.

Stem in cross section 175-225 µm and 9 cells wide, 10 cells high, medullary cells round to irregular polygonal, 12-29 x 8-20 µm, walls thickened, marginal cells oval to rectangular, walls distinctively thickened, 14-24 x 10-24 µm, dorsal cortical cells elongated oval to linear, 18-30 x 48-105 µm, walls thick, transversal thinner, trigones not enlarged, cuticula smooth.

Flagelliform branches scattered, up to 7 mm long, 80-90 µm in diameter, leaves of flagelliform branches distant, ovate triangular, weakly lobed at the apex, 80-100 µm wide, 80-120 µm long, cells moderately thickened, trigones slightly enlarged.

Leaves spreading at an angle of 75°-90° with the stem, trilobate, occasional bilobate, slightly asymmetric, rectangular, falcate by 0°-25°, dorsal margin slightly arched, ventral margin straight, distant, flat to apically weakly curved ventrally, dorsal base reaching the middle line of the stem, widest 0.3-0.4 of the leaf length above the base, 550-700 µm long, 200-290 µm wide at the base, 300-400 µm wide at the widest part, 170-340 µm wide at apex (at base of lobes), margin entire.

Leaf lobes sharp, flat, 2-7 cells wide at base, 3-7 cells long, straight, entire.

Vitta not developed, but a group of enlarged cells in central part of the leaf.

Leaf cells rather regular, getting smaller towards the margins, upper lamina cells quadrate to hexagonal, 15-21 x 20-30 µm, walls moderately thickened, trigones slightly enlarged, cuticula verrucose through ovate papillae, cells of the dorsal, basal lamina quadrate to rectangular, 13-20 x 15-27 µm, walls slightly thickened, trigones slightly enlarged, cuticula verrucose through ovate papillae, dorsal marginal cells quadrate, 12-21 x 16-20 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through ovate papillae, ventral marginal cells quadrate to irregular polygonal, 20-24 x 16-20 µm, walls moderately thickened, trigones slightly enlarged, cuticula verrucose through ovate papillae, central laminal cells oval, 18-25 x 27-43 µm, walls thin, trigones slightly enlarged, cuticula verrucose through ovate papillae.

Underleaves distant, appressed, 1-1.1 times as wide as the stem, transversely attached, connate on one side with the lateral leaves, hyaline, with 3-4 rows of chlorophyllous cells at the base, divided into 4 blunt lobes, that end in 2-3 cells, occasionally with smaller lateral teeth, 185-250 µm wide, 120-180 µm long, discus wider than long, 185-230 µm, 10-14 cells wide, 90-130 µm, 5-7 cells long, cells quadrate to rectangular, 10-18 x 15-30 µm, walls thickened, trigones not enlarged, cuticula verrucose through ovate papillae at the apex, almost smooth at the base, lobes 20-45 µm, 2-4 cells long, 2-3 cells wide at base.

Distinguishing characters:

Bazzania herzogiana is characterized by the (1) very remote leaves, giving the plants a wiry appearance at least in dry condition (2) the almost rectangular leaf shape, (3) the distant, partly hyaline underleaves with blunt lobes, and (4) the lack of a well-developed vitta.

Distribution:

Borneo (only known from the type location).

Specimen examined:

Malaysia: Borneo Island, State Sarawak, Marudi district, Dulit Ridge, [3° 21' 21.7" N, 114° 10' 37.1" E], ca. 1230 m, under ledge of sandstone rock behind waterfall, leg. P.W. RICHARDS 1944, 19 September 1932 (JE 04006222, Holotype).

Remarks:

MEIJER (1960) mentions similarities to *Bazzania subtilis*, which has a well developed vitta and different underleaves, and HERZOG (1950) compares it with *Bazzania vittata*, which develops a vitta and has completely hyaline underleaves.

The hyaline underleaves with 3 – 4 basal, chlorophyllose cells and the cell pattern of *B. herzogiana* rather indicate a relation to the section *Grandistipulae*.

***Bazzania indigenarum* (STEPH.) N. KITAG.** *Bulletin of Nara University of Education. Series B. Natural Sciences.* 26 (2):82. 1977.

≡ *Bazzania indigenara* (STEPH.) N. KITAG. *Bulletin of Nara University of Education. Series B. Natural Sciences.* 26 (2):82. 1977.²

≡ *Mastigobryum indigenarum* STEPH. *Species Hepaticarum.* 6. 469. 1924.

Figures:

Plate 19, Plate 20, Plate 21, Plate 22 – STEPHANI (1985) *Icones* no. 7331, 7332.

Description:

Plants brownish green, small, up to 2 cm long, with leaves 1.2-1.5 mm wide, dichotomously branched, rhizoids not seen.

Stem in cross section 160-175 µm and 9 cells wide, 125 µm and 9 cells high, medullary cells irregular polygonal, 14-25 x 13-22 µm, walls uneven thick-walled, marginal cells oval to rectangular, thick walled, 17-30 x 14-23 µm, dorsal cortical cells quadrate to rectangular, 10-22 x 20-45 µm, walls moderately thick-walled, trigones not enlarged, cuticula smooth.

Flagelliform branches few, up to 5 mm long, 80-90 µm in diameter, leaves of flagelliform branches distant, triangular to rectangular, shortly multilobate, 130-140 µm wide, 90-110 µm long, cells thick-walled, trigones slightly enlarged.

Leaves spreading at an angle of 60°-90° with the stem, trilobate, asymmetric, rectangular to ovate, falcate by 30°-45°, dorsal margin arched, ventral margin straight to slightly falcate, imbricate, flat to apically weakly curved ventrally, dorsal base reaching the middle line of the stem, widest 0.25-0.3 of the leaf length above the base, 670-760 µm long, 220-350 µm wide at the base, 260-350 µm wide at the widest part, 180-240 µm wide at apex (at base of lobes), margin apically crenulate or serrulate.

Leaf lobes sharp, slightly hooked ventrally, 1-3 cells wide at base, 2-4 cells long, ±straight to divaricate, entire.

Vitta well developed, sharply delimited, reaching 4/5 of the leaf length, 5-6 rows wide at the base, 2-3 rows wide at the upper end of the vitta, 2-4 cell rows from vitta to ventral margin, 12-15 cells from vitta to dorsal margin at widest part of leaf lobe, cells round to ovate, 19-25 x 15-40 µm, walls thin, trigones moderately thickened, cuticula verrucose through striolate papillae.

Leaf cells irregular, upper lamina cells quadrate to irregular polygonal, 11-15 x 9-18 µm, walls thick walled, trigones lacking, cuticula verrucose through striolate papillae, cells of the dorsal, basal lamina irregular polygonal, 10-14 x 8-18 µm, walls thick walled, trigones lacking, cuticula verrucose through striolate papillae, dorsal marginal cells rectangular to irregular polygonal, 14-16 x 8-14 µm, walls thick walled, trigones lacking, cuticula verrucose through striolate papillae, ventral marginal cells ovate, 13-22 x 10-14 µm, walls thick walled, trigones lacking, cuticula verrucose through striolate papillae.

Distinguishing characters:

Bazzania indigenarum is characterized by the (1) rather long leaf lobes (up to 4 cells long), (2) the vitta that is up to 6 cells wide at the base and (3) the often curved and rather fragile lobes of the underleaves. On the one hand side it is similar to *B. reicheliana* which is much larger, on the other hand with *B. subtilis* from which it differs in the characters mentioned above.

Distribution:

Vanuatu (only known from the type collection).

Specimen examined:

[**Vanuatu**] **New Hebrides:** Fortuna Island [170° 13' 1" E, 19° 31' 43" S], leg. NALIERES, Oct. 1912, det. FRANZ STEPHANI (G 0067023 – Holotype).

² The name KITAGAWA used has been adjusted to *indigenarum*, is not an adjective, but rather the genitive plural to the noun *indigena*. Therefore, the correct combination with *Bazzania* has to be *indigenarum*.

Bazzania palmatifida (STEPH.) GROLLE. *Journal of the Hattori Botanical Laboratory*. 31:1. 1968.

≡ *Mastigobryum palmatifidum* STEPH. *Species Hepaticarum*. 3. 503. 1908.

Figures:

Plate 23, Plate 24, Plate 25, Plate 26 – STEPHANI (1985) *Icones* no. 7213.

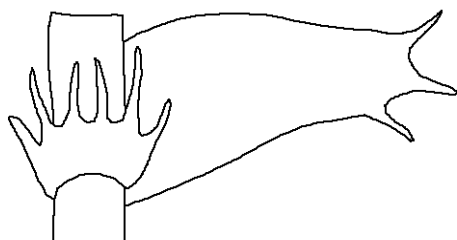


Figure 7: *Bazzania palmatifida* (STEPH.) GROLLE: Ventral view of the stem (redrawn after STEPHANI [1985] *Icones* no. 7213)

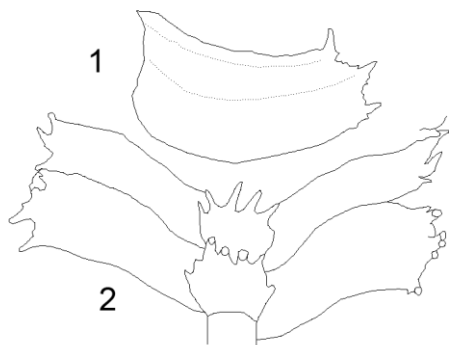


Figure 8: *Bazzania palmatifida* (STEPH.) GROLLE sensu KITAGAWA: 1 – Leaf, 2 – Ventral view of the stem (redrawn after KITAGAWA [1979])

Historical account:

As mentioned above it is very obvious that the drawings of STEPHANI (Figure 7) and KITAGAWA (Figure 8) show different plants. KITAGAWA studied the specimen ex herbarium GEHEEB (G) but used material collected by VAN ZANTEN in Papua New Guinea for his drawings (KITAGAWA [1979], fig. 1, except no. 12).

STEPHANI (1906) placed *B. palmatifida* in his “section V. Fissistipulae”. His drawing as well as his description clearly indicate to a member of this section. Multilobate underleaves are not rare in this section, even though the lobes are mostly different to those of *B. palmatifida*.

As a conclusion we will treat *B. palmatifida* as a separate taxon which differs from all the other species similar to *B. subtilis*. Plants handled as *B. palmatifida* in KITAGAWA (1979) and *B. subtilis* in MEAGHER (2019), as well as other specimens from various herbaria are treated as *Bazzania helgana*.

Description:

Plants brownish green, small, up to 1.5 cm long, with leaves 1.0-1.2 mm wide, dichotomously branched.

Stem in cross section 135-175 µm and 10 cells wide, 130 µm and 8 cells high, medullary cells irregular polygonal, 18-32 x 14-19 µm, walls uneven thick-walled, marginal cells oval to rectangular, thick walled, 12-28 x 9-15 µm, dorsal cortical cells irregular polygonal, 13-20 x 15-37 µm, walls thickened, trigones not enlarged, cuticula smooth.

Flagelliform branches scattered, up to 4 mm long, leaves of flagelliform branches distant, quadrate to shortly rectangular, entire to

shortly multilobate, 85-115 µm wide, 90-110 µm long, cells thick-walled, trigones slightly enlarged.

Leaves spreading at an angle of 60°-90° with the stem, trilobate, rarely bilobate, asymmetric, triangular-ovate, falcate by 25°-70°, dorsal margin arched, ventral margin straight to slightly falcate, imbricate, flat to apically curved ventrally, dorsal base reaching the middle line of the stem, widest 0.25-0.3 of the leaf length above the base, 650-700 µm long, 180-260 µm wide at the base, 280-310 µm wide at the widest part, 140-200 µm wide at apex (at base of lobes), margin apically crenulate or serrulate.

Leaf lobes sharp, slightly hooked ventrally, ±straight, the lateral divergent, serrulate.

Vitta well developed, not very sharply delimited, reaching the leaf apex, 7-8 rows wide at the base, 5 rows wide at the upper end of the vitta, 1-2 cell rows from vitta to ventral margin, 7-10 cells from vitta to dorsal margin at widest part of leaf lobe, cells round to ovate, 20-28 x 20-52 µm, walls thin, trigones thickened, cuticula verrucose through striolate papillae.

Leaf cells rather regular, cells of the dorsal, basal lamina quadrate to irregular polygonal, 14-23 x 10-19 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae, dorsal marginal cells rectangular to ovate, 15-18 x 12-16 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae, ventral marginal cells quadrate to ovate, 15-18 x 12-18 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae.

Underleaves approximate, loosely appressed to reflexed, 1.9-2.5 times as wide as the stem, transversely attached, connate on one side with the lateral leaves, chlorophyllous, divided to 1/3 to 1/2 into 4-5 lobes, with 2 rather large lateral teeth,

240-360 µm wide, 270-360 µm long, discus wider than long, 190-250 µm, 11-14 cells wide, 140-180 µm, 6-7 cells long, cells round to ovate, walls 18-25 x 17-38 µm, trigones thickened, cuticula slightly enlarged, verrucose through round to oval papillae at the apex, almost smooth at the base, lobes straight, 100-160 µm, 3-6 cells long, 2-3 cells wide at base, apical cell narrowly triangular, 2.5-4 times as long as wide, 11-12 x 30-47 µm, apically slightly to strongly thickened.

Distinguishing characters:

Bazzania palmatifida is characterized by (1) the square to rhombic shape of the underleaf discus, (2) its vitta that reaches the leaf apex, (3) ± thin walled leaf cells with enlarged trigones, and (4) the serrulate leaf lobes. It is similar to *B. palmatifidoides* which is smaller, has almost entire leaf lobes and a much smaller area between the vitta and the dorsal leaf margin (4-6 cell rows vs. 7-10 cell rows in *B. palmatifida*).

Distribution:

New Guinea (only known from the type collection).

Specimen examined:

New Guinea: leg. REV. J. CHALMERS, 1880, det. FRANZ STEPHANI (G 0067032 – Holotype).

***Bazzania palmatifidoides* U. SCHWARZ, SCHÄF.-VERW. & SHEVOK spec. nov.**

Figures:

Plate 27, Plate 28, Plate 29, Plate 30.

Holotype:

Indonesia: New Guinea Island, Province West Papua, Vogelkop Peninsula. Aifat river valley, 1° 6' 8" S, 132° 43' 33" E, 1250 m, leg. PIETER VAN ROYEN & HERMAN O. SLEUMER 6902c-I, 1961, det. RICLEF GROLLE, 1968, as *Bazzania palmatifida* (JE).

Description:

Plants brownish, small, up to 1.5 cm long, with leaves 0.9-1.1 mm wide, dichotomously branched, rhizoids not seen.

Stem in cross section 140-165 µm and 9 cells wide, 100 µm and 10 cells high, medullary cells irregular in outline, polygonal, 12-20 x 10-18 µm, walls strongly thickened, marginal cells oval to rectangular, strongly thickened, 13-26 x 12-20 µm, dorsal cortical cells rectangular to irregular polygonal, 12-20 x 17-40 µm, walls thickened, trigones not enlarged, cuticula smooth.

Flagelliform branches scattered, up to 5 mm long, leaves of flagelliform branches distant, triangular to ovate, entire to shortly multilobate, 95-130 µm wide, 80-120 µm long, cells thickened, trigones slightly enlarged.

Leaves spreading at an angle of 70°-90° with the stem, trilobate, asymmetric, oblong-ovate, falcate by 20°-40°, dorsal margin arched, ventral margin straight, distant to loosely imbricate, leaf apex curved ventrally, dorsal base not crossing the middle of the stem, widest 0.2-0.25 of the leaf length above the base, 500-530 µm long, 150-180 µm wide at the base, 230-260 µm wide at the widest part, 110-150 µm wide at apex (at base of lobes), margin entire to weakly crenulate.

Leaf lobes sharp, flat, 1-2 cells wide at base, 2-6 cells long, the lateral divergent, entire.

Vitta well developed, sharply delimited, reaching the leaf apex, 5-6 rows wide at the base, 3-5 rows wide at the upper end of the vitta, 1 cell rows from vitta to ventral margin, 4-6 cells from vitta to dorsal margin at widest part of leaf lobe, cells ovate, 18-30 x 22-55 µm, walls thin, trigones thickened, cuticula verrucose through striolate papillae.

Leaf cells rather regular, cells of the dorsal, basal lamina quadrate to rectangular, 14-18 x 12-24 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae, dorsal marginal cells round to quadrate, 13-18 x 13-21 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae, ventral marginal cells ovate, 17-20 x 13-20 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae.

Underleaves distant to approximate, loosely appressed, 1.5-1.6 times as wide as the stem, transversely attached, connate on one side with the lateral leaves, chlorophyllous, divided to 1/4-1/3 into 4 lobes, sometimes with 1-2 lateral teeth, 210-280 µm wide, 160-230 µm long, discus wider than long, 180-230 µm, 10-11 cells wide, 110-140 µm, 4-5 cells long, cells quadrate, oval or rectangular, 14-22 x 22-32 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through

round to oval papillae at the apex, almost smooth at the base, straight, lobes 30-90 µm, 2-5 cells long, 1-2 cells wide at base, apical cell narrowly triangular, 1.5-3 times as long as wide, 13-18 x 27-50 µm, mostly sharply pointed.

Distinguishing characters:

From all the other species treated in this article, *B. palmatifidoides* can be distinguished by (1) its small size and (2) the leaves that are constricted below the leaf lobes. It shares many characters with *B. palmatifida* but can be distinguished by the characters mentioned under the latter.

If *B. palmatifidoides* is only a small form of *B. palmatifida*, it has to be decided by future studies.

Etymology:

The species is named because of its resemblance to *B. palmatifida*.

Distribution:

Fergusson Island, New Guinea.

Specimen examined:

Indonesia: New Guinea Island, Province West Papua, Vogelkop Peninsula. Aifat river valley, 1° 6' 8" S, 132° 43' 33" E, 1250 m, leg. PIETER VAN ROYEN & HERMAN O. SLEUMER 6902c-II, 1961, det. RICLEF GROLLE, 1968, as *Bazzania palmatifida* (JE).

Indonesia: New Guinea Island, Province West Papua, Vogelkop Peninsula. Aifat river valley, 1° 6' 8" S, 132° 43' 33" E, 1250 m, leg. PIETER VAN ROYEN & HERMAN O. SLEUMER 6902c-III, 1961, det. RICLEF GROLLE, 1974, as *Bazzania subtilis* (JE).

Papua New Guinea: Fergusson Island, Province Milne Bay, D'Entrecasteaux Islands. Mountain S of Agamoia, 9° 34' 0" S, 150° 38' 0" E, 820 m, on trees in mossy forest, leg. LEONARD J. BRASS 26070, 1956, det. RICLEF GROLLE, 1969, conf. NAOFUMI KITAGAWA, 27 November 1978, as *Bazzania subtilis* (JE, duplicate ex L).

***Bazzania pulchella* (STEPH.) H. A. MILL. *Phytologia* 47:321. 1981**

≡ *Mastigobryum pulchellum* STEPH. *Species Hepaticarum*. 3. 442. 1908.

Figures:

Plate 31, Plate 32, Plate 33, Plate 34 – STEPHANI (1985) *Icones* no. 6904.

Description:

Plants pale green, small, up to 1.5 cm long, with leaves 0.9-1.2 mm wide, irregular to dichotomously branched, rhizoids not seen.

Stem in cross section 145-160 µm and 8 cells wide, 90-100 µm and 7 cells high, medullary cells irregular polygonal, 11-20 x 12-24 µm, walls thickened, marginal cells quadrate to rectangular, walls thickened, 10-27 x 14-20 µm, dorsal cortical cells rectangular to polygonal, 15-25 x 35-65 µm, walls evenly thickened, trigones not enlarged, cuticula smooth.

Flagelliform branches scattered, up to 5 mm long, 90-100 µm in diameter, leaves of flagelliform branches distant, triangular to quadrate, shortly multilobate, 90-110 µm wide, 90-110 µm long, cells moderately thick-walled, trigones slightly enlarged.

Leaves spreading at an angle of 70°-85° with the stem, trilobate, asymmetric, oblong-ovate, falcate by 30°-50°, dorsal margin arched, ventral margin straight, imbricate, leaf apex curved ventrally, dorsal base not crossing the middle of the stem, widest 0.3 of the leaf length above the base, 590-660 µm long, 200-240 µm wide at the base, 290-390 µm wide at the widest part, 200-260 µm wide at apex (at base of lobes), margin entire, towards the apex irregular crenulate to serrate.

Leaf lobes sharp, hooked ventrally, 1-3 cells wide at base, 1-3 cells long, straight forward to slightly divaricate, crenulate.

Vitta well developed, diffusely delimited, reaching 4/5 of the leaf length, 5-7 rows wide at the base, 2-4 rows wide at the upper end of the vitta, 1-3 cell rows from vitta to ventral margin, 13-14 cells from vitta to dorsal margin at widest part of leaf lobe, cells quadrate to oblong-ovate, 20-30 x 30-40 µm, walls thin, trigones moderately thickened, cuticula verrucose striolate papillae.

Leaf cells rather regular, upper lamina cells oval to quadrate, 12-18 x 13-16 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae, cells of the dorsal, basal lamina round to quadrate, 13-18 x 13-18 µm, walls moderately thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae, dorsal marginal cells round to quadrate, 13-16 x 14-18 µm, walls moderately thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae, ventral marginal cells round to quadrate, 10-16 x 12-20 µm, walls moderately thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae.

Underleaves distant, reflexed, 1.4-1.6 times as wide as the stem, transversely attached, connate on one side with the lateral leaves, chlorophyllous, divided to 1/5-1/3 into 4 lobes, sometimes with 1-2 small, lateral teeth, 220-270 µm wide, 180-230 µm long, discus wider than long, 220-260 µm, 12-13 cells wide, 130-170 µm, 5-7 cells long, cells irregular in shape, quadrate, oval or rectangular, 15-25 x 14-20 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae at the apex, almost smooth at the base, reflexed, lobes 30-70 µm, 2-3 cells long, 1-2 cells wide at base, apical cell narrowly oval, 1.6-2 times as long as wide, 15-18 x 24-40 µm, apically obtuse.

Distinguishing characters:

Bazzania pulchella is characterized by (1) the broad leaves that are less than twice as long as wide, (2) trilobate leaves with short, sometimes hooked apices, (3) the underleaves with rather short (1-3 cells long) lobes, and (4) the crenulate leaf apex.

Distribution:

Fiji, Samoa.

Specimen examined:

Fiji: Taveuni Island, Taveuni, 16° 52' 20" S, 179° 59' 25" W, 840 m, tree trunks in rain forest, leg. DEGELIUS P-204/m, 1970, det. RICLEF GROLLE, 1974, as *Bazzania subtilis* f. *pulchella* nom. herb. (JE, with *B. tridens*).

Samoa: Upolu Island, District Atua, Sekundärwald östlich Vaipu, 13° 58' 18" S, 171° 34' 47" W, 300 m, an Bäumen, leg. WOLFRAM SCHULTZE-MOTEL 4379, 1972, det. RICLEF GROLLE, 1974, as *Bazzania subtilis* f. *pulchella* nom. herb. (JE, Duplicate ex B).

Samoa: Upolu Island, District Tuamasaga, Berg Lanutoo, 13° 54' 22" S, 171° 49' 1" W, leg. MAX FLEISCHER B-1412, 1903, det. RICLEF GROLLE, 1974, as *Bazzania pulchella* (JE, Duplikat ex B).

Samoa: Upolu Island, District Tuamasaga, Bergwald bei Tiavi, 13° 56' 40" S, 171° 45' 55" W, 700 m, an Bäumen, leg. WOLFRAM SCHULTZE-MOTEL 3605c, 1972, det. RICLEF GROLLE, 1974, as *Bazzania subtilis* f. *pulchella* nom. herb. (JE, Duplicate ex B).

Samoa: Upolu Island, District Tuamasaga, Bergwald bei Tiavi, 13° 56' 40" S, 171° 45' 55" W, 760 m, an Bäumen und Baumfarnen, leg. WOLFRAM SCHULTZE-MOTEL 4329a, 1972), det. RICLEF GROLLE, 1974, as *Bazzania subtilis* f. *pulchella* nom. herb. (JE, Duplicate ex B).

Samoa: Upolu Island, District Tuamasaga, Fußweg zwischen Leaupuni und Lake Lanoto'o, 13° 53' 45" S, 171° 49' 50" W, 500 m, an Bäumen, leg. WOLFRAM SCHULTZE-MOTEL 3079, 1972, det. RICLEF GROLLE, 1974, as *Bazzania subtilis* f. *pulchella* nom. herb. (JE, Duplicate ex B).

Remarks:

STEPHANI (1985) Icones no. 7340 is also labeled as *Mastigobryum pulchellum*. As *M. pulchellum* was already described in STEPHANI (1908), STEPHANI (1924) renamed the plants from New Caledonia as *M. leratii*.

***Bazzania reicheliana* U. SCHWARZ, SCHÄF.-VERW. & SHEVOK spec. nov.**

Figures:

Plate 35, Plate 36, Plate 37, Plate 38.

Holotype:

France d'outre-mer: Nouvelle-Calédonie Island, Province Sud, Parc des Grandes Fougères, 21° 37' 0" S, 165° 45' 0" E, 400 m, auf Totholz, leg. K. REICHEL NC 774, 8 December 2010, det. FRANK MÜLLER, conf. DAVID MEAGHER, as *Bazzania* cf. *subtilis* (DR).

Description:

Plants pale green, small, up to 1 cm long, with leaves 0.9-1.2 mm wide, dichotomously branched, rhizoids rare, in bundles from base of underleaves.

Stem in cross section 200-250 µm and 11 cells wide, 170 µm and 10 cells high, medullary cells ovate to irregular polygonal, 14-20 x 11-32 µm, walls thickened, marginal cells quadrate to rectangular, walls thickened, 18-32 x 22-27 µm, dorsal cortical cells rectangular or elongated oval, 23-32 x 38-82 µm, walls thickened, trigones not enlarged, cuticula smooth.

Flagelliform branches scattered, up to 3 mm long, 140 µm in diameter, leaves of flagelliform branches distant, triangular, shortly multilobate, 80-100 µm wide, 70-90 µm long, cells moderately thick-walled, trigones slightly enlarged.

Leaves spreading at an angle of 60°-70° with the stem, trilobate, asymmetric, fragile, oblong-ovate, falcate by 30°-60°, dorsal margin arched, ventral margin straight to concave, imbricate, almost flat, dorsal base crossing the middle of the stem, widest 0.25-0.3 of the leaf length above the base, 1100-1200 µm long, 330-400 µm wide at the base, 500-530 µm wide at the widest part, 280-290 µm wide at apex (at base of lobes), margin irregular crenulate to serrate in the upper half of the leaf.

Leaf lobes sharp, weakly hooked ventrally, 2-4 cells wide at base, 2-3 cells long, the lateral rather divergent, crenulate to serrate.

Vitta well developed, diffusely delimited, almost reaching the leaf apex, 7-8 rows wide at the base, 5-7 rows wide at the upper end of the vitta, 1-2 cell rows from vitta to ventral margin, 6-10 cells from vitta to dorsal margin at widest part of leaf lobe, cells quadrate to oblong-ovate, 25-32 x 30-70 µm, walls thin, trigones thickened, cuticula smooth.

Leaf cells rather regular, upper lamina cells quadrate to ovate, 20-25 x 20-22 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae, cells of the dorsal, basal lamina quadrate to irregular polygonal, 14-19 x 16-21 µm, walls thickened, trigones not enlarged, cuticula smooth, dorsal marginal cells quadrate to short rectangular, 13-17 x 12-20 µm, walls thickened, trigones slightly enlarged, cuticula smooth, ventral marginal cells round to ovate, 16-21 x 11-17 µm, walls thickened, trigones slightly enlarged, cuticula smooth.

Underleaves approximate, reflexed, 1.6-2 times as wide as the stem, transversely attached, connate on one side with the lateral leaves, chlorophyllous, divided to 1/3 to 2/5 into 4-6 irregular lobes, sometimes with 1-2 small, lateral teeth, fragile, mostly missing in older parts of the stem, 400-490 µm wide, 320-430 µm long, discus mostly wider than long, 300-420 µm, 10-14 cells wide, 180-400 µm, 5-8 cells long, cells ovate to rectangular, 17-32 x 28-48 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae at the apex, almost smooth at the base, lobes 80-200 µm, 3-6 cells long, 2-4 cells wide at base, apical cell triangular, 2 times as long as wide, 13 x 25 µm, mostly sharply pointed.

Distinguishing characters:

The new species is distinguished from similar species by the following characters: (1) rather large leaves (1.1 – 1.2 mm long), (2) very irregular underleaf lobes, (3) the dorsal leaf base is crossing the stem midline, and (4) the fragility of leaves and underleaves often resulting in broken lobes. In size it resembles *B. helgana* which differs in the leaves less narrowing to the apex (250-380 µm wide at base of lobes against 280-290 µm in *B. reicheliana*) and 14-22 cells from vitta to dorsal margin (6-10 cells in *B. reicheliana*). Furthermore, the dorsal leaf base is not crossing the stem midline in *B. helgana* leaving a leaf-free strip of 1-2(-3) cells.

Etymology:

The species is named after DR. KATJA REICHEL (Berlin, Germany) a German botanist who discovered this species during her field trips in New Caledonia.

Distribution:

New Caledonia (only known from the type collection).

***Bazzania sikkimensis* (STEPH.) HERZOG** *Annales Bryologici* 12:78. 1939.

≡ *Mastigobryum sikkimense* STEPH. *Species Hepaticarum*. 3. 434. 1908.

Figures:

Plate 39, Plate 40, Plate 41 – DEL ROSARIO (1975) fig. 35, MIZUTANI (1967) fig. V, 10-20, SHARMA & SRIVASTAVA (1993) pl. 42, 43, 69 (fig. 7, 8), 76 (fig. 5, 6), STEPHANI (1985) Icones no. 6860, GAO (2003) plate 41, GAO & LAI (2003) tab. 347, ZHOU ET AL. (2012) fig. 28.

Description:

Plants pale brownish-green, small, up to 2 cm long, with leaves 1.5-2.0 mm wide, dichotomously branched, rhizoids not seen.

Stem in cross section 260-310 µm and 11-12 cells wide, 200 µm and 10 cells high, medullary cells round to irregular polygonal, 20-37 x 15-30 µm, walls thin, marginal cells oval to short rectangular, outer walls distinctively thickened, 18-32 x 12-22 µm, dorsal cortical cells irregular in outline, quadrate to rectangular or elongated oval, 20-27 x 32-52 µm, walls evenly thickened, trigones not enlarged, cuticula smooth.

Flagelliform branches scattered, up to 12 mm long, 150-200 µm in diameter, leaves of flagelliform branches distant, triangular, serrate at the apex, 160-180 µm wide, 130-160 µm long, cells thick-walled, trigones slightly enlarged.

Leaves spreading at an angle of 80°-90° with the stem, bilobate, asymmetric, oblong-ovate to triangular-ovate, falcate by 25°-40°, dorsal margin arched, ventral margin straight to concave, imbricate, weakly curved ventrally, dorsal base reaching the middle line of the stem, widest 0.25-0.35 of the leaf length above the base, 900-1250 µm long, 200-350 µm wide at the base, 450-600 µm wide at the widest part, 150-300 µm wide at apex (at base of lobes), margin entire.

Leaf lobes sharp, flat, 4-9 cells wide at base, 4-10 cells long, straight to slightly divergent, entire.

Vitta not developed, but a group of enlarged cells in central part of the leaf.

Leaf cells rather regular, getting smaller towards the margins, upper lamina cells quadrate to irregularly polygonal, 18-22 x 13-25 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through striolate papillae, cells of the dorsal, basal lamina quadrate to irregularly polygonal, 13-18 x 12-24 µm, walls thickened, trigones not enlarged, cuticula verrucose through striolate papillae, dorsal marginal cells quadrate to round, 12-17 x 13-18 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through striolate papillae, ventral marginal cells quadrate to irregularly polygonal, 17-22 x 16-19 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through striolate papillae, central laminal cells round to elongated oval, 22-35 x 20-37 µm, walls thin, trigones enlarged, cuticula verrucose through striolate papillae.

Underleaves approximate to imbricate, reflexed, 1.5-1.8 times as wide as the stem, sinuately attached, free or connate on one side with the lateral leaves, chlorophyllous, with 4 broad lobes, occasionally with smaller lateral teeth, 300-350 µm wide, 350-450 µm long, discus as long as wide, 20-27 cells wide, 17-20 cells long, cells quadrate to polytinal, 16-21 x 13-27 µm, walls thickened, trigones not enlarged, cuticula verrucose through round to oval papillae, lobes 18-32 µm, 1-4 cells long, 2-3 cells wide at base, apical cell triangular, 1 times as long as wide, 14-18 x 17-24 µm, obtusely pointed.

Distinguishing characters:

Bazzania sikkimensis can be distinguished by the (1) bilobate leaves, (2) the enlarged central cells that do not form a vitta (3) rather large underleaves with very short, ±triangular teeth like lobes.

Distribution:

Bhutan, Borneo, China, India, Nepal, Philippines, Taiwan, Thailand.

Specimen examined:

Philippines: Mindanao Island, Province Bukidnon, Mt. Kitanglad, tropical rain forest west to Malabalay, 8° 9' 38.23" N, 124° 55' 52.24" E, 2790 m, on rotten wood, leg. FELIX SCHUMM & UWE SCHWARZ, 19 August 1999 (Herbarium UWE SCHWARZ no. 4254)

Remarks:

DEL ROSARIO (1975) points out similarities to plants that he treated as *B. subtilis*. In particular the underleaves readily separate *B. sikkimensis* from *B. subtilis* and *B. acanonista*.

***Bazzania subtilis* (SANDE LAC.) SCHIFFN.** *Memorie del Reale Istituto Lombardo di Scienze e Lettere, Serie 3, Classe di Scienze Matematiche e Naturali.* 4:414. 1877.

≡ *Mastigobryum subtile* SANDE LAC. *Annales Museum Botanicum Lugduno-Batavi.* 1:302. 1864.

Figures:

Plate 42, Plate 43, Plate 44 – SANDE LACOSTE (1864) tab. VII, KITAGAWA (1977) fig. 5.

Description:

Plants pale green, small, up to 2 cm long, with leaves 1.2-1.5 mm wide, dichotomously branched, rhizoids not seen.

Stem in cross section 140-210 µm and 10 cells wide, 115 µm and 8 cells high, medullary cells irregular in outline, oval to polygonal, 14-29 x 12-19 µm, walls thin to thickened, marginal cells oval to short rectangular, outer walls thickened, 13-22 x 9-15 µm, dorsal cortical cells irregular in outline, oval, quadrate or short rectangular, 12-20 x 20-34 µm, walls evenly thickened, trigones slightly enlarged, cuticula smooth.

Flagelliform branches scattered, up to 7 mm long, 100 µm in diameter, leaves of flagelliform branches distant, triangular to quadrate, shortly multilobate, 72-82 µm wide, 75-80 µm long, cells moderately thick-walled, trigones slightly enlarged.

Leaves spreading at an angle of 80°-90° with the stem, trilobate, rarely bilobate, asymmetric, oblong-ovate, falcate by 20°-60°, dorsal margin arched, ventral margin straight to concave, loosely imbricate, flat, dorsal base not crossing the middle of the stem, widest 0.25-0.35 of the leaf length above the base, 570-630 µm long, 180-230 µm wide at the base, 260-300 µm wide at the widest part, 150-170 µm wide at apex (at base of lobes), margin entire.

Leaf lobes sharp, flat, 1-2 cells wide at base, 2-3 cells long, the lateral divergent, entire.

Vitta well developed, sharply delimited, reaching 4/5 of the leaf length, 3-4 rows wide at the base, 2-3 rows wide at the upper end of the vitta, 2-3 cell rows from vitta to ventral margin, 13-15 cells from vitta to dorsal margin at widest part of leaf lobe, cells quadrate to oblong-ovate, 17-24 x 24-40 µm, walls thin, trigones moderately thickened, cuticula verrucose striolate papillae.

Leaf cells rather regular, getting smaller towards the dorsal margin, upper lamina cells quadrate to irregularly polygonal, 10-14 x 11-16 µm, walls thickened, trigones not enlarged, cuticula verrucose through round to oval papillae, cells of the dorsal, basal lamina quadrate to irregularly polygonal, 13-18 x 13-19 µm, walls thickened, trigones not enlarged, cuticula verrucose through round to oval papillae, dorsal marginal cells quadrate to round, 11-14 x 11-13 µm, walls thickened, trigones not enlarged, cuticula verrucose through round to oval papillae, ventral marginal cells quadrate to irregularly polygonal, 11-16 x 10-18 µm, walls thickened, trigones moderately thickened, cuticula verrucose through round to oval papillae.

Underleaves distant, loosely appressed to reflexed, 1.25-1.5 times as wide as the stem, transversely attached, connate on one side with the lateral leaves, chlorophyllous, divided to 1/3 into 4 lobes, sometimes with 1-2 small, lateral teeth, 185-220 µm wide, 155-185 µm long, discus wider than long, 185-220 µm, 13-15 cells wide, 100-130 µm, 6-8 cells long, cells irregular in shape, quadrate, oval or rectangular, 14-19 x 13-26 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through round to oval papillae, reflexed, lobes 30-55 µm, 1-3 cells long, 2-3 cells wide at base, apical cell narrowly oval, 2.5-3 times as long as wide, 28-40 x 10-15 µm, obtusely pointed.

Distinguishing characters:

B. subtilis is distinguished from similar species by the combination of the following characters: (1) small size, stem with leaves 1.2-1.5 mm wide, (2) flat, trilobate leaves, (3) entire leaf margin and the (4) underleaves with 4 sharp teeth and a rather wide discus. It can only be confused with *B. pulchella* with leaves less than twice as long as wide, slightly shorter underleaf lobes and a crenulate leaf apex with hooked lobes.

Distribution:

Borneo, Java, Sumatra, New Guinea, Philippines.

Specimen examined:

Papua New Guinea: New Guinea Island, Province Milne Bay, Daga Area, Mt. Garatun, 9° 54' 13" S, 149° 23' 12" E, 1300 m, leg. NORMAN E.G. CRUTTWELL 24/c, 1972, det. RICLEF GROLLE, 1974, as *Bazzania subtilis*, conf. NAOFUMI KITAGAWA, 27 November 1978 (JE, Duplicate ex L).

Philippines: Mindanao Island, Province Misamis Oriental, Barangay Lunutan, tropical mountain rain forest at Mt. Lumot (Via Haruhay Trail) approaching from the intermediate camp, 8° 40' 42.77" N, 125° 1' 38.92" E, leg. FELIX SCHUMM & UWE SCHWARZ, 25 August 1999 (Herbarium UWE SCHWARZ 4775).

Remarks:

It seems that *B. subtilis* is rather rare in South East Asia. Until more material is on hand or existing specimens are reviewed, it is not possible to provide a final judgement on this point.

Bazzania vittata (GOTTSCHE) TREVIS. *Memorie del Reale Istituto Lombardo di Scienze e Lettere, Serie 3, Classe di Scienze Matematiche e Naturali* 4:414. 1877.

≡ *Mastigobryum vittatum* GOTTSCHE in GOTTSCHE, LINDENB. & NEES. *Synopsis hepaticarum*. Part 2. 216. 1845.

= *Mastigobryum integristipulum* STEPH. *Species Hepaticarum*. 3. 470. 1908. [fide DEL ROSARIO (1975)].

Figures:

Plate 45, Plate 46, Plate 47 – DEL ROSARIO (1975) fig. 37, LAI (1978) fig. 1, MEAGHER, D. (2019) fig. 33, STEPHANI (1985) Icones no. 7346.

Description:

Plants whitish-green, small, up to 1 cm long, with leaves 0.8-1.2 mm wide, irregular branched, rhizoids rare, at the base of the underleaves.

Stem in cross section 90-140 µm and 8 cells wide, 110 µm and 7 cells high, medullary cells round to irregular polygonal, 15-22 x 13-16 µm, walls moderately thickened, marginal cells irregular quadrate to rectangular, outer walls distinctively thickened, 21-30 x 13-28 µm, dorsal cortical cells rectangular to elongated hexagonal, 18-24 x 40-48 µm, walls evenly thickened, trigones not enlarged, cuticula smooth or verrucose through tiny round papillae.

Flagelliform branches sparse, up to 2 mm long, 50-60 µm in diameter, leaves of flagelliform branches distant, broad triangular, weakly lobed at the apex, 90 µm wide, 90 µm long, cells thin, trigones not enlarged.

Leaves spreading at an angle of 65°-80° with the stem, rounded to weakly trilobate, asymmetric, ovate, falcate by 35°-45°, dorsal margin arched, ventral margin straight to concave, imbricate, apically weakly curved ventrally, dorsal base reaching the middle line of the stem, widest 0.25-0.35 of the leaf length above the base, 500-600 µm long, 160-200 µm wide at the base, 310-390 µm wide at the widest part, 130-150 µm wide at apex (at base of lobes), margin entire.

Leaf lobes blunt, flat, 1-3 cells wide at base, 1-3 cells long, straight, entire.

Vitta well developed, diffusely delimited, reaching 2/3 of the leaf length, 3-5 rows wide at the base, 2-3 rows wide at the upper end of the vitta, 2-3 cell rows from vitta to ventral margin, 16-24 cells from vitta to dorsal margin at widest part of leaf lobe, cells quadrate to rectangular, 16-25 x 21-34 µm, walls thin, trigones moderately thickened, cuticula verrucose through tiny round papillae.

Leaf cells rather regular, getting smaller towards the margins, upper lamina cells quadrate to rhomboid, 12-14 x 11-16 µm, walls moderately thickened, trigones not enlarged, cuticula verrucose through tiny round papillae, cells of the dorsal, basal lamina quadrate to rhomboid, 12-14 x 10-16 µm, walls moderately thickened, trigones slightly enlarged, cuticula verrucose through tiny round papillae, dorsal marginal cells quadrate, 12-16 x 7-13 µm, walls moderately thickened, trigones slightly enlarged, cuticula verrucose through tiny round papillae, ventral marginal cells quadrate to rhomboid, 12-14 x 14-17 µm, walls moderately thickened, trigones not enlarged, cuticula verrucose through tiny round papillae.

Underleaves approximate, appressed, 1.2-1.8 times as wide as the stem, sinuously attached, free or connate on one side with the lateral leaves, hyaline, often with 1-3 rows of chlorophyllous cells at the base, broad ovate, sometimes retuse at the apex, very variable in size, 175-275 µm wide, 175-300 µm long, 15-20 cells wide, 10-12 cells long, cells rectangular, getting smaller towards the margin, 13-21 x 20-28 µm, walls thin, trigones not enlarged, cuticula smooth or verrucose through tiny round papillae, slime papillae often 1 or 2 at the apex of the underleaves.

Distinguishing characters:

From all the species handled in this article, *B. vittata* can easily be distinguished by its hyalin underleaves. In comparison to the other species, it is also markable that the verrucose cuticula is formed by tiny, dot-like papillae.

Distribution

Australia, Borneo, Java, Peninsular Malaysia, New Guinea, Philippines, Sri Lanka, Sulawesi, Sumatra, Taiwan, Thailand.

Specimen examined:

Philippines: Leyte Island, Province Leyte, Area around Lake Kasudsuran, Ormoc-City, Barangay Liberty, 11° 1' 32.33" N, 124° 44' 55.86" E, 720 m, on rotten wood, leg. FELIX SCHUMM & UWE SCHWARZ, 23 August 2000 (Herbarium UWE SCHWARZ no. 6369).

Philippines: Leyte Island, Province Leyte, Area around Lake Kasudsuran, Ormoc-City, Barangay Liberty, 11° 1' 32.33" N, 124° 44' 55.86" E, 720 m, on rotten wood, leg. FELIX SCHUMM & UWE SCHWARZ, 23 August 2000 (Herbarium UWE SCHWARZ no. 6379).

Philippines: Leyte Island, Province Leyte, Mt. Agipo, track from the summit of Mt. Agipo (10° 46' 43.74" N, 124° 49' 46.86" E) to Kadwa-An (10° 46' 14.94" N, 124° 48' 10.02" E), 10° 46' 54.83" N, 124° 48' 52.15" E, 700 m, on rotten wood, leg. FELIX SCHUMM & UWE SCHWARZ, 18 August 2000 (Herbarium UWE SCHWARZ no. 6198).

Philippines: Mindanao Island, Province Davao del Sur, Along Santa Cruz Trail, 6+ km to Mt. Apo between Big Rock and Tinikaran Campsite 1. 06° 58' 54.0" N, 125° 17' 25.0" E, 2000 m. Mixed hardwood forest with *Sphaeropteris* tree ferns. on hardwood trunk in filtered light, leg. JAMES R. SHEVOCK 60226, with LESLEY C. LUBOS, AIMAUELZON YORONG & ROMEO PATANO, 4 August 2022 (CAS, BRIT, CMUH, MO, Herbarium SCHÄFER-VERWIMP).

Philippines: Mindanao Island, Province Misamis Oriental, Barangay Lunutan, tropical mountain rain forest at Mt. Lumot (Via Haruhay Trail) approaching from the intermediate camp, 8° 40' 42.77" N, 125° 1' 38.92" E, on bark, leg. FELIX SCHUMM & UWE SCHWARZ, 25 August 1999 (Herbarium UWE SCHWARZ no. 4804).

Philippines: Mindanao Island, Province Misamis Oriental, Barangay Lunutan, tropical mountain rain forest at Mt. Lumot (Via Haruhay Trail) approaching from the intermediate camp, 8° 40' 42.77" N, 125° 1' 38.92" E, leg. FELIX SCHUMM & UWE SCHWARZ, 25 August 1999 (Herbarium UWE SCHWARZ no. 4775).

Philippines: Mindanao Island, Province North Cotabato, Bergregenwald beim Lake Venado, am Weg zum Gipfel des Mt. Apo, 7° 0' 9.28" N, 125° 16' 10.73" E, ca. 2210 m, auf Rinde, leg. UWE SCHWARZ, 20 March 1999 (Herbarium UWE SCHWARZ no. 3843).

Philippines: Mindanao Island, Province North Cotabato, Mountain rain forest at the east side of Lake Venado, 7° 0' 9.28" N, 125° 16' 10.73" E, ca. 2210 m, on bark, leg. UWE SCHWARZ, 20 March 1999 (Herbarium UWE SCHWARZ no. 3855).

Philippines: Mindanao Island, Province North Cotabato, Mountain rain forest at the east side of Lake Venado, 7° 0' 9.28" N, 125° 16' 10.73" E, ca. 2210 m, between *Anastrophyllum bidens* [3828], leg. UWE SCHWARZ, 20 March 1999 (Herbarium UWE SCHWARZ no. 3829).

Philippines: Mindanao Island, Province North Cotabato, Mt. Apo, Tropical mountain rain forest at Marbel-River-Campsite, 7° 0' 9.9" N, 125° 14' 46.03" E, 2040 m, on rotten wood, leg. FELIX SCHUMM & UWE SCHWARZ, 9 August 1999 (Herbarium UWE SCHWARZ no. 4392).

Philippines: Mindanao Island, Province North Cotabato, Mt. Apo, Tropical mountain rain forest at Marbel-River-Campsite, 7° 0' 9.9" N, 125° 14' 46.03" E, 1640 m, on soil, leg. FELIX SCHUMM & UWE SCHWARZ, 9 August 1999 (Herbarium UWE SCHWARZ no. 4376).

Philippines: Mindanao Island, Province North Cotabato, Tropical mountain rain forest near Lage Agko Campsite at the foot of Mt. Apo, 7° 1' 10.01" N, 125° 13' 22.51" E, 1240 m, on bark, leg. FELIX SCHUMM & UWE SCHWARZ, 7 August 1999 (Herbarium UWE SCHWARZ no. 4622).

Philippines: Mindanao Island, Province North Cotabato, Tropical mountain rain forest near Lage Agko Campsite at the foot of Mt. Apo, 7° 1' 10.01" N, 125° 13' 22.51" E, 1240 m, on tree fern, leg. FELIX SCHUMM & UWE SCHWARZ, 7 August 1999 (Herbarium UWE SCHWARZ no. 4606).

Philippines: Negros Island, Province Negros Occidental, Along the ridge trail well above the village of Naubok toward the summit slopes about Hapon-Haponon and Mt. Talinis. 09°14' 42.6" N, 123°07' 04.5" E, 1475 m. Mixed hardwood evergreen tropical rain forest with fern understory. On small diameter hardwood trunk in filtered light, leg. JAMES R. SHEVOCK 56235, with DARYL S. SALAS, 17 December 2019 (CAS, BRIT, CMUH, MO, Herbarium SCHÄFER-VERWIMP).

Philippines: Negros Island, Province Negros Oriental, Mt. Talinis (Cuernos de Negros), Lunga Nature Trail from Camp Vendiola to Lake Nailig, 9° 15' 34.88" N, 123° 10' 56.99" E, 1170 m, auf Baumfarn, leg. FELIX SCHUMM & UWE SCHWARZ, 10 August 2000 (Herbarium UWE SCHWARZ no. 5835).

Philippines: Negros Island, Province Negros Oriental, Mt. Talinis (Cuernos de Negros), Lunga Nature Trail from Camp Vendiola to Lake Nailig, 9° 15' 34.88" N, 123° 10' 56.99" E, 1100 m, on bark, leg. FELIX SCHUMM & UWE SCHWARZ, 10 August 2000 (Herbarium UWE SCHWARZ no. 5813).

Philippines: Negros Island, Province Negros Oriental, Mt. Talinis (Cuernos de Negros), Lunga Nature Trail from Camp Vendiola to Lake Nailig, 9° 15' 34.88" N, 123° 10' 56.99" E, 1170 m, on tree fern, leg. FELIX SCHUMM & UWE SCHWARZ, 10 August 2000 (Herbarium UWE SCHWARZ no. 5805).

Philippines: Negros Island, Province Negros Oriental, Mt. Talinis (Cuernos de Negros), Lunga Nature Trail from Camp Vendiola to Lake Nailig, 9° 15' 34.88" N, 123° 10' 56.99" E, 1100 m, on bark, leg. FELIX SCHUMM & UWE SCHWARZ, 10 August 2000 (Herbarium UWE SCHWARZ no. 5798).

Philippines: Panay Island, Province Antique, Municipality Culasi, Mt. Madja-as, forrest along the trail from Barangay Flores to the Batang-Batang ravine, 11° 21' 31.75" N, 122° 8' 29.29" E, 1340 m, on rotten wood, leg. UWE SCHWARZ, 36918 (Herbarium UWE SCHWARZ no. 7724 mixed with *Leucobryum bowringii*).

Remarks:

Similarities of *B. vittata* to *B. subtilis* were mentioned by SANDE LACOSTE (1864) mainly due to the well-developed vitta. The hyaline cells of the underleaves of *B. vittata* readily distinguish this species from the others addressed in this article.

The papillosity of the underleaves differs greatly, even within the same stem. There are underleaves with smooth cuticula (Plate 46: A, B), whereas some underleaves show a very verrucous surface (Plate 46: D, E, F). *Bazzania vittata* is quite common in the Philippines and was collected from the Islands of Mindanao, Negros, Leyte and Panay. At the current moment the authors are not yet able to judge if all these forms that differ in the shape of the leaf apex, development of the vitta or the papillosity of the cells belong to the same species or should be referred to other species, like for instance *B. semiopaca* N. KTAG. or *B. asperima* STEPH.

***Bazzania wiltensii* (SANDE LAC. ex STEPH.) SCHIFFN.** Conspectus Hepaticarum Archipelagi Indici. 180. 1898.

≡ *Mastigobryum wiltensii* SANDE LAC. ex STEPH. *Hedwigia* 25(6): 237 1886.

Figures:

Plate 48, Plate 49, Plate 50 – DEL ROSARIO (1975) fig. 34, STEPHANI (1886d) tab. II, fig. 21-23, STEPHANI (1985) Icones no. 6861.

Description:

Plants yellowish-brown, small, up to 1.5 cm long, with leaves 1.2-1.4 mm wide, irregular branched, rhizoids not seen.

Stem in cross section 180-220 µm and 9 cells wide, 130 µm and 8 cells high, medullary cells irregular polygonal, 18-31 x 12-21 µm, walls weakly thickened, marginal cells quadrate to rectangular, outer walls distinctively thickened, 17-32 x 14-25 µm, dorsal cortical cells quadrate to oval, 20-28 x 25-32 µm, walls evenly thickened, trigones not enlarged, cuticula smooth.

Flagelliform branches scattered, up to 7 mm long, 90-100 µm in diameter, leaves of flagelliform branches distant, triangular, weakly crenulate at the apex, 100-110 µm wide, 65-75 µm long, cells thick-walled, trigones slightly enlarged.

Leaves spreading at an angle of 80°-90° with the stem, bilobate, the ventral lobe usually smaller to vanishing, asymmetric, triangular, falcate by 30°-60°, dorsal margin arched, ventral margin concave, imbricate, weakly curved ventrally, dorsal base reaching the middle line of the stem, widest 0.2-0.25 of the leaf length above the base, 550-610 µm long, 200-340 µm wide at the base, 290-330 µm wide at the widest part, 70-80 µm wide at apex (at base of lobes), margin entire.

Leaf lobes blunt, flat, 1-3 cells wide at base, 1-4 cells long, straight to slightly divergent, entire.

Vitta not developed, but a group of enlarged cells in central part of the leaf.

Leaf cells rather regular, getting smaller towards the margins, upper lamina cells round, 15-22 x 18-24 µm, walls thin, trigones enlarged, cuticula verrucose through ovate papillae, cells of the dorsal, basal lamina round to irregular polygonal,

15-20 x 15-23 µm, walls thin, trigones enlarged, cuticula verrucose through ovate papillae, dorsal marginal cells round to oval, 12-14 x 12-17 µm, walls thickened, trigones slightly enlarged, cuticula verrucose through ovate papillae, ventral marginal cells rectangular, wider than long, 18-22 x 10-13 µm, walls thin, trigones slightly enlarged, cuticula verrucose through ovate papillae, central laminal cells round to oval, 23-28 x 18-27 µm, walls thin, trigones enlarged, cuticula verrucose through ovate papillae.

Underleaves approximate, appressed, 1-1.1 times as wide as the stem, transversely attached, free or connate on one side with the lateral leaves, chlorophyllous, broad ovate, retuse at the apex, 185-210 µm wide, 100-140 µm long, 9-14 cells wide, 5-7 cells long, cells round to ovate, 15-23 x 14-24 µm, walls thickened, trigones slightly enlarged, cuticula smooth.

Distribution:

Malaysia, Sumatra, Philippines.

Specimen examined:

Philippines: Mindanao Island, Province Misamis Oriental, Barangay Lunutan, tropical mountain rain forest at Mt. Lumot (Via Haruhay Trail) approaching from the intermediate camp, 8° 40' 42.77" N, 125° 1' 38.92" E, 2110 m, leg. FELIX SCHUMM & UWE SCHWARZ, 25 August 1999 (Herbarium UWE SCHWARZ no. 4776).

Remarks:

DEL ROSARIO (1975) mentions *B. wiltensii* and its relation to *B. subtilis*. As shown on the plates the underleaves of *B. wiltensii* are not lobate and the leaves don't develop a vitta. Furthermore, the leaves are much more narrowed towards the apex and the cell walls are thinner with markedly enlarged trigones.

6. Conclusion

• <i>B. palmatifida</i> • <i>B. palmatifidoides</i>	• <i>B. indigenarum</i> • <i>B. reichelianum</i>	• <i>B. acanonista</i> • <i>B. globuliformis</i>	• <i>B. acanoserrata</i> • <i>B. helgana</i> • <i>B. helgana</i> var. <i>minor</i>	• <i>B. pulchella</i> • <i>B. subtilis</i>
• Predominately trilobate • Vitta reaching to the leaf apex • Leaf cells thin walled with enlarged trigones • Underleaf lobes straight, not fragile • Leaf lobes entire to moderately serrulate	• Predominately trilobate • Vitta reaching 4/5 of the leaf • Leaf cells ± evenly thick walled • Underleaf lobes ± curved, fragile • Leaf lobes entire to moderately serrulate	• Predominately bilobate • Vitta reaching 4/5 of the leaf • Leaf cells ± evenly thick walled • Underleaf lobes straight, not fragile • Leaf lobes entire to moderately serrulate	• Predominately trilobate • Vitta reaching 4/5 of the leaf • Leaf cells ± evenly thick walled • Underleaf lobes straight, not fragile • Leaf lobes strongly serrulate	• Predominately trilobate • Vitta reaching 4/5 of the leaf • Leaf cells ± evenly thick walled • Underleaf lobes straight, not fragile • Leaf lobes entire to moderately serrulate
• New Guinea	• Western Pacific (New Caledonia, Vanuatu)	• SE Asia	• Malaysia to Australia	• Philippines to the Western Pacific (Fiji, Samoa)

Table 1: Overview of the morphological distinguishable groups

The close examination of specimens that would key out or have been synonymized and identified in the past as *Bazzania subtilis* showed that at least 10 different species (*B. acanonista*, *acanoserrata*, *globuliformis*, *helgana*, *indigenarum*, *palmatifida*, *palmatifidoides*, *pulchella*, *reicheliana*, and *subtilis*) can be distinguished. With *B. nitida* and *B. zonulata* there are two additional species that were not treated in this article.

Altogether this group is much more diverse in the South East Asian, Australia and the Pacific than previously assumed. Because of the experience with the “*subtilis*” – specimens from JE it is very likely that material from other collections will include additional undescribed taxa. The authors could also follow the species concept of STEPHANI (1908) and STEPHANI (1924), even though *B. subtilis* was used for plants which are now described as *B. acanonista*.

Based on the morphological attributes there seems to be five different groups (Table 1). If these groups represent a natural relationship, this would need to be investigated by future studies. Till now only forms around *B. palmatifida* show very different characters which would indicate a weak relation to *B. subtilis*. This clearly goes in line with STEPHANIS judgement where he placed *B. palmatifida* in sect. *Fissistipulae*. Genome sequencing and its analysis is nevertheless highly recommendable for all the respective species.

There are also signs that certain groups show similar distribution patterns. *B. reicheliana* from New Caledonia and *B. indigenarum* from Vanuatu have certain characters in common that are not shared with the other groups. Bilobate forms seem to be restricted to South East Asia. A final judgement will only be possible when more material is at hand.

7. New Taxa and Combinations

- *Bazzania acanonista* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK
- *Bazzania acanoserrata* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK
- *Bazzania globuliformis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK
- *Bazzania helgana* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK
- *Bazzania helgana* var. *minor* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK
- *Bazzania palmatifidoides* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK
- *Bazzania reicheliana* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

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9. Further specimens used in this article

Bazzania horridula SCHIFFN. *Nova Acta Academiae Caesareae Leopoldino-Carolinae Germanicae Naturae Curiosorum*. 60(2):258. pl. 11 fig. 12-22. 1893.

Philippines: Leyte Island, Province Leyte, Mt. Agipo, track from the summit of Mt. Agipo to Kadwa-An, 10° 46' 54.83" N, 124° 48' 52.15" E, 780 m, on rotten wood, leg. FELIX SCHUMM & UWE SCHWARZ, 18 August 2000 (Herbarium UWE SCHWARZ no. 6185).

Bazzania longicaulis (SANDE LAC.) SCHIFFN. *Conspectus Hepaticarum Archipelagi Indici*. 165. 1898.

Philippines: Negros Island, Province Negros Oriental, Mt. Talinis (Cuernos de Negros), Lunga Nature Trail, between Lake Nailik and Lake Yagumyum, 9° 14' 57.66" N, 123° 10' 49.87" E, 1580 m, on bark, leg. FELIX SCHUMM & UWE SCHWARZ, 11 August 2000 (Herbarium UWE SCHWARZ no. 5951)

Bazzania manillana (GOTTSCHE EX STEPH.) S. HATT. *The Botanical Magazin Tokyo*. 64:113. 1951.

Philippines: Negros Island, Province Negros Oriental, Mt. Talinis (Cuernos de Negros), Lunga Nature Trail, from Lake Yagumyum to Bediao, Dauin, 9° 15' 2.41" N, 123° 11' 10.32" E, leg. FELIX SCHUMM & UWE SCHWARZ, 12 August 2000 (Herbarium UWE SCHWARZ no. 6014).

Bazzania uncigera (REINW., BLUME & NEES) TREVIS. *Memorie del Reale Istituto Lombardo di Scienze e Lettere, Serie 3, Classe di Scienze Matematiche e Naturali* 4:415. 1877.

Philippines: Mindanao Island, Province Davao Oriental, Hamiguitan Range Wildlife Sanctuary, along east loop-trail section about 2-3 km from camp 4, mid-slopes of Mt. Hamiguitan just below the saturated boggy area. Small saturated mixed hardwood mossy tropical rain forest with podocarps and shrubs, 6° 43' 45.3" N, 126° 10' 40.4" E, 1085 m, on *Leptospermum* trunk in filtered light, leg. JAMES R. SHEVOCK 54897, with AIMAUELZON YORONG & DARYL SALAS, 18 June 2019 (CAS, BRIT, CMUH, MO, Herbarium SCHÄFER-VERWIMP).

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Plates

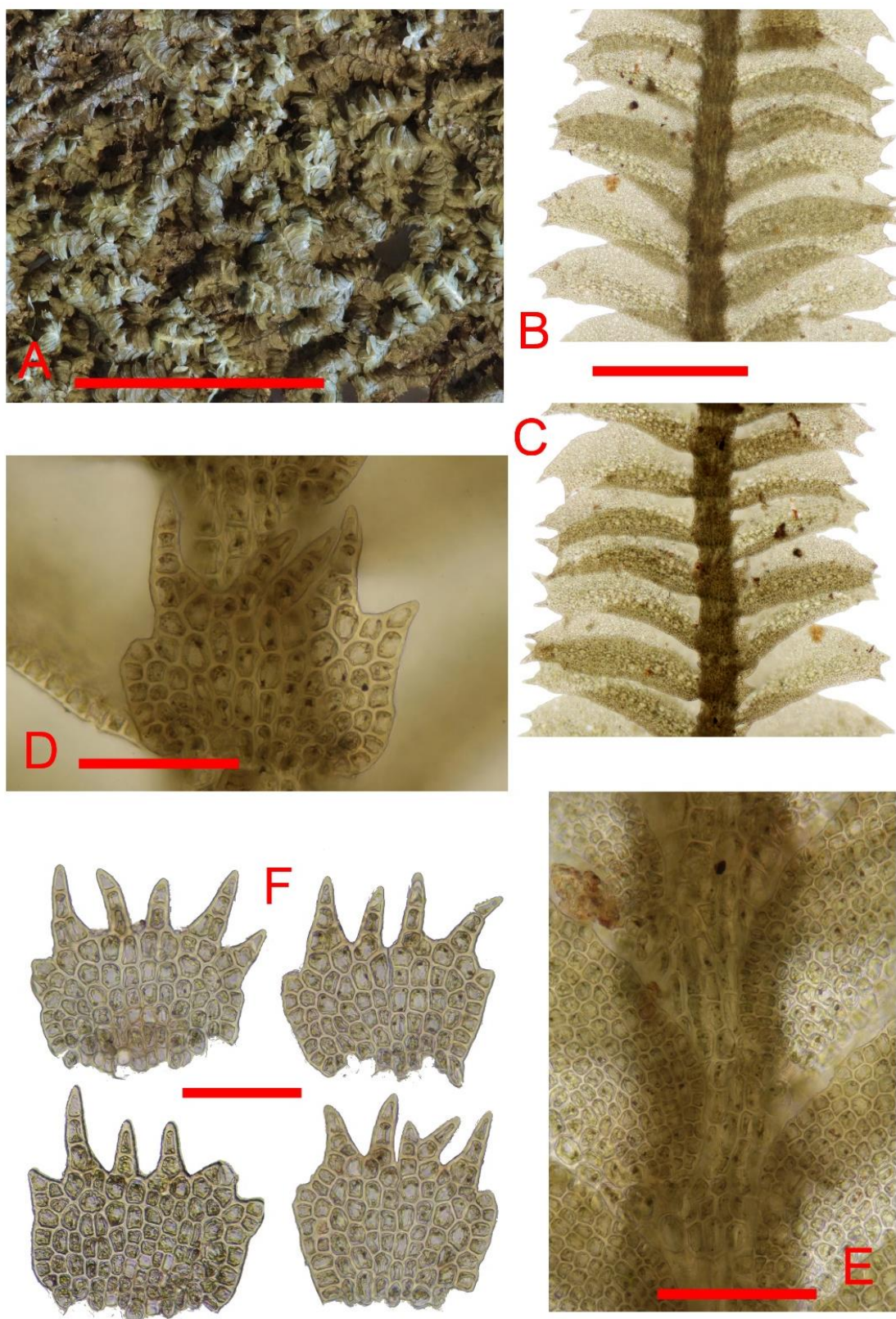
Bazzania acanonista U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

Plate 1: *Bazzania acanonista* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A – Plant; B, E – Plant dorsal; C, D – Plant ventral; F – Underleaves – Scales: A – 5 mm; B, C – 0.5 mm; D, E, F – 0.1 mm (from J.R. SHEVOCK 56240)

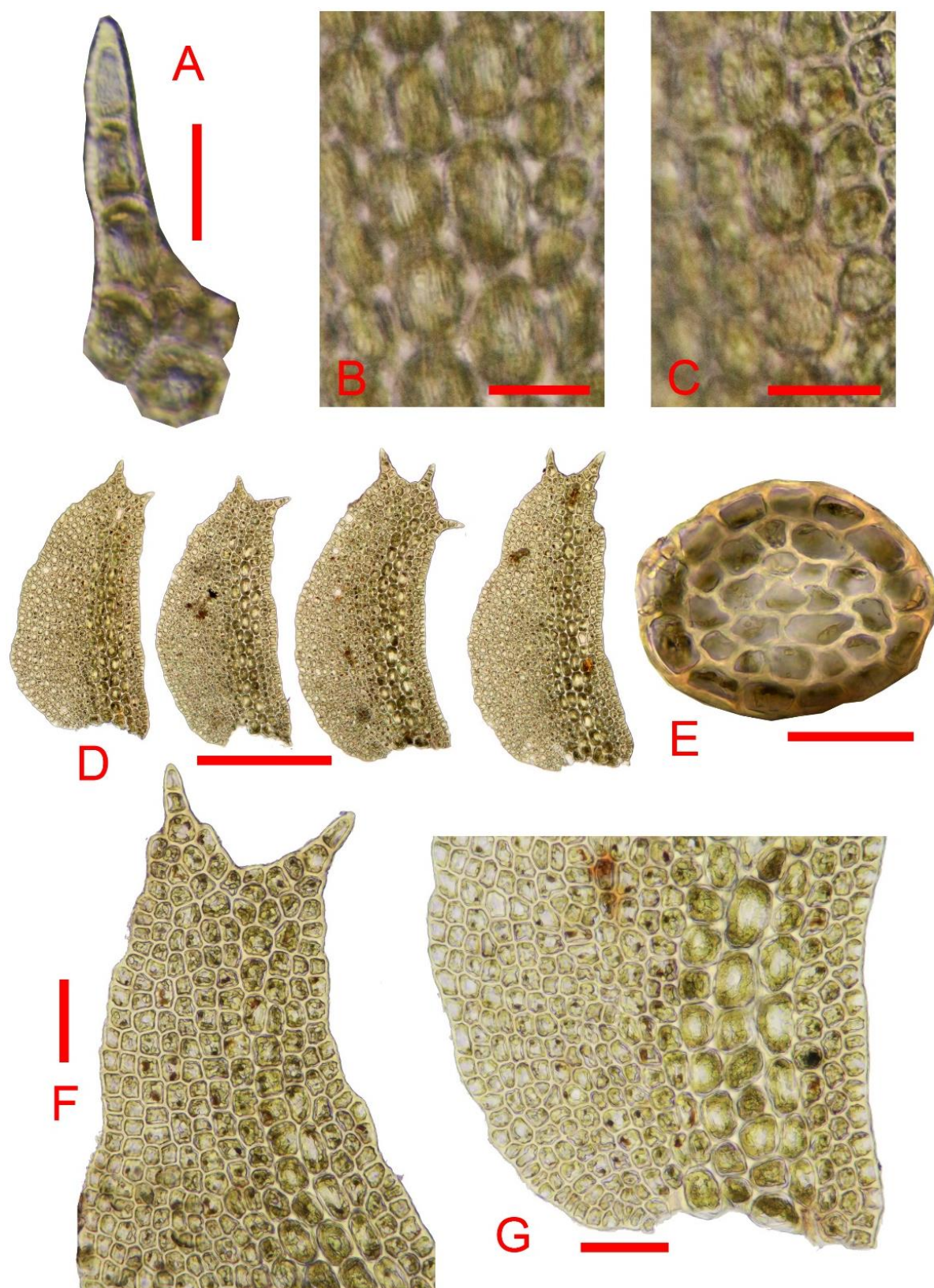


Plate 2: *Bazzania acanonista* U. SCHWARZ, SCHÄF.-VERW. & SHEVOK: A – Underleaf lobe; B – Basal leaf cells; C – Apical Leaf Cells; D – Leaves; E – Stem cross section; F – Leaf Apex; G – Leaf Base – Scales: A, B, C – 30 μ m; E, F, G – 50 μ m; D – 0.5 mm (from J.R. SHEVOK 56240)

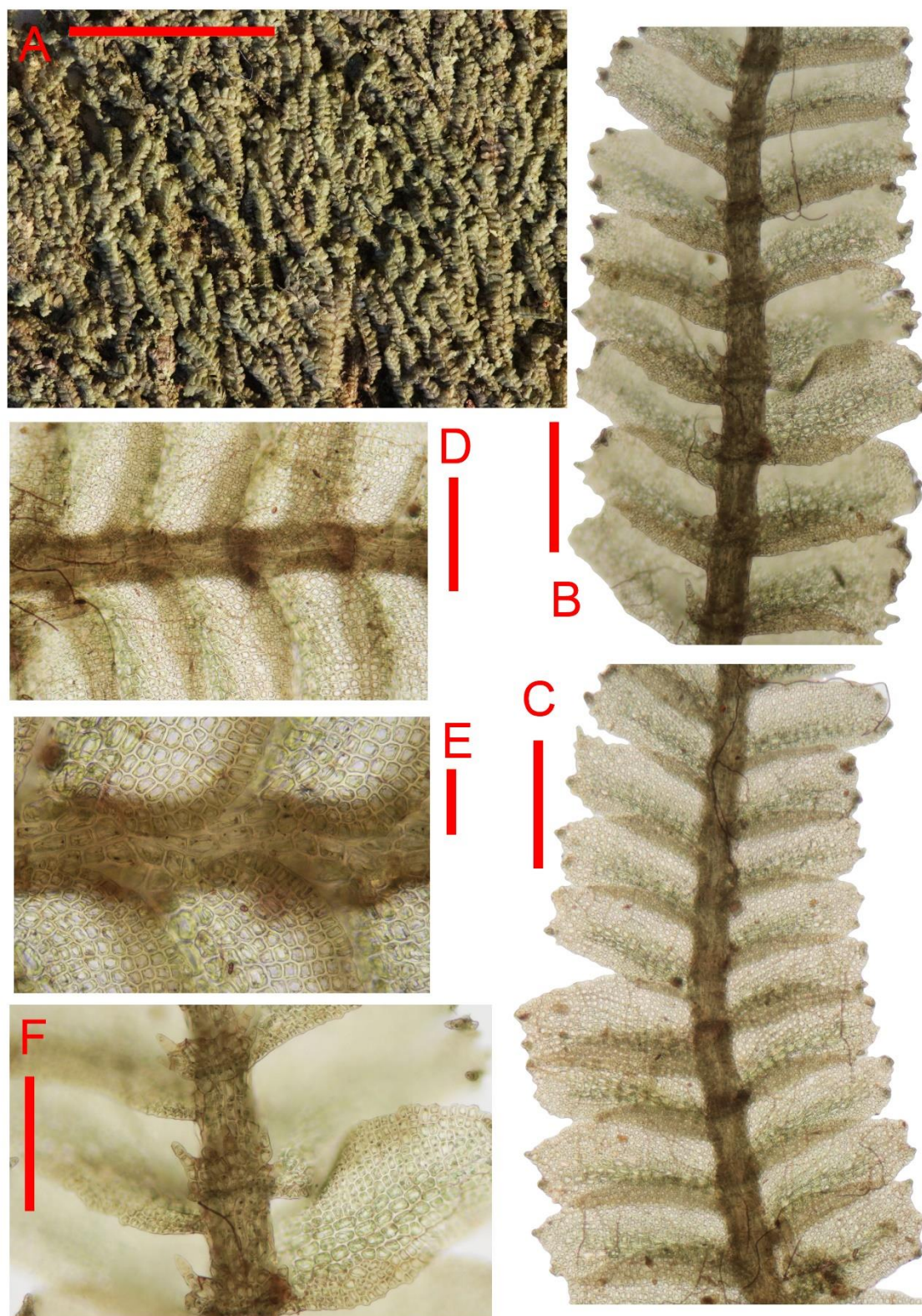
Bazzania acanoserrata U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

Plate 3: *Bazzania acanoserrata* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A – Habitus; B, F – Plant ventral; C, D, E – Plant dorsal – Scales: A – 0.5 cm; B, C – 0.3 mm; D, F – 0.2 mm; E – 50 µm (from JE G. EEN 12)

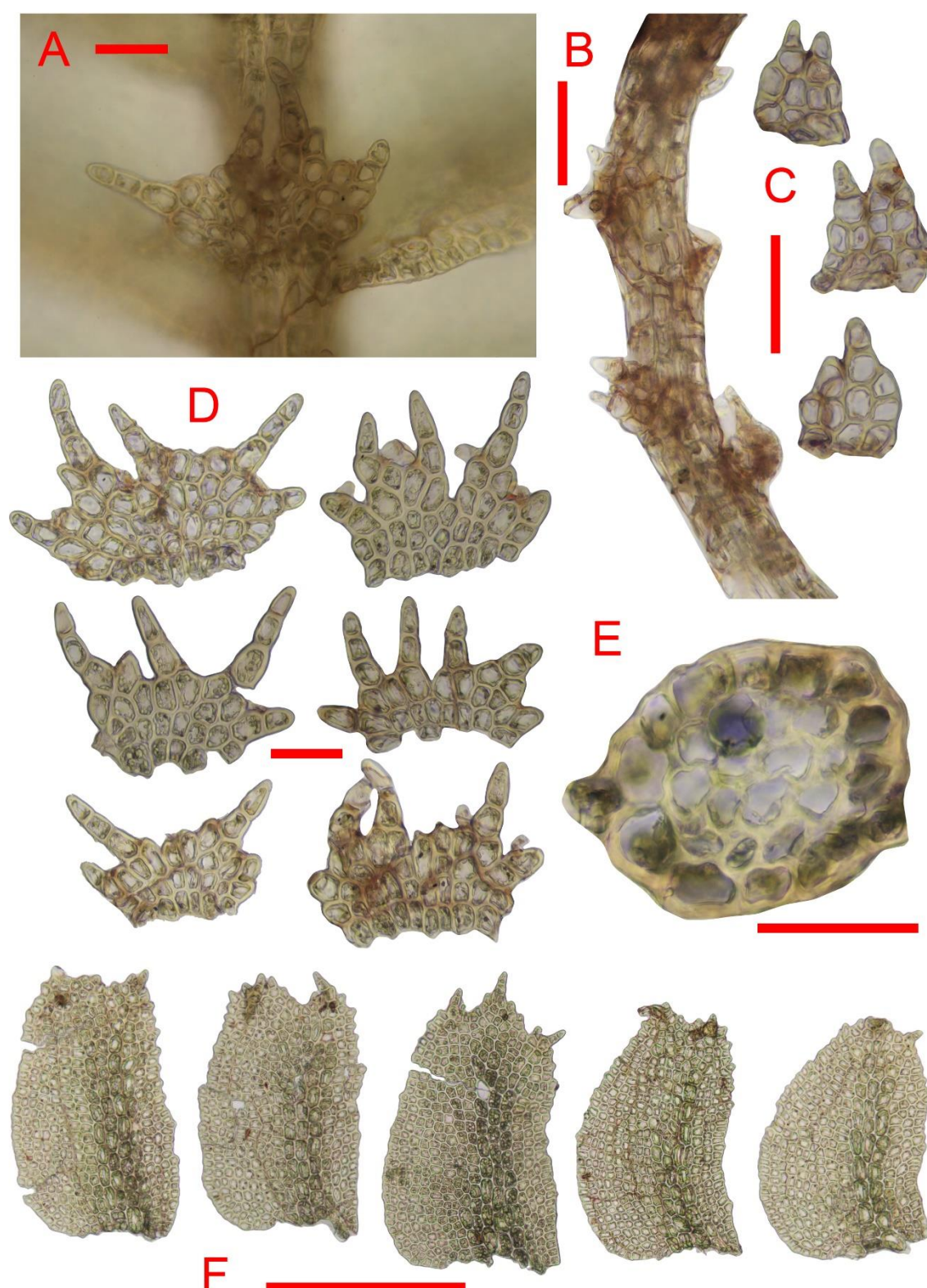


Plate 4: *Bazzania acanoserrata* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A – Plant ventral; B – Flagellate branch; C – Leaves of flagellate branch; D – Underleaves; E – Stem cross section; F – Leaves – Scales: A, B, C, D, E – 50 μ m; F – 0.3 mm (from JE G. EEN 12)

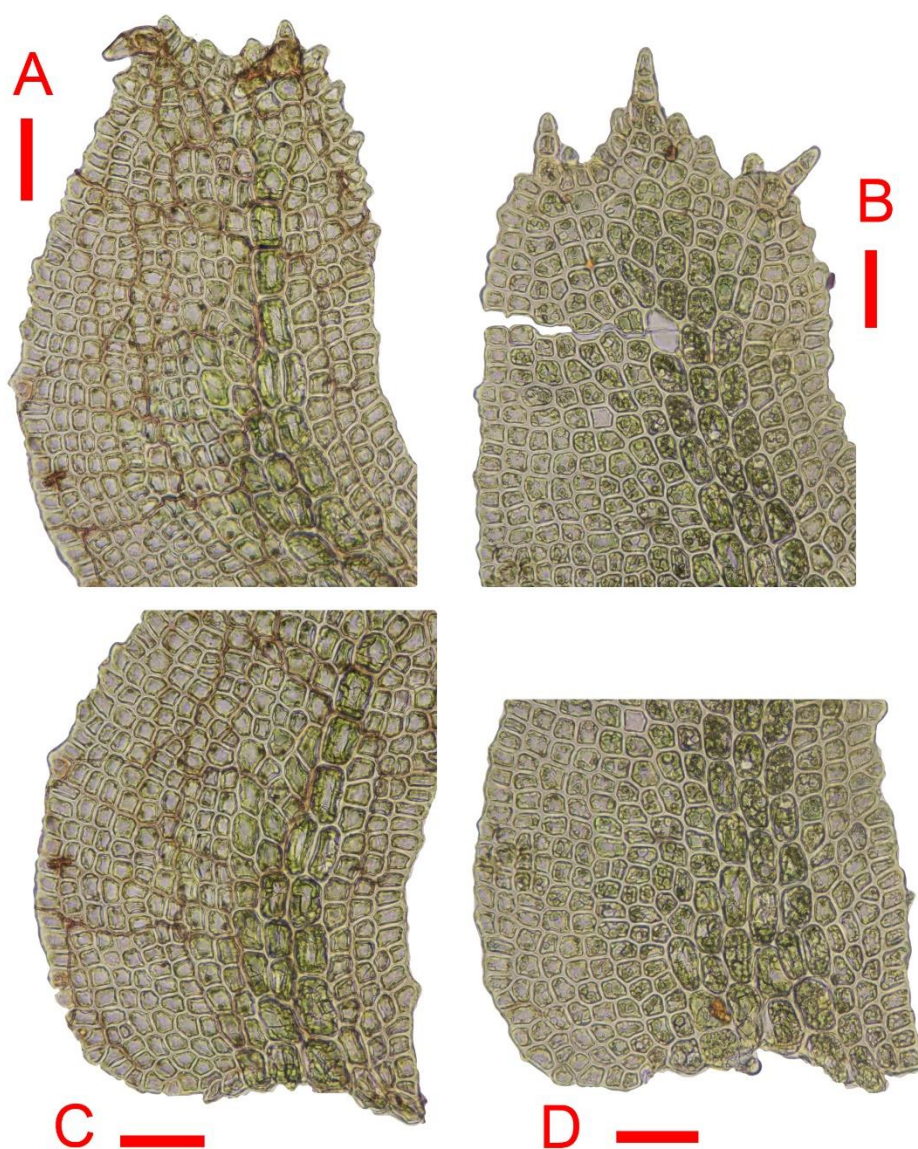


Plate 5: *Bazzania acanoserrata* U. SCHWARZ, SCHÄF.-VERW. & SHEVOK: A, B – Leaf apex; C, D – Leaf base – Scales: A, B, C, D – 50 μm (from JE G. EEN 12)

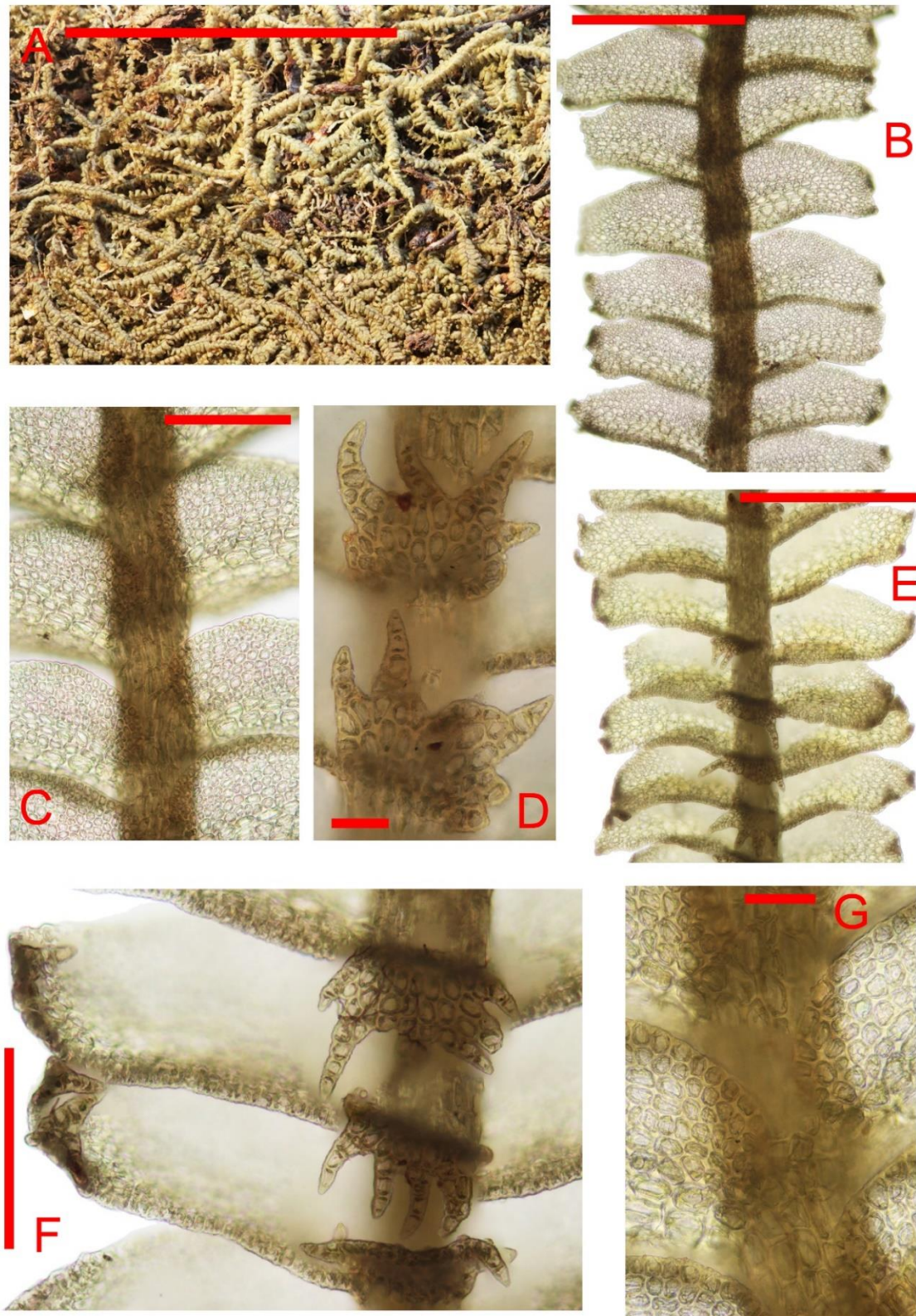
Bazzania globuliformis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

Plate 6: *Bazzania globuliformis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A – Habitus; B, C, G – Plants dorsal; D, E, F – Plants ventral – Scales: A – 1 cm; B, E – 0.5 mm; C, F – 0.2 mm; D, G – 50 µm (from UWE SCHWARZ 6231)

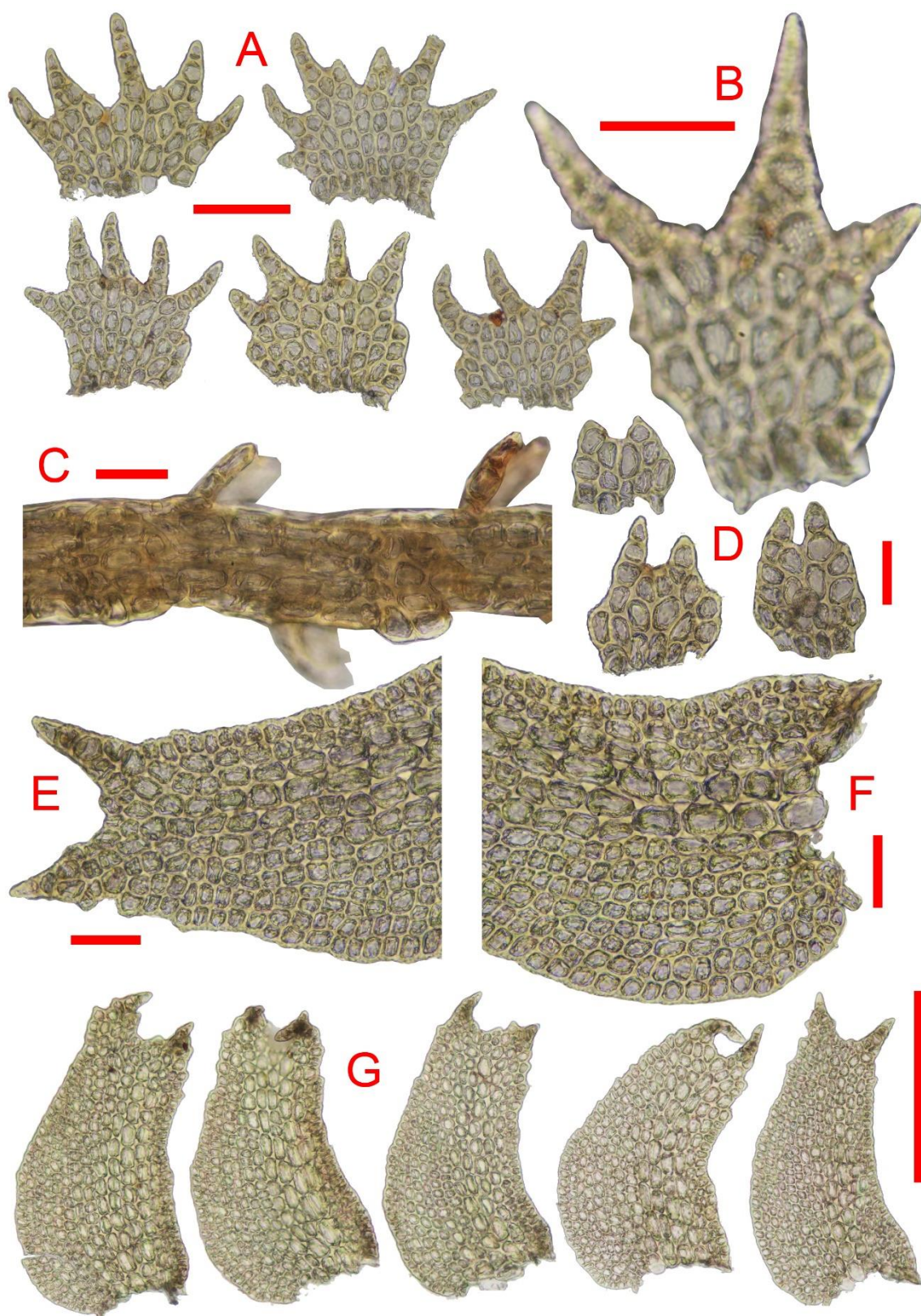


Plate 7: *Bazzania globuliformis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A – Underleaves; B – Cuticle of amphigastrium, C – Flagellate branch; D – Leaves of flagellate branch; E – Leaf apex; F – Leaf base; G – Leaves – Scales: A – 0.1 mm; B, C, D, E, F – 50 µm; G – 0.3 mm (from UWE SCHWARZ 6231)

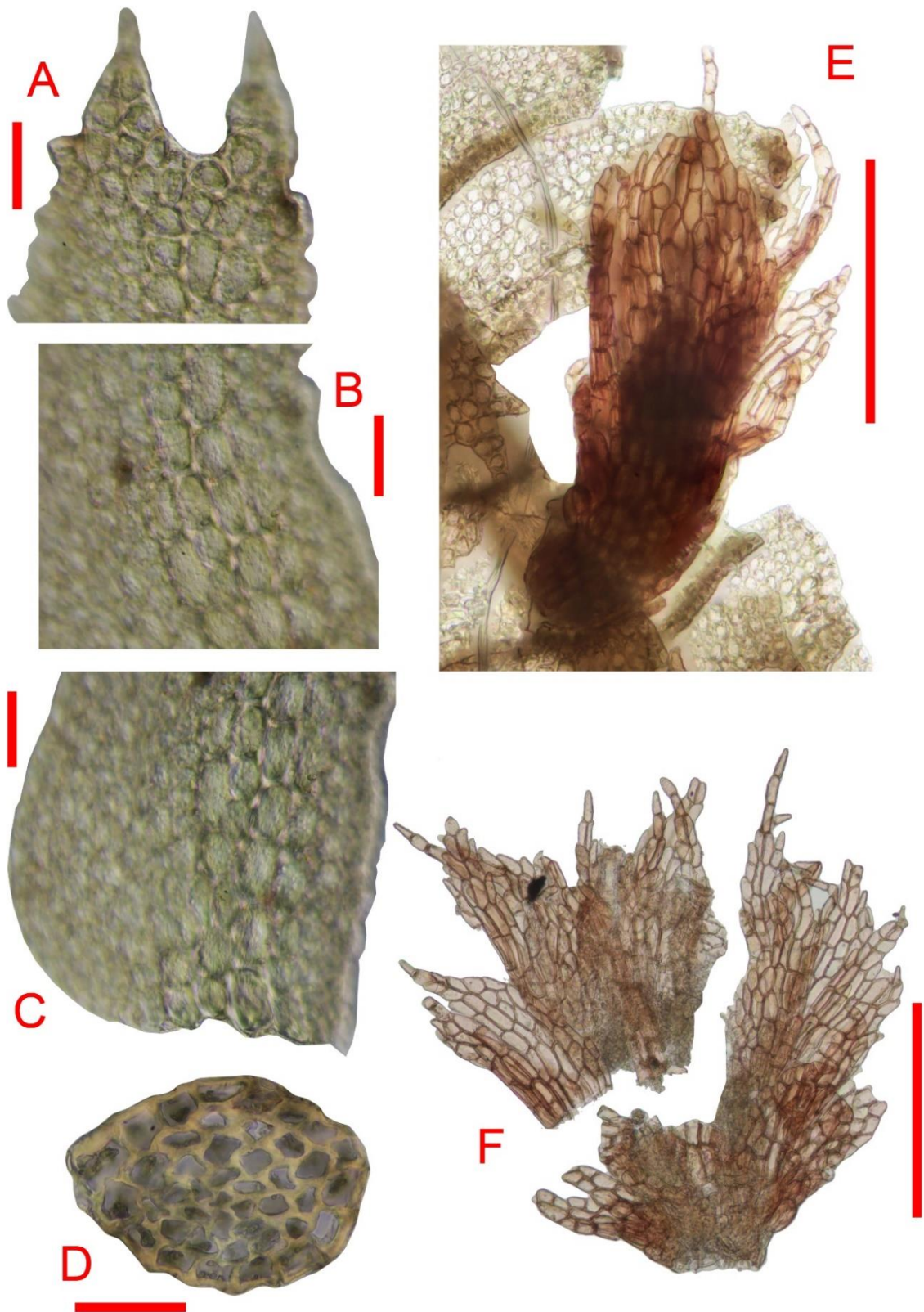
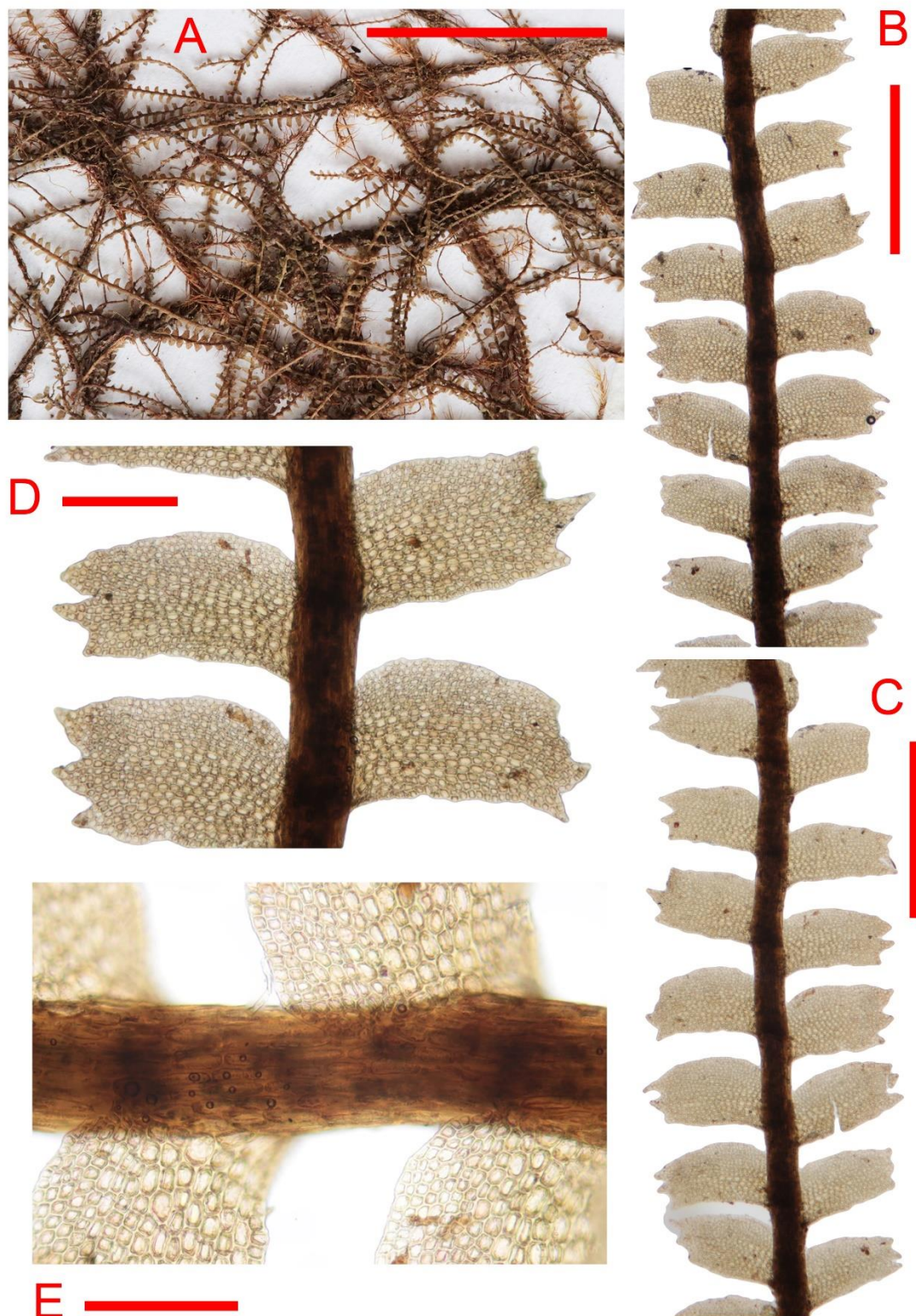


Plate 8: *Bazzania globuliformis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A – Leaf apex cuticula; B – Leaf middle cuticula, C – Leaf base cuticula; D – Stem cross section; E – Female inflorescence; F – Bracts – Scales: A, B, C, D – 50 µm; E, F – 0.3 mm (from UWE SCHWARZ 6231)

Bazzania herzogiana MEIJER.

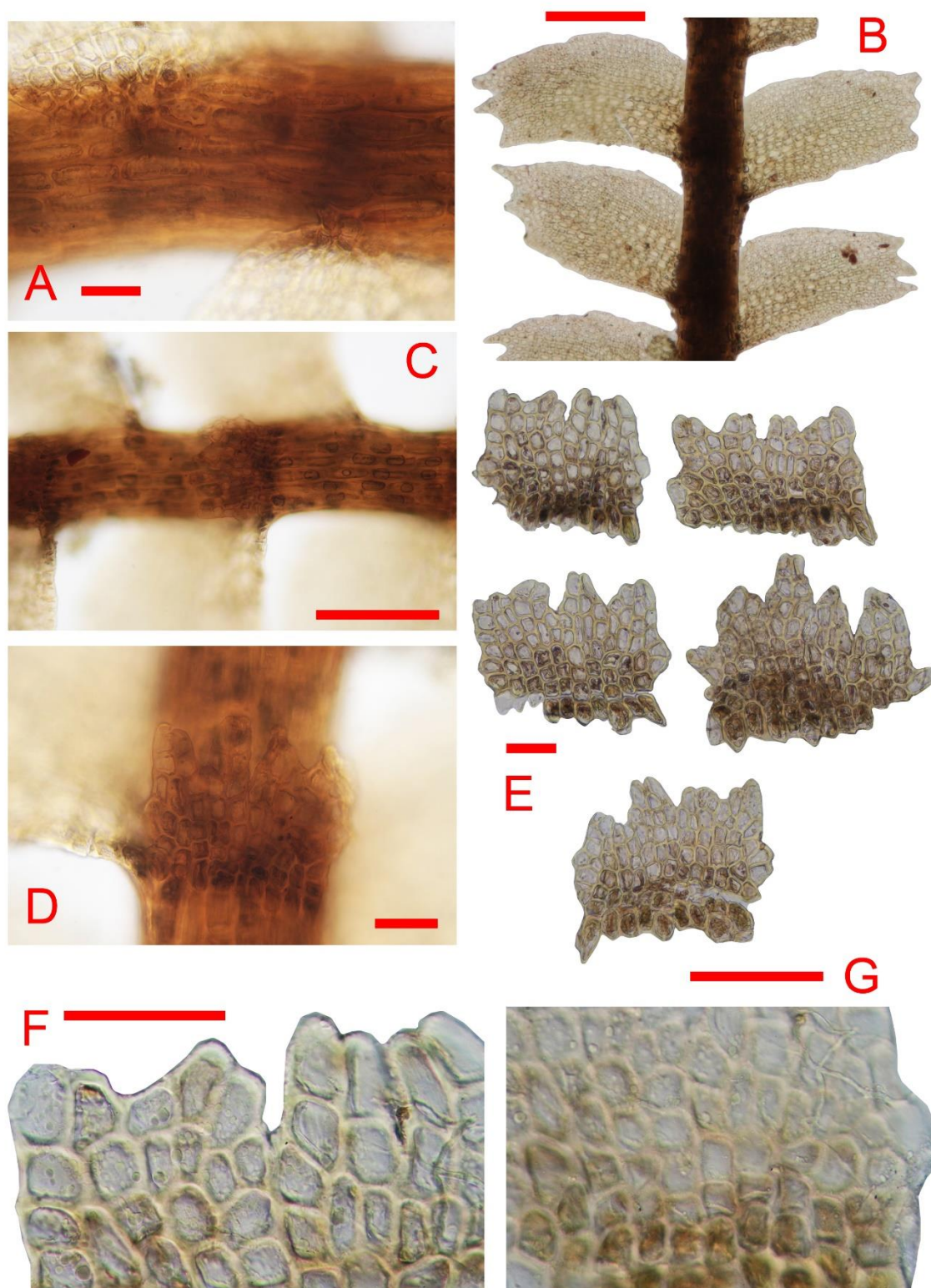


Plate 10: *Bazzania herzogiana* MEIJER: A – Plant dorsal; B, C, D – Plant ventral; E – Underleaves; F – Cuticula of underleaf apex; G – Cuticula of underleaf base – Scales: A, D, F, G – 50 μ m; B – 0.3 mm, C – 0.2 mm (from JE 4006222 – holotype)

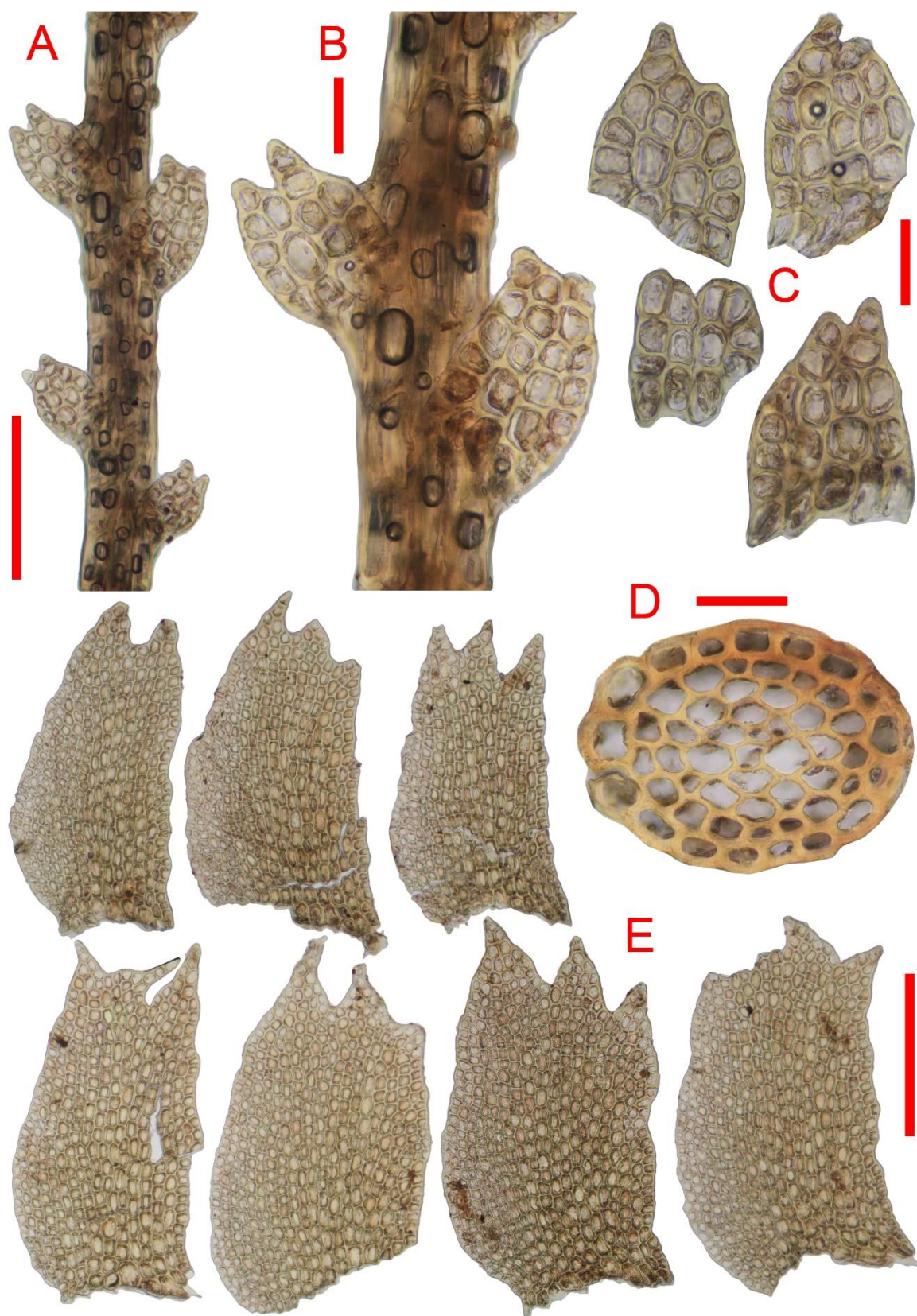


Plate 11: *Bazzania herzogiana* MEIJER: A, B – Flagellate branch; C – Leaves of flagellate branch; D – Stem cross section; E – Leaves – Scales: A – 0.2 mm; B, C, D – 50 μ m, E – 0.3 mm (from JE 4006222 – holotype)

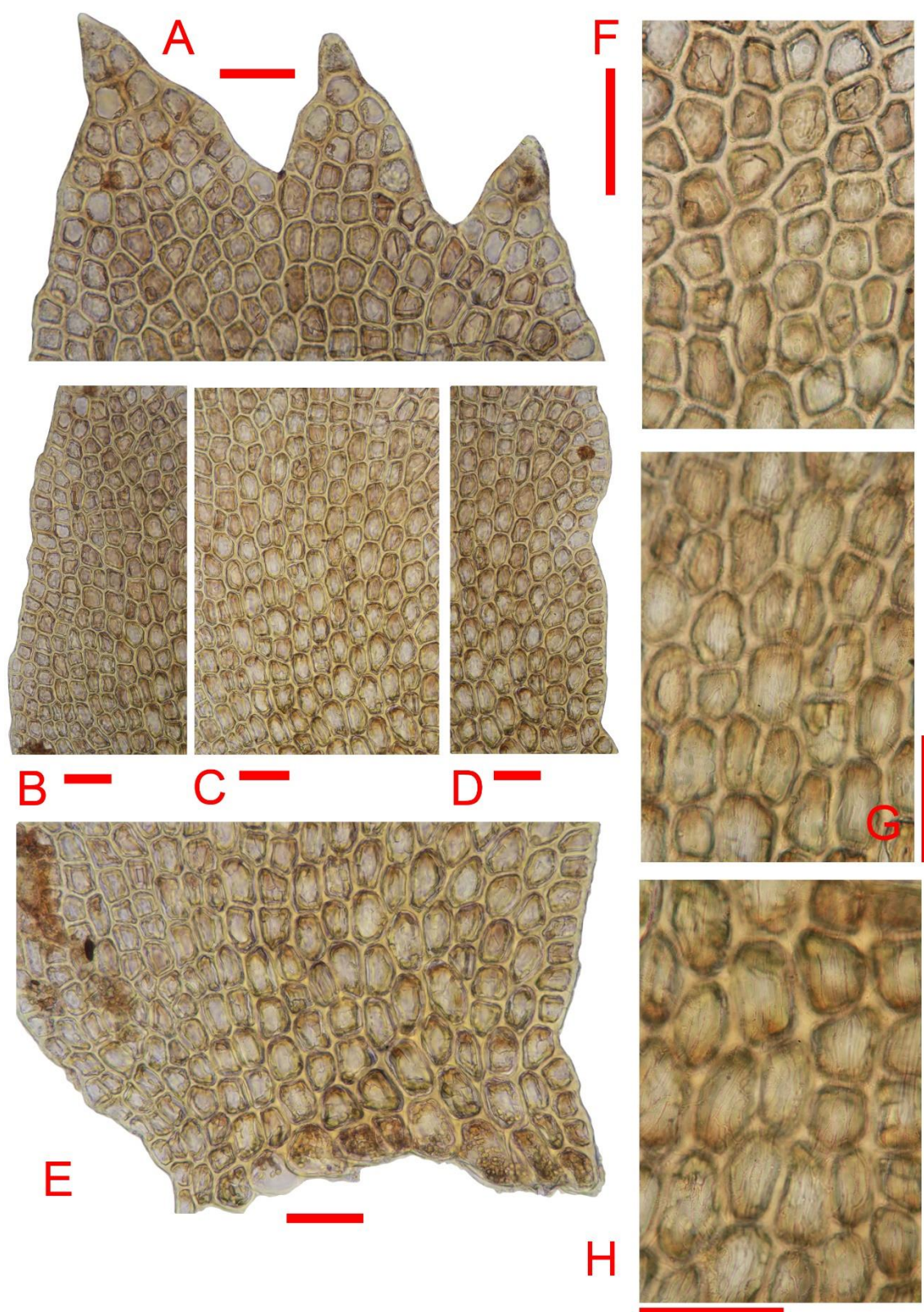


Plate 12: *Bazzania herzogiana* MEIJER: A – Leaf apex; B – Leaf middle dorsal; C – Leaf middle; D – Leaf middle ventral; E – Leaf base; F – Leaf apex cuticle; G – Leaf middle cuticle; H – Leaf base cuticle – Scales: A – H – 50 μ m (from JE 4006222 – holotype)

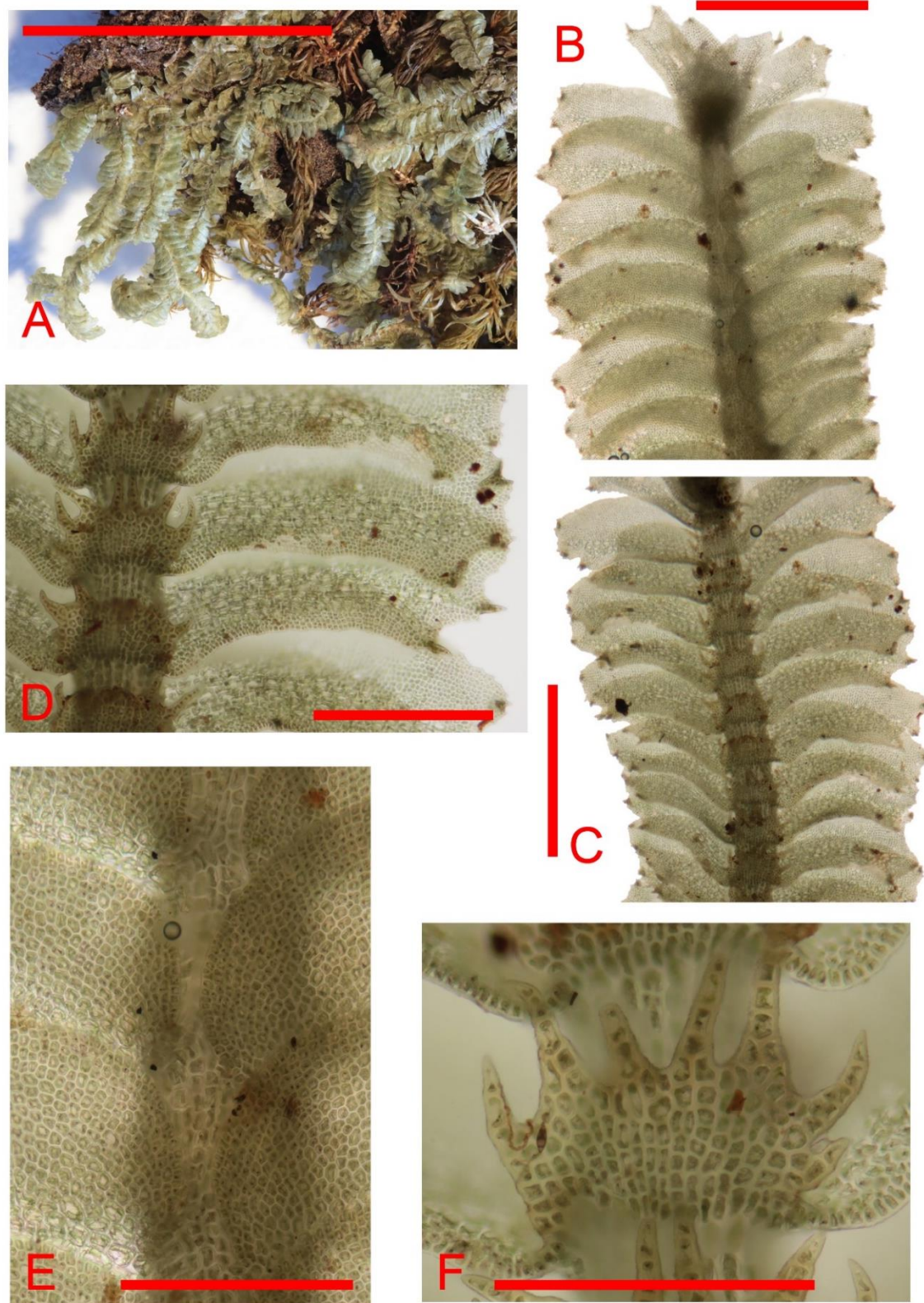
Bazzania helgana U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

Plate 13: *Bazzania helgana* (STEPH.) N. KITAG.: A – Habitus; B, E – Plants dorsal; C, D, F – Plants ventral – Scales: A – 1 cm; B, C – 1 mm; D – 0.5 mm; E, F – 0.3 mm (from A. SCHÄFER-VERWIMP 4040)

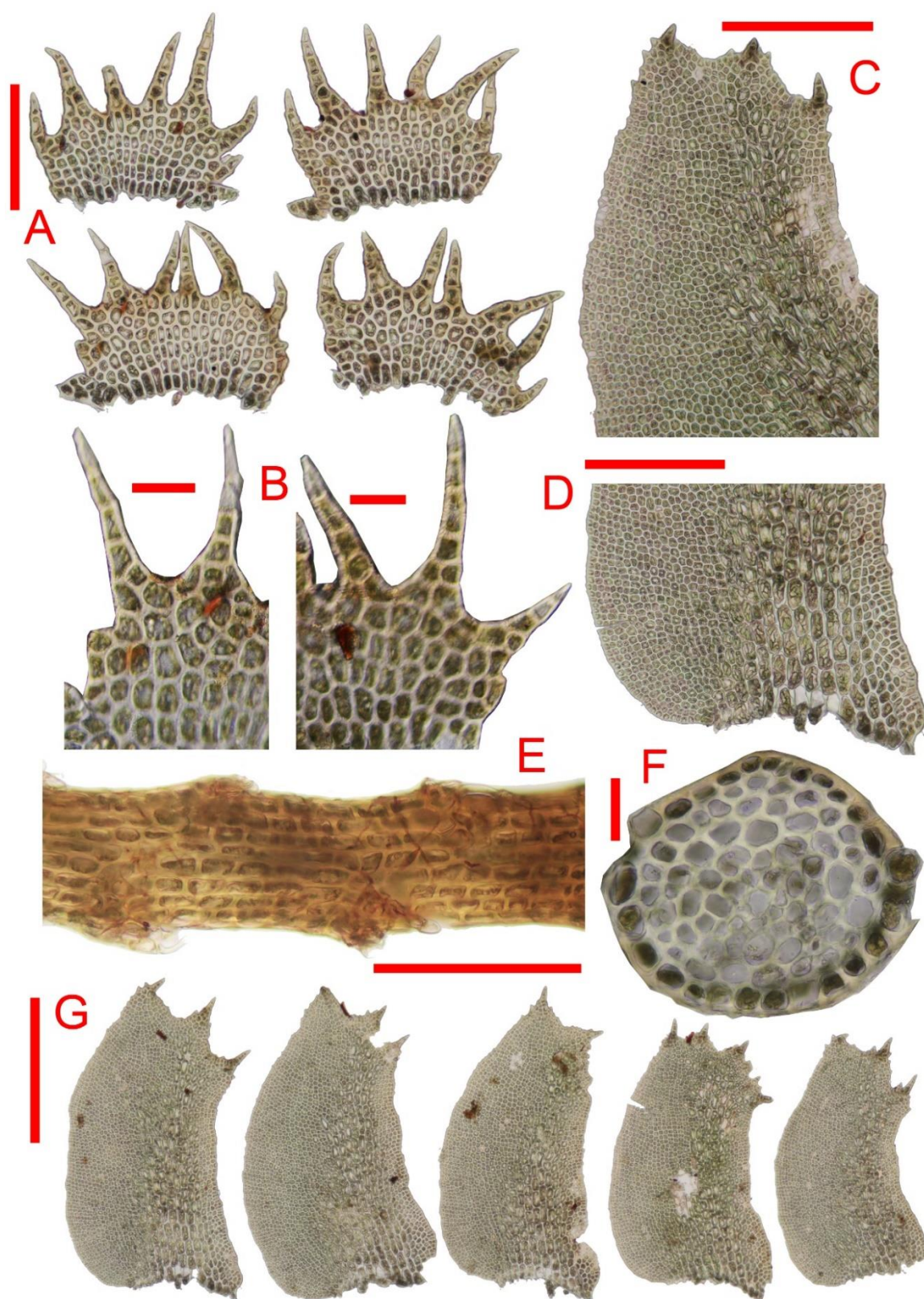


Plate 14: *Bazzania helgana* (STEPH.) N. KITAG.: A – Underleaves; B – Cuticula of amphigastria; C – Leaf apex; D – Leaf Base; E – Flagellate branch; F – Stem cross section; G – Leaves – Scales: A, E – 0.2 mm; B, F – 50 μ m; C, D – 250 μ m; G – 0.5 mm (from A. SCHÄFER-VERWIMP 4040)

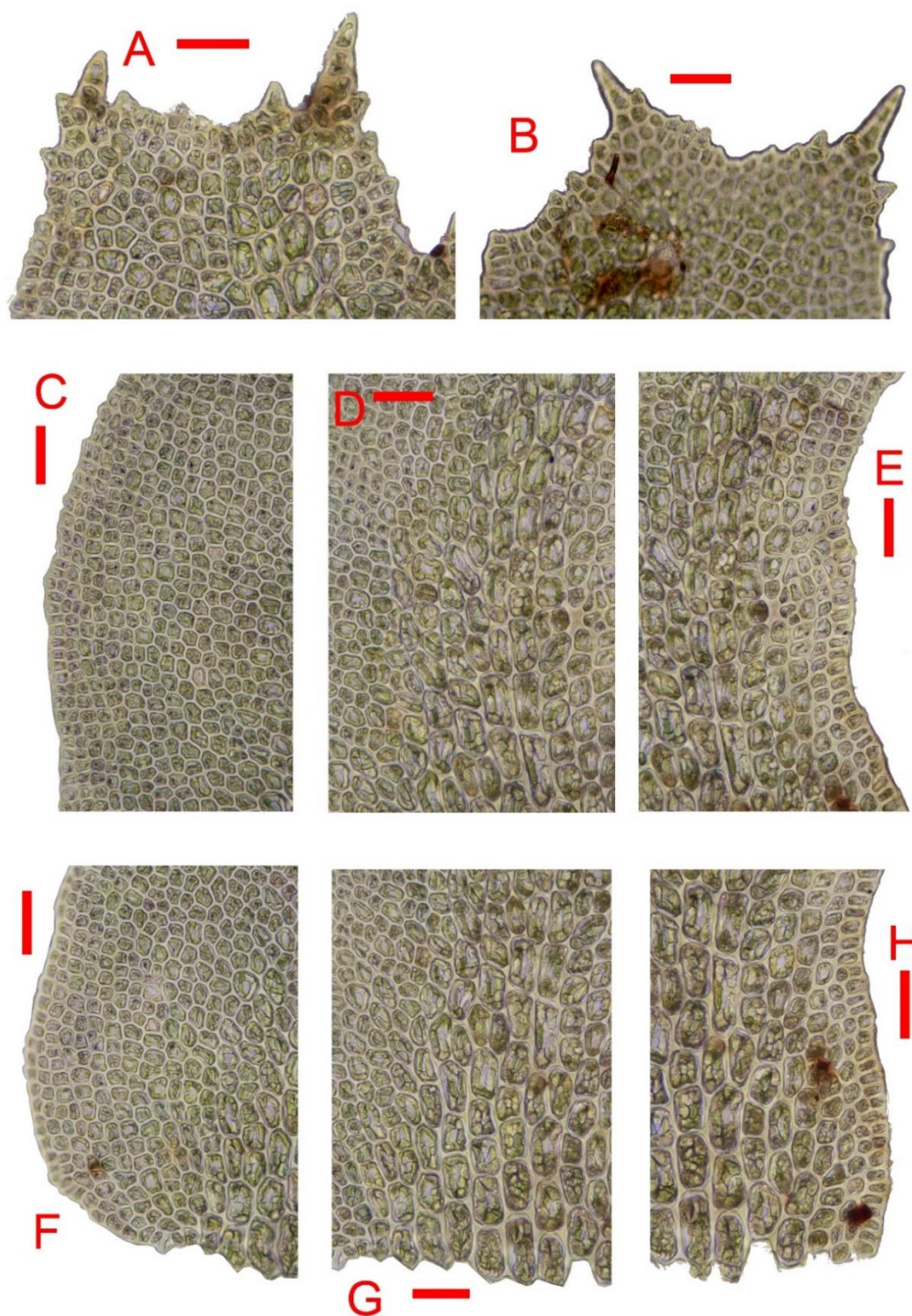


Plate 15: *Bazzania helgana* (STEPH.) N. KITAG.: A – Leaf Apex; B – Cuticula of leaf apex; C – Leaf middle dorsal; D – Leaf middle; E – Leaf middle ventral; F – Leaf base dorsal; G – Leaf base; H – Leaf base ventral – Scales: A, B, C, D, E, F, G, H – 50µm (from A. SCHÄFER-VERWIMP 4040)

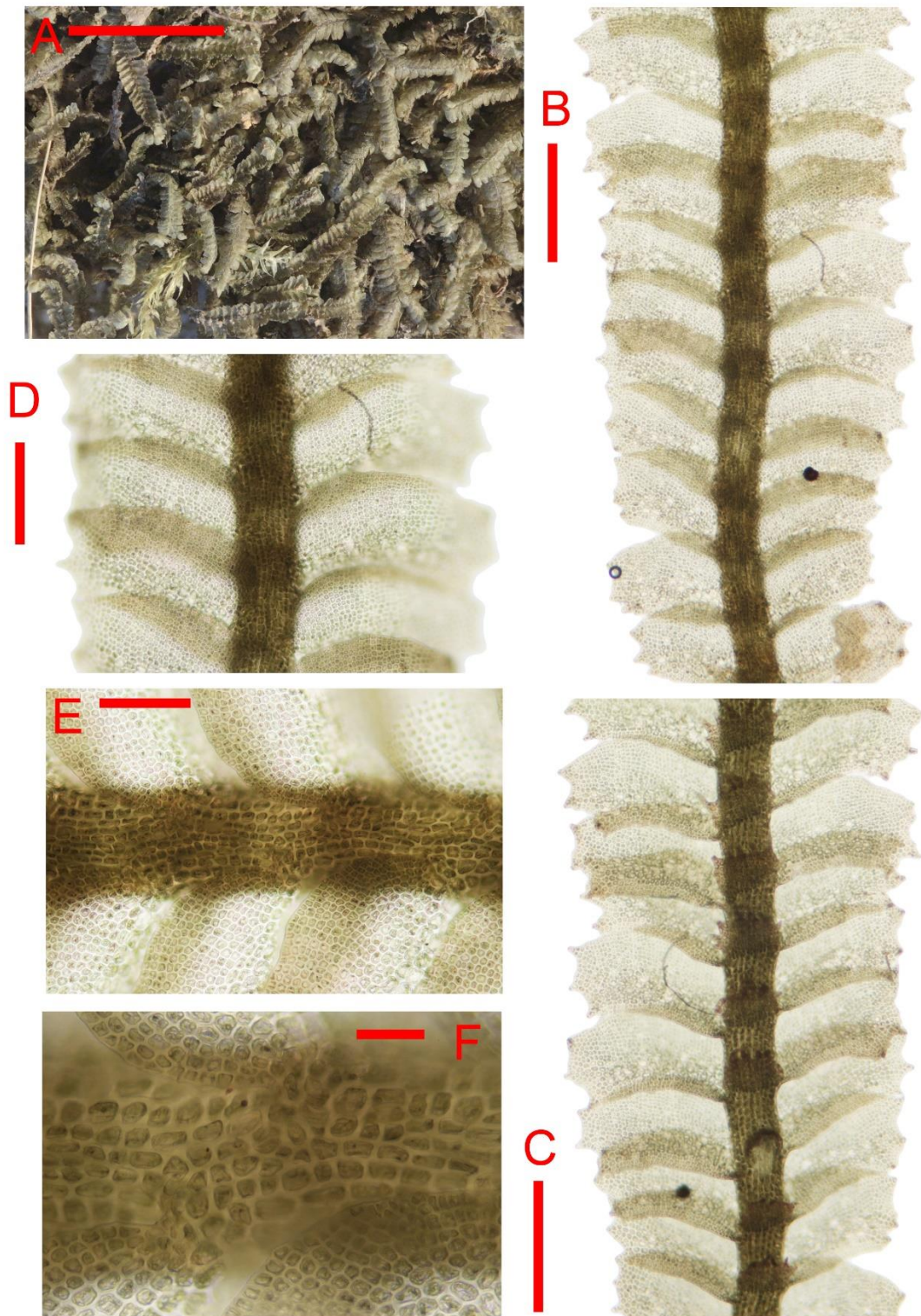
Bazzania helgana var. *minor* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

Plate 16: *Bazzania helgana* var. *minor* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A – Habitus; B, D, E, F – Plants dorsal; C – Plants ventral – Scales: A – 0.5 cm; B, C – 0.5 mm; D – 0.3 mm; E – 0.2 mm; F – 50 μ m (from JE STREIMANN 54114)

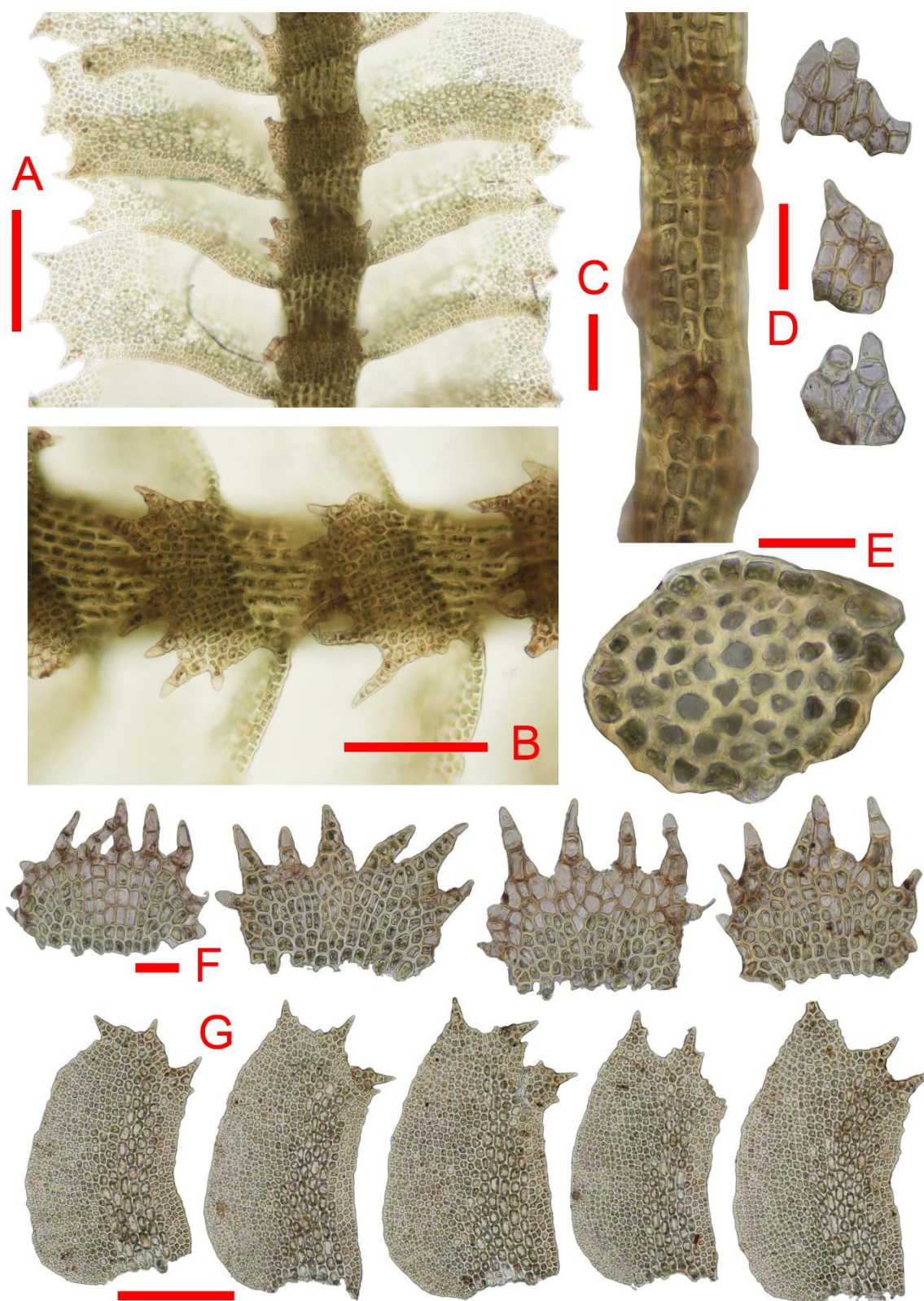


Plate 17: *Bazzania helgana* var. *minor* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A, B – Plants ventral; C – Flagellate branch; D – Leaves of flagellate branch; E – Stem cross section; F – Underleaves; G - Leaves – Scales: A, G – 0.3 mm; B – 0.2 mm; C, D, E, F – 50 μ m (from JE STREIMANN 54114)

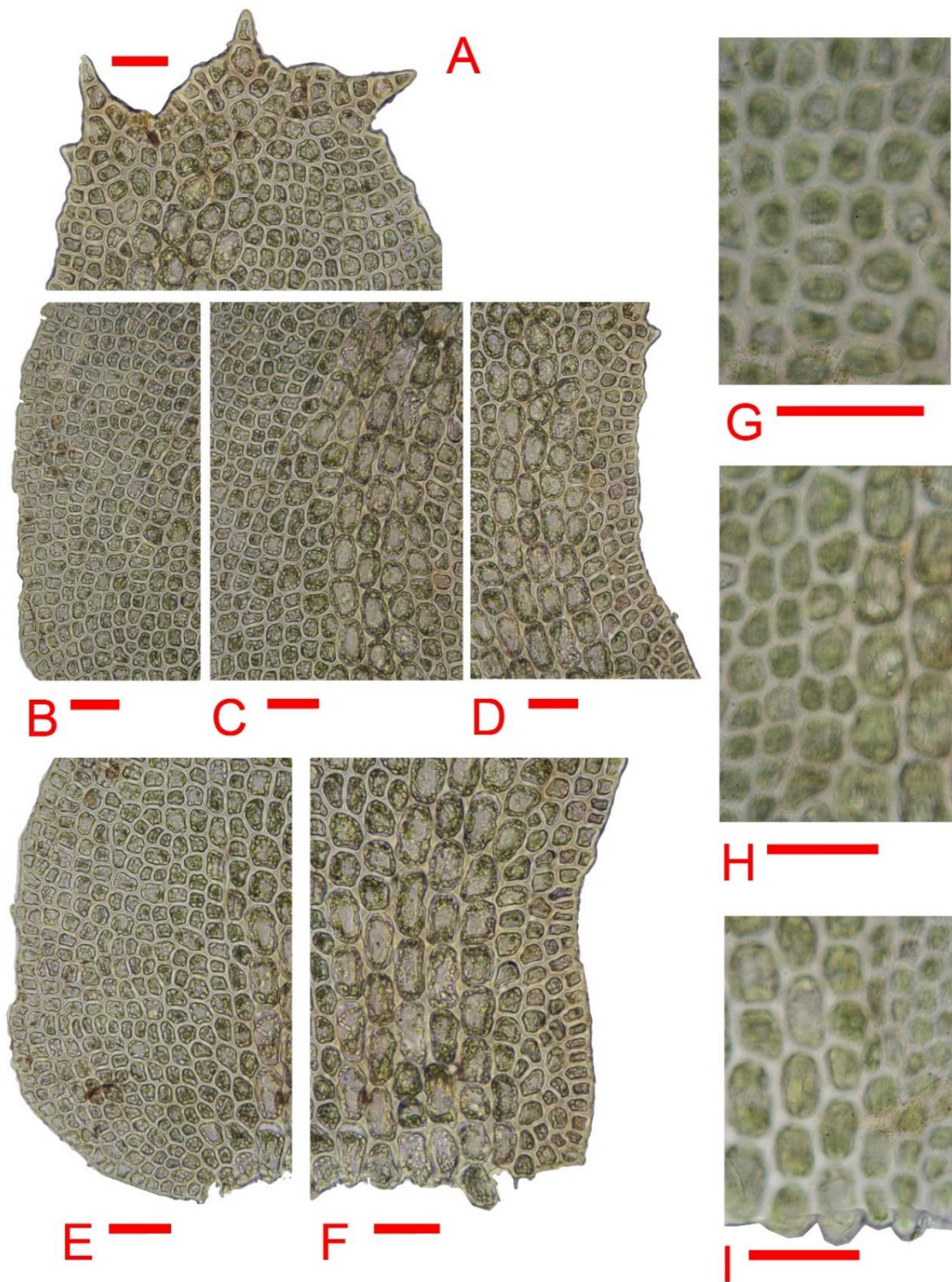


Plate 18: *Bazzania helgana* var. *minor* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A – Leaf apex; B – Leaf middle dorsal; C – Leaf middle; D – Leaf middle ventral; E – Leaf base dorsal; F – Leaf Base; G – Leaf apex cuticula; H – Leaf middle cuticula; I – Leaf base cuticula – Scales: A – I – 50 μ m (from JE STREIMANN 54114)

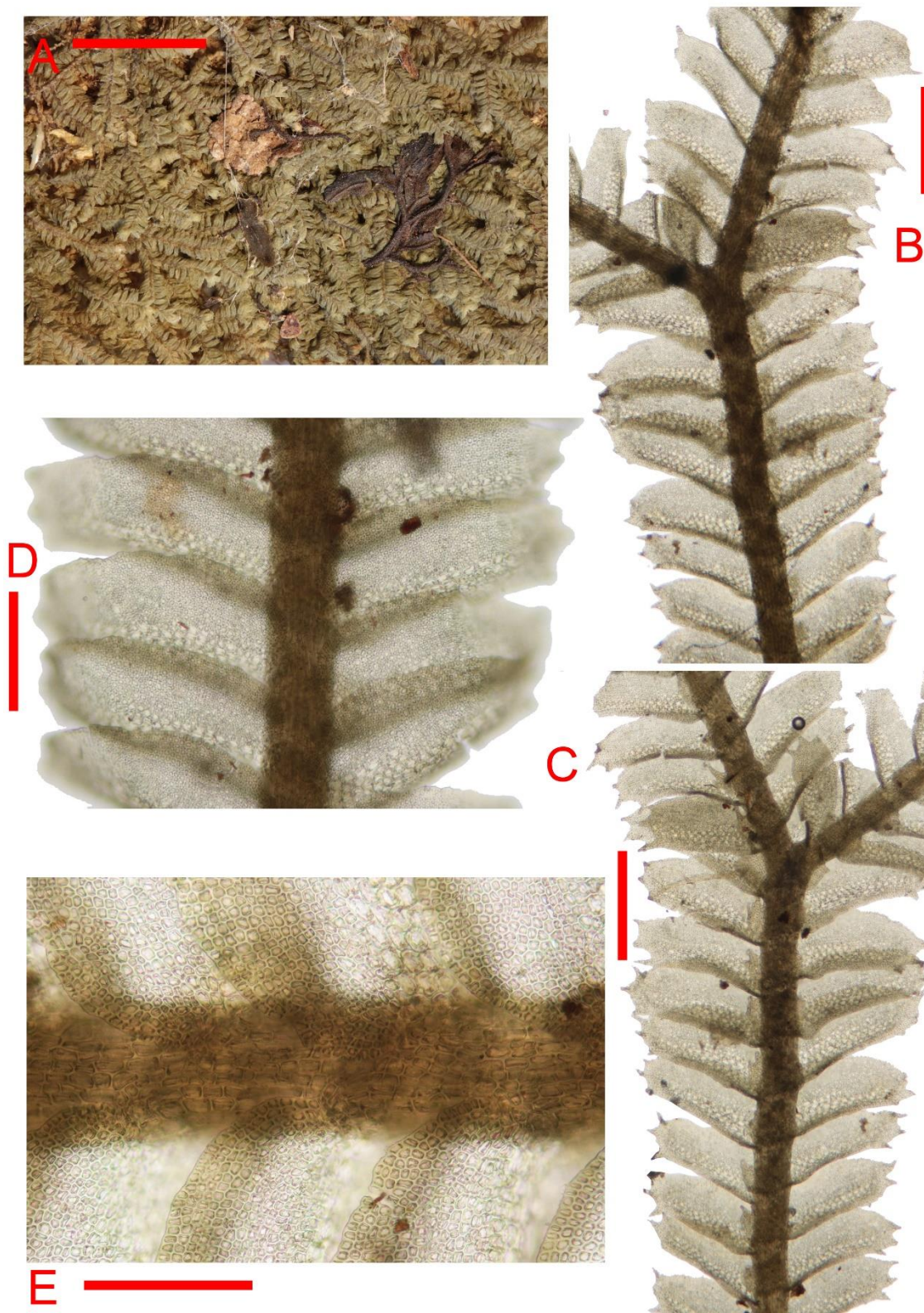
Bazzania indigenarum (STEPH.) N. KITAG.

Plate 19: *Bazzania indigenarum* (STEPH.) N. KITAG.: A – Habitus; B, D, E – Plants dorsal; C – Plants ventral – Scales: A – 0.5 cm; B, C – 0.5 mm; D – 0.3 mm; E, F – 0.2 mm (from G00067023 – Holotype)

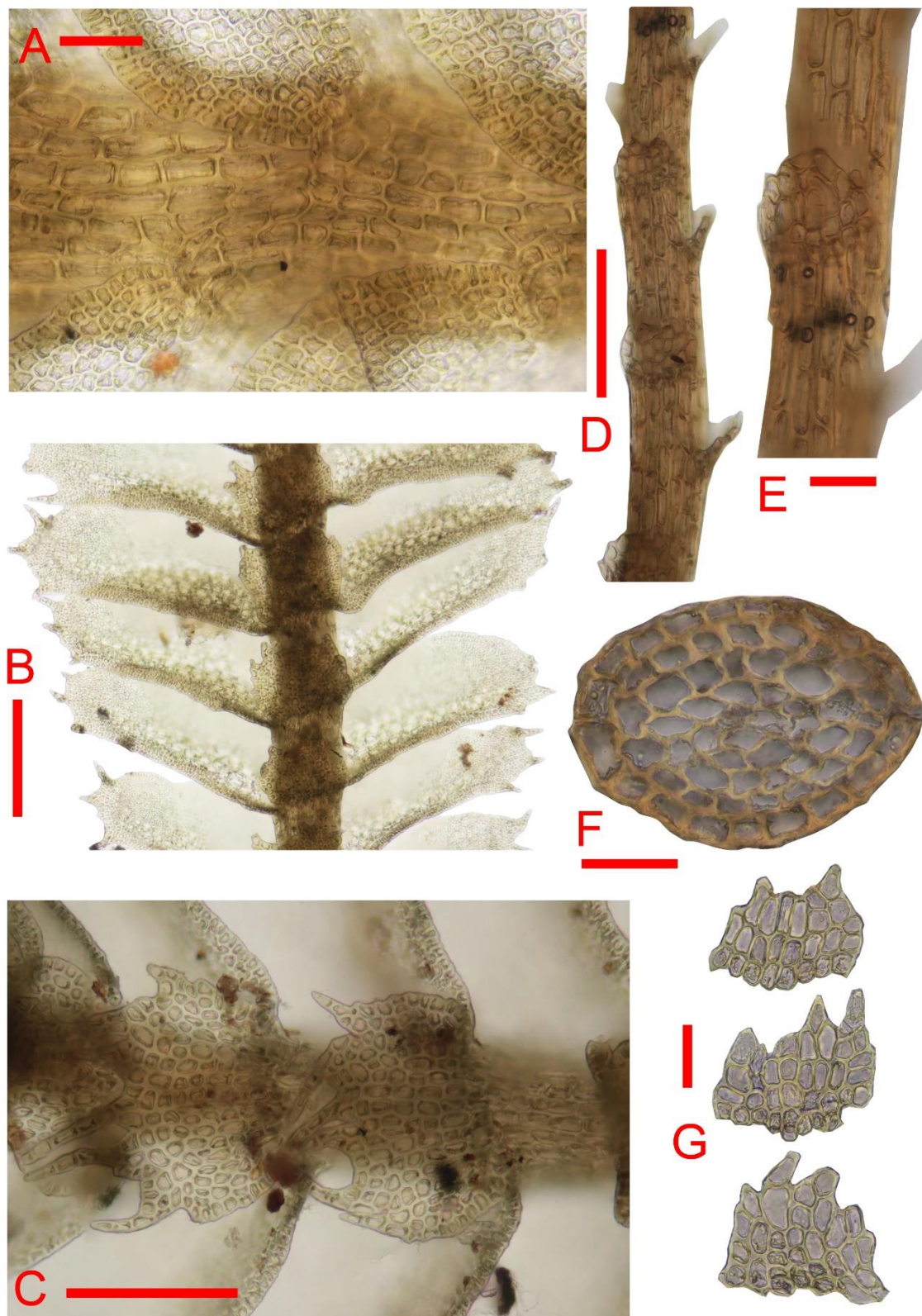


Plate 20: *Bazzania indigenarum* (STEPH.) N. KITAG.: A – Plant dorsal; B, C – Plants ventral; D, E – Flagellate branch; F – Stem cross section; G – Leaves of flagellate branch – Scales: A, E, F, G – 50 μ m; B – 0.3 mm; C, D – 0.2 mm (from G00067023 – Holotype)

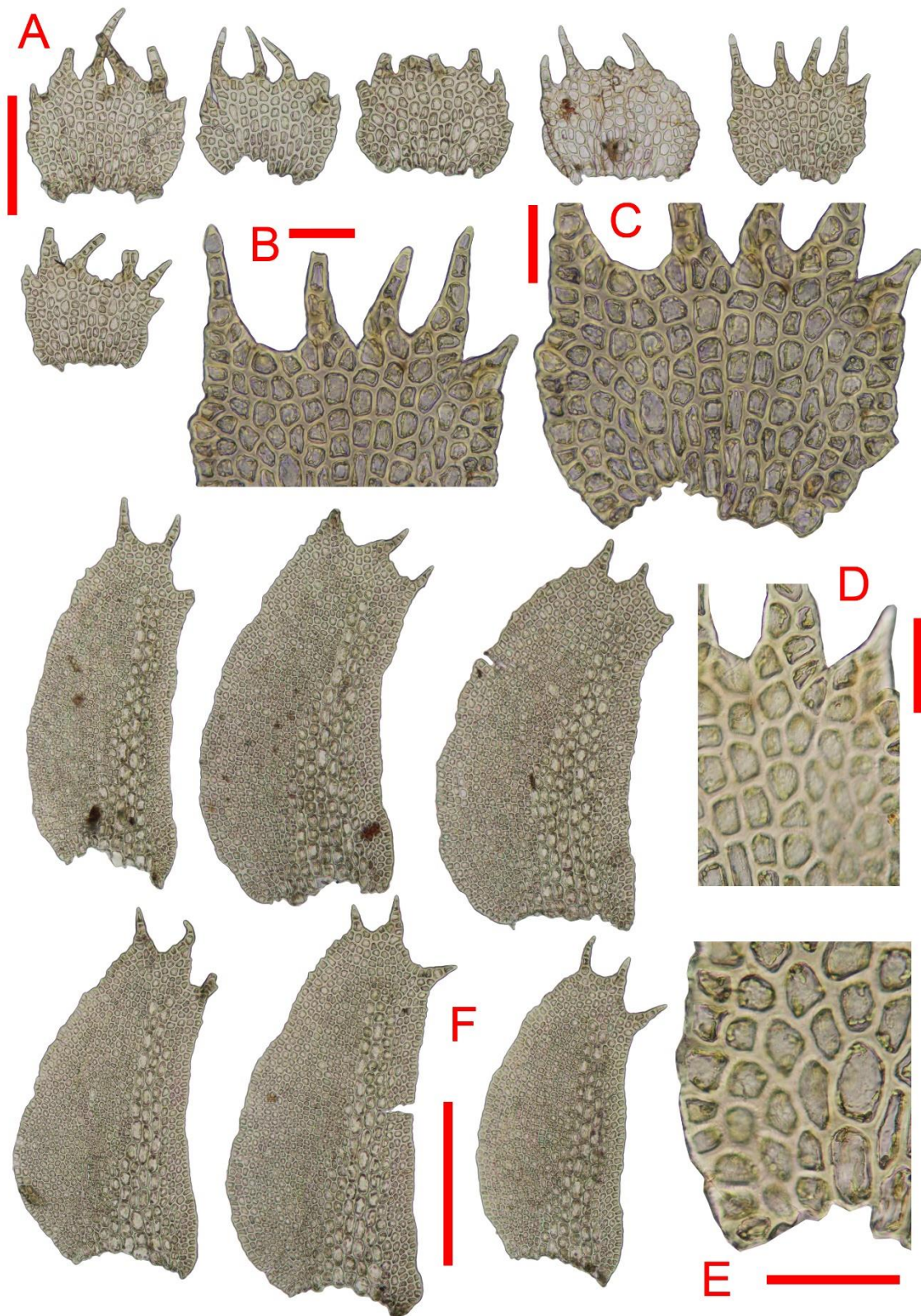


Plate 21: *Bazzania indigenarum* (STEPH.) N. KITAG.: A – Underleaf; B- Underleaf apex; C – Underleaf base; D – Cuticula of underleaf apex; E – Cuticula of underleaf base; F - Leaves – Scales: A – 0.2 mm; B, C, D, E – 50 µm; F – 0.3 mm (from G00067023 – Holotype)

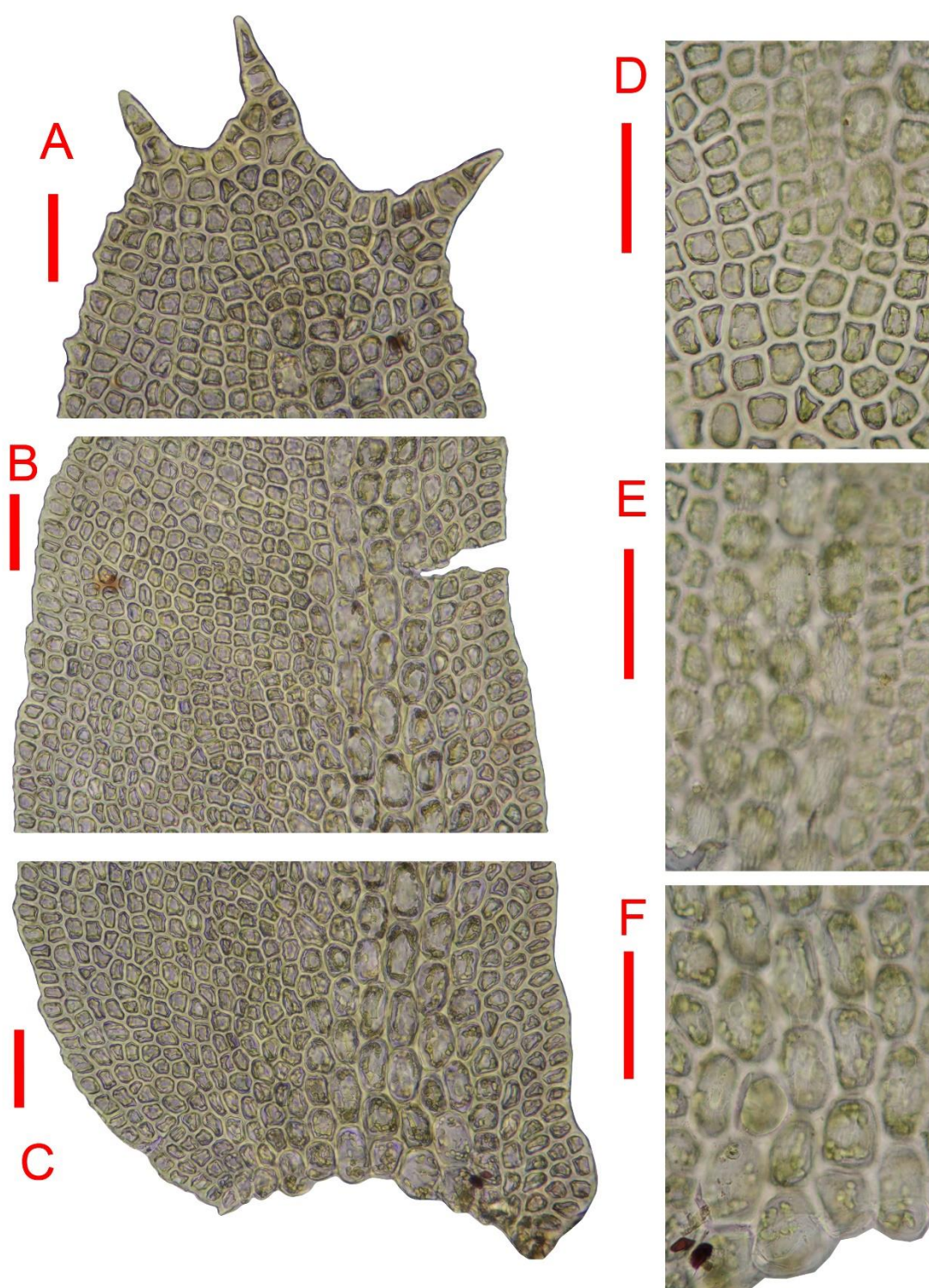


Plate 22: *Bazzania indigenarum* (STEPH.) N. KITAG.: A – Leaf apex; B – Leaf middle; C – Leaf base; D – Leaf apex cuticle; E – Leaf middle cuticle; F – Leaf base cuticle – Scales: A, B, C, D, E, F — 50 μ m (from G00067023 – Holotype)

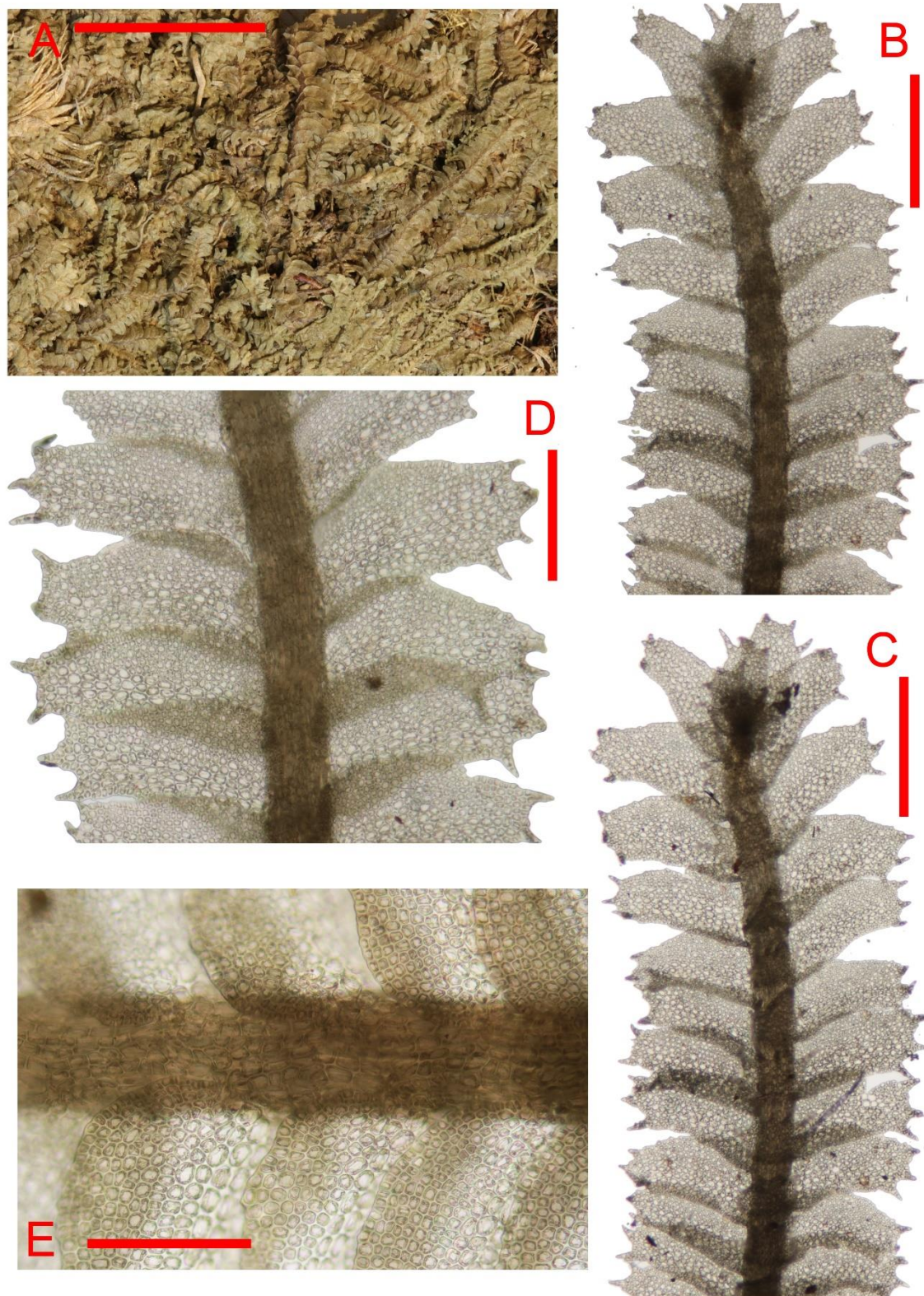
Bazzania palmatifida (STEPH.) GROLLE

Plate 23: *Bazzania palmatifida* (STEPH.) GROLLE: A – Habitus; B, D, E – Plant dorsal; C – Plant ventral – Scales: A – 0.5 cm; B, C – 0.5 mm; D, E – 0.2 mm (from G0067032 – Holotype)

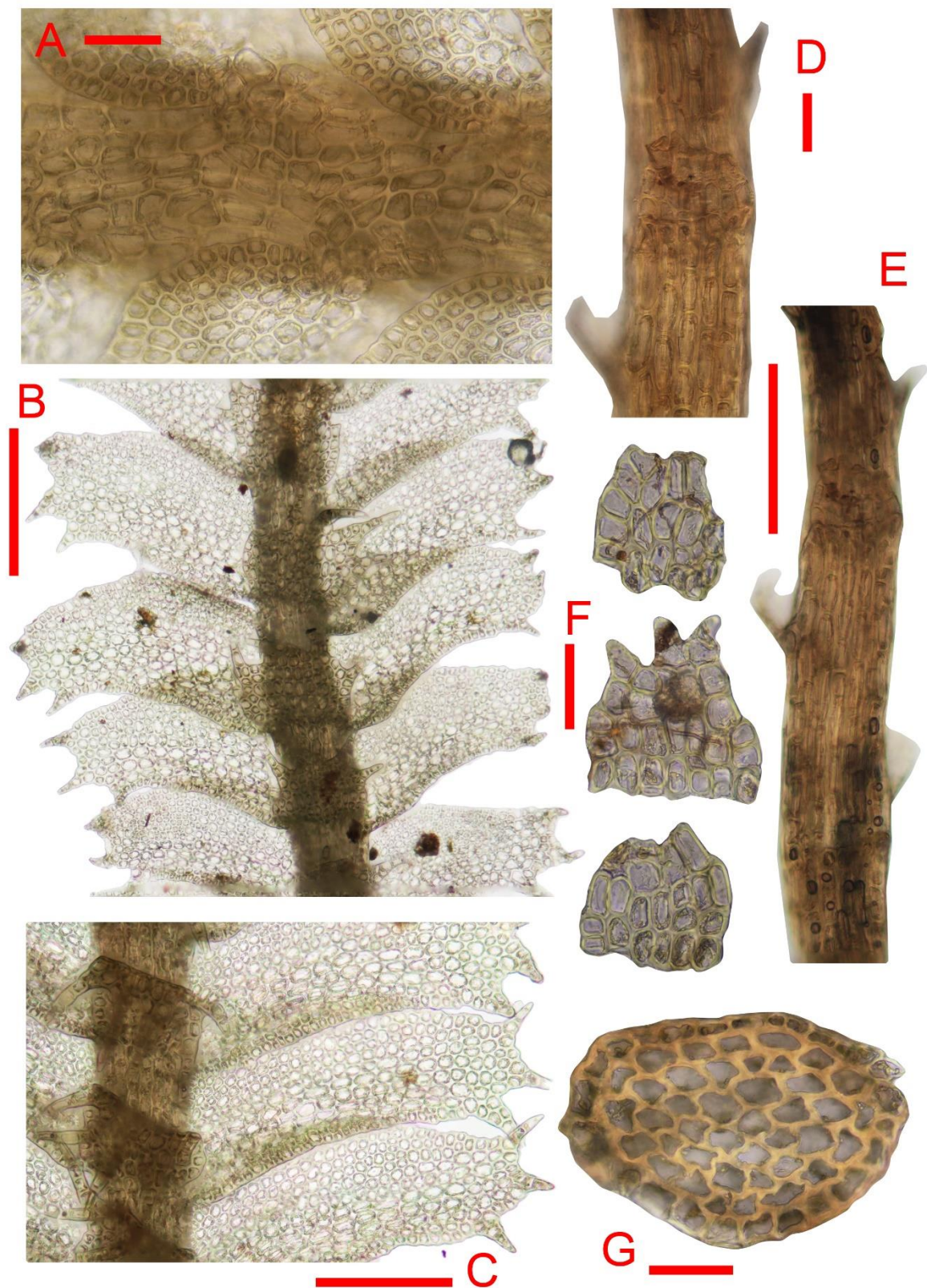


Plate 24: *Bazzania palmatifida* (STEPH.) GROLLE: A – Plant dorsal; B, C – Plant ventral; D, E – Flagellate branch; F – Leaves of flagellate branch; G – Stem cross section – Scales: A, D, F, G – 50 µm; B – 0.3 mm; C, E – 0.2 mm (from G0067032 – Holotype)

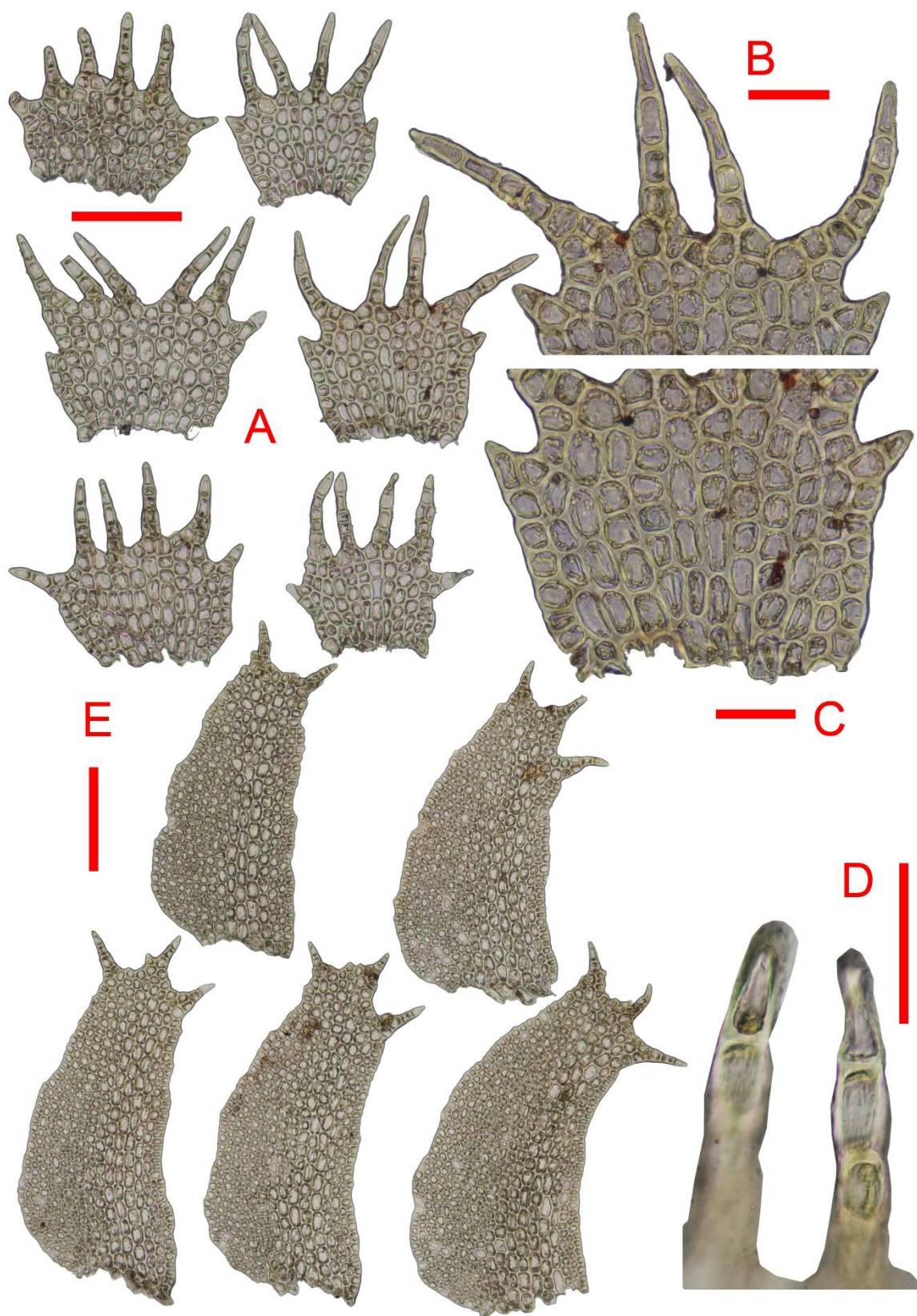


Plate 25: *Bazzania palmatifida* (STEPH.) GROLLE: A – Underleaves; B – Underleaf apex; C – Underleaf base; D – Cuticula of underleaf apex; E - Leaves – Scales: A, E – 0.2 mm; B, C, D – 50 μ m (from G0067032 – Holotype)

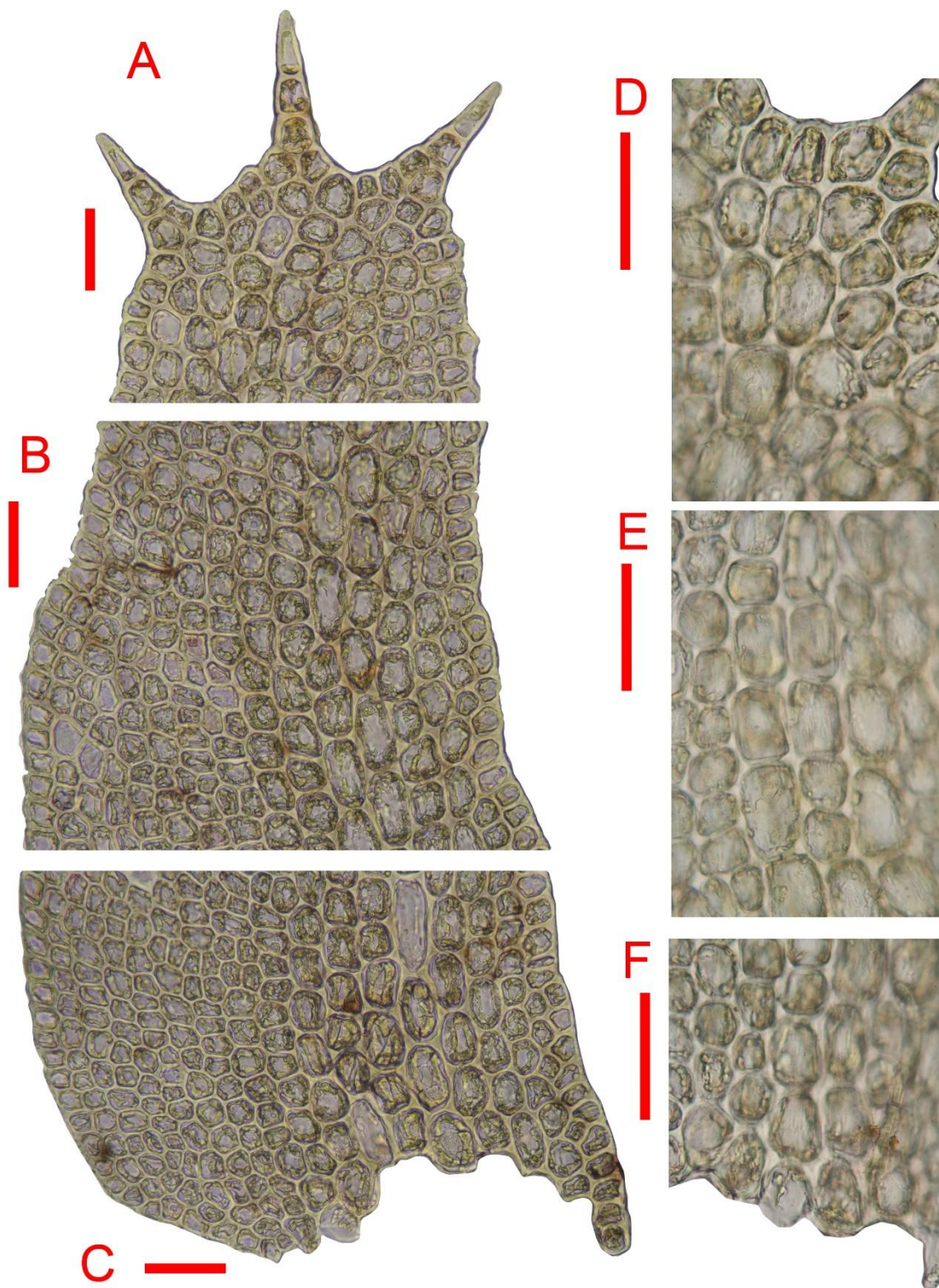


Plate 26: *Bazzania palmatifida* (STEPH.) GROLLE: A – Leaf apex; B – Leaf middle; C – Leaf base; D – Leaf apex cuticula; E – Leaf middle cuticula; F – Leaf base cuticula – Scales: A, B, C, D, E, F – 50 μm (from G0067032 – Holotype)

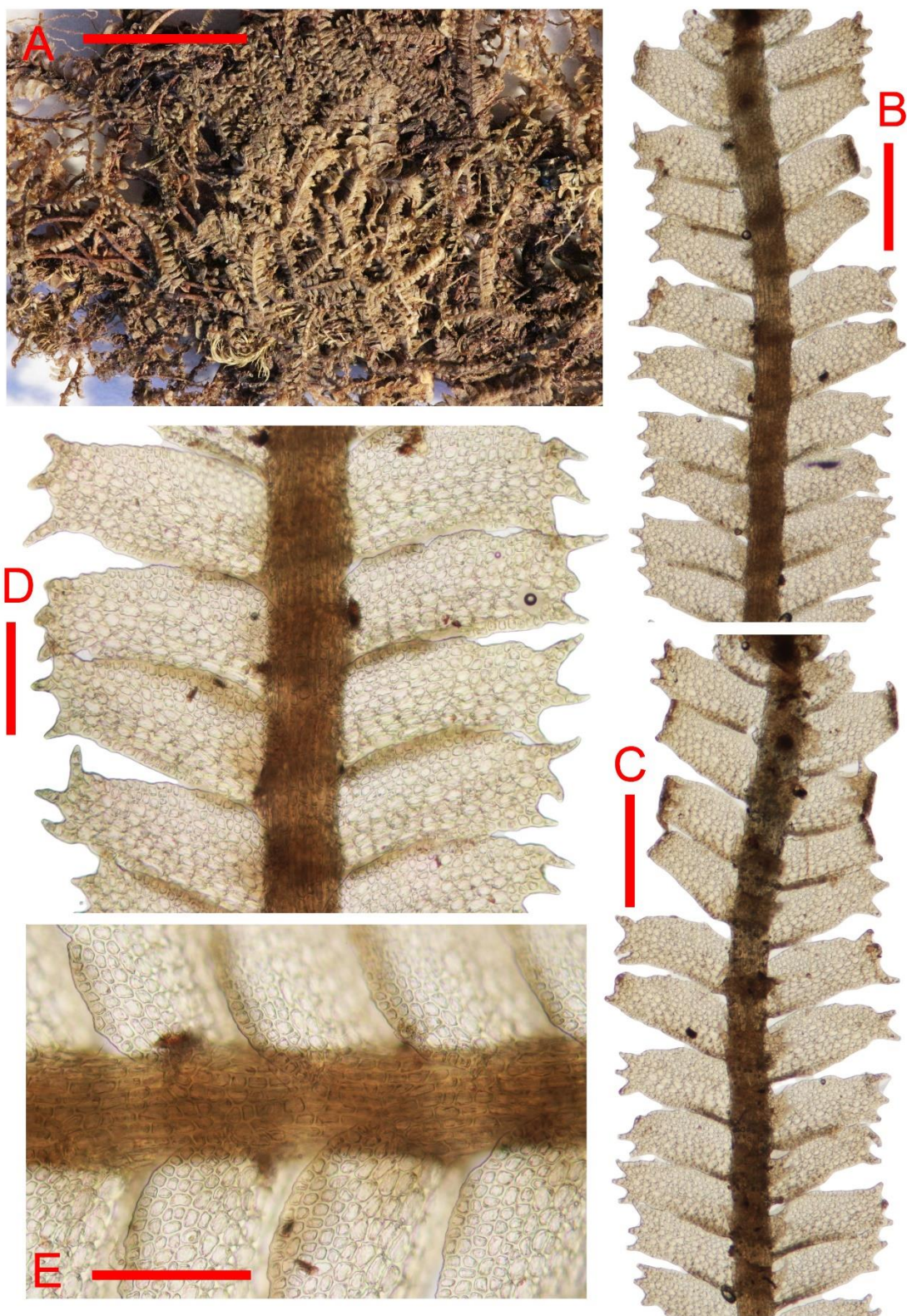
Bazzania palmatifidoides U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

Plate 27: *Bazzania palmatifidoides* (STEPH.) GROLLE: A – Habitus; B, D, E – Plant dorsal; C – Plant ventral – Scales: A – 0.5 cm; B, C – 0.4 mm; D, E – 0.2 mm (from JE V. ROYEN & SLEUMER 6902C-I)

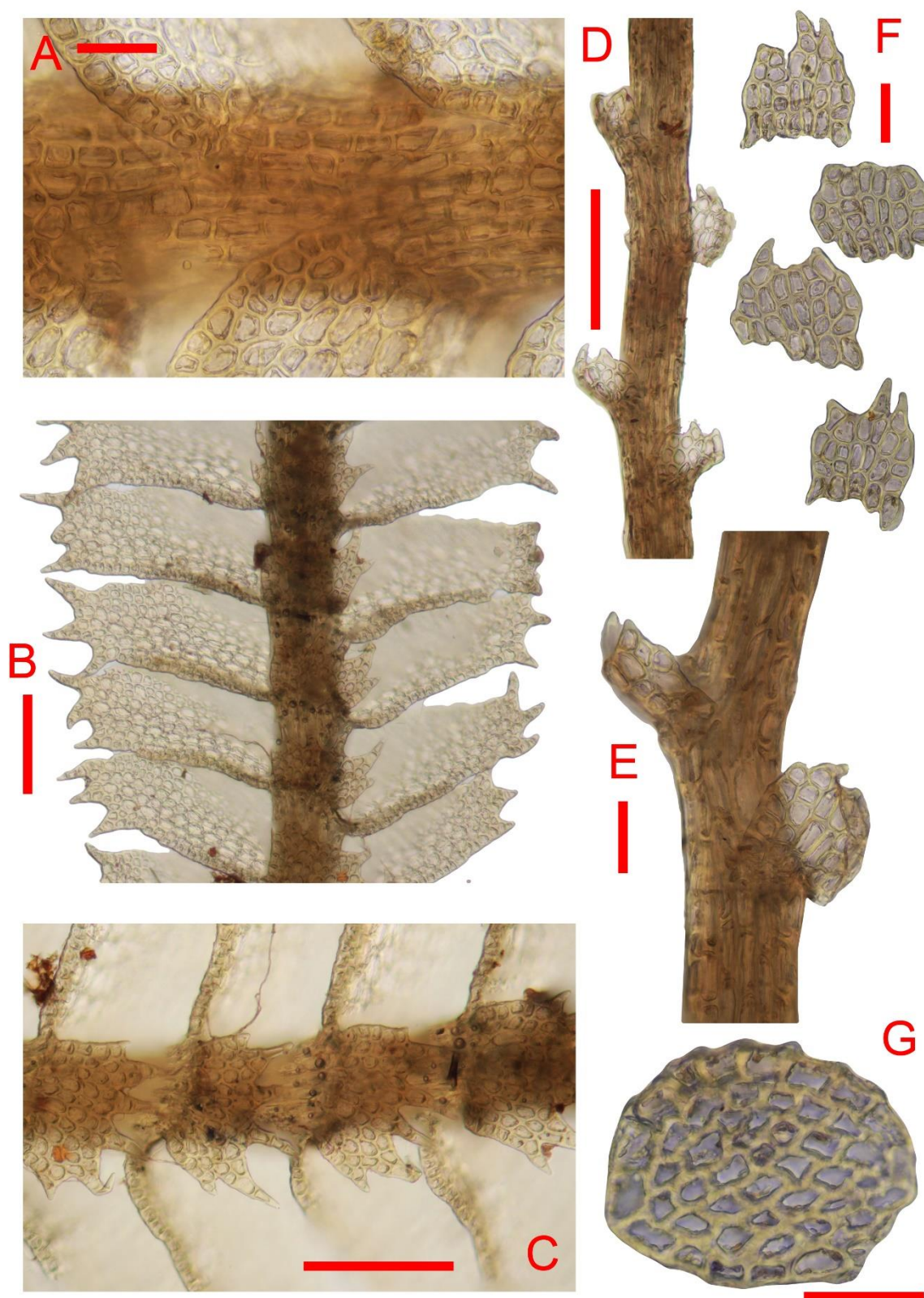


Plate 28: *Bazzania palmatifidoides* (STEPH.) GROLLE: A – Plant dorsal; B, C – Plant ventral; D, E – Flagellate branch; F – Leaves of flagellate branch; G – Stem cross section – Scales: A, E, F, G – 50 μ m; B, C, D – 0.2 mm (from JE V. ROYEN & SLEUMER 6902C-I)

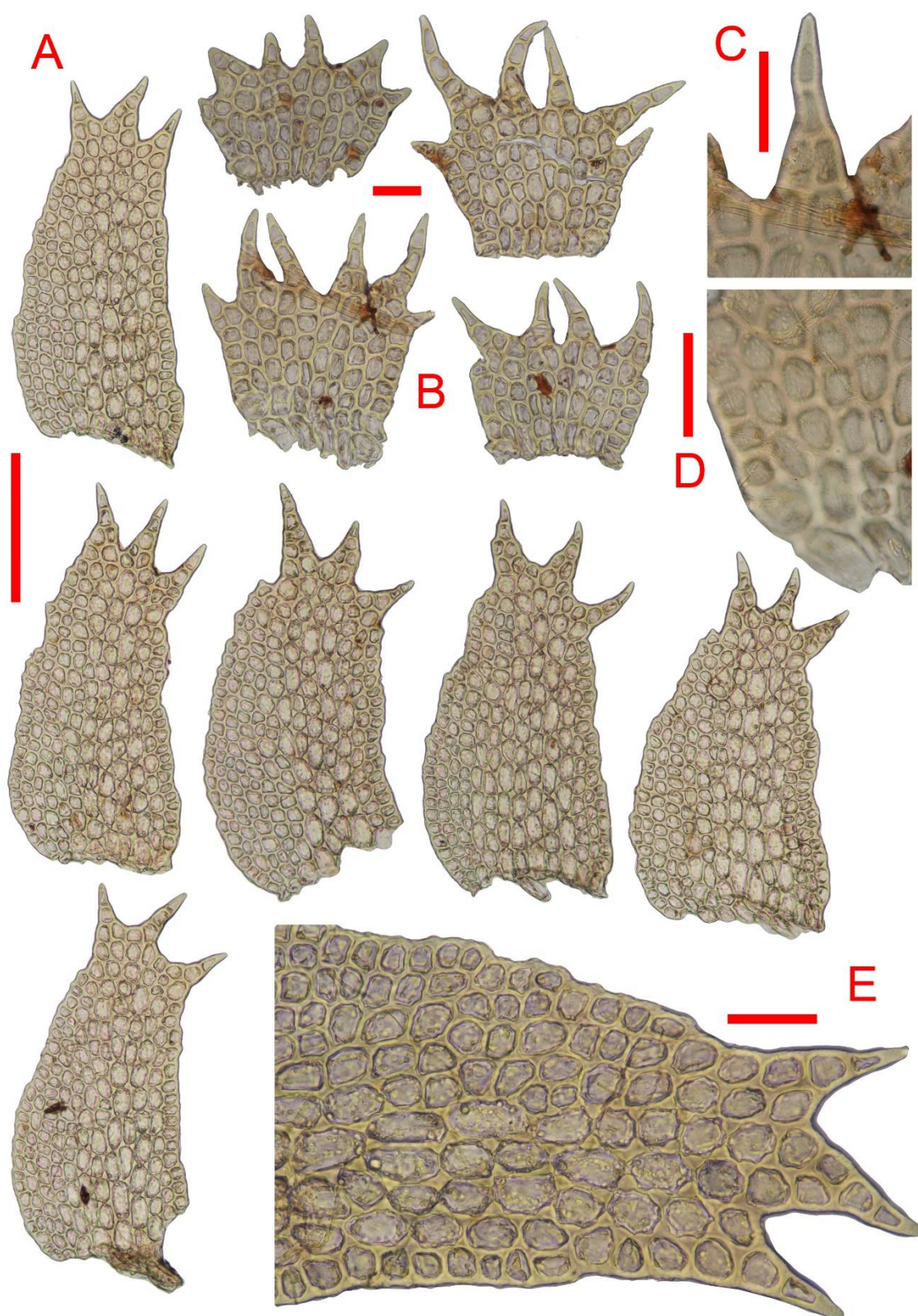


Plate 29: *Bazzania palmatifidoides* (STEPH.) GROLLE: A – Leaves; B – Underleaves; C – Underleaf apex cuticula; D – Underleaf base cuticula; E – Underleaf apex – Scales: A – 0.2 mm; B, C, D, E – 50 μ m (from JE V. ROYEN & SLEUMER 6902C-I)

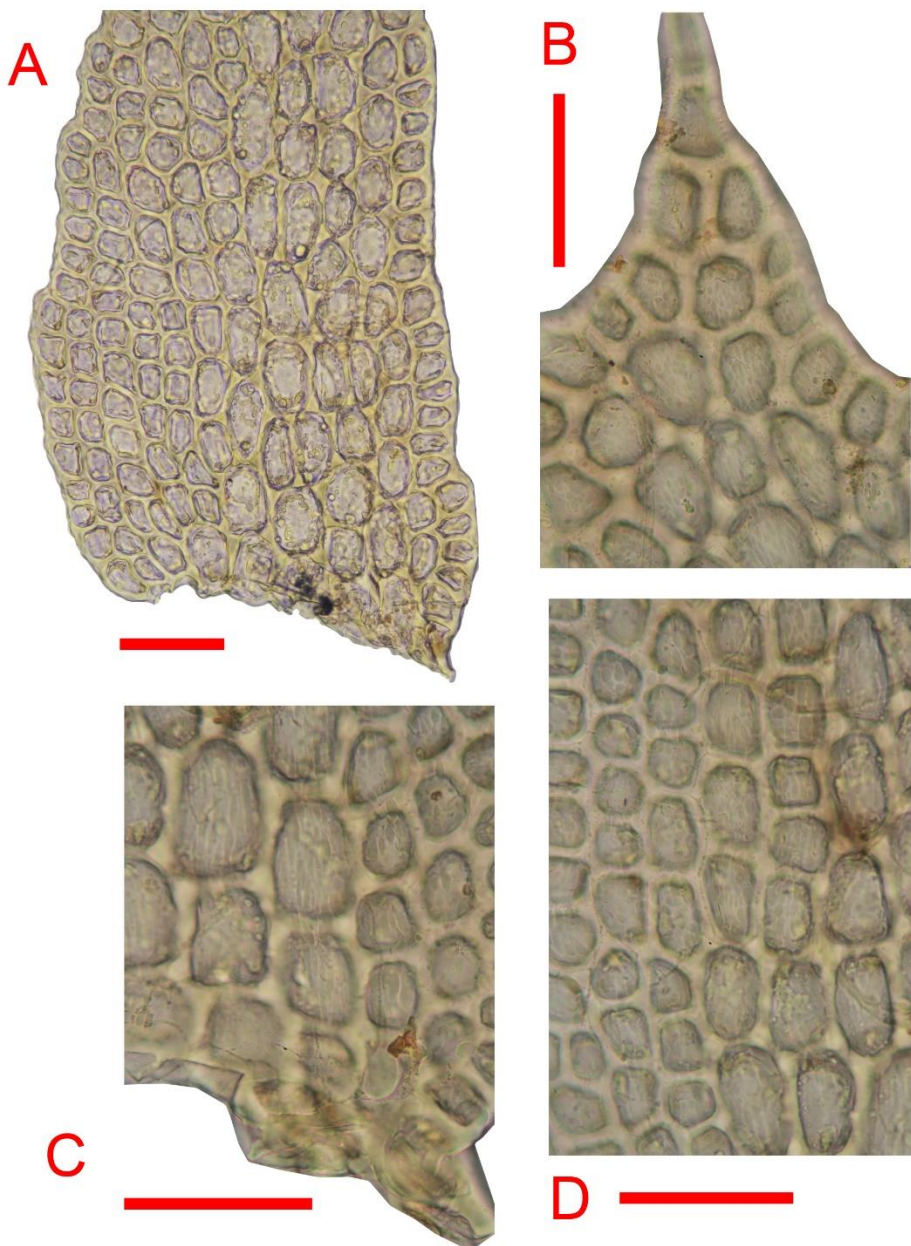


Plate 30: *Bazzania palmatifidoides* (STEPH.) GROLLE: A – Leaves base; B – Leaf apex cuticula; C – Leaf middle cuticula; D – Leaf base cuticula – Scales: A, B, C, D, E – 50 µm (from JE v. ROYEN & SLEUMER 6902C-I)

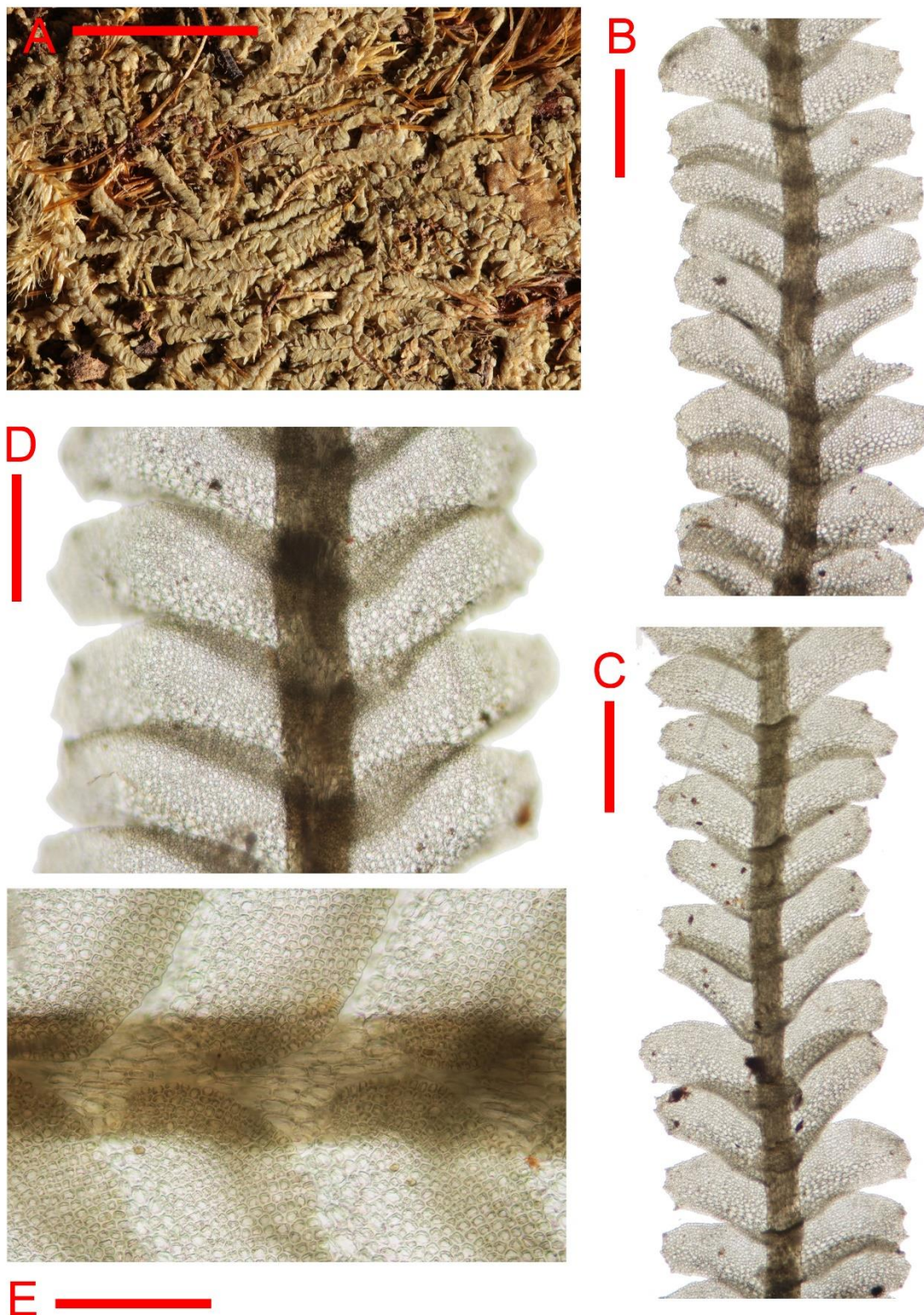
Bazzania pulchella (STEPH.) H. A. MILL.

Plate 31: *Bazzania pulchella* (STEPH.) H.A. MILL.: A – Habitus; B, D, E – Plants dorsal; C – Plants ventral – Scales: A – 5 mm; B, C – 0.5 mm; D – 0.3 mm; E – 0.2 mm (from JE M. FLEISCHER B-1412)

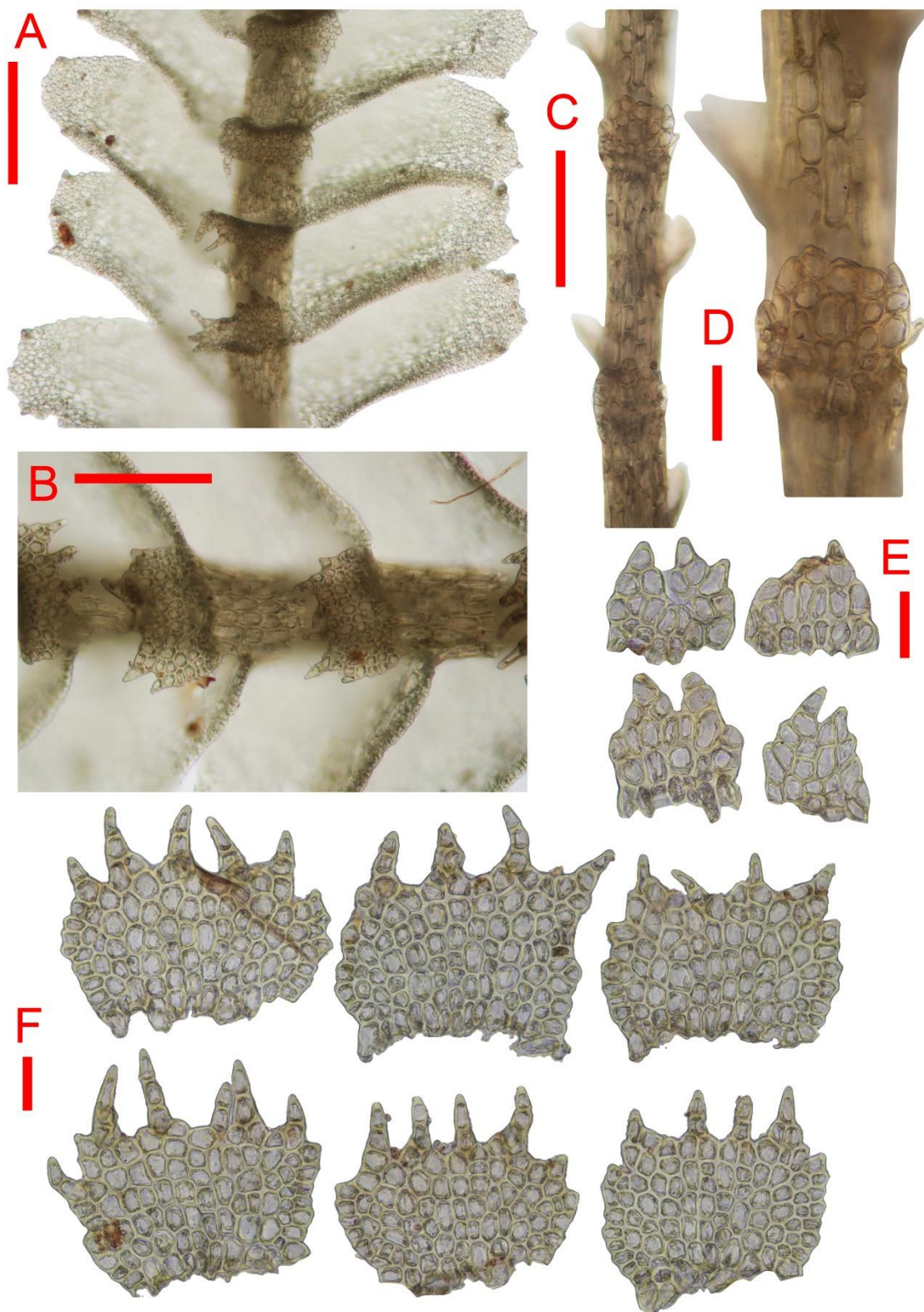


Plate 32: *Bazzania pulchella* (STEPH.) H.A. MILL.: A, B – Plant ventral; C, D – Flagellate branches; E – Leaves of flagellate branch; F – Underleaves – Scales: A – 0.3 mm; B, C – 0.2 mm; D, E, F – 50 μ m (from JE M. FLEISCHER B-1412)

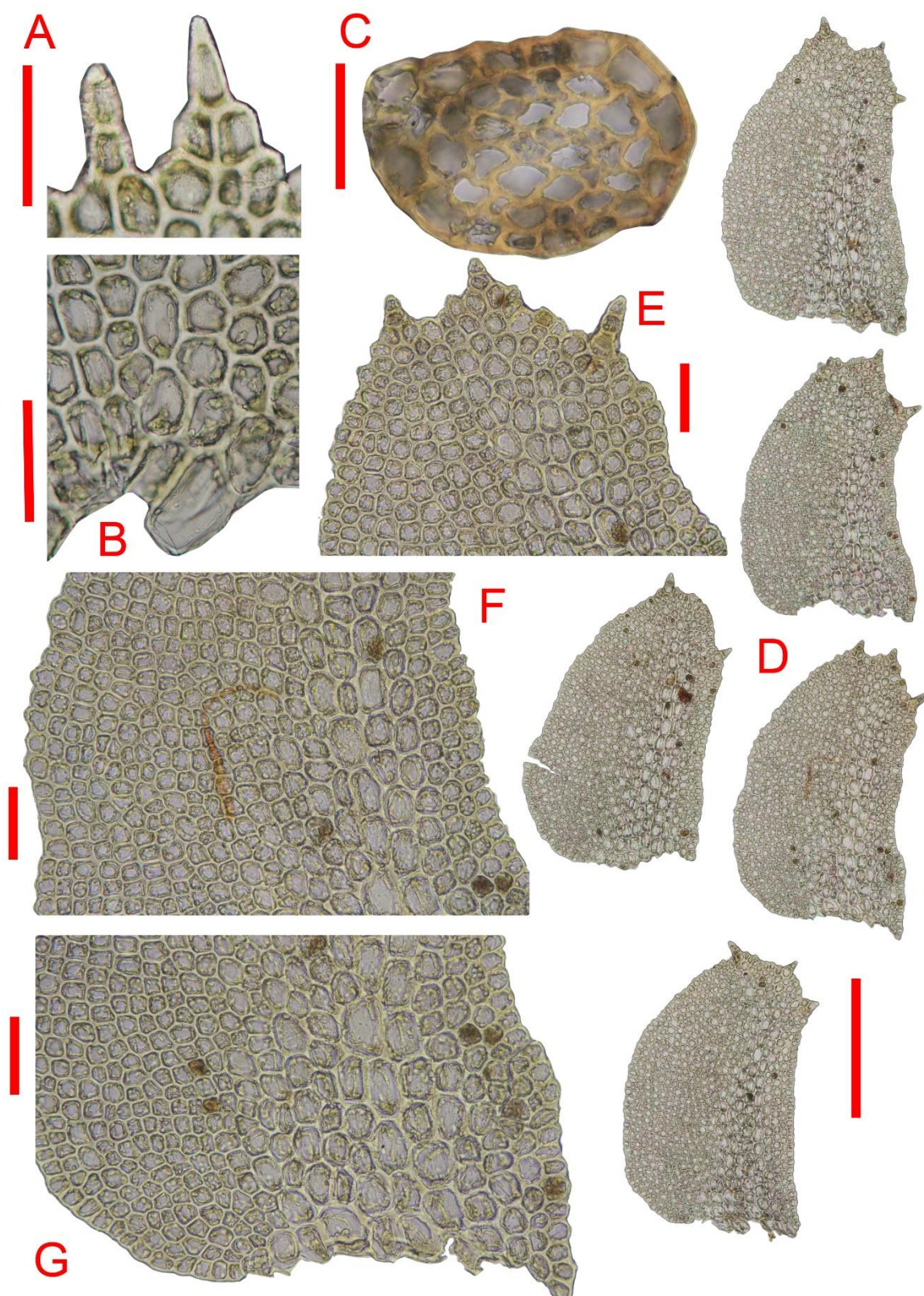


Plate 33: *Bazzania pulchella* (STEPH.) H.A. MILL.: A – Underleaf apex cuticula; B – Underleaf base cuticula; C – Stem cross section; D – Leaves; E – Leaf apex; F – Leaf middle; G – Leaf base – Scales: D – 0.3 mm; A, B, C, E, F, G – 50 μ m (from JE M. FLEISCHER B-1412)

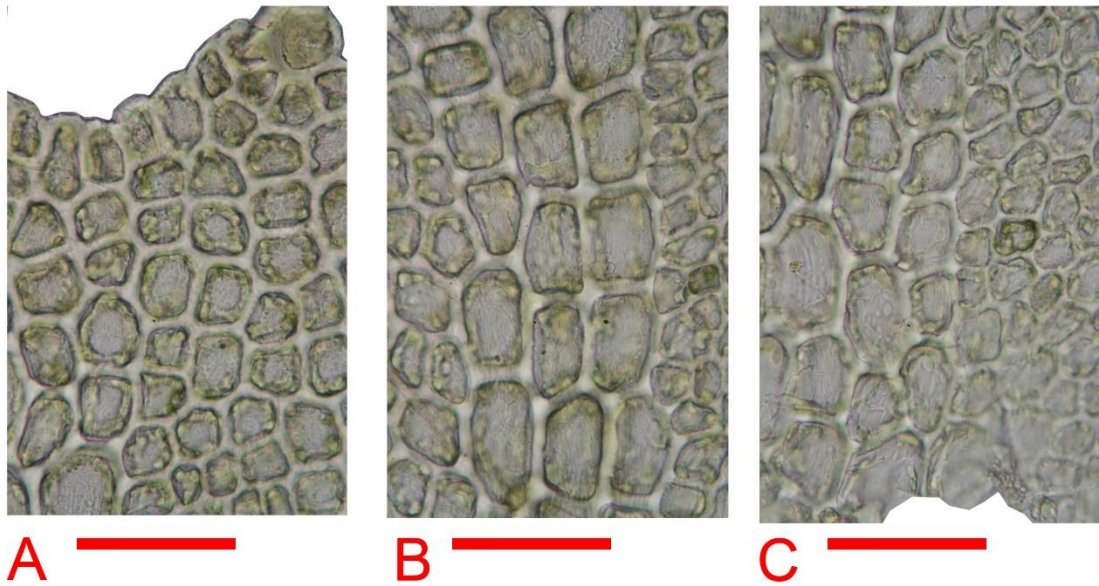


Plate 34: *Bazzania pulchella* (STEPH.) H.A. MILL.: A – Leaf apex cuticula; B – Leaf middle cuticula; C – Leaf base cuticula – Scales: A, B, C – 50 μ m (from JE M. FLEISCHER B-1412)

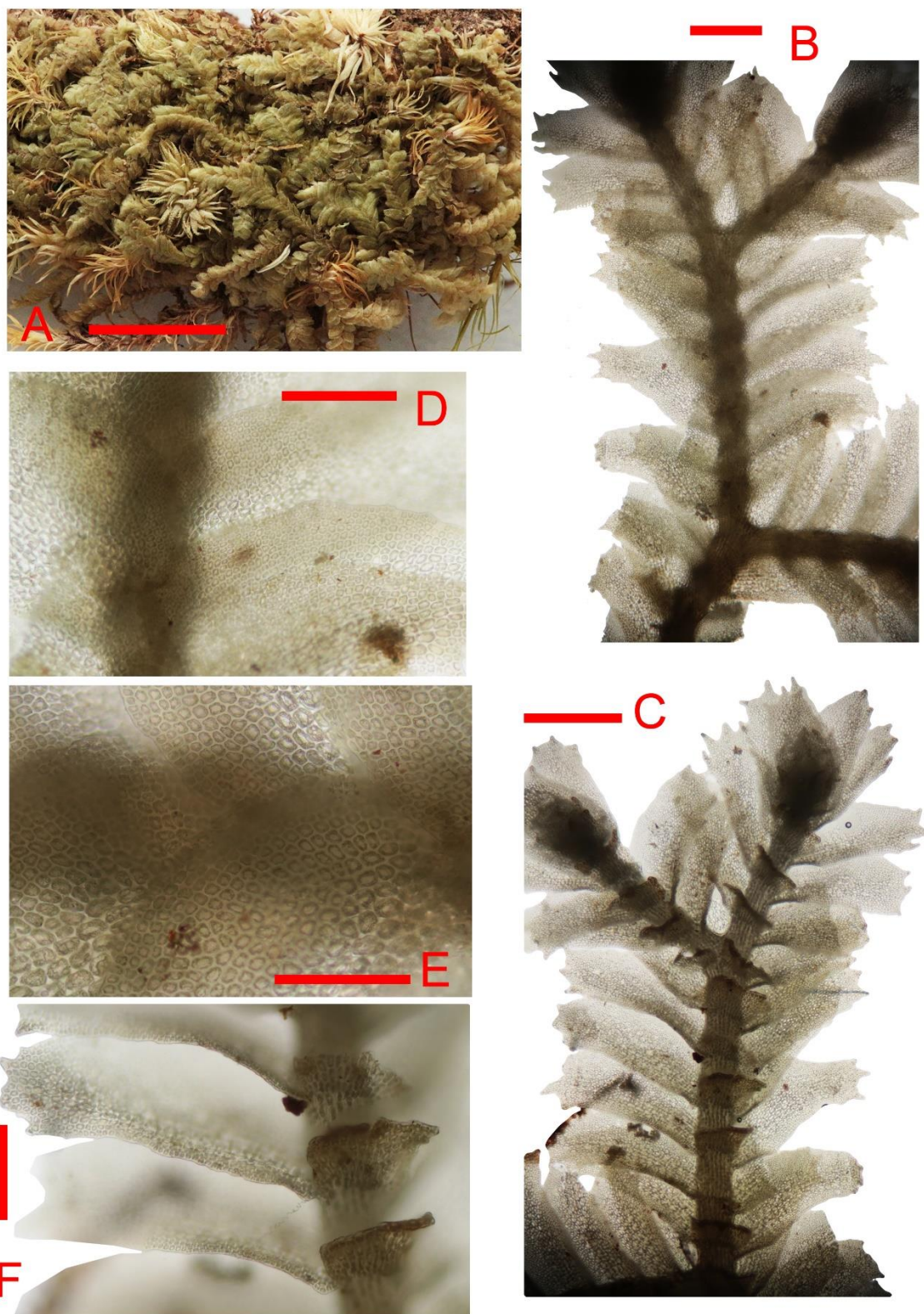
Bazzania reicheliana U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

Plate 35: *Bazzania reicheliana* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A – Habitus; B, D, E – Plants dorsal; C, F – Plants ventral – Scales: A – 0.5 cm; B, C – 0.5 mm; D, F – 0.3 mm, E – 0.2 mm (from DR KATJA REICHEL NC 774)

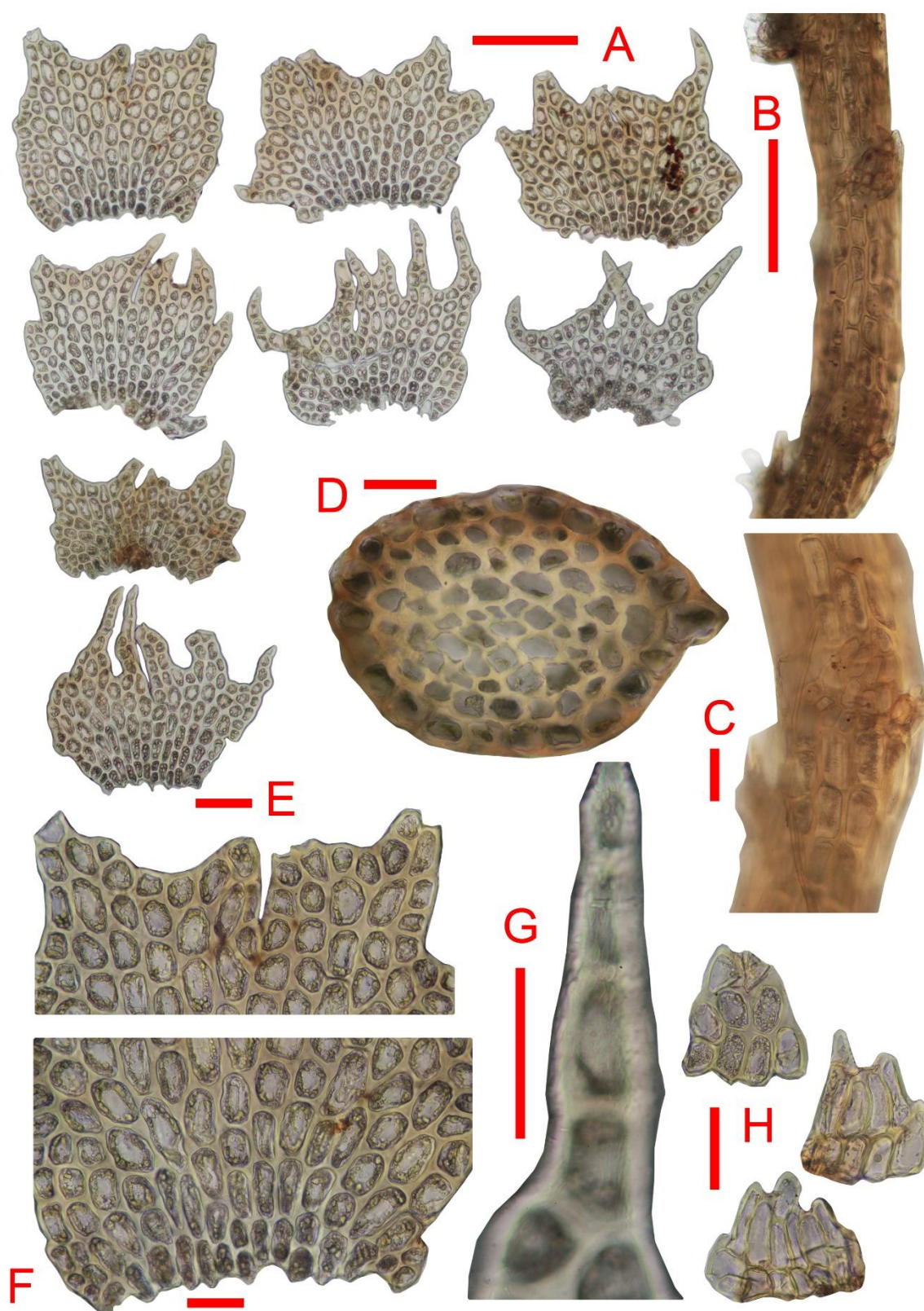


Plate 36: *Bazzania reicheliana* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A – Underleaves; B, C – Flagellate branches; D – Stem cross section; E – Underleaf apex; F – Underleaf base; G – Cuticula of underleaf apex; H – Leaves of flagellate branches – Scales: A, B – 0.2 mm; B, C, D, E, F, G, H – 50 μ m (from DR KATJA REICHEL NC 774)

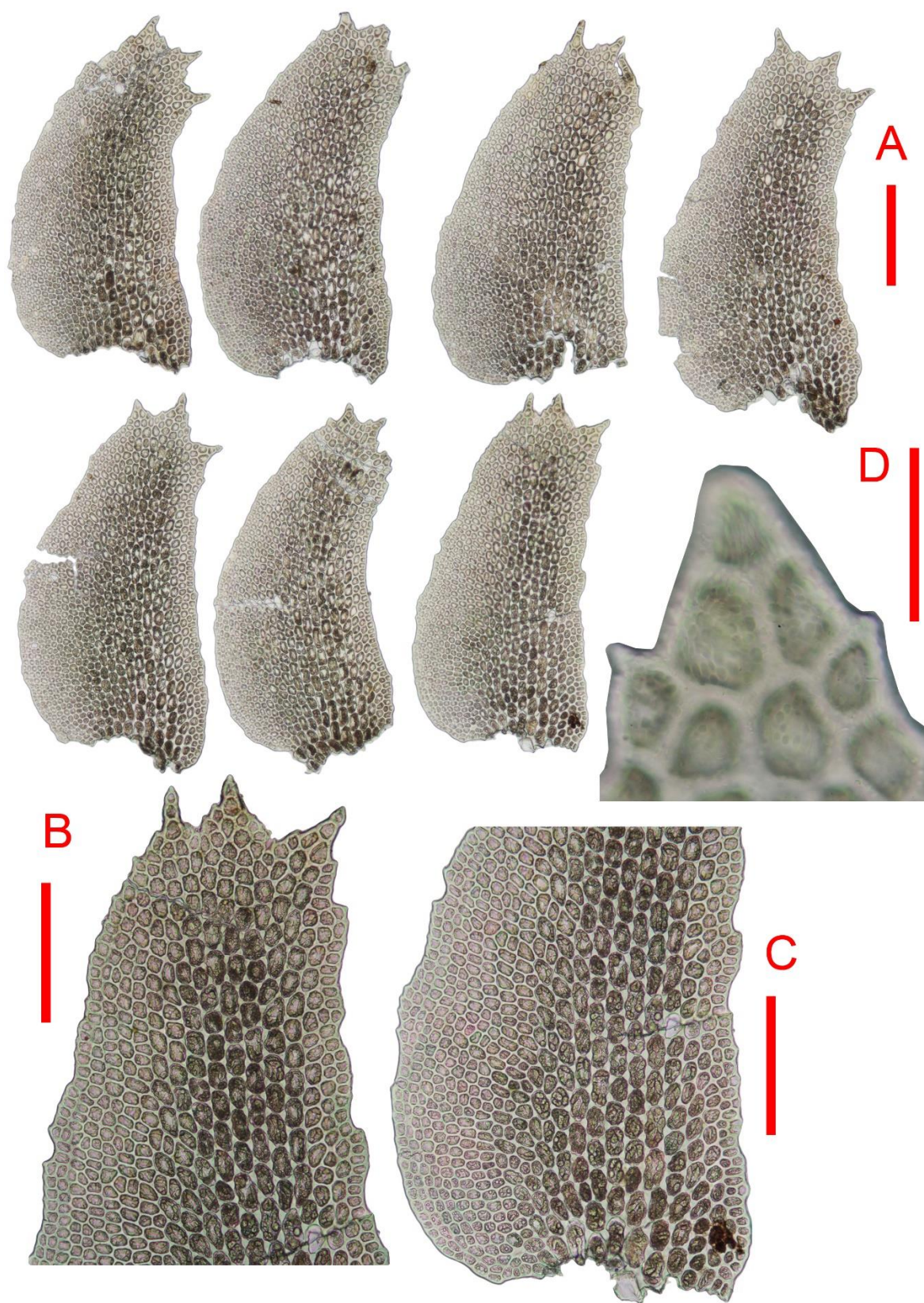


Plate 37: *Bazzania reicheliana* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A – Leaves; B – Leaf apex; C – Leaf base; D – Cuticula of leaf apex – Scales: A – 0.3 mm; B, C – 0.2 mm; D – 50 μ m (from DR KATJA REICHEL NC 774)

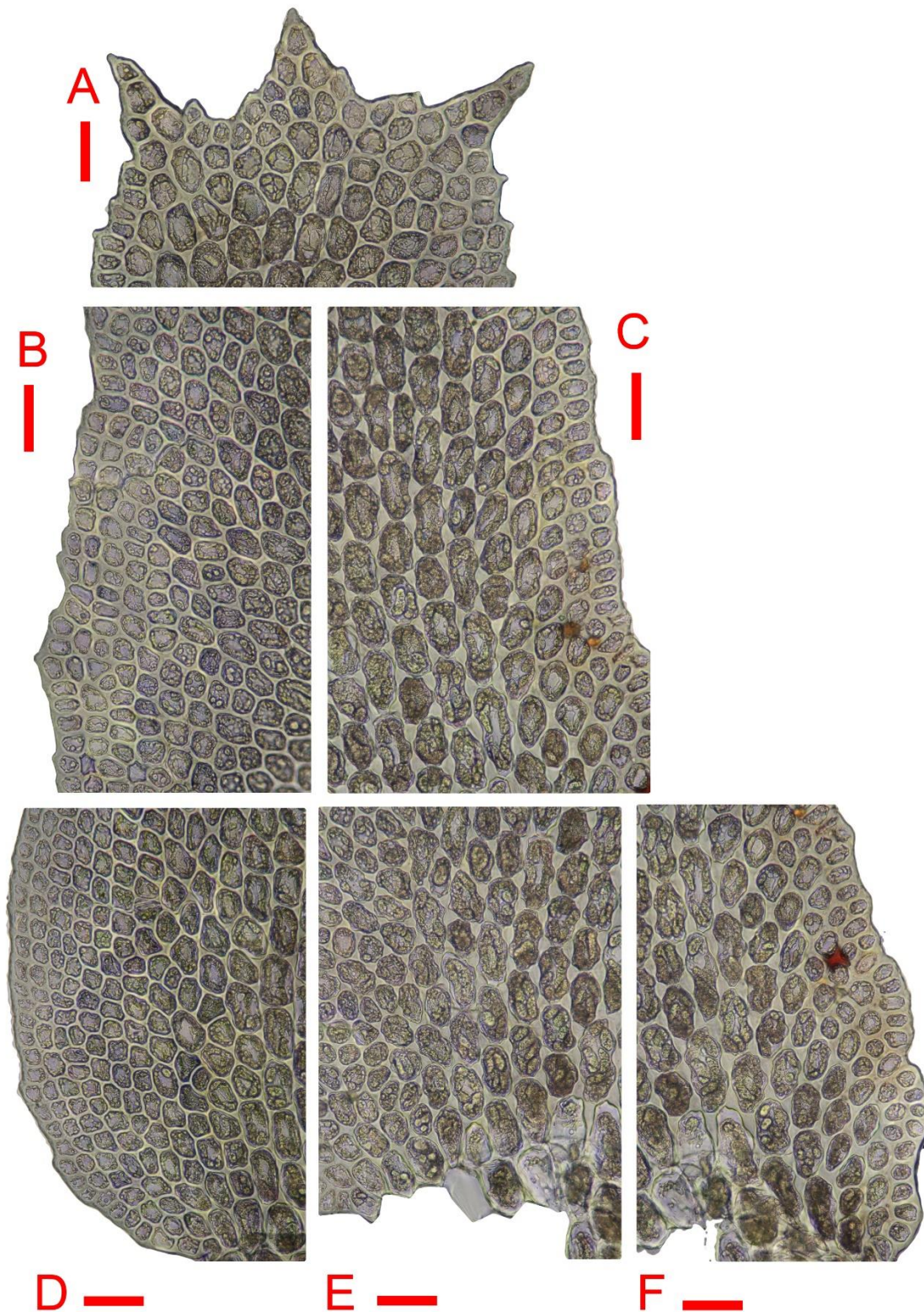


Plate 38: *Bazzania reicheliana* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK: A – Leaf Apex; B – Leaf middle dorsal; C – Leaf middle ventral; D – Leaf base dorsal; E – Leaf base; F – Leaf base ventral – Scales: A, B, C, D, E, F – 50 μm (from DR KATJA REICHEL NC 774)

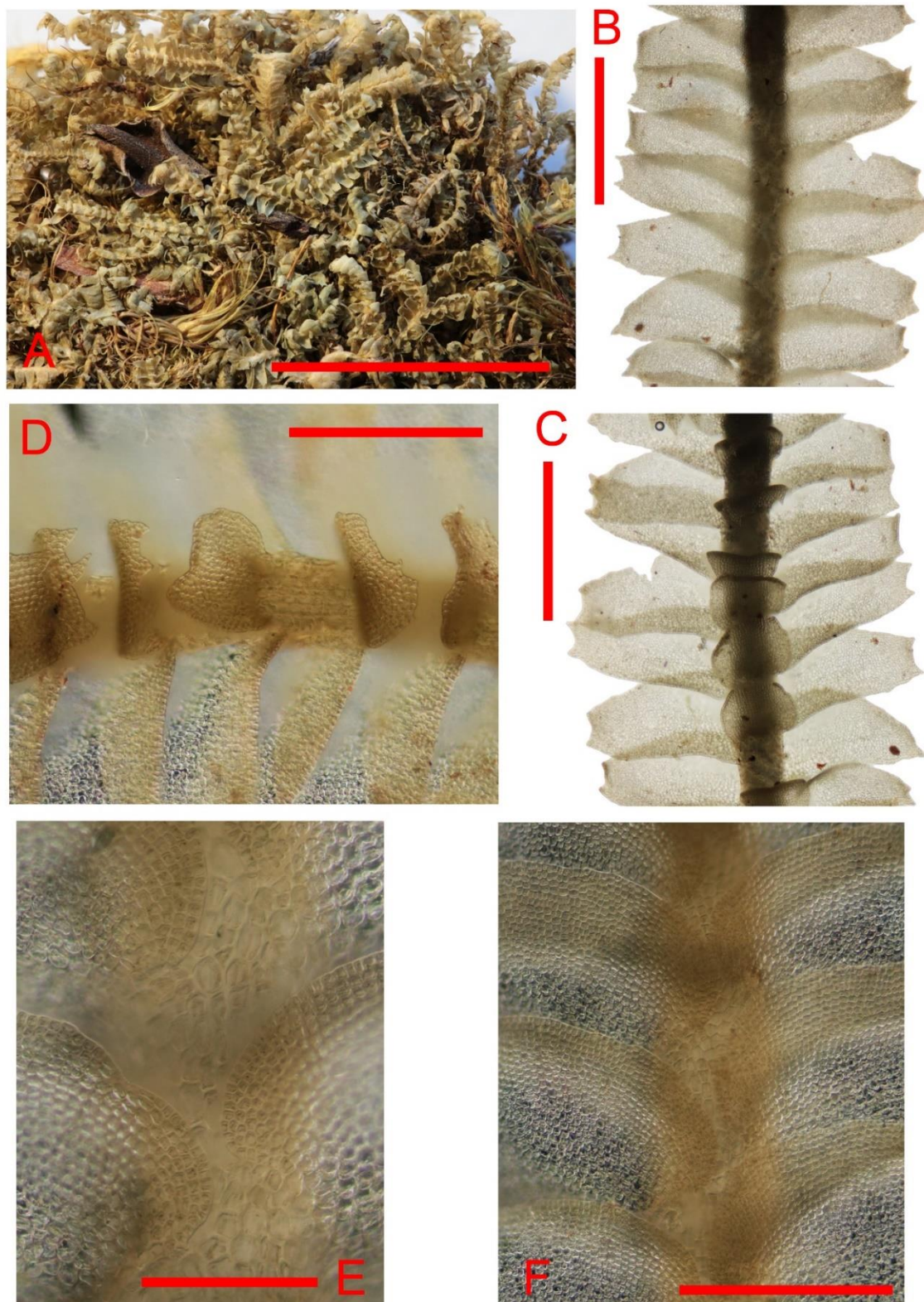
Bazzania sikkimensis (STEPH.) HERZOG

Plate 39: *Bazzania sikkimensis* (STEPH.) HERZOG: A – Habitus; B, E, F – Plants dorsal; C, D – Plants ventral – Scales: A – 1 cm; B, C – 1 mm; D, F – 0.5 mm, E – 0.2 mm (from UWE SCHWARZ 4254)

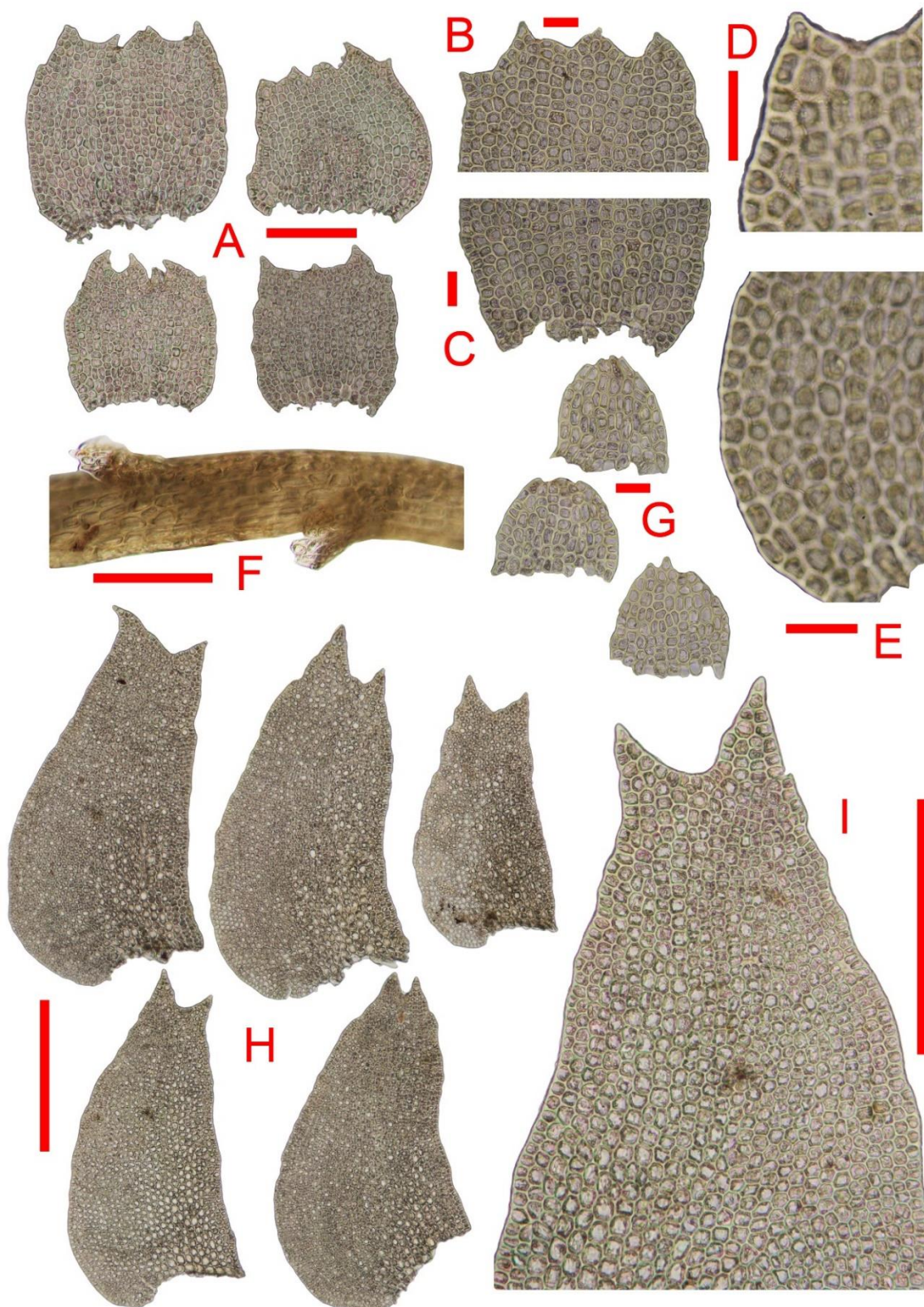


Plate 40: *Bazzania sikkimensis* (STEPH.) HERZOG: A – Underleaves; B- Underleaf apex; C – Underleaf base; D – Cuticula of amphigastrium apex; E – Cuticula of amphigastrium base; F – Flagellate branch; G – Leaves of flagellate branch; H – Leaves; I – Leaf apex – Scales: A, F – 0.2 mm; B, C, D, E, G – 50 μ m; H – 0.5 mm; I – 0.3 mm (from UWE SCHWARZ 4254)

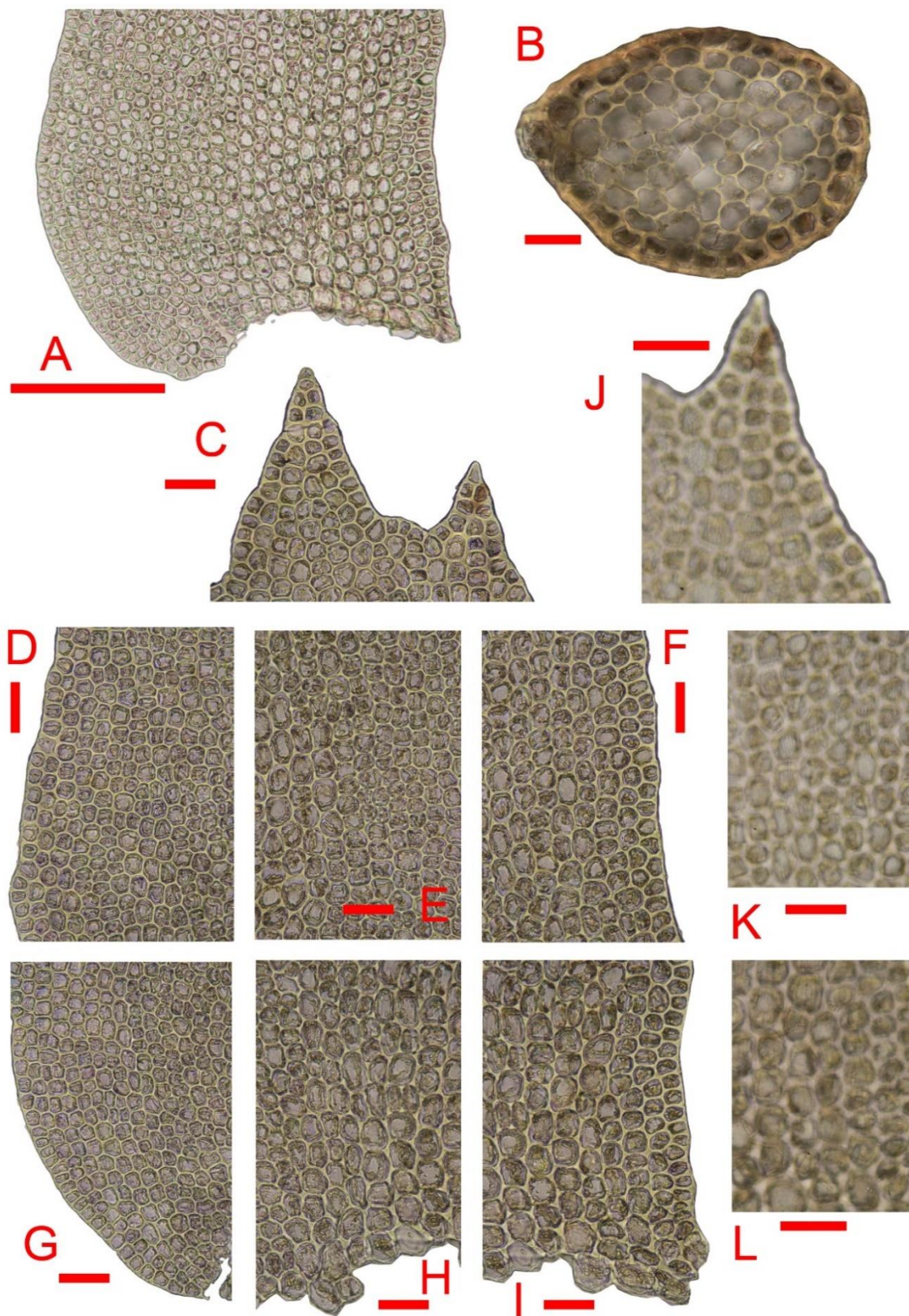


Plate 41: *Bazzania sikkimensis* (STEPH.) HERZOG: A – Leaf base; B – Stem Cross section; C, D, E, F, G, H, I – Leaf cells (apex, middle dorsal, middle, middle ventral, base dorsal, base, base ventral); J, K, L – Cuticula of leaf cells (apex, middle, base) – Scales: A – 0.2 mm; B – L – 50 µm (from UWE SCHWARZ 4254)

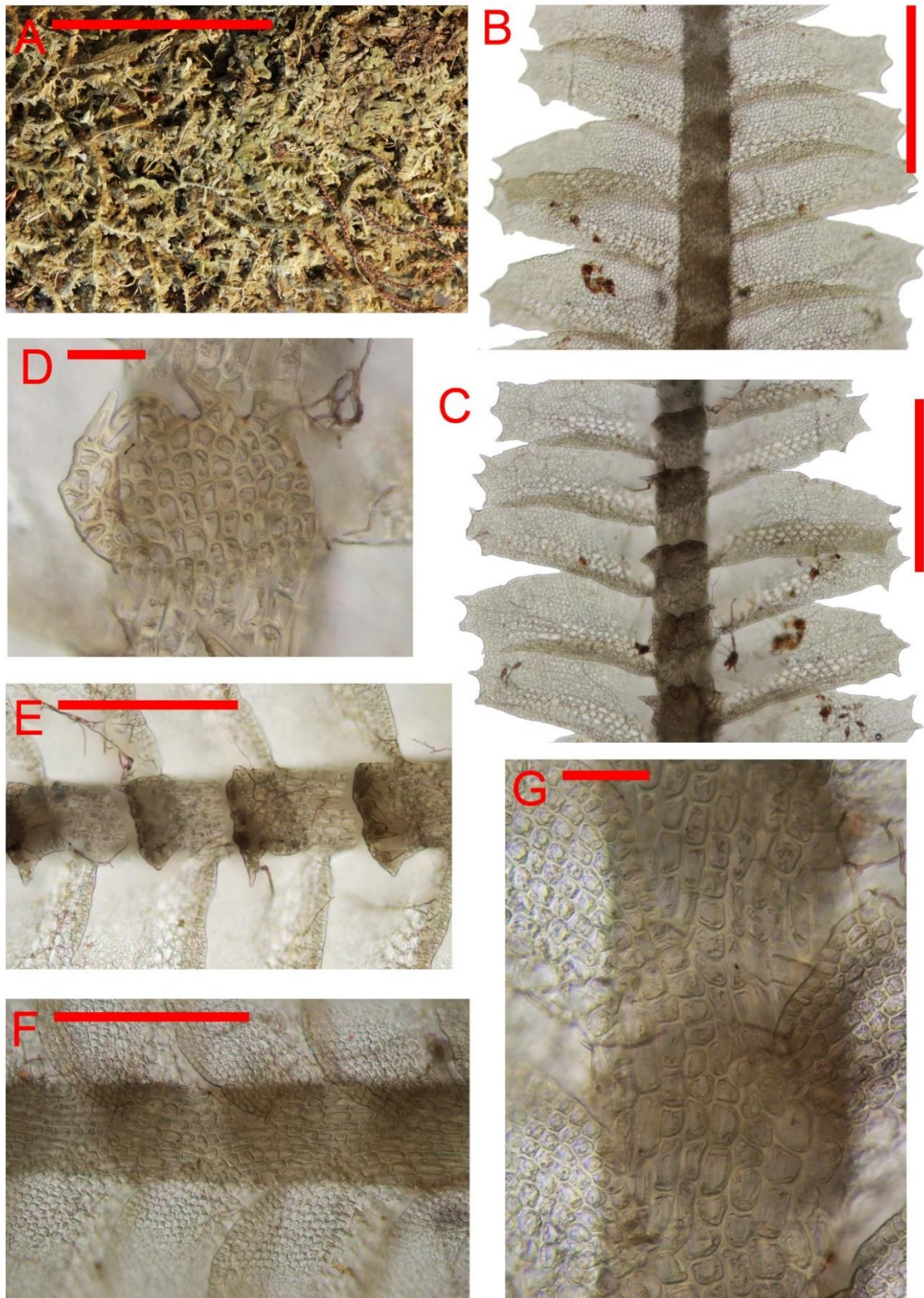
Bazzania subtilis (SANDE LAC.) SCHIFFN.

Plate 42: *Bazzania subtilis* (SANDE LAC.) SCHIFFN.: A – Habitus; B, F, G – Plants dorsal; C, D, E – Plants ventral – Scales: A – 1 cm; B, C – 0.5 mm; E, F – 0.3 mm; D, G – 50 μ m (from UWE SCHWARZ 4775)

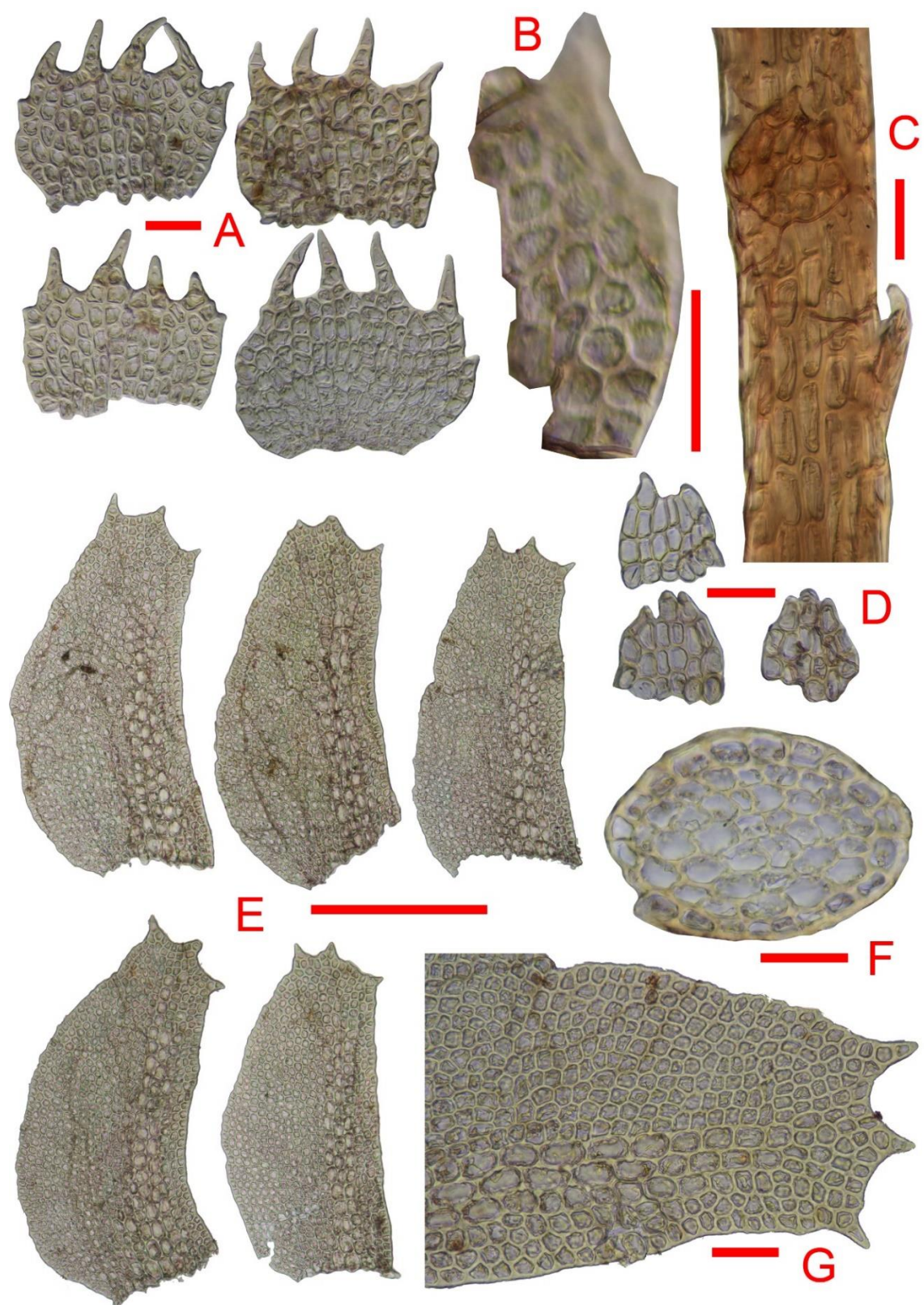


Plate 43: *Bazzania subtilis* (SANDE LAC.) SCHIFFN.: A – Underleaves; B – Cuticula of amphigastrium; C – Flagellate branch; D – Leaves of flagellate branch; E – Leaves; F – Stem cross section; G – Leaf apex – Scales: A, B, C, D, F, G – 50 μ m; E – 0.3 mm (from UWE SCHWARZ 4775)

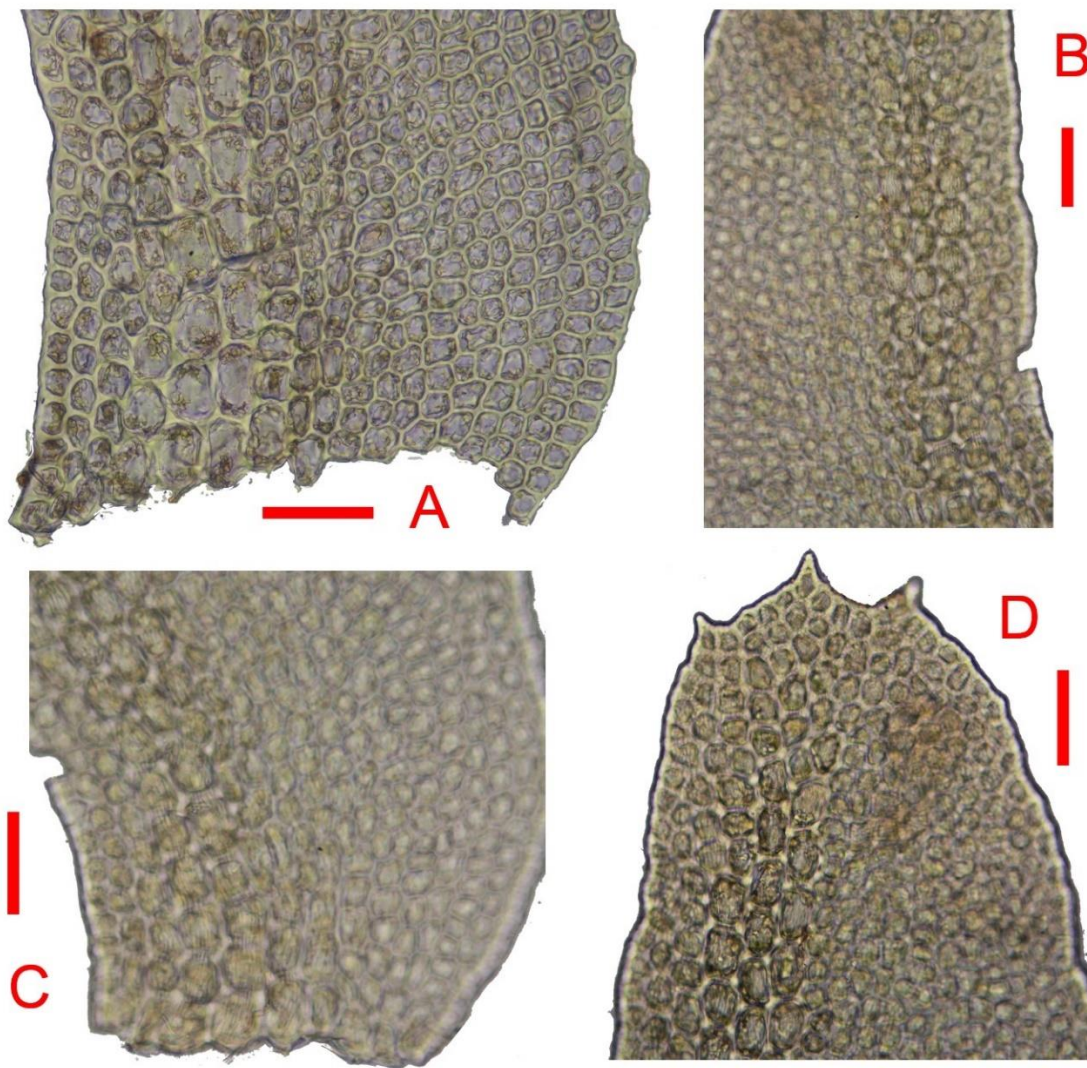


Plate 44: *Bazzania subtilis* (SANDE LAC.) SCHIFFN.: A – Leaf base; B – Cuticula leaf middle; C – Cuticula leaf base; D – Cuticula leaf apex – Scales: A, B, C, D – 50 μm (from UWE SCHWARZ 4775)

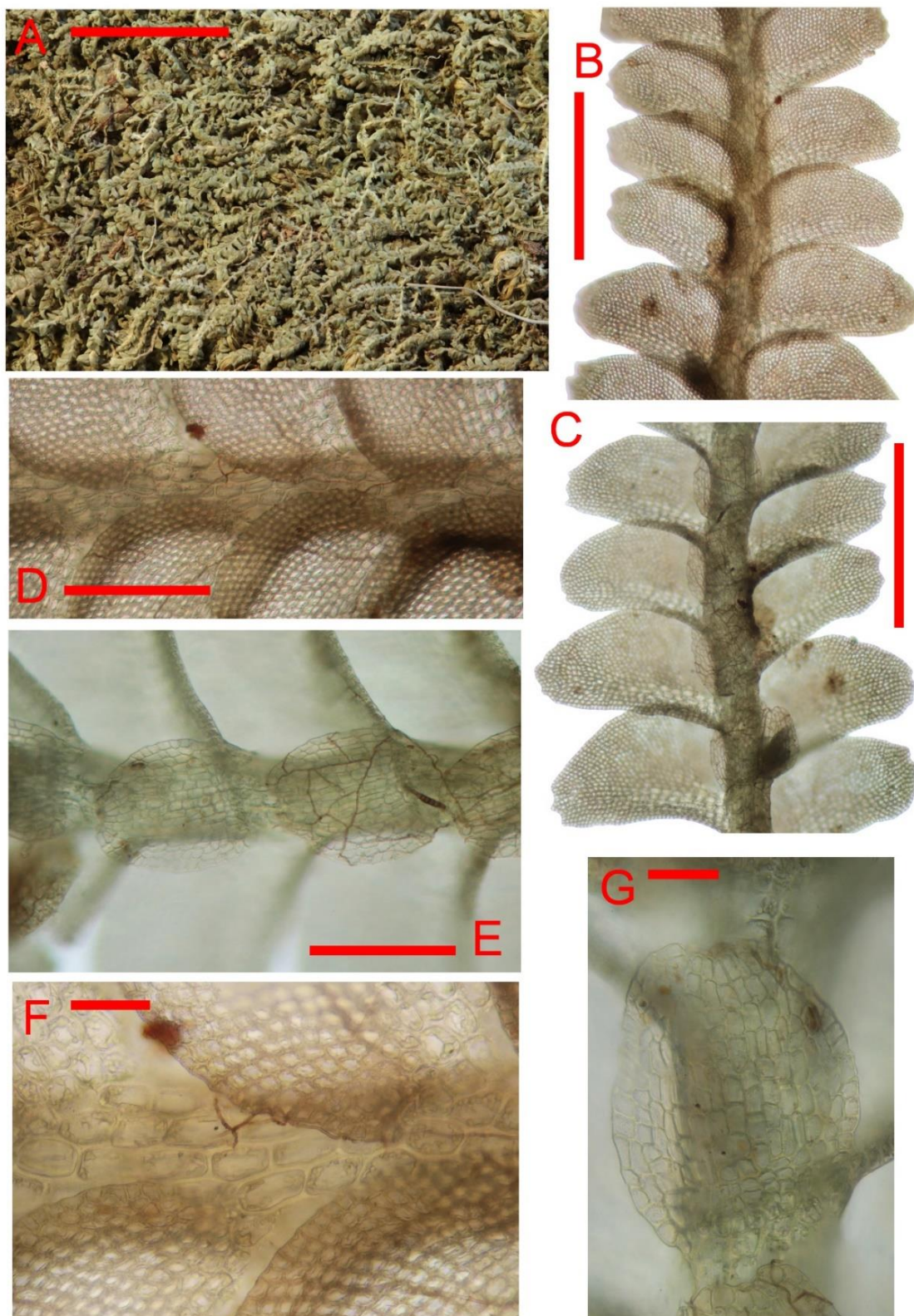
Bazzania vittata (GOTTSCHE) TREVIS.

Plate 45: *Bazzania vittata* (GOTTSCHE) TREVIS: A – Habitus; B, D, F – Plants dorsal; C, E, G – Plants ventral – Scales: A – 1 cm; B, C – 0.5 mm; D, E – 0.2 mm; F, G – 50 µm (from UWE SCHWARZ 6369)

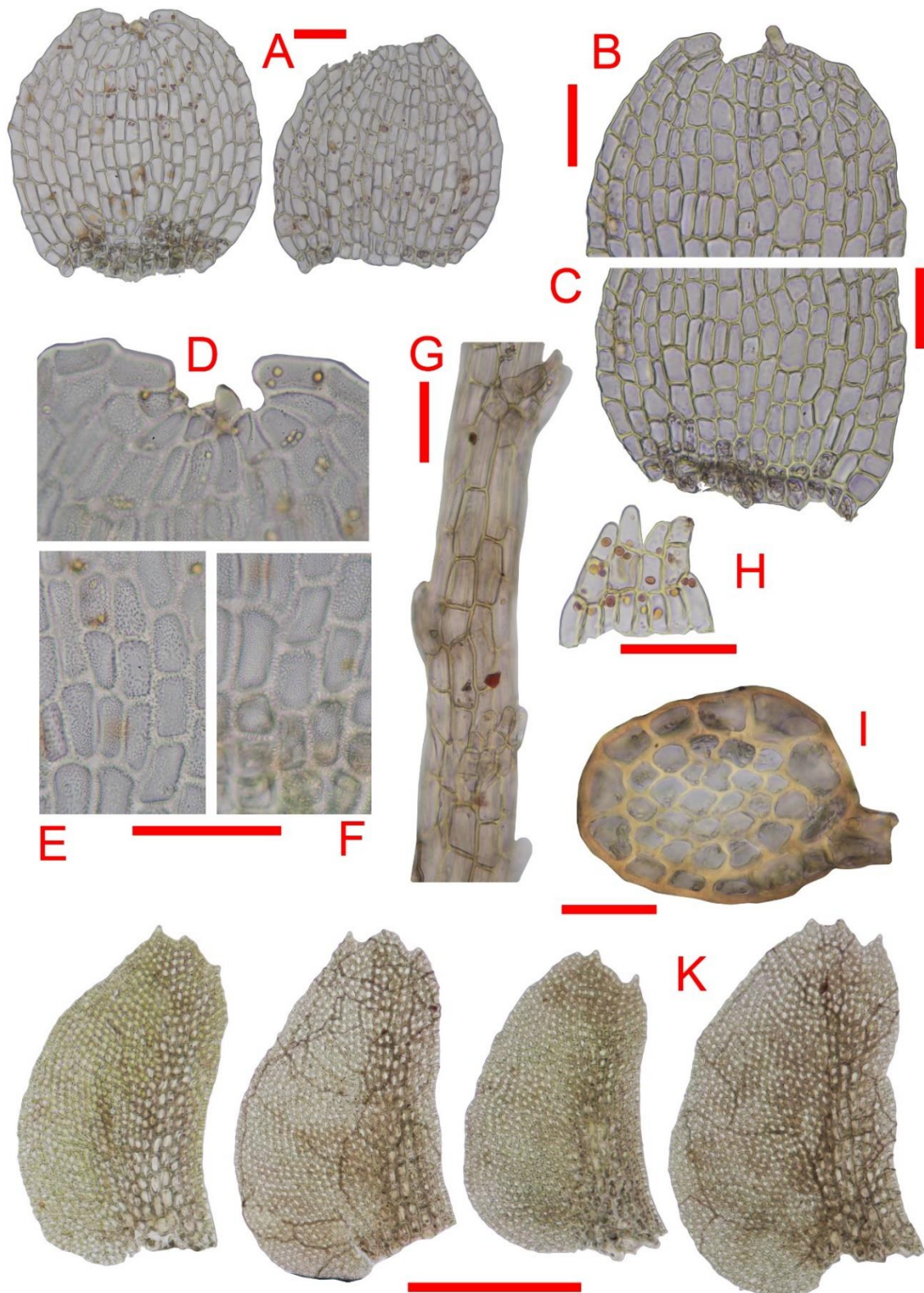


Plate 46: *Bazzania vittata* (GOTTSCHE) TREVIS: A – Underleaves; B – Underleaf apex; C – Underleaf base; D, E, F – Underleaf cuticula (apex, middle, base); G – Flagellate branch; H – Leaf of flagellate branch; I – Stem cross section; K – Leave – Scales: A – I – 50 μ m (D, E, F same scale); K – 0.3 mm (from UWE SCHWARZ 6369)

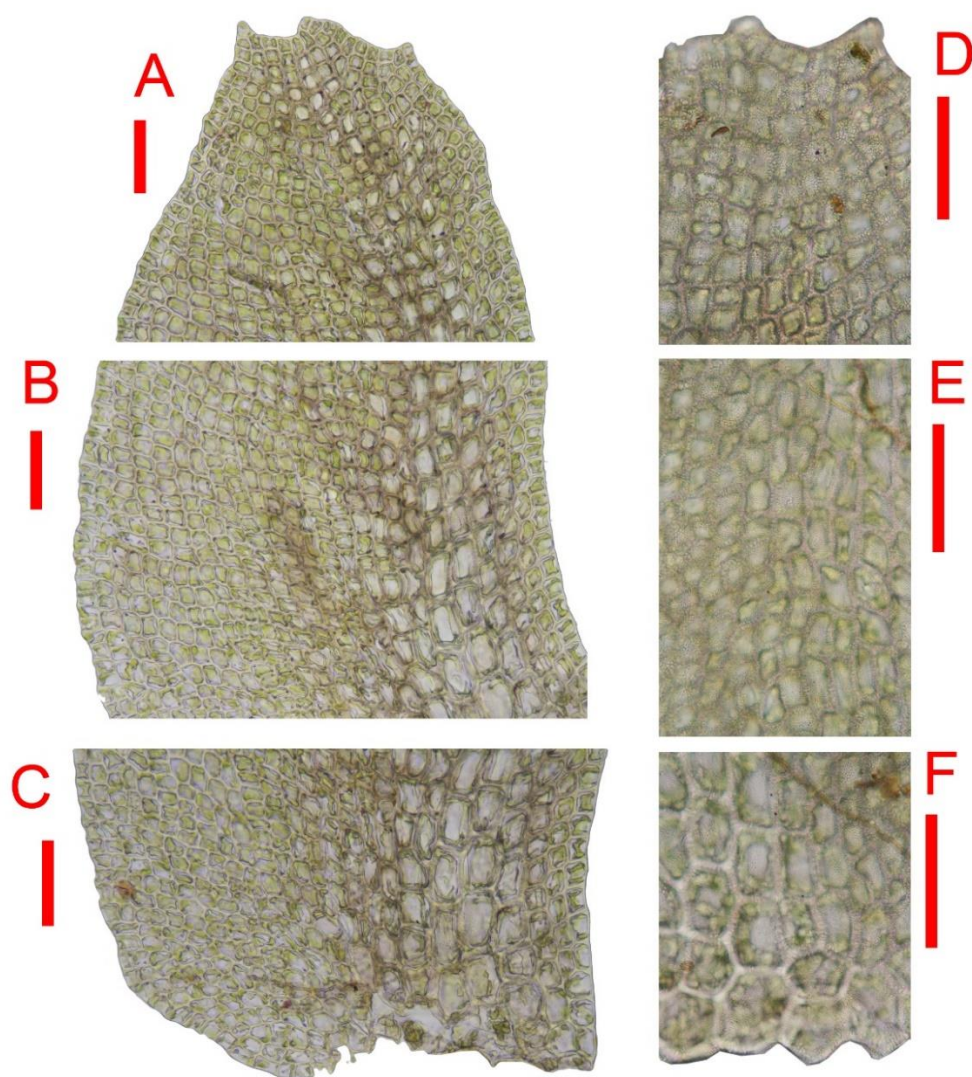


Plate 47: *Bazzania vittata* (GOTTSCHE) TREVIS: A – Leaf apex; B – Leaf middle; C – Leaf base; D – Cuticula leaf apex; E – Cuticula leaf middle; F – Cuticula leaf base – Scales: A – F – 50 µm (from UWE SCHWARZ 6369)

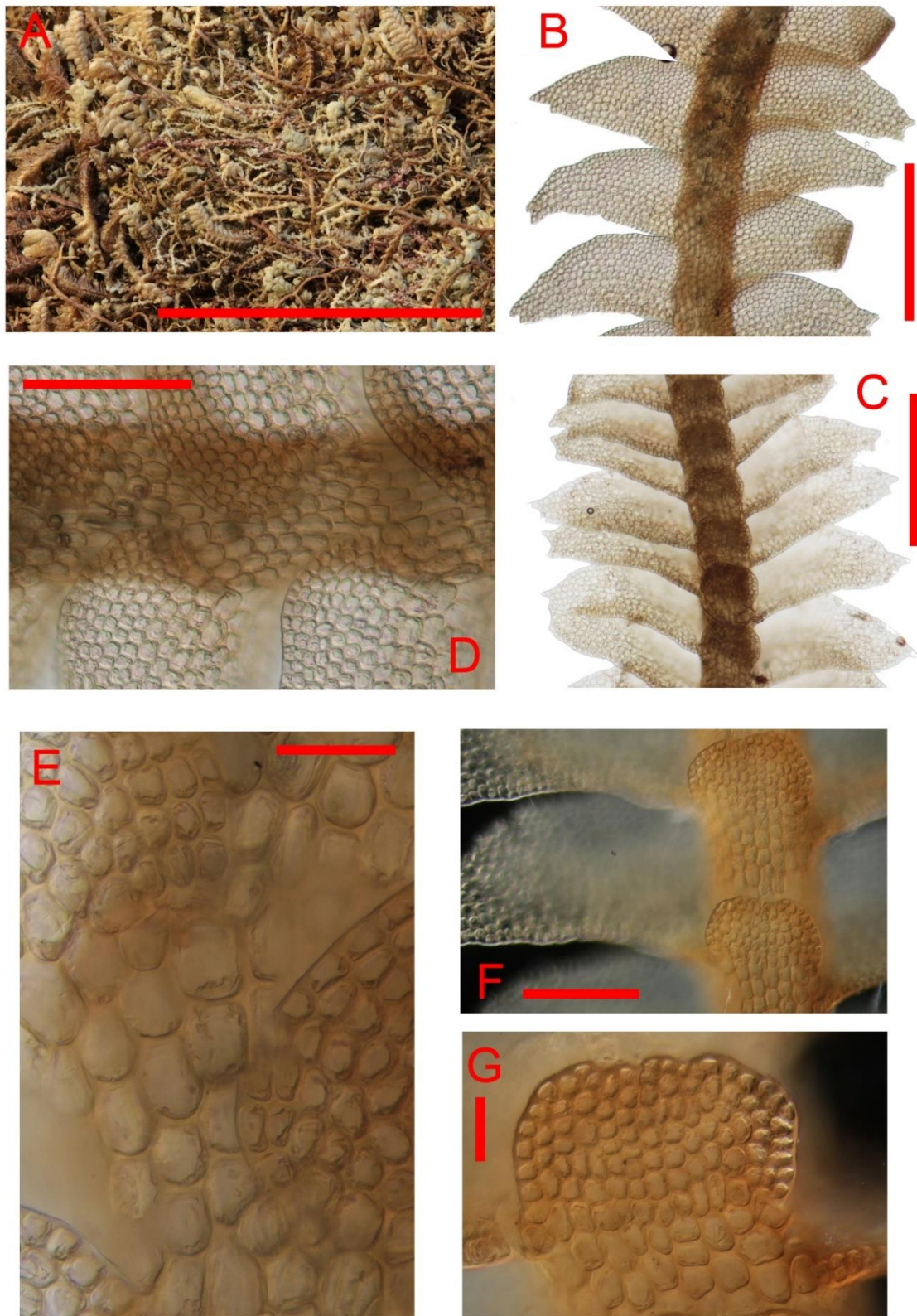
Bazzania wiltensii (STEPH.) SCHIFFN.

Plate 48: *Bazzania wiltensii* (STEPH.) SCHIFFN.: A – Habitus; B, D, E – Plants dorsal; C, F, G – Plants ventral – Scales: A – 1 cm; B, C – 0.5 mm; D, F – 0.2 mm; E, G – 50 µm (from UWE SCHWARZ 4776)

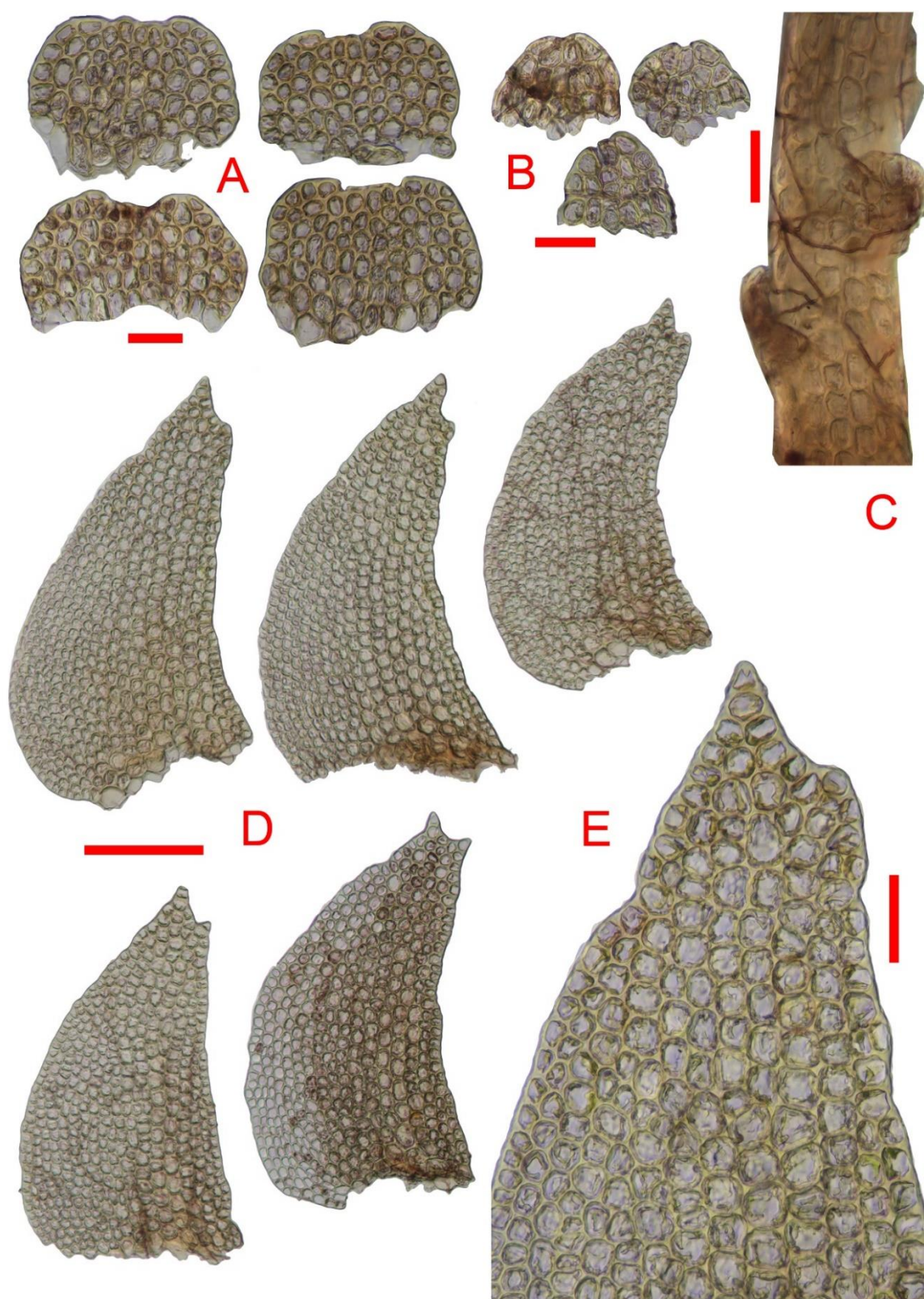


Plate 49: *Bazzania wiltensii* (STEPH.) SCHIFFN.: A – Underleaves; B – Leaves of flagellate branch; C – Flagellate branch; D – Leaves; E – Leaf apex – Scales: A, B, C, E – 50 μ m; D – 0.3 mm (from UWE SCHWARZ 4776)

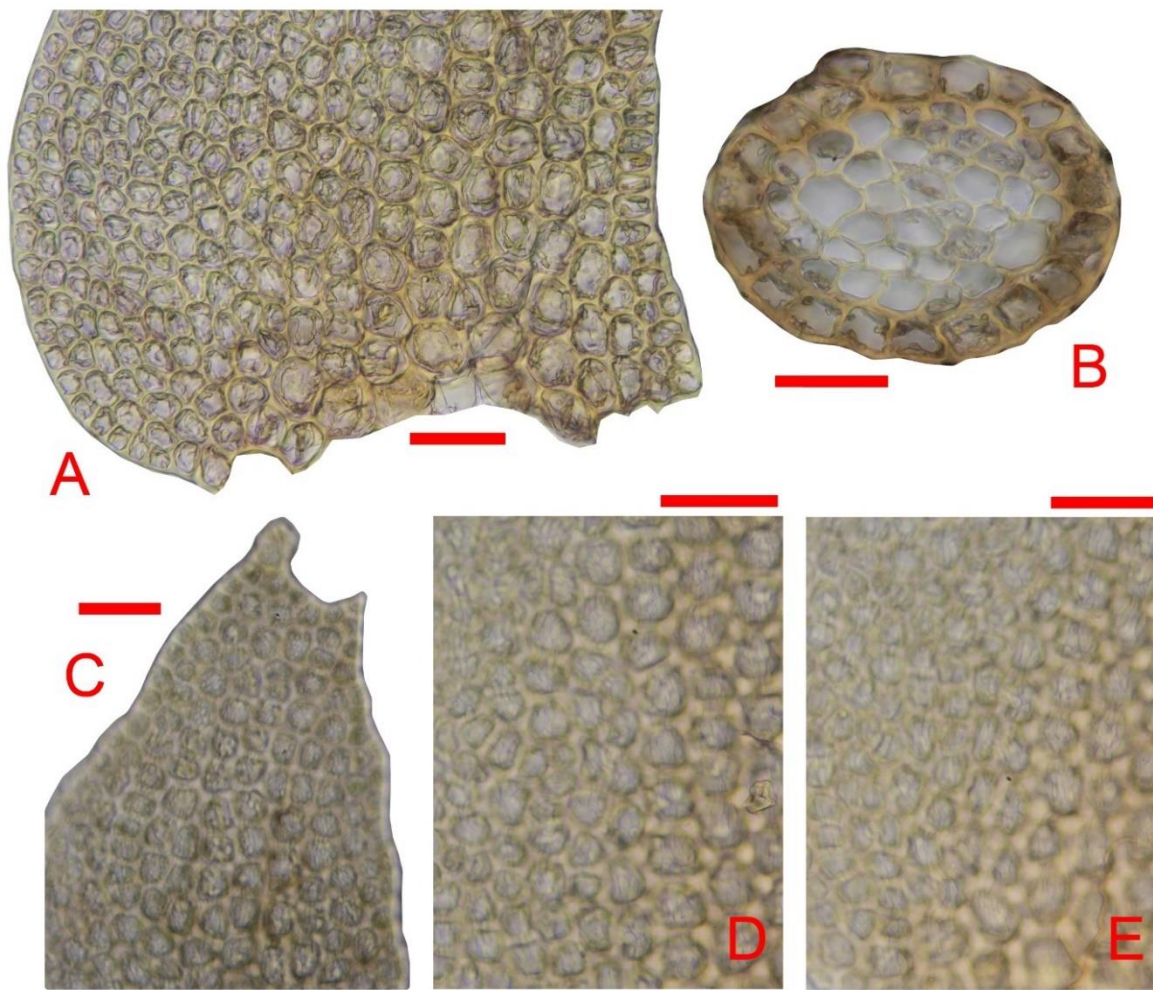


Plate 50: *Bazzania wiltensii* (STEPH.) SCHIFFN.: A – Leaf base; B – Stem cross section; C – Cuticula leaf apex; D – Cuticula leaf middle; E – Cuticula leaf base – Scales: A, B, C, D, E – 50 μm (from UWE SCHWARZ 4776)

Comparison of selected characters

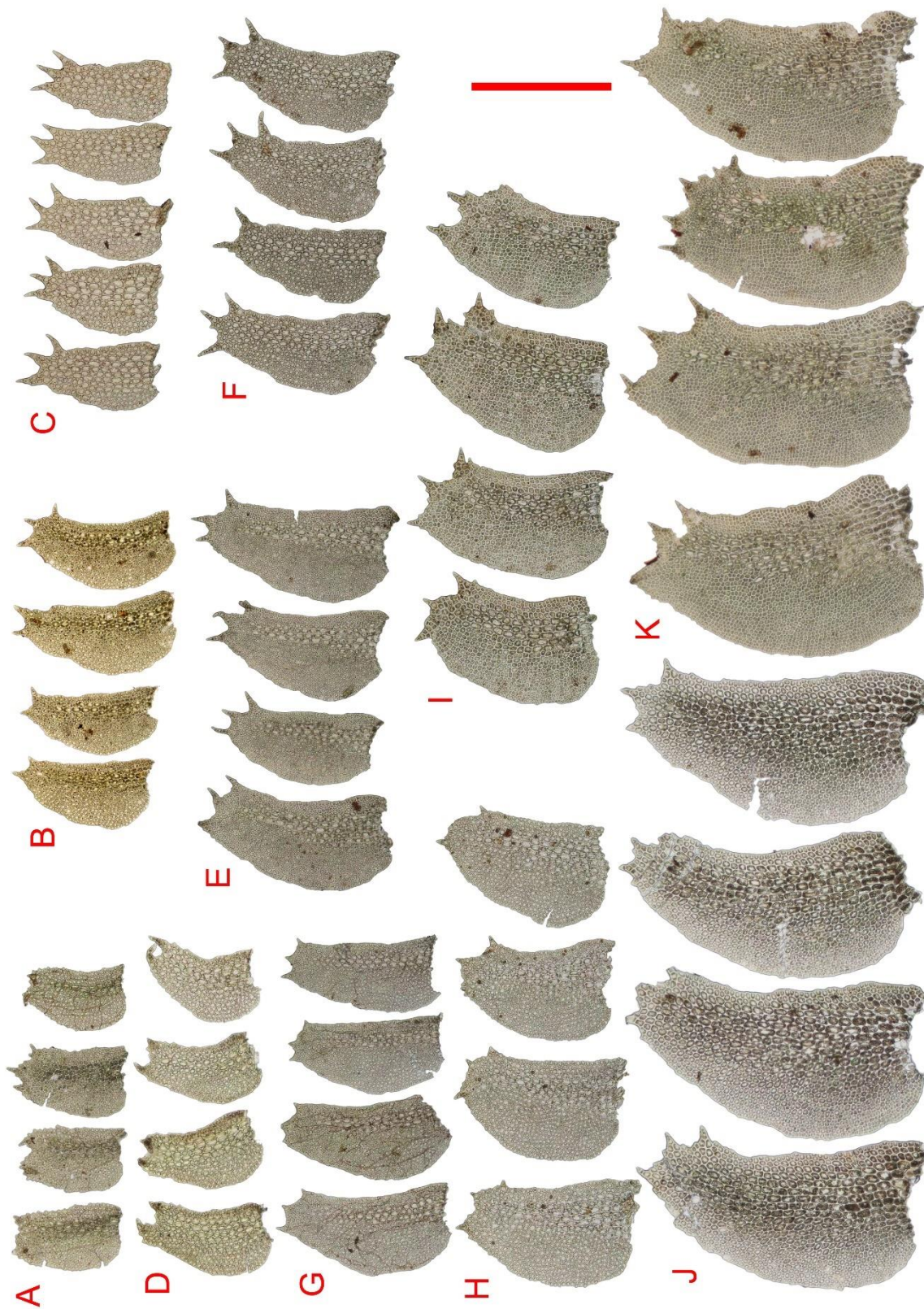


Plate 51: Leaf comparison of *B. acanoserrata* (A), *B. acanonista* (B), *B. palmatifidoides* (C), *B. globuliformis* (D), *B. indigenarum* (E), *B. palmatifida* (F), *B. subtilis* (G), *B. pulchella* (H), *B. helgana* var. *minor* (I), *B. reicheliana* (J), *B. helgana* (K) (all same scale – 0.5 mm)



Plate 52: Underleaves comparison of *B. acanoserrata* (A), *B. globuliformis* (B), *B. acanonista* (C), *B. subtilis* (D), *B. pulchella* (E), *B. palmatifidoides* (F), *B. helgana* var. *minor* (G), *B. indigenarum* (H), *B. palmatifida* (I), *B. helgana* (J), and *B. reicheliana* (K) (all same scale – 0.2 mm)

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