On Asian *Neolepidozia*

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Abstract: UWE SCHWARZ, ALFONS SCHÄFER-VERWIMP, JAMES R. SHEVOCK (2026): On Asian *Neolepidozia*. *Frahmia* 49:1-497[1].

This article provides an overview of the majority of known *Neolepidozia* taxa in Asia. We identified 54 different taxa (43 species, 10 varieties and 1 form). 32 species and 8 varieties are newly described. Eight species previously belonging to *Lepidozia* were transferred to *Neolepidozia*. All of these taxa are included in an illustrated key and are described and depicted. *Neolepidozia wallichiana*, which was thought to be a common and widespread Asian species, turned out to be very rare and most likely endemic to Nepal. *Neolepidozia longitudinalis* was reassigned to *Lepidozia*. Records of *N. capilligera* and *N. heterotexta* in Asia are erroneous and have been excluded.

1. Introduction

A considerable number of *Lepidozia* collections from the Philippines by the first and third author triggered a closer investigation of the group that is meanwhile treated as *Neolepidozia*. In comparison to *Lepidozia*, the cortical cells of the stem are markedly enlarged in *Neolepidozia*.

Initially we recognized at least 6 different forms from the Philippines. The identification attempts turned out to be quite challenging. Most of the specimens from the Philippines were identified as *N. wallichiana* that contradicted with our own observation. The available literature (DEL ROSARIO [1975], ENGEL & MERRILL [2004], HATTORI & MIZUTANI [1958], JOVET-AST [1947], KITAGAWA [1973], MIZUTANI [1968, 1974, 1976], PIIPPO [1984], STEPHANI [1906-1909, 1917-1924, 1985]) was unfortunately misleading. Articles with the description of new species (CHANG & GAO [1984], HERZOG [1921, 1931, 1950], KITAGAWA [1978]) could not contribute to the clarification of the situation.

The initial goal was a study of the genus *Neolepidozia* from the Philippines. We soon realized that an extension to Asia was required to get a better understanding of the group. We therefore extended the study area from Sri Lanka in the West, Japan in the North and the Solomon Islands in the East. New Caledonia was intentionally excluded. Further specimen of the second author and in particular the collections from JE, G and L revealed a much higher diversity than initially expected. It became obvious that the use of the quite uniform stem leaves led to a misinterpretation of the different forms. Branch leaf characters show a much higher diversity. We consider them as the most useful morphological character to distinguish different species.

Taking more than 8800 pictures of 178 specimens and the creation of numerous comparison sheets proved to be essential to visualize and understand the differences between the different forms. We finally distinguish 54 different taxa (43 species, 10 varieties, 1 form). All these taxa are included into an illustrated key, described and depicted.

The observed diversity let us assume that there might be further, hitherto undescribed species in the region. It would be advisable to study the collections in CANB, F, H, MO, MU, NICH and NY in particular. It will not just improve our understanding of the group but also contribute to a better picture about their distribution.

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Due to time and resource constrains, as well as the age of the specimens we omitted the genetical analysis of the taxa. Nevertheless, it would be highly recommendable to investigate if the morphological diversity can be supported by genetical studies.

Specimens of the second author will be deposited in the Haussknecht Herbarium (JE).

2. Historical remarks

The first records of *Neolepidozia* in Asia dates back to 1845 when GOTTSCHE, LINDENBERG & NEES described *L. wallichiana*. It is surprising that this species was described from Nepal, an area where *Neolepidozia* is rather rare. The genus is much more frequent in South East Asia. At least related species could have been found during this period. It was SANDE LACOSTE (1856), who described *Lepidozia wallichiana* var. *gracilis* from Java, the first taxon from tropical South East Asia.

Several decades passed before SCHIFFNER (1893) published *L. mamillosa*. The plant was first discovered in 1875 by Naumann in a mangrove forest in New Guinea. SCHIFFNER (1900) further introduced *L. massartiana* and its var. *laxa* from Java but did not provide a proper description. A valid description was provided nine years later by STEPHANI (1909).

STEPHANI already described *L. variifolia* in GEHEEB (1898) from Blitoeng (Pulau Belitung), an island east to Sumatra. It was the first species with asymmetric branch leaves. STEPHANI stated "*Folia ramulina dense imbricata, ..., laciiniis inaequalibus porrectis, dorsali longiore*" indicating a clear distinction to the hitherto described species with symmetric leaves.

The majority of the *Neolepidozia* species from the region date back to 1909 when STEPHANI (1906-1909) described *L. cuneifolia* (New Guinea), *L. ophiria* (Malacca), *L. papulosa* (Sumatra), *L. planifolia* (Japan) and *L. tenera* (Java) in Volume 3 of Species Hepaticarum. In Volume 6 of Species Hepaticarum (STEPHANI [1917-1924]), he added *L. augustana* (New Guinea), *L. expansa* (Philippines) and *L. paucidens* (Java). The rather short descriptions focusing on stem leaves did not allow the identification of the species, even when consulting STEPHANI's Icones Hepaticarum (1985).

HERZOG described 4 additional taxa between 1921 and 1950. These were *L. plumula* from Ceylon (HERZOG [1921]), *L. biloba* from the Philippines (HERZOG [1931]), *L. longitudinalis* and *L. wallichiana* var. *remotifolia* from Borneo (HERZOG [1950]). Unfortunately, HERZOG had only a limited access to the species in this group as evidenced by the *Neolepidozia* specimens from JE. They did not allow a closer investigation.

Only two additional species have been described from the region, *L. parvula* from Thailand by KITAGAWA (1978) and *L. hainanensis* from Hainan Island by CHANG in CHANG & GAO (1984).

L. capilligera does not occur in the region. According to ENGEL & MERRILL (2004) it is endemic to Tasmania. Specimens labelled as *L. capilligera* in JE likely represent an undescribed *Lepidozia* species that does not belong to *Neolepidozia*. The respective records in GROLLE & PIIPPO (1984) have to be omitted.

HÜRLIMANN (1983) mentions a specimen in G identified by STEPHANI as *Lepidozia theriotii* (= *N. heterotexta*) from the northern Maluku Islands. He further mentioned that W. MEIJER revised it as *L.* cf. *massartiana*. He also stated that *L. massartiana* does not occur in New Caledonia and *L. heterotexta* does not occur outside of New Caledonia and the New Hebrides.

Until the beginning of our studies the following 17 species had been described from the area under investigation:

1. *L. augustana* (New Guinea)
2. *L. biloba* (Philippines)
3. *L. cuneifolia* (Papua New Guinea)
4. *L. expansa* (Philippines)
5. *L. hainanensis* (China)
6. *L. longitudinalis* (Borneo)
7. *L. mamillosa* (New Guinea)
8. *L. massartiana* (Amboina)
   L. massartiana var. *laxa* (Amboina)
9. *L. ophiria* (Malay Peninsula)
10. *L. papulosa* (Sumatra)
11. *L. parvula* (Thailand)
12. *L. paucidens* (Java)
13. *L. planifolia* (Japan)
14. *L. plumula* (Sri Lanka)
15. *L. tenera* (Java)
16. *L. variifolia* (Borneo)
17. *L. wallichiana* (Nepal)
    L. wallichiana var. *gracilis* (Java)
    L. wallichiana var. *remotifolia* (Borneo)

HATTORI & MIZUTANI (1958) started a period of synonymisations. They considered *L. planifolia* to be conspecific with *L. wallichiana*. KITAGAWA (1973) provided a most valuable contribution to the understanding of *Neolepidozia* in Asia. He indicated that *L. papulosa* is by far more common in the region than *L. wallichiana*, which also fits with our

observations. Based on the study of selected types he provided an insight of the variability of *L. papulosa* and its relatives, finally putting *L. paucidens* as a synonym to *L. papulosa,* and *L. expansa* and *L. tenera* as a synonym to *L. massartiana*.

Although INOUE (1979) treated *L. cuneifolia* as a synonym of *L. wallichiana,* other authors like ENGEL & MERRILL (2004) did not follow his opinion.

PIIPPO (1984) considered *L. augustana* to be conspecific with *L. wallichiana,* and MITZUTANI & CHANG (1986) assigned *L. hainanensis* to the same species. The notes of MITZUTANI on the type specimen of *L. plumula* (JE 04009241) also indicate that he considers it to be conspecific with *L. wallichiana*.

ENGEL & MERRILL (2004) synonymized *L. expansa*, *L. tenera* and *L. variifolia* with *L. wallichiana*. They nevertheless stated that "Our experience with specimens determined as *T. wallichiana* indicates that a number of distinct taxa are probably involved, rather than a single widely distributed, polymorphic species ", a finding that was corroborated by our investigation.

BAPNA & KACHROO (2000) considered *L. parvula* to by conspecific with *L. robusta*, but this was rejected by HAGBORG & SÖDERSTRÖM (2023). *L. robusta* does not develop the typical enlarged cortical cells of the stem unlike *L. parvula*.

The following species were considered worth recognizing despite differences of opinion among authors:

1. *L. biloba* (Philippines)
2. *L. cuneifolia* (Papua New Guinea)
    - *L. massartiana* (Amboina) – treated as a separate species by KITAGAWA (1973), probable synonym of *L. cuneifolia* fide ENGEL & MERRILL (2004)
        - *L. expansa* (Philippines) – KITAGAWA (1973), synonym of *L. wallichiana* fide ENGEL & MERRILL (2004)
        - *L. tenera* (Java) –KITAGAWA (1973), synonym of *L. wallichiana* fide ENGEL & MERRILL (2004)
    - *L. massartiana* var. *laxa* (Amboina)
3. *L. longitudinalis* (Borneo)
4. *L. mamillosa* (New Guinea)
5. *L. ophiria* (Malay Peninsula)
6. *L. papulosa* (Sumatra)
    - *L. paucidens* (Java) – KITAGAWA (1973)
7. *L. parvula* (Thailand)
8. *L. wallichiana* (Nepal)
    - *L. augustana* (New Guinea) –PIIPPO (1984)
    - *L. hainanensis* (China) – MITZUTANI & CHANG (1986)
    - *L. planifolia* (Japan) – HATTORI & MIZUTANI (1958)
    - *L. plumula* (Sri Lanka) – according to the notes of MITZUTANI on specimen JE 04009241
    - *L. variifolia* (Borneo) – ENGEL & MERRILL (2004)
    - *L. wallichiana* var. *gracilis* (Java)
    - *L. wallichiana* var. *remotifolia* (Borneo)

Most of the specimens from the region that are kept in JE were identified as *L. cuneifolia* or L. *wallichiana* by GROLLE or MIZUTANI. It also reflects that most East and South East Asian specimens were identified as *L. wallichiana* as the result of the synonymizations. This also applies to the specimens of the authors prior to this study. The statement of KITAGAWA (1973) that *L. wallichiana* is rather rare and *L. papulosa* the more common species in the region was not considered in later studies.

Table 1 shows the current distribution of the *Neolepidozia* species in South, East and South East Asia. New records have been identified as *Neolepidozia wallichiana*, e.g. for Cambodia and Vietnam. One of the reasons is the lack of a usable identification keys and the statements by previous authors that *N. wallichiana* is the most common and widely distributed species. Based on our observations we consider most of these records to be doubtful.

Cambodia – BAKALIN et al. (2023)

- *wallichiana*

China – MIZUTANI & CHANG (1986), ZHU (2006)

- *wallichiana* (inclusive *Lepdiozia hainanensis*)

India – MAJUMDAR & SINGH (2015)

- *wallichiana*

Indonesia – SÖDERSTRÖM et al. (2010), GROLLE & PIIPPO (1984), STEPHANI (1909)

- *massartiana*
- *massartiana* var. *laxa*
- *papulosa* (inclusive *L. paucidens*)
- *tenera*
- *wallichiana*
- *wallichiana* var. *gracilis*

Japan – FURUKI & MIZUTANI (2004), HATTORI & MIZUTANI (1958)

- *mamillosa*
- *wallichiana* (inclusive *L. planifolia*)

Malaysia – LEE et al. (2022), NADHIFAH et al. in ELLIS et al. (2024), ENGEL & MERRILL (2004), HERZOG (1950)

- *cuneifolia*
- *longitudinalis*
- *mamillosa*
- *ophiria*
- *wallichiana* (inclusive *L. variifolia*)
- *wallichiana* var. *remotifolia*

Nepal – STEPHANI (1909)

- *wallichiana*

Papua New Guinea – GROLLE & PIIPPO (1984)

- *capilligera* (specimen in JE only contain a *Lepdiozia* species)
- *mamillosa*
- *massartiana* (based on the synonymized *L. tenera*)
- *wallichiana* (inclusive *L. augustana, L. cuneifolia*)

Philippines – TAN & ENGEL (1986)

- *biloba*
- *massartiana* (inclusive *L. expansa*)
- *ophiria*
- *papulosa*
- *wallichiana*

Singapore – JUSLÉN et. al. (2001)

- *mamillosa*
- *wallichiana*

Solomon Islands – GROLLE & PIIPPO (1984)

- *wallichiana* (inclusive *L. cuneifolia*)

Sri Lanka – LONG & RUBASINGHE (2014)

- *plumula*

Thailand – LAI et al. (2008)

- *papulosa*
- *parvula*

Vietnam – BAKALIN & VAN SINH (2016), SHU et al. (2017)

- *wallichiana*

Table 1: Distribution of *Neolepdiozia* species in East, South, and South East Asia as mentioned in the respective literature

3. Remarks on selected characters

Habitus and branching:

Neolepidozia species can reach a length from 1 to 4 cm. It is not always possible to determine the exact length since older parts are often decayed. The plants are regularly to irregularly, densely to weakly 1- or rarely 2-pinnate. Ordinarily leafed branches are either densely (Fig. 1 A) or remotely (Fig. 1 C) attached and of *Frullania*-type. There are occasionally branches originating ventral-intercalar that will develop into new stems. *N. lungaensis* in particular develops almost only this type or branching (Fig. 1 D). It seems that plants growing on soil show the tendency to develop ventral-intercalar branches compared to those growing on humus, bark or rotten wood. Female inflorescences or male branches are of ventral-intercalar origin. No other type of branching was observed in the specimens studied.

The general appearance greatly differs amongst the species. *N. katrinae* and *N. richardsii* (Fig. 2 A) as two extreme forms that have a *Kurzia*-like appearance. The *Frullania*-type of branching identifies them as *Neolepidozia*. There are all transitions between a bit more divergent leaves, like in *N. massartiana* (Fig. 2 B) to completely flattened plants as in *N. dinagatensis* (Fig. 2 C).

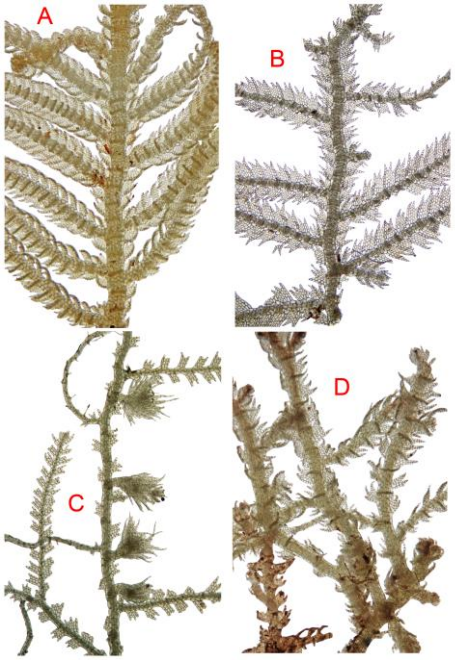

Fig. 1: General Habitus, A – *N. beckeri*, B – *N. papulosa*, C – *N. philippinensis*, D – *N. lungaensis*

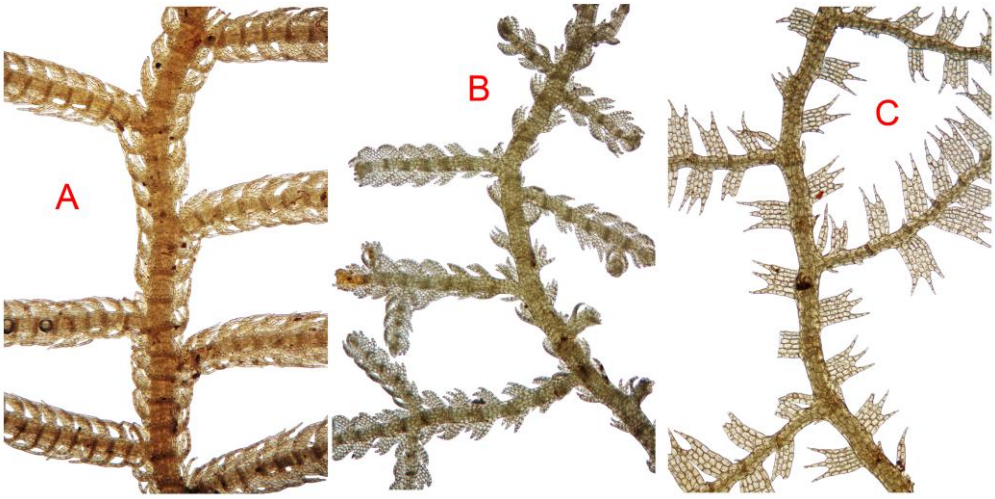

Fig. 2: Degree of flattening, A – *N. richardsii*, B – *N. massartiana*, C – *N. dinagatensis*

Stem:

The development of a layer of enlarged cortical stem cells is very characteristic for the genus *Neolepidozia*. Even though *Lepidozia longitudinalis* also develops a layer of enlarged cells (Plate 130 D) we do not treat this species as *Neolepidozia*. The branch leaf characters greatly differ from the other *Neolepidozia* species.

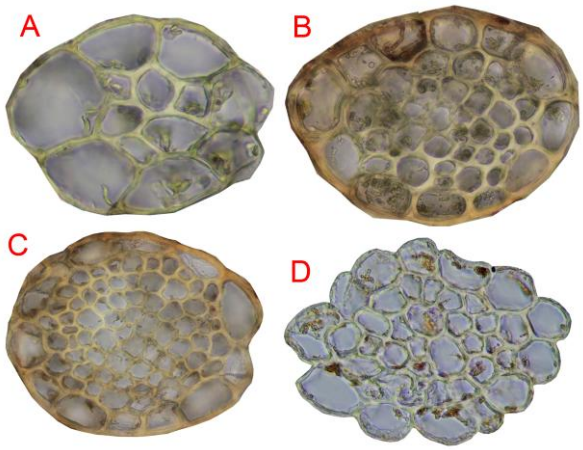

Fig. 3: Stem cross section, A – *N. cameronensis*, B – *N. hamiguitanensis*, C – *N. solomonensis*, D – *N. mamillosa* (magnification differs for the species)

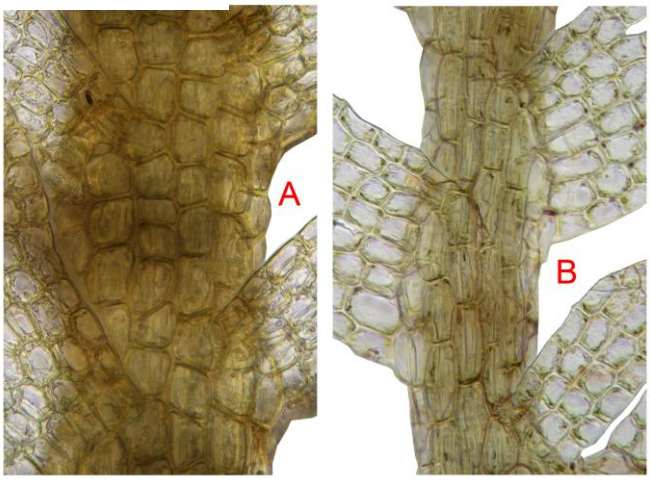

Fig. 4: Dorsal stem cortex: A – *N. cuneifolia* var. *luxurians*, B – *N. morobensis*

The cortical layer typically consists of 12 cells, e.g. in *N. hamiguitanensis* (Fig. 3 B). Small forms only develop a layer of 7 cells, like in *N. cameronensis* (Fig. 3 A), whereas the cortex can consist of up to 14 cells like in *N. solomonensis* (Fig. 3 C). There are likewise differences in the number of medullary cells. They reach from 7 (Fig. 3 A), to typically 30 – 40 (Fig. 3 B), up to 70 (Fig. 3 C), even reaching up to 90 in *N. richardsii*. As the number of cells coincide with the plant size, we do not treat them as a diagnostic character.

The only exception is *N. mamillosa* (Fig. 3 D). Whereas other *Neolepidozia* species develop a plain stem cortex, *N. mamillosa* has bulging cortical cells. The character might be helpful to distinguish sterile material.

Stem cells in dorsal view are usually square to shortly rectangular, as e.g. in *N. cuneifolia* var. *luxurians* (Fig. 4 A) but can also become elongated polygonal to almost linear in *N. morobensis* (Fig. 4 B). To use this character for distinguishing species was unfortunately not successful, as some plants develop short to elongated polygonal cells on the same stem.

Rhizoids:

If rhizoids are present, they are developed in the upper part on the dorsal side of the stem leaves (Fig. 6). They are smooth and do not show any inner structure. The originating cells are not altered when the rhizoids start to develop. Once they become numerous the cells become smaller, very likely because of secondary divisions. In these cases, they markedly differ from the normal underleaf disc cells. For quite a number of species we did not observe rhizoids. If they are lacking or not yet developed is hard to determine.

Fig. 6: Rhizoids: A – *N. papulosa*, B – *N. sarawakensis* var. *grandistipula*

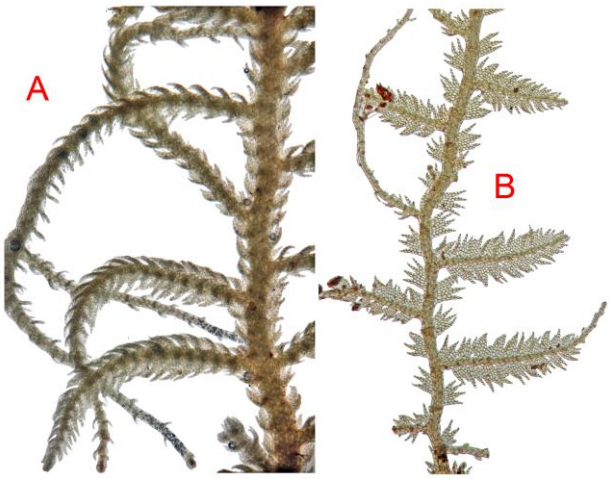

Fig. 5: Flagelliform branches: A – *N. hamiguitanensis*, B – *N. morobensis*

Branches:

Neolepidozia species develop two general types of branches, normally leaved branches and flagelliform branches. Normally leaved branches sometime turn into flagelliform ends (Fig. 5). They are up to 6 mm long whereas flagelliform branches can reach a length of up to 10 mm. Branches can be approximate or rather distant. They spread at an angle of 45° - 90° (Fig. 1, Fig. 2). Flagelliform branches usually do not appear in big quantity. They are sometimes nearly lacking.

Fig. 7: Ventral branch base: A – *N. hamiguitanensis*, B – *N. panayensis*

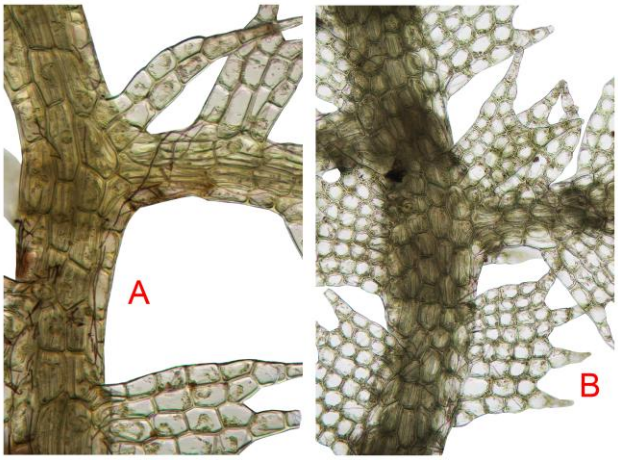

Fig. 8: Stem leaf at branch base: A – *N. dinagatensis*, B – *N. schaefer-verwimpii*

The first branch underleaf is developed at the ventral base of branch close to the stem (Fig. 7). It corresponds to the size of the normal underleaves but consists of only one lobe, even if the underleaves are 3 lobes wide.

Due to the *Frullania*-type of branching, there is only half of a stem leaf developed near the branch base. It is bilobate in most of the cases (Fig. 8 B) and corresponds with the characters of the normally developed stem leaves. In rare cases, like in *N. dinagatensis* (Fig. 8 A), the reduced stem leaf is lanceolate. Lanceolate half stem leaves are usually developed if the normal stem leaf consists of only 3 lobes.

Stem and branch leaves:

There is a high diversity of leaf characters in *Neolepidozia*. Stem leaves have a different shape and cell pattern compared to the respective branch leaves. It is not possible to infer to the branch leaf shape from the stem leaves. Even though stem leaves from different species look quite similar, branch leaves can markedly differ (Fig. 9). It was very likely one of the main reasons why different species have not been recognized in the past.

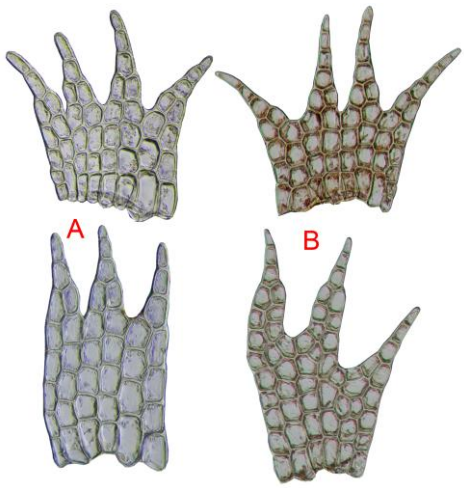

Fig. 9: Stem (top) and branch leaves (bottom): A – *N. papulosa*, B – *N. variifolia* var. *kairuruensis* (magnification differs for the figures)

Both, stem and branch leaves are highly diverse (Fig. 12). Most of the stem leaves have 4 lobes. Small plants only develop 3-lobate stem leaves, like *N. kasudsuranensis* (Fig. 12 H), *N. cameronensis* (Fig. 12 P), *N. philippinensis* (Fig. 12 Q), and *N. yorongii* ((Fig. 12 T). In particular the latter two species have very fragile leaves, where lobe characters cannot be observed. Less fragile stem leaves can be found with *N. arauluensis* (Fig. 12 A) and *N. schusteri* (Fig. 12 R). Large species, as *N. cuneifolia var. luxurians* (Fig. 12 W) can develop 5, in rare cases even 6 leaf lobes.

Lobes of the stem leaves are usually 2 cells, occasionally up to 4 cells wide at the base. Wider lobe bases often coincide with the tendency to secondary cell divisions, e.g. in *N. cuneifolia* var. *luxurians* (Fig. 12 C), *N. lungaensis* (Fig. 12 J), *N. mamillosa* (Fig. 12 K), *N. cuneifolia* var. *luxurians* (Fig. 12 W), or *N. solomonensis* (Fig. 12 Y). Due to the secondary divisions, the cell pattern becomes somehow irregular.

The division of the stem leaves can reach from 1/3, as in *N. panayensis* (Fig. 12 O) up to 4/5 in *N. katrinae* (Fig. 12 L). The latter one looks like a *Kurzia* species but the lack of a *Microlepidozia*-type of branching identifies it as a member of *Neolepidozia*. Species with very deeply divided branch leaves often develop rather long lobe cells.

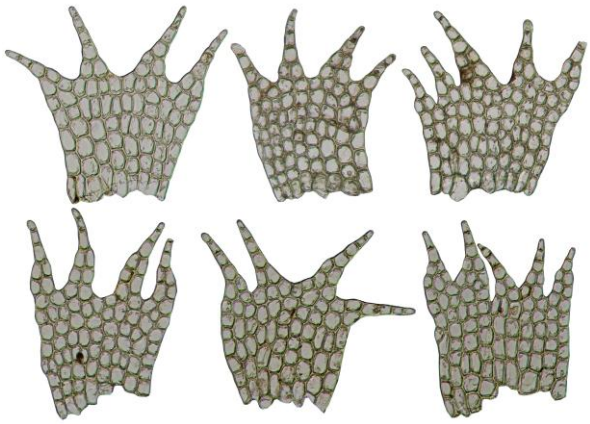

Fig. 10: Variation of stem leaves in *N. cuneifolia* var. *luxurians*

In some cases, one can also find asymmetric stem leaves, partially with falcate leaf lobes. These are often obliquely attached to the stem and the lobes bent down ventrally.

Stem leaves from the same plant can be very different, e.g. in *Neolepidozia cuneifolia* var. *luxurians* (Fig. 10). This makes it difficult to come to a correct judgment. As with any other character we tried to use only the stable characteristics in the key and cover most of the variation.

Branch leaves are likewise variable as the stem leaves (Fig. 13). Remarkable is a group of species with highly asymmetric branch leaves, e.g. *N. cuneifolia var. luxurians* (Fig. 13 C), *N. hamiguitanensis* (Fig. 13 H), *N. kasudsuranensis* (Fig. 13 J), *N. solomonensis* (Fig. 13 a), and *N. Neolepidozia cuneifolia* var. *luxurians* (Fig. 13 b). The base of the leaf lobes is rather broad in these cases and can reach up to 5 cells. Leaf lobes are usually 2 cells wide at the base for species with symmetric leaves. The symmetry of branch leaves can differ even at the same plant (Fig. 11). Branch leaves in the middle of a branch usually show the typical asymmetric shape, whereas branch leaves at the branch base become more symmetric. Branch leaves of species with symmetric leaves only show differences in size.

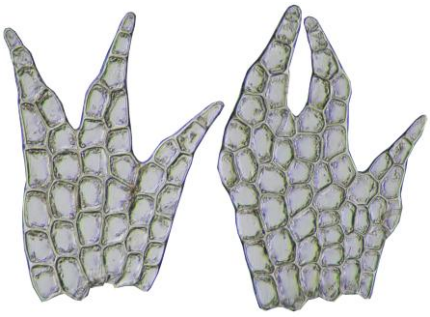

Fig. 11: Variation of stem leaf symmetry: *N. variifolia* (from SCHÄFER-VERWIMP 18816a)

Secondary cell divisions are sometimes even more developed than in stem leaves, e.g. *N. cuneifolia var. luxurians* (Fig. 13 C). Additional horizontal and vertical divisions lead to a rather irregular cell pattern.

Leaf cells in the basal row are often enlarged. Species with predominately isodiametric, median leaf disc cells can have elongated polygonal cells at the base. Earlier works did not always distinguish this fact and might lead to a different determination.

Fragility, lobe length and width, cell shape and size, discus hight, or margin areolation can vary as in stem leaves.

We found branch leaf symmetry particularly helpful to distinguish the major groups in *Neolepidozia*. As branch leaf characters are often neglected in older descriptions it is hardly possible to assign older species to the ones, we describe. A restudy of the respective specimen is necessary.

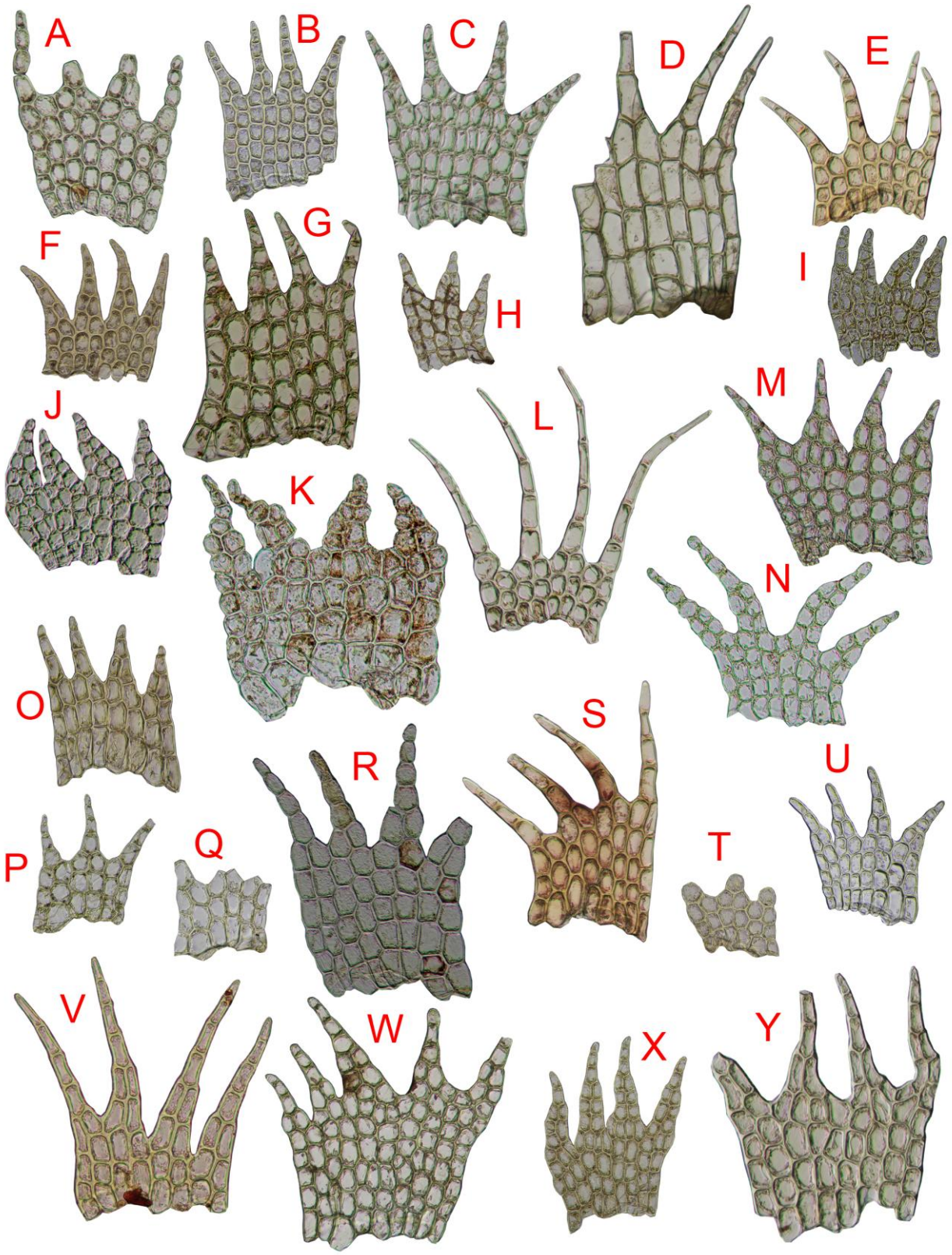

Fig. 12: Selected stem leaves: A – *N. arauluensis*, B – *N. beckeri*, C – *N. cuneifolia* var. *luxurians*, D – *N. dinagatensis,* E – *N. dulitensis*, F – *N. hamiguitanensis*, G – *N. kaindiensis*, H – *N. kasudsuranensis*, I – *N. massartiana*, J – *N. lungaensis*, K – *N. mamillosa*, L – *N. katrinae*, M – *N. schaefer-verwimpii*, N – *N. novoguineensis*, O – *N. panayensis*, P – *N. cameronensis*, Q – *N. philippinensis*, R – *N. schusteri*, S – *N. sarawakensis* var. *grandistipula*, T – *N. yorongii*, U – *N. papulosa*, V – *N. richardsii*, W – *N. cuneifolia* var. *luxurians*, X – *N. shevockii*, Y – *N. solomonensis* (same scale for all leaves)

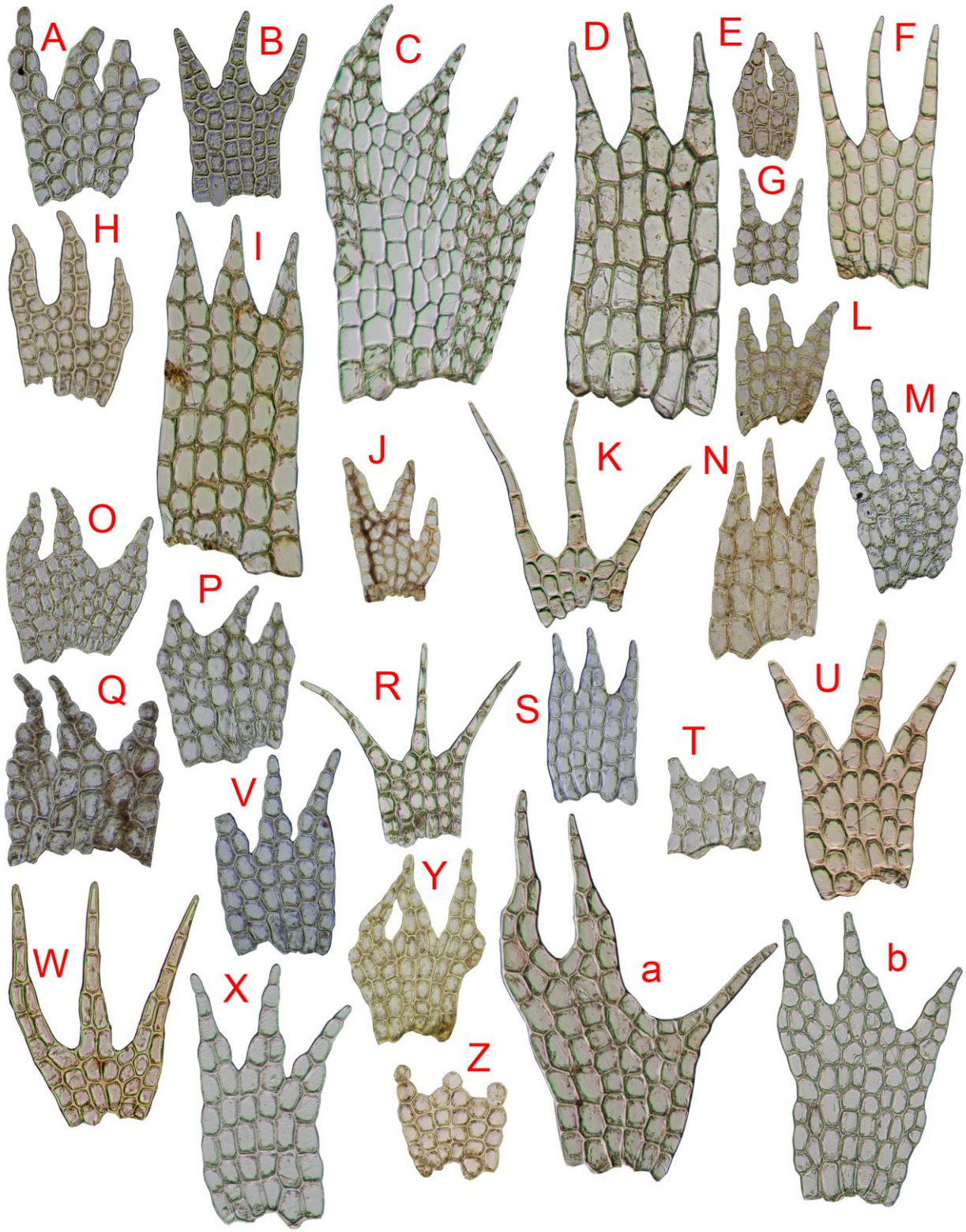

Fig. 13: Selected branch leaves: A – *N. arauluensis*, B – *N. beckeri*, C – *N. cuneifolia var. luxurians*, D – *N. dinagatensis,* E – *N. ingekarolae*, F – *N. dulitensis*, G – *N. cameronensis*, H – *N. hamiguitanensis*, I – *N. kaindiensis*, J – *N. kasudsuranensis*, K – *N. katrinae*, L – *N. massartiana*, M – *N. novoguineensis*, N – *N. panayensis*, O – *N. lungaensis*, P – *N. schaefer-verwimpii*, Q – *N. mamillosa*, R – *N. ophiria*, S – *N. papulosa*, T – *N. philippinensis*, U – *N. sarawakensis* var. *grandistipula*, V – *N. schusteri*, W – *N. richardsii*, X – *N. papulosa* var. *plumula*, Y – *N. shevockii*, Z – *N. yorongii*, a – *N. solomonensis*, b – *N. cuneifolia* var. *luxurians* (same scale for all leaves)

Papillosity of leaf cells:

Almost all species show some degree of leaf cell papillosity (Fig. 14). Papillae can be found on stem and branch leaves, male and female bracts, but rarely on underleaves. If present they are developed on the dorsal side of the branch and stem leaves. The ventral side is less papillose or papillae lacking completely. Papillae are often only weakly raised of the cuticle and best seen in oblique light.

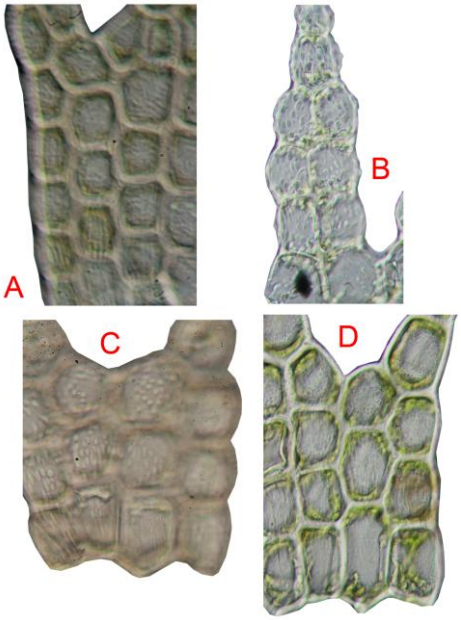

Fig. 14: Leaf cell papillosity: A – *N. beckeri*, B – *N. novoguineensis*, C – *N yorongii*, D – *N. ophiria*

In some cases, like in *N. novoguineensis* (Fig. 14 B) they are very prominent. The are sparsely spread and of a semi spherical shape on the branch leaf lobes. More often they are quite dense and round at the leaf lobes and become striate at the leaf disc cells (Fig. 14 A, C, D).

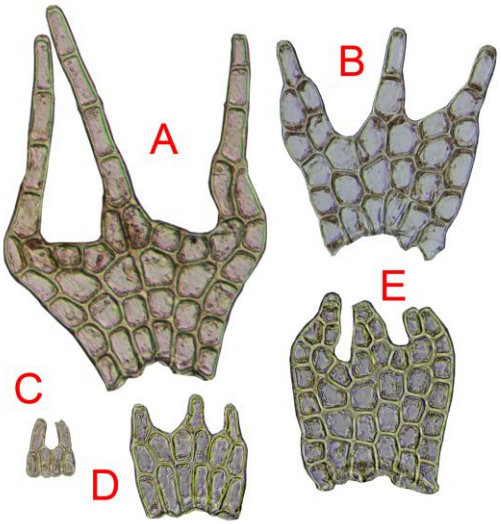

Fig. 15: Selected branch underleaves: A – *N. richardsii*, B – *N. variifolia* var. *kairuruensis*, C – *N panayensis*, D – *N. papulosa*, E – *N. beckeri* (same scale for all underleaves)

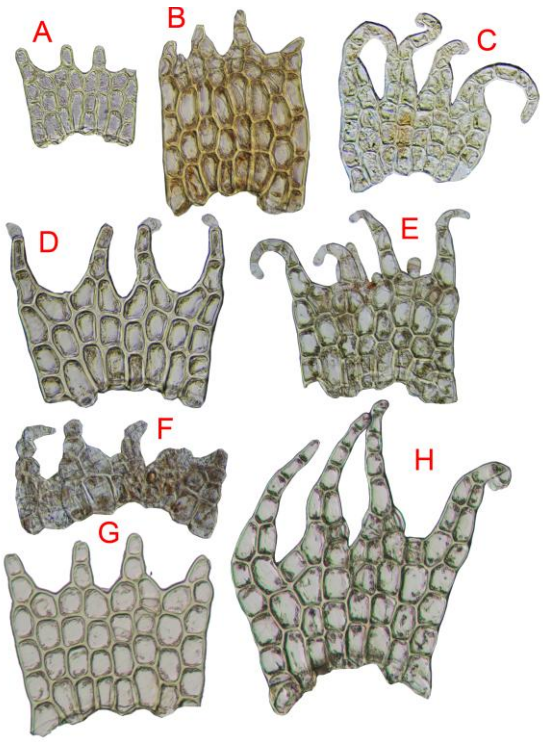

Fig. 16: Selected stem underleaves: A – *N. papulosa*, B – *N. sarawakensis* var. *grandistipula*, C – *N. winteri*, D – *N. solomonensis*, E – *N. schaefer-verwimpii*, F – *N. mamillosa*, G – *N. tenera*, H – *N. variifolia* var. *kairuruensis* (same scale for all underleaves)

The papillosity differs from leaf to leaf, even from the same branch or stem. A proper judgement is only possible if a larger number of leaves is observed.

Branch underleaves:

Branch underleaves are usually 2- or 3-lobate. Even though they can differ in shape and size there is less diversity (Fig. 15) compared the branch and stem leaves. They are rarely almost as big as the branch leaves as in *N. shaefer-verwimpii* (Fig. 15 A), develop a high discus as in *N. beckeri* (Fig. 15 E) or are very much reduced as in *N. panayensis* (Fig. 15 C). In these cases, they are of diagnostical importance. In most of the species they are as wide as the stem, 2- to 3-lobate and often with elongated basal cells. *N. papulosa* (Fig. 15 D) is a typical example for this. The overlapping of branch underleaves is sometimes important. They can overlap by up to 1/2 of their length as in *N. variifolia* var. *kairuruensis* (Fig. 15 B). In general, they are remotely or approximately attached. Stem underleaves look similar and are usually 4-lobate. Stem and branch underleaves usually develop a slime papilla at the end of their lobes but often decayed. A truncated end of an underleaf lobe is a good indication for the former existence a slime papilla.

The cuticle is smooth in most of the cases. The only species where we found papillae on the underleaves are *N. arauluensis, N. morobensis, N. palawanensis, N. richardsii*, and *N. solomonensis*.

Stem underleaves:

Stem underleaves are usually 4-lobate. Small forms only develop 3 lobes. Similarly to branch and stem leaves they often

differ in shape and size from the branch underleaves. Stem underleaves have a wide variation (Fig. 16) but they are only useful to distinguish species in a limited number of cases.

Sometimes they develop hooked lobes, like in *N. cuneifolia var. luxurians, N. lembangensis, N. schaefer-verwimpii* (Fig. 16 E)*, N. shevockii, N. schusteri, N. streimannii, N. variifolia* var. *kairuruensis,* and *N. winteri* (Fig. 16 C). But they differ along the stem, hooked and none-hooked lobes can be observed at the same stem. The height of the underleaf disc is sometimes helpful, e.g. to distinguish *N. papulosa* (Fig. 16 A) and *N. tenera* (Fig. 16 G). The largest stem underleaves can be observed in *N. variifolia* var. *kairuruensis* (Fig. 16 H) but the size varies from specimen to specimen.

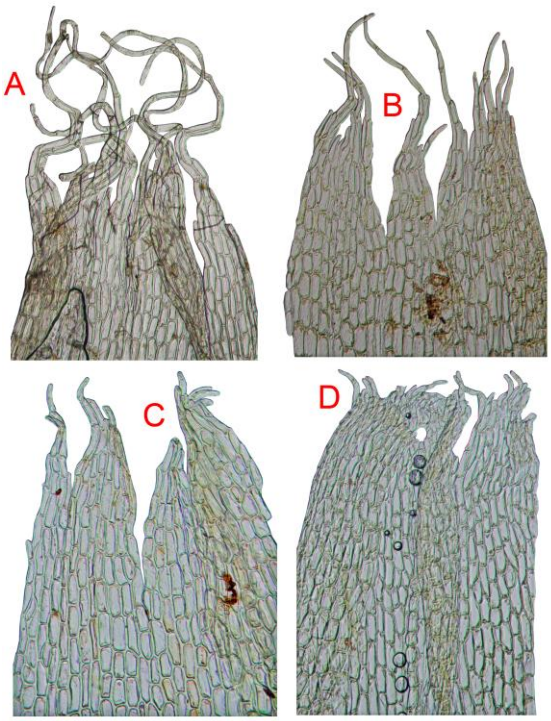

Fig. 17: Perianth mouth: A, B – *N. papulosa*, C – *N. schusteri*, D – *N. tangkulanensis*

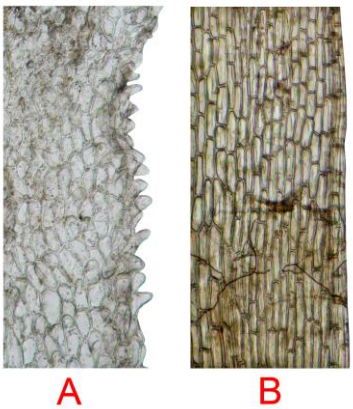

Fig. 18: Median perianth cells: A – *N. mamillosa*, B – *N. papulosa*

Perianth:

Female inflorescences and perianths are rarely developed. If developed it originates from the ventral side of the main stem.

The median cells of the perianth are rectangular to linear with a smooth surface (Fig. 18 B). The only exception is *N. mamillosa*. Median cells are elongated rhombic with mamillosely protruding ends (Fig. 18 A). *N. mamillosa* is the only known species so far with this type of perianth cells. Together with its habitats, namely soil in mangrove forests it is quite unique.

The perianth mouth can either be long ciliate with occasionally twisted mouth cells or crenulate to short ciliate. In the first case the cells are linear and rather thick walled, whereas in the latter case the cells are shorter with thinner cell walls (Fig. 17). The perianth mouth is particularly helpful to distinguish *N. papulosa* (Fig. 17 A, B) from *N. tangkulanensis* (Fig. 17 D), two species where the vegetative organs look quite similar.

Distinguishing characters:

Since most of the characters vary within the same plant one needs the combination of the following characters to reach a proper identification:

- Fragility of leaves
- Symmetry of branch leaves
- Tendency to produce secondary cell divisions
- Cell shape and size of the median cells of the branch leaf disc
- Distance between the branch underleaves
- Degree of leaf division
- Attachment of branch leaves
- Branch leaf disc width
- Perianth mouth

As far as the habitat information was available it could contribute to the identification as well. Most of the species grow on humus, rotten wood, bark or roots. Only *N. ingekarolae, N. lungaensis, N. mamillosa, N. massartiana, N. panayensis, N. papulosa, N. shevockii,* and *N. winteri* are known to grow on bare soil.

4. New Taxa and Combinations

- *Neolepidozia arauluensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia augustana* (STEPH.) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*
- *Neolepidozia beckeri* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia bickeri* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia cameronensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia cuneifolia* fo. *biloba* (HERZOG) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*
- *Neolepidozia cuneifolia* var. *luxurians* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*
- *Neolepidozia dinagatensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia dulitensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia hamiguitanensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia ingekarolae* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia kaindiensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia kasudsuranensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia katrinae* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia kolombangaraensis* U. Schwarz, Schäf.-Verw. & Shevock *spec. nov.*
- *Neolepidozia larutensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia lembangensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia limbawonensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia lungaensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia massartiana* (SCHIFFN. ex STEPH.) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*
- *Neolepidozia morobensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia novoguineensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia palawanensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia panayensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia papulosa* var. *apoensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*
- *Neolepidozia papulosa* var. *kalatunganensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*
- *Neolepidozia papulosa* var. *plumula* (HERZOG) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*
- *Neolepidozia papulosa* var. *sakuraii* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*
- *Neolepidozia papulosa* var. *uniseriata* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*
- *Neolepidozia parvula* (N. KITAG.) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*
- *Neolepidozia philippinensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia richardsii* (HERZOG) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*
- *Neolepidozia salasii* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia sarawakensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia sarawakensis* var. *grandistipula* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*
- *Neolepidozia sarawakensis* var. *rajaensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*
- *Neolepidozia schaefer-verwimpii* U. SCHWARZ & SHEVOCK *spec. nov.*
- *Neolepidozia schusteri* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia shevockii* U. SCHWARZ & SCHÄF.-VERW. *spec. nov.*
- *Neolepidozia solomonensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia streimannii* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia tangkulanensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia tenera* (STEPH.) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*
- *Neolepidozia variifolia* (STEPH. in GEHEEB) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*
- *Neolepidozia variifolia* var. *kairuruensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*
- *Neolepidozia winteri* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia yorongii* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*
- *Neolepidozia zantenii* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

5. Key to the Asian *Neolepidozia* species (exclusive species from New Caledonia)

Remarks:

To obtain the correct impression about a species it is required to study well developed material. Indicators for a good development are the size of the plants, the leaves and the development of sexual organs. As branches often becoming flagelliform at the end, leaves in the middle of the branch have to be studied.

Different species of *Neolepidozia* sometimes grow together. To prevent a misjudgement, only single plants have to be dissected and studied.

The figures used in the key should provide an impression of the respective characters. They are not drawn to the same scale. Please refer to the species descriptions and plates for scaled figures and measurements.

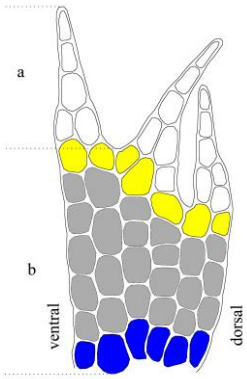

Fig. 19: Explanation of leaf characters (see text)

Within the key and the descriptions, we defined the leaf structure as shown in Fig. 19. The basal cells (marked in blue) in the bottom row of the leaf. The cells are quite often enlarged and markedly different to the other disc cells. The cells marked in grey and green are considered the median disc cells, the cells in yellow the basal lobe cells.

As the basal lobe cells are mostly divided by half we count the disc height as the sum of the basal cells the disc height and half of the basal lobe cell. In Fig. 19 the disc height would be 5.5 – 6.5 cells on the ventral division and 4.5 – 5.5 cells on the dorsal division.

The leaf lobe length is similarly calculated, i.e. the length of the leaf lobes plus half of the basal lobe cells, for Fig. 19 leading to a lobe length of 4.5 – 5.5 cells.

The leaf division is the ratio between the length of a lobe and the total length (a+b). In asymmetric leaves we mention the side of the leaf from where the ratio was calculate.

Leaf length and width is taken from a circumscription of the leaf. For leaves with spreading leaf lobes, we take the distance between the outermost lobe tips.

For a better overview there are several comparisons plates included. They depict species with similar characters.

- Species with fragile branch leaves: Plate 1 A – E, page 131
- Species with *Kurzia* habitus: Plate 2 A – C, page 132
- Species with asymmetric branch leaves: Plate 3, page 133
- Species with symmetric branch leaves but unequal leaf lobes: Plate 2 J – P, page 132
- Species with predominantly 2-lobate branch leaves: Plate 4 A - C, page 134
- Species with uniseriate branch leaf lobes: Plate 2 D – I, page 132
- Species with symmetric branch leaves that are divided for more of ½ of their leaf length: Plate 4 D – H, page 134
- Species with shallowly divided branch leaves that are more than 0.4 mm long: Plate 4 I – O, page 134
- Species with shallowly divided branch leaves that are less than 0.4 mm long: Plate 5 A – M, page 135

1 Branch leaves ventrically long decurrent, leaf insertion oblique, branch leaves spreading at an angle up to 45°, leaf lobes short and blunt (Fig. 20), plants resembling species of *Lepidozia* sect. *Microphyllae* (Malaysia – Borneo) ..... ***Lepidozia longitudinalis*** (page 61, plates page 259)

1* Branch leaves ventrically not or shortly decurrent, leaf longitudinally inserted, branch leaves spreading at an angle of more than 45°, if less than 45° than leaf lobes long and unseriate **2**

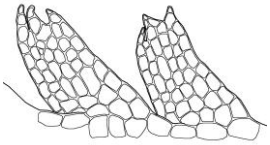

Fig. 20: *Lepidozia longitudinalis*, branch (from RICHARDS 2047)

2 (2* see page 14) Leaf lobes very fragile, leaf lobe tips missing in most of the leaves (also consult the comparison sheet – Plate 1 A – E, page 131) **3**

3 Stem leaf cells rectangular to elongated hexagonal (Fig. 21), smooth; half stem leaf near branching unilobate (Philippines – Mindanao) ..... ***Neolepidozia philippinensis*** (page 88, plates page 369)

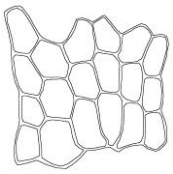

Fig. 21: *Neolepidozia philippinensis*, stem leaf (from YORONG 931b)

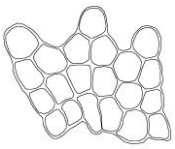

Fig. 22: *Neolepidozia yorongii,* stem leaf (from YORONG 931a)

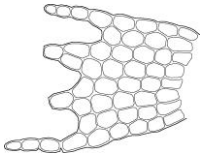

Fig. 23: *Neolepidozia arauluensis,* stem leaf (from STREIMANN 13611)

3* Stem leaf cells round, isodiametric to ovate or short rectangular; half stem leaf near branching bilobate ... **4**

4 Leaves very fragile, almost all leaf lobes missing, stem leaf disc up to 2.5 cells, up to 90 µm high (Fig. 22), median disc cells up to 30 µm long, cells distinctly papillose (Philippines – Mindanao) ..... ***Neolepidozia yorongii*** (page 117, plates page 483)

4* Leaves moderately fragile, half of the leaf lobes still intact, stem leaf disc 3.5 – 4.5 cells, 150 – 200 µm high (Fig. 23), median disc cells 30 – 40 µm long **5**

5 Branch underleaves large (Fig. 24), imbricate, leaf cells almost smooth, disc of stem and branch leaves trapezoid (Papua New Guinea – New Guinea) ..... ***Neolepidozia arauluensis*** (page 32, plates page 136)

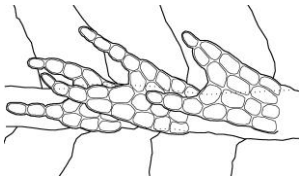

Fig. 24: *Neolepidozia arauluensis,* branch ventral (from STREIMANN 13611)

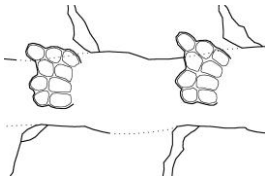

Fig. 25: *Neolepidozia schusteri,* branch ventral (from SCHUSTER 13611)

5* Branch underleaves small (Fig. 25), distant to approximate, but not overlapping each other, leaf cells papillose, disc of stem and branch leaves ± square, ovate to rectangular **6**

6 Branch leaves to almost $^1/_2$ divided, branch leaf disc trapezoid, base of branch leaf lobes often with blunt tooth (Fig. 26), (Papua New Guinea – New Guinea) ..... ***Neolepidozia streimannii*** (page 105, plates page 443)

6* Branch leaves $^1/_3$ to $^1/_2$ divided, branch leaf disc rectangular, base of branch leaf lobes without blunt tooth (Fig. 27) (Papua New Guinea – New Guinea) ..... ***Neolepidozia schusteri*** (page 99, plates page 423)

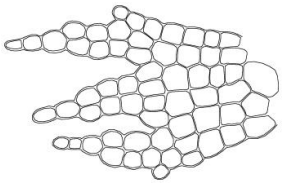

Fig. 26: *Neolepidozia streimannii*, branch leaf (from STREIMANN 13547)

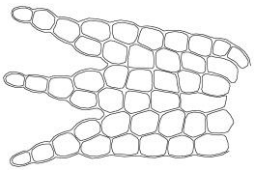

Fig. 27: *Neolepidozia schusteri,* branch leaf (from SCHUSTER 67-6268)

2* (2 see page 13) Leaf lobes not fragile, leaf lobe tips not missing but occasionally broken in a few leaves **7**

7 Plants with *Kurzia*-like habitus (Fig. 28), leaf lobes pointed towards the end of the branch or stem, cells of branch leaf lobes elongated, often more than 3 times as long as wide (also consult the comparison sheet – Plate 2 A – C, page 132) **8**

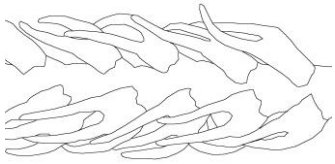

Fig. 28: *Neolepidozia katrinae*, branch (from PANG H 2654)

8 Branch underleaves almost as large as the branch leaves, lobes of branch underleaves up to 6 cells long (Fig. 30), branch leaf lobes biseriate above the basal lobe cells (Fig. 29) (Malaysia – Borneo, Philippines – Mindanao) ..... ***Neolepidozia richardsii*** (page 90, plates page 374)

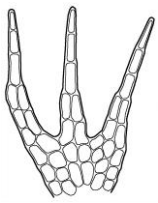

Fig. 29: *Neolepidozia richardsii*, branch leaf (from SHEVOCK 54810)

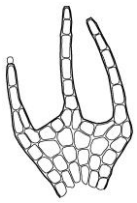

Fig. 30: *Neolepidozia richardsii*, branch underleaf (from SHEVOCK 54810)

8* Branch underleaves much smaller than the branch leaves, lobes of branch underleaves up to 3 cells long (Fig. 32, Fig. 34) **9**

9 Branch leaf lobes biseriate above the basal cells, median disc cells of branch and stem leaves elongated, cells of branch leaf lobes up to 3 times as long as wide (Fig. 31) (Thailand) ..... ***Neolepidozia parvula*** (page 87, plates page 363)

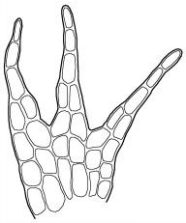

Fig. 31: *Neolepidozia parvula*, branch leaf (from TOUW 11808/A)

Fig. 32: *Neolepidozia parvula*, branch underleaf (from TOUW 11808/A)

9* Branch leaf lobes uniseriate above the basal cells (Fig. 33), median disc cells of branch and stem leaves rather isodiametric, cells of branch leaf lobes mostly more than 3 times as long as wide (Malaysia – Malay Peninsula) ..... ***Neolepidozia katrinae*** (page 54, plates page 228)

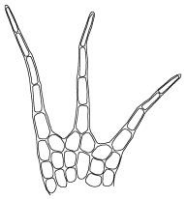

Fig. 33: *Neolepidozia katrinae*, branch leaf (from PANG H 2654)

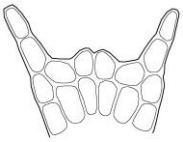

Fig. 34: *Neolepidozia katrinae*, branch underleaf (from PANG H 2654)

7 Plants not with *Kurzia*-like habitus, leaf lobes spreading away from the stem or branch at an angle of 45° or more, cells of branch leaf lobes sometimes elongated **10**

10 (10* see page 20) Branch leaves asymmetric, branch leaf lobes often pointing sidewards, usually of different size, basal row of branch leaf lobes frequently more than 2 cells wide[2] (also consult the comparison sheet – Plate 3, page 133) **11**

11 Stem leaves 3 – lobate (Fig. 35, Fig. 36) **12**

[2] Even in species with clearly asymmetric branch leaves, the branch leaves can be quite symmetric towards the base of the branch or if the plants are weakly developed. It is required to look for well developed branches and branch leaves to come to the correct conclusion.

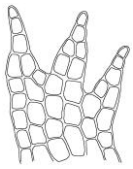

Fig. 35: *Neolepidozia kasudsuranensis,* stem leaf (from SCHWARZ 16978)

Fig. 36: *Neolepidozia cuneifolia* fo. *biloba,* stem leaf (from BAKER 7020)

12 Cell wall of stem and branch leaves thickened, stem leaves weakly asymmetric, disk up to 3.5 cells high, branch leaves 3 – lobate, disc up to 4.5 cells high (Fig. 37) (Philippines – Leyte) ..... ***Neolepidozia kasudsuranensis*** (page 52, plates page 223)

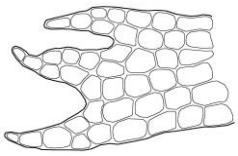

Fig. 37: *Neolepidozia kasudsuranensis,* branch leaf (from SCHWARZ 16978)

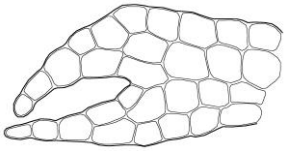

Fig. 38: *Neolepidozia cuneifolia* fo. *biloba,* branch leaf (from BAKER 7020)

12* Cell wall of stem and branch leaves thin, stem leaves rather symmetric, disk up to 2.5 cells high, branch leaves 2 – lobate, disc up to 3.5 cells high (Fig. 38) (Philippines – Luzon) ..... ***Neolepidozia cuneifolia* fo. *biloba*** (page 42, plates page 173)

11* Stem leaves 4 – lobate, exceptionally 3 – or 6 – lobate **13**

13 (13* see page 18) Well developed branch underleaves small, consisting of up to 12 cells, distantly arranged, distance between the underleaves usually larger than the underleaf length (Fig. 39, Fig. 40) **14**

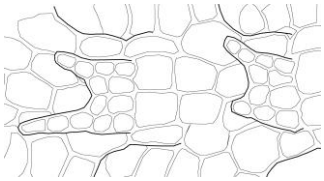

Fig. 39: *Neolepidozia cuneifolia*, branch ventral (from LORIA)

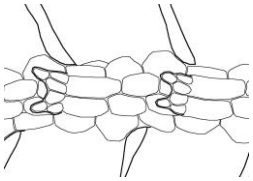

Fig. 40: *Neolepidozia zantenii*, branch ventral (from VAN ZANTEN 105)

14 Branch leaves weakly asymmetric (Fig. 41, Fig. 43), longest branch leaf lobes mostly up to 3.5 cells long (if longer than cells of the branch leaf disc up to 70µm long), branch underleaves small, mostly consisting of less than 10 cells (Fig. 42, Fig. 44) **15**

15 Branch leaves large, up to 450 µm long, branch leaf disc rectangular, branch underleaves small, mostly consisting of 6 cells (Fig. 42), leaf cells thin, median disc cells of the branch leaves up to 60 µm long (Indonesia – New Guinea) ..... ***Neolepidozia zantenii*** (page 118, plates page 488)

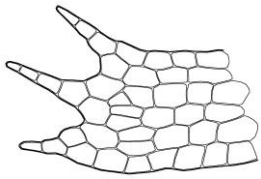

Fig. 41: *Neolepidozia zantenii*, branch leaf (from VAN ZANTEN 105)

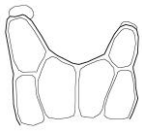

Fig. 42: *Neolepidozia zantenii*, branch underleaf (from VAN ZANTEN 105)

15* Branch leaves smaller, less than 300 µm long, branch leaf disc square, branch underleaves larger, mostly consisting of up to 10 cells (Fig. 44)[3], leaf cells thickened, median disc cells of the branch leaves up to 40 µm long (Japan – Okinawa Island; Taiwan;Thailand) ..... ***Neolepidozia schaefer-verwimpii*** (page 97, plates page 412)

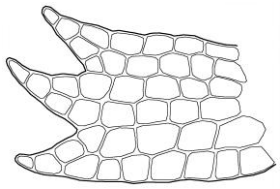

Fig. 43: *Neolepidozia schaefer-verwimpii*, branch leaf (from TOUW 10868)

Fig. 44: *Neolepidozia schaefer-verwimpii*, branch underleaf (from TOUW 10868)

14* Branch leaves stronger asymmetric (Fig. 45, Fig. 46, Fig. 47), longest branch leaf lobes usually more than 3.5 cells long, branch underleaves larger, well developed underleaves consisting of 10 or more cells (Fig. 53) **16**

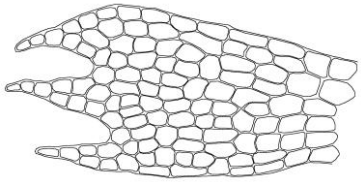

Fig. 45: *Neolepidozia cuneifolia var. luxurians,* branch leaf (from KOPONEN 35359)

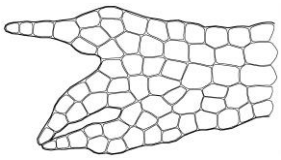

Fig. 46: *Neolepidozia cuneifolia* fo. *biloba,* branch leaf (from BAKER 7020a)

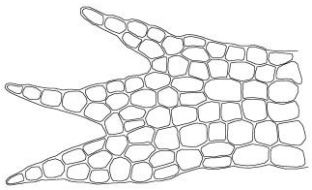

Fig. 47: *Neolepidozia cuneifolia*, branch leaf (from LORIA, Isotype)

16 Stem leaves 3-lobate (Fig. 49), base of stem leaf lobe 2 cells wide, disc without secondary cell divisions (Philippines - Luzon) ..... ***Neolepidozia cuneifolia* fo. *biloba*** (page 42, plates page 173)

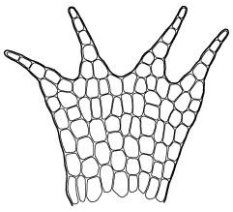

Fig. 48: *Neolepidozia cuneifolia* var. *luxurians,* stem leaf (from WINKLER 3094)

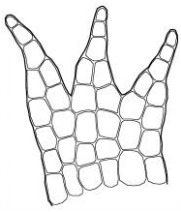

Fig. 49: *Neolepidozia cuneifolia* fo. *biloba,* stem leaf (from BAKER 7020a)

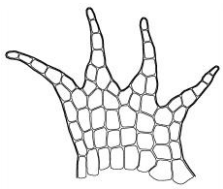

Fig. 50: *Neolepidozia cuneifolia,* stem leaf (from LORIA, Isotype)

16* Stem leaves usually 4-lobate, sometimes with up to 6 lobes, base of stem leaf often more than 2 cells wide, disc often with secondary cell divisions (Fig. 45, Fig. 47) **17**

17 Cell pattern of the branch leaf disc rather irregular, median disc of 3 – lobate leaves 10 – 12 cells wide, branch leaves partially divided to only ¼ of the leaf length at the ventral lobe (Fig. 45) (Indonesia – Borneo; Malaysia – Borneo; Papua New Guinea – New Guinea) ..... ***Neolepidozia cuneifolia* var. *luxurians*** (page 43, plates page 179)

17* Cell pattern of the branch leaf more regular, median disc of 3 – lobate leaves 6 – 8 cells wide, branch leaves usually divided by more than ¼ of the leaf length at the ventral lobe (Fig. 47) (Papua New Guinea – New Britain; New Guinea; Philippines – Leyte) ..... ***Neolepidozia cuneifolia*** (page 40, plates page 167)

[3] The branch underleaves of typical *N. schaefer-verwimpii* from Taiwan are usually larger and consist of more than 10 cells. Besides the weakly asymmetric leaves, there are also leaves that are symmetric.

13* (13 see page 16) Well developed branch underleaves larger, consisting of more than 12 cells, approximately arranged or overlapping, distance between the underleaves shorter than the underleaf length (Fig. 51, Fig. 52, Fig. 53) **18**

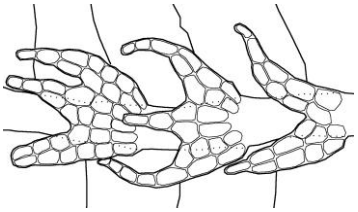

Fig. 51: *Neolepidozia variifolia* var. *kairuruensis*, branch ventral (from BORRELL 30)

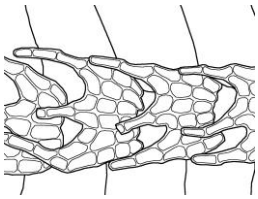

Fig. 52: *Neolepidozia solomonensis,* branch ventral (from BRAITHWAITE 4567)

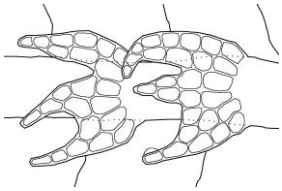

Fig. 53: *Neolepidozia variifolia*, branch ventral (from SCHÄFER-VERWIMP 18649)

18 Branch leaf lobes narrow, partially subulate, disc or lobe cells elongated (Fig. 54, Fig. 55, Fig. 56), often longer than 40 µm, branch underleaf disc usually 2.5 cells high **19**

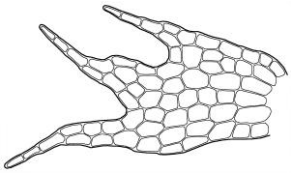

Fig. 54: *Neolepidozia solomonensis,* branch leaf (from BRAITHWAITE 4567)

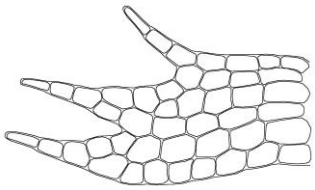

Fig. 55: *Neolepidozia augustana,* branch leaf (from SCHULTZE G00113399)

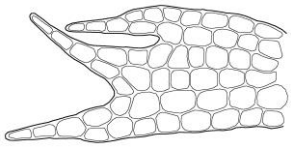

Fig. 56: *Neolepidozia palawanensis*, branch leaf (from OLSEN 2165b)

Fig. 57: *Neolepidozia solomonensis,* branch underleaf (from BRAITHWAITE 4567)

Fig. 58: *Neolepidozia augustana,* branch underleaf (from SCHULTZE G00113399)

Fig. 59: *Neolepidozia palawanensis*, branch underleaf (from OLSEN 2165b)

19 Branch underleaves markedly overlapping (Fig. 52), branch leaf lobes slightly flexuous, longitudinal cell walls of branch leaf and underleaf lobes slightly narrowed in the middle (Fig. 54) therefore cells slightly bone shaped, lobe cells of branch underleaves markedly elongated (Fig. 57) (Solomon Islands – Santa Isabel Island) ..... ***Neolepidozia solomonensis*** (page 103, plates page 437)

19* Branch underleaves approximate, hardly reaching each other or only weakly overlapping, longitudinal cell walls of branch leaf and underleaf lobes straight (Fig. 55, Fig. 56), lobe cells of branch underleaves isodiametric to shortly elongated (Fig. 58, Fig. 59) **20**

20 Cell walls of stem and branch leaves thin, trigones lacking, median branch leaf disc cells elongated, polygonal (Fig. 55), more than 40 µm long (Papua New Guinea – New Guinea)
..... ***Neolepidozia augustana*** (page 33, plates page 142)

20* Cell walls of stem and branch leaves thickened, trigones enlarged, median branch leaf disc cells ± isodiametric, round to ovate (Fig. 56), up to 40 µm long (Philippines – Palawan)
..... ***Neolepidozia palawanensis*** (page 73, plates page 308)

18* Branch leaf lobes broader, triangular to lingulate (Fig. 60, Fig. 61, Fig. 62, Fig. 63, Fig. 64), disc and lobe cells usually isodiametric, hardly longer than 40 µm, branch underleaf disc either 1.5 cells high or underleaves elongated rectangular and only divided up to $^{1}/_{3}$ of their lenght **21**

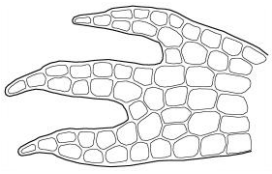

Fig. 60: *Neolepidozia hamiguitanensis*, branch leaf (from SHEVOCK 46951)

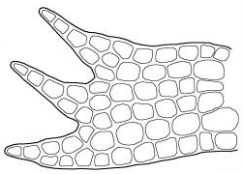

Fig. 61: *Neolepidozia beckeri*, branch leaf (from NULL 610)

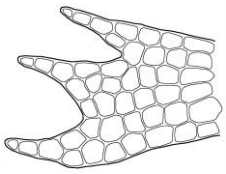

Fig. 62: *Neolepidozia kolombangaraensis*, branch leaf (from NORRIS & ROBERTS 49712)

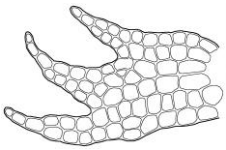

Fig. 63: *Neolepidozia variifolia*, branch leaf (from TEYSMANN 11137 – holotype)

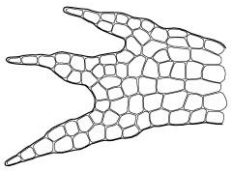

Fig. 64: *Neolepidozia variifolia* var. *kairuruensis*, branch leaf (from BORRELL 30)

21 Branch leaves more than 300 µm long, branch underleaves up to 3 times as wide as the stem, partially overlapping bottom of the underleaf above (Fig. 51), cells of all leaves rather thin, tips of the branch leaves often bent down ventrally, base of stem leaf lobes often more than 2 cells wide (Papua New Guinea – Kairuru Island, New Guinea) ..... ***Neolepidozia variifolia* var. *kairuruensis*** (page 112, plates page 466)

21* Branch leaves up to 300 µm long, branch underleaves up to 1.5 times as wide as the stem (Fig. 53), cells of all leaves rather thick-walled, tips of the branch leaves flat, stem leaves symmetric or asymmetric, base of stem leaf lobes mostly 2 cells wide **22**

22 Branch underleaves elongated rectangular, divided up to $^1/_3$ of the underleaf length (Fig. 65), branch leaves often only weakly asymmetric (Malaysia – Malay Peninsula) ..... ***Neolepidozia beckeri*** (page 35, plates page 150) [4]

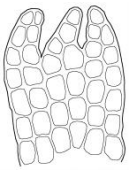

Fig. 65: *Neolepidozia beckeri*, branch underleaf (from NULL 610)

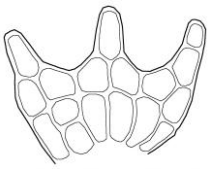

Fig. 66: *Neolepidozia kolombangaraensis*, branch underleaf (from NORRIS & ROBERTS 49712)

Fig. 67: *Neolepidozia variifolia*, branch underleaf (from TEYSMANN 11137 – holotype)

Fig. 68: *Neolepidozia hamiguitanensis*, branch underleaf (from SHEVOCK 46951)

22* Branch underleaves square to trapezoid, divided up to ½ of the underleaf length (Fig. 66, Fig. 67, Fig. 68), all branch leaves markedly asymmetric **23**

[4] The *Neolepidozia* species reported from India as *N. wallichiana* by MAJUMDAR & SINGH (2015) shows asymmetric branch leaves and stem leaves with the lobe base more than 2 cells wide. These characters will point towards a species related to *N. beckeri*. It will not fall in the range of *N. wallichiana* as to our understanding. The large stem underleaves, very distant branch leaves and the numerous cortical cells of the stem indicate that it is very likely a new, hitherto undescribed species.

23 Ventral and dorsal branch leaf division reaching up to $^1/_2$ of the leaf length (Fig. 60), branches gradually turning into flagellae (Philippines – Mindanao) ..... ***Neolepidozia hamiguitanensis*** (page 48, plates page 203)

23* Dorsal lobe of the branch leaves divided to $^1/_3$ of the leaf length (Fig. 62, Fig. 63), only on the ventral side deeper divided, branches not turning into flagellae **24**

24 Branch leaves rectangular to elongated trapezoid, discus up to 5.5 cells high, branch leaf lobes rather long, lingulate, up to 6.5 cells long (Fig. 63) (Indonesia – Belitung Island; Malaysia – Malay Peninsula; Philippines – Dinagat Island, Leyte, Mindanao) ..... ***Neolepidozia variifolia***[5] (page 109, plates page 460)

24* Branch leaves trapezoid to ovate, discus up to 4.5 cells high, branch leaf lobes short triangular, up to 4.5 cells long (Fig. 62) (Indonesia – New Guinea; Solomon Islands – Kolombangara Island) ..... ***Neolepidozia kolombangaraensis*** (page 55, plates page 233)

10* (10 see page 15) Most of the branch leaves symmetric, branch leaf lobes upright or divergent, usually of equal size and shape, if branch leaf lobes are rather unequal than lobe tips hardly point sidewards (for species with rather symmetric branch leaves but unequal leaf lobes consult the comparison sheet – Plate 2 J – P, page 132) **25**

25 Plants growing on soil in mangrove forests, perianth cells mamillose (Fig. 69), cortical stem cells bulging outwards (Fig. 70), lobe cells strongly constricted at the transverse walls (Fig. 71) (Indonesia – Borneo; Japan – Iriomote Island; Malaysia – Borneo; Papua New Guinea – New Guinea; Singapore) ..... ***Neolepidozia mamillosa*** (page 64, plates page 270)

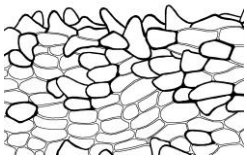

Fig. 69: *Neolepidozia mamillosa*, perianth cells (from CARR 11532)

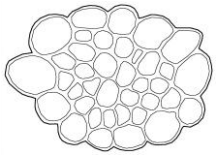

Fig. 70: *Neolepidozia mamillosa*, stem cross section (from CARR 11532)

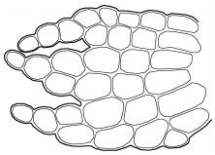

Fig. 71: *Neolepidozia mamillosa*, branch leaf (from CARR 11532)

25* Plants growing in different habitats, usually not in lowland areas, perianth cells smooth, cortical stem cells not bulging outwards, lobe cells moderately or not constricted at the transverse walls **26**

26 Branch leaves 2-lobate or predominantly 2-lobate with some 3-lobate intermixed (also consult the comparison sheet – Plate 4 A - C, page 134) **27**

27 Branch leaves weakly asymmetric, branch leaf lobes mostly more than 2 cells wide at the base (Fig. 72) (Philippines – Luzon) ..... ***Neolepidozia cuneifolia* fo. *biloba*** (page 42, plates page 173)

27* Branch leaves symmetric, branch leaf lobes usually 2 cells wide at the base (Fig. 73, Fig. 74, Fig. 75) **28**

[5] *Lepidozia expansa* seems to be closely related to *N. variifolia*. As we were not able to study the type material this has to be verified in future studies.

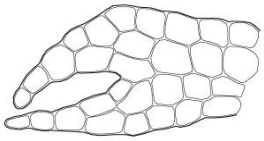

Fig. 72: *Neolepidozia cuneifolia* fo. *biloba,* branch leaf (from BAKER 7020/A)

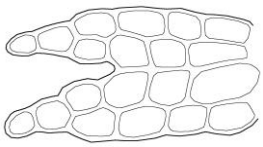

Fig. 73: *Neolepidozia ingekarolae,* branch leaf (from SCHÄFER-VERWIMP 18558)

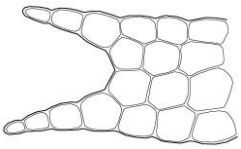

Fig. 74: *Neolepidozia cameronensis,* branch leaf (from SCHÄFER-VERWIMP 18705b)

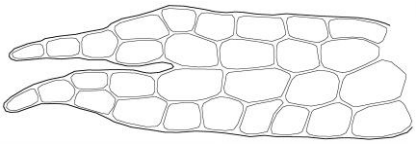

Fig. 75: *Neolepidozia sarawakensis* var. *grandidstipula,* branch leaf (from SCHÄFER-VERWIMP 39332)

28 Stem underleaves large, disc up to 3.5 cells high (Fig. 76), median branch leaf cells elongated (Fig. 75) (Malaysia – Borneo; Philippines – Panay, Taiwan) ..... ***Neolepidozia sarawakensis* var. *grandistipula*** (page 94 plates page 399)

28* Stem underleaves small to medium sized, disc 1.5 cells high (Fig. 77, Fig. 78), median branch leaf cells isodiametric (Fig. 73, Fig. 74) **29**

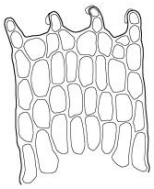

Fig. 76: *Neolepidozia sarawakensis* var. *grandidstipula,* stem underleaf (from RICHARDS 1974b)

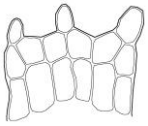

Fig. 77: *Neolepidozia cameronensis,* stem underleaf (from SCHÄFER-VERWIMP 18705b)

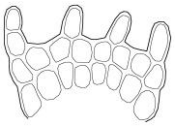

Fig. 78: *Neolepidozia ingekarolae,* stem underleaf (from SCHÄFER-VERWIMP 18558)

29 Branch leaf cells thick walled, disc cells less than 40 µm long, sinus between the branch leaf lobes narrow (Fig. 73), cells of branch underleaves predominantly short (Fig. 81), cells of female bracts coarsely papillose (Malaysia – Malay Peninsula) ..... ***Neolepidozia ingekarolae*** (page 50, plates page 210)

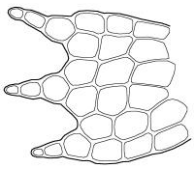

Fig. 79: *Neolepidozia cameronensis,* branch leaf (from TOUW 11808/B)

Fig. 80: *Neolepidozia cameronensis,* branch underleaf (from SCHÄFER-VERWIMP 18705b)

Fig. 81: *Neolepidozia ingekarolae,* branch underleaf (from SCHÄFER-VERWIMP 18558)

29* Branch leaf cells thin to moderately thick walled, disc cells larger than 40 µm long, sinus between the branch leaf lobes wide (Fig. 74, Fig. 79), cells of branch underleaves elongated (Fig. 80), (Malaysia – Malay Peninsula; Thailand) ..... ***Neolepidozia cameronensis*** (page 38, plates page 162)[6]

26* Branch leaves 3-lobate, sometimes becoming 2-lobate towards the very end of the branch **29**

[6] *Lepidozia planifolia* STEPH., Species Hepaticarum 3: 618. 1909, is another *Neolepidozia* species with bilobate branch leaves from Japan. Based on description and drawings by STEPHANI we are convinced that it is not identical with the species mentioned above. As the type material was not available for loan the status remains to be verified. It is also possible that *L. planifolia* is a bilobate form of *N. schaefer-verwimpii*.

30 (30* see page 23) Branch leaf lobes uniseriate, rarely one biseriate cell row above the basal lobe cells (Fig. 82, Fig. 83, Fig. 84, Fig. 85, Fig. 86, Fig. 87, also consult the comparison sheet – Plate 2 D – I, page 132) **31**

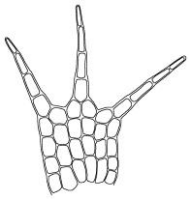

Fig. 82: *Neolepidozia ophiria*, branch leaf (from YORONG 651)

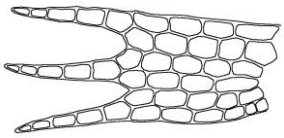

Fig. 83: *Neolepidozia dulitensis*, branch leaf (from RICHARDS 1974a)

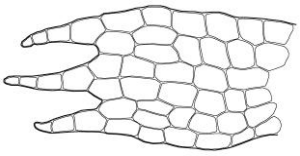

Fig. 84: *Neolepidozia wallichiana*, branch leaf (from GLM-B-0006484)

31 Branch leaves obliquely inserted, lateral leaf lobes divergent (Fig. 82) (Malaysia – Borneo, Malay Peninsula; Philippines – Mindanao, Negros) ..... ***Neolepidozia ophiria*** (page 71, plates page 301)

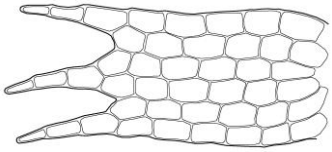

Fig. 85: *Neolepidozia dinagatensis*, branch leaf (from SHEVOCK 63846A)

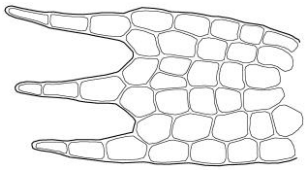

Fig. 86: *Neolepidozia papulosa* var. *uniseriata*, branch leaf (from SHEVOCK 62130)

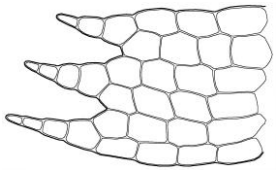

Fig. 87: *Neolepidozia papulosa* var. *kalatunganensis*, branch leaf (from SHEVOCK 61990)

31* Branch leaves longitudinally to weak obliquely inserted, lateral leaf lobes upright to weakly divergent (Fig. 83, Fig. 84, Fig. 85, Fig. 86, Fig. 87) **32**

32 Branches strongly flattened, branch leaves distant, branch leaf discs do not touch each other (Fig. 88) **33**

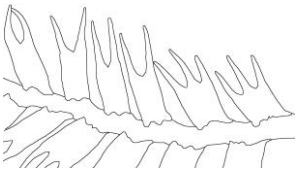

Fig. 88: *Neolepidozia dulitensis*, branch (from RICHARDS 1974a)

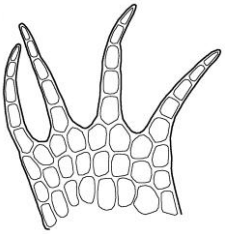

Fig. 89: *Neolepidozia dulitensis*, stem leaf (from RICHARDS 1974a)

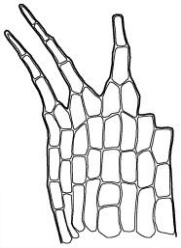

Fig. 90: *Neolepidozia dinagatensis*, stem leaf (from SHEVOCK 63846A)

33 Cells of stem leaf disc isodiametric (Fig. 89), square to hexagonal, rather thick walled, branch leaves up to 0.4 mm long (Malaysia - Borneo) ..... ***Neolepidozia dulitensis*** (page 47, plates page 197)[7]

33* Cells of stem leaf disc elongated (Fig. 90), rather thin walled, branch leaves more than 0.4 mm long (Philippines – Dinagat Island) ..... ***Neolepidozia dinagatensis*** (page 45, plates page 191)

32* Branches weakly flattened, branch leaves ± obliquely inserted, approximate, branch leaf discs touch or overlap each other **34**

[7] *Tricholepidozia fissifolia* (STEPH.) E.D. COOPER is a similar species from New Caledonia. It has however a lower branch leaf disc and bilobate branch leaves. If *N. dulitensis* and *N. dinagatensis* belong to the genus *Tricholepidozia* has still to be evaluated.

34 Cells of stem leaf disc elongated (Fig. 91), branch leaf lobes slightly bent down ventrally, branch leaf disc occasionally with secondary cell divisions (Fig. 84) (Nepal) ..... ***Neolepidozia wallichiana*** (page 114, plates page 473)

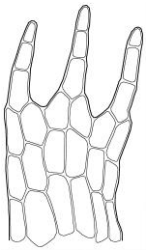

Fig. 91: *Neolepidozia wallichiana*, stem leaf (from GLM-B-0006484)

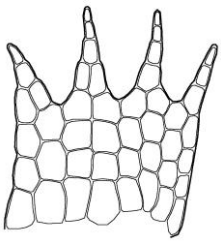

Fig. 92: *Neolepidozia papulosa* var. *kalatunganensis*, stem leaf (from SHEVOCK 61990)

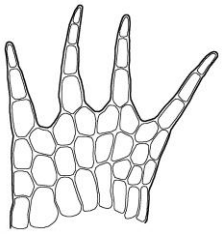

Fig. 93: *Neolepidozia papulosa* var. *uniseriata*, stem leaf (from SHEVOCK 62130)

34* Cells of stem leaf disc ± isodiametric to weakly elongated (Fig. 92, Fig. 93), less than 50 µm long, branch leaf lobes flat, branch leaf disc very rarely with secondary cell divisions (Fig. 86, Fig. 87) **35**

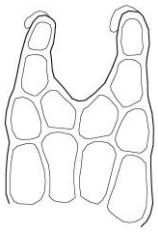

Fig. 94: *Neolepidozia papulosa* var. *uniseriata*, branch underleaf (from SHEVOCK 62130)

Fig. 95: *Neolepidozia papulosa* var. *kalatunganensis*, branch underlaf (from SHEVOCK 61990)

35 Branch underleaves minute, consisting of up to 8 cells (Fig. 95), cells of branch leaf lobes ± isodiametric, weakly constricted, branch leaf disc cells often more than 50 µm long (Philippines – Mindanao)
..... ***Neolepidozia papulosa* var. *kalatunganensis*** (page 80, plates page 338)

35* Branch underleaves medium sized, consisting of more than 8 cells (Fig. 94), cells of branch leaf lobes elongated, not constricted, branch leaf disc cells mostly less than 50 µm long (Indonesia – Sulawesi; Philippines – Mindanao)
..... ***Neolepidozia papulosa* var. *uniseriata*** (page 86, plates page 357)

30* (30 see page 22) Branch leaf lobes with one or several biseriate cell rows above the basal lobe cells **36**

36 Branch leaves divided for more than ½ of their length, branch leaf lobes up 4.5 – 6.5 cells long (Fig. 96, Fig. 97, Fig. 98, Fig. 99, Fig. 100, also consult the comparison sheet – Plate 4 D – H, page 134), (due to the variation of the plants, some species will also key out under those with shallowly divided branch leaves) **37**

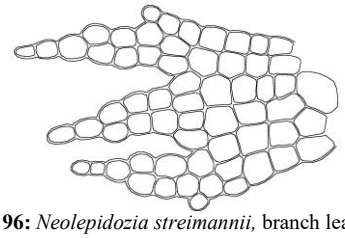

Fig. 96: *Neolepidozia streimannii,* branch leaf (from STREIMANN 13547)

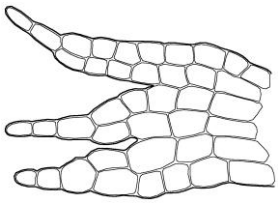

Fig. 97: *Neolepidozia lembangensis,* branch leaf (from WINTER 669)

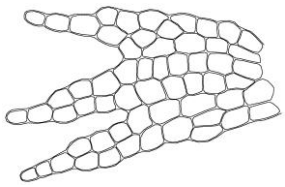

Fig. 98: *Neolepidozia novoguineensis*, branch leaf (from STREIMANN & VINAS 14581)

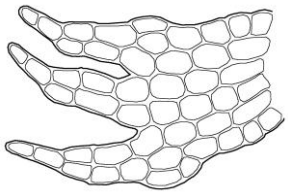

Fig. 99: *Neolepidozia shevockii*, branch leaf (from SHEVOCK 60200)

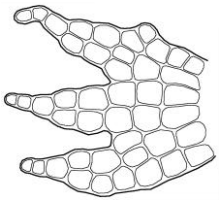

Fig. 100: *Neolepidozia winteri*, branch leaf (from WINTER 671)

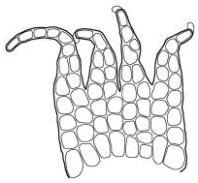

Fig. 101: *Neolepidozia winteri*, stem underleaf (from WINTER 671)

37 Well developed stem underleaves large, disc up to 3.5 cells high, lobes for 2 – 3 cells biseriate with an uniseriate tip up to 6 cells long (Fig. 101) (Indonesia – Java) ..... ***Neolepidozia winteri*** (page 116, plates page 478)

37* Well developed stem underleaves smaller, disc up to 2.5 cells high, lobes up to 2 cells biseriate with an uniseriate tip up to 2 cells long (Fig. 102, Fig. 103, Fig. 104, Fig. 105) (Indonesia – Java) **38**

Fig. 102: *Neolepidozia streimannii*, stem leaf (from STREIMANN 13547)

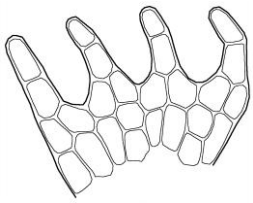

Fig. 103: *Neolepidozia lembangensis,* stem underleaf (from WINTER 669)

Fig. 104: *Neolepidozia novoguineensis*, strem underleaf (from STREIMANN & VINAS 14581)

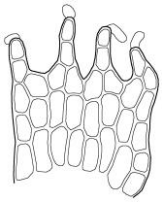

Fig. 105: *Neolepidozia shevockii,* stem underleaf (from SHEVOCK 60200)

38 Branch leaf lobe cells markedly constricted at the transverse walls, lateral base of branch leaf lobes often with blunt tooth (Fig. 96), plants usually fragile (Papua New Guinea – New Guinea) ..... ***Neolepidozia streimannii*** (page 105, plates page 443)

38* Branch leaf lobe cells not or only slightly constricted at the transverse walls, without a lateral tooth near the branch leaf lobe base, plants not fragile **39**

39 Branch leaf disc predominantly 2.5 cells high, rarely reaching 3.5 cells due to secondary cell divisions (Fig. 97), branch leaves rather remote, branch leaf discs rarely touching each other (Indonesia – Java) ..... ***Neolepidozia lembangensis*** (page 58, plates page 245)

39* Branch leaf disc 3.5 – 6.5 cells high (Fig. 98, Fig. 99), branch leaves approximate, branch leaf discs touching or overlapping each other **40**

40 Branch leaf cells moderately thickened, cells at the lobe base slightly elongated (Fig. 99), branch underleaf disc up to 2.5 cells high (Indonesia – Sulawesi, Sumatra; Malaysia – Malay Peninsula; Philippines – Leyte, Mindanao; Thailand) ..... ***Neolepidozia shevockii*** (page 101, plates page 430)

40* Branch leaf cells very thin, cells at the lobe base isodiametric (Fig. 98), branch underleaf disc up to 1.5 cells high (Papua New Guinea – New Guinea) ..... ***Neolepidozia novoguineensis*** (page 70, plates page 295)

36* Branch leaves divided up to ½ of their leaf length or less, branch leaf lobes 2.5 – 5.5 cells long **41**

41 Plants irregularly branched, most of the branches ventral-intercalar, turning into new main stems, with a few *Frullania*-type branches, branch leaves with irregular cell pattern (Fig. 106), base of stem leaf lobes up to 4 cells wide (Fig. 107), plants growing on bare soil (Philippines – Negros) ..... ***Neolepidozia lungaensis*** (page 62, plates page 264)

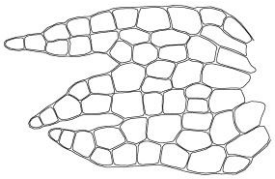

Fig. 106: *Neolepidozia lungaensis*, branch leaf (from SCHWARZ 5829)

Fig. 107: *Neolepidozia lungaensis*, stem leaf (from SCHWARZ 5829)

41* Plants regularly branched, most of the branches of *Frullania*-type, with a few ventral-intercalar branches, turning into new main stems, on rocks, humus, soil or rotten wood **42**

42 Branch underleaves large, imbricate, overlapping each other (Fig. 108, Fig. 109) **43**

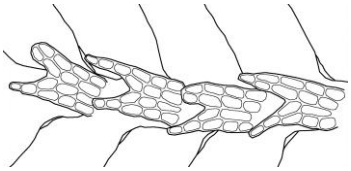

Fig. 108: *Neolepidozia larutensis,* branch ventral (from SCHÄFER-VERWIMP 19009/A)

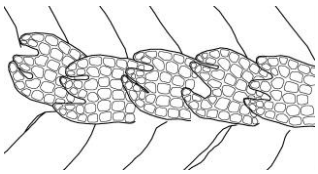

Fig. 109: *Neolepidozia beckeri,* branch ventral (from NULL 610)

43 Cells of branch leaf disc elongated (Fig. 110), branch underleaf disc up to 2.5 cells high (Fig. 111) (Malaysia – Malay Peninsula; Philippines – Negros) ..... ***Neolepidozia larutensis*** (page 56 plates page 238)

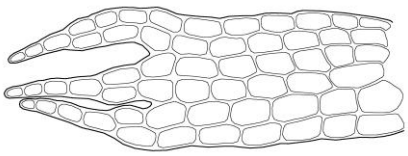

Fig. 110: *Neolepidozia larutensis,* branch leaf (from SCHÄFER-VERWIMP 19009/A)

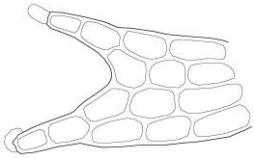

Fig. 111: *Neolepidozia larutensis,* branch underleaf (from SCHÄFER-VERWIMP 19009/A)

43* Cells of branch leaf disc isodiametric (Fig. 112), branch underleaf disc up to 4.5 cells high (Fig. 113) (Malaysia – Malay Peninsula) ..... ***Neolepidozia beckeri*** (page 35, plates page 150)

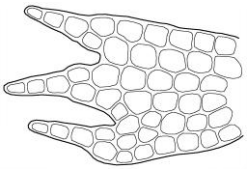

Fig. 112: *Neolepidozia beckeri,* branch leaf (from NULL 610)

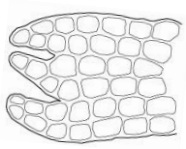

Fig. 113: *Neolepidozia beckeri,* branch underleaf (from NULL 610)

42* Branch underleaves small to medium sized, distant or approximate, not overlapping each other **44**

44 Majority of the branch leaves more than 0.4 mm long (also consult the comparison sheet – Plate 4 I – N, page 134)..... **45**

45 (45* see page 28) Branch leaves approximate, branch leaf discs touching or overlapping each other (Fig. 114) (sometimes only at the base) **46**

Fig. 114: *Neolepidozia papulosa* var. *plumula,* branch dorsal (from HERZOG - holotype)

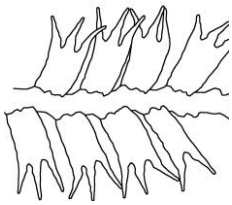

Fig. 115: *Neolepidozia sarawakensis*, branch dorsal (from RICHARDS 2153)

46 Branch leaf disc up to 9.5 cells high (Fig. 116), branch leaf lobes rather short, mostly up to 3.5 cells long (Papua New Guinea – New Guinea) ..... ***Neolepidozia kaindiensis*** (page 51, plates page 216)

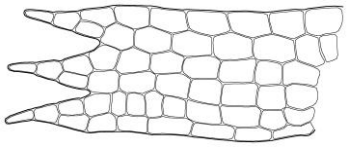

Fig. 116: *Neolepidozia kaindiensis,* branch leaf (from SCHUSTER 67-6247)

Fig. 117: *Neolepidozia kaindiensis,* branch underleaf (from SCHUSTER 67-6247)

46* Branch leaf disc up to 6.5 cells high (Fig. 118, Fig. 119, Fig. 120, Fig. 121), branch leaf lobes rather long, often 4.5 cells long or longer **47**

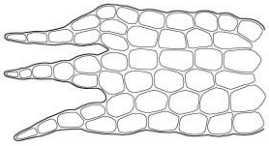

Fig. 118: *Neolepidozia papulosa* var. *plumula,* branch leaf (from HERZOG - holotype)

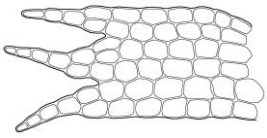

Fig. 119: *Neolepidozia papulosa* var. *plumula*, branch leaf (from ONRAEDT 76.L.2414)

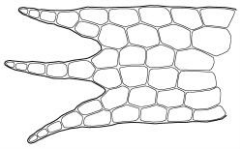

Fig. 120: *Neolepidozia papulosa* var. *quadrata*, branch leaf (from SCHÄFER-VERWIMP 39192)

47 Branch leaf disc cells mostly longer than 50 µm, discus of well-developed stem underleaves 1.5 – 2.5 cells long (Fig. 122) (Nepal) ..... ***Neolepidozia wallichiana*** (page 114, plates page 473)

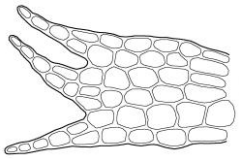

Fig. 121: *Neolepidozia wallichiana*, branch leaf (redrawn from SHARMA & SRIVASTAVA [1993])

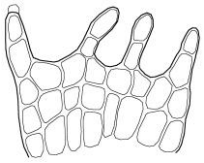

Fig. 122: *Neolepidozia wallichiana*, stem underleaf (redrawn from SHARMA & SRIVASTAVA [1993])

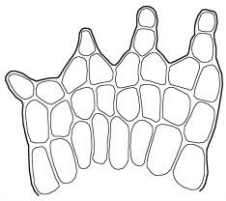

Fig. 123: *Neolepidozia papulosa* var. *plumula,* stem underleaf (from HERZOG – holotype of *Lepidozia plumula*)

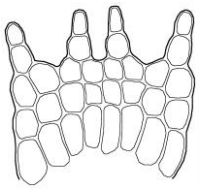

Fig. 124: *Neolepidozia papulosa* var. *plumula,* stem underleaf (from ONRAEDT 76.L.2414)

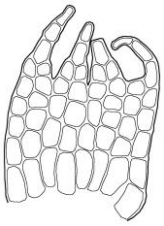

Fig. 125: *Neolepidozia papulosa* var. *quadrata*, stem underleaf (from SCHÄFER-VERWIMP 39192)

47* Branch leaf disc cells mostly shorter than 50 µm, discus of well-developed stem underleaves 2.5 – 4.5 cells long (Fig. 123, Fig. 124, Fig. 125) **48**

48 Branch leaf disc rectangular, quite often with secondary cell divisions (Fig. 118, Fig. 119), cells of branch leaf and underleaf lobes weakly constricted (Fig. 126, Fig. 127) (Sri Lanka)
Neolepidozia papulosa* var. *plumula (page 82, plates page 345)

48* Branch leaf disc square, rarely with secondary cell divisions (Fig. 120), cells of branch leaf and underleaf lobes not constricted (Fig. 128) (Taiwan)
Neolepidozia papulosa* var. *sakuraii (page 84, plates page 352)

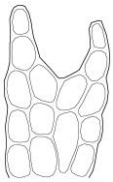

Fig. 126: *Neolepidozia papulosa* var. *plumula,* branch underleaf (from HERZOG – holotype of *Lepidozia plumula*)

Fig. 127: *Neolepidozia papulosa* var. *plumula,* branch underleaf (from ONRAEDT 76.L.2414)

Fig. 128: *Neolepidozia papulosa* var. *sakuraii*, branch underleaf (from SCHÄFER-VERWIMP 39192)

44* Branch leaves distant, branch leaf discs do not touch each other (Fig. 115) **49**

49 Base of branch leaf lobes in most of the leaves more than 2 cells wide (Fig. 129) (Malaysia – Borneo)
... ***Neolepidozia sarawakensis* var. *rajaensis*** (page 96, plates page 406)

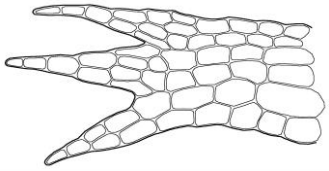

Fig. 129: *Neolepidozia sarawakensis* var. *rajaensis,* branch leaf (from WINKLER 3165)

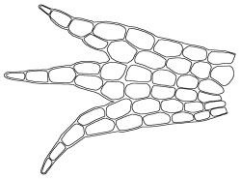

Fig. 130: *Neolepidozia sarawakensis* var. *grandistipula,* branch leaf (from RICHARDS 1974b)

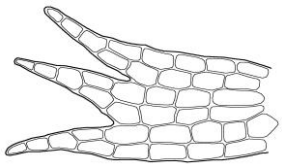

Fig. 131: *Neolepidozia sarawakensis* var. *grandistipula,* branch leaf (from SCHWARZ 7713)

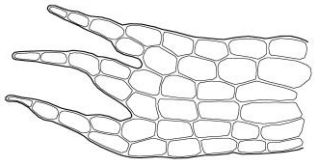

Fig. 132: *Neolepidozia sarawakensis,* branch leaf (from RICHARDS 2513)

49* Base of branch leaf lobes in most of the leaves 2 cells wide (Fig. 130, Fig. 131, Fig. 132) **50**

50 Stem underleaves subquadrate to elongated rectangular, usually longer than wide, disc up to 4.5 cells high (Fig. 133), branch leaf disc often trapezoid (Fig. 130, Fig. 131), becoming smaller at the base, lobes often spreading sidewards (Malaysia – Borneo; Philippines – Panay, Taiwan)
Neolepidozia sarawakensis* var. *grandistipula (page 94 plates page 399)

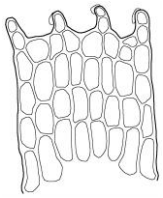

Fig. 133: *Neolepidozia sarawakensis* var. *grandistipula,* stem underleaf (from RICHARDS 1974b)

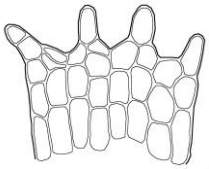

Fig. 134: *Neolepidozia sarawakensis,* stem underleaf (from RICHARDS 2513)

50* Stem underleaves trapezoid to transversely rectangular, usually wider than long, disc up to 2.5 cells high (Fig. 134), branch leaf disc rectangular (Fig. 132), not becoming smaller at the base, lobes mostly upright (Malaysia – Borneo)
..... ***Neolepidozia sarawakensis*** (page 93, plates page 392)

45* (45 see page 26) Majority of the branch leaves less than 0.4 mm long (also consult the comparison sheet – Plate 5 A – M, page 135) **51**

51 Bilobate branch underleaves consisting of up to 10 cells (due to secondary cell divisions sometimes up to 12 cells) (Fig. 135, Fig. 136, Fig. 137, Fig. 138) **52**

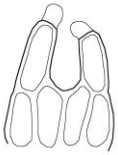

Fig. 135: *Neolepidozia panayensis,* branch underleaf (from SCHWARZ 7180)

Fig. 136: *Neolepidozia bickeri,* branch underleaf (from SCHÄFER-VERWIMP 18594/A)

Fig. 137: *Neolepidozia salasii,* branch underleaf (from SHEVOCK 56230)

Fig. 138: *Neolepidozia papulosa* var. *apoensis,* branch underleaf (from SCHWARZ 4684)

52 Basal cells of the branch leaf disc large, up to 80 µm long (Fig. 139) (Papua New Guinea – New Guinea; Philippines – Panay; Taiwan – Orchid Island) ..... ***Neolepidozia panayensis*** (page 74, plates page 314)

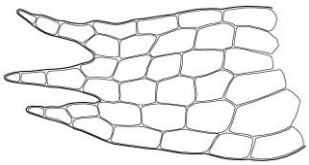

Fig. 139: *Neolepidozia panayensis,* branch leaf (from SCHWARZ 7180)

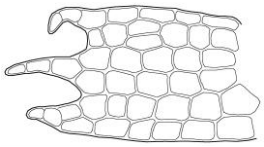

Fig. 140: *Neolepidozia bickeri,* branch leaf (from SCHÄFER-VERWIMP 18594/A)

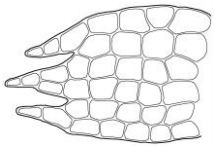

Fig. 141: *Neolepidozia salasii,* branch leaf (from SHEVOCK 56230)

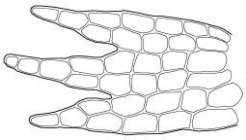

Fig. 142: *Neolepidozia papulosa* var. *apoensis,* branch leaf (from SCHWARZ 4684)

52* Basal cells of the branch leaf disc smaller (Fig. 140, Fig. 141, Fig. 142), only up to 50 µm long **53**

53 Branch leaves up to 0.2 mm long, divided up to 0.5 of the leaf length (Fig. 142), branch leaf lobes flat, cuticle markedly papillose (Indonesia – Sulawesi; Philippines – Mindanao) ..... ***Neolepidozia papulosa* var. *apoensis*** (page 79, plates page 333)

53* Branch leaves more than 0.2 mm long, divided up to 0.3 of the leaf length, lobes bent ventrally, cuticle weakly to strongly papillose **54**

54 Branch leaves ± flat, longitudinally attached, only lobes hooked ventrally, disc cells often with secondary divisions (Fig. 140), branch leaf cells weakly papillose (Malaysia – Borneo, Malay Peninsula; Thailand) ..... ***Neolepidozia bickeri*** (page 36, plates page 155)

54* Branch leaves concave, obliquely attached, disc cells without secondary divisions (Fig. 141), branch leaf cells strongly papillose (Philippines – Negros) ..... ***Neolepidozia salasii*** (page 91, plates page 386)

51* Bilobate branch underleaves consisting of more than 10 cells **55**

55 Most of the branch leaves with some lobes wider than 2 cells at the base (Fig. 143, Fig. 144, Fig. 145, Fig. 146) **56**

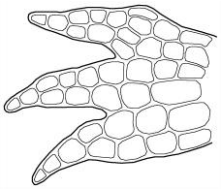

Fig. 143: *Neolepidozia limbawonensis*, branch leaf (from SHEVOCK 54633)

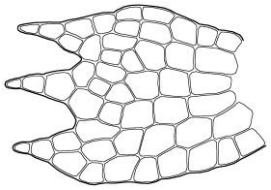

Fig. 144: *Neolepidozia schaefer-verwimpii,* branch leaf (from SCHÄFER-VERWIMP 37449)

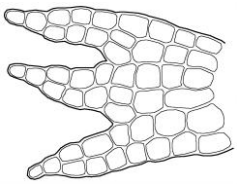

Fig. 145: *Neolepidozia morobensis*, branch leaf (from STREIMANN & BELLAMY 12985)

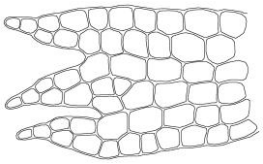

Fig. 146: *Neolepidozia tangkulanensis,* branch leaf (from YORONG 931c)

56 Branch leaves ± ovate, cell walls thin, disc frequently with secondary cell divisions (Fig. 144), cuticle almost smooth (Japan – Ryukyu Islands, Taiwan, Thailand)
..... ***Neolepidozia schaefer-verwimpii***[8] (page 97, plates page 412)

56* Branch leaves rectangular to trapezoid, cell walls moderately thickened, disc rarely with secondary cell divisions (Fig. 143, Fig. 145, Fig. 146), cuticle markedly papillose **57**

57 Stem and branch leaves obliquely inserted, stem leaf lobes often wider than 2 cells at the base (Fig. 147) (Philippines – Mindanao)
..... ***Neolepidozia limbawonensis*** (page 59, plates page 251)

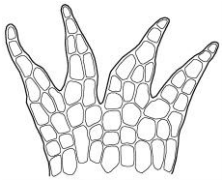

Fig. 147: *Neolepidozia limbawonensis*, stem leaf (from SHEVOCK 54633)

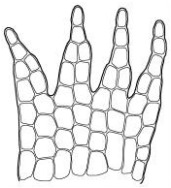

Fig. 148: *Neolepidozia morobensis*, branch leaf (from STREIMANN & BELLAMY 12985)

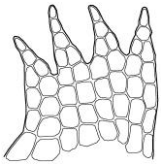

Fig. 149: *Neolepidozia tangkulanensis,* stem leaf (from YORONG 931c)

57* Stem and branch leaves longitudinally inserted, stem leaf lobes 2 cells at the base, very rarely wider (Fig. 148, Fig. 149) **58**

58 Branch leaves 250 – 300 µm long, divided up to 0.4 of the leaf length, disc cells exceeding 30 µm, perianth mouth crenulate to short ciliate (Papua New Guinea – New Guinea; Philippines – Mindanao)
..... ***Neolepidozia tangkulanensis*** (page 106, plates page 449)

58* Branch leaves up to 250 µm long, divided up to 0.5 of the leaf length, disc cells often less than 30 µm long (perianth not observed) (Papua New Guinea – New Guinea)
..... ***Neolepidozia morobensis*** (page 68, plates page 288)

55* Most of the branch leaves with lobes 2 cells wide at the base **59**

59 Branch leaf lobe cells markedly constricted at the transverse walls (Fig. 150), perianth mouth crenulate, leaves often fragile (Papua New Guinea – New Guinea)
. ***Neolepidozia schusteri*** (page 99, plates page 423)

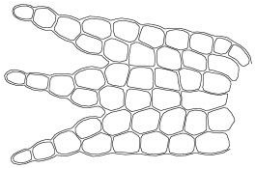

Fig. 150: *Neolepidozia schusteri,* branch leaf (from SCHUSTER 67-6268)

[8] The plants depicted as *L. wallichiana* in HATTORI & MIZUTANI 1958 resemble *Neolepidozia schaefer-verwimpii*, due to the isodiametric cells of a rather irregular cell arrangement. Specimens of *N. wallichiana* from Japan have to be restudied to verify their identity.

59* Branch leaf lobe cells not or only slightly constricted at the transverse walls, perianth mouth crenulate or ciliate, leaves not fragile (Fig. 151, Fig. 152, Fig. 142, Fig. 153, Fig. 154) **60**

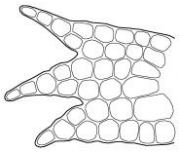

Fig. 151: *Neolepidozia massartiana,* branch leaf (from SCHWARZ 4776)

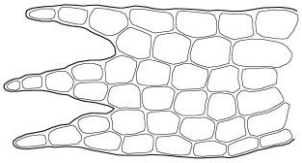

Fig. 152: *Neolepidozia papulosa,* branch leaf (from SCHÄFER-VERWIMP 18816b)

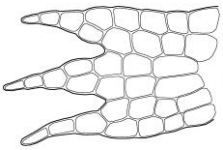

Fig. 153: *Neolepidozia papulosa* var. *sakuraii*, branch leaf (from SAKURAI 11694)

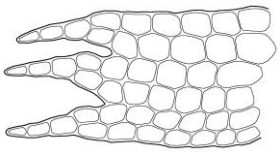

Fig. 154: *Neolepidozia tenera,* branch leaf (from SCHWARZ 4735)

60 Branch leaves oblique inserted, often ± asymmetric, branch underleaves rather large compared to the lateral leaves, more than half of the length of the branch leaves (Indonesia – Java, New Guinea, Sumatra; Malaysia – Borneo, Malay Peninsula; Philippines – Leyte, Mindanao, Negros; Taiwan) ..... ***Neolepidozia massartiana*** (page 65, plates page 276)

60* Branch leaves longitudinally inserted, symmetric, branch underleaves small to medium sized compared to the lateral leaves, less than half of the length of the branch leaves (Fig. 155, Fig. 156, Fig. 157) **61**

Fig. 155: *Neolepidozia papulosa,* branch underleaf (from SCHÄFER-VERWIMP 18816b)

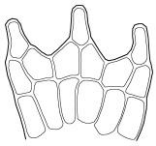

Fig. 156: *Neolepidozia papulosa* var. *sakuraii*, branch underleaf (from SAKURAI 11694)

Fig. 157: *Neolepidozia tenera,* branch underleaf (from SCHWARZ 4735)

61 Plants densely pinnately branched, tips of branch leaves bent towards the ventral side of the branch, stem leaves more than 350 µm long (Indonesia – Java; Malaysia – Borneo; Philippines – Mindanao) ..... ***Neolepidozia tenera*** (page 107, plates page 455)

61* Plants loosely pinnately branched, branch leaves flat, stem leaves up to 350 µm long **62**

62 Branch leaf disc rectangular, longer than wide, 3.5 – 4.5 cells high (Fig. 152), walls of branch leaf cells moderately thickened (Indonesia – Borneo, Sulawesi, Sumatra; Malaysia – Borneo, Malay Peninsula; Philippines – Leyte, Mindanao, Negros; Sri Lanka)
..... ***Neolepidozia papulosa* s. str.** (page 76, plates page 320)

62* Branch leaf disc ± square, shorter or as long as wide, 2.5 – 3.5 cells high, walls of branch leaf cells thin (Fig. 153) (Taiwan)
Neolepidozia papulosa* var. *sakuraii (page 84, plates page 352)

6. Treatment of Taxa

Remark:

The specimens that we studied are marked with an exclamation mark (!). We intentionally omitted the term isotype for new taxa when duplicates of the respective specimen were distributed and not studied by us. As species can grow intermixed, we refer to these specimens as duplicates. In order to determine the status of an isotype, the relevant specimens must be studied in detail.

Neolepidozia arauluensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Papua New Guinea: New Guinea, Morobe Province, Araulu Logging Area, 26 km SE of Wau, 7° 28' S, 146° 48' E, 1900 m, *Podocarpus*, *Phyllocladus* and *Fagaceae* dominated ridge forest, at base of uprooted tree, leg. H. STREIMANN 13611, 29 January 1981 (JE!, det. R. GROLLE 1982 as *Lepidozia wallichiana*, duplicates: CANB, LAE, NICH).

Figures:

Plate 6, Plate 7, Plate 8, Plate 9, Plate 10, Plate 11.

Comparison Plate 1 – B.

Description

Plants pale yellowish green, small, up to 1.5 cm long, stem with leaves 0.7 mm wide, leaves fragile, leaf lobes often missing. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparse, up to 4 mm long. **Rhizoids** not seen. **Stem** in cross section 100 µm wide and 100 µm high, cortical cells 10, 21 – 34 × 15 – 20 µm, cell walls thickened, medullary cells 15, 10 – 18 × 8 – 15 µm, cell walls thickened, trigones small, dorsal cortical cells ovate to elongated rectangular, 32 – 48 × 51 – 74 µm, 1.5 – 2.1 as long as wide, cell walls thickened, trigones lacking to small, cuticle smooth. **Stem leaves** distant, longitudinally inserted, spreading at an angle of 50° – 75°, leaves trapezoid, symmetric to weakly asymmetric, flat, 270 – 400 µm wide, 270 – 360 µm long, 0.8 – 1.3 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 – 8 cells wide, 3.5 – 4.5 cells long, 150 – 250 µm wide, 150 – 190 µm long, 0.7 – 1.1 as long as wide, median cells hexagonal, polygonal to short rectangular, 32 – 38 × 34 – 51 µm, 1 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells hexagonal, polygonal to rectangular, 27 – 36 × 38 – 45 µm, 1.3 – 1.4 as long as wide, leaf lobes 3 – 4, weakly divergent, 4.5 – 5.5 cells long, straight, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 5 cells long, cells ovate to barrel shaped, constricted at the transversal walls, 22 – 30 × 27 – 40 µm, 1.1 – 1.5 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to striate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed, 1.1 – 1.7 times as wide as the stem, underleaves trapezoid, 160 – 240 µm wide, 190 – 220 µm long, 0.8 – 1.3 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 6 – 8 cells wide, 2.5 – 3.5 cells long, 120 – 210 µm wide, 120 – 150 µm long, 0.6 – 1.3 as long as wide, median cells ovate to elongated polygonal, 26 – 30 × 26 – 40 µm, 0.9 – 1.5 as long as wide, cell walls thickened, trigones enlarged, cuticle smooth, basal cells elongated polygonal, in particular in the central part, 20 – 25 × 40 – 60 µm, 1.7 – 3 as long as wide, leaf lobes 3 – 4, weakly divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 18 – 27 × 30 – 43 µm, 1.1 – 2 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 35° -80°, leaves rectangular to trapezoid, symmetric, flat, 220 – 340 µm wide, 310 – 370 µm long, 1.1 – 1.6 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, partially with a blunt marginal tooth at the lobe base, disc 6 cells wide, 3.5 – 4.5 cells long, 120 – 220 µm wide, 160 – 210 µm long, 0.8 – 1.5 as long as wide, median cells hexagonal, polygonal to short rectangular, 27 – 36 × 21 – 40 µm, 0.7 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells square, polygonal to elongated ovate, 23 – 35 × 25 – 49 µm, 1.1 – 1.6 as long as wide, leaf lobes 3, upright to divergent, 3.5 – 5.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 4 cells long, cells ovate to barrel shaped, constricted at the transversal walls, cells 24 – 33 × 31 – 37 µm, 0.9 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to striate papillae. **Branch underleaves** imbricate, overlapping 0.5 of the underleaf length, transversely attached, appressed, 1.3 – 1.9 times as wide as the branch, underleaves rectangular to trapezoid, 130 – 170 µm wide, 160 – 220 µm long, 1.1 – 1.7 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 – 6 cells wide, 1.5 – 3.5 cells long, 70 – 150 µm wide, 80 – 130 µm long, 0.7 – 1.7 as long as wide, median cells ovate to elongated polygonal, 25 – 37 × 32 – 40 µm, 0.9 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells rectangular to elongated polygonal, in particular

in the central part, 18 – 25 × 40 – 60 µm, 1.8 – 3 as long as wide, leaf lobes 2 – 3, weakly divergent, 2.5 – 4.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 4 cells long, cells 19 – 29 × 18 – 40 µm, 0.9 – 1.7 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to striate papillae at the lobe tips.

Distinguishing characters:

The species is characterised by (1) the moderately fragile leaves, (2) the trapezoid leaf disc that is 3.5 – 4.5 cells high, and (3) large underleaves that overlap each other by up to half their length.

Similar species:

A similar species with fragile leaves is *N. yorongii*, which has a smaller leaf disc (up to 2.5 cells) and more distant underleaves.

It also bears a close resemblance to *N. schusteri*, which has square-to-rectangular branch leaf discs and remote underleaves. which has a square to rectangular branch leaf disc and remote underleaves.

N. streimannii has smaller branch underleaves that are remotely attached, smaller branch leaves with a longer multiseriate part of its lobes, and shorter basal cells of the branch underleaves.

The specimen BRASS 23276 in JE was identified as *N. mamillosa*, most likely due to the constricted branch leaf lobe cells. This species has robust leaves and regular branch leaves, as well as smaller branch underleaves. *N. mamillosa* grows in mangrove forests, rather than at higher elevations in mountainous regions.

Distribution:

Papua New Guinea (New Guinea).

Specimen studied:

[Papua New Guinea]: New Guinea, Milne Bay District, North slopes of Mt. Dayman, Maneau Range, 1550 m, leg. L.J. BRASS 23276, March – November 1953 (!JE, det. M. MIZUTANI 1976 as *Lepidozia mamillosa*, remark by R. GROLLE 1984 "probabely f. of *L. wallichiana* with vegetative reproduction", duplicate: A).

Etymology:

The species is named after the Araulu Logging area where the species was discovered.

Remark:

The plants from the specimen BRASS 23276 are more fragile than those of the type collection. It develops smaller branch underleaves that are hardly overlapping each other due to the broken leaf lobes. The branch leaves do not show an occasional lateral tooth near the lobe base. Nevertheless, the plants fit well within the range of *N. arauluensis*.

Neolepidozia augustana (STEPH.) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*

Basionym:

Lepidozia augustana STEPH. Species Hepaticarum 6: 320. 1922.

Type:

Nova Guinea. Augusta Fluss. leg. *Prof. Dr. L. Schultze*. 1910 (G00113399!, rev. R. GROLLE as *Lepidozia cuneifolia* STEPH. 1909 [= *L. augustana* STEPH. 1922, Typus], note "Type" by M. MIZUTANI July 1965, det. J.J. ENGEL 2002 as *Telaranea wallichiana* [GOTT.] SCHUST. TYPE of *Lepidozia augustana* STEPH.).

Figures:

STEPHANI (1985) Icones no. 5220.

Plate 12, Plate 13, Plate 14, Plate 15, Plate 16, Plate 17, Plate 18, Plate 19.

Comparison Plate 3 – A.

Description

Plants yellowish brown, medium sized, up to 2 cm long, stem with leaves up to 0.9 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 4 mm long, not flagelliform at the end. **Flagelliform branches**

sparse, up to 5 mm long. **Rhizoids** not seen. **Stem** in cross section 200 µm wide and 160 µm high, cortical cells 12, 31 – 48 × 20 – 49 µm, cell walls thickened, medullary cells up to 60, 9 – 23 × 9 – 21 µm, cell walls thickened, trigones enlarged, dorsal cortical cells square to short rectangular, 53 – 65 × 40 – 74 µm, 0.6 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** approximate, longitudinally to obliquely inserted, spreading at an angle of 60° – 80°, leaves square to short rectangular, symmetric to weakly asymmetric, flat, 360 – 420 µm wide, 400 – 480 µm long, 1 – 1.3 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 8 cells wide, 3.5 – 5.5 cells long, 220 – 250 µm wide, 200 – 280 µm long, 0.8 – 1.3 as long as wide, median cells elongated polygonal to rectangular, 32 – 36 × 39 – 54 µm, 1.2 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle occasionally with striate papillae, basal cells elongated polygonal, 29 – 38 × 59 – 70 µm, 1.8 – 2 as long as wide, leaf lobes 4, divergent, 4.5 – 5.5 cells long, straight to weakly falcate, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 5 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 19 – 28 × 39 – 48 µm, 1.4 – 2.2 as long as wide, cell walls thin to weakly thickened, trigones small, cuticle with elliptical papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, recurved, 1 – 1.1 times as wide as the stem, underleaves square to short rectangular, 280 – 300 µm wide, 250 – 330 µm long, 0.9 – 1.1 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 8 cells wide, 2.5 – 3.5 cells long, 180 – 230 µm wide, 140 – 190 µm long, 0.7 – 1 as long as wide, median cells rectangular to elongated polygonal, 26 – 34 × 36 – 49 µm, 1.1 – 1.8 as long as wide, cell walls weakly thickened, trigones small, cuticle smooth, basal cells elongated polygonal to rectangular, 30 – 40 × 41 – 61 µm, 1.4 – 1.7 as long as wide, leaf lobes (3 -) 4, upright to divergent, 2.5 – 5.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 4 cells long, cells 20 – 27 × 35 – 46 µm, 1.4 – 1.9 as long as wide, cell walls weakly thickened, trigones small, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 60° – 80°, leaves rectangular to trapezoid, asymmetric, flat, 240 – 340 µm wide, 410 – 490 µm long, 1.2 – 1.8 as long as wide, divided by 0.3 – 0.6 of the leaf length, divided by 0.3 – 0.4 on the ventral side, margin entire, disc 6 cells wide, 3.5 – 5.5 cells long, 140 – 190 µm wide, 190 – 310 µm long, 1.1 – 2 as long as wide, median cells elongated polygonal, 30 – 41 × 38 – 52 µm, 1.3 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle almost smooth, basal cells ovate to elongated polygonal, 30 – 40 × 44 – 67 µm, 1.3 – 2.2 as long as wide, leaf lobes 3, upright, divergent to weakly falcate, 3.5 – 5.5 cells long, 2 – 3 cells wide at base, multiseriate part 2 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, cells 16 – 31 × 34 – 47 µm, 1.2 – 2.9 as long as wide, cell walls thin, trigones lacking, cuticle occasionally with round to elliptical papillae. **Branch underleaves** distant, transversely attached, recurved, 1 – 1.2 times as wide as the branch, underleaves square to rectangular, 115 – 190 µm wide, 140 – 210 µm long, 0.9 – 1.8 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 4 – 6 cells wide, 1.5 – 2.5 cells long, 90 – 170 µm wide, 85 – 135 µm long, 0.6 – 1.3 as long as wide, median cells square, rectangular to elongated polygonal, 27 – 33 × 28 – 41 µm, 1 – 1.5 as long as wide, cell walls weakly thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 22 – 35 × 38 – 60 µm, 1.5 – 2.7 as long as wide, leaf lobes 2 – 3, upright to weakly divergent, 2.5 – 3.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 – 3 cells long, cells 17 – 24 × 24 – 39 µm, 1.1 – 1.7 as long as wide, cell walls weakly thickened, trigones small, cuticle smooth. **Perianth** originating ventrally from the main stem, 5 mm long, narrowed towards the mouth, 5 – plicate in the uppermost part. **Perianth mouth** ciliate, mouth cells linear, 11 – 14 × 70 – 82 µm, 5.9 – 6.4 as long as wide, cell walls thick, trigones small, cuticle smooth, median cells ovate, rectangular to linear, 18 – 30 × 32 – 80 µm, 1.1 – 4.4 as long as wide, cell walls thin, trigones weakly enlarged, cuticle smooth. **Female bracts** ovate, not united, margin weakly dentate, ciliate at the apex, 700 – 750 µm wide, 1200 – 1500 µm long, 1.7 – 2 as long as wide, median cells elongated polygonal to linear, 23 – 35 × 72 – 140 µm, 2.2 – 5.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Female bracteole** triangular, margin weakly dentate, ciliate at the apex, 600 – 700 µm wide, 700 – 1000 µm long, 1.2 – 1.4 as long as wide, median cells elongated polygonal, 18 – 35 × 68 – 93 µm, 2.7 – 4.1 as long as wide, cell walls thin, trigones lacking, cuticle smooth.

Distinguishing characters:

The species is characterised (1) its rather large size, with branch leaves often exceeding 400 µm in length, (2) the medium-sized branch underleaves consisting of more than 12 cells, (3) the elongated branch leaf disc cells that are up to twice as long as wide, (4) narrow branch leaf lobes, and (5) a lack of secondary cell division in the branch leaf disc.

Similar species:

N. augustana shares many characteristics with *N. palawanensis*. However, the latter one has smaller, ovate cells that are only up to 40 µm long and distinctly developed trigones.

N. variifolia var. *kairuruensis* is similar in size, but has much larger branch underleaves that overlap each other, as well as smaller and rather isodiametric branch leaf disc cells.

N. solomonensis has even larger, more overlapping branch underleaves and bone-shaped branch leaf lobe cells.

N. zantenii, based on a specimen in JE (VAN ZANTEN 105), which MIZUTANI identified as *L. augustana*, has smaller branch underleaves consisting of fewer than ten cells, as well as larger branch leaf disc cells with very thin walls.

In some cases, *N. augustana* resembles *N. cuneifolia* var. *luxurians*. However, this species has a branch leaf disc that is up to twelve cells wide, which leads to a rather irregular cell pattern and smaller branch underleaves.

All other species with asymmetric leaves either have smaller branch leaves or frequently develop secondary cell divisions in the branch leaf disc.

Distribution:

Papua New Guinea (New Guinea).

Specimen studied:

Papua New Guinea: New Guinea, West Sepik Province, Frieda River prospecting area of Frieda Copper Co., between M 6 and M 29 of Nena area, 9 km NW of Frieda Base Camp, 4° 40' S, 141° 43' E, 850 - 1000 m, tropical rainforest on slope facing S, on bush, collection site no. 3b, leg. TIMO KOPONEN 34911, 2 August 1981 (JE!, det. S. PIIPPO as *Lepidozia wallichiana*, duplicate: H).

Remark:

The specimen in Geneva (G) was identified as *L. cuneifolia* by GROLLE 1965 which was followed by ENGEL & MERRILL (2004) who listed *L. augustana* as a synonym of *Telaranea cuneifolia*, despite stating that its leaf lobes are only 2 cells wide at the base. GROLLE & PIIPPO (1984) combined it with *L. wallichiana* following the synonymisation of *L. cuneifolia* with *L. wallichiana* by INOUE (1979).

However, the aforementioned characteristics, as well as the differences to similar species, led us to conclude that *N. augustana* is a distinct species.

Neolepidozia beckeri U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Malaysia: Flora of Malaya, Gunong Siku, Pahang (Cameron Highlands), 6000 ft. +, in montane mossy forests, abundant on horizontal trunks, leg. W.S. NULL 610, 30 July 1970 (JE! - holotype, det. M. MIZUTANI 1976 as *Lepidozia cuneifolia*). The specimen consists of 2 species, *Neolepidozia beckeri* (NULL 610) and *Neolepidozia massartiana* (NULL 610a).

Figures:

Plate 20, Plate 21, Plate 22, Plate 23, Plate 24.

Comparison Plate 3 – K.

Description:

Plants pale yellowish green, small, up to 1.5 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, not flagelliform at the end. **Flagelliform branches** scattered, up to 7 mm long. **Rhizoids** not seen. **Stem** in cross section 195 µm wide and 175 µm high, cortical cells 12, 31 – 52 × 26 – 42 µm, cell walls thickened, medullary cells up to 45, 13 – 30 × 12 – 24 µm, cell walls thickened, trigones enlarged, dorsal cortical cells square to short rectangular, 36 – 45 × 36 – 58 µm, 1 – 1.5 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Stem leaves** imbricate, obliquely inserted, spreading at an angle of 40° – 60°, leaves square to short rectangular, weakly asymmetric, flat, 190 – 240 µm wide, 240 – 300 µm long, 1.2 – 1.5 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 3.5 – 5.5 cells long, 170 – 190 µm wide, 130 – 170 µm long, 0.7 – 1 as long as wide, median cells square, hexagonal to short rectangular, 21 – 28 × 23 – 35 µm, 1.1 – 1.5 as long as wide, cell walls thickened, trigones small, cuticle with striate papillae, basal cells ovate to short rectangular, 20 – 32 × 37 – 43 µm, 1.2 – 2 as long as wide, leaf lobes 4, upright to divergent, 4.5 – 5.5 cells long, straight to weakly falcate, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 15 – 20 × 21 – 28 µm, 1.3 – 1.7 as long as wide, cell walls thickened, trigones small, cuticle with round to elliptical papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed to moderately spreading away from the stem, 0.9 – 1 times as wide as the stem, underleaves transversely rectangular, 170 – 190 µm wide, 180 – 200 µm long, 1 – 1.1 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 8 cells wide, 2.5 – 3.5 cells long, 150 – 185 µm wide, 110 –

140 µm long, 0.6 – 0.8 as long as wide, median cells square, hexagonal to short rectangular, 22 – 28 × 28 – 35 µm, 1.1 – 1.6 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells short elongated polygonal, 25 – 28 × 33 – 39 µm, 1.2 – 1.4 as long as wide, leaf lobes 4, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 18 – 28 × 22 – 28 µm, 1 – 1.2 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, obliquely inserted, spreading at an angle of 40° – 60°, leaves square, rectangular to trapezoid, symmetric to weakly asymmetric, flat, 140 – 190 µm wide, 240 – 290 µm long, 1.3 – 1.9 as long as wide, divided by 0.3 – 0.4 of the leaf length, margin entire, disc 6 – 8 cells wide, 4.5 – 6.5 cells long, 110 – 175 µm wide, 135 – 190 µm long, 0.8 – 1.5 as long as wide, median cells square, hexagonal to short rectangular, 18 – 29 × 22 – 33 µm, 1 – 1.4 as long as wide, cell walls thickened, trigones small, cuticle with striate papillae, basal cells ovate to short rectangular, 17 – 25 × 34 – 43 µm, 1.5 – 2 as long as wide, leaf lobes 3 – 4, upright to weakly divergent, occasionally falcate, 3.5 – 5.5 cells long, 2 – 3 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 4 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, cells 14 – 22 × 18 – 28 µm, 1 – 1.5 as long as wide, cell walls thickened, trigones small, cuticle with round to elliptical papillae. **Branch underleaves** imbricate, overlapping 0.3 of the underleaf length, transversely attached, appressed, 2.1 – 2.4 times as wide as the branch, underleaves square to short rectangular, 140 – 160 µm wide, 180 – 200 µm long, 1.2 – 1.4 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 6 cells wide, 3.5 – 4.5 cells long, 110 – 160 µm wide, 120 – 140 µm long, 0.8 – 1.3 as long as wide, median cells square, hexagonal to short rectangular, 23 – 30 × 27 – 33 µm, 1.1 – 1.3 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells short elongated polygonal, 22 – 28 × 38 – 45 µm, 1.4 – 1.8 as long as wide, leaf lobes 3, upright, 2.5 – 3.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 cells long, cells 16 – 22 × 21 – 25 µm, 1.1 – 1.5 as long as wide, cell walls thickened, trigones small, cuticle smooth.

Distinguishing characters:

The most striking character of *N. beckeri* are the large branch underleaves, that are up to twice as wide as the branch with a disc that is up to 4.5 cells high. None of the other *Neolepidozia* species we studied, develop these large underleaves. Furthermore, it is characterised by (1) the small branch leaf cells with thickened walls and papillose cuticle, (2) the imbricate, obliquely inserted leaves, and (3) the branch leaf lobe base that are occasionally more than 2 cells wide. Even though the branch leaves are mostly symmetric, some asymmetric leaves with falcate lobes can be found.

Similar species:

The weakly asymmetric leaves of *N. beckeri* point towards *N. variifolia* which has smaller branch underleaves and more asymmetric branch leaves. The rather large branch underleaves of *N. variifolia* var. *kairuruensis* have a different shape and are deeper divided.

N. massartiana, which has similar obliquely inserted branch leaves, usually has more symmetrical branch leaves, thinner cell walls and smaller branch underleaves.

Branches with symmetric leaves might resemble *N. winteri* due to their large underleaves and obliquely inserted leaves. Its branch leaves are more deeply divided. Furthermore, the median branch leaf cells can reach up to 40 µm in length, and the lobes of the stem underleaves are longer.

Distribution:

Malaysia (Malay Peninsula). Only known from the type collection.

Etymology:

The species is named dedicated to the German bryologist CHRISTIAN BECKER (Leipzig) for his most valuable contribution to the exploration of the bryophyte flora of Leipzig.

Neolepidozia bickeri U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Malaysia: State Pahang, Frasers Hill, Parklandschaft im Ort, Regenwald-Rand, 3° 42' 39.5" N, 101° 44' 11.4" E, 1300 m, an Baumfarnstamm (*Cyathea*) in kleiner Bachschlucht, leg. SCHÄFER-VERWIMP & VERWIMP, 20 May 1997 (herbarium SCHÄFER-VERWIMP 18594/A!).

Figures:

Plate 25, Plate 26, Plate 27, Plate 28, Plate 29, Plate 30, Plate 31.

Comparison Plate 5 – B.

Description

Plants pale yellowish green, medium sized, up to 2 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type, often with ventral intercalar stem innovations. **Branches** up to 3 mm long, occasionally flagelliform at the end. **Flagelliform branches** scattered, up to 5 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 130 µm wide and 95 µm high, cortical cells 10, 28 – 40 × 15 – 30 µm, cell walls thickened, medullary cells up to 20, 13 – 23 × 13 – 18 µm, cell walls thin, trigones enlarged, dorsal cortical cells isodiametric to elongated polygonal, 25 – 34 × 35 – 62 µm, 1 – 2.2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** approximate, longitudinally inserted, spreading at an angle of 60° – 85°, leaves square to short rectangular, weakly to markedly asymmetric, lobes bent down ventrally, 190 – 230 µm wide, 210 – 295 µm long, 0.9 – 1.5 as long as wide, divided by 0.3 – 0.5 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 4.5 cells long, 160 – 195 µm wide, 125 – 210 µm long, 0.7 – 1.2 as long as wide, median cells isodiametric to elongated polygonal, 21 – 33 × 30 – 38 µm, 0.9 – 1.6 as long as wide, cell walls thin to weakly thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal, 23 – 34 × 32 – 49 µm, 1.1 – 1.8 as long as wide, leaf lobes 4, upright to divergent, 2.5 – 4.5 cells long, straight to weakly falcate, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 – 4 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 16 – 19 × 25 – 31 µm, 1.3 – 1.8 as long as wide, cell walls thin to weakly thickened, trigones small, cuticle smooth, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 0.8 – 0.9 times as wide as the stem, underleaves square to transversely rectangular, 105 – 140 µm wide, 95 – 125 µm long, 0.8 – 1.2 as long as wide, divided by 0.2 – 0.5 of the leaf length, disc 6 – 8 cells wide, 1.5 – 2.5 cells long, 95 – 130 µm wide, 50 – 95 µm long, 0.4 – 0.8 as long as wide, median cells isodiametric polygonal, 15 – 18 × 17 – 21 µm, 1 – 1.3 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 15 – 22 × 25 – 30 µm, 1.3 – 2 as long as wide, leaf lobes 3 – 4, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 13 – 15 × 20 – 34 µm, 1.4 – 2.5 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 60° – 80°, leaves rectangular, symmetric to weakly asymmetric, lobes bent ventrally, 150 – 170 µm wide, 270 – 305 µm long, 1.7 – 1.9 as long as wide, divided by 0.3 – 0.4 of the leaf length, divided by 0.3 on the ventral side, margin entire, disc 6 – 7 cells wide, 4.5 – 6.5 cells long, 140 – 160 µm wide, 180 – 220 µm long, 1.1 – 1.6 as long as wide, median cells isodiametric to elongated polygonal, 27 – 36 × 35 – 46 µm, 1.1 – 1.4 as long as wide, cell walls thin to weakly thickened, trigones lacking, cuticle almost smooth or with striate papillae, basal cells elongated polygonal, 32 – 40 × 40 – 54 µm, 1.2 – 1.6 as long as wide, leaf lobes 3, upright, 3.5 cells long, 2 (-3) cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, cells 15 – 20 × 26 – 34 µm, 1.4 – 1.9 as long as wide, cell walls thin to weakly thickened, trigones lacking, cuticle almost smooth or with round papillae. **Branch underleaves** distant, transversely attached, upright to spreading, 0.8 – 1 times as wide as the branch, underleaves square, trapezoid to rectangular, 65 – 95 µm wide, 70 – 95 µm long, 0.9 – 1.2 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 4 – 6 cells wide, 0.5 – 2.5 cells long, 50 – 90 µm wide, 40 – 65 µm long, 0.5 – 0.9 as long as wide, median cells square, 21 – 23 × 18 – 19 µm, 0.8 – 0.9 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal, 16 – 21 × 24 – 34 µm, 1.2 – 2.1 as long as wide, leaf lobes 2 – 3, upright to weakly divergent, 1,5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 11 – 16 × 25 – 32 µm, 1.6 – 2.7 as long as wide, cell walls thickened, trigones lacking, cuticle smooth. **Male branches** originating ventrally – intercalar from the main stem, straight, up to 0.8 mm long, with leaves up to 0.5 mm wide. **Male bracts** imbricate, obliquely attached, ovate to trapezoid, 190 – 220 µm wide, 195 – 260 µm long, 1 – 1.2 as long as wide, divided by 0.4 of the leaf length, disc 140 – 220 µm wide, 110 – 160 µm long, median cells elongated polygonal, 16 – 29 × 30 – 50 µm, 1.1 – 2.1 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 17 – 22 × 26 – 42 µm, 1.4 – 1.9 as long as wide, cell walls thin, trigones lacking, cuticle smooth, leaf lobes 2 – 3, upright to bent inwards, 2.5 – 4.5 cells long, 2 – 5 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cells 16 – 24 × 25 – 50 µm, 1.5 – 2.1 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Underleaves** imbricate, transversely attached, appressed to the branch, underleaves square to rectangular, 75 – 110 µm wide, 90 – 145 µm long, 1.2 – 1.3 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 4 – 5 cells wide, 1.5 – 3.5 cells long, 65 – 105 µm wide, 50 – 95 µm long, median cells isodiametric to elongated polygonal, 17 – 25 × 22 – 33 µm, 1 – 1.6 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells isodiametric to elongated polygonal, 17 – 22 × 20 – 32 µm, 1 – 1.8 as long as wide, cell walls thickened, trigones small, cuticle smooth, leaf lobes 2, upright, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 15 – 16 × 30 – 37 µm, 2 – 2.5 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Sexuality** monoicous. **Perianth** originating ventrally from the main stem, 3 mm long, weakly narrowed towards the mouth, plicate in the upper third. **Perianth mouth** ciliate, mouth cells linear, 22 – 30 × 34 – 76 µm, 1.5 – 3.3 as long as wide, cell walls moderately

thickened, trigones small, cuticle smooth, median cells rectangular to elongated polygonal, 10 – 14 × 50 – 83 µm, 4.2 – 6.4 as long as wide, cell walls thin, trigones weakly enlarged, cuticle smooth. **Female bracts** ovate, not united, margin weakly dentate, ciliate at the apex, 570 – 590 µm wide, 840 – 1080 µm long, 1.5 – 1.8 as long as wide, median cells elongated polygonal to linear, 20 – 27 × 47 – 90 µm, 1.8 – 4.5 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal to linear, 20 – 42 × 56 – 80 µm, 1.3 – 3.9 as long as wide, leaf lobes 3 – 4, 3.5 – 10.5 cells long, 2 – 5 cells wide at base, multiseriate part 4 – 5 cells long, uniseriate part 2 – 8 cells long, cells elongated polygonal to linear, cells 13 – 20 × 34 – 94 µm, 2 – 6.3 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Female bracteole** ovate, margin weakly dentate, 390 µm wide, 490 µm long, 1.3 as long as wide, median cells elongated polygonal, 19 – 25 × 26 – 66 µm, 1.1 – 3.5 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal, 20 – 27 × 31 – 47 µm, 1.3 – 1.7 as long as wide, leaf lobes 3, 4.5 – 6.5 cells long, 3 – 4 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 3 cells long, cells elongated polygonal to linear, cells 12 – 23 × 26 – 39 µm, 1.1 – 3.3 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth.

Distinguishing characters:

N. bickeri is characterised by (1) hooked lobes of the stem and branch leaves, (2) the uniseriate lobes of the stem leaves, (3) the basal cells of the branch leaf disc that are hardly elongated, (4) the thin-walled cells, and (5) the small branch underleaves, which usually consist of eight or fewer cells. *N. bickeri* is one of the few species in which we could document a monoicous inflorescence.

The plants from Thailand, in particular, develop a higher branch leaf disc. Compared to the type material, it can be up to 8.5 cells high.

Similar species:

N. papulosa var. *uniseriata*, with likewise uniseriate stem leaf lobes, does not develop hooked branch leaf lobes. It also has larger branch underleaves and enlarged cells at the base of the branch leaf disc.

N. tenera with hooked leaf lobes is larger, more regularly branched, has much larger underleaves and does not show the tendency to develop secondary cell divisions in the branch leaf disc.

The leaves of *N. papulosa* var. *kalatunganensis* bear some resemblance to those of *N. bickeri*. However, its leaf lobes are not hooked, its branch leaf disc is ovate, the branch leaf disc cells are larger, and its branch leaf lobe cells are slightly constricted.

N. salasii also has similar leaves. However, these are concave and more obliquely attached, with strongly papillose cells.

Distribution:

Malaysia (Borneo, Malay Peninsula), Thailand.

Specimens studied:

[Malaysia]: Borneo, Sarawak, Dulit, under 300 m, on clay soil on crest of ridgge in primary forest, leg. P.W. RICHARDS 2356, 29 October 1932 (JE!, det. TH. HERZOG as *Lepidozia wallichiana*).

Malaysia: State Pahang, Frasers Hill, Primär-Regenwald am Bishopstrail, 1300 m, auf feuchten, morschen *Cyathea*-Stamm, leg. SCHÄFER-VERWIMP & VERWIMP 18645/B, 21 May 1997 (herbarium SCHÄFER-VERWIMP! 18645/B).

Thailand: Nakornsrithamarat, granitic massive Khao (Mt.) Luang. Evergreen forest near Camp II, 8° 30’ N, 99° 45’ E, 1000 m, on tree trunks, leg. A TOUW 11580, 4 February 1966 (Rijksherbarium Leiden, L4601350!, det. N. KITAGAWA as *Lepidozia papulosa*).

Etymology:

The species is dedicated to the late German bryologist ANTON BICKER (1907 – 1988), master carpenter and a self-taught scientist who introduced the second author to the world of bryophytes.

Neolepidozia cameronensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Malaysia: State Pahang, Cameron Highlands, Nebelwald im Gipfelbereich des Gunung Brinchang, 4° 31' 5.6" N, 101° 22' 57.6" E, 2000 m, an Baumbasis, leg. SCHÄFER-VERWIMP & VERWIMP 18705b, 22 May 1997 (herbarium SCHÄFER-VERWIMP 18705b!).

Figures:

Plate 32, Plate 33, Plate 34, Plate 35.

Comparison Plate 4 – C.

Description:

Plants pale yellowish green, small, up to 1.5 cm long, stem with leaves 0.35 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 2 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 2 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 80 µm wide and 60 µm high, cortical cells 7, 17 – 32 × 16 – 29 µm, cell walls moderately thickened, medullary cells up to 10, 9 – 15 × 9 – 16 µm, cell walls moderately thickened, trigones small, dorsal cortical cells elongated polygonal, 20 – 30 × 41 – 57 µm, 1.8 – 2.5 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Stem leaves** distant, longitudinally inserted, spreading at an angle of 60° – 85°, leaves square to trapezoid, symmetric to weakly asymmetric, flat, 175 – 190 µm wide, 150 – 220 µm long, 0.8 – 1.2 as long as wide, divided by 0.5 – 0.6 of the leaf length, margin entire, disc 6 cells wide, 1.5 – 2.5 cells long, 105 – 150 µm wide, 65 – 115 µm long, 0.5 – 0.9 as long as wide, median cells isodiametric polygonal, 24 – 38 × 27 – 37 µm, 0.8 – 1.2 as long as wide, cell walls thin, trigones lacking, cuticle sparsely with striate papillae, basal cells isodiametric to elongated polygonal, 28 – 38 × 35 – 50 µm, 1 – 1.8 as long as wide, leaf lobes 3, upright to divergent, 3.5 – 4.5 cells long, straight, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells ovate to elongated polygonal, not to weakly constricted at the transversal walls, 11 – 28 × 19 – 35 µm, 1.3 – 1.7 as long as wide, cell walls thin, trigones lacking, cuticle almost smooth, half stem leaf near branch base lanceolate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed, 0.4 – 0.7 times as wide as the stem, underleaves square to transversely rectangular, 75 – 110 µm wide, 65 – 95 µm long, 0.8 – 0.9 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 5 – 6 cells wide, 1.5 – 2.5 cells long, 60 – 90 µm wide, 35 – 55 µm long, 0.5 – 0.8 as long as wide, median cells isodiametric polygonal, 15 – 17 × 15 – 21 µm, 0.9 – 1.3 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 12 – 18 × 23 – 26 µm, 1.3 – 2.1 as long as wide, leaf lobes 3, upright to weakly divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 11 – 14 × 25 – 33 µm, 2.1 – 2.7 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 40° – 60°, leaves square to rectangular, symmetric, flat, 100 – 190 µm wide, 155 – 220 µm long, 1.2 – 1.7 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 4 – 6 cells wide, 2.5 cells long, 90 – 155 µm wide, 85 – 120 µm long, 0.7 – 1.2 as long as wide, median cells isodiametric polygonal, 27 – 36 × 30 – 39 µm, 1 – 1.4 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells isodiametric to elongated polygonal, 27 – 36 × 38 – 54 µm, 1.2 – 2 as long as wide, leaf lobes 2 (-3), upright to weakly divergent, 3.5 – 4.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 3 – 4 cells long, cells ovate to isodiametric polygonal, not or weakly constricted at the transversal walls, cells 14 – 30 × 22 – 33 µm, 1.1 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle almost smooth. **Branch underleaves** distant, transversely attached, upright, 0.7 – 0.8 times as wide as the branch, underleaves square to trapezoid, 40 – 50 µm wide, 40 – 50 µm long, 0.9 – 1.3 as long as wide, divided by 0.4 – 0.6 of the leaf length, disc 3 – 4 cells wide, 0.5 cells long, 30 – 45 µm wide, 20 – 25 µm long, 0.5 – 0.7 as long as wide, basal cells elongated polygonal, 13 – 15 × 21 – 26 µm, 1.4 – 2 as long as wide, leaf lobes 2, upright, 1.5 – 2.5 cells long, 1 – 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 10 – 15 × 19 – 25 µm, 1.5 – 2.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. cameronensis is characterised by (1) the bilobate leaves in the most part of the branch, (2) the short, isodiametric branch leaf cells, (3) the thin cell walls, and (4) the small branch underleaves.

Similar species:

N. ingekarolae is to a certain degree similar to *N. cameronensis*. However, the cells of its branch leaves are thick-walled, its branch leaf disc cells are less than 40 µm long and the sinus between its branch leaf lobes is narrow.

N. cuneifolia fo. *biloba* also develops bilobate branch leaves. The base of its branch leaf disc lobes are often wider than two cells and longer than in *N. cameronensis*.

While branches with bilobate leaves are highly distinctive, those with intermixed trilobate leaves bear some resemblance to *N. papulosa* var. *kalatunganensis*. Compared to *N. cameronensis*, the latter species has larger branch leaf disc cells, which are usually over 40 µm long, as well as longer branch leaves and thinner cell walls.

Distribution:

Malaysia (Malay Peninsula), Thailand.

Etymology:

The species is named after the Cameron Highlands where the species was discovered.

Specimen studied:

Thailand: Nakornsrithamarat, granitic massive Khao (Mt.) Luang. Sumit region, stunted mossy forest, 8° 30' N, 99° 45' E, 1740 m, on trees, leg. A TOUW 11808/B, 5 February 1966 (Rijksherbarium Leiden, L4601354!). The specimen includes two *Neolepidozia* species, *N. parvula* 11808/A and *N. cameronensis* which was separated as 11808/B.

Neolepidozia cuneifolia (STEPH.) FULFORD ET J. TAYLOR. *Brittonia* 11(2): 85. 1959.

≡ *Lepidozia cuneifolia* STEPH. Species Hepaticarum 3: 618. 1909.

≡ *Telaranea cuneifolia* (STEPH.) J.J. ENGEL & G.L. MERR. *Fieldiana: Botany, New Series* 44: 145. 2004.

Type:

Nova Guinea. leg. *Loria*. Herb. Levier. mixta c. *Lepidozia lawesii* (G 00069618, isotype JE 0401678!).

Figures:

PIIPPO (1984) Fig. 4 c, f, h, j (as *Lepidozia wallichiana*), STEPHANI (1985) Icones no. 5296, VON KONRAT et al. (2014) Figs. 2 and 3. Only PIIPPO (1984) and STEPHANI (1985) depict the type specimen. Illustrations that are not based on the type might show different species. STEPHANI (1985) Icones no. 5296 presents a part of a branch on the upper left with the comment "Gehört nicht hier her [does not belong here]". As the drawing of the branch fits very well with the branches of the type we assume that it was depicted from the genuine material.

Plate 37, Plate 38, Plate 39, Plate 40, Plate 41.

Comparison Plate 3 – H.

Description (from JE 0401678, isotype):

Plants pale yellowish green, medium sized, up to 3 cm long, stem with leaves 0.8 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 6 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 180 µm wide and 130 µm high, cortical cells 12, 28 – 50 × 14 – 25 µm, cell walls thickened, medullary cells 40 – 46, 10 – 21 × 9 – 23 µm, cell walls thin to thickened, trigones small to enlarged, dorsal cortical cells rectangular to elongated polygonal, 32 – 50 × 43 – 70 µm, 0.9 – 1.8 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Stem leaves** distant, longitudinally inserted, spreading at an angle of 60° – 90°, leaves square, weakly to markedly asymmetric, flat, 280 – 410 µm wide, 260 – 340 µm long, 0.8 – 1.1 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 4.5 cells long, 190 – 240 µm wide, 110 – 190 µm long, 0.5 – 1 as long as wide, median cells isodiametric polygonal to short rectangular, 18 – 38 × 29 – 41 µm, 0.9 – 2.1 as long as wide, cell walls thin to weakly thickened, trigones small, cuticle occasionally with striate papillae, basal cells elongated polygonal, 22 – 38 × 39 – 49 µm, 1.2 – 2 as long as wide, leaf lobes 4, upright to divergent, 4.5 – 5.5 cells long, weakly falcate, 2 – 3 cells wide at base, multiseriate part 2 cells long, uniseriate part 3 – 4 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 16 – 32 × 22 – 27 µm, 0.8 – 1.4 as long as wide, cell walls thin to weakly thickened, trigones small, cuticle with round to elliptical papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 0.9 – 1.1 times as wide as the stem, underleaves transversely rectangular, 160 – 220 µm wide, 140 – 160 µm long, 0.7 – 0.9 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 8 cells wide, 2.5 – 3.5 cells long, 150 – 170 µm wide, 70 – 120 µm long, 0.4 – 0.8 as long as wide, median cells short rectangular to elongated polygonal, 20 – 24 × 25 – 33 µm, 1.1 – 1.4 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 17 – 23 × 28 – 39 µm, 1.2 – 2.1 as long as wide, leaf lobes 4, upright to weakly divergent, 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 15 – 20 × 12 – 31 µm, 0.8 – 1.6 as long as wide, cell walls thickened, trigones small, cuticle smooth.

Branch leaves approximate, longitudinally inserted, spreading at an angle of 60° -70°, leaves rectangular to trapezoid, asymmetric, flat, 180 – 220 µm wide, 280 – 390 µm long, 1.3 – 2 as long as wide, divided by 0.3 – 0.5 of the leaf length, divided by 0.3 – 0.4 on the ventral side, margin entire, disc 6 – 8 cells wide, 5.5 – 7.5 cells long, 110 – 200 µm wide, 140 – 220 µm long, 0.9 – 2 as long as wide, median cells square to elongated polygonal, 20 – 30 × 20 – 41 µm, 0.8 – 1.8 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to striate papillae, basal cells hexagonal to elongated polygonal, 20 – 30 × 21 – 46 µm, 1.1 – 1.5 as long as wide, leaf lobes 3, upright to weakly divergent, 3.5 – 6.5 cells long, (2-) 3 – 4 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 4 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, cells 15 – 28 × 18 – 32 µm, 1.1 – 1.3 as long as wide, cell walls thin to weakly thickened, trigones small, cuticle with round to elliptical papillae. **Branch underleaves** distant, transversely attached, appressed, 0.8 – 1.2 times as wide as the branch, underleaves square to rectangular, 70 – 95 µm wide, 70 – 110 µm long, 0.9 – 1.2 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 4 – 5 cells wide, 1 – 2.5 cells long, 65 – 85 µm wide, 35 – 65 µm long, 0.5 – 0.9 as long as wide, median cells polygonal, 17 – 25 × 18 – 34 µm, 0.8 – 1.9 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells rectangular to elongated polygonal, in particular in the central part, 16 – 25 × 24 – 37 µm, 1.1 – 2.1 as long as wide, leaf lobes 2, weakly divergent, 1.5 – 2.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 11 – 20 × 15 – 27 µm, 1.1 – 1.8 as long as wide, cell walls thickened, trigones small, cuticle smooth.

Distinguishing characters:

The species is characterised by (1) by the small, distant branch underleaves that are smaller than or barely wider than the stem and consist of fewer than 12 cells, (2) the secondary cell divisions in the branch leaf disc that lead to an irregular cell pattern, (3) a branch leaf disc that is six to eight cells wide, and (4) the branch leaves that are divided by more than a quarter of the leaf length at the ventral side.

Similar species:

Besides *N. wallichiana*, a significant proportion of the specimens in JE were identified as *N. cuneifolia*. Based on our understanding of this species, it is quite rare in the region, so most of the previous identifications had to be revised. Only a few other species with asymmetric branch leaves could be mistaken as *N. cuneifolia.*

N. cuneifolia var. *luxurians* shares many characteristics with *N. cuneifolia*, but it is a larger plant with branch leaves that are divided only up to $^1/_4$ of the leaf length and a branch leaf disc that is up to 12 cells wide. Based on the available material it seems that there is a gradual transition between these forms. It is not always possible to place a specimen to one or the other form with certainty.

N. kolombangaraensis, also bears some resemblance to *N. cuneifolia*, but it has a shorter, somewhat trapezoidal branch leaf disc and larger, more approximate branch underleaves.

N. zantenii also has asymmetric leaves and thin-walled cells, as well as rather small branch underleaves. However, its branch leaves are larger and less asymmetric than those of *N. cuneifolia*, and the branch leaf disc cells are much longer than 40 µm.

N. variifolia is of similar size, but has larger branch underleaves that are wider than the branch and often more thickened cell walls.

Weakly developed plants of *N. cuneifolia* only develop rather symmetric branch leaves. These resemble the leaves of *N. papulosa* to a certain degree. However, there are at least a few branch leaves that suggest a closer relationship with *N. cuneifolia*.

Distribution:

Papua New Guinea (New Britain, New Guinea), Philippines (Leyte).

As mentioned above, *N. cuneifolia* appears to be quite rare. As records in the literature are often questionable, the distribution mentioned is based on the specimens we have studied.

Specimens studied:

[Papua New Guinea]: Neuguinea, leg. LORIA (JE 0401677!, aus der HERZOG-Glyzerin-Präp.-Sammlung herbarisiert von GROLLE 1965).

[Papua New Guinea]: SO - Neuguinea, Moroka, 1300 m, leg. LORIA, det. STEPHANI (JE 0401678!, JE-H1251 ex FI, isotype, det. R. GROLLE 1974 as *Lepidozia wallichiana*).

Papua New Guinea: New Britain, Epap River, Nakanai Mountains, 45 km SE of Hoskins, 5° 45' S, 150° 44' E, 300 m, on river flats dominated by *Dillenia*, *Pometia* and *Syzygium*, leg. H. STREIMANN 40708, 20 February 1989 (JE!, det. R. GROLLE 1992 as *Lepidozia wallichiana*, duplicate: CANB).

Papua New Guinea: New Britain, Nakanai Mountains, 5° 45' S, 150° 46' E, 520 m, on main ridge dominated by *Castanopsis* and *Calophyllum*, on tree trunk, leg. H. STREIMANN 40537, 19 February 1989 (JE! det. R. GROLLE 1992 as *Lepidozia wallichiana*, duplicates: CANB, H, LAE, NICH).

Philippines: Leyte Island, Leyte Province, Area around Lake Kasudsuran, Ormoc-City, Barangay Liberty, 11° 1' 32.33" N, 124° 44' 55.86" E, 720 m, auf morschem Holz, leg. FELIX SCHUMM & UWE SCHWARZ, 23 August 2000, with *Arthrocormus schimperi, Bazzania vittata, Heteroscyphus coalitus* and *Zoopsis liukiuensis* (herbarium UWE SCHWARZ No. 6410!).

Philippines: Leyte Island, Leyte Province, Area around Lake Kasudsuran, Ormoc-City, Barangay Liberty, 11° 1' 32.33" N, 124° 44' 55.86" E, auf Rinde, 720 m, leg. FELIX SCHUMM & UWE SCHWARZ, 23 August 2000 (herbarium UWE SCHWARZ No. 6465a!).

Remark:

According to GROLLE & PIIPPO (1984*) Lepidozia cuneifolia* was synonymized with *Lepidozia wallichiana* by INOUE (1979) leading to a situation that the former species was not further recognized. ENGEL & MERRILL (2004) treated *Telaranea cuneifolia* as a distinct species again leading to several new records in the region.

N. cuneifolia, as it is understood in this article, seems to appear only in South East Asia. Records from other areas belong to different species. The plants from Fiji depicted in VON KONRAT et al. (2014) Fig. 2 & 3 show rather long cells of the branch leaf lobes as it is typical for *N. augustana*. If the Fiji plants belong to this or even to another species has to be verified.

NADHIFAH, ADJIE & BUDKE in ELLIS ET AL. (2024) reported that *N. cuneifolia* occurs in the Solomon Islands. Due to the proximity of the collection site to that of the holotype of *N. kolombangaraensis*, it is very likely that the specimen belongs to *N. kolombangaraensis* as well.

Neolepidozia cuneifolia fo. *biloba* (HERZOG) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*

Basionym:

≡ *Lepidozia biloba* HERZOG. *Annales Bryologici* 4: 83. 1931.

Type:

Philippines: [Luzon Island, Laguna Province], Mt. Makiling, [14° 8' 7" N, 122° 11' 35" E], auf faulem Holz, leg. BAKER 7020, 19 January 1914 (holotype JE 04010503!). There are two specimens labelled BAKER 7020 in JE, one collected on January 11, 1914 and the other on January 19, 1914. As HERZOG (1931) mentions the collection date as 19.I.14 in his original description and the specimen includes plants that he separated there is no doubt about the identity of the holotype.

Figures:

HERZOG (1931) fig. 1 a-b.

Plate 43, Plate 44, Plate 45, Plate 46, Plate 47 (from BAKER 7020, JE 04010503 – holotype of *Lepidozia biloba*).

Plate 48 (from BAKER 7020a, JE 04010502).

Comparison Plate 2 – P, Comparison Plate 3 – I, Comparison Plate 4 – A.

Description

Plants pale yellowish green, small, up to 5 mm long, stem with leaves 0.4 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 2 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 2 mm long. **Rhizoids** not seen. **Stem** in cross section 75 µm wide and 50 µm high, cortical cells 7, 22 – 30 × 12 – 24 µm, cell walls thickened, medullary cells up to 10, 12 – 15 × 9 – 13 µm, cell walls moderately thickened, trigones moderately enlarged, dorsal cortical cells elongated polygonal, 20 – 26 × 36 – 56 µm, 1.8 – 2.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** distant, longitudinally inserted, spreading at an angle of 50° – 80°,

leaves rectangular to trapezoid, symmetric, flat, 115 – 155 µm wide, 135 – 170 µm long, 1 – 1.4 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 cells wide, 2.5 – 3.5 cells long, 65 – 120 µm wide, 70 – 90 µm long, 0.7 – 1.1 as long as wide, median cells isodiametric polygonal to short rectangular, 16 – 20 × 22 – 26 µm, 1.2 – 1.4 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 14 – 20 × 27 – 29 µm, 1.5 – 2 as long as wide, leaf lobes (2-) 3, divergent, 3.5 – 4.5 cells long, straight, 2 (-3) cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 13 – 17 × 15 – 28 µm, 1.2 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth, half stem leaf near branch base lanceolate, not divided, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed, 0.7 – 1 times as wide as the stem, underleaves square to trapezoid, 55 – 105 µm wide, 55 – 120 µm long, 0.9 – 1.3 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 4 – 6 cells wide, 0.5 – 3.5 cells long, 35 – 105 µm wide, 35 – 90 µm long, 0.7 – 1.4 as long as wide, median cells isodiametric polygonal, 12 – 18 × 16 – 36 µm, 1.1 – 2.3 as long as wide, cell walls thin, trigones small, cuticle smooth, basal cells elongated polygonal, 12 – 18 × 20 – 36 µm, 1.3 – 2.6 as long as wide, leaf lobes 2 – 3, upright to divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 10 – 17 × 16 – 22 µm, 1.3 – 2 as long as wide, cell walls thin, trigones small, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 50° – 80°, leaves ovate, rectangular to trapezoid, symmetric to asymmetric, flat, 90 – 165 µm wide, 190 – 270 µm long, 1.5 – 2.2 as long as wide, divided by 0.3 – 0.5 of the leaf length, margin entire, disc 4 – 7 cells wide, 2.5 – 5.5 cells long, 55 – 150 µm wide, 100 – 175 µm long, 0.8 – 1.9 as long as wide, median cells isodiametric polygonal, 18 – 26 × 18 – 34 µm, 1 – 1.4 as long as wide, cell walls thin, trigones lacking, cuticle occasionally with striate papillae, basal cells elongated polygonal, 16 – 25 × 22 – 36 µm, 1 – 2 as long as wide, leaf lobes 2 – 3, upright to divergent, 3.5 – 5.5 cells long, 2 – 3 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 2 – 3 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, cells 14 – 18 × 17 – 26 µm, 1.1 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle with round to elliptical papillae. **Branch underleaves** distant, transversely attached, appressed, 0.6 – 1.3 times as wide as the branch, underleaves square to trapezoid, 55 – 70 µm wide, 55 – 105 µm long, 0.9 – 1.5 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 cells wide, 0.5 – 1.5 cells long, 40 – 60 µm wide, 25 – 60 µm long, 0.5 – 1.2 as long as wide, median cells isodiametric polygonal, 17 × 24 µm, 1.4 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 16 – 20 × 20 – 42 µm, 1.3 – 2.3 as long as wide, leaf lobes 2, upright to divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 cells long, cells 13 – 16 × 18 – 27 µm, 1.4 – 1.8 as long as wide, cell walls thin, trigones lacking, cuticle smooth.

Distinguishing characters:

N. cuneifolia fo. *biloba* is characterised by (1) its small size, (2) trilobate stem leaves that are sometimes only bilobate, (3) mostly bilobate branch leaves when weakly developed, and (4) the asymmetric trilobate branch leaves in better-developed plants.

Similar species:

The holotype of *N. cuneifolia* fo. *biloba* is unique, with its branch leaves being mostly bilobate and often asymmetric.

Other species with bilobate branch leaves, such as (*N. ingekarolae* and *N. cameronensis*, have symmetrical branch leaves. Furthermore, the former has thickened cell walls, whereas the latt4er does not demonstrate branch leaf lobes wider than two cells at the base.

Better-developed plants (JE 04010502) produce trilobate leaves as well as bilobate leaves, which resemble those of of *N. cuneifolia*. The very thin cell walls and well-developed branch underleaves, which are wider than the branch, distinguish *N. cuneifolia* fo. *biloba* from that species. Having observed similar, weakly developed *N. cuneifolia* plants, particularly in the Philippines, we do not believe that recognising this form as a species is justified.

Distribution:

Philippines (Luzon).

Specimen studied:

Philippines: [Luzon Island, Laguna Province], Mt. Makiling, [14° 8' 7" N, 122° 11' 35" E, on bark], leg. BAKER 7020, 11 January 1914 (JE 04010502!, paratype).

Neolepidozia cuneifolia var. *luxurians* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*

Holotype:

Papua New Guinea: New Guinea, West Sepik Province, Frieda River prospecting area of Frieda Copper Co. Along trail in second growth tropical rainforest, 0.5 km SWW of Frieda Base Camp, 4° 42' S, 141° 47' E, collection site no. 8c, 500 m, on boulder, leg. TIMO KOPONEN 35359, 4 August 1981 (JE!, det. S. PIIPPO as *Lepidozia wallichiana*, duplicate: H).

Figures:

Plate 49, Plate 50, Plate 51, Plate 52, Plate 53 (from KOPONEN 35359 – holotype).

Plate 55, Plate 56, Plate 57, Plate 58, Plate 59, Plate 60 (from WINKLER 3094).

Comparison Plate 3 – G.

Description

Plants pale yellowish green, medium sized, up to 3 cm long, stem with leaves 0.85 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 4 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 10 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 260 µm wide and 160 µm high, cortical cells 12, 45 – 63 × 15 – 38 µm, cell walls thickened, medullary cells up to 80, 12 – 30 × 9 – 14 µm, cell walls thin, trigones small, dorsal cortical cells square to elongated polygonal, 38 – 45 × 39 – 70 µm, 0.9 – 1.7 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Stem leaves** distant, longitudinally inserted, spreading at an angle of 40° – 80°, leaves square, symmetric to weakly asymmetric, flat, 260 – 370 µm wide, 300 – 380 µm long, 1 – 1.5 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 8 – 12 cells wide, 4.5 – 5.5 cells long, 180 – 240 µm wide, 170 – 230 µm long, 0.8 – 1 as long as wide, median cells isodiametric polygonal to short rectangular, 26 – 40 × 32 – 43 µm, 1.1 – 1.2 as long as wide, cell walls thin, trigones lacking, cuticle with striate papillae, basal cells hexagonal to elongated polygonal, 20 – 28 × 35 – 50 µm, 1.4 – 1.9 as long as wide, leaf lobes 4 (- 6), upright to divergent, 4.5 – 5.5 cells long, straight, 2 – 4 cells wide at base, multiseriate part 2 cells long, uniseriate part 3 – 4 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 16 – 30 × 35 – 39 µm, 1.3 – 2.4 as long as wide, cell walls thin, trigones lacking, cuticle with elliptical papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 0.8 – 1 times as wide as the stem, underleaves transversely rectangular, 180 – 230 µm wide, 170 – 200 µm long, 0.8 – 0.9 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 8 cells wide, 2.5 – 3.5 cells long, 160 – 200 µm wide, 110 – 150 µm long, 0.6 – 0.8 as long as wide, median cells polygonal to rectangular, 18 – 28 × 24 – 38 µm, 1 – 1.7 as long as wide, cell walls weakly thickened, trigones small, cuticle smooth, basal cells elongated polygonal to rectangular, 18 – 30 × 33 – 42 µm, 1.4 – 1.8 as long as wide, leaf lobes 4, upright to weakly divergent, 2.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 3 cells long, cells 18 – 21 × 17 – 22 µm, 0.9 – 1.1 as long as wide, cell walls weakly thickened, trigones small, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves ovate to rectangular, asymmetric, flat, 240 – 350 µm wide, 480 – 580 µm long, 1.7 – 2.2 as long as wide, divided by 0.2 – 0.5 of the leaf length, divided by 0.2 – 0.3 on the ventral side, margin entire, disc 6 – 12 cells wide, 5.5 – 9.5 cells long, 120 – 280 µm wide, 250 – 420 µm long, 1 – 2.9 as long as wide, median cells isodiametric to elongated polygonal, 20 – 38 × 26 – 55 µm, 0.9 – 2.1 as long as wide, cell walls thin, trigones lacking, cuticle occasionally with striate papillae, basal cells elongated polygonal, 23 – 42 × 41 – 50 µm, 1.2 – 1.9 as long as wide, leaf lobes 3 – 4, upright, 4.5 – 6.5 cells long, 3 – 4 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, cells 20 – 26 × 26 – 33 µm, 1 – 1.5 as long as wide, cell walls thin, trigones lacking, cuticle with round to elliptical papillae. **Branch underleaves** distant, transversely attached, appressed, 1 – 1.3 times as wide as the branch, underleaves square to rectangular, 110 – 150 µm wide, 120 – 160 µm long, 0.8 – 1.5 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 4 – 6 cells wide, 1.5 – 2.5 cells long, 85 – 140 µm wide, 60 – 100 µm long, 0.4 – 1.1 as long as wide, median cells square to polygonal, 22 – 28 × 22 – 30 µm, 0.9 – 1.4 as long as wide, cell walls weakly thickened, trigones lacking, cuticle smooth, basal cells square, rectangular to elongated polygonal, 20 – 30 × 35 – 55 µm, 1.3 – 2 as long as wide, leaf lobes 2 – 3, upright to weakly divergent, 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 1 – 2 cells long, cells 15 – 30 × 21 – 34 µm, 1.1 – 1.4 as long as wide, cell walls weakly thickened, trigones lacking, cuticle smooth.

Distinguishing characters:

When well-developed, *N. cuneifolia* var. *luxurians* is a rather distinct form. The (1) large, up to 0.6 mm long branch leaves, (2) the up to 12 cells wide branch leaf disc, (3) the small and distant branch underleaves, and (4) the branch leaves that are divided up to $^1/_3$ of the leaf length on the ventral side are very characteristic.

Similar species:

In some cases, *N. cuneifolia* var. *luxurians* resembles *N. augustana*. However, the latter species has a branch leaf disc that is only up to eight cells wide, which leads to a rather regular cell pattern and larger branch underleaves.

This variety can also be confused with *N. cuneifolia* which is smaller in all parts. As intermediate forms exist it is not always possible to assign a specimen to one or the other form with certainty.

Distribution:

Indonesia (Borneo), Malaysia (Borneo), Papua New Guinea (New Guinea).

Specimens studied:

[Indonesia]: Fl. v. Borneo, Koeala-Koeroen, leg. H. LAMPMANN 1924 mit R. WEGNER, I 1925, (JE!, det.TH. HERZOG as *Lepidozia wallichiana*, rev.TH. HERZOG as *Lepidozia variifolia* - *wallichiana* stroke out).

[Malaysia]: Borneo, Sarawak, Mount Dulit, on shaded sandstone boulder in torrent, leg. P.W. RICHARDS 2607, 17 August 1932 (JE!, det. TH. HERZOG as *Lepidozia wallichiana*).

[Malaysia]: Borneo, Sarawak, Mount Dulit, on shaded sandstone boulder in torrent, leg. P.W. RICHARDS 2607a, 17 August 1932 (JE!, det. TH. HERZOG as *Lepidozia wallichiana*). Remark by R. GROLLE 1980: "aus Glyzerinpräparat herbarisiert durch GROLLE 1980". Specimen renamed to 2607a since Richards 2607 already exists.

[Malaysia]: West Borneo, auf dem Bukit Lubang Temarni, 300 - 500 m, leg. HANS WINKLER 3094, 5 December 1924 (JE!, det. TH. HERZOG as *Lepidozia cuneifolia* ?, rev. M. MIZUTANI 1976 as *Lepidozia wallichiana*).

[Malaysia]: West Borneo, auf dem Bukit Lubang Temaru i, 300 - 500 m, leg. HANS WINKLER 3094a, 1924 (JE! det. TH. HERZOG as *Lepidozia cuneifolia*, renamed to 3094a as the specimen WINKLER 3094 already exists).

Papua New Guinea: New Guinea, Milne Bay District, North slopes of Mt. Dayman, Maneau Range, rain forest, 700 m, log in rain forest, leg. L.J. BRASS 22182, 1953 (JE!, det. R. GROLLE 1969 as *Lepidozia cuneifolia*, rev. M. MIZUTANI 1976 as *Lepidozia wallichiana*).

Papua New Guinea: New Guinea, West Sepik Province, Frieda River prospecting area of Frieda Copper Co., 0.5 km N of Frieda Base Camp, 4° 42' S, 141° 47' E, 400 m, in tropical rainforest along Peache Creek, collection site no. 8f, on cliff, leg. TIMO KOPONEN 35990, 8 August 1981 (JE! det. S. PIIPPO as *Lepidozia wallichiana*, duplicate: H).

Etymology:

The name of the variety reflects the luxurious appearance compared to *N. cuneifolia*.

Neolepidozia dinagatensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Philippines: Dinagat Island, Dinagat Island Province, Off of the 10 km road on the summit ridge of Mt. Redondo accessed from Loreto, Barangay Esparanza. on trail on east side the summit ridge, 10° 21' 14.7" N, 125° 38' 30.3" E, 840 m, Bonsai mixed hardwood forest, on hardwood trunk in filtered light, leg. JAMES R. SHEVOCK 63846A with GIO VINCENT BALANSAG & AIMANUELZON P. YORONG, 22 June 2024 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, BUKH, CAS, CMUH, MO, PNH).

Figures:

Plate 61, Plate 62, Plate 63, Plate 64, Plate 65.

Comparison Plate 2 – G.

Description:

Plants pale yellowish green, small, up to 1.5 cm long, stem with leaves 1.1 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparse, up to 3 mm long. **Rhizoids** not seen. **Stem** in cross section 190 µm wide and 140 µm high, cortical cells 9, 35 – 54 × 25 – 42 µm, cell walls thickened, medullary cells 20, 16 – 27 × 9 – 20 µm, cell walls moderately thickened, trigones moderately enlarged, dorsal cortical cells square to elongated polygonal, 56 – 62 × 54 – 100 µm, 0.9 – 1.7 as long as wide, cell walls thickened, trigones moderately enlarged, cuticle smooth. **Stem leaves** distant, longitudinally inserted, spreading at an angle of 60° – 90°, leaves rectangular, symmetric, flat, 240 – 340 µm wide, 360 – 510 µm long, 1.2 – 2

as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 – 8 cells wide, 2.5 – 4.5 cells long, 180 – 250 µm wide, 180 – 300 µm long, 0.9 – 1.6 as long as wide, median cells elongated polygonal to rectangular, 38 – 44 × 55 – 65 µm, 1.4 – 1.7 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal to rectangular, 33 – 52 × 77 – 95 µm, 1.5 – 2.9 as long as wide, leaf lobes 3 – 4, upright to weakly divergent, 3.5 – 4.5 cells long, straight to weakly falcate, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 3 – 4 cells long, cells elongated polygonal to rectangular, not constricted at the transversal walls, 15 – 24 × 44 – 56 µm, 2.3 – 3.4 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, half stem leaf near branch base lanceolate, not divided, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed to spreading away from the stem, 1 – 1.4 times as wide as the stem, underleaves elongated or transversely rectangular to trapezoid, 150 – 330 µm wide, 190 – 230 µm long, 0.6 – 1.5 as long as wide, divided by 0.3 – 0.6 of the leaf length, disc 6 – 8 cells wide, 1.5 – 2.5 cells long, 130 – 204 µm wide, 90 – 160 µm long, 0.4 – 1.2 as long as wide, median cells rectangular to elongated polygonal, 25 – 35 × 36 – 41 µm, 1.1 – 1.6 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells elongated polygonal to rectangular, 22 – 30 × 66 – 95 µm, 2.3 – 3.5 as long as wide, leaf lobes 3 – 4, upright to divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 18 – 23 × 34 – 52 µm, 1.5 – 2.6 as long as wide, cell walls thickened, trigones lacking, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 70° – 80°, leaves rectangular, symmetric, flat, 160 – 290 µm wide, 480 – 590 µm long, 1.7 – 3.4 as long as wide, divided by 0.3 – 0.4 of the leaf length, margin entire, disc 4 – 7 cells wide, 3.5 – 5.5 cells long, 150 – 220 µm wide, 290 – 400 µm long, 1.5 – 2.5 as long as wide, median cells square, hexagonal to short rectangular, 38 – 53 × 52 – 75 µm, 1.2 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 28 – 44 × 68 – 106 µm, 1.9 – 3 as long as wide, leaf lobes 2 – 3, upright, 2.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, cells 18 – 29 × 52 – 63 µm, 2 – 3.4 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch underleaves** distant, transversely attached, upright to spreading, 0.9 – 1.4 times as wide as the branch, underleaves square to elongated trapezoid, 90 – 115 µm wide, 90 – 105 µm long, 0.9 – 1.1 as long as wide, divided by 0.5 – 0.6 of the leaf length, disc 4 cells wide, 0.5 cells long, 70 – 100 µm wide, 45 – 55 µm long, 0.5 – 0.7 as long as wide, basal cells elongated polygonal, 19 – 28 × 42 – 68 µm, 1.8 – 2.6 as long as wide, leaf lobes 2, upright to weakly divergent, 1,5 – 2,5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 cells long, cells 16 – 21 × 33 – 53 µm, 1.7 – 2.5 as long as wide, cell walls thickened, trigones lacking, cuticle smooth.

Distinguishing characters:

The species is characterized by the (1) setaceous stem and branch leaf lobes that are uniseriate except the basal cell row, (2) the flat habitus of the branches with branch leaves spreading up to 90°, (3) the elongated cells of the stem leaf disc, (4) the small branch underleaves, (5) the lanceolate reduced stem leaf near the branch insertion, and (6) the smooth cuticle.

Similar species:

N. dinagatensis strongly resembles *N. dulitensis*. However, the latter species is a smaller plant with branch leaves that are only up to 400 µm long, and stem leaves with isodiametric disc cells that do not exceed 35 µm.

There is also some resemblance to *N. papulosa* var. *uniseriata* which likewise has smaller branch leaves. Its branch leaves are slightly obliquely attached, giving the plants a less flat appearance.

Like *N. dinagatensis*, *N. sarawakensis* is a rather large plant with obliquely inserted leaves and biseriate branch leaf lobes at the base and falcate stem leaf lobes.

The isotype of *N. wallichiana* has branch leaves with uniseriate lobes. These branch leaves spread at an angle of less than 90° and are inserted less obliquely. Drawings of *N. wallichiana* demonstrate that the lobes of the branch leaves are usually biseriate at the base.

Distribution:

Philippines (Dinagat Island). Only known from the type location.

Etymology:

The species is named after Dinagat Island where the species was discovered.

Remark:

The holotype consists of only a few, isolated stems, as *N. dulitensis* grows intermixed between other bryophytes not creating well defined cushions.

Neolepidozia dulitensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

[Malaysia]: Sarawak, Dulit Ridge, on tree trunk in moss-forest, ca. 1230 m, leg. P.W. RICHARDS 1974a, 19 September 1932 (JE0401704!, M. MIZUTANI July 1976 "Syntype of *Lepidozia wallichiana* var. *remotifolia* Herz. 1949, = *Lepidozia ophiria* STEPH."). The specimen consists of 2 species, primarily *Neolepidozia sarawakensis* var. *grandistipula* (1974b) and a few stems of *Neolepidozia dulitensis* (1974a). MIZUTANIs remark refers to the separated stems of *Neolepidozia dulitensis* that he mistakenly considered to be *N. ophiria*.

Figures:

Plate 67, Plate 68, Plate 69, Plate 70, Plate 71, Plate 72.

Comparison Plate 2 – E.

Description

Plants brownish (yellowish green on specimen label), medium sized, up to 3 cm long, stem with leaves 0.7 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type, female branches ventral-intercalar. **Branches** up to 3 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparse, up to 5 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 160 µm wide and 130 µm high, cortical cells 12, 25 – 35 × 16 – 33 µm, cell walls thickened, medullary cells up to 40, 9 – 19 × 7 – 18 µm, cell walls moderately thickened, trigones moderately enlarged, dorsal cortical cells square to elongated polygonal, 38 – 45 × 48 – 72 µm, 1.3 – 1.9 as long as wide, cell walls thickened, trigones moderately enlarged, cuticle smooth. **Stem leaves** distant, obliquely inserted, spreading at an angle of 45° – 70°, leaves square to rectangular, weakly asymmetric, flat, 240 – 370 µm wide, 280 – 310 µm long, 0.8 – 1.3 as long as wide, divided by 0.5 – 0.6 of the leaf length, margin entire, disc 6 – 8 cells wide, 2.5 – 3.5 cells long, 150 – 210 µm wide, 110 – 140 µm long, 0.6 – 0.9 as long as wide, median cells isodiametric polygonal, 24 – 29 × 28 – 34 µm, 1.1 – 1.3 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells ovate to elongated polygonal, 21 – 35 × 32 – 38 µm, 1.1 – 1.6 as long as wide, leaf lobes 3 – 4, upright to divergent, 5.5 cells long, falcate, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 5 cells long, cells elongated polygonal to rectangular, not constricted at the transversal walls, 18 – 22 × 31 – 38 µm, 1.5 – 1.9 as long as wide, cell walls thickened, trigones lacking, cuticle smooth, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 0.9 – 1.3 times as wide as the stem, underleaves elongated or transversely rectangular to trapezoid, 165 – 200 µm wide, 165 – 205 µm long, 0.8 – 1.2 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 6 – 8 cells wide, 2.5 cells long, 120 – 170 µm wide, 80 – 105 µm long, 0.5 – 0.8 as long as wide, median cells isodiametric polygonal, 20 – 27 × 27 – 33 µm, 1.2 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal to rectangular, 19 – 22 × 36 – 48 µm, 1.9 – 2.3 as long as wide, leaf lobes 3 – 4, upright to weakly divergent, 2.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 – 3 cells long, cells 16 – 22 × 36 – 49 µm, 1.8 – 2.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 40° – 70°, leaves elongated rectangular, symmetric, flat, 110 – 180 µm wide, 380 – 410 µm long, 2.1 – 3.7 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 4 – 6 cells wide, 3.5 – 5.5 cells long, 110 – 160 µm wide, 190 – 220 µm long, 1.2 – 1.9 as long as wide, median cells elongated polygonal, 28 – 32 × 32 – 45 µm, 1 – 1.5 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal, 29 – 33 × 45 – 60 µm, 1.5 – 2 as long as wide, leaf lobes 2 – 3, upright, 5.5 – 6.5 cells long, 2 cells wide at base, multiseriate part 1 (-2) cells long, uniseriate part 5 – 6 cells long, cells rectangular, not constricted at the transversal walls, cells 18 – 24 × 26 – 38 µm, 1.1 – 1.7 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Branch underleaves** distant, transversely attached, upright to spreading, 1.1 – 1.5 times as wide as the branch, underleaves square, rectangular to trapezoid, 75 – 115 µm wide, 95 – 120 µm long, 0.8 – 1.6 as long as wide, divided by 0.5 – 0.6 of the leaf length, disc 4 cells wide, 0.5 – 1.5 cells long, 60 – 75 µm wide, 35 – 55 µm long, 0.5 – 0.8 as long as wide, basal cells elongated polygonal, 18 – 20 × 28 – 32 µm, 1.6 – 1.7 as long as wide, leaf lobes 2, upright to divergent, 2,5 – 3,5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 – 3 cells long, cells 13 – 19 × 18 – 30 µm, 1 – 2.3 as long as wide, cell walls thickened, trigones lacking, cuticle smooth. **Female inflorescence** originating ventrally from the main stem, 0.7 mm long, 0.9 mm wide, densely leaved. **Female bracts** appressed, ovate, 4-lobate, margin dentate, 340 – 430 µm wide, 420 – 620 µm long, 1.2 – 1.4 as long as wide, median cells ovate to elongated polygonal, 21 – 37 × 36 – 69 µm, 1.7 – 2.5 as long as wide, cell walls thin, trigones small, cuticle smooth. **Female bracteole** rectangular, deeply 3-lobate, lobes up to 7 cells long, margin dentate, 260 µm wide, 530 µm long, 2 times as long as wide, cell walls thin, trigones lacking, cuticle smooth.

Distinguishing characters:

The species is characterized by the (1) setaceous stem and branch leaf lobes that are uniseriate except the basal cell row, (2) 2.5 – 3.5 cells high stem leaf disc, (3) the flat habitus of the branches with branch leaves spreading more than 45°, (3) isodiametric hexagonal stem leaf disc, (4) the small branch underleaves, the (5) the smooth cuticle, and (6) the often falcate stem leaf lobes.

Similar species:

N. dulitensis is closely related to *Neolepidozia dinagatensis*, a larger plant with branch leaves measuring over 400 µm in length. Furthermore, the stem leaf disc consists of rectangular cells measuring more than 50 µm in length.

Compared to other species with setaceous leaves, i.e. *N. katrinae, N. ophiria,* and *N. richardsii* the habitus is not *Kurzia*-like and the branch leaves are more spreading.

N. dulitensis also resembles *N. papulosa* var. *uniseriata* which likewise has slightly obliquely attached branch leaves, giving the plants a less flat appearance.

Distribution:

Malaysia (Borneo).

Etymology:

The species is named after the Dulit Ridge where the species was discovered.

Specimens studied:

[Malaysia]: Borneo, Sarawak, Dulit Ridge, ca. 1230 m, on the trunks in moss forest, leg. P.W. RICHARDS 1949, 19 August 1932 (JE!, det. TH. HERZOG as *Lepidozia wallichiana*).

[Malaysia]: Borneo, Sarawak, Dulit Ridge, ca. 1230 m, trunk of small tree in moss-forest, leg. P.W. RICHARDS 1969b, 19 September 1932 (JE! det. TH. HERZOG as *Lepidozia wallichiana*). The specimen comprises two species, *Neolepidozia tenera* (1969a), and *N. dulitensis* (1969b).

Remark:

MIZUTANIs conclusion that *Lepidozia wallichiana* var. *remotifolia* (≡ *Neolepidozia sarawakensis*) is identical to *Lepidozia ophira* is most likely based on the fact, that he did not distinguish the two species in the type specimen. The plants he separated and named as *L. ophiria* are treated as *N. dulitensis* by us, whereas the second species is tretated as *N. sarawakensis* var. *grandistipula*. We believe, that neither of these two species is identical to *Lepidozia sarawakensis*.

Neolepidozia hamiguitanensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

[Philippines]: Mindanao Island, Province Davao Oriental, San Isidro, Hamiguitan Range Wildlife Sanctuary, along trail from camp 2 to Twin Falls. Mid slope of Mt. Hamiguitan, a 7000 hectar reserve for the endemic Philippine eagle, small stream over volcanic rock., 6° 43' 44.3" N, 126° 10' 17.7" E, 900 m, mixed hardwood forest with *Pandanus*, leg. JAMES R. SHEVOCK 46951, with AIMANUELZON YORONG, 23 June 2015 (herbarium SCHÄFER-VERWIMP!, duplicates: CAS, CMUH, PNH).

Figures:

Plate 73, Plate 74, Plate 75, Plate 76, Plate 77.

Comparison Plate 3 – J.

Description

Plants pale yellowish green, small, up to 1.5 cm long, stem with leaves up to 0.5 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, often flagelliform at the end. **Flagelliform branches** numerous, up to 5 mm long. **Rhizoids** not seen. **Stem** in cross section 190 µm wide and 130 µm high, cortical cells 12, 22 – 32 × 13 – 41 µm, cell walls thickened, medullary cells up to 35, 11 – 24 × 10 – 21 µm, cell walls thickened, trigones moderately enlarged, dorsal cortical cells square, hexagonal to short rectangular, 33 – 46 × 41 – 49 µm, 0.9 – 1.4 as long as wide, cell walls thickened, trigones moderately enlarged, cuticle smooth. **Stem leaves** approximate, obliquely inserted, spreading

at an angle of 40° – 70°, leaves square, asymmetric, flat, 210 – 310 µm wide, 210 – 250 µm long, 0.8 – 1 as long as wide, divided by 0.5 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 1.5 – 3.5 cells long, 180 – 230 µm wide, 75 – 135 µm long, 0.4 – 0.7 as long as wide, median cells hexagonal, 19 – 28 × 27 – 33 µm, 1.1 – 1.5 as long as wide, cell walls thickened, trigones small, cuticle with striate papillae, basal cells ovate to elongated polygonal, 22 – 27 × 29 – 45 µm, 1.3 – 1.8 as long as wide, leaf lobes 4, weakly divergent, 3.5 – 4.5 cells long, often falcate, 2 cells wide at base, multiseriate part 2 cells long, uniseriate part 2 – 3 cells long, cells elongated ovate to polygonal, not constricted at the transversal walls, 18 – 23 × 26 – 33 µm, 1.1 – 1.8 as long as wide, cell walls thickened, trigones small, cuticle with round papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 0.9 – 1.1 times as wide as the stem, underleaves transversely rectangular, 180 – 220 µm wide, 150 – 180 µm long, 0.7 – 1 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 8 cells wide, 1.5 – 2.5 cells long, 150 – 200 µm wide, 75 – 120 µm long, 0.4 – 0.8 as long as wide, median cells round to elongated ovate, 19 – 22 × 20 – 26 µm, 1 – 1.4 as long as wide, cell walls thickened, trigones moderately enlarged, cuticle smooth, basal cells elongated ovate, 16 – 23 × 26 – 44 µm, 1.1 – 2.2 as long as wide, leaf lobes 4, upright, 2.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cells 12 – 18 × 18 – 28 µm, 1.5 – 1.8 as long as wide, cell walls thickened, trigones moderately enlarged, cuticle smooth. **Branch leaves** approximate, longitudinally to obliquely inserted, spreading at an angle of 40° – 60°, leaves rectangular to trapezoid, asymmetric, flat, 190 – 250 µm wide, 250 – 280 µm long, 1 – 1.4 as long as wide, divided by 0.5 – 0.7 of the leaf length, divided by 0.5 on the ventral side, margin entire, disc 6 cells wide, 2.5 – 5.5 cells long, 120 – 170 µm wide, 90 – 145 µm long, 0.5 – 1.2 as long as wide, median cells square, hexagonal to short rectangular, 25 – 30 × 22 – 36 µm, 0.8 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 19 – 28 × 28 – 49 µm, 1.3 – 2 as long as wide, leaf lobes 3, upright to divergent, 4.5 – 6.5 cells long, 2 – 3 cells wide at base, multiseriate part 3 – 5 cells long, uniseriate part 2 cells long, cells square, short rectangular to elongated ovate, not constricted at the transversal walls, cells 12 – 21 × 19 – 34 µm, 1.1 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** approximate, transversely attached, upright to spreading, 1.4 – 1.9 times as wide as the branch, underleaves square, ovate to trapezoid, 130 – 170 µm wide, 120 – 160 µm long, 0.9 – 1.1 as long as wide, divided by 0.4 – 0.6 of the leaf length, disc 6 cells wide, 1.5 – 2.5 cells long, 110 – 160 µm wide, 60 – 90 µm long, 0.4 – 0.8 as long as wide, median cells square to hexagonal, 19 – 25 × 20 – 28 µm, 1 – 1.1 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells elongated ovate or polygonal, 21 – 25 × 30 – 40 µm, 1.3 – 1.9 as long as wide, leaf lobes 3, upright, 2.5 – 3.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 12 – 16 × 19 – 30 µm, 1.6 – 2 as long as wide, cell walls thickened, trigones small, cuticle smooth.

Distinguishing characters:

The species is characterised by (1) the branch leaves that are sometimes divided to more than ½ of their length on the ventral side, (2) branches that often turn into flagellae, (3) the small size, (4) the small, thick-walled cells, and (5) the rather obliquely attached stem and branch leaves.

Similar species:

This species resembles *N. variifolia*, but its branch leaves are less deeply divided and its stem leaves are more symmetrical. Furthermore, the branch leaf cells of *N. hamiguitanensis* are thicker and the branch leaves are more obliquely inserted compared to *N. variifolia*.

Distribution:

Philippines (Mindanao).

Specimen studied:

Philippines: Mindanao Island, Davao Oriental Province, Municipality San Isidro, Hamiguitan Range Wildlife Sanctuary, on trail from camp 4 below the mid-slopes of the summit ridge of peak 1 of Mt. Hamiguitan about the saturated boggy area., 6° 43' 47.4" N, 126° 11' 14.6" E, 1175 m, Mixed hardwood and podocarp tropical rain forest with dense bryophyte cover, leg. JAMES R. SHEVOCK 54839 with AIMANUELZON YORONG & DARYL SALAS, 17 June 2019 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Etymology:

The species is named after the Hamiguitan Range Wildlife Sanctuary where the species was discovered.

Neolepidozia ingekarolae U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Malaysia: State Pahang, Frasers Hill, Weg zum Jerian [Jeriau] -Wasserfall, [3° 43' 24.2" N, 101° 43' 5.5" E], 1020 m, auf Sand über Fels an Bachufer, bei Hochwasser submers, leg. SCHÄFER-VERWIMP & VERWIMP 18558, 20 May 1997 (herbarium SCHÄFER-VERWIMP 18558!).

Figures:

Plate 80, Plate 81, Plate 82, Plate 83, Plate 84, Plate 85.

Comparison Plate 4 – B.

Description

Plants yellowish green, medium sized, up to 2 cm long, stem with leaves up to 0.5 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, flagelliform at the end. **Flagelliform branches** sparse, up to 6 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 130 µm wide and 90 µm high, cortical cells 10, 20 – 46 × 15 – 38 µm, cell walls thickened, medullary cells up to 30, 8 – 18 × 6 – 14 µm, cell walls thickened, trigones moderately enlarged, dorsal cortical cells ovate, rectangular to elongated polygonal, 29 – 41 × 47 – 72 µm, 1.3 – 2.4 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Stem leaves** distant, obliquely inserted, spreading at an angle of 50° – 80°, leaves rectangular to trapezoid, symmetric to weakly asymmetric, lobes weakly bent down ventrally, 160 – 250 µm wide, 190 – 210 µm long, 0.8 – 1.3 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 6 – 8 cells wide, 2.5 cells long, 110 – 180 µm wide, 85 – 115 µm long, 0.5 – 0.9 as long as wide, median cells square to isodiametric polygonal, 19 – 26 × 22 – 36 µm, 1.1 – 1.4 as long as wide, cell walls thickened, trigones lacking, cuticle with striate papillae, basal cells ovate to elongated polygonal, 19 – 29 × 37 – 49 µm, 1.7 – 2.1 as long as wide, leaf lobes 3 – 4, divergent, 3.5 – 4.5 cells long, straight, 2 cells wide at base, multiseriate part 2 cells long, uniseriate part 2 – 3 cells long, cells elongated ovate to polygonal, weakly constricted at the transversal walls, 15 – 19 × 25 – 31 µm, 1.6 – 1.7 as long as wide, cell walls thickened, trigones lacking, cuticle with round papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed, 0.9 – 1.2 times as wide as the stem, underleaves transversely rectangular, 110 – 150 µm wide, 85 – 100 µm long, 0.6 – 0.8 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 6 – 8 cells wide, 1.5 cells long, 90 – 140 µm wide, 45 – 66 µm long, 0.4 – 0.6 as long as wide, basal cells square, ovate to short rectangular, 15 – 19 × 19 – 28 µm, 1.3 – 1.6 as long as wide, leaf lobes 3 – 4, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 15 – 20 × 17 – 29 µm, 1.1 – 1.7 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, longitudinally to obliquely inserted, spreading at an angle of 30° – 70°, leaves square to short rectangular, symmetric to weakly asymmetric, flat, 90 – 150 µm wide, 180 – 230 µm long, 1.4 – 2 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 4 – 6 cells wide, 2.5 – 3.5 cells long, 60 – 140 µm wide, 90 – 120 µm long, 0.8 – 1.7 as long as wide, median cells isodiametric to shortly elongated polygonal, 22 – 30 × 29 – 39 µm, 1.2 – 1.4 as long as wide, cell walls thick, trigones small, cuticle almost smooth, basal cells ovate to elongated polygonal, 23 – 27 × 42 – 50 µm, 1.8 – 2.2 as long as wide, leaf lobes 2 – 3, upright, 3.5 – 4.5 cells long, 2 (- 3) cells wide at base, multiseriate part 2 cells long, uniseriate part 2 – 3 cells long, cells elongated ovate to polygonal, weakly constricted at the transversal walls, cells 13 – 22 × 19 – 33 µm, 1.3 – 1.7 as long as wide, cell walls thickened, trigones small, cuticle with round to elliptical papillae. **Branch underleaves** distant, transversely attached, upright, 1.1 – 1.3 times as wide as the branch, underleaves transversely rectangular, 60 – 80 µm wide, 45 – 60 µm long, 0.6 – 0.8 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 4 cells wide, 0.5 – 1.5 cells long, 50 – 65 µm wide, 25 – 35 µm long, 0.5 – 0.6 as long as wide, basal cells square to elongated polygonal, 15 – 18 × 14 – 25 µm, 0.9 – 1.5 as long as wide, leaf lobes 2, upright to weakly divergent, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 15 – 20 × 20 – 25 µm, 1.2 – 1.7 as long as wide, cell walls thickened, trigones lacking, cuticle smooth. **Female inflorescence** originating ventrally from the main stem, 0.7 mm long, 0.5 mm wide, densely leaved. **Female bracts** spreading, ovate, 3-4 lobate, margin weakly toothed, 220 – 230 µm wide, 410 – 550 µm long, 1.8 – 2.5 as long as wide, median cells rectangular to elongated polygonal, 13 – 20 × 34 – 51 µm, 2.1 – 2.8 as long as wide, cell walls thickened, trigones small, cuticle with striate papillae, leaf lobes 3, 3.5 – 4.5 cells long, 2 – 4 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 -3 cells long, cells linear, cells 11 – 15 × 38 – 57 µm, 2.9 – 4.8 as long as wide, cell walls thickened, trigones small, cuticle with round papillae. **Female bracteole** ovate to rectangular, margin weakly dentate, 230 µm wide, 390 µm long, 1.7 times as long as wide, median cells rectangular to elongated polygonal, 17 – 21 × 33 – 50 µm, 1.9 – 2.8 as long as wide, cell walls thickened, trigones lacking, cuticle with striate papillae, leaf lobes 3 – 4, 3.5 cells long, 2 – 4 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 3 cells long, cells linear, cells 17 – 22 × 32 – 50 µm, 1.9 – 2.8 as long as wide, cell walls thickened, trigones small, cuticle with round papillae.

Distinguishing characters:

N. ingekarolae is characterised by (1) bilobate branch leaves that are mixed with trilobate ones, (2) the low, only 2.5 cells high branch leaf disc, (3) the small branch underleaves often consisting of only 6 cells, (4) the low stem leaf disc that is only 1.5 cells high, and (5) the papillose bracts and bracteoles.

Similar species:

N. cameronensis, another species with partially bilobate branch leaves has thin-walled cells a wider sinus between the branch leaf lobes and longer branch leaf disc cells.

N. cuneifolia fo. *biloba* likewise has thinner cell walls and larger branch leaf disc cells, as well as asymmetric branch leaves with lobes that are occasionally more than two cells wide at the base.

N. ingekarolae is one of the few species that grows on sandy soil, whereas most of the other *Neolepidozia* species prefer humus, rotten wood or bark.

Distribution:

Malaysia (Malay Peninsula). Only known from the type location.

Etymology:

The species is named after INGE VERWIMP (Herdwangen-Schönach), the co-collector of the species.

Neolepidozia kaindiensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

[Papua New Guinea]: New Guinea, Wau District, Summit of Mt. Kaindi, SSW of Wau, 7° 21' 20" S, 146° 40' 42" E, 2350 m, wet, mossy forest, leg. R.M. SCHUSTER 67-6247, 26-27 May (JE!, det. R. GROLLE 1987 as *Lepidozia wallichiana*).

Figures:

Plate 86, Plate 87, Plate 88, Plate 89, Plate 90, Plate 91, Plate 92.

Comparison Plate 4 – I.

Description

Plants pale yellowish green, large, up to 3 cm long, stem with leaves up to 0.9 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 5 mm long, not flagelliform at the end. **Flagelliform branches** scattered, up to 7 mm long. **Rhizoids** not seen. **Stem** in cross section 160 µm wide and 110 µm high, cortical cells 12, 20 – 37 × 14 – 25 µm, cell walls thickened, medullary cells up to 20, 16 – 28 × 15 – 21 µm, cell walls thin, trigones small, dorsal cortical cells rectangular to elongated polygonal, 26 – 37 × 57 – 84 µm, 1.5 – 3.2 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Stem leaves** approximate to imbricate, longitudinally inserted, spreading at an angle of 50° – 80°, leaves short rectangular, weakly asymmetric, flat, 250 – 310 µm wide, 360 – 420 µm long, 1.3 – 1.6 as long as wide, divided by 0.3 – 0.5 of the leaf length, margin entire, disc 8 cells wide, 3.5 – 5.5 cells long, 220 – 290 µm wide, 210 – 290 µm long, 0.8 – 1.3 as long as wide, median cells square to shortly elongated polygonal, 33 – 47 × 42 – 56 µm, 1 – 1.7 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells shortly elongated polygonal, 27 – 49 × 54 – 80 µm, 1.4 – 2.1 as long as wide, leaf lobes 4, upright to weakly divergent, 3.5 – 4.5 cells long, straight, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 19 – 29 × 33 – 42 µm, 1.2 – 2.1 as long as wide, cell walls thin, trigones lacking, cuticle smooth, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1 – 1.2 times as wide as the stem, underleaves square, 165 – 200 µm wide, 170 – 220 µm long, 0.9 – 1.1 as long as wide, divided by 0.2 – 0.3 of the leaf length, disc 8 cells wide, 1.5 – 3.5 cells long, 140 – 200 µm wide, 115 – 175 µm long, 0.7 – 1 as long as wide, median cells elongated polygonal, 21 – 29 × 31 – 45 µm, 1.2 – 2 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 25 – 34 × 51 – 63 µm, 1.6 – 2.3 as long as wide, leaf lobes 4, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 15 – 24 × 28 – 45 µm, 1.2 – 2 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 50° – 80°, leaves rectangular, weakly narrowed towards the apex, symmetric, leaf lobes occasionally bent down, 210 – 250 µm wide, 410 – 530 µm long, 1.7 – 2.5 as long as wide, divided by 0.1 – 0.3 of the leaf length, margin entire, disc 6

cells wide, 5.5 – 8.5 cells long, 180 – 230 µm wide, 310 – 390 µm long, 1.4 – 2.1 as long as wide, median cells square to shortly elongated polygonal, 37 – 49 × 47 – 62 µm, 1.1 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells ovate to elongated polygonal, 35 – 51 × 58 – 72 µm, 1.1 – 2.1 as long as wide, leaf lobes 3, upright, 3.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cells square to elongated polygonal, not constricted at the transversal walls, cells 29 – 38 × 30 – 58 µm, 0.9 – 1.8 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch underleaves** distant, transversely attached, spreading away from the stem, 1.1 – 1.4 times as wide as the branch, 85 – 110 µm wide, 120 – 185 µm long, 1.4 – 1.9 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 cells wide, 1.5 – 2.5 cells long, 75 – 100 µm wide, 75 – 120 µm long, 0.9 – 1.4 as long as wide, median cells square to isodiametric polygonal, 28 – 32 × 29 – 42 µm, 1 – 1.4 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 26 – 29 × 40 – 50 µm, 1.4 – 1.9 as long as wide, leaf lobes 2, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 19 – 26 × 24 – 38 µm, 1.1 – 2 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Perianth** originating ventrally from the main stem, 4 mm long, weakly narrowed towards the mouth, 5 – plicate in the upper third. **Perianth mouth** ciliate, mouth cells linear, 12 – 16 × 50 – 80 µm, 3.3 – 6.3 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, median cells rectangular to elongated polygonal, 24 – 34 × 47 – 110 µm, 1.9 – 4.2 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Female bracts** triangular ovate to ovate, margin with a few teeth, shortly 3 – 4 lobate, 700 µm wide, 920 – 1100 µm long, 1.3 – 1.6 as long as wide, median cells elongated polygonal, 22 – 35 × 40 – 120 µm, 1.1 – 5.5 as long as wide, cell walls thin, trigones lacking, cuticle smooth, leaf lobes 4, 3.5 – 6.5 cells long, 3 – 5 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 1 – 2 cells long, cells ovate to linear, cells 14 – 22 × 42 – 71 µm, 2.5 – 4.9 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Female bracteole** triangular, margin with a few teeth, teeth ending in a slime papillae, 520 µm wide, 860 µm long, 1.7 as long as wide, median cells elongated polygonal, 20 – 31 × 47 – 100 µm, 1.6 – 5 as long as wide, cell walls thin, trigones lacking, cuticle smooth, leaf lobes 4, 4.5 – 6.5 cells long, 2 – 4 cells wide at base, multiseriate part 3 – 4 cells long, uniseriate part 2 – 3 cells long, cells elongated polygonal to linear, cells 19 – 28 × 48 – 83 µm, 1.9 – 3.8 as long as wide, cell walls thin, trigones lacking, cuticle smooth.

Distinguishing characters:

N. kaindiensis is one of the larger species. (1) Its branch leaves can reach 0.5 mm or more in length. It is further characterised by (2) the high branch leaf disc, which can be up to 8.5 cells high, (3) branch leaves that are only divided by up to $^1/_3$ of their leaf length, the (4) thin walled and smooth cells, and (5) the rather short cells of the branch leaf disc. Even though the branch leaf disc cells are quite variable they are often only as long as wide. In some cases, they form regular horizontal rows that were not observed in other specimens.

Similar species:

N. kaindiensis resembles *N. papulosa*, but has a longer branch leaf disc. However, the latter species always has a shorter branch leaf disc and more elongated cells. Typically, the two central cells in the basal row of the branch leaf disc are enlarged. Furthermore, *N. papulosa* has very rarely a smooth cuticle and thicker cell walls.

N. sarawakensis and its varieties have shorter branch leaf discs that are up to 5.5 cells high, more elongated branch leaf disc cells and more asymmetric stem leaves.

In terms of size *N. larutensis* also approaches *N. kaindiensis*. However, the latter species has larger branch underleaves that overlap each other.

Distribution:

Papua New Guinea (New Guinea. Only known from the type collection.

Etymology:

The species is named after Mt. Kaindi in New Guinea where the species was discovered.

Neolepidozia kasudsuranensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Philippines: Leyte Island, Leyte Province, Area around Lake Kasudsuran, Ormoc-City, Barangay Liberty, 11° 1' 32.33" N, 124° 44' 55.86" E, auf Rinde, 720 m, leg. FELIX SCHUMM & UWE SCHWARZ, 23 August 2000 (herbarium UWE SCHWARZ No. 16978!).

Figures:

Plate 93, Plate 94, Plate 95, Plate 96, Plate 97.

Comparison Plate 3 – N.

Description:

Plants yellowish brown, small, up to 1 cm long, stem with leaves up to 0.4 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 2 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 2 mm long. **Rhizoids** not seen. **Stem** in cross section 100 µm wide and 70 µm high, cortical cells 8, 15 – 36 × 15 – 33 µm, cell walls moderately thickened, medullary cells up to 10, 9 – 20 × 12 – 15 µm, cell walls thin, trigones small, dorsal cortical cells hexagonal to elongated polygonal, 27 – 38 × 33 – 52 µm, 1 – 1.8 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** distant, longitudinally inserted, spreading at an angle of 60° – 90°, leaves square to weakly trapezoid, asymmetric, flat, 120 – 170 µm wide, 130 – 190 µm long, 0.8 – 1.1 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 6 cells wide, 1.5 – 3.5 cells long, 90 – 130 µm wide, 55 – 115 µm long, 0.5 – 0.9 as long as wide, median cells square, hexagonal to short rectangular, 18 – 24 × 23 – 29 µm, 1 – 1.3 as long as wide, cell walls thin, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 20 – 28 × 25 – 40 µm, 1.2 – 1.9 as long as wide, leaf lobes 3, weakly divergent, 3.5 – 4.5 cells long, straight to falcate, 2 – 3 cells wide at base, multiseriate part 2 cells long, uniseriate part 2 – 3 cells long, cells square to short rectangular, not constricted at the transversal walls, 13 – 20 × 18 – 24 µm, 1.2 – 1.7 as long as wide, cell walls thin, trigones small, cuticle with round to ovate papillae, half stem leaf near branch base lanceolate, not lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, upright, 0.7 – 1 times as wide as the stem, underleaves transversely rectangular to rectangular, 65 – 100 µm wide, 80 – 85 µm long, 0.8 – 1.3 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 4 – 6 cells wide, 1.5 – 2.5 cells long, 60 – 100 µm wide, 50 – 60 µm long, 0.6 – 0.9 as long as wide, median cells hexagonal, 13 – 20 × 14 – 18 µm, 0.8 – 1.2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 11 – 16 × 23 – 35 µm, 1.6 – 2.4 as long as wide, leaf lobes 2 – 3, upright to weakly divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 11 – 17 × 14 – 20 µm, 0.9 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves rectangular to trapezoid, asymmetric, flat, 140 – 170 µm wide, 200 – 240 µm long, 1.2 – 1.6 as long as wide, divided by 0.4 – 0.6 of the leaf length, divided by 0.4 on the ventral side, margin entire, disc 6 cells wide, 3.5 – 5.5 cells long, 95 – 140 µm wide, 95 – 155 µm long, 0.7 – 1.4 as long as wide, median cells hexagonal to elongated polygonal, 19 – 26 × 19 – 32 µm, 0.9 – 1.2 as long as wide, cell walls thin, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 18 – 25 × 35 – 39 µm, 1.4 – 2.2 as long as wide, leaf lobes usually 3, upright, divergent to weakly falcate, 3.5 – 4.5 cells long, 2 – 4 cells wide at base, multiseriate part 3 – 4 cells long, uniseriate part 2 – 3 cells long, cells square, hexagonal to short rectangular, not constricted at the transversal walls, cells 10 – 20 × 19 – 23 µm, 1 – 2.3 as long as wide, cell walls thin, trigones small, cuticle with ovate papillae. **Branch underleaves** distant, transversely attached, upright, 0.9 – 1 times as wide as the branch, underleaves square, 65 – 75 µm wide, 65 – 75 µm long, 0.9 – 1 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 4 cells wide, 1.5 cells long, 40 – 70 µm wide, 40 – 50 µm long, 0.6 – 1 as long as wide, basal cells elongated polygonal, 17 – 20 × 20 – 27 µm, 1.2 – 1.4 as long as wide, leaf lobes 2, upright, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 11 – 15 × 12 – 36 µm, 1.1 – 2.4 as long as wide, cell walls thickened, trigones small, cuticle smooth.

Distinguishing characters:

The species is characterised by (1) the 3-lobate stem leaves, (2) the asymmetric branch leaves, (3) the small size, (4) the lanceolate reduced stem leaf near the branch insertion, and (5) the small stem and branch underleaves that are hardly wider than the stem.

Similar species:

The cell pattern of *N. kasudsuranensis* is similar to that of *N. variifolia*. However, the latter species is larger, has four-lobed stem leaves and larger stem and branch underleaves.

The fact that *N. kasudsuranensis* has 3-lobate stem leaves sets it apart from the other *Neolepidozia* species with asymmetric branch leaves, making it a quite unique species.

Distribution:

Philippines (Leyte). Only known from the type collection.

Etymology:

The species is named after Lake Kasudsuran where the species was discovered.

Neolepidozia katrinae U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Malaysia: State Pahang, Genting Highlands, moss / elfin forest, 2200 m, on woodland floor, leg. W.C. PANG (JE-H2654!, det. R. GROLLE as *Lepidozia ophiria*).

Figures:

Plate 98, Plate 99, Plate 100, Plate 101, Plate 102.

Comparison Plate 2 – B.

Description

Plants pale brownish, small, up to 1 cm long, stem with leaves up to 0.4 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 2 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparse, up to 2 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 110 µm wide and 110 µm high, cortical cells 9, 21 – 42 × 10 – 37 µm, cell walls thickened, medullary cells up to 20, 11 – 25 × 11 – 20 µm, cell walls thickened, trigones enlarged, dorsal cortical cells ovate elongated polygonal, 24 – 38 × 46 – 73 µm, 1.3 – 3 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Stem leaves** approximate to imbricate, obliquely inserted, spreading at an angle of 10° – 30°, leaves trapezoid, symmetric to weakly asymmetric, lobes directed towards the stem apex, 480 – 570 µm wide, 400 – 430 µm long, 0.7 – 0.9 as long as wide, divided by 0.7 – 0.8 of the leaf length, margin entire, disc 8 cells wide, 1.5 – 2.5 cells long, 150 – 220 µm wide, 90 – 130 µm long, 0.4 – 0.8 as long as wide, median cells isodiametric polygonal to weakly elongated, 24 – 32 × 30 – 35 µm, 1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated ovate to polygonal, 22 – 33 × 31 – 44 µm, 1.3 – 1.6 as long as wide, leaf lobes 4, divergent, 4.5 – 6.5 cells long, straight to weakly falcate, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 4 – 6 cells long, cells rectangular to linear, not constricted at the transversal walls, 12 – 22 × 53 – 62 µm, 2.6 – 5 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed, 0.9 – 1.3 times as wide as the stem, underleaves transversely rectangular to trapezoid, 180 – 240 µm wide, 140 – 150 µm long, 0.6 – 0.8 as long as wide, divided by 0.5 – 0.6 of the leaf length, disc 6 – 8 cells wide, 1.5 cells long, 110 – 170 µm wide, 60 – 80 µm long, 0.4 – 0.7 as long as wide, basal cells elongated polygonal, 18 – 24 × 35 – 43 µm, 1.6 – 2.3 as long as wide, leaf lobes 3 – 4, divergent, 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 cells long, cells 15 – 24 × 31 – 38 µm, 1.4 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, obliquely inserted, spreading at an angle of 20° – 30°, leaves trapezoid, symmetric to asymmetric, lobes directed towards the branch apex, 260 – 390 µm wide, 260 – 350 µm long, 0.7 – 1.2 as long as wide, divided by 0.6 – 0.8 of the leaf length, divided by 0.6 – 0.7 on the ventral side, margin entire, disc 6 cells wide, 1.5 – 2.5 cells long, 110 – 160 µm wide, 60 – 110 µm long, 0.4 – 0.9 as long as wide, median cells isodiametric polygonal to short rectangular, 21 – 26 × 26 – 34 µm, 1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle almost smooth, basal cells ovate to elongated polygonal, 21 – 27 × 29 – 53 µm, 1.3 – 2 as long as wide, leaf lobes 3, upright to falcate, 4.5 – 5.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 4 – 5 cells long, cells rectangular to linear, not constricted at the transversal walls, cells 12 – 21 × 52 – 67 µm, 2.6 – 5.6 as long as wide, cell walls moderately thickened, trigones small, cuticle almost smooth. **Branch underleaves** imbricate, transversely attached, spreading away from the branch, 1.1 – 1.3 times as wide as the branch, underleaves square to trapezoid, 110 – 160 µm wide, 120 – 125 µm long, 0.8 – 1.1 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 6 cells wide, 1.5 cells long, 80 – 125 µm wide, 60 – 70 µm long, 0.6 – 0.8 as long as wide, basal cells elongated polygonal, 15 – 23 × 30 – 38 µm, 1.7 – 2.1 as long as wide, leaf lobes 3, upright to weakly divergent, 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 cells long, cells 14 – 21 × 22 – 31 µm, 1.4 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

Neolepidozia katrinae is a unique species. Its (1) *Kurzia*-like appearance, (2) the low branch leaf disc that is only 1.5 or 2.5 cells high, and (3) the small branch underleaves distinguish it from all the other *Kurzia* species.

Similar species:

The *Frullania*-type branching pattern distinguishes *N. katrinae* from similar *Kurzia* species. There is also some resemblance to *Tricholepidozia*-species with obliquely inserted leaves. These species however, have 4-lobate branch leaves, that are spreading more than 30° from the stem and thin cells walls.

The only other *Neolepidozia* species with a *Kurzia*-like habitus are *N. richardsii* and, to a certain extent, *N. parvula*. Both species have biseriate branch leaf lobes in the lower part. Furthermore, the former species has very large branch underleaves, whereas the latter has branch leaves that spread at a wider angle than those of *N. katrinae*.

MITZUTANI identified the specimen as *N. ophiria*, which has, however, a higher branch leaf disc and branch leaves that spread at an angle of more than 45°.

Distribution:

Malaysia (Malay Peninsula). Only known from the type collection.

Etymology:

The species is named after KATRIN SCHWARZ (Radeberg) who supported the first author in his bryological activities during the last decades.

Neolepidozia kolombangaraensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Solomon Islands: Kolombangara [Island], [Western Guadalcanal Province], In rainforest on upper slopes of mountain near Mt. Veve in center of island. UMTG 57M, TM, 210-220, 870-880, 7° 57' S, 157° 5' E, 1400 - 1600 m, on moist, shaded bark of tree, leg. D.H. NORRIS & G.L. ROBERTS 49712, 12 August 1977 (Rijksherbarium Leiden, L 0090612!, det. S. PIIPPO 1984 as *Lepidozia wallichiana*).

Figures:

Plate 103, Plate 104, Plate 105, Plate 106, Plate 107.

Comparison Plate 3 – L.

Description:

Plants pale yellowish green, medium sized, up to 2 cm long, stem with leaves up to 0.5 mm wide, leaves not fragile. **Branching** 1- to bipinnate, of *Frullania*-type. **Branches** up to 2 mm long, not flagelliform at the end. **Flagelliform branches** numerous, up to 5 mm long. **Rhizoids** not seen. **Stem** in cross section 130 µm wide and 110 µm high, cortical cells 11, 20 – 35 × 13 – 21 µm, cell walls thickened, medullary cells up to 30, 10 – 24 × 10 – 17 µm, cell walls moderately thickened, trigones small, dorsal cortical cells isodiametric to elongated polygonal, 25 – 31 × 28 – 60 µm, 1 – 2 as long as wide, cell walls thickend, trigones small, cuticle smooth. **Stem leaves** approximate, obliquely inserted, spreading at an angle of 40° – 90°, leaves square, rectangular to trapezoid, symmetric, lobes partially bent down ventrally, 160 – 220 µm wide, 195 – 210 µm long, 1 – 1.3 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 – 8 cells wide, 2.5 – 4.5 cells long, 120 – 180 µm wide, 100 – 125 µm long, 0.6 – 1 as long as wide, median cells isodiametric to elongated polygonal, 22 – 25 × 24 – 33 µm, 1.1 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle almost smooth, basal cells isodiametric to elongated polygonal, 23 – 28 × 26 – 38 µm, 1 – 1.6 as long as wide, leaf lobes (3-) 4, upright to divergent, 2.5 – 4.5 cells long, straight, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 4 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, 15 – 20 × 19 – 29 µm, 1.1 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1.1 – 1.4 times as wide as the stem, underleaves transversely rectangular to trapezoid, 160 – 185 µm wide, 115 – 150 µm long, 0.6 – 0.8 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 8 cells wide, 2.5 cells long, 110 – 160 µm wide, 65 – 105 µm long, 0.4 – 0.8 as long as wide, median cells isodiametric to elongated polygonal, 17 – 23 × 24 – 30 µm, 1.1 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 15 – 24 × 29 – 38 µm, 1.5 – 2 as long as wide, leaf lobes 4, divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 16 – 20 × 18 – 28 µm, 1.1 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves trapezoid, asymmetric, flat, 170 – 200 µm wide, 200 – 250 µm long, 1.1 – 1.3 as long as wide, divided by 0.3 – 0.6 of the leaf length, divided by 0.3 – 0.4 on the ventral side, margin entire, disc 6 – 8 cells wide, 2.5 – 5.5 cells long, 90 – 160 µm wide, 90 – 170 µm long, 0.6 – 1.5 as long as wide,

median cells isodiametric to elongated polygonal, 22 – 30 × 24 – 35 µm, 0.9 – 1.5 as long as wide, cell walls moderately thickened, trigones lacking, cuticle almost smooth, basal cells elongated polygonal, 20 – 30 × 28 – 40 µm, 1.3 – 1.7 as long as wide, leaf lobes 3, upright, divergent to weakly falcate, 2.5 – 4.5 cells long, 2 – 4 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 3 cells long, cells elongated polygonal, not constricted at the transversal walls, cells 18 – 24 × 25 – 30 µm, 1.1 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** approximate, transversely attached, appressed, 1.4 – 1.9 times as wide as the branch, underleaves rectangular to trapezoid, 80 – 100 µm wide, 90 – 140 µm long, 1.1 – 1.5 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 4 cells wide, 1.5 – 2.5 cells long, 60 – 90 µm wide, 60 – 80 µm long, 0.7 – 1.1 as long as wide, median cells isodiametric polygonal, 25 – 27 × 23 – 29 µm, 0.9 – 1.1 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 20 – 25 × 29 – 42 µm, 1.2 – 1.9 as long as wide, leaf lobes 2 – 3, upright to weakly divergent, 1.5 – 2.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 17 – 21 × 24 – 30 µm, 1.3 – 1.8 as long as wide, cell walls thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. kolombangaraensis is characterised by (1) the asymmetric branch leaves that are hardly longer than wide, (2) the branch leaf disc that is no more than 3.5 cells high at the dorsal division, (3) the rather large branch underleaves, that do not overlap each other, the (4) rather obliquely inserted stem leaves, and (5) the triangular branch leaf lobes.

Similar species:

This species is related to *N. variifolia*, which has longer branch leaf discs, larger underleaves that sometimes overlap, and more lingulate branch leaf lobes compared to the triangular ones found in *N. kolombangaraensis*. It also bears some resemblance to *N. cuneifolia*, which has a rectangular branch leaf disc and smaller, more distant underleaves.

Distribution:

Indonesia (New Guinea), Solomon Islands (Kolombangara Island).

Etymology:

The species is named after the Kolombangara Island where the species was discovered.

Specimen studied:

Indonesia: W – Neuguinea, Woropko, 100 m, on dead tree-fern in rain forest, leg. VAN ZANTEN 205b, 1959 (JE!, det. M. MIZUTANI as *Lepidozia cuneifolia*, rev. R. GROLLE 1974 as *Lepidozia wallichiana*).

Remarks:

NADHIFAH, ADJIE & BUDKE reported in ELLIS ET AL. (2024) the occurrence of *N. cuneifolia* in the Solomon Islands. The specimen origins from the Solomon Islands. Kolombangara, in rainforest on middle slopes of mountain on ridge N of Vanga River on NW side of island, UTMG 57M, TM, 210-220, 850-860, 7°57'S, 157°03'E, 15 August 1977, leg. D. H. NORRIS & G.L. ROBERTS 49761 (MO-3342346). Even though we have not seen that specimen it is very likely that it belongs to *N. kolombangaraensis* as well.

Neolepidozia larutensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Malaysia: State Perak, Taiping, Bukit Larut (Maxwell Hill), Regenwald an der Straße zur Sendestation, an feuchten Hang, 1080 m, an *Cyathea*-Stamm, leg. SCHÄFER-VERWIMP & VERWIMP 19009/A, 27 May 1997 (herbarium SCHÄFER-VERWIMP 19009/A!).

Figures:

Plate 108, Plate 109, Plate 110, Plate 111, Plate 112, Plate 113, Plate 114.

Comparison Plate 4 – O, Comparison Plate 5 – N.

Description:

Plants pale yellowish green, small, up to 1.5 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate to bipinnate, of *Frullania*-type. **Branches** up to 2 mm long, not flagelliform at the end. **Flagelliform branches** scattered, up to 4 mm long. **Rhizoids** not seen. **Stem** in cross section 150 µm wide and 110 µm high, cortical cells 12, 21

– 38 × 15 – 26 µm, cell walls thickened, medullary cells up to 30, 10 – 23 × 11 – 19 µm, cell walls thickened, trigones small, dorsal cortical cells elongated polygonal, 24 – 30 × 48 – 74 µm, 1.6 – 3.1 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Stem leaves** approximate, obliquely inserted, spreading at an angle of 50° – 90°, leaves square, rectangular to trapezoid, symmetric to weakly asymmetric, flat, 280 – 330 µm wide, 240 – 340 µm long, 0.9 – 1.1 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 3.5 cells long, 130 – 190 µm wide, 100 – 190 µm long, 0.6 – 1.5 as long as wide, median cells elongated polygonal, 19 – 30 × 26 – 48 µm, 1.4 – 1.9 as long as wide, cell walls thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 20 – 31 × 28 – 51 µm, 1.3 – 2.5 as long as wide, leaf lobes 4, upright to divergent, 4.5 cells long, straight, 2 cells wide at base, multiseriate part 2 cells long, uniseriate part 3 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, 18 – 26 × 37 – 44 µm, 1.5 – 2.2 as long as wide, cell walls thickened, trigones small, cuticle with round papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1.1 – 1.2 times as wide as the stem, underleaves square to transversely trapezoid, 175 – 200 µm wide, 140 – 170 µm long, 0.8 – 0.9 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 8 cells wide, 1.5 – 2.5 cells long, 115 – 155 µm wide, 80 – 105 µm long, 0.5 – 0.8 as long as wide, median cells elongated polygonal, 18 – 21 × 25 – 29 µm, 1.4 – 1.5 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 16 – 23 × 34 – 40 µm, 1.7 – 2.3 as long as wide, leaf lobes 4, divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 14 – 20 × 20 – 36 µm, 1.3 – 2.3 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves rectangular, symmetric, flat, 150 – 240 µm wide, 320 – 430 µm long, 1.6 – 2.9 as long as wide, divided by 0.3 – 0.4 of the leaf length, margin entire, disc 6 cells wide, 4.5 – 5.5 cells long, 110 – 150 µm wide, 180 – 280 µm long, 1.3 – 2.2 as long as wide, median cells elongated polygonal, 25 – 31 × 37 – 51 µm, 1.3 – 1.7 as long as wide, cell walls thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 22 – 30 × 37 – 60 µm, 1.2 – 2.6 as long as wide, leaf lobes 3, upright to divergent, 3.5 – 5.5 cells long, 2 (-3) cells wide at base, multiseriate part 2 cells long, uniseriate part 3 – 4 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, cells 16 – 24 × 27 – 45 µm, 1.6 – 2.2 as long as wide, cell walls thickened, trigones small, cuticle with round papillae. **Branch underleaves** imbricate, overlapping 0.1 – 0.3 of the underleaf length, transversely attached, appressed, 1.3 – 1.6 times as wide as the branch, underleaves rectangular, 85 – 100 µm wide, 140 – 200 µm long, 1.6 – 2.2 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 cells wide, 1.5 – 2.5 cells long, 60 – 85 µm wide, 90 – 100 µm long, 1.1 – 1.7 as long as wide, median cells isodiametric to elongated polygonal, 21 – 24 × 28 – 43 µm, 1.2 – 1.8 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 18 – 24 × 36 – 47 µm, 1.9 – 2.2 as long as wide, leaf lobes 2, upright to weakly divergent, 2.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 – 3 cells long, cells 13 – 20 × 21 – 30 µm, 1.3 – 1.8 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Perianth** originating ventrally from the main stem, 3 mm long, slightly narrowed towards the mouth, multi – plicate in the upper third. **Perianth mouth** ciliate, mouth cells linear, 9 – 13 × 52 – 80 µm, 4.3 – 7.8 as long as wide, cell walls thickened, trigones small, cuticle smooth, median cells elongated polygonal to linear, 18 – 29 × 44 – 107 µm, 1.7 – 5.9 as long as wide, cell walls thickened, trigones small, cuticle with striate papillae. **Female bracts** ovate, margin weakly dentate, 480 – 500 µm wide, 940 – 1100 µm long, 2 – 2.2 as long as wide, median cells elongated polygonal to linear, 18 – 27 × 49 – 177 µm, 2.1 – 8.9 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells isodiametric to elongated polygonal, 26 – 29 × 30 – 54 µm, 1 – 2 as long as wide, leaf lobes 3 – 4, 4.5 – 8.5 cells long, 3 – 4 cells wide at base, multiseriate part 1 – 4 cells long, uniseriate part 2 – 6 cells long, cells linear, cells 8 – 14 × 37 – 52 µm, 2.6 – 5.9 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Female bracteole** triangular, margin with a few teeth, teeth ending in a slime papillae, 440 µm wide, 840 µm long, 1.9 as long as wide, median cells elongated polygonal to linear, 21 – 34 × 46 – 117 µm, 1.8 – 5.1 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells ovate to elongated polygonal, 26 – 38 × 42 – 57 µm, 1.1 – 2.2 as long as wide, leaf lobes 3, 3.5 – 6.5 cells long, 3 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 6 cells long, cells rectangular to linear, cells 15 – 19 × 46 – 80 µm, 2.6 – 5.3 as long as wide, cell walls thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. larutensis is characterised by (1) the large branch underleaves that overlap of up to $^1/_3$ of their length, (2) the branch leaves that are up to 3 times as long as wide, (3) the elongated cells of the branch leaf disc, and (4) the branch leaf disc that is up to 5.5 cells high.

Similar species:

In terms of cell pattern, *N. larutensis* resembles *N. papulosa*. The latter, however, has smaller branch leaves and distant branch underleaves that do not overlap. It also has a lower branch leaf disc. Furthermore, *N. papulosa* has straight branch leaf lobes, whereas those of *N. larutensis* tend to become sigmoid.

Other *Neolepidozia* species with rather large branch leaves, such as *N. sarawakensis* and its varieties or *N. kaindiensis*, *N. larutensis* has imbricate branch leaves, larger and overlaping branch underleaves, and thick-walled, rather papillose branch leaf lobe cells.

Distribution:

Malaysia (Malay Peninsula), Philippines (Negros).

Etymology:

The species is named after the Bukit Larut where the species was discovered.

Specimen studied:

Philippines: Negros Island, Negros Occidental Province, Along the ridge trail well above the village of Naubok towards the summit slopes about Hapon-Haponon and Mt. Talinis, 9° 14' 30" N, 123° 7' 1" E, 1340 m, Mixed hardwood evergreen tropical rain forest with fern understory, on rotten hardwood log in filtered light, leg. JAMES R. SHEVOCK 56192, with DARYL S. SALAS, 16 December 2019 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Neolepidozia lembangensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Indonesia: Java, Jawa Barat Province, Rim of Tangkuban Peraku (volcano) north of Lembang (Bandung), 6° 45' 34.4" S, 107° 36' 41.5" E, 1830 m, fine soil on rotten wood of *Erica* trees at crater rim, leg. GERHARD WINTER 669, 14 January 1987 (herbarium SCHÄFER-VERWIMP!, duplicate: FR 0153251).

Figures:

Plate 115, Plate 116, Plate 117, Plate 118, Plate 119, Plate 120.

Comparison Plate 2 – K, Comparison Plate 4 – E.

Description:

Plants brownish, small, up to 1 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparse, up to 3 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 140 µm wide and 120 µm high, cortical cells 12, 24 – 40 × 18 – 33 µm, cell walls moderately thickened, medullary cells up to 30, 15 – 22 × 10 – 21 µm, cell walls thin, trigones small, dorsal cortical cells hexagonal to elongated polygonal, 32 – 38 × 33 – 57 µm, 1 – 1.8 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Stem leaves** distant, obliquely inserted, spreading at an angle of 50° – 70°, leaves ovate to trapezoid, symmetric, lobes partially bent down ventrally, 280 – 370 µm wide, 290 – 330 µm long, 0.8 – 1.1 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, occasionally with a blunt tooth, disc 6 – 8 cells wide, 2.5 – 4.5 cells long, 130 – 280 µm wide, 110 – 170 µm long, 0.5 – 1.2 as long as wide, median cells isodiametric to elongated polygonal, 23 – 30 × 28 – 38 µm, 1.1 – 1.4 as long as wide, cell walls thin, trigones lacking, cuticle with striate papillae, basal cells elongated polygonal, 15 – 28 × 30 – 59 µm, 1.4 – 2.3 as long as wide, leaf lobes 3 – 4, upright to divergent, 4.5 – 5.5 cells long, straight to weakly falcate, 2 – 3 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 16 – 30 × 27 – 44 µm, 1.1 – 2.7 as long as wide, cell walls thin, trigones lacking, cuticle with round papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1.3 – 1.5 times as wide as the stem, underleaves square to transversely trapezoid, 150 – 210 µm wide, 130 – 175 µm long, 0.6 – 1.1 as long as wide, divided by 0.4 – 0.6 of the leaf length, disc 6 – 8 cells wide, 1.5 – 2.5 cells long, 120 – 170 µm wide, 60 – 85 µm long, 0.4 – 0.7 as long as wide, median cells square, 19 – 25 × 19 – 24 µm, 0.8 – 1 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells square to rectangular, 19 – 24 × 28 – 47 µm, 1.4 – 2.2 as long as wide, leaf lobes 3 – 4, upright to divergent, 3.5 – 5.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 -5 cells long, cells 18 – 22 × 19 – 43 µm, 1.1 – 2 as long as wide, cell walls thin, trigones square to rectangular, cuticle smooth. **Branch leaves** imbricate, longitudinally to obliquely inserted, spreading at an angle of 50° – 70°, leaves rectangular, ovate to trapezoid, symmetric, lobes partially bent ventrally, 160 – 260 µm wide, 200 – 260 µm long, 0.8 – 1.4 as long as wide, divided by 0.5 – 0.6 of the leaf length, margin entire, disc 6 cells wide, 1.5 – 3.5 cells long, 90 – 170 µm wide, 90 – 130 µm long, 0.6 – 1.3 as long as wide, median cells square to short rectangular, 26 – 32 × 25 – 42 µm, 0.9 – 1.6 as long as wide, cell

walls thin, trigones lacking, cuticle with striate papillae, basal cells elongated polygonal, 25 – 30 × 40 – 58 µm, 1.3 – 2.3 as long as wide, leaf lobes 3, upright to divergent, 4.5 – 6.5 cells long, 2 – 3 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 4 cells long, cells square to rectangular, not constricted at the transversal walls, cells 20 – 25 × 30 – 42 µm, 1.2 – 2.1 as long as wide, cell walls thin, trigones lacking, cuticle with large round papillae. **Branch underleaves** distant, transversely attached, upright, 0.8 – 1 times as wide as the branch, underleaves rectangular to trapezoid, 90 – 140 µm wide, 105 – 145 µm long, 0.8 – 1.4 as long as wide, divided by 0.4 – 0.7 of the leaf length, disc 4 – 6 cells wide, 0.5 – 1.5 cells long, 60 – 130 µm wide, 50 – 75 µm long, 0.5 – 1 as long as wide, basal cells elongated polygonal, 19 – 33 × 31 – 44 µm, 1.2 – 2 as long as wide, leaf lobes 2 – 3, upright to weakly divergent, 2.5 – 4.5 cells long, 2 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 1 – 2 cells long, cells 16 – 22 × 24 – 33 µm, 1.2 – 2.1 as long as wide, cell walls thin, trigones lacking, cuticle smooth.

Distinguishing characters:

N. lembangensis is characterised by (1) the deeply divided branch leaves, (2) the thin cell walls, (3) the large, round papillae at the branch leaf lobes, (4) the often elongated branch leaf disc cells, (5) blunt teeth that occasionally exist at the base of the leaf lobes, and (6) the individual stem or branch leaves that are differently shaped.

Similar species:

The only other species with thin cell walls and large papillae on the lobe cells is *N. novoguineensis*. However, the latter species has larger, regularly shaped leaves, a higher branch leaf disc, and isodiametric cells.

N. shevockii with similarly deeply divided branch leaves has thicker cell walls, a higher branch leaf disc and rather regular stem leaves with straight lobes. The base of the branch leaf lobes is more often 3 – 4 cells wide.

N. winteri which is found in the same location, has straight branch leaf lobes without a tooth at their base. Its leaves are inserted more obliquely, it has large stem underleaves and its cell walls are thick.

N. morobensis also shows some similarity to *N. lembangensis* but it has shorter branch leaf disc cells and thick-walled cells.

Distribution:

Indonesia (Java). Only known from the type collection.

Etymology:

The species is named after the city of Lembang where the species was discovered.

Neolepidozia limbawonensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Philippines: Mindanao Island, Bukidnon Province, Mid-elevation section of Limbawon Mountain near Dumagongdong Stream accessed by trail from Kibalabag Barangay, 8° 15' 47.8" N, 125° 10' 43.6" E, 1500 m, Tropical mixed hardwood rain forest, on hardwood trunk in filtered light, leg. JAMES R. SHEVOCK 54633, with AIMANUELZON YORONG & DARYL SALAS, 9 June 2019 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Figures:

Plate 121, Plate 122, Plate 123, Plate 124, Plate 125, Plate 126, Plate 127, Plate 128.

Comparison Plate 5 – D.

Description:

Plants pale yellowish green, small, up to 1.5 cm long, stem with leaves up to 0.45 mm wide, leaves not fragile. **Branching** 1- to bipinnate, of *Frullania*-type. **Branches** up to 3 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparce, up to 4 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 170 µm wide and 130 µm high, cortical cells 12, 25 – 47 × 17 – 39 µm, cell walls thickened, medullary cells up to 50, 9 – 18 × 9 – 16 µm, cell walls thickened, trigones enlarged, dorsal cortical cells isodiametric to elongated polygonal, 28 – 42 × 25 – 53 µm, 0.8 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** approximate, obliquely inserted, spreading at an angle of 50° – 70°, leaves square to trapezoid, symmetric to weakly asymmetric, lobes bent down ventrally, 190 – 260 µm wide, 200 – 230 µm long, 0.8 – 1.1 as long as wide, divided by 0.4 – 0.6 of the leaf

length, margin entire, disc 8 – 9 cells wide, 2.5 – 3.5 cells long, 150 – 190 µm wide, 90 – 130 µm long, 0.5 – 0.8 as long as wide, median cells isodiametric to elongated polygonal, 18 – 31 × 18 – 31 µm, 0.8 – 1.5 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 21 – 35 × 34 – 46 µm, 1.3 – 1.8 as long as wide, leaf lobes 4, upright to weakly divergent, 3.5 – 5.5 cells long, straight, 2 – 4 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 3 cells long, cells elongated polygonal, not constricted at the transversal walls, 11 – 20 × 20 – 34 µm, 1.3 – 2.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with round papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, upright, 1.1 – 1.3 times as wide as the stem, underleaves transversely rectangular to trapezoid, 160 – 190 µm wide, 140 – 160 µm long, 0.8 – 0.9 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 8 cells wide, 2.5 – 3.5 cells long, 140 – 180 µm wide, 80 – 125 µm long, 0.5 – 0.8 as long as wide, median cells isodiametric to elongated polygonal, 18 – 30 × 22 – 29 µm, 1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 21 – 27 × 30 – 46 µm, 1.1 – 2.1 as long as wide, leaf lobes 4, upright to weakly divergent, 1.5 – 2.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 19 – 23 × 17 – 24 µm, 0.9 – 1.2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** approximate, obliquely inserted, spreading at an angle of 50° – 80°, leaves square to trapezoid, symmetric, leaf lobes bending down ventrally, 160 – 190 µm wide, 210 – 230 µm long, 1.2 – 1.4 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 cells wide, 2.5 – 4.5 cells long, 110 – 150 µm wide, 95 – 130 µm long, 0.6 – 1.1 as long as wide, median cells isodiametric to shortly elongated polygonal, 19 – 28 × 24 – 31 µm, 0.9 – 1.4 as long as wide, cell walls moderately thickened, trigones lacking, cuticle with striate papillae, basal cells isodiametric to elongated polygonal, 23 – 28 × 30 – 44 µm, 1.3 – 1.6 as long as wide, leaf lobes 3, upright to weakly divergent, 3.5 – 6.5 cells long, 2 – 4 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 2 – 3 cells long, cells elongated polygonal, not constricted at the transversal walls, cells 16 – 24 × 25 – 34 µm, 1 – 1.9 as long as wide, cell walls moderately thickened, trigones small, cuticle with large round papillae. **Branch underleaves** approximate, transversely attached, upright, 1 – 1.2 times as wide as the branch, 90 – 100 µm wide, 120 – 135 µm long, 1.3 – 1.4 as long as wide, divided by 0.3 of the leaf length, disc 4 cells wide, 1.5 – 2.5 cells long, 75 – 95 µm wide, 80 – 95 µm long, 0.9 – 1.2 as long as wide, median cells isodiametric polygonal, 23 – 28 × 18 – 27 µm, 0.8 – 1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 21 – 27 × 32 – 37 µm, 1.2 – 1.5 as long as wide, leaf lobes 2, upright, 1.5 – 2.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 16 – 21 × 18 – 30 µm, 0.9 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Male branches** originating ventrally – intercalar from the main stem, straight to falcate, up to 1.2 mm long, with leaves up to 0.2 mm wide. **Male bracts** imbricate, obliquely attached, ovate to trapezoid, 160 µm wide, 175 µm long, 1.1 as long as wide, divided by 0.4 of the leaf length, disc 110 – 140 µm wide, 110 µm long, median cells elongated polygonal, 15 – 25 × 28 – 41 µm, 1.5 – 2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 16 – 22 × 34 – 51 µm, 2 – 2.7 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, leaf lobes 2, divergent, 2.5 cells long, 3 – 4 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 cells long, cells 12 – 22 × 23 – 31 µm, 1 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Underleaves** imbricate, transversely attached, appressed, underleaves rectangular, 60 – 85 µm wide, 95 – 150 µm long, 1.6 – 1.8 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 cells wide, 0.5 – 2.5 cells long, 40 – 80 µm wide, 55 – 80 µm long, median cells isodiametric polygonal, 18 – 24 × 20 – 23 µm, 1 – 1.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 16 – 25 × 30 – 42 µm, 1.2 – 2.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, leaf lobes 2, upright to weakly divergent, 1.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 3 cells long, cells 16 – 23 × 22 – 31 µm, 1.3 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Sexuality** monoicous. **Perianth** originating ventrally from the main stem, 2.5 mm long, not narrowed towards the mouth, multi – plicate in the upper third. **Perianth mouth** ciliate, mouth cells linear, 9 – 13 × 54 – 75 µm, 4.5 – 8.3 as long as wide, cell walls thickened, trigones small, cuticle smoth, median cells elongated polygonal to linear, 18 – 24 × 41 – 93 µm, 1.8 – 4.9 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae. **Female bracts** ovate, margin with a few blunt teeth, 430 – 460 µm wide, 720 – 800 µm long, 1.6 – 1.9 as long as wide, median cells elongated polygonal, 19 – 36 × 46 – 69 µm, 1.9 – 3.1 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells ovate to elongated polygonal, 32 – 44 × 52 – 89 µm, 1.4 – 2.1 as long as wide, leaf lobes 4, 3.5 – 7.5 cells long, 2 – 4 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 3 – 5 cells long, cells linear, cells 10 – 13 × 45 – 64 µm, 4.2 – 6.1 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Female bracteole** ovate to triangular, margin with a few blunt teeth, 270 µm wide, 440 µm long, 1.6 as long as wide, median cells elongated polygonal, 17 – 27 × 31 – 75 µm, 1.4 – 4.4 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae, basal cells ovate to elongated polygonal, 31 – 44 × 53 – 68 µm, 1.3 – 2.2 as long as wide, leaf lobes 4, 3.5 – 5.5 cells long, 2 – 4 cells wide at base,

multiseriate part 1 – 3 cells long, uniseriate part 2 – 3 cells long, cells linear, cells 12 – 19 × 38 – 61 µm, 2.5 – 5.1 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae.

Distinguishing characters:

N. limbawonensis is characterised by (1) the distinct, obliquely inserted stem and branch leaves, (2) median cells of the branch leaf disc that barely exceed 30 µm, (3) the lobe bases of stem and branch leaves that are up to four cells wide, (4) the rather strongly papillose cells of branch and stem leaves, as well as of bracts and bracteoles, and (4) the monoecy.

Similar species:

N. limbawonensis can be mistaken for *N. massartiana* as they are similar in size, and both species have obliquely inserted leaves. However, the leaf lobes are only two cells wide at the base, and the cells are less papillose. Furthermore, we have not observed a monoicous sexual condition in *N. massartiana.*

The leaf shape and papillosity of *N. limbawonensis* are similar to those of *N. papulosa* var. *apoensis* to a certain degree. By contrast, this variety has longitudinally attached leaves, bases of branch and stem leaves that are two cells wide, and short rectangular cells that mostly exceed 30 µm.

Another species with similar leaf shape and papillosity is *N. morobensis*. It has longitudinally attached leaves, rather distant branch underleaves, and shorter cells of the perianth mouth and the bract lobes.

Distribution:

Philippines (Mindanao). Only known from the type collection.

Etymology:

The species is named after Limbawon Mountain where the species was discovered.

Lepidozia longitudinalis **HERZOG.** *Transactions of the British Bryological Society* 1(4): 312. 1950.

≡ *Neolepidozia longitudinalis* (HERZOG) E.D. COOPER. *Phytotaxa* 97(2): 56. 2013.

≡ *Telaranea longitudinalis* (HERZOG) R.M. SCHUST. The Hepaticae and Anthocerotae of North America 2: 30. 1969.

≡ *Acrolepidozia longitudinalis* (HERZOG) R.M. SCHUST. *Journal of the Hattori Botanical Laboratory* 26: 254. 1963.

Type:

[Malaysia]: Sarawak. Ulu Koyan, alt. c. 800 m, sandstone rocks in river bed in shade of *Dipteris*. leg. P.W. RICHARDS 2047 (JE 04000714!, det. J.J. ENGEL 2008 as *Telaranea longitudinalis*).

Note by HERZOG on the specimen label: "(+ *Cololej. fissilobula* n.sp.! entnommen)".

Note by MIZUTANI: "The material is probably type of *Lepidozia longitudinalis* Herz. 1949. Hab. of originals of *L. longitudinalis* and *Cololejeunea fissilobula* are probably misprint. This material probably has no connection *C. fissilobula*. This material has no *Cololejeunea*, and original disc. mentioned ramicola. M. MIZUTANI, July 1976".

Figures:

HERZOG (1950) fig. 29.

Plate 129, Plate 130, Plate 131, Plate 132, Plate 133.

Description:

Plants greenish to brownish, small, up to 1.5 cm long, stem with leaves up to 0.4 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 3 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 190 µm wide and 160 µm high, cortical cells 12, 27 – 50 × 13 – 37 µm, cell walls moderately thickened, medullary cells up to 70, 10 – 26 × 9 – 18 µm, cell walls thin, trigones lacking, dorsal cortical cells isodiametric to elongated polygonal, 35 – 45 × 39 – 58 µm, 0.9 – 1.5 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Stem leaves** distant, obliquely inserted, spreading at an angle of 30° – 50°, leaves square to trapezoid, with oblique base, ventrally decurrent, symmetric, flat, 200 – 220 µm wide, 240 – 310 µm long, 1.2 – 1.4 as long as wide, divided by 0.2 – 0.4 of the leaf length, margin entire, disc 8 cells wide, 3.5 – 5.5 cells long, 150 – 220 µm wide, 150 – 250 µm long, 0.8 – 1.5 as long as wide, median

cells hexagonal to elongated polygonal, 20 – 33 × 19 – 38 µm, 1 – 1.6 as long as wide, cell walls thin, trigones small, cuticle smooth, basal cells elongated polygonal, 22 – 43 × 32 – 48 µm, 1.1 – 1.6 as long as wide, leaf lobes 4, upright, 2.5 – 4.5 cells long, straight, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 4 cells long, cells square to elongated polygonal, weakly constricted at the transversal walls, 20 – 26 × 18 – 34 µm, 0.9 – 1.3 as long as wide, cell walls thin, trigones small, cuticle smooth, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, upright, 0.7 – 0.8 times as wide as the stem, underleaves transversely rectangular, 130 – 190 µm wide, 110 – 140 µm long, 0.7 – 0.9 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 8 cells wide, 2.5 – 3.5 cells long, 100 – 190 µm wide, 80 – 110 µm long, 0.5 – 0.8 as long as wide, median cells square to hexagonal, 18 – 20 × 19 – 26 µm, 1 – 1.3 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated ovate to polygonal, 20 – 28 × 29 – 39 µm, 1.4 – 1.7 as long as wide, leaf lobes 4, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 15 – 22 × 30 – 37 µm, 1.4 – 2.1 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch leaves** approximate, longitudinally to obliquely inserted, spreading at an angle of 40° – 70°, leaves rectangular, with oblique base, ventrally decurrent, symmetric, flat, 200 – 230 µm wide, 410 – 540 µm long, 1.9 – 2.7 as long as wide, divided by 0.1 – 0.2 of the leaf length, divided by 0.1 – 0.2 on the ventral side, margin entire, disc 6 – 7 cells wide, 7.5 – 10.5 cells long, 140 – 230 µm wide, 330 – 440 µm long, 1.5 – 2.8 as long as wide, median cells hexagonal to short rectangular, 22 – 37 × 26 – 42 µm, 1.1 – 1.2 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 30 – 52 × 41 – 59 µm, 1.1 – 1.4 as long as wide, leaf lobes 3, upright, 2.5 – 3.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 cells long, cells square to short rectangular, not constricted at the transversal walls, cells 22 – 30 × 21 – 29 µm, 0.8 – 1.3 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch underleaves** distant, transversely attached, upright, 0.5 – 0.6 times as wide as the branch, underleaves trapezoid, 95 – 110 µm wide, 70 – 80 µm long, 0.6 – 0.8 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 6 cells wide, 1.5 – 2.5 cells long, 70 – 110 µm wide, 40 – 50 µm long, 0.4 – 0.7 as long as wide, basal cells elongated ovate to polygonal, 15 – 22 × 19 – 31 µm, 0.9 – 1.7 as long as wide, leaf lobes 2 – 3, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 13 – 15 × 13 – 24 µm, 1 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

The species is characterised by (1) short stem and branch leaf lobes, (2) oblique leaf base that is decurrent on the ventral side, (3) the rather irregular branching, and (4) the enlarged cortical stem cells.

Similar species:

Lepidozia longitudinalis shows no resemblance to any other *Neolepidozia* species. It displays a high similarity to species previously combined in *Lepidozia* sect. *Microphyllae*, e.g. *L. trichodes.* It can immediately be distinguished from this group by its enlarged cortical stem cells.

Distribution:

Malaysia (Borneo). Only known from the type collection. A second specimen in JE from Sarawak, labelled as *L longitudinalis* (*Eggers*, BOR 4,03) contains a *Kurzia* species.

Remark:

Due to its major differences from other *Neolepidozia* species we exclude *L. longitudinalis* from that genus and retain it as a member of *Lepidozia* for the time being. As the species is clearly defined by its enlarged cortical stem cells, it is up to future studies to decide whether the genus *Acrolepidozia*, that was established by SCHUSTER (1963), is justified.

Neolepidozia lungaensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

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, ca. 1300 m, on soil, leg. FELIX SCHUMM & UWE SCHWARZ, 10 August 2000 (herbarium UWE SCHWARZ 5829!, isotype: herbarium SCHÄFER-VERWIMP!).

Figures:

Plate 134, Plate 135, Plate 136, Plate 137, Plate 138, Plate 139.

Comparison Plate 2 – J.

Description

Plants pale yellowish green, small, up to 1 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** irregular, some branches of *Frullania*-type, majority ventral-intercalar, developing into main stems. **Branches** up to 2 mm long, not flagelliform at the end. **Flagelliform branches** scattered, up to 4 mm long. **Rhizoids** not seen. **Stem** in cross section 135 µm wide and 120 µm high, cortical cells 10, 29 – 43 × 22 – 34 µm, cell walls moderately thickened, medullary cells up to 15, 21 – 31 × 11 – 22 µm, cell walls moderately thickened, trigones small, dorsal cortical cells elongated polygonal, 29 – 43 × 49 – 71 µm, 1.3 – 2.2 as long as wide, cell walls moderately thickened, trigones lacking to small, cuticle smooth. **Stem leaves** distant to approximate, obliquely inserted, spreading at an angle of 40° – 80°, leaves ovate to trapezoid, weakly asymmetric, lobes bent down ventrally, 270 – 370 µm wide, 260 – 330 µm long, 0.8 – 1.1 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 8 – 13 cells wide, 2.5 – 4.5 cells long, 170 – 260 µm wide, 140 – 200 µm long, 0.5 – 1.2 as long as wide, median cells isodiametric to weakly elongated polygonal, 24 – 35 × 36 – 44 µm, 1.3 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 27 – 33 × 37 – 51 µm, 1.2 – 1.8 as long as wide, leaf lobes 4, upright to weakly divergent, 4.5 – 6.5 cells long, straight to weakly falcate, 2 – 4 cells wide at base, multiseriate part 3 – 4 cells long, uniseriate part 2 – 3 cells long, cells square, ovate to elongated polygonal, weakly constricted at the transversal walls, 21 – 25 × 20 – 42 µm, 1 – 1.8 as long as wide, cell walls thin, trigones lacking, cuticle with round papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1.1 – 1.2 times as wide as the stem, underleaves square to trapezoid, 190 – 220 µm wide, 140 – 180 µm long, 0.7 – 0.9 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 8 cells wide, 1.5 – 3.5 cells long, 130 – 180 µm wide, 75 – 110 µm long, 0.4 – 0.8 as long as wide, median cells square to hexagonal, 22 – 28 × 23 – 34 µm, 0.9 – 1.3 as long as wide, cell walls moderately thickened, trigones lacking to small, cuticle smooth, basal cells ovate to elongated polygonal, 20 – 25 × 36 – 50 µm, 1.6 – 2.5 as long as wide, leaf lobes 4, upright to weakly divergent, 2.5 – 4.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 1 – 2 cells long, cells 15 – 21 × 18 – 38 µm, 1.2 – 1.9 as long as wide, cell walls thin to moderately thickened, trigones lacking to small, cuticle smooth. **Branch leaves** approximate to imbricate, longitudinally to obliquely inserted, spreading at an angle of 50° – 70°, leaves square, ovate to elongated rectangular, weakly asymmetric, leaf lobes weakly bending down ventrally, 170 – 220 µm wide, 200 – 310 µm long, 1.2 – 1.7 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 – 11 cells wide, 3.5 – 5.5 cells long, 110 – 180 µm wide, 125 – 175 µm long, 0.8 – 1.3 as long as wide, median cells isodiametric to elongated polygonal, 23 – 33 × 29 – 39 µm, 1.1 – 1.4 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 23 – 29 × 37 – 50 µm, 1.4 – 1.8 as long as wide, leaf lobes 3, upright to weakly divergent, 3.5 – 5.5 cells long, 2 – 4 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 2 – 3 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, cells 19 – 25 × 19 – 41 µm, 1 – 1.9 as long as wide, cell walls thin, trigones lacking, cuticle with round papillae. **Branch underleaves** approximate, transversely attached, spreading away from the stem, 1.1 – 2.1 times as wide as the branch, underleaves square, transversely to elongated rectangular, 95 – 170 µm wide, 100 – 170 µm long, 0.9 – 1.3 as long as wide, divided by 0.3 – 0.6 of the leaf length, disc 4 – 6 cells wide, 1.5 – 3.5 cells long, 80 – 145 µm wide, 55 – 120 µm long, 0.5 – 1.3 as long as wide, median cells isodiametric to elongated polygonal, 22 – 27 × 27 – 35 µm, 1.2 – 1.4 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells isodiametric to elongated polygonal, 24 – 28 × 29 – 44 µm, 1.1 – 1.8 as long as wide, leaf lobes 2 – 3, upright, 1.5 – 3.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 1 – 2 cells long, cells 17 – 24 × 20 – 39 µm, 1.1 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth.

Distinguishing characters:

N. lungaensis is characterised by (1) the base of the branch leaf lobes being up to 4 cells wide, (2) the frequent secondary divisions of the branch leaf disc cells, leading to a disc width of up to 12 cells, (3) the rather isodiametric branch leaf disc cells, and (4) the predominantly ventral-intercalar branching pattern.

Similar species:

The branch leaf shape and cell pattern resemble those of *N. schaefer-verwimpii*. This species however, has a regular, *Frullania*-type branching pattern and the multiseriate part of the branch leaf lobes is only 1 – 2 cells long. The branch leaf lobes of *N. schaefer-verwimpii* are short triangular unlike those of *N. lungaensis*, which are elongated.

N. novoguineensis with thin-walled, papillose lobe cells is a larger plant with deeper divided branch leaves. *N. lungaensis* is one of the few species that grows on bare, sandy soil.

Distribution:

Philippines (Negros). Only known from the type collection.

Etymology:

The species is named after the Lunga nature trail on Negros Island where the species was discovered.

Neolepidozia mamillosa (SCHIFFN.) E.D. COOPER. *Phytotaxa* 97(2): 56. 2013.

≡ *Lepidozia mamillosa* SCHIFFN. *Nova Acta Acad. Caes. Leop.- Carol. German. Nat. Cur.* 60 (2): 254. 1893.

≡ *Telaranea mamillosa* (SCHIFFN.) J.J. ENGEL & G.L. MER. *Fieldiana, Bot., n.s.* 44: 166. 2024.

Type:

In Nova Guinea ad terram; lgt. Dr. Naumann in Expeditione navis "Gazelle" (Jun. 1875) (FH).

Figures:

PIIPPO (1984) fig. 4, d, g, i, k. SCHIFFNER (1893) tab. XV, fig. 15-19.

Plate 140, Plate 141, Plate 142, Plate 143, Plate 144, Plate 145 (from CARR 11532).

Description (based on CARR 11532):

Plants yellowish brown, small, up to 1 cm long, stem with leaves up to 0.7 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparse, up to 2 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 230 µm wide and 165 µm high, cortical cells 13, 38 – 51 × 28 – 38 µm, cell walls thickened, medullary cells up to 30, 18 – 28 × 17 – 37 µm, cell walls thickened, trigones small, dorsal cortical cells isodiametric to elongated polygonal, 35 – 49 × 42 – 87 µm, 1.2 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** imbricate, obliquely inserted, spreading at an angle of 55° – 85°, leaves square to transversely rectangular, weakly asymmetric, lobes bent down ventrally, 320 – 420 µm wide, 310 – 390 µm long, 0.9 – 1.1 as long as wide, divided by 0.3 – 0.4 of the leaf length, margin entire, disc 8 – 14 cells wide, 2.5 – 4.5 cells long, 230 – 420 µm wide, 200 – 250 µm long, 0.5 – 1 as long as wide, median cells isodiametric to weakly elongated polygonal, 28 – 51 × 44 – 55 µm, 1 – 1.6 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal, 40 – 61 × 62 – 87 µm, 1.2 – 2 as long as wide, leaf lobes 4, upright to weakly divergent, 3.5 – 6.5 cells long, straight to weakly falcate, 2 – 4 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 2 – 4 cells long, cells round to ovate, constricted at the transversal walls, 25 – 35 × 28 – 51 µm, 1 – 1.6 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1.1 – 1.4 times as wide as the stem, underleaves transversely rectangular, 180 – 285 µm wide, 100 – 150 µm long, 0.5 – 0.6 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 8 – 10 cells wide, 0.5 – 1.5 cells long, 150 – 245 µm wide, 50 – 100 µm long, 0.3 – 0.5 as long as wide, basal cells elongated polygonal, 21 – 32 × 35 – 43 µm, 1.3 – 1.7 as long as wide, leaf lobes 4, upright to divergent, 1.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 18 – 27 × 22 – 30 µm, 1 – 1.3 as long as wide, cell walls moderately thickened, trigones lacking to small, cuticle smooth. **Branch leaves** approximate, obliquely inserted, spreading at an angle of 50° – 70°, leaves square, ovate to trapezoid, weakly asymmetric, leaf lobes weakly bending down ventrally, 180 – 220 µm wide, 240 – 300 µm long, 1.2 – 1.4 as long as wide, divided by 0.3 – 0.5 of the leaf length, margin entire, disc 6 – 7 cells wide, 2.5 – 3.5 cells long, 120 – 220 µm wide, 125 – 170 µm long, 0.6 – 1.3 as long as wide, median cells isodiametric to elongated polygonal, 29 – 40 × 33 – 55 µm, 1 – 1.4 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal, 29 – 40 × 55 – 76 µm, 1.9 – 2.2 as long as wide, leaf lobes 3, upright, 2.5 – 5.5 cells long, 2 – 4 cells wide at base, multiseriate part 1 – 4 cells long, uniseriate part 2 – 3 cells long, cells round to ovate, constricted at the transversal walls, cells 28 – 33 × 28 – 49 µm, 1 – 1.6 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Branch underleaves** approximate, transversely attached, spreading away from the stem, 1.3 – 1.8 times as wide as the branch, underleaves transversely rectangular, 170 – 200 µm wide, 100 – 135 µm long, 0.6 – 0.8 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 6 cells wide, 0.5 – 1.5 cells long, 135 – 190 µm wide, 50 – 90 µm long, 0.3 – 0.7 as long as wide, basal cells elongated polygonal, 26 – 34 × 38 – 60 µm, 1.4 – 1.9 as long as wide, leaf lobes 3, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 25 – 31 × 28 – 38 µm, 0.9 – 1.4 as long as wide, cell walls moderately thickened, trigones lacking to small, cuticle smooth. **Perianth** originating ventrally from the main stem, 3 mm long, not narrowed towards the mouth, multi – plicate in the upper third. **Perianth mouth** ciliate, mouth cells ovate, 20 – 32 × 32 – 55 µm, 1.4 – 2.1 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, median cells ovate to elongated polygonal, 32 – 37 × 43 – 100 µm, 1.3 – 2.9 as long as wide, cell walls moderately thickened, trigones lacking to small, cuticle strongly mamillose. **Female bracts** ovate, margin with a

few blunt teeth, 690 – 850 µm wide, 1200 – 1350 µm long, 1.4 – 2 as long as wide, median cells elongated polygonal, 60 – 70 × 98 – 160 µm, 1.4 – 2.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells ovate to elongated polygonal, 62 – 72 × 103 – 125 µm, 1.5 – 2 as long as wide, leaf lobes 3 – 4, 5.5 – 11.5 cells long, 4 – 5 cells wide at base, multiseriate part 5 – 8 cells long, uniseriate part 2 – 3 cells long, cells ovate, cells 45 – 65 × 77 – 180 µm, 1.6 – 3.1 as long as wide, cell walls thin, trigones lacking, cuticle smooth.

Distinguishing characters:

The most striking character of *N. mamillosa* are (1) the strongly mamillose perianth cells. None of the other *Neolepidozia* we studied develops this kind of cells. The identification of sterile material is a bit more challenging. The (2) strongly constricted transversal wall of the branch leaf lobe cells leading to an unevenly margined lobe, the (3) short, mostly rounded cells of the branch leaf lobe, and (4) the bulging cortical cells of the stem (observe the stem cross section) will distinguish it from other species. As already mentioned by GROLLE (1967) *N. mamillosa* is a lowland plant growing on soil in mangrove forest. The other species treated in this article prefer mountainous areas, often growing on other substrates.

Similar species:

The material from JE identified as *N. mamillosa* consisted also of *N. arauluensis*, *N. schusteri*, and *N. streimannii.* These species have fragile leaves, more regular branch leaves and larger branch underleaves. They also appear at higher elevations in mountain areas. Another species with constricted transversal walls of the leaf lobes is *N. yorongii*. This species however, is also very fragile with only the leaf disc remaining at the stem and the branch.

Distribution:

Indonesia (Borneo), Japan (Iriomote Island), Malaysia (Borneo), Papua New Guinea (New Guinea), Singapore (based on JUSLÉN et. al. [2001]).

Specimens studied:

Indonesia: O-Borneo, District Samarinda, Mangrove - forest, on sandy soil under *Rhizophora*, leg. MEIJER B3113, 1952 (JE! ex L, det. MEIJER 1958 as *Lepidozia mamillosa*, teste R. GROLLE 1966 as *Lepidozia mamillosa*).

Japan: Ryukyu, Iriomote Isl. Okinawa-ken, Yaeyama-gun, Taketomi-cho, Funaura, 24° 23’ 09.3” N, 123° 49’ 14.1” E, 1 m alt., on moist sandy soil in mangrove forest, leg. T. YAMAGUCHI 38455, 20 September 2017 (herbarium SCHÄFER-VERWIMP!, det. T. YAMAGUCHI as *Neolepidozia mamillosa*).

[Papua New Guinea]: Neuguinea, leg. NAUMANN (JE!, Isotype “aus Glyzerinpräparat herbarisiert durch GROLLE 1984“).

[Papua New Guinea]: New Guinea, SO-Neuguinea, Kanosia, sea level, terrestrical in edge of Mangrove swamp, leg. CARR 11532, 1935 (JE! ex L, det. R. GROLLE 1966 as *Lepidozia mamillosa*, duplicate: NY).

Remark:

The record of *N. mamillosa* from Mt. Kinabalu in MIZUTANI (1974) very likely belongs to another species as it was found at an elevation of 1340 – 1400 m and not in a typical lowland, mangrove forest. The material has to be restudied to verify its identity.

Although we did not see the specimen collected by JUSLÉN in Singapore, it is highly likely that the species can be found there.

Neolepidozia massartiana (SCHIFFN. ex STEPH.) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*

Basionym:

Lepidozia massartiana SCHIFFN. ex STEPH. Species Hepaticarum 3: 611. 1909.

Synonyms:

≡ *Lepidozia massartiana* SCHIFFN. *Hedwigia.* 39: 196. 1900. *nom. ill.*

Type:

Java. Urwald von Tjibodas, an faulem Holze; c. per. I. 1895 (No. 1158 p.p.), leg. *J. Massart*. (G00115402 or G00281053).

Figures:

STEPHANI (1985) Icones no. 5252. The drawings are based on material from Amboina and Tahiti. Based on the scanned specimen from Amboina, leg. G. KARTSTEN (G00280930) we do not think that the plants belong to *N. massartiana*, as the branch leaves are longitudinally inserted and not bent ventrally. In addition, ENGEL & MERRILL (2004) indicated that the plants from Tahiti resemble *L. cuneifolia*. We are certain that STEPHANIs drawings depict different species.

Plate 146, Plate 147, Plate 148, Plate 149, Plate 150, Plate 151 (from SCHÄFER-VERWIMP 24810a).

Plate 152, Plate 153, Plate 154, Plate 155, Plate 156, Plate 157 (from SCHWARZ 4776).

Comparison Plate 2 – O, Comparison Plate 5 – I.

Description (based on SCHÄFER-VERWIMP 24810a):

Plants yellowish green, small, up to 1 cm long, stem with leaves up to 0.5 mm wide, leaves not fragile. **Branching** irregular to bipinnate, of *Frullania*-type, often with ventral intercalar branches turning into new stems. **Branches** up to 2 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 3 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 150 µm wide and 120 µm high, cortical cells 12, 23 – 36 × 20 – 32 µm, cell walls thickened, medullary cells up to 35, 9 – 18 × 11 – 17 µm, cell walls thickened, trigones small, dorsal cortical cells isodiametric to elongated polygonal, 31 – 44 × 30 – 48 µm, 0.8 – 1.3 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Stem leaves** distant, obliquely inserted, spreading at an angle of 30° – 50°, leaves square, rectangular to trapezoid, asymmetric, lobes bent down ventrally, 165 – 210 µm wide, 195 – 250 µm long, 1 – 1.2 as long as wide, divided by 0.3 – 0.5 of the leaf length, margin entire, disc 8 – 10 cells wide, 2.5 – 4.5 cells long, 140 – 200 µm wide, 100 – 155 µm long, 0.6 – 1 as long as wide, median cells square, rectangular to elongated polygonal, 20 – 32 × 23 – 37 µm, 1 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle almost smooth, basal cells elongated polygonal, 18 – 25 × 34 – 40 µm, 1.5 – 2.2 as long as wide, leaf lobes 4 (-5), upright to weakly divergent, 2.5 – 3.5 cells long, straight to falcate, 2 – 4 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 15 – 22 × 21 – 30 µm, 1.1 – 1.8 as long as wide, cell walls moderately thickened, trigones small, cuticle almost smooth, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed, 1 – 1.4 times as wide as the stem, underleaves square to rectangular, 155 – 185 µm wide, 140 – 170 µm long, 0.9 – 1.1 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 6 – 8 cells wide, 2.5 – 3.5 cells long, 125 – 185 µm wide, 90 – 130 µm long, 0.5 – 0.9 as long as wide, median cells hexagonal to isodiametric polygonal, 20 – 29 × 28 – 35 µm, 1 – 1.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells isodiametric to elongated polygonal, 22 – 35 × 33 – 43 µm, 1.2 – 1.7 as long as wide, leaf lobes 4, upright to weakly divergent, 2.5 – 3.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 1 – 2 cells long, cells 13 – 16 × 19 – 31 µm, 1.2 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** approximate, obliquely inserted, spreading at an angle of 35° – 60°, leaves rectangular to trapezoid, symmetric to weakly asymmetric, bent ventrally, 125 – 160 µm wide, 210 – 240 µm long, 1.4 – 1.8 as long as wide, divided by 0.3 – 0.4 of the leaf length, margin entire, disc 6 cells wide, 2.5 – 4.5 cells long, 90 – 140 µm wide, 120 – 160 µm long, 0.9 – 1.6 as long as wide, median cells isodiametric to elongated polygonal, 19 – 28 × 24 – 38 µm, 1.1 – 1.4 as long as wide, cell walls thin, trigones lacking to small, cuticle smooth, basal cells elongated polygonal, 20 – 25 × 25 – 40 µm, 1.3 – 1.7 as long as wide, leaf lobes 3, upright, 2.5 – 4.5 cells long, 2 – 3 cells wide at base, multiseriate part 2 cells long, uniseriate part 2 – 3 cells long, cells square to elongated polygonal, not constricted at the transversal walls, cells 15 – 22 × 19 – 34 µm, 1.1 – 2 as long as wide, cell walls thin, trigones lacking to small, cuticle almost smooth. **Branch underleaves** approximate, transversely attached, appressed, 1 – 1.3 times as wide as the branch, underleaves square to rectangular, 90 – 135 µm wide, 130 – 155 µm long, 1 – 1.7 as long as wide, divided by 0.2 – 0.3 of the leaf length, disc 4 – 6 cells wide, 2.5 – 4.5 cells long, 80 – 125 µm wide, 100 – 130 µm long, 0.8 – 1.4 as long as wide, median cells square to isodiametric or elongated polygonal, 18 – 25 × 23 – 29 µm, 1 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 19 – 31 × 30 – 41 µm, 1.3 – 1.7 as long as wide, leaf lobes 2 – 3, upright, 1.5 – 2.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 12 – 23 × 15 – 29 µm, 0.8 – 2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. massartiana is characterised by (1) the obliquely inserted stem and branch leaves, (2) the rather short branch leaf disc cells that are less than 1.5 times as long as wide, (3) the asymmetric stem leaves, and (4) branch underleaves that are rather large compared to the lateral leaves.

Similar species:

This species is closely related to *N. papulosa* and *N. papulosa* var. *sakuraii*. Both have branch leaves that are attached longitudinally. Furthermore, the former has larger branch leaves with elongated disc cells, whereas the latter has thin cell walls without trigones. We fully agree with KITAGAWA (1973) who addressed the close relationship between these two species. Following him, we will also maintain *N. massartiana* as a distinct species.

N. tenera which was synonymized with *N. massartiana* by KITAGAWA (1973) has to our understanding a higher branch leaf disc and rather longitudinally attached branch leaves with hooked leaf lobes.

Lepidozia expansa STEPH., also synonymized to *N. massartiana* by KITAGAWA (1973) has asymmetric branch leaves as depicted by STEPHANI (1985) described by STEPHANI (1922). However, it is more likely that *L. expansa* belongs to species related to *Lepidozia variifolia*. Further study of the relevant specimens is required to confirm its identity. Since several species of *Neolepidozia* can grow intermixed it is possible that previous authors studied material similar to *N. massartiana*.

N. beckeri, which has similar obliquely inserted branch leaves, usually has more asymmetric branch leaves, thicker cell walls and larger branch underleaves.

N. limbawonensis can be mistaken for *N. massartiana* as they are similar in size, and both species have obliquely inserted leaves. However, the leaf lobes of the former are often more than two cells wide at the base, and the cells strongly papillose. Furthermore, we have not observed a monoicous sexual condition in *N. massartiana*.

Distribution:

Indonesia (Java, New Guinea, Sumatra), Malaysia (Borneo, Malay Peninsula), Philippines (Leyte, Mindanao, Negros), Taiwan.

Specimens studied:

[Indonesia:] New Guinea, W-Neuguinea, slope above the Mt. Tombrok, at lake Anggi Gita, 2100 m, on tree trunk, leg. BERGMAN H12, 1949 (JE!, det. S. HATTORI as *Lepidozia wallichiana*, teste R. GROLLE as *Lepidozia wallichiana*, duplicate: S).

Indonesia: Sumatra, North Sumatra, Hochland von Brastagi, Westaufstieg zum Gunung Sibayak, 3° 14' 12.2" N, 98° 29' 54.3" E, 1820 m, Strauchvegetation mit reichlich *Pandanus*, on volcanic rock wall in filtered light, leg. SCHÄFER-VERWIMP & VERWIMP, 16 May 2005 (herbarium SCHÄFER-VERWIMP 24810a!).

[Malaysia]: Borneo, West Borneo, auf dem Bukit Mulu, 800 - 900 m, leg. HANS WINKLER 3067/a (JE!, det. TH. HERZOG as *Lepidozia wallichiana*). Combined specimen of Winkler 3056a, 3334 and 3067/a.

[Malaysia]: W - Borneo, Bukit Mulu, 900 m, leg. HANS WINKLER 3067/a_III, 2 December 1924 (JE!, det. TH. HERZOG as *Lepidozia cuneifolia*, rev. M. MIZUTANI 1967 as *Lepidozia wallichiana*). Specimen renamed to 3067/a_III, since there are 3 specimens labeled WINKLER 3067/a.

Malaysia: Flora of Malaya, Gunong Siku, Pahang (Cameron Highlands), 6000 ft. +, in montan + montan mossy forests, abundant on horizontal trunks, leg. W.S. NULL 610a, 30 July 1970 (JE!, det. M. MIZUTANI 1976 as *Lepidozia cuneifolia*). The specimen consists of 2 species, *Neolepidozia beckeri* (NULL 610) and *Neolepidozia massartiana* (NULL 610a). MIZUTANIs identification referes to NULL 610.

Malaysia: State Pahang, Cameron Highlands, Parit Falls Park (near Tanah Rata), secondary lower mountain forest, 4° 28' 0" N, 101° 23' 0" E, 1466 m, leg. M.E. REINER-DREHWALD & U. DREHWALD 2007020, 28 July 2007 (duplicate: herbarium SCHÄFER-VERWIMP!).

Philippines: Leyte Island, 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, auf morschem Holz, leg. FELIX SCHUMM & UWE SCHWARZ, 18 August 2000 (herbarium UWE SCHWARZ 6184!).

Philippines: Mindanao Island, Misamis Oriental Province, Barangay Lunutan, tropical mountain rain forest at Mt. Lumot (Via Haruhay Trial) approaching from the intermediate camp, 8° 40' 42.77" N, 125° 1' 38.92" E, 2110 m, leg. FELIX SCHUMM & UWE SCHWARZ, 25 August1999, associated with *Bazzania wiltensii, Bazzania densa, Herbertus spec., Kurzia, spec., Lepidozia trichodes* and *Nowellia borneensis* (herbarium UWE SCHWARZ No. 4776!).

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, ca. 1300 m, auf Gestein, leg. FELIX SCHUMM & UWE SCHWARZ, 10 August 2000 (herbarium UWE SCHWARZ 5809a!).

Taiwan: Nantou County, Alishan Range, Lulishan Major Wildlife Habitat Area, off of highway 18, 23° 28' 9" N, 120° 50' 47" E, 2325 m, mixed hardwood forest with planted *Cryptomeria japonica* and *Pinus armandii*, on bark of *Cryptomeria* in partly filtered light, leg. A. SCHÄFER-VERWIMP 37905, with JIA-DONG YANG, KUEI-YU YAO, JAMES R. SHEVOCK, 28 June 2018 (herbarium SCHÄFER-VERWIMP 37905!, duplicates: TAIE, TAIM).

Remark:

As the type specimen was not available for loan, our understanding of *N. massartiana* is based on the remarks of KITAGAWA (1973) who studied the type from Java, Tjibodas collected by MASSART (G73).

ENGEL & MERRILL (2004) only studied material collected by SCHIFFNER 1894 from Tjibodas located in F. They treated "*L. massartiana* STEPH. as a probable synonym of *T. cuneifolia*, and SCHIFFNER's plant as *T. wallichiana*". Due to the diversity within the genus, it is essential to study the type or respective references to obtain a proper understanding of a species. It is very likely that the collections of SCHIFFNER consist of several species. Therefore, we do not follow the judgement of ENGEL & MERRILL (2004). It is also recommended to restudy specimens identified as *Lepidozia massartiana* or *L. wallichiana* located in North American Herbaria (e.g. F, NY).

HÜRLIMANN (1985) mentions a specimen in G from the North Moluccas ("Insel Batjen bei Halmaheira" = Pulau Bacan) that was collected 1888 by WARBURG and identified by STEPHANI as *L. theriotii*. Already W. Meijer revised the identification to *L.* cf. *massartiana*.

Neolepidozia morobensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Papua New Guinea: New Guinea, Morobe Province, Manki Trig., Bulolo-Watut Divide, 7° 18' S, 148° 37' E, 1530 m, broad ridge, with *Castanopsis-Lithocarpus* dominated forest, on moist, shaded rotting log, leg. H. STREIMANN & A. BELLAMY 12985, 26 January 1981 (JE!, det. R. GROLLE, 1982, as *Lepidozia wallichiana*, duplicates: CANB, LAE, NICH).

Figures:

Plate 158, Plate 159, Plate 160, Plate 161, Plate 162, Plate 163, Plate 164.

Comparison Plate 5 – F.

Description

Plants pale yellowish green, small, up to 1.5 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 2 mm long, occasionally flagelliform at the end. **Flagelliform branches** scattered, up to 2 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 120 µm wide and 115 µm high, cortical cells 12, 27 – 30 × 16 – 24 µm, cell walls thickened, medullary cells up to 30, 14 – 20 × 10 – 18 µm, cell walls thickened, trigones small, dorsal cortical cells rectangular to elongated polygonal, 19 – 28 × 38 – 75 µm, 1.5 – 3.9 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Stem leaves** distant, longitudinally inserted, spreading at an angle of 50° – 70°, leaves square to trapezoid, symmetric, flat, 155 – 230 µm wide, 210 – 225 µm long, 1 – 1.4 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 – 8 cells wide, 2.5 – 3.5 cells long, 125 – 170 µm wide, 100 – 120 µm long, 0.6 – 1 as long as wide, median cells isodiametric polygonal, 19 – 26 × 27 – 31 µm, 1.1 – 1.4 as long as wide, cell walls moderately thickened, trigones lacking, cuticle with striate papillae, basal cells elongated polygonal, 19 – 25 × 32 – 50 µm, 1.3 – 2.1 as long as wide, leaf lobes 3 – 4, upright to weakly divergent, 4.5 cells long, straight, 2 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2- 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 16 – 22 × 26 – 36 µm, 1.2 – 2 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed, 0.9 – 1.2 times as wide as the stem, underleaves transversely rectangular, 90 – 150 µm wide, 70 – 100 µm long, 0.7 – 1 as long as wide, divided by 0.2 – 0.5 of the leaf length, disc 6 – 8 cells wide, 1.5 – 2.5 cells long, 75 – 130 µm wide, 45 – 70 µm long, 0.4 – 0.9 as long as wide, median cells square, 15 – 19 × 17 – 22 µm, 0.9 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 15 – 19 × 24 – 35 µm, 1.3 – 2.3 as long as wide, leaf lobes 3 – 4, upright to weakly divergent, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 13 – 21 × 25 – 36 µm, 1.7 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves ovate, rectangular to trapezoid, symmetric to weakly asymmetric, flat, 120 – 165 µm wide, 205 – 250 µm long, 1.3 – 2.1

as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 cells wide, 2.5 – 4.5 cells long, 95 – 150 µm wide, 95 – 140 µm long, 0.7 – 1.5 as long as wide, median cells isodiametric to elongated polygonal, 24 – 27 × 23 – 33 µm, 1 – 1.3 as long as wide, cell walls moderately thickened, trigones lacking to small, cuticle with striate papillae, basal cells elongated polygonal, 20 – 27 × 24 – 48 µm, 1.2 – 2.3 as long as wide, leaf lobes 3, upright to bent internally, 4.5 – 6.5 cells long, 2 – 3 cells wide at base, multiseriate part 3 – 4 cells long, uniseriate part 2 – 3 cells long, cells ovate to elongated polygonal, weakly constricted at the transversal walls, cells 19 – 26 × 18 – 31 µm, 0.9 – 1.6 as long as wide, cell walls moderately thickened, trigones lacking to small, cuticle with round papillae. **Branch underleaves** distant, transversely attached, appressed, 0.8 – 1.1 times as wide as the branch, underleaves square to trapezoid, 55 – 95 µm wide, 65 – 125 µm long, 1.2 – 1.4 as long as wide, divided by 0.5 – 0.7 of the leaf length, disc 4 cells wide, 0.5 – 2.5 cells long, 45 – 80 µm wide, 35 – 55 µm long, 0.5 – 1 as long as wide, median cells hexagonal, 20 – 21 × 17 – 19 µm, 0.8 – 1 as long as wide, cell walls moderately thickened, trigones small, cuticle with round papillae, basal cells ovate to elongated polygonal, 15 – 20 × 18 – 26 µm, 1.1 – 1.6 as long as wide, leaf lobes 2, upright to weakly divergent, 1.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 3 cells long, cells 17 – 21 × 23 – 28 µm, 1.2 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle with round papillae. **Male branches** originating ventrally – intercalar from the stem from the main stem, straight, up to 0.7 mm long, with leaves up to 0.26 mm wide. **Male bracts** imbricate, transversely attached, ovate to square, 150 µm wide, 170 µm long, 1.1 as long as wide, divided by 0.5 of the leaf length, disc 130 – 140 µm wide, 90 µm long, basal cells elongated polygonal, 13 × 19 µm, 1.5 as long as wide, cell walls thin, trigones lacking, cuticle smooth, leaf lobes 2, upright, 1.5 – 3.5 cells long, 4 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 10 – 12 × 19 – 25 µm, 1.9 – 2.1 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Underleaves** distant, transversely attached, underleaves trapezoid, 70 µm wide, 55 µm long, 0.8 as long as wide, divided by 0.5 of the leaf length, disc 4 cells wide, 0.5 cells long, 45 – 65 µm wide, 25 µm long, basal cells elongated polygonal, 13 × 19 µm, 1.5 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, leaf lobes 2, divergent, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 10 – 12 × 19 – 25 µm, 1.9 – 2.1 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Perianth** originating ventrally from the main stem, 2.5 mm long, weakly narrowed towards the mouth, multi – plicate in the upper fourth. **Perianth mouth** shortly ciliate, mouth cells linear, 16 – 26 × 56 – 96 µm, 2.8 – 6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, median cells elongated polygonal to linear, 8 – 13 × 44 – 60 µm, 3.7 – 6.5 as long as wide, cell walls thickened, trigones lacking, cuticle smooth. **Female bracts** ovate, margin with a few teeth, 450 – 520 µm wide, 780 – 840 µm long, 1.6 – 1.7 as long as wide, median cells elongated polygonal to linear, 26 – 43 × 48 – 98 µm, 1.2 – 3.8 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, leaf lobes 4, 3.5 – 6.5 cells long, 3 – 5 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 5 cells long, cells elongated polygonal, cells 14 – 17 × 28 – 50 µm, 1.8 – 3.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. morobensis is characterised by (1) branch leaves that are divided by up to ½ of their leaf length, (2) the short branch leaf disc cells that is up to 1.3 as long as wide, (3) the moderately thickened disc cells, and (4) the papillose cells of the branch leaves and underleaves.

Similar species:

N. morobensis is closely related to *N. novoguineensis*. The latter species has longer branch leaves with a higher disc and thin cell walls.

N. lembangensis also shows some similarity to *N. morobensis* but it has elongated branch leaf disc cells and thin cell walls.

N. limbawonensis with similar leaf shape and papillosity has obliquely attached leaves, rather approximate branch underleaves, and longer cells of the perianth mouth and the bract lobes.

There is also some resemblance to *N. papulosa* var. *apoensis* which also has deeply divided branch leaves and a papillose cuticle. The cells of its branch leaf lobes are short rectangular and longer than those of *N. morobensis*.

Distribution:

Papua New Guinea (New Guinea).

Etymology:

The species is named after the Morobe Province where the species was discovered.

Specimens studied:

Papua New Guinea: New Guinea, Morobe Province, Manki Trig., Bulolo-Watut Divide, 7° 18' S, 148° 37' E, 1530 m, broad ridge, with *Castanopsis-Lithocarpus* dominated forest, on moist, shaded rotting log, leg. H. STREIMANN & A. BELLAMY 12989, 26 January 1981 (JE!, det. R. GROLLE, 1982, as *Lepidozia wallichiana*, duplicates: CANB, LAE, NICH).

Papua New Guinea: New Guinea, Morobe Province, Rawlinson Range, near Ogeramnang airstrip, ca. 5 km NNW of Ogeramnang, 6° 25' S, 147° 20' E, 1800 - 1900 m, in rich primary-growth rainforest along ridge, moist, diffusely lit log, collection site no. 10o, leg. DANIEL H. NORRIS 59951, 21 May 1981 (JE!, det. S. Piippo 1983 as *Lepidozia wallichiana*, duplicate: H).

Neolepidozia novoguineensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Papua New Guinea: New Guinea, Central Province, Varirata National Park, Sogeri, 9° 25' S, 147° 21' E, 600 m, *Castanopsis* and *Schizomeria* dominated disturbed forest, on rotting log, leg. H. STREIMANN & A. VINAS 14581, 5 February 1981 (JE!, det. R. GROLLE, 1982, as *Lepidozia wallichiana*, duplicates: CANB, LAE).

Figures:

Plate 165, Plate 166, Plate 167, Plate 168, Plate 169, Plate 170.

Comparison Plate 2 – L, Comparison Plate 4 – F.

Description

Plants pale yellowish green, small, up to 1 cm long, stem with leaves up to 0.5 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 2 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 2 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 130 µm wide and 120 µm high, cortical cells 12, 23 – 39 × 18 – 28 µm, cell walls thickened, medullary cells up to 30, 10 – 26 × 10 – 19 µm, cell walls thickened, trigones small, dorsal cortical cells rectangular to elongated polygonal, 25 – 31 × 46 – 86 µm, 1.8 – 3.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** distant, longitudinally inserted, spreading at an angle of 50° – 70°, leaves rectangular to trapezoid, weakly asymmetric, flat, 190 – 400 µm wide, 240 – 310 µm long, 0.8 – 1.4 as long as wide, divided by 0.5 – 0.7 of the leaf length, margin entire, disc 6 – 8 cells wide, 2 – 4 cells long, 130 – 220 µm wide, 90 – 150 µm long, 0.5 – 1.2 as long as wide, median cells isodiametric to elongated polygonal, 21 – 31 × 25 – 39 µm, 1 – 1.7 as long as wide, cell walls thin, trigones lacking, cuticle with striate papillae, basal cells isodiametric to elongated polygonal, 28 – 38 × 45 – 50 µm, 1.3 – 1.8 as long as wide, leaf lobes 3 – 4, upright ot divergent, 4.5 – 6.5 cells long, straight to weakly falcate, 2 – 3 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 2 – 4 cells long, cells ovate to elongated polygonal, weakly constricted at the transversal walls, 20 – 30 × 28 – 38 µm, 1.1 – 1.5 as long as wide, cell walls thin, trigones lacking, cuticle with round papillae, half stem leaf near branch base 1- or 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed, 0.9 – 1.4 times as wide as the stem, underleaves transversely rectangular to trapezoid, 125 – 165 µm wide, 100 – 160 µm long, 0.6 – 1.1 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 6 – 8 cells wide, 1 – 3 cells long, 90 – 145 µm wide, 60 – 105 µm long, 0.5 – 1.1 as long as wide, median cells square to elongated polygonal, 17 – 23 × 18 – 33 µm, 1.1 – 1.5 as long as wide, cell walls thin, trigones small, cuticle smooth, basal cells elongated polygonal, 16 – 22 × 26 – 41 µm, 1.3 – 2 as long as wide, leaf lobes 3 – 4, upright to weakly divergent, 1.5 – 3.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 1 – 2 cells long, cells 15 – 19 × 17 – 33 µm, 1 – 2.2 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves trapezoid, symmetric, flat, 140 – 235 µm wide, 260 – 330 µm long, 1.3 – 2.3 as long as wide, divided by 0.3 – 0.6 of the leaf length, divided by 0.3 – 0.5 on the ventral side, margin entire, disc 4 – 7 cells wide, 2 – 5 cells long, 80 – 170 µm wide, 125 – 185 µm long, 0.8 – 2.1 as long as wide, median cells isodiametric to elongated polygonal, 24 – 30 × 25 – 37 µm, 1 – 1.3 as long as wide, cell walls thin, trigones lacking, cuticle with striate papillae, basal cells elongated polygonal, 20 – 30 × 32 – 40 µm, 1.2 – 1.9 as long as wide, leaf lobes 2 – 3, upright, 4.5 – 6.5 cells long, 2 – 3 cells wide at base, multiseriate part 2 – 5 cells long, uniseriate part 2 – 3 cells long, cells ovate to elongated polygonal, weakly constricted at the transversal walls, cells 18 – 25 × 24 – 38 µm, 1.1 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle with round papillae. **Branch underleaves** distant, transversely attached, appressed, 0.9 – 1.3 times as wide as the branch, underleaves square to trapezoid, 65 – 130 µm wide, 75 – 125 µm long, 1 – 1.4 as long as wide, divided by 0.4 – 0.6 of the leaf length, disc 4 cells wide, 0.5 – 1.5 cells long, 45 – 110 µm wide, 40 – 65 µm long,

0.6 – 1 as long as wide, basal cells elongated polygonal, 17 – 30 × 23 – 47 µm, 1.3 – 1.9 as long as wide, leaf lobes 2, upright to weakly divergent, 1.5 – 2.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 14 – 22 × 22 – 32 µm, 1.3 – 2.2 as long as wide, cell walls thin, trigones lacking, cuticle smooth.

Distinguishing characters:

N. novoguineensis is characterised by (1) branch leaves that are divided by up to ½ or more of their leaf length, the (2) large branch leaves that are up to 330 µm long, (3) the short branch leaf disc cells that are up to 1.3 as long as wide, (4) the thin disc cells, (5) the coarse papillose cells of the branch leaves, the (6) long biseriate part of the branch leaf lobes, and (7) the rather small branch underleaves.

Similar species:

N. shevockii - *N. novoguineensis* sometimes has a leaf shape similar to that of *N. shevockii*. However, the latter has moderately thickened cell walls and larger branch underleaves with a disc that is usually 2.5 cells high.

N. novoguineensis is also related to *N. morobensis*. The latter species has shorter branch leaves with a lower disc and thicker cell walls.

N. lembangensis, another species with thin cell walls has a low branch leaf disc that is only up to 2.5 cells high.

N. streimannii with similarly short branch leaf disc cells has more constricted transversal cell walls of the branch leaf lobes and occasionally develops a blunt tooth at the lateral base of the branch leaf lobes.

N. sarawakensis var. *grandistipula* has similarly sized branch leaves. However, the leaf cells are smooth and rather elongated with enlarged trigones.

Distribution:

Papua New Guinea (New Guinea).

Etymology:

The species is named after the island of New Guinea where the species was discovered.

Specimen studied:

Papua New Guinea: New Guinea, Central Province, Varirata National Park, Sogeri, 22 km ENE of Port Moresby, 9° 25' S, 147° 21' E, 600 m, *Castanopsis* and *Schizomeria* dominated disturbed forest, base of large *Schizomeria*, leg. H. STREIMANN & A. VINAS 14566, 5 February 1981 (JE!, det. R. GROLLE 1982 as *Lepidozia wallichiana*, duplicates: CANB, LAE).

Neolepidozia ophiria (GOTTSCHE EX STEPH.) E.D. COOPER. *Phytotaxa* 97(2): 56. 2013.

≡ *Lepidozia ophiria* GOTTSCHE EX STEPH. Species Hepaticarum. 3: 611. 1909.

≡ *Telaranea ophiria* (GOTTSCHE EX STEPH.) J.J. ENGEL & G.L. MER. *Fieldiana, Bot., n.s.* 44: 176. 2024.

Type:

Malacca. Mt. Ophir. *Capt. Mixon* 972c (G00115430).

Figures:

STEPHANI (1985) Icones no. 5259, MIZUTANI (1974) Fig. II.

Plate 171, Plate 172, Plate 173, Plate 174, Plate 175, Plate 176 (from YORONG 651).

Plate 177 (from SCHWARZ 4820b).

Comparison Plate 2 – D.

Description (based on YORONG 651):

Plants pale yellowish green, small, up to 1 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1- to bipinnate, of *Frullania*-type. **Branches** up to 4 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 4 mm long. **Rhizoids** not seen. **Stem** in cross section 150 µm wide and 130 µm high, cortical cells 12, 24 – 45 × 17 – 37 µm, cell walls thin to moderately thickened, medullary cells up to 30, 11 – 21 × 14 – 22 µm, cell walls thin, trigones

lacking, dorsal cortical cells isodiametric to elongated polygonal, 25 – 37 × 33 – 62 µm, 1 – 2.5 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Stem leaves** approximate to imbricate, obliquely inserted, spreading at an angle of 40° – 70°, leaves trapezoid, symmetric, flat, 350 – 410 µm wide, 290 – 320 µm long, 0.8 – 0.9 as long as wide, divided by 0.6 – 0.7 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 3.5 cells long, 160 – 190 µm wide, 100 – 140 µm long, 0.6 – 0.9 as long as wide, median cells square, hexagonal to short rectangular, 18 – 29 × 22 – 32 µm, 1 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 22 – 31 × 31 – 38 µm, 1.2 – 1.5 as long as wide, leaf lobes 4, strongly divergent, 4.5 – 5.5 cells long, straight, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 4 – 5 cells long, cells rectangular to linear, not constricted at the transversal walls, 11 – 24 × 41 – 49 µm, 1.8 – 4.1 as long as wide, cell walls moderately thickened, trigones small, cuticle with small round to ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1.6 – 1.9 times as wide as the stem, underleaves square to transversely trapezoid, 140 – 230 µm wide, 125 – 140 µm long, 0.6 – 0.9 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 6 – 8 cells wide, 1.5 – 2.5 cells long, 100 – 160 µm wide, 60 – 85 µm long, 0.4 – 0.9 as long as wide, median cells square to hexagonal, 19 – 26 × 21 – 25 µm, 1 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 16 – 25 × 28 – 38 µm, 1.4 – 1.8 as long as wide, leaf lobes 3 – 4, upright to divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 -2 cells long, cells 15 – 21 × 26 – 39 µm, 1.2 – 2.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, obliquely inserted, spreading at an angle of 30° – 70°, leaves trapezoid, symmetric, flat, 280 – 340 µm wide, 280 – 350 µm long, 0.9 – 1 as long as wide, divided by 0.5 – 0.6 of the leaf length, margin entire, disc 6 cells wide, 2.5 – 4.5 cells long, 120 – 150 µm wide, 120 – 160 µm long, 0.9 – 1.3 as long as wide, median cells hexagonal to elongated polygonal, 26 – 30 × 29 – 39 µm, 1.1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to striate papillae, basal cells elongated polygonal, 25 – 32 × 42 – 46 µm, 1.4 – 1.8 as long as wide, leaf lobes 3, strongly divergent, 4.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 3 cells long, cells rectangular to linear, not constricted at the transversal walls, cells 14 – 28 × 37 – 50 µm, 1.5 – 2.8 as long as wide, cell walls moderately thickened, trigones small, cuticle with small round to ovate papillae. **Branch underleaves** distant, transversely attached, upright, 1.3 – 1.6 times as wide as the branch, underleaves trapezoid, 120 – 190 µm wide, 100 – 150 µm long, 0.8 – 1.2 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 – 6 cells wide, 1.5 cells long, 70 – 140 µm wide, 60 – 80 µm long, 0.5 – 0.9 as long as wide, basal cells elongated polygonal, 20 – 30 × 35 – 50 µm, 1.5 – 2 as long as wide, leaf lobes 2 – 3, divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 17 – 28 × 29 – 41 µm, 1.3 – 1.8 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. ophiria is a rather unique species. It is one of the species with (1) setaceous, uniseriate leaf lobes. The (2) obliquely attached branch leaves that spread at an angle of 30° - 70°, (3) the 2.5 - 4.5 cells high branch leaf disc and (4) the isodiametric stem leaf disc cells are characteristic.

Variation and similar species:

KITAGAWA (1978) already noted its similarity to *N. parvula*, which has a more *Kurzia*-like appearance, a branch leaf disc that is usually 4.5 cells high, and biseriate branch leaf lobes at the base. *N. richardsii* has likewise biseriate branch leaf lobes at the base, as well as particularly large underleaves.

The type specimen of *N. katrinae* was identified by GROLLE as *N. ophiria*. However, the former has a lower branch leaf disc that is only 2.5 cells high, and the branch leaf lobes are almost parallel to the branch.

N. dulitensis and *Neolepidozia dinagatensis* have longitudinally attached leaves, unlike *N. ophiria* where they are attached obliquely.

N. ophiria can also be mistaken for *N. papulosa* var. *uniseriata* with setaceous branch leaf lobes. However, this variety has a higher branch leaf disc and branch leaves that spread by more than 70°.

The plants from Mindanao (SCHWARZ 4820b) can be distinguished by their hooked stems and branch leaf lobes, which are sometimes weakly falcate. Furthermore, the base of the branch leaf lobes is occasionally wider than two cells. However, we do not consider these differences to be significant enough to establish a different species.

Distribution:

Malaysia (Borneo, Malay Peninsula), Philippines (Mindanao, Negros).

Specimens studied:

Philippines: Mindanao Island, Misamis Oriental Province, Barangay Lunutan, tropical mountain rain forest at Mt. Lumot (Via Haruhay Trial) approaching from the intermediate camp, 8° 40' 42.77" N, 125° 1' 38.92" E, auf Rinde, leg. FELIX SCHUMM & UWE SCHWARZ, 25.08.1999 with *Frullania* spec., *Heteroscyphus coalitus, Neolepidozia papulosa, Riccardia* spec., *Saccogynidium muricellum,* and *Schistochila* spec. (herbarium UWE SCHWARZ 4820b). Only a few stems that are intermixed among the other bryophytes.

Philippines: Negros Island, Province Negros Occidental, Bago, Barangay Mailom, Sitio Pata-an, Mt. Kanlaon National Park, a junction trail going to Avatar, 10° 27' 2.3" N, 123° 8' 18.8" E, 1979 m, dense forest with palms, *Freycinetia* sp. as dominant plant and *Dacrydium* sp. as dominant tree, on exposed roots, in filtered light, leg. AIMANUELZON P. YORONG 651, 6 July 2022 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Remark:

N. ophiria was already collected in 1965 by SHARP & IWATSUKI on Mt. Kanlaon and published by MIZUTANI (1974). The rediscovery of this species by YORONG fits in very well with these earlier observations.

Neolepidozia palawanensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Philippines: Palawan, Penigisan, leg. OLSEN 2165b, 1961 (JE! ex S – holotype, det. R. GROLLE 1974 as *Lepidozia wallichiana*, rev. M. MIZUTANI 1976 as *Lepidozia cuneifolia*).

Figures:

Plate 178, Plate 179, Plate 180, Plate 181, Plate 182, Plate 183.

Comparison Plate 3 – C.

Description

Plants yellowish brown, medium sized, up to 2 cm long, stem with leaves up to 0.7 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, not flagelliform at the end. **Flagelliform branches** numerous, up to 6 mm long. **Rhizoids** not seen. **Stem** in cross section 200 µm wide and 160 µm high, cortical cells 12, 31 – 45 × 16 – 35 µm, cell walls thickened, medullary cells up to 60, 8 – 23 × 8 – 19 µm, cell walls thickened, trigones enlarged, dorsal cortical cells square to elongated polygonal, 34 – 42 × 38 – 61 µm, 0.9 – 1.8 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Stem leaves** approximate, longitudinally to obliquely inserted, spreading at an angle of 40° – 80°, leaves square to short rectangular, symmetric to weakly asymmetric, flat, 310 – 370 µm wide, 320 – 370 µm long, 1 – 1.2 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 8 cells wide, 3.5 – 5.5 cells long, 180 – 240 µm wide, 160 – 220 µm long, 0.7 – 1.2 as long as wide, median cells round to elongated ovate, 25 – 32 × 32 – 45 µm, 1 – 1.4 as long as wide, cell walls moderately thickened, trigones enlarged, cuticle with striate papillae, basal cells elongated ovate, 23 – 32 × 45 – 56 µm, 1.6 – 2.1 as long as wide, leaf lobes 4 (- 5), divergent, 3.5 – 5.5 cells long, straight to weakly falcate, 2 – 3 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 3 – 4 cells long, cells elongated polygonal, not constricted at the transversal walls, 15 – 24 × 27 – 41 µm, 1.6 – 1.8 as long as wide, cell walls moderately thickened, trigones enlarged, cuticle with round to ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, recurved, 1.1 – 1.4 times as wide as the stem, underleaves transversely rectangular, 210 – 280 µm wide, 180 – 240 µm long, 0.7 – 1 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 8 – 10 cells wide, 2.5 – 3.5 cells long, 160 – 280 µm wide, 110 – 160 µm long, 0.4 – 0.9 as long as wide, median cells round to elongated ovate, 20 – 28 × 30 – 37 µm, 1.1 – 1.6 as long as wide, cell walls thickened, trigones enlarged, cuticle smooth, basal cells elongated ovate, 22 – 28 × 38 – 52 µm, 1.7 – 2.1 as long as wide, leaf lobes 4 – 5, upright to weakly divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 12 – 18 × 18 – 31 µm, 1.5 – 1.8 as long as wide, cell walls thickened, trigones enlarged, cuticle smooth. **Branch leaves** approximate to imbricate, longitudinally inserted, spreading at an angle of 60° – 70°, leaves rectangular to trapezoid, asymmetric, flat, 200 – 270 µm wide, 390 – 450 µm long, 1.5 – 2.1 as long as wide, divided by 0.4 – 0.6 of the leaf length, divided by 0.4 on the ventral side, margin entire, disc 6 cells wide, 4.5 – 6.5 cells long, 130 – 220 µm wide, 170 – 270 µm long, 0.9 – 1.9 as long as wide, median cells square, hexagonal to short rectangular, 28 – 33 × 26 – 40 µm, 0.9 – 1.3 as long as wide, cell walls weakly thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 23 – 37 × 39 – 45 µm, 1.1 – 2 as long as wide, leaf lobes 3 (- 4), upright to weakly divergent, 4.5 – 5.5 cells long, 2 – 3 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, cells 16 – 33 × 29 – 38 µm, 1.2 – 1.8 as long as wide, cell walls weakly thickened, trigones small, cuticle with ovate papillae. **Branch underleaves**

imbricate, overlapping 0.1 – 0.2 of the underleaf length, transversely attached, upright, 1.5 – 2 times as wide as the branch, underleaves rectangular to trapezoid, 110 – 200 µm wide, 180 – 220 µm long, 1 – 1.6 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 – 6 cells wide, 2.5 – 3.5 cells long, 95 – 170 µm wide, 100 – 130 µm long, 0.6 – 1.2 as long as wide, median cells ovate to elongated polygonal, 22 – 30 × 24 – 43 µm, 0.9 – 1.5 as long as wide, cell walls thickened, trigones enlarged, cuticle smooth, basal cells elongated ovate, 18 – 27 × 38 – 46 µm, 1.7 – 2.2 as long as wide, leaf lobes 2 – 3, upright to weakly divergent, 2.5 – 3.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 16 – 20 × 24 – 33 µm, 1.2 – 1.8 as long as wide, cell walls thickened, trigones enlarged, cuticle with round papillae.

Distinguishing characters:

The species is characterised by (1) the ovate, rather than angular cells, (2) the rather broad branch underleaves that are up to twice as wide as the stem, (3) the symmetric stem leaves, and (4) the rather narrow branch leaf lobes.

Similar species:

The species resembles *N. variifolia* which has angular cells, more asymmetric stem leaves, and broader branch leaf lobes.

N. solomonensis has angular cells as well, even narrower branch leaf lobes and larger underleaves.

N. palawanensis shares many characteristics with *N. augustana*. However, the latter one has smaller, ovate cells that are longer than 40 µm long with thin walls and no or only small trigones.

Distribution:

Philippines (Palawan). Only known from the type collection.

Etymology:

The species is named after Palawan Island where the species was discovered.

Neolepidozia panayensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Philippines: Panay Island, Antique Province, Muncipality Culasi, Mt. Madja-as, forest near the Batang-Batang slope, 11° 21' 0.18" N, 122° 9' 10.62" E, auf Erde, 1400 m, leg. UWE SCHWARZ, 28 January 2001 (herbarium UWE SCHWARZ 7180!, isotype: herbarium SCHÄFER-VERWIMP!).

Figures:

Plate 184, Plate 185, Plate 186, Plate 187, Plate 188, Plate 189.

Comparison Plate 5 – A.

Description:

Plants pale yellowish green, large, up to 4 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 4 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparse, up to 3 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 185 µm wide and 145 µm high, cortical cells 12, 30 – 52 × 18 – 35 µm, cell walls thickened, medullary cells up to 55, 9 – 24 × 10 – 19 µm, cell walls thickened, trigones small, dorsal cortical cells square to elongated polygonal, 38 – 45 × 63 – 99 µm, 1.5 – 2.6 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Stem leaves** approximate, longitudinally inserted, spreading at an angle of 40° – 60°, leaves square, asymmetric, flat, 195 – 220 µm wide, 215 – 300 µm long, 1.1 – 1.5 as long as wide, divided by 0.3 – 0.5 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 3.5 cells long, 170 – 210 µm wide, 135 – 190 µm long, 0.7 – 1 as long as wide, median cells elongated polygonal, 22 – 32 × 40 – 53 µm, 1.5 – 2.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 28 – 43 × 58 – 74 µm, 1.5 – 2.4 as long as wide, leaf lobes 4, upright, 1.5 – 3.5 cells long, straight, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 14 – 27 × 29 – 46 µm, 1.2 – 2.6 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed, 0.7 – 0.8 times as wide as the stem, underleaves trapezoid, 135 – 160 µm wide, 100 – 140 µm long, 0.7 – 1 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 8 cells wide, 1.5 – 2.5 cells long, 115 – 160 µm wide, 60 – 90 µm long, 0.4 – 0.8 as long as wide, median

cells isodiametric polygonal, 17 – 21 × 17 – 23 µm, 0.9 – 1.2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 18 – 23 × 31 – 42 µm, 1.5 – 2.1 as long as wide, leaf lobes 4, upright, 1.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 3 cells long, cells 15 – 18 × 21 – 32 µm, 1.3 – 2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** approximate to imbricate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves rectangular, symmetric, flat, 160 – 185 µm wide, 280 – 370 µm long, 1.8 – 2 as long as wide, divided by 0.3 – 0.4 of the leaf length, margin entire, disc 6 cells wide, 3.5 – 5.5 cells long, 140 – 175 µm wide, 170 – 265 µm long, 1.1 – 1.8 as long as wide, median cells elongated polygonal, 29 – 37 × 45 – 60 µm, 1.4 – 1.8 as long as wide, cell walls moderately thickened, trigones lacking, cuticle with striate papillae, basal cells elongated polygonal, 32 – 45 × 66 – 90 µm, 1.5 – 2.8 as long as wide, leaf lobes 3, upright, 3.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, cells 16 – 27 × 38 – 55 µm, 1.8 – 2.4 as long as wide, cell walls moderately thickened, trigones lacking, cuticle with ovate papillae. **Branch underleaves** distant, transversely attached, upright, 0.6 – 0.8 times as wide as the branch, underleaves transversely rectangular, 48 – 70 µm wide, 47 – 62 µm long, 0.7 – 1.2 as long as wide, divided by 0.5 – 0.7 of the leaf length, disc 4 – 6 cells wide, 0.5 cells long, 40 – 70 µm wide, 18 – 30 µm long, 0.3 – 0.7 as long as wide, basal cells elongated polygonal, 13 – 17 × 24 – 29 µm, 1.5 – 2.2 as long as wide, leaf lobes 2 – 3, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 10 – 13 × 21 – 31 µm, 1.7 – 2.8 as long as wide, cell walls thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. panayensis characterised by (1) the elongated disc cells of the stem and branch leaves, (2) the large basal cells of the branch leaf disc that can reach up to 90 µm, (3) the tiny branch underleaves that are often only composed of 6 cells, and (4) the rather broad and short branch leaf lobes.

Similar species:

The species is similar to *N. wallichiana*, which also has elongated disc cells and symmetrical branch leaves. However, it differs in the larger branch underleaves, smaller basal disc cells of the branch leaves and the longer, narrower branch leaf lobes.

N. papulosa var. *kalatunganensis* develops large branch leaf disc cells and small branch underleaves as well. However, this species has a square branch leaf disc, narrower branch leaf lobes, and isodiametric disc cells.

N. zantenii, another species with very long branch leaf disc cells and small branch underleaves has asymmetrical branch leaves that are more than 400 µm long.

Other species with long branch leaf disc cells tend to have much larger branch leaves or develop secondary cell divisions, or have even a rather strong papillose cuticle.

Distribution:

Papua New Guinea (New Guinea), Philippines (Panay), Taiwan (Orchid Island).

Etymology:

The species is named after Panay Island where the species was discovered.

Specimens studied:

[Papua New Guinea]: New Guinea, SO-Neuguinea, Strickland River, leg. W. BÄUERLEIN, 1885 (JE ex MEL-46940!, det. STEPHANI as *Lepidozia wallichiana*, conf. R. GROLLE 1974 as *Lepidozia wallichiana*, conf. M. MIZUTANI 1976 as *Lepidozia wallichiana*). Remark by R. GROLLE: "durch undeutliche Schreibweise auch als "Auckland River" zu lesen, wie bei STEPHANI 1889: 265".

Papua New Guinea: New Guinea, Central Province, K.B. Sawmill, Ehu Creek, 13 km SW of Sogeri, 9° 29' S, 147° 31' E, 600 m, lower montane forest, *Alphitonia*, *Elmerrilla* and *Celtis* dominated, on side of gully, leg. H. STREIMANN & E.K. NAONI 16524, 16 February 1981 (JE!, det. R. GROLLE 1982 as *Lepidozia wallichiana*, duplicates: CANB, LAE, NICH, UPNG).

Papua New Guinea: New Guinea, Central Province, K.B. Sawmill, Ehu Creek, 13 km SW of Sogeri, 9° 29' S, 147° 31' E, 600 m, lower montane forest, *Alphitonia*, *Elmerrilla* and *Celtis* dominated, on side of gully, leg. H. STREIMANN & E.K. NAONI 16525, 16 February 1981 (JE!, det. R. GROLLE 1982 as *Lepidozia wallichiana*, duplicates: CANB, LAE).

Taiwan: Botel Tobago [Orchid Island, Lan Yu], 300 - 400 m, an Baumfarn, leg. SCHWABE-BEHN 118, May – June 1947 (JE!, det. TH. HERZOG as *Lepidozia wallichiana*).

Taiwan: Botel Tobago [Orchid Island, Lan Yu], 300 - 400 m, an Baumfarn, leg. SCHWABE 116, (JE!, det. TH. HERZOG as *Lepidozia wallichiana*). Remark by R. GROLLE: "aus Glyzerinpräparat der HERZOG-Samml. Herbarisiert durch GROLLE 1977".

Neolepidozia papulosa (STEPH.) FULFORD ET J. TAYLOR. *Brittonia* 11(2): 85. 1959.

≡ *Lepidozia papulosa* STEPH. Species Hepaticarum. 3: 609. 1909.

Type:

Sumatra Nord, e regione prope lacum, Toba, inter muscos parce, 1891 legit el *Elia Modigliani*.

STEPHANI (1909) mentions two specimens in the original description– one from Sumatra and one from Luzon – a lectotype has still to be selected. As we did not study the respective specimens, we will not do it here. As STEPHANI (1985) used material from Sumatra for his drawings, it would be advisable to use this specimen as a lectotype.

Figures:

STEPHANI (1985) Icones no. 5261.

Plate 190, Plate 191, Plate 192, Plate 193, Plate 194, Plate 195, Plate 196 (from SCHÄFER-VERWIMP 18816b).

Plate 197, Plate 198, Plate 199, Plate 200, Plate 201, Plate 202 (from SCHWARZ 6199).

Comparison Plate 5 – J (from SCHÄFER-VERWIMP 18816b).

Description (based on SCHÄFER-VERWIMP 18816b):

Plants pale yellowish green, small, up to 1 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 4 mm long, occasionally flagelliform at the end. **Flagelliform branches** numerous, up to 2 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 170 µm wide and 110 µm high, cortical cells 12, 13 – 55 × 21 – 45 µm, cell walls thickened, medullary cells up to 35, 10 – 20 × 8 – 16 µm, cell walls thickened, trigones enlarged, dorsal cortical cells elongated polygonal, 26 – 32 × 43 – 55 µm, 1.5 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** imbricate, longitudinally inserted, spreading at an angle of 40° – 70°, leaves square to trapezoid, symmetric, flat, 240 – 290 µm wide, 230 – 290 µm long, 1 – 1.2 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 3.5 cells long, 150 – 200 µm wide, 110 – 160 µm long, 0.6 – 1 as long as wide, median cells short rectangular to elongated polygonal, 22 – 30 × 30 – 50 µm, 1.1 – 2 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 19 – 34 × 43 – 61 µm, 1.7 – 2.3 as long as wide, leaf lobes 4, upright to divergent, 3.5 – 4.5 cells long, straight, 2 (-3) cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells ovate to elongated polygonal, not to weakly constricted at the transversal walls, 15 – 25 × 30 – 38 µm, 1.4 – 2 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed or spreading away from the stem, 1.1 – 1.2 times as wide as the stem, underleaves square, transversely rectangular to trapezoid, 130 – 160 µm wide, 110 – 140 µm long, 0.8 – 1.1 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 6 – 8 cells wide, 1.5 – 2.5 cells long, 115 – 140 µm wide, 80 – 100 µm long, 0.6 – 0.8 as long as wide, median cells ovate to elongated polygonal, 15 – 18 × 19 – 28 µm, 1.3 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 16 – 25 × 30 – 50 µm, 1.6 – 2.5 as long as wide, leaf lobes 3 – 4, upright to weakly divergent, 1.5 – 2.5 cells long, 2 (-3) cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 12 – 16 × 16 – 35 µm, 1.3 – 2.7 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** approximate to imbricate, longitudinally inserted, spreading at an angle of 50° – 60°, leaves rectangular, symmetric, flat, 140 – 190 µm wide, 240 – 310 µm long, 1.4 – 1.9 as long as wide, divided by 0.4 – 0.5 of the leaf length, divided by 0.4 on the ventral side, margin entire, disc 6 cells wide, 3.5 – 4.5 cells long, 110 – 140 µm wide, 130 – 200 µm long, 1 – 1.7 as long as wide, median cells isodiametric to elongated polygonal, 24 – 30 × 29 – 39 µm, 1 – 1.5 as long as wide, cell walls moderately thickened, trigones lacking, cuticle almost smooth or with striate papillae, basal cells elongated polygonal, 22 – 29 × 40 – 59 µm, 1.8 – 2.1 as long as wide, leaf lobes 3, upright to divergent, 3.5 – 4.5 cells long, 2 (-3) cells wide at base, multiseriate part 1 – 2 (-3) cells long, uniseriate part (2-) 3 – 4 cells long, cells square to elongated polygonal, not or weakly constricted at the transversal walls, cells 15 – 21 × 25 – 35 µm, 1.4 – 2.1 as long as wide, cell walls moderately thickened, trigones lacking, cuticle with ovate papillae. **Branch**

underleaves approximate, transversely attached, upright, 1.1 – 1.5 times as wide as the branch, underleaves square to rectangular, 75 – 120 µm wide, 95 – 145 µm long, 1 – 1.6 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 4 – 6 cells wide, 1.5 – 2.5 cells long, 65 – 115 µm wide, 60 – 100 µm long, 0.7 – 1.3 as long as wide, median cells square, 21 – 24 × 24 – 33 µm, 1.1 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 20 – 25 × 45 – 54 µm, 1.8 – 2.7 as long as wide, leaf lobes 2 – 3, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 14 – 18 × 27 – 42 µm, 1.5 – 3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Perianth** originating ventrally from the main stem, 2.8 mm long, weakly narrowed towards the mouth, multi – plicate in the upper fourth. **Perianth mouth** long ciliate, mouth cells linear, 11 – 15 × 41 – 75 µm, 2.7 – 6.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, median cells elongated polygonal to linear, 20 – 30 × 54 – 99 µm, 2.3 – 5 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae. **Female bracts** ovate, margin with a few teeth, 500 µm wide, 950 µm long, 1.9 as long as wide, median cells elongated polygonal to linear, 23 – 38 × 58 – 150 µm, 2.3 – 6.5 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, basal cells ovate to elongated polygonal, 26 – 35 × 35 – 76 µm, 1.3 – 2.4 as long as wide, leaf lobes 4, 4.5 – 5.5 cells long, 3 – 5 cells wide at base, multiseriate part 1 -2 cells long, uniseriate part 4 – 5 cells long, cells elongated polygonal to linear, cells 13 – 23 × 45 – 56 µm, 2.2 – 3.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Female bracteole** rectangular, margin with a few teeth, 550 µm wide, 1050 µm long, 1.9 as long as wide, median cells elongated polygonal, 30 – 42 × 46 – 88 µm, 1.5 – 2.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells ovate to elongated polygonal, 29 – 40 × 38 – 56 µm, 1.2 – 1.9 as long as wide, leaf lobes 4, 5.5 – 8.5 cells long, 3 – 4 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 3 – 5 cells long, cells linear, cells 10 – 18 × 52 – 76 µm, 3.7 – 5.8 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. papulosa is characterised by (1) the longitudinally attached, symmetric branch leaves, (2) the square to short rectangular median cells of the branch leaf disc that are up to 40 µm long, (3) the branch leaf lobes that are mostly 2 cells wide at the base, (4) that branch leaf lobes that are mostly 4.5 cells long, and (5) often markedly enlarged median cells of the basal row of the branch leaf disc. In comparison with the median cells, these cells are elongated polygonal and up to 60 µm long.

Based on our understanding of *N. papulosa*, the following characteristics can vary: cell wall thickness; cell papillosity; stem and branch leaf disc height; width of the branch leaf lobe base; length of the biseriate part; leaf symmetry; and number of stem leaf lobes.

Constricted transversal cell walls of the branch leaf lobes as drawn by STEPHANI (1985) sometimes occur but do not seem to be a reliable distinguishing character for this species.

Variation and similar species:

Neolepidozia papulosa var. *plumula* shares most of its characters with *N. papulosa.* However, the former has bases of branch leaf lobes that are often more than two cells wide, longer branch leaves that are more than 350 µm long, longer branch leaf disc cells, and larger branch underleaves.

Neolepidozia papulosa var. *apoensis* is altogether a smaller plant with deeper divided branch leaves, which are only up to 220 µm long, and rather strongly papillose branch leaf cells.

The branch leaf disc of *N. papulosa* var. *kalatunganensis* is ± square-shaped, its disc cells are larger and its branch underleaves are smaller.

Plants with rather narrow branch leaves (e.g. BALNETI) resemble somewhat N. *kaindiensis*, which is however, a larger plant with a longer branch leaf disc lobe.

Forms of N. *cuneifolia* sometimes develop rather symmetric leaves in particular in the lower part of the branch which resemble those of *N. papulosa*. So far, we were always able to find at least some typical asymmetric branch leaves in these cases, allowing us to assign these specimens to *N. cuneifolia*.

KITAGAWA (1973) already mentioned that *N. papulosa* is closely related to *N. massartiana* only differing in the more obliquely spreading leaves that are more or less incurved. We fully agree with his opinion. We used the more longitudinally attached branch leaves, the markedly elongated median cells in the basal disc row, and the more symmetrical stem leaves as characteristics that distinguish *N. papulosa* from *N. massartiana*.

N. tenera is another relative of *N. papulosa*. Even though we did not have authentic material of *N. tenera* we consider the incurved branch leaves, the higher stem underleaf disc and the hardly enlarged cells of the branch leaf base as distinguishing characteristics of *N. tenera*.

The most reliable character to distinguish *N. papulosa* from *N. tangkulanensis* are the cells of the perianth mouth. *N. papulosa* develops a longly ciliate perianth mouth where it is only crenulate in *N. tangkulanensis*. It is more difficult to distinguish sterile plants. Even though *N. tangkulanensis* seems to have branch leaf lobes that are more often 3 cells wide and the biseriate part of the branch leaf lobes is up to 3.5 cells long, these are characters that can occasionally be observed in *N. papulosa*. It might not be possible to distinguish these to species with certainty if perianths are not developed.

N. papulosa is often mistaken as *N. wallichiana*. We agree with KITAGAWA (1973) that the median branch leaf cells in *N. papulosa* are isodiametric to slightly elongated rather than markedly elongated in *N. wallichiana*. They reach up to 40 µm in length in *N. papulosa* and often more than 50 µm in *N. wallichiana*. *N. wallichiana* has furthermore larger branch leaves and thinner cell walls.

Distribution:

Indonesia (Borneo, Sulawesi, Sumatra), Malaysia (Borneo, Malay Peninsula), Philippines (Leyte, Mindanao, Negros), Sri Lanka.

Judging from the studied specimens, *N. papulosa* is the most common species of *Neolepidozia* in the region. It seems that it does not occur in New Guinea and the Pacific area east to it.

Specimens studied:

[Indonesia]: Borneo, Ostborneo, leg. D. BALNETI s.n., (JE!, det. TH. HERZOG as *Lepidozia massartiana*, rev. M. MIZUTANI 1976 as *Lepidozia wallichiana*).

Indonesia: Sulawesi, Sulawesi Tengah, Regenwald oberhalb der Siedlung Toro im Kulawi-Tal am westlichen Rand des Lore Lindu Nationalpark, alt. ca. 1.130 m, WGS84 1° 29' 23" S, 120° 01' 31" O, leg. S. ABRAHAMCZYK, 27 März 2007 (JE – Bryo 8348!).

Indonesia: Sumatra, North Sumatra, Hochland von Brastagi, Westaufstieg zum Gunung Sibayak, 3° 14' 12.2" N, 98° 29' 54.3" E, 1820 m, Strauchvegetation mit reichlich *Pandanus*, on volcanic rock wall in filtered light, leg. SCHÄFER-VERWIMP & VERWIMP, 16 May 2005 (herbarium SCHÄFER-VERWIMP 24810b!).

[Malaysia]: Borneo, West Borneo, auf dem Bukit Mulu, um 800 m, leg. HANS WINKLER 3056, 1 December 1924 (JE!, det. TH. HERZOG as *Lepidozia wallichiana*).

[Malaysia]: Borneo, West Borneo, auf dem Bukit Mulu, 800 - 900 m, leg. HANS WINKLER 3056a (JE!, det. TH. HERZOG as *Lepidozia wallichiana*). Combined specimen of Winkler 3056a, 3334 and 3067/a. Specimen renamed to 3056a since WINKLER 3056 already exists.

[Malaysia]: West Borneo: Bukit Mulu, ca. 800 m, leg. HANS WINKLER 3056b, 1 December 1924 (JE!, det. TH. HERZOG as *Lepidozia cuneifolia* "transiens in *L. gunnianam*", rev. M. MIZUTANI 1976 as *Lepidozia wallichiana*). Specimen renamed to 3056b as WINKLER 3056 and 3056a already exist.

[Malaysia]: Borneo, West Borneo, auf dem Bukit Mulu, 800 - 900 m, leg. HANS WINKLER 3334 (JE!, det. TH. HERZOG as *Lepidozia wallichiana*). Permanent slide. Combined specimen of Winkler 3056a, 3334 and 3067/a.

Malaysia: Pahang, 2.5 miles on the Genting Highlands road, ridge crest in lower montane to upper montane forest ecotone, 3300 ft., leg. GILLIS EEN 19, 21 April 1972 (JE!, det. R. GROLLE as *Lepidozia wallichiana*).

Malaysia: State Pahang, Cameron Highlands, Nebelwald im Gipfelbereich des Gunung Brinchang, 4° 31' 5.6" N, 101° 22' 57.6" E, 2000 m, an Baumbasis, leg. SCHÄFER-VERWIMP & VERWIMP 18705a, 22 May 1997 (herbarium SCHÄFER-VERWIMP 18705a!).

Malaysia: State Pahang, Cameron Highlands, Tanah Rata, Regenwald am Weg über die Robinsonfälle zum Gunong Beremban, 1500 m, auf morschen Holz, leg. SCHÄFER-VERWIMP & VERWIMP, 23 Mai 1997 (herbarium SCHÄFER-VERWIMP 18816b!), with *Neolepidozia variifolia*.

Malaysia: State Pahang, Cameron Highlands, Tanah Rata, Sekundärwald im Ortsbereich, 1550 m, an morschen Stamm, leg. SCHÄFER-VERWIMP & VERWIMP 18690b, 21. May 1997 (herbarium SCHÄFER-VERWIMP 18690b!). The specimen consists of 2 species, *Neolepidozia papulosa* (18690b) and *N. shevockii* (18690a).

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, on rotten wood, 700 m, leg. FELIX SCHUMM & UWE SCHWARZ, 18 August 2000 (herbarium UWE SCHWARZ 6199!).

Philippines: Mindanao Island, North Cotabato Province, Mountain rain forest at the east side of Lake Venado, 7° 0' 9.28" N, 125° 16' 10.73" E, auf morschem Holz, leg. UWE SCHWARZ, 20 March1999 (herbarium UWE SCHWARZ 3849!).

Philippines: Mindanao Island, North Cotabato Province, Mt. Apo, Tropical mountain rain forest at Marbel-River-Campsite, 7° 0' 9.9" N, 125° 14' 46.03" E, 1710 m, auf morschm Holz, leg. FELIX SCHUMM & UWE SCHWARZ, 08 August 1999, with *Kurzia geniculata* and *Zoopsis liukiuensis* (herbarium Uwe Schwarz 4394!).

Philippines: Mindanao Island, North Cotabato Province, Mt. Apo, Tropical mountain rain forest at Marbel-River-Campsite, 7° 0' 9.9" N, 125° 14' 46.03" E, auf morschm Holz, leg. FELIX SCHUMM & UWE SCHWARZ, 9 August 1999 (herbarium UWE SCHWARZ 4380!).

Philippines: Mindanao Island, Province Bukidnon, Mid-elevation section of Limbawon Mountain near Dumagongdong Stream accessed by trail from Kibalabag Barangay, 8° 15' 47.8" N, 125° 10' 43.6" E, 1500 m, Tropical mixed hardwood rain forest, on hardwood trunk in filtered light, leg. JAMES R. SHEVOCK 54629, with AIMANUELZON YORONG & DARYL SALAS, 9 June 2019 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Philippines: Negros Island, Province Negros Occidental, Along the ridge trail well above the village of Naubok towards the summit slopes about Hapon-Haponon and Mt. Talinis, 9° 14' 42.6" N, 123° 7' 4.5" E, 1475 m, mixed hardwood evergreen tropical rain forest with fern understory, on tree fern trunk in filtered light, leg. JAMES R. SHEVOCK 56259 with DARYL S. SALAS, 17 December 2019 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

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, ca. 1300 m, auf Gestein, leg. FELIX SCHUMM & UWE SCHWARZ, 10 August 2000 (herbarium UWE SCHWARZ 5809b!).

[Sri Lanka]: Nuwara Eliya district, Pattipola, ca. 1850 m, sur les arbres, leg. M. ONRAEDT 76.L.2414, 16 March 1976 (JE!, det. R. GROLLE 1976 as *Lepidozia wallichiana*).

Neolepidozia papulosa var. *apoensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*

Holotype:

Philippines: Mindanao Island, North Cotabato Province, Mt. Apo, tropical mountain rain forest between Lake Agko and Marbel River camp site, 7° 1' 10.01" N, 125° 13' 22.51" E, 1240 – 1490 m, leg. FELIX SCHUMM & UWE SCHWARZ, 8 August 1999 (mixed amongst *Lejeunea* spec., herbarium SCHWARZ 4684!).

Figures:

Plate 203, Plate 204, Plate 205, Plate 206, Plate 207.

Comparison Plate 5 – K.

Description:

Plants pale yellowish green, medium sized, up to 2 cm long, stem with leaves up to 0.5 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 4 mm long, not flagelliform at the end. **Flagelliform branches** scattered, up to 9 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 115 µm wide and 95 µm high, cortical cells 12, 19 – 26 × 13 – 19 µm, cell walls thickened, medullary cells up to 25, 10 – 18 × 11 – 17 µm, cell walls thin to thickened, trigones small, dorsal cortical cells elongated polygonal, 19 – 25 × 40 – 79 µm, 2 – 3.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** distant, obliquely inserted, spreading at an angle of 50° – 70°, leaves trapezoid, symmetric to weakly asymmetric, lobes bent down ventrally, 190 – 260 µm wide, 185 – 210 µm long, 0.8 – 1.1 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 3.5 cells long, 120 – 160 µm wide, 80 – 115 µm long, 0.5 – 0.9 as long as wide, median cells isodiametric to elongated polygonal, 18 – 24 × 28 – 33 µm, 1.2 – 1.7 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 18 – 22 × 34 – 44 µm, 1.5 – 2.2 as long as wide, leaf lobes 4, upright to divergent, 3.5 – 4.5 cells long, straight to weakly falcate, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, 16 – 22 × 27 – 35 µm, 1.3 – 2.2 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant,

transversely attached, appressed, 1 – 1.4 times as wide as the stem, underleaves square to transversely rectangular, 120 – 135 µm wide, 100 – 140 µm long, 0.8 – 1.1 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 8 cells wide, 1.5 – 2.5 cells long, 95 – 125 µm wide, 65 – 100 µm long, 0.5 – 1.1 as long as wide, median cells isodiametric to elongated polygonal, 15 – 19 × 20 – 36 µm, 1.3 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 10 – 18 × 27 – 40 µm, 1.7 – 3.6 as long as wide, leaf lobes (3-) 4, upright, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 14 – 16 × 26 – 37 µm, 1.6 – 2.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 60° – 70°, leaves rectangular, symmetric, flat, 110 – 115 µm wide, 180 – 215 µm long, 1.6 – 2 as long as wide, divided by 0.3 – 0.5 of the leaf length, margin entire, disc 6 cells wide, 2.5 – 3.5 cells long, 85 – 110 µm wide, 95 – 150 µm long, 1 – 1.6 as long as wide, median cells isodiametric to elongated polygonal, 17 – 23 × 22 – 36 µm, 1.1 – 1.6 as long as wide, cell walls moderately thickened, trigones lacking, cuticle with striate papillae, basal cells elongated polygonal, 18 – 22 × 31 – 49 µm, 1.6 – 2.5 as long as wide, leaf lobes 3, upright, 3.5 cells long, 2 cells wide at base, multiseriate part 2 cells long, uniseriate part 2 – 3 cells long, cells elongated polygonal, not constricted at the transversal walls, cells 13 – 19 × 27 – 34 µm, 1.6 – 2.5 as long as wide, cell walls moderately thickened, trigones lacking, cuticle with ovate papillae. **Branch underleaves** distant, transversely attached, upright, 0.7 – 1 times as wide as the branch, underleaves square, 60 – 65 µm wide, 50 – 70 µm long, 0.8 – 1.1 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 cells wide, 0.5 – 1.5 cells long, 40 – 60 µm wide, 25 – 40 µm long, 0.5 – 1 as long as wide, basal cells elongated polygonal, 15 – 17 × 23 – 28 µm, 1.4 – 1.8 as long as wide, leaf lobes 2, upright to divergent, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 10 – 16 × 21 – 26 µm, 1.5 – 2.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. papulosa var. *apoensis* is characterised by (1) the branch leaves that are divided up to the half of the leaf length, (2) the low branch leaf disc that is only 2.5 – 3.5 cells high, (3) the partially elongated cells of the median branch leaf disc and markedly larger cells of the basal row (4) the rather strongly papillose cells of branch leaves.

Similar species:

The var. *apoensis* can be distinguished from *N. papulosa* and its varieties, in particular *N. papulosa* var. *sakuraii*, by its deeper-divided branch leaves, which are only up to 220 µm long, and its rather strongly papillose branch leaf cells.

It also shows similarities to *N. limbawonensis*, which has obliquely inserted leaves and branch leaf lobe bases up to four cells wide. *N. morobensis* likewise has deeply divided branch leaves and a papillose cuticle. The cells of the branch leaf lobes are isodiametric and shorter than those of var. *apoensis*.

Distribution:

Indonesia (Sulawesi), Philippines (Mindanao).

Specimen studied:

[Indonesia]: Ceram, Hoale-Pass, 1600 m, leg. STRESEMANN 49, 1911 (JE!, det. TH. HERZOG as *Lepidozia subtrichoides*, rev. M. MIZUTANI 1976 as *Lepidozia wallichiana*).

Etymology:

The species is named after the Mt. Apo where the species was discovered.

Neolepidozia papulosa var. *kalatunganensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*

Holotype:

Philippines: Mindanao Island, Bukidnon Province, Cinchona Forest Reserve, southeastern section of Kitanglad Range, Kaatuan Barangay, Lantapan municipality, 8° 3' 48.71" N, 125° 0' 32.15" E, 1320 m, mixed evergreen hardwood tropical rain forest, on base of hardwood tree trunk in filtered light, leg. JAMES R. SHEVOCK 61990, with AIMANUELZON P. YORONG & ROMEO PATANO, 13 July 2023 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Figures:

Plate 208, Plate 209, Plate 210, Plate 211, Plate 212, Plate 213, Plate 214.

Comparison Plate 2 – I.

Description:

Plants brownish, medium sized, up to 2 cm long, stem with leaves up to 0.5 mm wide, leaves not fragile. **Branching** 1- to bipinnate, of *Frullania*-type. **Branches** up to 4 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparse, up to 3 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 140 µm wide and 90 µm high, cortical cells 10, 29 – 41 × 18 – 39 µm, cell walls moderately thickened, medullary cells up to 25, 10 – 20 × 11 – 17 µm, cell walls moderately thickened, trigones small, dorsal cortical cells isodiametric to elongated polygonal, 28 – 43 × 45 – 67 µm, 1.2 – 2.4 as long as wide, cell walls thin, trigones small, cuticle smooth. **Stem leaves** imbricate, longitudinally inserted, spreading at an angle of 50° – 80°, leaves square to trapezoid, symmetric to weakly asymmetric, flat, 250 – 320 µm wide, 280 – 320 µm long, 1 – 1.1 as long as wide, divided by 0.3 – 0.5 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 3.5 cells long, 210 – 260 µm wide, 170 – 200 µm long, 0.7 – 0.9 as long as wide, median cells isodiametric to elongated polygonal, 33 – 45 × 39 – 53 µm, 1 – 1.3 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 35 – 50 × 51 – 67 µm, 1.2 – 1.6 as long as wide, leaf lobes 4, upright to weakly divergent, 3.5 – 4.5 cells long, straight, 2 cells wide at base, multiseriate part 1 -2 cells long, uniseriate part 2 – 4 cells long, cells elongated polygonal, not constricted at the transversal walls, 19 – 36 × 27 – 41 µm, 1.1 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1 – 1.1 times as wide as the stem, underleaves transversely rectangular, 110 – 160 µm wide, 90 – 110 µm long, 0.7 – 0.9 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 6 – 8 cells wide, 1.5 cells long, 100 – 130 µm wide, 50 – 65 µm long, 0.4 – 0.6 as long as wide, basal cells elongated polygonal, 15 – 21 × 26 – 36 µm, 1.5 – 2.1 as long as wide, leaf lobes 3 – 4, upright to weakly divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 13 – 16 × 23 – 31 µm, 1.6 – 1.9 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** approximate to imbricate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves square to rectangular, symmetric, flat, 175 – 200 µm wide, 280 – 310 µm long, 1.5 – 1.7 as long as wide, divided by 0.4 of the leaf length, margin entire, disc 6 – 7 cells wide, 3.5 – 4.5 cells long, 140 – 185 µm wide, 170 – 190 µm long, 0.9 – 1.3 as long as wide, median cells square to weakly elongated polygonal, 30 – 47 × 44 – 51 µm, 1.1 – 1.7 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 33 – 43 × 54 – 68 µm, 1.3 – 1.9 as long as wide, leaf lobes 3, upright to weakly divergent, 3.5 – 4.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 3 – 4 cells long, cells round, ovate to elongated polygonal, weakly constricted at the transversal walls, cells 18 – 35 × 26 – 36 µm, 0.9 – 1.6 as long as wide. **Branch underleaves** distant, transversely attached, upright, 0.7 – 0.8 times as wide as the branch, underleaves square to trapezoid, 40 – 60 µm wide, 40 – 60 µm long, 0.7 – 1.3 as long as wide, divided by 0.5 – 0.6 of the leaf length, disc 4 cells wide, 0.5 – 1.5 cells long, 40 – 55 µm wide, 20 – 30 µm long, 0.4 – 0.7 as long as wide, basal cells elongated polygonal, 13 – 15 × 20 – 26 µm, 1.5 – 1.7 as long as wide, leaf lobes 2, upright to weakly divergent, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 13 – 16 × 18 – 32 µm, 1.3 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Male branches** originating ventrally – intercalar from the stem from the main stem, straight, up to 0.9 mm long, with leaves up to 0.4 mm wide. **Male bracts** imbricate, obliquely attached, rectangular, 220 µm wide, 270 µm long, 1.2 as long as wide, divided by 0.4 of the leaf length, disc 150 – 190 µm wide, 175 µm long, median cells elongated polygonal, 20 – 29 × 39 – 72 µm, 1.6 – 3.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 27 – 32 × 41 – 67 µm, 1.3 – 2.4 as long as wide, cell walls thin, trigones lacking, cuticle smooth, leaf lobes 2, upright to weakly divergent, 3.5 cells long, 3 – 4 cells wide at base, multiseriate part 2 cells long, uniseriate part 2 cells long, cells 20 – 22 × 32 – 42 µm, 1.5 – 2 as long as wide, cell walls thin, trigones small, cuticle smooth. **Underleaves** approximate, transversely attached, upright, underleaves trapezoid, 55 – 65 µm wide, 60 – 85 µm long, 1.1 – 1.3 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 cells wide, 0.5 – 1.5 cells long, 40 – 55 µm wide, 35 – 40 µm long, basal cells elongated polygonal, 15 – 20 × 28 – 38 µm, 1.4 – 2.5 as long as wide, cell walls thin, trigones lacking, cuticle smooth, leaf lobes 2, divergent, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 10 – 14 × 23 – 26 µm, 1.9 – 2.3 as long as wide, cell walls thin, trigones small, cuticle smooth. **Sexuality** probably monoicous. **Perianth** originating ventrally from the main stem, 2.5 mm long, narrowed towards the mouth, multi – plicate in the upper half. **Perianth mouth** ciliate, mouth cells linear, 10 – 17 × 42 – 71 µm, 3.6 – 5.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, median cells elongated polygonal to linear, 23 – 29 × 39 – 89 µm, 1.5 – 3.9 as long as wide, cell walls thin, trigones small, cuticle smooth. **Female bracts** ovate to triangular, margin with a few teeth, 630 – 710 µm wide, 810 – 950 µm long, 1.3 as long as wide, median cells elongated polygonal to linear, 20 – 36 × 48 – 76 µm, 1.6 – 3.1 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal to linear, 20 – 48 × 59 – 72 µm, 1.2 – 3.6 as long as wide, leaf lobes 4, 3.5 – 8.5 cells long, 2 – 4 cells wide at base, multiseriate part 3 – 4 cells long, uniseriate part 3 – 4 cells long, cells elongated polygonal, cells 17 – 23 × 39 – 58 µm, 2 – 2.9 as long as wide, cell walls thin, trigones lacking, cuticle smooth.

Distinguishing characters:

N. *papulosa* var. *kalatunganensis* is characterised by (1) the small branch leaves consisting of fewer than 10 cells, (2) the large, thin-walled median disc cells in the branch leaves up to 50 µm long, (3) the weakly constricted cells in the branch leaf lobes, (4) the uniseriate branch leaf lobes, and (5) the short, round cells directly above the branch leaf lobe base.

Similar species:

The only other species with similarly large, thin-walled branch leaf disc cells is *N. panayensis*. Its disc cells are even larger and can reach up to 70 µm in length, the branch leaf lobes are not uniseriate and the cells directly above the branch leaf lobe base are elongated.

N. papulosa var. *sakuraii* and *N. papulosa* var. *uniseriata* have sometimes similar branch leaves but have larger branch underleaves, smaller disc cells and longer branch leaf lobes consisting of elongated cells.

There is also some resemblance to *N. bickeri*, which has rather flat branch leaves that are hooked only in the leaf lobes with none constricted cells. It also has smaller branch leaf disc cells and a rectangular branch leaf disc.

The branches of *N. cameronensis* with trilobate leaves bear some resemblance to those of *N. papulosa* var. *kalatunganensis*. However, the branch leaves of the former species are shorter, with branch leaf disc cells measuring less than 40 µm and thicker cell walls.

Distribution:

Philippines (Mindanao).

Specimen studied:

Philippines: Mindanao Island, Bukidnon Province, Cinchona Forest Reserve, southeastern section of Kitanglad Range, Kaatuan Barangay, Lantapan municipality, on the concrete road towards Kulasihan Falls trail, 8° 3' 48.71" N, 125° 0' 32.15" E, 1320 m, Mixed evergreen hardwood tropical rain forest, on base of hardwood tree trunk in filtered light, leg. JAMES R. SHEVOCK 61685, with AIMANUELZON P. YORONG & ROMEO PATANO, 13 July 2023 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Etymology:

The species is named after the Kalatungan Range where the species was discovered.

Neolepidozia papulosa var. *plumula* (HERZOG) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*

Basionym:

Lepidozia plumula HERZOG. *Beihefte zum Botanischen Centralblatt. Zweite Abteilung, Systematik, Pflanzengeographie, angewandte Botanik* 38(2): 331. 1921. (fide notes of MITZUTANI on specimen JE 04009241).

Type:

Fl. v. Ceylon, Im Hochland von Nuwara – Eliya, ca. 1800 m, leg TH. HERZOG, Februar 1906 (JE, holotype of *Lepidozia plumula*, M. MIZUTANI July 1976 "Holotype of *Lepidozia plumula* HERZOG 1921 = *Lepidozia wallichiana* Gott.").

Figures:

HERZOG (1921) Fig. 10 (as *Lepidozia plumula*).

Plate 215, Plate 216, Plate 217, Plate 218, Plate 219, Plate 220, Plate 221.

Comparison Plate 4 – J.

Description:

Plants pale brownish green, small, up to 1.5 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 4 mm long, occasionally flagelliform at the end. **Flagelliform branches** numerous, up to 6 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 195 µm wide and 165 µm high, cortical cells 12, 36 – 54 × 20 – 38 µm, cell walls thickened, medullary cells up to 40, 15 – 34 × 15 – 21 µm, cell walls thickened, trigones enlarged, dorsal cortical cells isodiametric to elongated polygonal, 24 – 45 × 50 – 91 µm, 1.1 – 3.8 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** imbricate, longitudinally inserted, spreading at an angle of 50° – 60°, leaves square to trapezoid, symmetric to weakly

asymmetric, flat, 290 – 360 µm wide, 270 – 320 µm long, 0.9 – 1 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 3.5 cells long, 190 – 240 µm wide, 130 – 170 µm long, 0.6 – 0.9 as long as wide, median cells shortly elongated polygonal, 31 – 40 × 39 – 52 µm, 1.1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 29 – 42 × 44 – 63 µm, 1 – 1.8 as long as wide, leaf lobes 4, upright to divergent, 4.5 cells long, straight to weakly falcate, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells ovate to elongated polygonal, not to weakly constricted at the transversal walls, 20 – 29 × 34 – 42 µm, 1.2 – 1.8 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1.1 – 1.2 times as wide as the stem, underleaves square, transversely rectangular to trapezoid, 180 – 210 µm wide, 120 – 150 µm long, 0.6 – 0.8 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 8 cells wide, 1.5 – 2.5 cells long, 130 – 170 µm wide, 70 – 110 µm long, 0.4 – 0.8 as long as wide, median cells isodiametric to elongated polygonal, 20 – 26 × 28 – 34 µm, 1.1 – 1.7 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 15 – 26 × 35 – 50 µm, 1.6 – 2.9 as long as wide, leaf lobes 4, upright to divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 15 – 20 × 23 – 31 µm, 1.2 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves rectangular, symmetric, flat, 200 – 250 µm wide, 380 – 440 µm long, 1.7 – 2.2 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 cells wide, 4.5 – 5.5 cells long, 140 – 200 µm wide, 230 – 270 µm long, 1.2 – 1.8 as long as wide, median cells isodiametric to elongated polygonal, 31 – 41 × 39 – 54 µm, 1.1 – 1.7 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 30 – 39 × 56 – 78 µm, 1.5 – 2.3 as long as wide, leaf lobes 3, upright to weakly divergent, 3.5 – 5.5 cells long, 2 – 3 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 4 cells long, cells ovate to elongated polygonal, not or weakly constricted at the transversal walls, cells 23 – 30 × 35 – 46 µm, 1.2 – 1.9 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** approximate, transversely attached, spreading away from the stem, 1.1 – 1.3 times as wide as the branch, underleaves square to rectangular, 100 – 140 µm wide, 160 – 200 µm long, 1.1 – 1.7 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 4 – 6 cells wide, 1.5 – 2.5 cells long, 80 – 130 µm wide, 95 – 120 µm long, 0.8 – 1.3 as long as wide, median cells isodiametric to elongated polygonal, 27 – 36 × 32 – 40 µm, 1 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 25 – 30 × 51 – 65 µm, 1.9 – 2.2 as long as wide, leaf lobes 2 – 3, upright to weakly divergent, 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 cells long, cells 21 – 29 × 31 – 39 µm, 1.3 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Perianth** originating ventrally from the main stem, 2.9 mm long, weakly narrowed towards the mouth, multi – plicate in the upper fourth. **Perianth mouth** long ciliate, mouth cells linear, 9 – 13 × 54 – 82 µm, 4.5 – 7.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, median cells elongated polygonal to linear, 18 – 22 × 40 – 90 µm, 2.2 – 4.7 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae. **Female bracts** ovate, margin entire, 510 – 550 µm wide, 940 – 950 µm long, 1.7 – 1.8 as long as wide, median cells elongated polygonal, 10 – 15 × 17 – 39 µm, 1.4 – 3.9 as long as wide, cell walls thin, trigones small, cuticle smooth, basal cells ovate to elongated polygonal, 11 – 20 × 18 – 41 µm, 1.1 – 2.9 as long as wide, leaf lobes 4, 2.5 – 9.5 cells long, 3 – 5 cells wide at base, multiseriate part 1 – 4 cells long, uniseriate part 2 – 7 cells long, cells elongated polygonal to linear, cells 7 – 12 × 21 – 36 µm, 1.8 – 4.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Female bracteole** ovate to triangular, margin with 2 long teeth below the lobes, 400 µm wide, 700 µm long, 1.8 as long as wide, median cells elongated polygonal, 14 – 33 × 57 – 86 µm, 1.8 – 6.1 as long as wide, cell walls thin, trigones small, cuticle smooth, basal cells ovate to elongated polygonal, 25 – 33 × 68 – 85 µm, 2.1 – 3.3 as long as wide, leaf lobes 4, 3.5 – 7.5 cells long, 3 – 4 cells wide at base, multiseriate part 2 – 5 cells long, uniseriate part 2 – 3 cells long, cells elongated polygonal, cells 13 – 18 × 26 – 49 µm, 1.6 – 2.9 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. *papulosa* var. *plumula* is characterised by (1) the rather large branch leaves, which can reach up to 440 µm in length, (2) the branch leaf lobe bases, which are often wider than two cells, (3) the rather long branch leaf disc cells, which are often longer than 40 µm, and (4) the rather large branch underleaves.

Similar species:

N. *papulosa* var. *plumula* shares most of its characters with *N. papulosa.* However, the latter has bases of branch leaf lobes that are rarely more than two cells wide, shorter branch leaves that are up to 310 µm long, shorter branch leaf disc cells, and smaller branch underleaves that are up to 150 µm long.

N. tenera, which is related to *N. papulosa* and its varieties, has hooked branch leaf lobes and a higher stem and branch underleaf disc.

Distribution:

Sri Lanka. Only known from the type collection.

Neolepidozia papulosa var. *sakuraii* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*

≡ *Lepidozia sakuraii* HERZOG & BUCHLOH. *in sched.*

Holotype:

[Taiwan]: Formosa, Berg Arisan, leg. K. SAKURAI 11694, January 1936 (JE!, det. TH. HERZOG ET BUCHLOH as *Lepidozia sakuraii* nov. spec., det. M. MIZUTANI 1976 as *L. wallichiana*).

Figures:

Plate 222, Plate 223, Plate 224, Plate 225, Plate 226 (from SAKURAI 11694, *Lepidozia sakurai in sched.*).

Comparison Plate 4 – K, Comparison Plate 5 – L.

Description:

Plants pale yellowish green, medium sized, up to 3 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 2 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparse. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 170 µm wide and 140 µm high, cortical cells 12, 30 – 42 × 18 – 28 µm, cell walls thickened, medullary cells up to 50, 9 – 23 × 10 – 19 µm, cell walls thickened, trigones enlarged, dorsal cortical cells elongated polygonal, 26 – 35 × 51 – 74 µm, 1.5 – 2.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** approximate to distant, longitudinally inserted, spreading at an angle of 50° – 70°, leaves square, symmetric, flat, 270 – 290 µm wide, 280 – 300 µm long, 1 as long as wide, divided by 0.5 of the leaf length, margin entire, disc 8 cells wide, 2.5 cells long, 220 – 250 µm wide, 130 – 150 µm long, 0.5 – 0.7 as long as wide, median cells isodiametric to shortly elongated polygonal, 32 – 41 × 40 – 47 µm, 1.1 – 1.3 as long as wide, cell walls moderately thickened, trigones lacking, cuticle with striate papillae, basal cells elongated polygonal, 40 – 47 × 56 – 67 µm, 1.3 – 1.6 as long as wide, leaf lobes 4, 4.5 cells long, straight, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells ovate to elongated polygonal, not to weakly constricted at the transversal walls, 23 – 33 × 38 – 51 µm, 1.3 – 1.9 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1 – 1.3 times as wide as the stem, underleaves square, 140 – 160 µm wide, 150 – 155 µm long, 1 – 1.1 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 8 cells wide, 2.5 cells long, 120 – 145 µm wide, 70 – 105 µm long, 0.5 – 0.9 as long as wide, median cells elongated polygonal, 18 – 23 × 25 – 36 µm, 1.2 – 1.8 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal, 18 – 23 × 39 – 47 µm, 2 – 2.2 as long as wide, leaf lobes 4, upright to divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 16 – 22 × 23 – 41 µm, 1.4 – 2.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** approximate to imbricate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves square, symmetric, flat, 160 – 175 µm wide, 250 – 280 µm long, 1.6 – 1.7 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 cells wide, 2.5 – 3.5 cells long, 140 – 160 µm wide, 130 – 155 µm long, 0.8 – 1.1 as long as wide, median cells isodiametric to elongated polygonal, 27 – 35 × 32 – 43 µm, 1.1 – 1.5 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal, 29 – 34 × 39 – 64 µm, 1.1 – 2.2 as long as wide, leaf lobes 3, 3.5 – 4.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells ovate to elongated polygonal, not or weakly constricted at the transversal walls, cells 17 – 30 × 32 – 56 µm, 1.2 – 2 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** distant, transversely attached, spreading away from the stem, 1 – 1.6 times as wide as the branch, underleaves transversely rectangular to trapezoid, 85 – 120 µm wide, 110 – 130 µm long, 0.9 – 1.5 as long as wide, divided by 0.4 of the leaf length, disc 4 – 6 cells wide, 1.5 – 2.5 cells long, 75 – 115 µm wide, 65 – 80 µm long, 0.6 – 1.1 as long as wide, median cells isodiametric to elongated polygonal, 20 – 23 × 29 – 33 µm, 1.3 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 15 – 26 × 36 – 44 µm, 1.7 – 2.5 as long as wide, leaf lobes 2 -3, upright to weakly divergent, 1.5 – 2.5 cells long, 2.5 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 14 – 19 × 29 – 35 µm, 1.7 – 2.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. papulosa var. *sakuraii* is characterised by (1) a ± square branch leaf disc that is often only 2.5 cells high, with (2) cells up to 50 µm long that rarely undergo secondary cell division, and (3) branch leaves divided to half their length.

Similar species:

Naturally *N. papulosa* var. *sakuraii* shares the greatest similarities with *N. papulosa* and its varieties.

N. papulosa has branch leaves that are less deeply divided and a rectangular branch leaf disc, as well as thicker cell walls. *N. papulosa* var. *plumula* likewise has a rectangular branch leaf disc with secondary cell divisions and branch leaf lobes that are often wider than two cells at the base. However, the branch leaf disc of *N. papulosa* var. *kalatunganensis* is also ± square-shaped, but its disc cells are larger and its branch underleaves are smaller. *N. papulosa* var. *apoensis* has deeper-divided branch leaves that are up to 220 µm long and rather strongly papillose branch leaf cells.

There is also some resemblance to *N. schaefer-verwimpii*. The latter species, however, has short triangular branch leaf lobes that are often wider than two cells at the base and has usually frequently developed secondary cell divisions.

Lepidozia hainanensis has likewise symmetric leaves with a rather regular cell pattern, longitudinally attached branch leaves and small disc cells. Even though we did not examine the type we are convinced that this species represents a form of *N. papulosa* var. *sakuraii.*

Distribution:

Taiwan.

Specimens studied:

Taiwan: Nantou County, Lugu Township, Sitou, alt. 1085 m, 23° 40’ 21.9” N, 120° 47’ 51.0” E, on dry to mesic tree base, trail side, planted conifer stand (mainly *Taiwania cryptomerioides* and *Cryptomeria japonica*), leg. K.Y. YAO, 23 December 2017 (Bryophyta Taiwanica Exsiccata no. 111, herbarium SCHÄFER-VERWIMP!, det. J.-D. YANG as *Lepidozia wallichiana*).

Taiwan: Nantou County, Lugu Township, Xitou Forest Recreation Area, *Cryptomeria* plantation near Villa 6628-6631; 1180 m; 23° 40.3’ N, 120° 48.0’ E, at base of old *Crypotmeria japonica* in filtered light, leg. A. SCHÄFER-VERWIMP XT-42 (37241), with YU-CHWEN HSU, CHAO-LING KUO, LIANG-CHI WANG, KANG-YU FAN & GERHARD WINTER, 5 October 2016 (herbarium SCHÄFER-VERWIMP 37241!; duplicates: TAIM, TAIE, both as *Lepidozia wallichiana*).

Taiwan: Nantou County, Sun-Link-Sea Forest Recreation Area (Shanlinxi), 23° 38' 10.6" N, 120° 47' 48.2" E, 1765 m, *Rhododendron* Forest trail, on rotten wood in partly filtered light, leg. A. SCHÄFER-VERWIMP 43179, with KUEI-YU YAO, JAMES R. SHEVOCK & GERHARD WINTER, 17 October 2025 (herbarium SCHÄFER-VERWIMP 43179!, duplicate: TAIE).

Taiwan: Nantou County, Sun-Link-Sea Forest Recreation Area (Shanlinxi), 23° 38' 12.3" N, 120° 47' 47.4" E, 1780 m, *Rhododendron* Forest trail, on dead tree stem in partly filtered light, leg. A. SCHÄFER-VERWIMP 43182, with KUEI-YU YAO, JAMES R. SHEVOCK & GERHARD WINTER, 17 October 2025 (herbarium SCHÄFER-VERWIMP 43182!, duplicate: TAIE).

Taiwan: Nantou County, Sun-Link-Sea Forest Recreation Area (Shanlinxi), 23° 38' 10.9" N, 120° 47' 37.6" E, 1745 m, *Rhododendron* Forest trail, on rotten log in partly filtered light, leg. A. SCHÄFER-VERWIMP 43187, with KUEI-YU YAO, JAMES R. SHEVOCK & GERHARD WINTER, 17 October 2025 (herbarium SCHÄFER-VERWIMP 43187!, duplicate: TAIE).

Taiwan: Nantou County, Sun-Link-Sea Forest Recreation Area (Shanlinxi), 23° 38' 3.1" N, 120° 47' 16.3" E, 1730 m, *Cryptomeria* forest stand with hardwoods along Yueling trail, on bark of *Cryptomeria* in partly filtered light, leg. A. SCHÄFER-VERWIMP 39192, with KUEI-YU YAO, JAMES R. SHEVOCK & GERHARD WINTER, 28 October 2018 (herbarium SCHÄFER-VERWIMP 39192!, duplicates: CAS, FR, TAIE all as *N. wallichiana*).

Taiwan: Nantou, Chitou [Xitou], 1200 m, on bark of *Cryptomeria japonica* near road, leg. KOHSAKU YAMADA 14025, 26 - 28 July 1979 (JE! ex hb. K. YAMADA, det. K. YAMADA 1980 as *Lepidozia wallichiana*).

Etymology:

The variety is named after the Japanese bryologist KYUICHI SAKURAI (1889 – 1963) who discovered this species.

Neolepidozia papulosa var. *uniseriata* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*

Holotype:

Philippines: Mindanao Island, Misamis Oriental Province, Gingoog City, Talangisog Forest Park, Eureka Barangay, 8° 41' 29.62" N, 125° 14' 30.05" E, 560 m, Lower evergreen mixed hardwood tropical rain forest with palm understory, on metamorphic clayey soil in filtered light, leg. JAMES R. SHEVOCK 62130, with LESLEY C. LUBOS, AIMANUELZON P. YORONG & ROMEO PATANO, 19 July 2023 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Figures:

Plate 227, Plate 228, Plate 229, Plate 230, Plate 231, Plate 232.

Comparison Plate 2 – H.

Description:

Plants yellowish green, medium sized, up to 2.5 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type, innovations ventral-intercalar. **Branches** up to 6 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparse, up to 5 mm long. **Rhizoids** not seen. **Stem** in cross section 120 µm wide and 110 µm high, cortical cells 10, 24 – 38 × 20 – 33 µm, cell walls thickened, medullary cells up to 20, 12 – 20 × 11 – 17 µm, cell walls thickened, trigones enlarged, dorsal cortical cells elongated polygonal, 27 – 36 × 43 – 81 µm, 1.4 – 2.4 as long as wide, cell walls moderately thickened, trigones enlarged, cuticle smooth. **Stem leaves** approximate, obliquely inserted, spreading at an angle of 60° – 80°, leaves trapezoid, symmetric to weakly asymmetric, flat, 270 – 400 µm wide, 320 – 390 µm long, 1 – 1.2 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 3.5 cells long, 190 – 270 µm wide, 130 – 210 µm long, 0.5 – 0.9 as long as wide, median cells isodiametric to shortly elongated polygonal, 29 – 42 × 44 – 62 µm, 1.2 – 1.9 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 27 – 41 × 54 – 73 µm, 1.7 – 2.4 as long as wide, leaf lobes 4, upright to divergent, 3.5 – 5.5 cells long, straight to weakly falcate, 2 (-3) cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 5 cells long, cells elongated polygonal, not constricted at the transversal walls, 23 – 38 × 42 – 66 µm, 1.4 – 2.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1 – 1.2 times as wide as the stem, underleaves square, transversely rectangular to trapezoid, 130 – 220 µm wide, 120 – 190 µm long, 0.7 – 0.9 as long as wide, divided by 0.3 – 0.6 of the leaf length, disc 6 – 8 cells wide, 1.5 cells long, 115 – 170 µm wide, 55 – 110 µm long, 0.4 – 0.7 as long as wide, basal cells elongated polygonal, 18 – 27 × 37 – 63 µm, 2 – 2.4 as long as wide, leaf lobes 3 – 4, upright to divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 18 – 24 × 25 – 40 µm, 1.3 – 2.2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** approximate to imbricate, longitudinally inserted, spreading at an angle of 40° – 60°, leaves rectangular, symmetric, flat, 180 – 220 µm wide, 320 – 390 µm long, 1.5 – 1.9 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 – 7 cells wide, 3.5 – 4.5 cells long, 140 – 190 µm wide, 180 – 220 µm long, 1 – 1.5 as long as wide, median cells isodiametric to weakly elongated polygonal, 33 – 42 × 38 – 54 µm, 1.2 – 1.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 30 – 39 × 43 – 68 µm, 1.4 – 2.1 as long as wide, leaf lobes 3, upright to weakly divergent, 3.5 – 4.5 cells long, 2 cells wide at base, multiseriate part 1 (-2) cells long, uniseriate part 3 – 4 cells long, cells elongated polygonal, not constricted at the transversal walls, cells 20 – 36 × 44 – 75 µm, 1.5 – 2.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch underleaves** distant, transversely attached, spreading away from the stem, 0.8 – 1.3 times as wide as the branch, underleaves rectangular to trapezoid, 85 – 150 µm wide, 100 – 130 µm long, 0.8 – 1.5 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 – 6 cells wide, 0.5 – 1.5 cells long, 75 – 120 µm wide, 50 – 75 µm long, 0.5 – 0.9 as long as wide, basal cells elongated polygonal, 22 – 27 × 33 – 52 µm, 1.2 – 2.2 as long as wide, leaf lobes 2 – 3, upright to divergent, 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 cells long, cells 18 – 27 × 28 – 32 µm, 1 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. *papulosa* var. *uniseriata* is characterised by (1) by the uniseriate branch leaf lobes that very rarely develop a biseriate row at the base, (2) the rather large branch underleaves, (3) the smooth cuticule, the (4) rather long branch leaf lobe cells that are often more than twice as long as wide, and (5) the enlarged central cells at the base of the branch leaf disc that are characteristic of *N. papulosa* and its relatives.

Similar species:

N. papulosa var. *kalatunganensis* also has uniseriate branch leaf lobes. However, the cells of the leaf lobes are shorter, especially the ones above the lobe base. Furthermore, it has smaller branch underleaves and larger branch leaf disc cells.

The leaf shape also resembles that of *Neolepidozia dinagatensis* and of *N. dulitensis.* The former is a much larger plant, with branch leaves that are typically over 400 µm long. Both species have a very flat appearance with longitudinally attached leaves. In contrast, the leaves of *N. papulosa* var. *uniseriata* are weakly obliquely attached.

N. bickeri, with likewise uniseriate stem leaf lobes, develops hooked branch leaf lobes. It also has smaller branch underleaves and does not have enlarged cells at the base of the branch leaf disc.

Distribution:

Indonesia (Sulawesi), Philippines (Mindanao).

Specimens studied:

Indonesia: Sulawesi, Sulawesi Tengah, Regenwald oberhalb der Siedlung Toro im Kulawi-Tal am westlichen Rand des Lore Lindu Nationalparks, alt. ca. 1.130 m, WGS84 1° 29' 23" S, 120° 01' 31" O, mit u.a. *Lejeunea sordida* (NEES) NEES, *Trichocolea tomentella* (EHRH.) DURMORT. und *Leucobryum* sp., leg. S. ABRAHAMCZYK, 13 März 2007 (JE – Bryo 7867!).

Philippines: Mindanao Island, Bukidnon Province, On secondary trail paralleling midslope of Mt. Malimumu toward overview of upper watershed area of Opis River above waterfalls accessed from San Fernando via Magkalungay Barangay, 7° 52' 33" N, 125° 24' 26.7" E, 900 m, Mixed hardwood forest with tree ferns and *Pandanus*, on tree fern snag in filtered light, leg. JAMES R. SHEVOCK, 59718, with LESLEY C. LUBOS & ROMEO PATANO, 19 July 2022 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Etymology:

The species is named after the uniseriate branch leaf lobes.

Neolepidozia parvula (N. KITAG.) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*

Basionym:

Lepidozia parvula N. KITAG. *Acta Phytotaxonomica et Geobotanica* 29: 60. 1978. Fig. 6.

Type:

[Thailand]: Nakawn Sritamarat: at the summit of Mt. Khao Luang, 1780 m, on tree trunk in moist shrubby forest, *M. Tagawa & N. Kitagaiwa* T4897, Jan. 21, 1966. Type in herb. KYO. Duplicates in NICH, L (L.4601352! – istotype).

Figures:

KITAGAWA (1978) Fig. 6.

Plate 233, Plate 234, Plate 235, Plate 236, Plate 237, Plate 238 (from TOUW 11808 A).

Comparison Plate 2 – A.

As the isotype in L consists of poorly developed plants, we decided to depict the plants collected by TOUW from the same mountain.

Description:

Plants pale yellowish green, small, up to 1.5 cm long, stem with leaves up to 0.5 mm wide, leaves not fragile. **Branching** 1- to 2-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparse, up to 3 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 115 µm wide and 85 µm high, cortical cells 11, 20 – 37 × 10 – 19 µm, cell walls thickened, medullary cells up to 25, 11 – 21 × 8 – 16 µm, cell walls thickened, trigones enlarged, dorsal cortical cells elongated polygonal, 19 – 31 × 44 – 74 µm, 1.7 – 3.9 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** distant, obliquely inserted, spreading at an angle of 50° – 70°, leaves trapezoid, symmetric to asymmetric, flat, 180 – 270 µm wide, 170 – 210 µm long, 0.7 – 1.1 as long as wide, divided by 0.6 – 0.7 of the leaf length, margin entire, disc 6 – 8 cells wide, 1.5 – 2.5 cells long, 85 – 130 µm wide, 50 – 90 µm long, 0.4 – 0.8 as long as wide, median cells isodiametric to shortly elongated polygonal, 15 – 21 × 19 – 25 µm, 1.1 – 1.5 as long as wide, cell walls moderately thickened, trigones

small, cuticle with striate papillae, basal cells elongated polygonal, 14 – 17 × 22 – 30 µm, 1.5 – 1.9 as long as wide, leaf lobes (3-) 4, divergent, 3.5 – 4.5 cells long, straight to weakly falcate, 2 (-3) cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells elongated polygonal, 11 – 18 × 21 – 31 µm, 1.4 – 2.2 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, upright, 1.2 – 1.5 times as wide as the stem, underleaves transversely rectangular to trapezoid, 120 – 140 µm wide, 75 – 95 µm long, 0.6 – 0.7 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 8 cells wide, 1.5 cells long, 85 – 110 µm wide, 35 – 60 µm long, 0.4 – 0.6 as long as wide, basal cells elongated polygonal, 14 – 19 × 19 – 25 µm, 1.2 – 1.6 as long as wide, leaf lobes 4, upright to divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 11 – 15 × 19 – 22 µm, 1.4 – 2 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, obliquely inserted, spreading at an angle of 30° – 60°, leaves trapezoid, symmetric, lobes weakly bent towards the stem apex, 160 – 230 µm wide, 165 – 210 µm long, 0.7 – 1.2 as long as wide, divided by 0.6 – 0.7 of the leaf length, divided by 0.6 on the ventral side, margin entire, disc 6 cells wide, 2.5 cells long, 65 – 100 µm wide, 65 – 90 µm long, 0.7 – 1.2 as long as wide, median cells isodiametric to elongated polygonal, 15 – 21 × 20 – 27 µm, 1.3 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 12 – 23 × 25 – 33 µm, 1.3 – 2.4 as long as wide, leaf lobes 3, divergent, 4.5 cells long, 2 cells wide at base, multiseriate part 2 cells long, uniseriate part 3 cells long, cells elongated polygonal, not constricted at the transversal walls, cells 11 – 15 × 23 – 31 µm, 1.6 – 2.4 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** distant, transversely attached, upright, 1.3 – 1.4 times as wide as the branch, underleaves square to trapezoid, 65 – 100 µm wide, 40 – 90 µm long, 0.5 – 1.2 as long as wide, divided by 0.5 – 0.6 of the leaf length, disc 4 – 6 cells wide, 0.5 – 1.5 cells long, 45 – 65 µm wide, 20 – 40 µm long, 0.3 – 0.9 as long as wide, basal cells elongated polygonal, 14 – 17 × 19 – 22 µm, 1.3 – 1.4 as long as wide, leaf lobes 2 (-3), upright to divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 14 – 17 × 19 – 27 µm, 1.3 – 1.8 as long as wide, cell walls moderately thickened, trigones small, cuticle with round papillae.

Distinguishing characters:

N. *parvula* is characterised by (1) its *Kurzia*-like appearance with deeply divided leaves, (2) the obliquely inserted leaves, (3) the partially biseriate branch leaf lobes, (4) the rather small size with branch leaves that are barely exceeding 250 µm, and (5) the small branch underleaves.

Similar species:

KITAGAWA (1978) noted its similarity to *N. ophiria*, which, however, has a less *Kurzia*-like appearance and a branch leaf disc that is usually 3.5 cells high with uniseriate branch leaf lobes.

N. parvula shares partially biseriate branch leaf lobes with *N. richardsii*, a larger plant with very large stem leaves and branch underleaves. Another species with a *Kurzia*-like appearance is *N. katrinae*, which has uniseriate branch leaf lobes that are strongly bent towards the branch apex and consist of much longer cells.

Distribution:

Thailand.

Specimen studied:

Thailand: Nakornsrithamarat, granitic massive Khao (Mt.) Luang. Sumit region, stunted mossy forest, 8° 30' N, 99° 45' E, 1740 m, on trees, leg. A TOUW 11808/A, 5 February 1966 (Rijksherbarium Leiden, L.4601354!). The specimen includes two *Neolepidozia* species, *N. parvula* 11808/A and *N. cameronensis* which was separated as 11808/B.

Remark:

BAPNA & KACHROO (2000) synonymised *Lepidozia parvula* with *L. robusta* Steph. The latter shows the typical characteristics of *Lepidozia* and does not belong to *Neolepidozia*. Following HAGBORG & SÖDERSTRÖM (2023), we also disagree with the synonymisation of *N. parvula* with *L. robusta*.

Neolepidozia philippinensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Philippines: Mindanao Island, Bukidnon Province, Quezon, Barangay Luminato, Sitio Sto. Domingo, Mount Pinamantawan, Tangkulan Range, 7° 45' 56.1" N, 125° 13' 43.6" E, 1673 m, Slope trail, mossy forest, just 25 meters

to summit of Mt. Pinamantawan, with ferns and tree ferns as dominant understory plant, on fallen hardwood branch, in filtered light, leg. AIMANUELZON P. YORONG 931b, 29 August 2022 (herbarium SCHÄFER-VERWIMP!, duplicate: CAS). This specimen is a mix of the following 3 species: YORONG 931a (holotype of *Neolepidozia yorongii*, YORONG 931b (holotype of *Neolepidozia philippinensis*), and YORONG 931c (holotype of *Neolepidozia tangkulanensis*).

Figures:

Plate 239, Plate 240, Plate 241, Plate 242, Plate 243.

Comparison Plate 1 – E.

Description:

Plants yellowish green, small, up to 1 cm long, stem with leaves up to 0.4 mm wide, leaves fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 2 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 4 mm long. **Rhizoids** not seen. **Stem** in cross section 120 µm wide and 110 µm high, cortical cells 10, 22 – 35 × 19 – 36 µm, cell walls thin, medullary cells up to 20, 9 – 22 × 8 – 18 µm, cell walls moderately thickened, trigones small, dorsal cortical cells elongated polygonal, 29 – 38 × 58 – 99 µm, 1.6 – 3.4 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Stem leaves** distant, longitudinally inserted, spreading at an angle of 70° – 80°, leaves square, symmetric, flat, 140 – 165 µm wide, 130 – 155 µm long, 0.8 – 0.9 as long as wide, divided by 0.2 – 0.4 of the leaf length, margin entire, disc 6 cells wide, 1.5 – 2.5 cells long, 115 – 160 µm wide, 80 – 125 µm long, 0.5 – 0.8 as long as wide, median cells hexagonal to short rectangular, 23 – 35 × 29 – 40 µm, 1 – 1.3 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 22 – 38 × 36 – 48 µm, 1.3 – 2.1 as long as wide, leaf lobes 3, upright, 2 cells wide at base, multiseriate part 1 cells long, cells elongated polygonal, not constricted at the transversal walls, 22 – 30 × 30 – 44 µm, 1.3 – 1.8 as long as wide, cell walls thin, trigones small, cuticle smooth, half stem leaf near branch base lanceolate, 2 cells wide and 3 cells long. **Stem underleaves** distant, transversely attached, upright, 0.9 – 1.1 times as wide as the stem, underleaves transversely linear, 95 – 120 µm wide, 60 – 70 µm long, 0.5 – 0.7 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 6 – 8 cells wide, 1.5 cells long, 90 – 120 µm wide, 35 – 45 µm long, 0.3 – 0.5 as long as wide, basal cells elongated ovate to polygonal, 17 – 20 × 19 – 28 µm, 1.1 – 1.6 as long as wide, leaf lobes 3 – 4, upright, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 15 – 18 × 24 – 27 µm, 1.5 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 40° – 55°, leaves rectangular to trapezoid, symmetric, flat, 100 – 170 µm wide, 175 – 210 µm long, 1.2 – 1.8 as long as wide, divided by 0.3 – 0.4 of the leaf length, margin entire, disc 3 – 6 cells wide, 2.5 – 3.5 cells long, 75 – 160 µm wide, 115 – 140 µm long, 0.9 – 1.5 as long as wide, median cells hexagonal to elongated polygonal, 28 – 32 × 35 – 49 µm, 1.2 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 22 – 37 × 37 – 56 µm, 1.3 – 1.8 as long as wide, leaf lobes 2 – 3, upright, 2 cells wide at base, multiseriate part 1 cells long, cells elongated polygonal, not constricted at the transversal walls, cells 18 – 28 × 49 – 51 µm, 1.8 – 2.7 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch underleaves** distant, transversely attached, upright, 0.8 – 1.2 times as wide as the branch, underleaves transversely linear, 65 – 70 µm wide, 30 – 45 µm long, 0.5 – 0.6 as long as wide, divided by 0.1 – 0.3 of the leaf length, disc 4 cells wide, 0.5 – 1.5 cells long, 50 – 70 µm wide, 25 – 40 µm long, 0.4 – 0.7 as long as wide, basal cells square to ovate, 17 – 18 × 20 – 23 µm, 1.1 – 1.4 as long as wide, leaf lobes 2, 2 cells wide at base. **Female inflorescence** originating ventrally from the main stem, 0.9 mm long, 0.9 mm wide, densely leaved. **Female bracts** spreading, rectangular, 4-lobate, margin weakly toothed, marginal cells partially ending in slime papillae, 330 µm wide, 500 µm long, 1.5 as long as wide, median cells elongated polygonal, 24 – 40 × 40 – 65 µm, 1.3 – 2.2 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 20 – 30 × 35 – 40 µm, 1.3 – 1.9 as long as wide, leaf lobes 5, 2.5 – 5.5 cells long, 2 – 4 cells wide at base, multiseriate part 1 – 4 cells long, uniseriate part 1 – 3 cells long, cells rectangular to linear, cells 15 – 31 × 32 – 88 µm, 1 – 5.9 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth.

Distinguishing characters:

This species is characterised by (1) fragile leaves, (2) angular, often elongated stem and branch leaf cells, (3) the lanceolate half stem leaf near the branch base, and (4) the very low disc of the stem and branch underleaves.

Similar species:

The cell pattern of this species resembles that of *N. dulitensis* which has thicker cell walls, a brownish colour in herbarium specimen and does not have fragile leaves. All other species with fragile leaves have shorter, i.e. square, hexagonal to round cells.

Distribution:

Philippines (Mindanao). Only known from the type collection.

Etymology:

The species is named after the Republic of the Philippines, the only country so far, where the species was found.

Neolepidozia richardsii (HERZOG) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*

Basionym:

Lepidozia richardsii HERZOG. *Transactions of the British Bryological Society* 1(4): 313. 1950.

Lectotype (Designated here):

[Malaysia]: Sarawak, Dulit Ridge, alt. c. 1230 m, large cushions round base of trees in moss-forest, leg. P.W. RICHARDS 1068, 1 Aug. 1932 (JE!, lectotype, with *Acromastigium inaequilaterum* [L. & L.]).

Figures:

Plate 244, Plate 245, Plate 246, Plate 247, Plate 248, Plate 249 (from RICHARDS 1068).

Plate 250, Plate 251, Plate 252, Plate 253, Plate 254, Plate 255 (from SHEVOCK 54810).

Comparison Plate 2 – C.

Description (based on RICHARDS 1068):

Plants pale brownish green, medium sized, up to 2.5 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 15 mm long, flagelliform at the end. **Flagelliform branches** sparse, up to 5 mm long. **Rhizoids** not seen. **Stem** in cross section 230 µm wide and 210 µm high, cortical cells 12, 41 – 58 × 21 – 26 µm, cell walls thickened, medullary cells up to 80, 12 – 25 × 11 – 21 µm, cell walls thickened, trigones enlarged, dorsal cortical cells square to rectangular, 50 – 56 × 42 – 61 µm, 0.8 – 1.2 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Stem leaves** imbricate, obliquely inserted, spreading at an angle of 30° – 40°, leaves trapezoid, symmetric to weakly asymmetric, lobes bent down ventrally, 420 – 500 µm wide, 370 – 430 µm long, 0.8 – 1 as long as wide, divided by 0.6 – 0.8 of the leaf length, margin entire, disc 8 cells wide, 1.5 – 3.5 cells long, 220 – 280 µm wide, 100 – 150 µm long, 0.4 – 0.7 as long as wide, median cells isodiametric polygonal to ovate, 30 – 37 × 33 – 43 µm, 1.1 – 1.3 as long as wide, cell walls thickened, trigones small to enlarged, cuticle with striate papillae, basal cells ovate to elongated polygonal, 29 – 37 × 37 – 50 µm, 1.1 – 1.4 as long as wide, leaf lobes 4, upright to divergent, 4.5 – 5.5 cells long, straight to weakly falcate, 2 (-3) cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells elongated polygonal to linear, not constricted at the transversal walls, 17 – 32 × 52 – 62 µm, 1.6 – 3.4 as long as wide, cell walls thickened, trigones small, cuticle with ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** imbricate, transversely attached, obliquely spreading with lobes turned to the stem apex, 1.3 – 1.5 times as wide as the stem, underleaves ovate to trapezoid, 300 – 540 µm wide, 340 – 440 µm long, 0.8 – 1.3 as long as wide, divided by 0.5 – 0.8 of the leaf length, disc 8 cells wide, 1.5 – 3.5 cells long, 190 – 320 µm wide, 100 – 170 µm long, 0.3 – 0.8 as long as wide, median cells isodiametric polygonal to ovate, 34 – 45 × 46 – 56 µm, 1.2 – 1.4 as long as wide, cell walls thickened, trigones small to enlarged, cuticle with striate papillae, basal cells ovate to elongated polygonal, 29 – 37 × 42 – 61 µm, 1.3 – 1.7 as long as wide, leaf lobes 4, upright to weakly divergent, 4.5 – 5.5 cells long, 2 – 4 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells 21 – 28 × 43 – 60 µm, 1.5 – 2.9 as long as wide, cell walls thickened, trigones small, cuticle with ovate papillae. **Branch leaves** imbricate, obliquely inserted, spreading at an angle of 40° – 50°, leaves trapezoid, symmetric, bent ventrally to upright, 330 – 490 µm wide, 400 – 470 µm long, 1 – 1.3 as long as wide, divided by 0.7 of the leaf length, margin entire, disc 6 – 8 cells wide, 2.5 – 3.5 cells long, 120 – 260 µm wide, 120 – 150 µm long, 0.5 – 1.2 as long as wide, median cells isodiametric to elongated polygonal, 29 – 37 × 35 – 46 µm, 1 – 1.3 as long as wide, cell walls thickened, trigones small, cuticle with striate papillae, basal cells ovate to elongated polygonal, 25 – 33 × 39 – 58 µm, 1.4 – 1.9 as long as wide, leaf lobes 3 – 4, divergent, 4.5 – 6.5 cells long, 2 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 3 – 4 cells long, cells elongated polygonal to linear, not constricted at the transversal walls, cells 17 – 24 × 62 – 83 µm, 3 – 4.2 as long as wide, cell walls thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** imbricate, overlapping 0.5 – 0.6 of the underleaf length, transversely attached, upright, 1.5 – 1.9 times as wide as the branch, underleaves trapezoid, 330 – 490 µm wide, 400 – 450 µm long, 0.8 – 1.4 as long as wide, divided by 0.6 – 0.8 of the leaf length, disc 6 cells wide, 2.5 – 3.5 cells long, 120 – 210 µm wide, 100 – 150 µm long, 0.5 – 1.3 as long as wide, median cells isodiametric to elongated polygonal, 31 – 37 × 34 – 50 µm, 1.1 – 1.4 as long as wide, cell walls thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 25 – 34 × 43 – 62 µm, 1.6 –

2.2 as long as wide, leaf lobes 3, upright to divergent, 4.5 – 6.5 cells long, 2 – 4 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 4 – 6 cells long, cells 17 – 23 × 49 – 79 µm, 2.3 – 4.1 as long as wide, cell walls thickened, trigones small, cuticle with round papillae. **Female inflorescence** originating ventrally from the main stem, 1.5 mm long, 1.5 mm wide, densely leaved. **Female bracts** spreading, ovate, 5-6 – lobate, margin weakly toothed, 630 – 750 µm wide, 800 – 980 µm long, 1.3 as long as wide, median cells elongated polygonal, 21 – 27 × 41 – 77 µm, 2 – 3.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells isodiametric polygonal, 17 – 25 × 24 – 38 µm, 1 – 1.9 as long as wide, leaf lobes 4 – 6, 3.5 – 7.5 cells long, 3 – 5 cells wide at base, multiseriate part 2 – 5 cells long, uniseriate part 2 – 4 cells long, cells elongated polygonal to linear, cells 10 – 28 × 50 – 74 µm, 1.8 – 6.1 as long as wide, cell walls thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. richardsii is characterised by (1) its *Kurzia*-like appearance, (2) the large stem and branch underleaves that are as long as the respective leaves, and (3) the multiseriate part of the branch leaf lobes that is up to 4 cells long.

Similar species:

Another species with *Kurzia*-like appearance is *N. katrinae*. It has however, much smaller underleaves and the leaf lobes are completely uniseriate. *N. ophiria* has more spreading branch leaves, smaller underleaves and uniseriate leaf lobes.

To a certain extent, *N. parvula* resembles *N. richardsii*. Both species have biseriate branch leaf lobes in the lower part, but the latter is larger and develops very large stem and branch underleaves, that make it very unique.

Distribution:

Malaysia (Borneo), Philippines (Mindanao).

Specimens studied:

[Malaysia]: Sarawak, Dulit Ridge, alt. c. 1230 m, bases of trees in open moss-forest, leg. P.W. RICHARDS 1936, 18 Sept. 1932 (JE!, with *Acromastigium inaequilaterum* [L. & L.]).

Philippines: Mindanao Island, Province Davao Oriental, Hamiguitan Range Wildlife Sanctuary, on trail from camp 4 to slopes near the summit ridge of peak of Mt. Hamiguitan, mixed hardwood and podocarp tropical rain forest with palms and Pandanus, 6° 44' 9.1" N, 126° 11' 3" E, 1545 m, leg. JAMES R. SHEVOCK 54810, with AIMANUELZON YORONG & DARYL SALAS, 17 June 2019 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, BUKH, CAS, CMUH, MO, PNH).

Neolepidozia salasii U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Philippines: Negros Island, Negros Occidental Province, Along the ridge trail well above the village of Naubok towards the summit slopes about Hapon-Haponon and Mt. Talinis, 9° 14' 42.6" N, 123° 7' 4.5" E, 1475 m, Mixed hardwood evergreen tropical rain forest with fern understory, on volcanic clayey soil and litter in shade, leg. JAMES R. SHEVOCK 56230, with DARYL S. SALAS, 17 December 2019 (herbarium SCHÄFER-VERWIMP!, duplicate: BRIT, CAS, CMUH, MO).

Figures:

Plate 256, Plate 257, Plate 258, Plate 259, Plate 260, Plate 261.

Comparison Plate 5 – N.

Description:

Plants brownish green, medium sized, up to 2 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 4 mm long, not flagelliform at the end. **Flagelliform branches** scattered, up to 4 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 225 µm wide and 160 µm high, cortical cells 12, 32 – 48 × 17 – 44 µm, cell walls thickened, medullary cells up to 50, 9 – 31 × 10 – 25 µm, cell walls moderately thickened, trigones enlarged, dorsal cortical cells isodiametric to weakly elongated polygonal, 30 – 47 × 40 – 57 µm, 0.9 – 1.9 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** imbricate, obliquely inserted, spreading at an angle of 50° – 70°, leaves square to rhombic, asymmetric, lobes bent down ventrally, 210 – 330 µm wide, 230 – 310 µm long, 0.9 – 1.3 as long as wide, divided by 0.2 – 0.4 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 4.5 cells long, 190 – 280 µm wide, 150 – 230 µm long, 0.7 – 1 as long as wide,

median cells ovate, isodiametric to elongated polygonal, 34 – 48 × 34 – 63 µm, 1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells ovate to elongated polygonal, 27 – 41 × 48 – 68 µm, 1.3 – 2.4 as long as wide, leaf lobes 4, upright, 2.5 – 3.5 cells long, straight, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells elongated polygonal, not constricted at the transversal walls, 22 – 32 × 31 – 45 µm, 1 – 1.9 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 0.9 – 1 times as wide as the stem, underleaves transversely rectangular to trapezoid, 180 – 210 µm wide, 120 – 170 µm long, 0.7 – 0.8 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 8 cells wide, 1.5 – 2.5 cells long, 160 – 210 µm wide, 85 – 120 µm long, 0.4 – 0.7 as long as wide, median cells isodiametric polygonal, 20 – 25 × 25 – 28 µm, 1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 23 – 32 × 31 – 46 µm, 1.3 – 1.7 as long as wide, leaf lobes 4, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 11 – 25 × 20 – 32 µm, 1 – 2.7 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, obliquely inserted, spreading at an angle of 50° – 60°, leaves ovate to rectangular, symmetric, bent down ventrally, 185 – 210 µm wide, 295 – 320 µm long, 1.5 – 1.6 as long as wide, divided by 0.3 of the leaf length, margin entire, disc 6 cells wide, 3.5 – 4.5 cells long, 155 – 200 µm wide, 195 – 225 µm long, 1.1 – 1.4 as long as wide, median cells isodiametric to elongated polygonal, 33 – 45 × 36 – 48 µm, 1 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 32 – 39 × 45 – 70 µm, 1.4 – 2.2 as long as wide, leaf lobes 3, upright, 2.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 cells long, cells elongated polygonal, not constricted at the transversal walls, cells 18 – 30 × 25 – 46 µm, 1 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** distant, transversely attached, upright, 0.7 – 0.9 times as wide as the branch, underleaves trapezoid, 70 – 125 µm wide, 65 – 90 µm long, 0.7 – 1.1 as long as wide, divided by 0.4 – 0.6 of the leaf length, disc 4 – 6 cells wide, 0.5 – 1.5 cells long, 60 – 125 µm wide, 30 – 50 µm long, 0.4 – 0.5 as long as wide, basal cells elongated polygonal, 18 – 25 × 25 – 30 µm, 1 – 1.4 as long as wide, leaf lobes 2 – 3, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 13 – 16 × 20 – 30 µm, 1.3 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Female inflorescence** originating ventrally from the main stem, 0.8 mm long, 0.9 mm wide, densely leaved. **Female bracts** spreading, ovate, 4 (-5)-lobate, margin with several large teeth, 510 µm wide, 540 µm long, 1.1 as long as wide, median cells isodiametric to elongated polygonal, 16 – 25 × 25 – 48 µm, 1.1 – 2.7 as long as wide, cell walls thin to moderately thickened, trigones small, cuticle almost smooth, basal cells isodiametric to elongated polygonal, 15 – 19 × 20 – 37 µm, 1.3 – 2.1 as long as wide, leaf lobes 4 (-5), 4.5 – 8.5 cells long, 4 – 5 cells wide at base, multiseriate part 3 -5 cells long, uniseriate part 2 – 3 cells long, cells elongated polygonal, cells 13 – 21 × 45 – 64 µm, 2.4 – 4 as long as wide, cell walls thickened, trigones enlarged, cuticle with ovate papillae. **Female bracteole** trapezoid, margin with on large tooth on each side, 330 µm wide, 290 µm long, 0.9 times as long as wide, median cells elongated polygonal, 15 – 18 × 16 – 28 µm, 1 – 1.6 as long as wide, cell walls thin, trigones small, cuticle with round to elliptical papillae, basal cells isodiametric polygonal, 11 – 15 × 20 – 26 µm, 1.3 – 2 as long as wide, leaf lobes 4, 3.5 – 5.5 cells long, 3 – 5 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 2 -3 cells long, cells elongated polygonal, cells 13 – 21 × 32 – 48 µm, 1.5 – 3.5 as long as wide, cell walls moderately thickened, trigones enlarged, cuticle with round to elliptical papillae.

Distinguishing characters:

N. *salasii* is characterised by (1) its large size, (2) the regularly arranged branches, (3) the concave and hooked stem and branch leaves, (4) the small underleaves, which often have a disc only 0.5 cells high, and (5) the strongly papillose cells of the branch leaves.

Similar species:

N. tenera is also quite large and has regularly arranged branches with hooked leaves. However, the branch leaves are rather flat, except for the lobes, which are much larger, with a disc up to 3.5 cells high.

N.panayensis, which has similarly small branch underleaves, has flat leaves and larger, elongated branch leaf disc cells that are only weakly papillose.

As mentioned in the key, *N. bickeri* has ± flat branch leaves that are attached longitudinally, often has secondary cell divisions and a weakly papillose cuticle.

Distribution:

Philippines (Negros). Only known from the type collection.

Etymology:

The species is named after Philippine bryologist DARYL S. SALAS, the co-collector of this species.

Neolepidozia sarawakensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Synonyms:

= *Lepidozia wallichiana* var. *remotifolia* HERZOG. *Transactions of the British Bryological Society* 1(4): 312. 1950. *syn. nov.*

Holotype:

[Malaysia]: Sarawak, Dulit Ridge, ca. 1230 m, on old termites' nest on tree trunk near ground in open forest, leg. P.W. RICHARDS 2153, 5 October 1932 (JE04010703!, holotype of *Lepidozia wallichiana* var. *remotifolia*, M. MIZUTANI July 1976 "Syntype of *Lepidozia wallichiana* var. *remotifolia* Herz. 1949, → Lectotype").

Figures:

Plate 262, Plate 263, Plate 264, Plate 265, Plate 266, Plate 267, Plate 268.

Comparison Plate 4 – M.

Description:

Plants pale yellowish green, medium sized, up to 3 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 4 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 2 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 160 µm wide and 130 µm high, cortical cells 12, 25 – 37 × 18 – 34 µm, cell walls thickened, medullary cells up to 40, 12 – 20 × 8 – 17 µm, cell walls thin to thickened, trigones small to enlarged, dorsal cortical cells rectangular to elongated polygonal, 29 – 39 × 43 – 93 µm, 1.4 – 3.2 as long as wide, cell walls moderately thickened, trigones lacking to small, cuticle smooth. **Stem leaves** distant, obliquely inserted, spreading at an angle of 50° – 70°, leaves square to trapezoid, symmetric to weakly asymmetric, flat, 210 – 295 µm wide, 200 – 280 µm long, 0.8 – 1.2 as long as wide, divided by 0.4 – 0.7 of the leaf length, margin entire, disc 8 cells wide, 1.5 – 3.5 cells long, 140 – 210 µm wide, 70 – 135 µm long, 0.4 – 0.9 as long as wide, median cells isodiametric to elongated polygonal, 24 – 28 × 29 – 41 µm, 1.1 – 1.5 as long as wide, cell walls weakly thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 22 – 40 × 31 – 51 µm, 0.9 – 2.1 as long as wide, leaf lobes 4, upright to divergent, 3.5 – 4.5 cells long, straight to weakly falcate, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 3 – 4 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 17 – 31 × 34 – 45 µm, 1.2 – 2.1 as long as wide, cell walls thin, trigones small, cuticle with round to elliptical papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1 – 1.2 times as wide as the stem, underleaves transversely rectangular to trapezoid, 130 – 180 µm wide, 110 – 160 µm long, 0.8 – 0.9 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 8 cells wide, 1.5 – 2.5 cells long, 120 – 155 µm wide, 70 – 105 µm long, 0.5 – 0.8 as long as wide, median cells isodiametric to elongated polygonal, 16 – 25 × 19 – 32 µm, 1.2 – 1.8 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 17 – 26 × 28 – 47 µm, 1.6 – 2.3 as long as wide, leaf lobes 4, upright to divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 14 – 19 × 15 – 31 µm, 1 – 1.8 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Branch leaves** approximate to imbricate, longitudinally inserted, spreading at an angle of 60° – 80°, leaves rectangular, symmetric, flat, 220 – 260 µm wide, 410 – 620 µm long, 1.6 – 2.4 as long as wide, divided by 0.4 of the leaf length, margin entire, disc 6 – 7 cells wide, 3.5 – 5.5 cells long, 140 – 230 µm wide, 230 – 360 µm long, 1.4 – 1.8 as long as wide, median cells elongated polygonal, 28 – 47 × 38 – 82 µm, 1.2 – 1.7 as long as wide, cell walls thin, trigones small, cuticle smooth, basal cells elongated polygonal, 32 – 58 × 61 – 80 µm, 1.2 – 2.2 as long as wide, leaf lobes (2-) 3, upright to divergent, 3.5 – 4.5 cells long, 2 (-3) cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 2 – 3 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, cells 23 – 36 × 37 – 60 µm, 1.1 – 2.5 as long as wide, cell walls thin, trigones small, cuticle with round to elliptical papillae. **Branch underleaves** approximate, transversely attached, spreading away from the stem, 0.7 – 0.9 times as wide as the branch, underleaves square to rectangular, 70 – 95 µm wide, 90 – 140 µm long, 1.1 – 1.5 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 4 cells wide, 1.5 cells long, 60 – 95 µm wide, 55 – 80 µm long, 0.7 – 1.1 as long as wide, basal cells elongated polygonal, 21 – 34 × 40 – 61 µm, 1.7 – 2.1 as long as wide, leaf lobes 2, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 12 – 35 × 17 – 34 µm, 0.9 – 2.3 as long as wide, cell walls moderately

thickened, trigones small, cuticle smooth. **Male branches** originating ventrally – intercalar from the main stem, straight, 1.3 mm long, with leaves 0.6 mm wide. **Male bracts** imbricate, obliquely attached, ovate to trapezoid, 240 – 330 µm wide, 420 – 480 µm long, 1.5 – 1.8 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 110 – 220 µm wide, 190 – 300 µm long, median cells elongated polygonal, 19 – 30 × 24 – 86 µm, 1 – 3.8 as long as wide, cell walls thin, trigones small, cuticle with round to elliptical papillae, basal cells elongated polygonal, 20 – 32 × 31 – 70 µm, 1.6 – 2.3 as long as wide, cell walls thin, trigones small, cuticle with round to elliptical papillae, leaf lobes 3 – 4, upright to divergent, 2.5 – 5.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 2 – 3 cells long, cells 16 – 26 × 39 – 49 µm, 1.9 – 2.8 as long as wide, cell walls elongated polygonal, trigones small, cuticle with round to elliptical papillae. **Underleaves** approximate, transversely attached, appressed to the stem, underleaves square to short rectangular, 85 – 90 µm wide, 120 – 180 µm long, 1.4 – 2 as long as wide, divided by 0.3 of the leaf length, disc 4 cells wide, 1.5 – 2.5 cells long, 60 – 85 µm wide, 80 – 120 µm long, median cells elongated polygonal, 30 – 34 × 37 – 43 µm, 1.2 – 1.3 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 18 – 31 × 49 – 65 µm, 1.6 – 3.6 as long as wide, cell walls thickened, trigones small, cuticle smooth, leaf lobes 2, upright, 1.5 – 2.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 17 – 19 × 22 – 38 µm, 1.3 – 2 as long as wide, cell walls elongated polygonal, trigones small, cuticle smooth. **Sexuality** monoicous. **Female inflorescence** originating ventrally from the main stem, 0.8 mm long, 0.8 mm wide, densely leaved. **Female bracts** spreading, ovate, 4-lobate, margin with several large teeth, 340 – 350 µm wide, 520 – 560 µm long, 1.5 – 1.6 as long as wide, median cells ovate to elongated polygonal, 19 – 32 × 33 – 73 µm, 1.7 – 2.5 as long as wide, cell walls thin, trigones small, cuticle smooth, basal cells ovate, 19 – 25 × 28 – 35 µm, 1.2 – 1.8 as long as wide, leaf lobes 4, 2.5 – 8.5 cells long, 2 – 4 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 2 – 5 cells long, cells elongated polygonal, cells 14 – 24 × 33 – 50 µm, 1.6 – 2.9 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Female bracteole** rectangular, margin entire, 200 µm wide, 360 µm long, 1.8 times as long as wide, median cells elongated polygonal, 18 – 29 × 30 – 77 µm, 1.3 – 4.1 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells ovate, 22 – 32 × 28 – 53 µm, 1.1 – 2.1 as long as wide, leaf lobes 4, 3.5 – 5.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells elongated polygonal, cells 14 – 21 × 28 – 42 µm, 2 – 2.1 as long as wide, cell walls thickened, trigones small, cuticle with round to elliptical papillae.

Distinguishing characters:

N. sarawakensis is characterised by (1) the large branch leaves measuring more than 400 µm in length, (2) the obliquely inserted stem leaves with falcate lobes, (3) the disc of the branch underleaves that is only up to 2.5 cells high, (4) the rather distant branch leaves with elongated disc cells and (5) its monoicy.

Similar species:

The stem underleaves of *N. sarawakensis* var. *grandistipula* are much larger, with disc up to 6.5 cells high.

In comparison to *N. sarawakensis* var. *rajaensis*, *N. sarawakensis* exhibits a lack of secondary cell division within the branch leaf disc and has branch leaf lobes that are only 2 cells wide at the base.

Like *N. sarawakensis*, *N. dinagatensis* is a rather large plant. The latter, however, has uniseriate branch leaf lobes and straight stem leaf lobes.

N. larutensis also has elongated branch leaf disc cells. However, its branch leaves are imbricately attached, and the branch underleaves are larger and overlap each other.

Distribution:

Malaysia (Borneo). Only known from the type collection.

Remark:

As these plants do not represent a variety of *N. wallichiana*, a new name had to be chosen. We omitted *remotifolia* and any name dedicated to HERZOG, as there are already respective species in the genus *Telaranea*.

Neolepidozia sarawakensis var. *grandistipula* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*

Holotype:

[Malaysia]: Sarawak, Dulit Ridge, on tree trunk in moss-forest, ca. 1230 m, leg. P.W. RICHARDS 1974b, 19 September 1932 (JE0401704!, M. MIZUTANI July 1976 "Syntype of *Lepidozia wallichiana* var. *remotifolia* Herz. 1949, = *Lepidozia ophiria* STEPH.").The specimen consists of 2 species, primarily *Neolepidozia sarawakensis* var.

grandistipula (1974b) and a few stems of *Neolepidozia dulitensis* (1974a). MIZUTANIs remark refers to the separated stems of *Neolepidozia dulitensis* that he mistakenly considered to be *N. ophiria*.

Figures:

Plate 269, Plate 270, Plate 271, Plate 272, Plate 273, Plate 274, Plate 275.

Comparison Plate 4 – N.

Description

Plants brownish, medium sized, up to 2 cm long, stem with leaves up to 0.7 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 6 mm long, often flagelliform at the end. **Flagelliform branches** scattered, up to 4 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 160 µm wide and 135 µm high, cortical cells 13, 22 – 42 × 20 – 34 µm, cell walls thickened, medullary cells up to 35, 15 – 24 × 13 – 17 µm, cell walls thickened, trigones enlarged, dorsal cortical cells elongated polygonal to linear, 24 – 35 × 61 – 86 µm, 1.9 – 3.6 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Stem leaves** distant, obliquely inserted, spreading at an angle of 40° – 60°, leaves square to rectangular, weakly asymmetric, lobes bent down ventrally, 250 – 330 µm wide, 300 – 410 µm long, 1.1 – 1.3 as long as wide, divided by 0.4 – 0.7 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 4.5 cells long, 170 – 220 µm wide, 130 – 220 µm long, 0.7 – 1.2 as long as wide, median cells ovate to elongated polygonal, 22 – 28 × 32 – 42 µm, 1.3 – 1.6 as long as wide, cell walls thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 25 – 36 × 48 – 60 µm, 1.4 – 2.2 as long as wide, leaf lobes 4, upright to divergent, 3.5 – 4.5 cells long, straight to falcate, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, 17 – 28 × 38 – 49 µm, 1.5 – 2.2 as long as wide, cell walls thickened, trigones small, cuticle with ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, upright, 1.1 – 1.3 times as wide as the stem, underleaves square, 160 – 190 µm wide, 190 – 270 µm long, 1.1 – 1.7 as long as wide, divided by 0.1 – 0.3 of the leaf length, disc 8 cells wide, 3.5 – 4.5 cells long, 150 – 180 µm wide, 150 – 220 µm long, 0.9 – 1.5 as long as wide, median cells elongated polygonal, 21 – 28 × 37 – 54 µm, 1.4 – 2.4 as long as wide, cell walls moderately thickened, trigones small to enlarged, cuticle smooth, basal cells elongated polygonal, 22 – 27 × 44 – 62 µm, 1.7 – 2.5 as long as wide, leaf lobes 0, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 13 – 18 × 18 – 31 µm, 1.3 – 2.2 as long as wide, cell walls moderately thickened, trigones small to enlarged, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 40° – 60°, leaves rectangular to trapezoid, symmetric, flat, 210 – 320 µm wide, 400 – 440 µm long, 1.3 – 2.1 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 cells wide, 3.5 – 4.5 cells long, 120 – 200 µm wide, 210 – 260 µm long, 1.1 – 2 as long as wide, median cells elongated polygonal, 28 – 38 × 44 – 58 µm, 1.3 – 1.8 as long as wide, cell walls thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 30 – 38 × 52 – 69 µm, 1.6 – 2.2 as long as wide, leaf lobes 3, divergent, 4.5 – 5.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, cells 20 – 34 × 39 – 51 µm, 1.5 – 2.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** distant, transversely attached, upright, 0.8 – 1.1 times as wide as the branch, underleaves rectangular to trapezoid, 80 – 90 µm wide, 120 – 140 µm long, 1.4 – 1.6 as long as wide, divided by 0.2 – 0.3 of the leaf length, disc 4 cells wide, 2.5 cells long, 60 – 90 µm wide, 80 – 105 µm long, 1 – 1.6 as long as wide, median cells elongated polygonal, 20 – 26 × 25 – 42 µm, 1.2 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 22 – 30 × 34 – 44 µm, 1.1 – 1.8 as long as wide, leaf lobes 2, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 13 – 18 × 18 – 33 µm, 1.3 – 2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Female inflorescence** originating ventrally from the main stem, 1.1 mm long, 1.2 mm wide, densely leaved. **Female bracts** spreading, ovate, 4-lobate, margin weakly toothed, 400 – 480 µm wide, 720 – 780 µm long, 1.6 – 1.8 as long as wide, median cells elongated polygonal, 21 – 31 × 50 – 88 µm, 1.7 – 4.2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 20 – 26 × 28 – 42 µm, 1.4 – 1.6 as long as wide, leaf lobes 4, 3.5 – 6.5 cells long, 3 – 4 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 1 – 4 cells long, cells elongated polygonal to linear, cells 17 – 26 × 32 – 68 µm, 1.9 – 3.8 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Female bracteole** ovate to rectangular, margin entire, 250 µm wide, 520 µm long, 2.1 times as long as wide, median cells ovate to elongated polygonal, 24 – 31 × 47 – 76 µm, 1.8 – 2.7 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 18 – 28 × 51 – 68 µm, 1.8 – 3.6 as long as wide, leaf lobes 4, 3.5 – 4.5 cells long, 2 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 4 cells long, cells elongated polygonal, cells 16 – 25 × 42 – 50 µm, 1.9 – 3.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. sarawakiensis is characterised by (1) rather distant, obliquely inserted stem leaves, (2) the large, square stem underleaves, (3) trapezoid branch leaves, and (4) the elongated disc cells of the branch leaves that sometimes reach almost 60 µm.

Similar species:

There are close similarities with *N. sarawakensis*, which has smaller stem underleaves, with a disc that is only up to 2.5 cells high.

There are also similarities to *Neolepidozia dinagatensis* and *N. dulitensis*. These two species have smaller stem underleaves, a branch leaf disc that is not widened towards the apex and branch leaf lobes that are not biseriate at the base. *N. dinagatensis* has furthermore, symmetric stem leaves without falcate lobes and a lower stem leaf disc.

Distribution:

Malaysia (Borneo), Philippines (Panay), Taiwan.

Etymology:

The species is named after the state of Sarawak where the species was discovered.

Specimens studied:

[Malaysia]: Sarawak, Dulit Ridge, on tree trunk in moss-forest, ca. 1230 m, leg. P.W. RICHARDS 1974c, 19 September 1932 (JE0401705!, det. TH. HERZOG as *Lepidozia wallichiana* var. *remotifolia*). Remark by R. GROLLE: "aus Glyzerinpräparat herbarisiert durch GROLLE 1980". The specimen oviously consists of stems taken from 1974b to create a permanent slide. The plants were herbarised from a permanent slide by GROLLE.

Philippines: Panay Island, Antique Province, Muncipality Culasi, Mt. Madja-as, forest near the Batang-Batang slope, 11° 21' 0.18" N, 122° 9' 10.62" E, 1400 m, on rotten wood, leg. UWE SCHWARZ, 28 January 2001 (herbarium UWE SCHWARZ 7713!).

Taiwan: Yilan County, Along highway 7 at km road marker 67 at edge of Mingchih Forest Recreation Area, 23° 38' 45.2" N, 121° 28' 33.7" E, 1140 m, *Cryptomeria* forest with single hardwoods, at base of *Cryptomeria japonica* in partly filtered light, leg. A. SCHÄFER-VERWIMP 39332, with KUEI-YU YAO, JAMES R. SHEVOCK & GERHARD WINTER, 1 November 2018 (herbarium SCHÄFER-VERWIMP 39332!, duplicates: CAS, FR, TAIE all as *Lepidozia wallichiana*).

Neolepidozia sarawakensis var. *rajaensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*

Holotype:

[Malaysia]: Fl. borneensis, West Borneo, auf dem Bukit Raja, um 1250 m, leg. HANS WINKLER 3165, 17 December 1924 (JE!, det. TH. HERZOG as *Lepidozia cuneifolia* ?, rev. M. MIZUTANI 1976 as *Lepidozia wallichiana*).

Figures:

Plate 276, Plate 277, Plate 278, Plate 279, Plate 280, Plate 281.

Comparison Plate 4 – L.

Description:

Plants brownish green, medium sized, up to 2 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 5 mm long, occasionally flagelliform at the end. **Flagelliform branches** scattered, up to 10 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 145 µm wide and 120 µm high, cortical cells 12, 24 – 40 × 15 – 27 µm, cell walls thickened, medullary cells up to 25, 18 – 29 × 13 – 20 µm, cell walls moderately thickened, trigones enlarged, dorsal cortical cells elongated polygonal, 29 – 38 × 56 – 82 µm, 1.6 – 2.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** distant, obliquely inserted, spreading at an angle of 50° – 60°, leaves rectangular, asymmetric, lobes bent down ventrally, 270 – 360 µm wide, 340 – 390 µm long, 0.9 – 1.3 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 8 – 9 cells wide, 2.5 – 5.5 cells long, 180 – 220 µm wide, 150 – 220 µm long, 0.7 – 1.2 as long as wide, median cells elongated polygonal, 25 – 32 × 39 – 52 µm, 1.3 – 2.1 as long as wide, cell walls thin, trigones small, cuticle smooth, basal cells elongated polygonal, 29 – 39 × 46 – 65 µm, 1.3 – 1.8 as long as wide, leaf lobes 4, divergent, 3.5 – 4.5 cells long, falcate, 2 (-3) cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 cells long, cells elongated polygonal,

not constricted at the transversal walls, 19 – 26 × 33 – 58 µm, 1.3 – 3.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1 – 1.1 times as wide as the stem, underleaves square to transversely rectangular, 160 – 165 µm wide, 145 – 170 µm long, 0.9 – 1.1 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 8 cells wide, 2.5 – 3.5 cells long, 120 – 165 µm wide, 90 – 120 µm long, 0.7 – 0.9 as long as wide, median cells isodiametric polygonal, 17 – 28 × 23 – 35 µm, 1 – 1.5 as long as wide, cell walls thin, trigones small, cuticle smooth, basal cells elongated polygonal, 18 – 26 × 39 – 50 µm, 1.6 – 2.3 as long as wide, leaf lobes 0, upright to weakly divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 2 cells long, cells 18 – 24 × 23 – 30 µm, 1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 50° – 60°, leaves rectangular to trapezoid, symmetric, flat, 180 – 240 µm wide, 350 – 460 µm long, 1.7 – 2 as long as wide, divided by 0.4 – 0.5 of the leaf length, divided by 0.4 on the ventral side, margin entire, disc 6 – 7 cells wide, 3.5 – 4.5 cells long, 140 – 200 µm wide, 190 – 290 µm long, 1.2 – 1.7 as long as wide, median cells isodiametric to elongated polygonal, 26 – 40 × 38 – 61 µm, 1.1 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 28 – 37 × 46 – 67 µm, 1.5 – 1.8 as long as wide, leaf lobes 3, divergent to upright, 3.5 – 4.5 cells long, 2 – 4 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 3 cells long, cells elongated polygonal, not constricted at the transversal walls, cells 21 – 27 × 34 – 52 µm, 1.6 – 2.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch underleaves** distant, transversely attached, spreading away from the stem, 1 – 1.3 times as wide as the branch, underleaves square to rectangular, 90 – 110 µm wide, 120 – 170 µm long, 1.1 – 1.7 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 4 – 6 cells wide, 1.5 – 2.5 cells long, 85 – 110 µm wide, 70 – 115 µm long, 0.7 – 1.3 as long as wide, median cells isodiametric polygonal, 18 – 26 × 19 – 30 µm, 1 – 1.2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 18 – 32 × 30 – 59 µm, 1.4 – 2.5 as long as wide, leaf lobes 2 – 3, upright, 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 cells long, cells 17 – 23 × 20 – 29 µm, 1.1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. *sarawakensis* var. *rajaensis* is characterised by (1) the comparatively narrow branch leaves, which are up to twice as long as wide and reach a length of more than 400 µm, (2) the elongated disc cells of the branch leaves, which have occasional secondary divisions and are almost 60 µm long, (3) the bases of the branch leaf lobes, which are up to four cells wide, and (4) the falcate lobes of the stem leaves.

Similar species:

The main difference between *N. sarawakensis* var. *rajaensis* and *N. sarawakensis* is that the former has a broad branch leaf disc base up to four cells wide, whereas the latter has a base up to two cells wide. It has less falcate stem leaf lobes and more divergent branch leaf lobes. Furthermore, it has smaller and more numerous medullary cells.

N. larutensis, a species with long, narrow branch leaves, has larger branch underleaves that overlap each other, branch leaves which are imbricately arranged, and a stronger papillose cuticle.

Some forms of *N. papulosa* might resemble *N. sarawakensis* var. *rajaensis*. However, they have branch leaf lobes that are rarely more than two cells wide, and stem leaves with straight instead of falcate lobes. They also have a stronger papillose cuticle.

Distribution:

Malaysia (Borneo). Only known from the type collection.

Specimen studied:

[Malaysia]: W - Borneo, auf dem Bukit Raja, um 1250 m, leg. HANS WINKLER 3165a, 1924 (JE!, det. TH. HERZOG as *Lepidozia cuneifolia*). Separate specimen with permanent slide of WINKLER 3165 are renamed to WINKLER 3165a.

Etymology:

The species is named after the Bukit Raja where the species was discovered.

Neolepidozia schaefer-verwimpii U. SCHWARZ & SHEVOCK *spec. nov.*

Holotype:

Taiwan: County Taipei, New Taipei City, Manyueyuan National Forest Recreation area, mixed hardwood coniferous forest, 24° 49' 24" N, 121° 26' 54" E, 525 m, at base of coniferous tree along "self-guided trail" in filtered light, leg. A. SCHÄFER-VERWIMP TP-35 (37449), with YU-CHWEN HSU & GERHARD WINTER, 11. Oktober 2016 (herbarium SCHÄFER-VERWIMP 37449!, duplicate: TAIM).

Figures:

Plate 282, Plate 283, Plate 284, Plate 285, Plate 286 (from SCHÄFER-VERWIMP 37449).

Plate 287, Plate 288, Plate 289, Plate 290, Plate 291, Plate 292 (from TOUW No. 10868).

Comparison Plate 3 – M, Comparison Plate 5 – E.

The drawings of HATTORI & MIZUTANI (1958, Fig III, 1 – 15) very likely depict *N. schaefer-verwimpii*. Studies of the respective material is required to prove its identity.

Description:

Plants pale yellowish green, small, up to 1 cm long, stem with leaves up to 0.7 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 2 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 175 µm wide and 110 µm high, cortical cells 12, 24 – 40 × 16 – 33 µm, cell walls moderately thickened, medullary cells up to 35, 11 – 18 × 10 – 18 µm, cell walls moderately thickened, trigones small, dorsal cortical cells isodiametric to elongated polygonal, 34 – 41 × 34 – 59 µm, 0.9 – 1.7 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** approximate, longitudinally inserted, spreading at an angle of 60° – 90°, leaves square to trapezoid, weakly asymmetric, flat, 230 – 320 µm wide, 240 – 330 µm long, 1 – 1.3 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 4.5 cells long, 190 – 270 µm wide, 120 – 190 µm long, 0.5 – 1 as long as wide, median cells isodiametric polygonal, 30 – 40 × 29 – 44 µm, 0.9 – 1.2 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 29 – 44 × 39 – 56 µm, 1.2 – 1.9 as long as wide, leaf lobes 4, upright to weakly divergent, 2.5 – 4.5 cells long, straight, 2 – 4 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 20 – 26 × 30 – 42 µm, 1.3 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1.1 – 1.3 times as wide as the stem, underleaves transversely rectangular to trapezoid, 165 – 180 µm wide, 125 – 140 µm long, 0.8 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 8 cells wide, 1.5 – 2.5 cells long, 110 – 150 µm wide, 65 – 90 µm long, 0.5 – 0.8 as long as wide, median cells square to isodiametric polygonal, 19 – 25 × 19 – 27 µm, 0.9 – 1.3 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 18 – 20 × 27 – 36 µm, 1.4 – 1.9 as long as wide, leaf lobes 4, upright to weakly divergent, 2.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 cells long, cells 14 – 19 × 25 – 28 µm, 1.4 – 1.9 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 50° – 80°, leaves ovate, symmetric, flat, 180 – 200 µm wide, 255 – 310 µm long, 1.3 – 1.6 as long as wide, divided by 0.3 of the leaf length, margin entire, disc 6 – 9 cells wide, 3.5 – 6.5 cells long, 110 – 200 µm wide, 170 – 220 µm long, 0.9 – 2 as long as wide, median cells isodiametric polygonal, 27 – 36 × 38 – 45 µm, 1.1 – 1.5 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 23 – 43 × 38 – 53 µm, 0.9 – 2 as long as wide, leaf lobes 3, upright to weakly divergent, 2.5 – 3.5 cells long, 2 – 4 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 3 cells long, cells isodiametric to elongated polygonal, not constricted at the transversal walls, cells 21 – 34 × 28 – 40 µm, 1 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch underleaves** approximate, transversely attached, spreading away from the stem, 1.1 – 1.2 times as wide as the branch, underleaves square to trapezoid, 85 – 110 µm wide, 80 – 120 µm long, 0.8 – 1.3 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 cells wide, 1.5 cells long, 60 – 100 µm wide, 50 – 70 µm long, 0.6 – 1 as long as wide, basal cells elongated polygonal, 22 – 26 × 25 – 37 µm, 1.1 – 1.7 as long as wide, leaf lobes 3, upright to weakly divergent, 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 cells long, cells 15 – 23 × 25 – 33 µm, 1.1 – 1.9 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth.

Distinguishing characters:

N. schaefer-verwimpii is characterised by (1) symmetric, ovate branch leaves, (2) the mostly short, isodiametric cells, (3) the branch leaf lobes that are often more than 2 cells wide at the base, and (4) the frequently occurring secondary cell divisions of the branch leaf disc, resulting in an overall width of up to 9 cells.

Although most branch leaves of *N. schaefer-verwimpii* are symmetrical, some weakly asymmetric leaves are usually present. If they are produced in greater quantities, they alter the appearance of the plants.

Similar species:

Similar branch leaves can be found in *N. lungaensis*. However, this species has obliquely inserted leaves, frequent ventral-intercalary branches that develop into new stems, and longer branch leaf lobes.

There is also some resemblance to *N. papulosa* var. *sakurai*. This form, however, has longer branch leaf lobes and usually no secondary cell divisions.

Plants have often been identified as *N. wallichiana*, which has much longer cells of the branch leaf disc.

Distribution:

Japan (Okinawa Island), Taiwan, Thailand.

Specimens studied:

Japan: Ryukyu Islands, Okinawa Island, Okinawa-ken, Kunigami-gun, Kunigami-son, Mt. Iyu, 400 m, on moist rotten log by stream in evergreen broad-leaved forest, leg. T. YAMAGUCHI, 22 June 1992, Bryophytes of Asia 93. Fasc. 4 (1997), (JE!, det. T. YAMAGUCHI as *Lepidozia wallichiana*). Distributed by Herbarium of Hiroshima University (HIRO).

Japan: Ryukyu, Okinawa Island, SE area of Mt. Tamachiji (Okinawa-ken, Kunigami-gun, Higashi-son), 26.66317° N, 128.1747° E, 230 m alt., on trunk of tree fern, leg. T. YAMAGUCHI, K. NISHIHATA & T. IKEMATSU in hb. T. YAMAGUCHI 40655 (Herb. SCHÄFER-VERWIMP, det. T. YAMAGUCHI as *Neolepidozia planifolia*). Bryophytes of Asia 773, Fasc. 31, ed. by T. YAMAGUCHI. Distributed by the Herbarium of Hiroshima University (HIRO).

Taiwan: Nantou County, Chitou [Xitou], 1200 m, on trunk base of *Cryptomeria japonica*, leg. KOHSAKU YAMADA 14040, 26 - 28 July 1979 (JE! ex hb. K. YAMADA, det. K. YAMADA 1980 as *Lepidozia wallichiana*).

Thailand: Udawn, sandstone massive Phu (Mt.) Krading. Forest along streamlet near Forest Station, 16° 50' N, 101° 45' E, 1200 m, on rocks in streambed, leg. A. TOUW No. 10868, 14 January 1966 (Rijksherbarium Leiden, L.4601353!).

Etymology:

The species is named after the German bryologist A. SCHÄFER-VERWIMP, who contributed tremendously to the bryological research of East and South East Asia.

Remark:

N. schaefer-verwimpii seems to have a northern distribution. So far, it has not been found in the tropical regions of South East Asia. It is also very likely that specimens of *N. wallichiana* reported from Japan actually belong to *N. schaefer-verwimpii*.

ENGEL & MERRILL (2004) assigned certain *Neolepidozia* material from Japan and Taiwan to *Telaranea planifolia*, based on its lectotype (FAURIE 654, G) from Japan. As the scanned image of the type of *Lepidozia planifolia* in G (G00069689) also shows bilobate branch leaves that correspond to STEPHANI (1985) Icones no. 5259 and his initial description in STEPHANI (1906-1909) we do not consider *L. planifolia* to be conspecific with *N. schaefer-verwimpii*. Since the type of *L. planifolia* was not available for loan, this topic has to be clarified at a later point of time.

Neolepidozia schusteri U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Papua New Guinea: New Guinea, Wau District, summit of Mt. Kaindi, SSW of Wau, wet, mossy forest, leg. R.M. SCHUSTER 67-6268, 26-27 May 1967 (JE!, det. M. MIZUTANI 1976 as *Lepidozia mamillosa*).

Figures:

Plate 293, Plate 294, Plate 295, Plate 296, Plate 297, Plate 298, Plate 299.

Comparison Plate 1 – C.

Description

Plants yellowish green, small, up to 1.5 cm long, stem with leaves up to 0.8 mm wide, leaves fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, not flagelliform at the end. **Flagelliform branches** scattered, up to 6 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 150 µm wide and 115 µm high, cortical cells 12, 27 – 40 × 13 – 26 µm, cell walls moderately thickened, medullary cells up to 45, 11 – 24 × 12 – 21 µm, cell walls moderately thickened, trigones small, dorsal cortical cells rectangular to elongated polygonal, 22 – 31 × 66 – 84 µm, 2.1 – 3.8 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Stem leaves** approximate, longitudinally to obliquely inserted, spreading at an angle of 45° – 80°, leaves square to weakly trapezoid, asymmetric, flat, 290 – 390 µm wide, 310 – 430 µm long, 1 – 1.4 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 8 cells wide, 3.5 – 4.5 cells long, 150 – 250 µm wide, 150 – 240 µm long, 0.7 – 1.2 as long as wide, median cells isodiametric to elongated polygonal, 27 – 38 × 38 – 46 µm, 1 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 28 – 38 × 46 – 61 µm, 1.4 – 1.7 as long as wide, leaf lobes 4, upright to weakly divergent, 4.5 – 5.5 cells long, straight to weakly falcate, 2 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 2 – 4 cells long, cells ovate, constricted at the transversal walls, 21 – 37 × 30 – 50 µm, 1.1 – 1.6 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1.3 – 1.5 times as wide as the stem, underleaves transversely rectangular to trapezoid, 130 – 180 µm wide, 140 – 180 µm long, 0.9 – 1.2 as long as wide, divided by 0.2 – 0.5 of the leaf length, disc 6 – 8 cells wide, 2.5 – 3.5 cells long, 95 – 160 µm wide, 80 – 140 µm long, 0.6 – 1.3 as long as wide, median cells elongated polygonal, 19 – 27 × 24 – 43 µm, 1 – 1.8 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 16 – 28 × 35 – 60 µm, 1.3 – 2.7 as long as wide, leaf lobes 3 – 4, upright, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 15 – 22 × 27 – 42 µm, 1.8 – 2 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 50° – 80°, leaves rectangular, symmetric, flat, 190 – 210 µm wide, 290 – 340 µm long, 1.5 – 1.7 as long as wide, divided by 0.3 – 0.5 of the leaf length, divided by 0.3 – 0.4 on the ventral side, margin entire, disc 6 cells wide, 3.5 – 4.5 cells long, 115 – 175 µm wide, 145 – 210 µm long, 0.9 – 1.7 as long as wide, median cells isodiametric to elongated polygonal, 26 – 36 × 35 – 40 µm, 1.1 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 25 – 32 × 43 – 52 µm, 1.3 – 1.9 as long as wide, leaf lobes 3, upright ot weakly divergent, 4.5 – 5.5 cells long, 2 – 3 (-4) cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 4 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, cells 23 – 29 × 28 – 36 µm, 1.2 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** approximate, transversely attached, upright, 1.1 – 1.2 times as wide as the branch, underleaves rectangular to trapezoid, 80 – 125 µm wide, 120 – 165 µm long, 1.1 – 1.6 as long as wide, divided by 0.3 – 0.4 of the leaf length, disc 4 – 6 cells wide, 1.5 – 2.5 cells long, 55 – 125 µm wide, 70 – 115 µm long, 0.8 – 1.5 as long as wide, median cells square to elongated polygonal, 22 – 28 × 28 – 34 µm, 1 – 1.4 as long as wide, cell walls thickened, trigones small, cuticle almost smooth, basal cells elongated polygonal, 19 – 25 × 32 – 51 µm, 1.3 – 2.2 as long as wide, leaf lobes 2 – 3, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 21 – 27 × 28 – 39 µm, 1.2 – 1.9 as long as wide, cell walls moderately thickened, trigones small, cuticle almost smooth. **Perianth** originating ventrally from the main stem, 3.1 mm long, weakly narrowed towards the mouth, multi – plicate in the upper third. **Perianth mouth** crenulate to short ciliate, mouth cells linear, 10 – 13 × 46 – 60 µm, 3.5 – 5.9 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, median cells rectangular to elongated polygonal, 25 – 38 × 64 – 130 µm, 2 – 5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Female bracts** ovate, margin with a few teeth, 750 µm wide, 1100 µm long, 1.5 as long as wide, median cells elongated polygonal to linear, 26 – 37 × 47 – 97 µm, 1.6 – 3.7 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 34 – 44 × 58 – 84 µm, 1.7 – 2.3 as long as wide, 5.5 – 6.5 cells long, 5 – 6 cells wide at base, multiseriate part 4 – 5 cells long, uniseriate part 2 – 3 cells long, cells elongated polygonal, cells 15 – 21 × 30 – 67 µm, 2 – 4.2 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to ovate papillae.

Distinguishing characters:

N. schusteri is characterised by (1) the fragile leaves, (2) the small, hardly overlapping branch underleaves, (3) the rather regular cell pattern of the branch leaf disc, (4) the constricted transversal cell walls of the leaf lobes, (5) branch leaves that are divided by 1/3 – 1/2 of their leaf length, and (6) the crenulate to short ciliate perianth mouth.

Similar species:

N. arauluensis has much larger branch underleaves, fewer medullary cells within the stem and branch leaves that are more trapezoidal in shape than the rectangular ones found in *N. schusteri*.

There are also similarities to *N. streimannii*, which has branch leaves divided by up to ½ of their leaf length and occasionally has a blunt tooth at the base of the branch leaf lobes. Furthermore, the stem and branch leaves are somehow flexuous and the branch leaf disc is often only 2.5 cells high.

Even though the type specimen was identified as *L. mamillosa*, it is already the habitat collection site that distinguish the two species. *N. mamillosa* is a lowland plant growing in mangrove forests, whereas *N. schusteri* origins from tropical mountain rain forest. Besides the collection site *N. mamillosa* differs in the somehow irregular leaf, the bulging hyalodermis cells of the stem cross section, and the mamillose perianth cells.

Distribution:

Papua New Guinea (New Guinea).

Etymology:

The species is named after the legendary German-American bryologist R.M. SCHUSTER (1921 – 2012), the collector of this species.

Specimen studied:

Papua New Guinea: New Guinea, Morobe Province, Spreader Divide, 12 km NW of Aseki, 7° 16' S, 146° 6' E, 2000 m, *Nothofagus* - Podocarpaceae dominated ridge, on shaded, moist forest floor, leg. H. STREIMANN & E. TAMBA 12005, 21 January 1981 (JE!, det. R. GROLLE 1982 as *Lepidozia wallichiana*, duplicates: CANB, LAE).

Neolepidozia shevockii U. SCHWARZ & SCHÄF.-VERW. *spec. nov.*

Holotype:

Philippines: Mindanao Island, Province Davao del Sur, Along Santa Cruz Trail to Mt. Apo at Rock E-Camp, 6° 58' 33.7" N, 125° 17' 39.5" E, 1890 m, mixed hardwood forest with *Sphaeropteris* tree ferns, on volcanic rock wall in filtered light, leg. JAMES R. SHEVOCK 60200, with LESLEY C. LUBOS, AIMANUELZON YORONG & ROMEO PATANO, 4 August 2022 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, BUKH, CAS, CMUH, MO, PNH).

Figures:

Plate 300, Plate 301, Plate 302, Plate 303, Plate 304, Plate 305, Plate 306.

Comparison Plate 2 – M, Comparison Plate 4 – G.

Description

Plants yellowish green, small, up to 1 cm long, stem with leaves up to 0.6 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 2 mm long, occasionally flagelliform at the end. **Flagelliform branches** scattered, up to 5 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 105 µm wide and 90 µm high, cortical cells 12, 15 – 26 × 13 – 22 µm, cell walls moderately thickened, medullary cells up to 25, 9 – 17 × 9 – 16 µm, cell walls thin to moderately thickened, trigones small, dorsal cortical cells isodiametric to elongated polygonal, 24 – 30 × 35 – 68 µm, 1.3 – 2.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** approximate, longitudinally to obliquely inserted, spreading at an angle of 50° – 70°, leaves rectangular to weakly trapezoid, symmetric to weakly asymmetric, lobes bent down ventrally, 190 – 235 µm wide, 265 – 300 µm long, 1.2 – 1.5 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 8 cells wide, 3.5 – 4.5 cells long, 140 – 190 µm wide, 125 – 160 µm long, 0.7 – 1.1 as long as wide, median cells elongated polygonal, 21 – 26 × 30 – 36 µm, 1.2 – 1.7 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 19 – 26 × 30 – 43 µm, 1.4 – 2.2 as long as wide, leaf lobes 4, upright to weakly divergent, 4.5 – 6.5 cells long, straight to weakly falcate, 2 – 3 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 2 – 3 cells long, cells elongated polygonal, not constricted at the transversal walls, 15 – 20 × 27 – 46 µm, 1.6 – 2.9 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1.2 – 1.4 times as wide as the stem, underleaves square to transversely rectangular, 130 – 170 µm wide, 155 – 190 µm long, 1 – 1.5 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 8 – 10 cells wide, 2.5 – 3.5 cells long, 105 – 145 µm wide, 85 – 120 µm long, 0.6 – 1.1 as long as wide, median cells elongated polygonal, 17 – 21 × 24 – 38 µm, 1.3 – 2.2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 16 – 20 × 32 – 41 µm, 1.9 – 2.1 as long as wide, leaf lobes 4 (-5), upright to hooked, 2.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 – 3 cells long, cells 12 – 15 × 22 – 36 µm, 1.5 – 3 as

long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 45° – 65°, leaves rectangular to trapezoid, symmetric to weakly asymmetric, flat, 150 – 210 µm wide, 265 – 335 µm long, 1.4 – 2.1 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 – 8 cells wide, 3.5 – 6.5 cells long, 100 – 155 µm wide, 135 – 185 µm long, 1 – 1.9 as long as wide, median cells elongated polygonal, 22 – 31 × 30 – 41 µm, 1 – 1.7 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 20 – 25 × 31 – 52 µm, 1.2 – 2.4 as long as wide, leaf lobes 3, upright to weakly falcate, 4.5 – 6.5 cells long, 2 – 4 cells wide at base, multiseriate part 3 – 4 cells long, uniseriate part 2 – 3 cells long, cells elongated polygonal, not constricted at the transversal walls, cells 12 – 22 × 30 – 41 µm, 1.5 – 2.5 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** distant, transversely attached, upright, 1 – 1.3 times as wide as the branch, underleaves rectangular to trapezoid, 65 – 110 µm wide, 100 – 140 µm long, 0 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 – 6 cells wide, 1.5 – 2.5 cells long, 50 – 90 µm wide, 55 – 70 µm long, 0.6 – 1.4 as long as wide, median cells square to elongated polygonal, 17 – 20 × 20 – 26 µm, 1.1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 14 – 19 × 27 – 30 µm, 1.5 – 2.1 as long as wide, leaf lobes 2 – 3, upright to weakly divergent, 1.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 3 cells long, cells 12 – 17 × 18 – 31 µm, 1.1 – 2.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Male branches** originating ventrally – intercalar from the main stem, straight to weakly falcate, up to 0.6 mm long, with leaves up to 0.25 mm wide. **Male bracts** imbricate, transversely attached, ovate to square, 120 – 160 µm wide, 120 – 150 µm long, 0.9 – 1 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 90 – 135 µm wide, 75 – 80 µm long, median cells elongated polygonal, 12 – 17 × 21 – 25 µm, 1.2 – 2 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, cell walls thin, trigones lacking, cuticle smooth, leaf lobes 2, divergent, 3.5 cells long, 3 – 4 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cell walls thin, trigones lacking, cuticle smooth. **Underleaves** approximate, transversely attached, appressed to the stem, underleaves rectangular to lanceolate, 80 µm wide, 130 µm long, 1.6 as long as wide, divided by 0.6 of the leaf length, disc 4 cells wide, 2.5 cells long, 55 – 80 µm wide, 55 µm long, median cells isodiametric polygonal, 18 – 19 × 20 – 22 µm, 1.1 – 1.2 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 20 – 22 × 23 – 30 µm, 1 – 1.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, leaf lobes 2 – 2, upright to divergent, 2.5 – 3.5 cells long, 3 cells wide at base, multiseriate part 2 cells long, uniseriate part 1 – 2 cells long, cells 18 – 19 × 20 – 22 µm, 1.1 – 1.2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. shevockii is characterised by (1) the rather symmetrical branch leaves that are sometimes divided up to half their length, (2) the slightly elongated cells in the branch leaf disc, (3) the sometimes rather large branch underleaves that almost overlap each other, and (4) a mixture of leaves with very symmetrical branch leaves that have two-cell-wide lobes at the base, and leaves with lobes that are often up to four cells wide. In extreme cases, the margin of the branch leaf bulges outwards near the base of the lobe.

Similar species:

In particular symmetric branch leaves with two-cell-wide lobe bases of *N. shevockii* look very similar to those of *N. papulosa*. However, careful examination always reveals branch leaves with expanded lobe bases.

N. novoguineensis sometimes has a leaf shape similar to that of *N. shevockii*. However, the former has very thin-walled cells and smaller branch underleaves with a disc that is usually 1.5 cells high.

Compared to *N. lembangensis*, *N. shevockii* has a higher branch leaf disc, thicker cell walls and lacks the blunt teeth that are occasionally developed near the lobe base of leaves and underleaves.

Like *N. shevockii*, *N. sarawakensis* var. *rajaensis* has branch leaf lobe bases that are wider than two cells. However, the latter species has larger branch leaves, which can be up to 400 µm long. Its disc cells are thinner and elongated, and its lobe bases do not bulge outwards.

Distribution:

Indonesia (Sulawesi, Sumatra), Malaysia (Malay Peninsula), Philippines (Leyte, Mindanao), Thailand.

Etymology:

The species is named after JAMES R. SHEVOCK (San Francisco, USA) an American bryologist who was the senior collector of this species and is an active researcher of the bryophyte flora of the Philippines.

Specimens studied:

Indonesia: Sulawesi, Sulawesi Tengah, Regenwald oberhalb des Sungai Salo Pebatua im Lore Lindu Nationalpark bei Toro, alt. ca. 1.130 m, WGS84 1° 29' 23" S, 120° 01' 31" O, mit u.a. *Acanthorrhynchium papillatum* (HARV.) M. FLEISCH. und *Bazzania* sp., leg. S. ABRAHAMCZYK, 13 März 2007 (JE – Bryo 7824!).

Indonesia: Sumatra, North Sumatra, Hochland von Brastagi, Südost-Aufstieg von Semangat Gunung zum Gunung Sibayak, 1500 m, dichte Bambus-Vegetation mit einzelnen Bäumen, auf Fels haftend, leg. SCHÄFER-VERWIMP & VERWIMP, 17 May 2005 (herbarium SCHÄFER-VERWIMP 24857!).

Malaysia: State Pahang, Cameron Highlands, Tanah Rata, Parklandschaft im Siedlungsbereich, 1550 m, auf Rohhumus an Waldrand, leg. SCHÄFER-VERWIMP & VERWIMP, 21 May 1997 (herbarium SCHÄFER-VERWIMP 18687!).

Malaysia: State Pahang, Cameron Highlands, Tanah Rata, Sekundärwald im Ortsbereich, 1550 m, an morschen Stamm, leg. SCHÄFER-VERWIMP & VERWIMP 18690, 21. May 1997 (herbarium SCHÄFER-VERWIMP 18690a!). The specimen consists of 2 species, *Neolepidozia papulosa* (18690b) and *N. shevockii* (18690a).

Philippines: Leyte Island, Leyte Province, Area around Lake Kasudsuran, Ormoc-City, Barangay Liberty, 11° 1' 32.33" N, 124° 44' 55.86" E, 720 m, auf morschem Holz, leg. FELIX SCHUMM & UWE SCHWARZ, 23 August 2000 (herbarium UWE SCHWARZ 6453a!).

Philippines: Leyte Island, Leyte Province, Area around Lake Kasudsuran, Ormoc-City, Barangay Liberty, 11° 1' 32.33" N, 124° 44' 55.86" E, 720 m, auf morschem Holz, leg. FELIX SCHUMM & UWE SCHWARZ, 23 August 2000 (herbarium UWE SCHWARZ 6453b!).

Philippines: Mindanao Island, Bukidnon Province, Cinchona Forest Reserve, southeastern section of Kitanglad Range, Kaatuan Barangay, Lantapan municipality, along concrete road just below the reserve headquarters of Asean Heritage Park, 8° 3' 30.06" N, 125° 0' 18.69" E, 1230 m, Mixed evergreen hardwood tropical rain forest with planted palms, on Pinius trunk in filtered light, leg. JAMES R. SHEVOCK 62014, with AIMANUELZON P. YORONG, 14 July 2023 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Philippines: Mindanao Island, Bukidnon Province, Mandupao Trail to Lusong Peak from Dahilayan I-P Park & Resort, 8° 11' 33.6" N, 124° 51' 40.4" E, 1410 m, Mixed lower disturbed hardwood tropical rain forest with tree ferns, on hardwood trunc in sun to filtered light, leg. JAMES R. SHEVOCK 63443, with LESLEY C. LUBOS & AIMANUELZON P. YORONG, 5 June 2024 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Philippines: Mindanao Island, Misamis Oriental Province, Mt. Balatukan, Municipality Gingoog City, Sitio San Isidro, Barangay Lunotan, on unimproved trail below Scout Camp, 25 km from Gingoog City, 8° 43' 46.4" N, 125° 0' 22.7" E, 1350 m, mixed evergreen hardwood tropical rain forest, on hardwood snag in filtered light, leg. JAMES R. SHEVOCK 60854, with LESLEY C. LUBOS & GIO V. BALANSAG, 21 January 2023, with a few strands of *Zoopsis liukiuensis* (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, BUKH, CAS, CMUH, E, F, MO, PTBG).

Thailand: Udawn, sandstone massive Phu (Mt.) Krading, along Mae Nam Pong River, dense evergreen forest, 16° 50' N, 101° 45' E, 1150 m, on tree trunks, leg. A. TOUW No. 11037, 15 January 1966 (Rijksherbarium Leiden, L.4601351!, det. N. KITAGAWA as *Lepidozia papulosa*).

Neolepidozia solomonensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Solomon Islands: Santa Ysabel, 280 m, on tree bases, leg. BRAITHWAITE 4567, 1965 (JE! - holotype, det. R. GROLLE 1973 as *Lepidozia cuneifolia*, conf. M. MIZUTANI 1976 as *Lepidozia cuneifolia*, duplicate. in Hb. Eger).

Figures:

Plate 307, Plate 308, Plate 309, Plate 310, Plate 311, Plate 312.

Comparison Plate 3 – F.

Description

Plants yellowish brown, large, up to 4 cm long, stem with leaves up to 0.9 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 5 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 15 mm long. **Rhizoids** not seen. **Stem** in cross section 230 µm wide and 200 µm high, cortical cells 13, 32 – 58 × 18 –

31 µm, cell walls thickened, medullary cells up to 70, 14 – 28 × 8 – 19 µm, cell walls moderately thickened, trigones moderately enlarged, dorsal cortical cells square to elongated polygonal, 45 – 67 × 34 – 56 µm, 0.6 – 1.2 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Stem leaves** approximate, obliquely inserted, spreading at an angle of 50° – 70°, leaves square to weakly trapezoid, symmetric to weakly asymmetric, flat, 400 – 480 µm wide, 420 – 440 µm long, 0.9 – 1.1 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 8 – 9 cells wide, 2.5 – 4.5 cells long, 210 – 300 µm wide, 180 – 260 µm long, 0.6 – 1.1 as long as wide, median cells hexagonal to elongated polygonal, 27 – 36 × 30 – 48 µm, 0.8 – 1.5 as long as wide, cell walls thickened, trigones enlarged, cuticle with striate papillae, basal cells elongated polygonal, 25 – 37 × 38 – 53 µm, 1.2 – 1.7 as long as wide, leaf lobes 4, upright to divergent, 4.5 – 5.5 cells long, straight to weakly falcate, 2 – 3 cells wide at base, multiseriate part 2 cells long, uniseriate part 3 – 5 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 18 – 25 × 40 – 52 µm, 1.7 – 2.5 as long as wide, cell walls thickened, trigones enlarged, cuticle with round to ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, recurved, 0.9 – 1.5 times as wide as the stem, underleaves transversely rectangular, 260 – 330 µm wide, 200 – 240 µm long, 0.6 – 0.9 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 8 cells wide, 2.5 – 3.5 cells long, 220 – 290 µm wide, 130 – 170 µm long, 0.5 – 0.8 as long as wide, median cells round to elongated ovate, 28 – 34 × 35 – 47 µm, 1.2 – 1.4 as long as wide, cell walls thickened, trigones enlarged, cuticle almost smooth, basal cells elongated ovate, 22 – 35 × 44 – 60 µm, 1.7 – 2.1 as long as wide, leaf lobes 4, upright to weakly divergent, 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 cells long, cells 21 – 25 × 32 – 42 µm, 1.5 – 1.9 as long as wide, cell walls thickened, trigones enlarged, cuticle almost smooth. **Branch leaves** approximate to imbricate, longitudinally inserted, spreading at an angle of 60° – 80°, leaves trapezoid, asymmetric, flat, 320 – 420 µm wide, 480 – 600 µm long, 1.4 – 1.6 as long as wide, divided by 0.4 – 0.6 of the leaf length, divided by 0.4 – 0.5 on the ventral side, margin entire, disc 6 – 8 cells wide, 4.5 – 7.5 cells long, 140 – 260 µm wide, 200 – 330 µm long, 0.8 – 2.3 as long as wide, median cells elongated polygonal, partially with secondary divisions, 31 – 40 × 35 – 57 µm, 1.1 – 1.5 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 24 – 41 × 52 – 65 µm, 1.3 – 2.2 as long as wide, leaf lobes 3, upright, divergent to weakly falcate, 4.5 – 6.5 cells long, 2 – 4 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 2 – 4 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, cells 19 – 30 × 38 – 53 µm, 1.7 – 2.4 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** imbricate, overlapping 0.4 – 0.5 of the underleaf length, transversely attached, upright, 1.8 – 2.4 times as wide as the branch, underleaves ovate to trapezoid, 170 – 250 µm wide, 230 – 310 µm long, 1.1 – 1.6 as long as wide, divided by 0.4 – 0.6 of the leaf length, disc 4 – 6 cells wide, 1.5 – 3.5 cells long, 90 – 230 µm wide, 110 – 140 µm long, 0.5 – 1.4 as long as wide, median cells rectangular to elongated polygonal, 30 – 35 × 34 – 46 µm, 1.1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 25 – 31 × 40 – 58 µm, 1.6 – 1.9 as long as wide, leaf lobes 2 – 3, upright to weakly divergent, 2.5 – 4.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cells 18 – 34 × 46 – 70 µm, 1.6 – 2.6 as long as wide, cell walls moderately thickened, trigones small, cuticle with round papillae.

Distinguishing characters:

The species is characterised by (1) its large size, (2) its subulate branch leaf lobes, with lobe cells that are often constricted in the middle, (3) its broad branch underleaves, which are up to 2.5 times wider than the stem, and (4) its branch leaf lobe cells, which are often more than twice as long as wide.

Similar species:

This species resembles *N. variifolia* var. *kairuruensis* and *N. palawanensis* which are smaller and have shorter disc cells. Furthermore, the branch leaf lobe cells of these species are not constricted in the middle.

N. augustana is another species with large, asymmetric branch leaves. It has, however smaller branch underleaves that do not overlap each other.

All other species with asymmetric branch leaves are either smaller, have smaller branch leaves or asymmetric stem leaves.

Distribution:

Solomon Islands (Santa Isabel Island). Only known from the type collection.

Etymology:

The species is named after the Solomon Islands where the species was discovered.

Neolepidozia streimannii U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Papua New Guinea: New Guinea, Morobe Province, Araulu Logging Area, 26 km SE of Wau, 7° 28' S, 146° 48' E, 1900 m, *Podocarpus*, *Phyllocladus* and Fagaceae dominated ridge forest, on humus rich ground, leg. H. STREIMANN 13547, 29 January 1981 (JE!, det. R. GROLLE 1982 as *Lepidozia wallichiana*, duplicates: CANB, LAE, NICH).

Figures:

Plate 313, Plate 314, Plate 315, Plate 316, Plate 317.

Comparison Plate 1 – A, Comparison Plate 4 – D.

Description

Plants yellowish green, small, up to 1.5 cm long, stem with leaves up to 0.7 mm wide, leaves fragile. **Branching** 1-pinnate, of *Frullania*-type, or irregular. **Branches** up to 3 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 2 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 115 µm wide and 110 µm high, cortical cells 9, 25 – 40 × 16 – 31 µm, cell walls thickened, medullary cells up to 25, 11 – 16 × 10 – 17 µm, cell walls thickened, trigones moderately enlarged, dorsal cortical cells elongated polygonal, 27 – 36 × 51 – 61 µm, 1.5 – 2 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Stem leaves** approximate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves square, ovate to trapezoid, symmetric to weakly asymmetric, flat, 200 – 370 µm wide, 280 – 330 µm long, 0.9 – 1.6 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 3.5 – 4.5 cells long, 160 – 240 µm wide, 110 – 180 µm long, 0.6 – 1.1 as long as wide, median cells isodiametric polygonal, 25 – 35 × 26 – 40 µm, 1 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate to striate papillae, basal cells elongated polygonal, 24 – 34 × 39 – 51 µm, 1.4 – 1.9 as long as wide, leaf lobes 4, upright to weakly divergent, 4.5 – 6.5 cells long, straight to weakly falcate, 2 – 3 (-4) cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 3 – 4 cells long, cells ovate, constricted at the transversal walls, 23 – 32 × 30 – 41 µm, 1.1 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with round papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed to the stem, 1.5 – 1.7 times as wide as the stem, underleaves transversely rectangular to trapezoid, 140 – 180 µm wide, 125 – 145 µm long, 0.7 – 1 as long as wide, divided by 0.3 – 0.7 of the leaf length, disc 6 – 8 cells wide, 1.5 – 3.5 cells long, 90 – 150 µm wide, 50 – 95 µm long, 0.3 – 0.9 as long as wide, median cells isodiametric to elongated polygonal, 17 – 20 × 22 – 32 µm, 1.1 – 1.8 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal, 15 – 27 × 22 – 30 µm, 1.1 – 1.9 as long as wide, leaf lobes 3 – 4, upright to weakly divergent, 2.5 – 4.5 cells long, 2 cells wide at base, multiseriate part 1 (-2) cells long, uniseriate part 2 – 4 cells long, cells 14 – 19 × 24 – 36 µm, 1.3 – 2.3 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Branch leaves** approximate to imbricate, longitudinally inserted, spreading at an angle of 50° – 80°, leaves ovate, rectangular to trapezoid, symmetric, flat, 190 – 220 µm wide, 265 – 280 µm long, 1.2 – 1.4 as long as wide, divided by 0.4 – 0.6 of the leaf length, divided by 0.4 – 0.5 on the ventral side, margin entire or with a blunt tooth at the lobe base, disc 6 – 7 cells wide, 3.5 – 4.5 cells long, 110 – 190 µm wide, 110 – 155 µm long, 0.7 – 1.3 as long as wide, median cells isodiametric polygonal, 25 – 34 × 26 – 33 µm, 0.9 – 1.2 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells elongated polygonal, 22 – 29 × 36 – 40 µm, 1.4 – 1.7 as long as wide, leaf lobes 3, upright to divergent, 4.5 – 6.5 cells long, 2 – 4 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 2 – 4 cells long, cells ovate, constricted at the transversal walls, cells 17 – 31 × 19 – 41 µm, 1 – 1.5 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** distant, transversely attached, appressed to the stem, 1.2 – 1.4 times as wide as the branch, underleaves transversely rectangular to rectangular, 75 – 125 µm wide, 100 – 140 µm long, 1 – 1.6 as long as wide, divided by 0.3 – 0.6 of the leaf length, disc 4 – 6 cells wide, 1.5 – 2.5 cells long, 55 – 105 µm wide, 55 – 80 µm long, 0.6 – 1.2 as long as wide, median cells isodiametric polygonal, 16 – 23 × 15 – 29 µm, 0.9 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 12 – 21 × 20 – 32 µm, 1.3 – 1.7 as long as wide, leaf lobes 2 – 3, upright, 1.5 – 4.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 4 cells long, cells 14 – 19 × 23 – 32 µm, 1.2 – 2.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. streimannii is characterised by (1) the fragile leaves, (2) the ovate cells of the branch leaf lobes that are transversally constricted, (3) occasional occurrence of a blunt tooth at the base of the branch leaf lobe, (4) rather coarse papillose leaf cells, (5) the remotely attached, small branch underleaves, and the branch leaves that are divided up to 1/2 of their length.

Similar species:

There are similarities to *N. arauluensis*, which has larger branch underleaves that overlap up to 1/2 of their length, larger branch leaves with a shorter multiseriate part of its lobes, and longer basal cells of the branch underleaves.

N. schusteri has a branch disc that is more rectangular than trapezoid, with entire leaf margins and no blunt tooth at the base of the lobes. Its branch leaves are divided by up to 0.4 of their length and have a less flexuous appearance.

N. novoguineensis has similarly short branch leaf disc cells and less constricted transverse cell walls in the branch leaf lobes, which do not have a blunt tooth at the lateral base.

N. mamillosa has an irregular cell pattern and imbricately attached branch leaves, and a stem hyalodermis with bulging cells.

Distribution:

Papua New Guinea (New Guinea).

Etymology:

The species is named after the Estonian – Australian bryologist HEINAR STREIMANN (1938 – 2001), the collector of this species.

Specimen studied:

Papua New Guinea: New Guinea, Wau District, summit of Mt. Kaindi, SSW of Wau, wet, mossy forest, leg. R.M. SCHUSTER 67-6167b (!JE, det. M. MIZUTANI 1976 as *Lepidozia mamillosa*, remark by R. GROLLE 1984 "probabely f. of *L. wallichiana* with vegetative reproduction").

Neolepidozia tangkulanensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Philippines: Mindanao Island, Bukidnon Province, Quezon, Barangay Luminato, Sitio Sto. Domingo, Mount Pinamantawan, Tangkulan Range, 7° 45' 56.1" N, 125° 13' 43.6" E, 1673 m, Slope trail, mossy forest, just 25 meters to summit of Mt. Pinamantawan, with ferns and tree ferns as dominant understory plant, on fallen hardwood branch, in filtered light, leg. AIMANUELZON P. YORONG 931c, 29 August 2022 (herbarium SCHÄFER-VERWIMP!, duplicate: CAS). This specimen is a mix of the following 3 species: YORONG 931a (holotype of *Neolepidozia yorongii*, YORONG 931b (holotype of *Neolepidozia philippinensis*), and YORONG 931c (holotype of *Neolepidozia tangkulanensis*).

Figures:

Plate 319, Plate 320, Plate 321, Plate 322, Plate 323, Plate 324.

Comparison Plate 5 – G.

Description

Plants pale yellowish green, small, up to 1.5 cm long, stem with leaves up to 0.5 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 4 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 3 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 120 µm wide and 100 µm high, cortical cells 10, 23 – 37 × 17 – 28 µm, cell walls moderately thickened, medullary cells up to 20, 15 – 22 × 15 – 18 µm, cell walls thickened, trigones small, dorsal cortical cells rectangular to elongated polygonal, 23 – 31 × 59 – 85 µm, 1.9 – 3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** distant, longitudinally inserted, spreading at an angle of 50° – 70°, leaves square to trapezoid, symmetric to weakly asymmetric, flat, 180 – 195 µm wide, 190 – 220 µm long, 1 – 1.2 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 – 8 cells wide, 2.5 – 4.5 cells long, 140 – 190 µm wide, 95 – 130 µm long, 0.5 – 0.9 as long as wide, median cells isodiametric polygonal, 24 – 30 × 25 – 38 µm, 1 – 1.5 as long as wide, cell walls thin, trigones lacking, cuticle with striate papillae, basal cells elongated polygonal, 23 – 39 × 25 – 36 µm, 0.9 – 1.3 as long as wide, leaf lobes 3 – 4, upright to weakly divergent, 3.5 – 4.5 cells long, straight to weakly falcate, 2 – 3 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 3 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, 15 – 21 × 18 – 29 µm, 1.1 – 1.6 as long as wide, cell walls thin, trigones small, cuticle with round papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed to the stem, 0.9 – 1.1 times as wide as the stem, underleaves square to transversely rectangular, 125 – 160 µm wide, 135 –

150 µm long, 0.9 – 1.1 as long as wide, divided by 0.1 – 0.3 of the leaf length, disc 6 – 8 cells wide, 1.5 – 3.5 cells long, 115 – 150 µm wide, 100 – 130 µm long, 0.7 – 0.9 as long as wide, median cells isodiametric to elongated polygonal, 19 – 22 × 26 – 39 µm, 1.2 – 2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 18 – 28 × 31 – 42 µm, 1.1 – 1.9 as long as wide, leaf lobes 3 – 4, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 15 – 19 × 16 – 29 µm, 0.9 – 1.7 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch leaves** approximate to imbricate, longitudinally inserted, spreading at an angle of 50° – 80°, leaves rectangular, symmetric, flat, 140 – 170 µm wide, 255 – 310 µm long, 1.5 – 2 as long as wide, divided by 0.3 – 0.4 of the leaf length, margin entire, disc 6 cells wide, 3.5 – 5.5 cells long, 120 – 170 µm wide, 155 – 200 µm long, 1 – 1.5 as long as wide, median cells isodiametric to elongated polygonal, 27 – 32 × 30 – 39 µm, 1.1 – 1.3 as long as wide, cell walls thin, trigones lacking, cuticle with striate papillae, 25 – 36 × 34 – 46 µm, 1 – 1.6 as long as wide, leaf lobes 3, upright or bent inwards, 3.5 – 5.5 cells long, 2 – 3 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 3 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, cells 15 – 26 × 21 – 36 µm, 1.1 – 1.7 as long as wide, cell walls thin, trigones lacking, cuticle with ovate papillae. **Branch underleaves** distant, transversely attached, appressed to the stem, 0.9 – 1 times as wide as the branch, underleaves square to rectangular, 75 – 85 µm wide, 80 – 115 µm long, 1 – 1.5 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 4 cells wide, 1.5 – 2.5 cells long, 65 – 75 µm wide, 55 – 85 µm long, 0.7 – 1.2 as long as wide, median cells isodiametric polygonal, 18 – 22 × 22 – 25 µm, 1 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 18 – 25 × 25 – 33 µm, 1.3 – 1.5 as long as wide, leaf lobes 2, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 cells long, cells 16 – 18 × 19 – 25 µm, 1.2 – 1.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Perianth** originating ventrally from the main stem, slightly narrowed towards the mouth, multi – plicate in the upper third. **Perianth mouth** crenulate, mouth cells linear, 8 – 10 × 24 – 42 µm, 2.7 – 5.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, median cells elongated polygonal, 19 – 25 × 42 – 81 µm, 2 – 3.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Female bracts** ovate, margin with a few teeth, 500 – 590 µm wide, 950 – 960 µm long, 1.6 – 1.9 as long as wide, median cells elongated polygonal to linear, 22 – 37 × 36 – 134 µm, 1.3 – 6.1 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 33 – 48 × 43 – 97 µm, 1.1 – 2.4 as long as wide, leaf lobes 3 – 4, 4.5 – 5.5 cells long, 3 – 5 cells wide at base, multiseriate part 4 – 5 cells long, uniseriate part 1 cells long, cells ovate to elongated polygonal, cells 8 – 12 × 24 – 40 µm, 2.4 – 5 as long as wide, cell walls moderately thickened, trigones small, cuticle small.

Distinguishing characters:

N. tangkulanense is characterised by (1) the crenulate perianth mouth, (2) the rather short cells of the branch leaf disc, (3) the leaf lobes without constricted transverse cell walls, and (4) the uniseriate part of the branch leaf lobes that are only up 1 – 2 cells long.

Similar species:

N. tangkulanense is related to *N. papulosa*, which has a ciliate perianth mouth. Sterile material is more difficult to distinguish. The branch leaf lobes in *N. papulosa* have a longer uniseriate part and the basal cells of the branch leaves are often markedly enlarged, compared to the median disc cells.

N. schusteri, another species with crenulate perianth mouth has fragile leaves and markedly constricted cells of the branch leaf lobes.

Distribution:

Philippines (Mindanao). Only known from the type collection.

Etymology:

The species is named after Tangkulan Range where the species was discovered.

Neolepidozia tenera (STEPH.) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*

Basionym:

Lepidozia tenera STEPH. Species Hepaticarum 3: 608. 1909.

Type:

Java. (G000113393).

Figures:

STEPHANI (1985) Icones no. 5278 (Java) and 5277 (New Caledonia).

Plate 325; Plate 326, Plate 327, Plate 328, Plate 329 (from SCHWARZ 4735).

Comparison Plate 5 – M.

Description (based on SCHWARZ 4735):

Plants pale yellowish green, medium sized, up to 2 cm long, stem with leaves up to 0.7 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 4 mm long, occasionally flagelliform at the end. **Flagelliform branches** scattered, up to 6 mm long. **Rhizoids** not seen. **Stem** in cross section 200 µm wide and 150 µm high, cortical cells 12, 32 – 49 × 19 – 32 µm, cell walls moderately thickened, medullary cells up to 60, 12 – 23 × 14 – 21 µm, cell walls moderately thickened, trigones moderately enlarged, dorsal cortical cells square to elongated polygonal, 28 – 58 × 34 – 61 µm, 0.6 – 1.7 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** imbricate, obliquely inserted, spreading at an angle of 50° – 70°, leaves square to trapezoid, symmetric to weakly asymmetric, lobes bent down ventrally, 250 – 340 µm wide, 370 – 420 µm long, 1.1 – 1.5 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 3.5 – 5.5 cells long, 210 – 250 µm wide, 170 – 230 µm long, 0.7 – 1 as long as wide, median cells isodiametric to elongated polygonal, 32 – 43 × 34 – 51 µm, 1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle almost smooth, basal cells elongated polygonal, 37 – 45 × 43 – 71 µm, 1.1 – 1.8 as long as wide, leaf lobes 4, upright to weakly divergent, 4.5 – 5.5 cells long, straight, 2 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 -4 cells long, cells elongated polygonal, not constricted at the transversal walls, 19 – 29 × 35 – 43 µm, 1.3 – 2 as long as wide, cell walls moderately thickened, trigones small, cuticle with round papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 1.2 – 1.3 times as wide as the stem, underleaves square to transversely rectangular, 240 – 270 µm wide, 230 – 260 µm long, 0.9 – 1.1 as long as wide, divided by 0.2 – 0.3 of the leaf length, disc 8 cells wide, 3.5 – 4.5 cells long, 210 – 250 µm wide, 150 – 200 µm long, 0.6 – 0.8 as long as wide, median cells isodiametric polygonal, 29 – 37 × 36 – 43 µm, 1 – 1.5 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal, 25 – 39 × 49 – 60 µm, 1.4 – 2.1 as long as wide, leaf lobes 4, upright to weakly divergent, 1.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cells 21 – 28 × 32 – 37 µm, 1.3 – 1.5 as long as wide, cell walls moderately thickened, trigones lacking, cuticle smooth. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves rectangular, symmetric, lobes bent down ventrally, 180 – 190 µm wide, 330 – 360 µm long, 1.8 – 2 as long as wide, divided by 0.4 of the leaf length, margin entire, disc 6 cells wide, 3.5 – 6.5 cells long, 160 – 180 µm wide, 190 – 230 µm long, 1.1 – 1.4 as long as wide, median cells isodiametric polygonal, 31 – 42 × 32 – 49 µm, 1 – 1.2 as long as wide, cell walls moderately thickened, trigones small, cuticle almost smooth, basal cells elongated polygonal, 30 – 38 × 39 – 61 µm, 1.3 – 1.7 as long as wide, leaf lobes 3, upright, 4.5 cells long, 2 cells wide at base, multiseriate part 2 cells long, uniseriate part 3 cells long, cells elongated polygonal, not constricted at the transversal walls, cells 20 – 28 × 32 – 41 µm, 1.3 – 1.9 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae. **Branch underleaves** approximate, transversely attached, spreading away from the stem, 1 – 1.2 times as wide as the branch, underleaves rectangular, 105 – 110 µm wide, 170 – 190 µm long, 1.6 – 1.7 as long as wide, divided by 0.3 of the leaf length, disc 4 cells wide, 2.5 – 3.5 cells long, 80 – 110 µm wide, 120 – 135 µm long, 1.2 – 1.5 as long as wide, median cells isodiametric polygonal, 26 – 30 × 31 – 38 µm, 1.1 – 1.4 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 27 – 32 × 40 – 52 µm, 1.3 – 1.9 as long as wide, leaf lobes 2, upright, 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 cells long, cells 21 – 27 × 29 – 34 µm, 1.1 – 1.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. tenera is characterised by (1) forming rather large plants with a very regular branching, (2) branch leaves with its lobes bent ventrally, (3) the high branch leaf disc that is up to 6.5 cells high, and (4) the large stem underleaves with mostly isodiametric cells and a disc that is up to 4.5 cells high.

Similar species:

N. tenera is related to *N. papulosa* and its varieties. The latter however, is smaller, less regularly branched, has smaller stem underleaves with a disc that is only up to 2.5 cells high, branch leaf lobes that are hardly bent ventrally and a branch leaf disc that is only up to 4.5 cells high. In particular *N. papulosa* var. *plumula* has the tendency to develop secondary cell divisions in the branch leaf disc.

N. salasii is also quite large and has regularly arranged branches with hooked leaves. However, the branch leaves are rather concave, with a disc that us usually more than 4.5 cells high. and shorter branch leaf lobes.

Another species with hooked branch leaf lobes is *N. bickeri*. This species, however, is usually smaller, less regularly branched and has much smaller branch underleaves.

N. massartiana to which *N. tenera* was synonymized by KITAGAWA (1973) has to our understanding a lower branch leaf disc and obliquely attached branch leaves without hooked leaf lobes.

Distribution:

Indonesia (Java), Malaysia (Borneo), Philippines (Mindanao).

Specimens studied:

[Malaysia]: Flora Borneenses, West Borneo, Bukit Mulu, 900 m, leg. HANS WINKLER 3067/a_II, 2 December 1924 (JE!, det. TH. HERZOG as *Lepidozia cuneifolia* "transiens in *L. gunnianam* St.", rev. M. MIZUTANI 1967 as *Lepidozia wallichiana*). Specimen renamed to 3067/a_II, since there are 3 specimens labeled WINKLER 3067/a.

[Malaysia]: Borneo, Sarawak, Dulit Ridge, ca. 1230 m, trunk of small tree in moss-forest, leg. P.W. RICHARDS 1969a, 19 September 1932 (JE!, det. TH. HERZOG as *Lepidozia wallichiana*). The specimen consists of 2 forms, *Neolepidozia tenera* (1969a), and *N. dulitensis* (1969b).

Philippines: Mindanao Island, Misamis Oriental Province, Barangay Lunutan, tropical mountain rain forest at Mt. Lumot (Via Haruhay Trial) 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 4192!).

Philippines: Mindanao Island, Misamis Oriental Province, Barangay Lunutan, Mt. Lumot, southwest of Gingoog City, 8° 42' 30.6" N, 125° 1' 14.44" E, on rotten wood, 1670 m, leg. FELIX SCHUMM & UWE SCHWARZ, 24 August 1999 (herbarium UWE SCHWARZ No. 4735!).

Philippines: Mindanao Island, Misamis Oriental Province, Barangay Lunutan, tropical mountain rain forest at Mt. Lumot (Via Haruhay Trial) approaching from the intermediate camp, 8° 40' 42.77" N, 125° 1' 38.92" E, auf Rinde, leg. FELIX SCHUMM & UWE SCHWARZ, 25.08.1999 with *Frullania* spec., *Heteroscyphus coalitus, Neolepidozia ophiria, Riccardia* spec., *Saccogynidium muricellum,* and *Schistochila rubiseta* (herbarium Uwe Schwarz 4820a!).

Philippines: Mindanao Island, Misamis Oriental Province, Barangay Lunutan, tropical mountain rain forest at Mt. Lumot (Via Haruhay Trial) 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 4816!).

Remark:

KITAGAWA (1973) synonymized *L. tenera* with *L. massartiana* indicating that the degree of obliquely inserted leaves and the incurved leaves changes gradually. Even though we agree, we consider the size, stem underleaf characters and the branch leaf disc as distinguishing characters.

ENGEL & MERRILL (2004) put *L. tenera* as a synonym to *Telaranea wallichiana*. The short branch leaf disc cells show that there is no direct relation between the two species.

STEPHANI (1985) depicts on plate 5277 plants from New Caledonia. According to HÜRLIMANN (1985), all plants from New Caledonia identified as *L. tenera* belong to *L. heterotexta*.

Neolepidozia variifolia (STEPH. IN GEHEEB) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *comb. nov.*

Basionym:

Lepidozia variifolia STEPH. IN GEHEEB. *Bibliotheca Botanica* 8. Heft 44: 29. 1898.

Type:

Ill[a]. Blitoeng in Mt[e]. Sagem. leg. *Teysman* No. 11137. ex Herb. Beccari 1886. (G00128053!, det. J.J. ENGEL 2001 as *Telaranea wallichiana*).

Figures:

STEPHANI (1985) Icones no. 5282.

Plate 330, Plate 331, Plate 332, Plate 333, Plate 334, Plate 335.

Comparison Plate 3 – D.

Description

Plants pale yellowish green, small, up to 1 cm long, stem with leaves up to 0.4 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 3 mm long long. **Rhizoids** not seen. **Stem** in cross section 120 µm wide and 120 µm high, cortical cells 12, 23 – 31 × 14 – 22 µm, cell walls thickened, medullary cells up to 45, 10 – 16 × 9 – 13 µm, cell walls moderately thickened, trigones moderately enlarged, dorsal cortical cells square to rectangular, 28 – 34 × 31 – 45 µm, 1.1 – 1.5 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Stem leaves** approximate, obliquely inserted, spreading at an angle of 50° – 70°, leaves trapezoid, asymmetric, flat, 180 – 260 µm wide, 170 – 280 µm long, 0.9 – 1.3 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 3.5 cells long, 150 – 190 µm wide, 70 – 130 µm long, 0.4 – 0.8 as long as wide, median cells square to hexagonal, 22 – 27 × 21 – 29 µm, 1 – 1.2 as long as wide, cell walls moderately thickened, trigones moderately enlarged, cuticle with striate papillae, basal cells elongated polygonal, 19 – 31 × 29 – 40 µm, 1.2 – 1.7 as long as wide, leaf lobes 4, divergent, 3.5 – 4.5 cells long, straight to falcate, 2 cells wide at base, multiseriate part 2 cells long, uniseriate part 2 – 3 cells long, cells square to elongated polygonal, not constricted at the transversal walls, 15 – 22 × 18 – 25 µm, 1.1 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to ovate papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, upright to recurved, 1.3 – 1.5 times as wide as the stem, underleaves transversely rectangular, 165 – 190 µm wide, 110 – 150 µm long, 0.7 – 0.9 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 8 cells wide, 1.5 – 2.5 cells long, 120 – 170 µm wide, 60 – 95 µm long, 0.4 – 0.7 as long as wide, median cells square to hexagonal, 18 – 21 × 19 – 21 µm, 1 – 1.2 as long as wide, cell walls thickened, trigones enlarged, cuticle smooth, basal cells elongated ovate to elongated polygonal, 17 – 21 × 27 – 40 µm, 1.3 – 2.2 as long as wide, leaf lobes 4, upright to weakly divergent, 2.5 cells long, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 cells long, cells 13 – 17 × 14 – 19 µm, 1 – 1.3 as long as wide, cell walls thickened, trigones not enlarged, cuticle smooth. **Branch leaves** approximate to imbricate, longitudinally inserted, spreading at an angle of 50° – 70°, leaves rectangular to trapezoid, asymmetric, flat, 160 – 220 µm wide, 250 – 300 µm long, 1.1 – 1.8 as long as wide, divided by 0.3 – 0.6 of the leaf length, divided by 0.3 – 0.4 on the ventral side, margin entire, disc 6 cells wide, 3.5 – 8.5 cells long, 90 – 160 µm wide, 100 – 195 µm long, 0.7 – 1.8 as long as wide, median cells square, hexagonal to short rectangular, 21 – 27 × 19 – 32 µm, 0.9 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells square, hexagonal to short rectangular, 18 – 27 × 25 – 45 µm, 1.1 – 1.9 as long as wide, leaf lobes 3, upright, divergent to weakly falcate, 4.5 – 7.5 cells long, 2 – 3 cells wide at base, multiseriate part 3 – 5 cells long, uniseriate part 2 – 3 cells long, cells square, hexagonal to short rectangular, not constricted at the transversal walls, cells 12 – 20 × 18 – 26 µm, 1.3 – 1.5 as long as wide, cell walls moderately thickened, trigones small, cuticle with ovate papillae. **Branch underleaves** imbricate, overlapping 0.1 – 0.3 of the underleaf length, transversely attached, upright, 1.8 – 2.3 times as wide as the branch, underleaves trapezoid, 80 – 180 µm wide, 95 – 150 µm long, 0.8 – 1.2 as long as wide, divided by 0.4 – 0.5 of the leaf length, disc 4 – 6 cells wide, 1.5 – 2.5 cells long, 70 – 150 µm wide, 50 – 85 µm long, 0.5 – 1 as long as wide, median cells square, hexagonal to short rectangular, 19 – 21 × 18 – 23 µm, 0.9 – 1.2 as long as wide, cell walls thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 17 – 20 × 21 – 35 µm, 1.2 – 1.8 as long as wide, leaf lobes 2 -3, upright to divergent, 2.5 – 3.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 1 – 3 cells long, cells 15 – 17 × 20 – 29 µm, 1.3 – 1.9 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Male branches** originating ventrally – intercalar from the main stem, straight, 0.7 mm long, with leaves 0.45 mm wide. **Male bracts** imbricate to julaceous, transversely attached, ovate, 280 µm wide, 310 µm long, 1.1 as long as wide, divided by 0.5 – 0.6 of the leaf length, disc 160 – 250 µm wide, 140 – 150 µm long, median cells elongated polygonal, 15 – 22 × 28 – 45 µm, 1.3 – 3 as long as wide, cell walls thin, trigones lacking, cuticle smooth, leaf lobes 4. **Underleaves** imbricate, transversely attached, underleaves square to short rectangular, 130 µm wide, 145 µm long, 1.1 as long as wide, divided by 0.2 – 0.3 of the leaf length, disc 6 cells wide, 2.5 cells long, 80 – 120 µm wide, 100 – 110 µm long, median cells rectangular, 20 – 22 × 27 – 40 µm, 1.2 – 1.9 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells rectangular, leaf lobes 3, 2 cells wide at base.

Distinguishing characters:

The species is characterised by (1) the rather small size, (2) the often asymmetric stem leaves, (3) the broad branch underleaves that are up to two times wider than the stem, (4) the small cell size, and (5) the long multiseriate part of the branch leaf lobes.

There are differences between the material from Malaysia and that from the Philippines. *N. variifolia* from the Philippines usually has smaller branch underleaves, a more rectangular branch leaf disc, and rectangular stem underleaves. However, as *N. variifolia* is quite variable, we do not believe that these differences are sufficient to establish a new taxon.

Similar species:

N. variifolia is closely related to *N. variifolia* var. *kairuruensis*. This variety has longer branch leaves that often exceed 300 µm in length, branch underleaves that are up to three times as wide as the stem and usually overlap each other, rather thin cell walls, and hooked branch leaf lobes.

It also resembles *N. hamiguitanensis*, which has branch leaves that are deeper divided on the ventral side and ordinary branches that turn into flagellae at their end.

N. palawanensis also shares characteristics with *N. variifolia*. However, the former has narrower branch leaf lobes, more symmetrical stem leaves and ovate rather than angular branch leaf disc cells.

N. cuneifolia can easily be distinguished by its small branch leaves that are barely wider than the stem and do not overlap. The cells of *N. cuneifolia* are usually slightly elongated and thin-walled, and are more likely to undergo secondary cell divisions.

The asymmetric leaves of *N. beckeri* also point towards *N. variifolia*. The former has very distinctive branch underleaves that overlap significantly and are divided rather shallowly.

Distribution:

Indonesia (Belitung Island), Malaysia (Malay Peninsula), Philippines (Dinagat Island, Leyte, Mindanao).

Specimens studied:

Malaysia: Malaya, Cameron Highland, Forest Reserve northwest of Brinchang, about 2000 m, on humus in mossy forest, leg. H. INOUE, 14 October 1966, Bryophyta Selecta Exsiccata No. 457 (JE!, det. M. MIZUTANI as *Lepidozia variifolia*).

Malaysia: Perak State, Cameron Highlands, Jungle Walkway Nr. 10, Abstieg vom Mt. Jasar, Bergregenwald, 1500 m, epiphytisch auf übererdetem Ast, leg. OLIVER DÜRHAMMER 111, 16 April 1994 (herbarium SCHÄFER-VERWIMP D-111!).

Malaysia: Perak State, Cameron Highlands, Jungle Walkway Nr. 3, Ericaceae-Bergwald, 1600 m, epiphytisch auf übererdeten Stämmen, leg. OLIVER DÜRHAMMER 77, 12. April 1994 (herbarium SCHÄFER-VERWIMP D-77!).

Malaysia: State Pahang, 2.5 miles on the Genting Highlands road, ridge crest in lower montane to upper montane forest ecotone, 3300 ft., leg. GILLIS EEN 29, 21 April 1972 (JE!, det. R. GROLLE as *Lepidozia wallichiana*).

Malaysia: State Pahang, 2.5 miles on the Genting Highlands road, ridge crest in lower montane to upper montane forest ecotone, 3300 ft., leg. GILLIS EEN 23, 21 April 1972 (JE!, det. R. GROLLE as *Lepidozia wallichiana*).

Malaysia: State Pahang, 2.5 miles on the Genting Highlands road, ridge crest in lower montane to upper montane forest ecotone, 3300 ft., leg. GILLIS EEN 23a, 21 April 1972 (JE!, det. M. MIZUTANI 1976 as *Lepidozia cuneifolia*, renamed to 23a as the specimen EEN 23 already exists).

Malaysia: State Pahang, Cameron Highlands, Tanah Rata, Regenwald am Weg über die Robinsonfälle zum Gunong Beremban, 1450 m, an morschem Stumpf, leg. SCHÄFER-VERWIMP & VERWIMP, 23 May 1997 (herbarium SCHÄFER-VERWIMP 18779/B!).

Malaysia: State Pahang, Cameron Highlands, Tanah Rata, Regenwald am Weg über die Robinsonfälle zum Gunong Beremban, 1500 m, auf morschem Holz, leg. SCHÄFER-VERWIMP & VERWIMP, 23 Mai 1997 (herbarium SCHÄFER-VERWIMP 18816a!), with *Neolepidozia papulosa*.

Malaysia: State Pahang, Frasers Hill, Primär-Regenwald am Bishopstrail, 3° 43' 16.5" N, 101° 44' 31" E, 1300 m, auf feuchtem, morschem Stamm, leg. SCHÄFER-VERWIMP & VERWIMP, 21 May1997 (herbarium SCHÄFER-VERWIMP 18649!).

Malaysia: State Pahang, Frasers Hill, Weg zum Jerian [Jeriau] -Wasserfall, 3° 43' 24.2" N, 101° 43' 5.5" E, 1020 m, auf morschen Baumstamm (*Cyathea*), leg. SCHÄFER-VERWIMP & VERWIMP 18552/A, 20 Mai 1997 (herbarium SCHÄFER-VERWIMP 18552/A!).

Philippines: Dinagat Island, Dinagat Island Province, Off of the 10 km road on the summit ridge of Mt. Redondo accessed from Loreto, Barangay Esparanza. on ridge below mining buildings and above stream, 10° 21' 10.5" N, 125° 37' 43.6" E, 760 m, Mixed hardwood forest with palms, on hardwood trunk in filtered light, leg. JAMES R. SHEVOCK 63915, with GIO VINCENT BALANSAG & AIMANUELZON P. YORONG, 23 June 2024 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, BUKH, CAS, CMUH, MO, PNH).

Philippines: Leyte Island, Leyte Province, 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, with *Bazzania vittata* and *Leucobryum* spec. (herbarium UWE SCHWARZ 6373!).

Philippines: Mindanao Island, Bukidnon Province, from mid-elevation section of Limbawon Mountain toward the summit along ridge east of Dumagongdong Stream drainage by newly cut trail accessed from Kibalabag Barangay, 8° 15' 46.2" N, 125° 10' 51.6" E, 1560 m, tropical mixed hardwood rain forest, on hardwood log in filtered light, leg. JAMES R. SHEVOCK 54697, with AIMANUELZON YORONG, 11 June 2019 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Philippines: Mindanao Island, Bukidnon Province, Mt. Pantaron Range, St. Peter, Malaybalay, Along trail of Sitio Mahayag, Barangay St. Peter to Mt. Pantaron Peak, 8° 15' 34.16" N, 125° 19' 52.2" E, 1111 m, disturbed lowland dipterocarp forest of Mt. Pantaron Range, on trunk of tree fern in filtered light, leg. DARYL S. SALAS 136, with AIRA DELA ROSA, 12 October 2019 (herbarium SCHÄFER-VERWIMP!, duplicate: CAS).

Philippines: Mindanao Island, Bukidnon Province, on ridge about Natampod Village accessed from San Fernando via the newly built Bukidnon-Laak Road (Natampod section), 7° 51' 53.6" N, 125° 25' 2.8" E, 1140 m, mixed hardwood forest, on trunk of tree fern in filtered light, leg. JAMES R. SHEVOCK 59920, with LESLEY C. LUBOS, ROMEO PATANO, 24 July 2022 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, E, MO, PTBG, TNS).

Philippines: Mindanao Island, Bukidnon Province, on trail paralleling the lower slopes of Mt. Malimumu accessed from San Fernando via Magkulungay Barangay, 7° 52' 15.8" N, 125° 24' 12.4" E, 900 m, mixed secondary hardwood forest with tree ferns, on hardwood trunk in filtered light, leg. JAMES R. SHEVOCK 59794, with LESLEY C. LUBOS & ROMEO PATANO, 20 July 2022 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Philippines: Mindanao Island, Bukidnon Province, from mid-elevation section of Limbawon Mountain toward the summit along ridge above crossing of Dumagongdong Stream accessed by trail from Kibalabag Barangay (village), 8° 16' 5.9" N, 125° 10' 51" E, 1685 m, Tropical mixed hardwood rain forest with *Pandanus* and podocarps draped in bryophytes, on hardwood stump in filtered light, leg. JAMES R. SHEVOCK 54663, with AIMANUELZON YORONG, 10 June 2019 (herbarium SCHÄFER-VERWIMP!, duplicates: BRIT, CAS, CMUH, MO).

Remark:

ENGEL & MERRILL 2004 synonymized *Lepidozia variifolia* with *Telaranea wallichiana*. The asymmetric branch leaves but also the rather isodiametric cells of the stem leaves immediately distinguish *N. variifolia* from *N. wallichiana*.

Neolepidozia variifolia var. *kairuruensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *var. nov.*

Holotype:

Papua New Guinea: Kairuru Island, East Sepik District, 3° 22' S, 143° 33' E, leg. W. BORRELL 30, September 1979 (JE!, det. R. GROLLE 1981 as *Telaranea wallichiana*, duplicate: CANB).

Figures:

Plate 336, Plate 337, Plate 338, Plate 339, Plate 340, Plate 341, Plate 342.

Comparison Plate 3 – E.

Description

Plants yellowish brown, medium sized, up to 3 cm long, stem with leaves up to 0.7 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 4 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 140 – 210 µm wide and 100 – 150 µm high, cortical cells 11 – 14, 25 – 44 × 18 – 40 µm, cell walls thickened, medullary cells up to 40, 10 – 30 × 7 – 20 µm, cell walls moderately thickened, trigones small, dorsal cortical cells elongated polygonal, 38 – 42 × 44 – 62 µm, 1.1 – 1.6 as long as wide, cell walls thickened, trigones lacking to small, cuticle smooth. **Stem leaves**

approximate, longitudinally inserted, spreading at an angle of 50° – 90°, leaves square, symmetric, flat, 280 – 420 µm wide, 290 – 350 µm long, 0.8 – 1.2 as long as wide, divided by 0.5 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 4.5 cells long, 190 – 250 µm wide, 130 – 180 µm long, 0.6 – 0.9 as long as wide, median cells square to polygonal, 25 – 41 × 34 – 39 µm, 0.8 – 1.4 as long as wide, cell walls weakly thickened, trigones lacking, cuticle with striate papillae, basal cells hexagonal to elongated polygonal, 26 – 35 × 36 – 59 µm, 1.3 – 2.3 as long as wide, leaf lobes 4, divergent, 4.5 – 5.5 cells long, straight, 2 – 3 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 3 – 4 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 22 – 32 × 33 – 41 µm, 1.1 – 1.7 as long as wide, cell walls weakly thickened, trigones lacking, cuticle with elliptical papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed to the stem, 1.5 – 1.9 times as wide as the stem, underleaves trapezoid, 210 – 310 µm wide, 160 – 240 µm long, 0.6 – 0.9 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 8 cells wide, 1.5 – 3.5 cells long, 140 – 250 µm wide, 95 – 165 µm long, 0.5 – 0.9 as long as wide, median cells square, rectangular to elongated polygonal, 23 – 36 × 31 – 46 µm, 1.2 – 1.4 as long as wide, cell walls weakly thickened, trigones small, cuticle smooth, basal cells elongated polygonal to rectangular, 18 – 28 × 35 – 47 µm, 1.4 – 2.3 as long as wide, leaf lobes 4, upright to divergent, 2.5 – 3.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 3 cells long, cells 17 – 26 × 27 – 39 µm, 1.4 – 1.8 as long as wide, cell walls weakly thickened, trigones small, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 50° – 80°, leaves ovate to trapezoid, asymmetric, often bent down ventrally, 250 – 380 µm wide, 350 – 420 µm long, 0.9 – 1.4 as long as wide, divided by 0.4 – 0.6 of the leaf length, divided by 0.4 on the ventral side, margin entire, disc 6 – 7 cells wide, 4.5 – 6.5 cells long, 130 – 210 µm wide, 160 – 250 µm long, 0.8 – 1.6 as long as wide, median cells hexagonal to elongated polygonal, 22 – 36 × 31 – 44 µm, 1 – 1.4 as long as wide, cell walls thin, trigones lacking, cuticle almost smooth, basal cells hexagonal to elongated polygonal, 25 – 38 × 38 – 53 µm, 1 – 1.6 as long as wide, leaf lobes 3, upright to divergent, 3.5 – 7.5 cells long, 3 – 4 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, cells 22 – 37 × 27 – 35 µm, 0.8 – 1.4 as long as wide, cell walls thin, trigones small, cuticle with round to elliptical papillae. **Branch underleaves** imbricate, overlapping 0.2 – 0.3 of the underleaf length, transversely attached, appressed, 2.4 – 3.1 times as wide as the branch, underleaves trapezoid, 210 – 260 µm wide, 160 – 250 µm long, 0.7 – 1.1 as long as wide, divided by 0.4 – 0.6 of the leaf length, disc 6 cells wide, 1.5 – 3.5 cells long, 100 – 180 µm wide, 80 – 130 µm long, 0.5 – 1.2 as long as wide, median cells square to polygonal, 23 – 33 × 27 – 39 µm, 1.1 – 1.2 as long as wide, cell walls weakly thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal, 20 – 30 × 34 – 44 µm, 1.5 – 1.8 as long as wide, leaf lobes 3, divergent to curved, 2.5 – 5.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 3 cells long, uniseriate part 2 – 4 cells long, cells 18 – 28 × 34 – 43 µm, 1.2 – 2.1 as long as wide, cell walls weakly thickened, trigones lacking, cuticle occasionally with round papillae. **Male branches** originating ventrally – intercalar from the main stem, circinate, up to 2 mm long, with leaves 0.25 mm wide. **Male bracts** imbricate to julaceous, transversely attached, broadly ovate, 160 – 220 µm wide, 190 – 250 µm long, 1 – 1.6 as long as wide, divided by 0.4 – 0.6 of the leaf length, disc 120 – 220 µm wide, 80 – 140 µm long, median cells rectangular to elongated polygonal, 20 – 28 × 29 – 50 µm, 1.1 – 2 as long as wide, cell walls thin, trigones lacking, cuticle smooth, leaf lobes 2. **Underleaves** imbricate, transversely attached, slightly spreading away from the stem, underleaves square to short rectangular, 65 – 75 µm wide, 85 – 120 µm long, 1.3 – 1.6 as long as wide, divided by 0.2 – 0.3 of the leaf length, disc 4 cells wide, 1.5 – 2.5 cells long, 50 – 75 µm wide, 65 – 80 µm long, median cells elongated polygonal, 18 – 21 × 22 – 38 µm, 1.1 – 1.9 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, leaf lobes 2, 2 cells wide at base.

Distinguishing characters:

Among the studied *Neolepidozia* species with asymmetric leaves, *N. variifolia* var. *kairuruensis* is characterised by (1) the large branch underleaves that are up to 3 times wider than the stem, (2) the cells of the leaf lobes that are less than twice as long as wide, (3) rather thin cell walls, and (4) the branch leaves that are often bent downwards to the ventral side.

Similar species:

N. variifolia var. *kairuruensis* shares most of the characteristics with *N. variifolia* which has smaller underleaves that are less overlapping. The latter also has thicker cell walls and branch leaves that are hardly bent down ventrally.

N. variifolia var. *kairuruensis* is also similar to *N. augustana* which has smaller branch underleaves, that are attached rather distantly. Furthermore, it does not exhibit the hooked branch leaf lobes found *in N. variifolia var. kairuruensis.*

N. palawanensis has round to ovate cells and longer cells in the branch leaf lobes.

Distribution:

Papua New Guinea (Kairuru Island, New Guinea).

Specimens studied:

[Papua New Guinea]: Neuguinea, Terr. of N.G., Sepik Distr., Prince Alexander Ranges, Slopes of Mt. Toru, lowland rain forest, corticolous, 1000 m, leg. ROBBINS 2337, 1959 (JE!, det. R. GROLLE 1965 as *Lepidozia cuneifolia*, rev. R. GROLLE 1974 as *Lepidozia wallichiana*).

[Papua New Guinea]: New Guinea, East Sepik, Sepik District, Wewak-Angoram, Prince Alexander Range, Maprik-Buttrack, rain forest, base of large tree on root humus 800 m, leg. ROBBINS 2015, 1959 (JE!, det. R. GROLLE 1974 as *Lepidozia wallichiana*, rev. M. MIZUTANI 1976 as *Lepidozia cuneifolia*).

[Papua New Guinea]: New Guinea, Sepik District, Ambunti Subdistrict, Along Yapa (Hunstein River), 500 feet, epiphytic on branches of tall tree on river bank, leg. R.D. HOOGLAND & L.A. CRAVEN 10.741, 29 July 1966 (JE!, det. R. GROLLE 1971 as *Lepidozia cuneifolia*, conf. M. MIZUTANI 1976 as *Lepidozia cuneifolia*, duplicates: CANB, FH, G, L, LAE, TNS).

[Papua New Guinea]: NO-Neuguinea, Sepik Distr., Wewak-Angoram Area, Slopes of Mt. Toru, 1000 m, on rotten log, leg. ROBBINS 2337a, 1959 (JE!, det. R. GROLLE 1966 as *Lepidozia cuneifolia*, rev. R. GROLLE 1974 as *Lepidozia wallichiana*, det. M. MIZUTANI 1976 as *Lepidozia cuneifolia*). Specimen renamed to 2337a, since a specimen labeled ROBBINS 2337 already exists.

Papua New Guinea: Kairuru Island, East Sepik District, 3° 22' S, 143° 33' E, leg. W. BORRELL 29, September 1979 (JE!, det. R. GROLLE 1981 as *Telaranea wallichiana*, duplicate: CANB).

Papua New Guinea: Kairuru Island, East Sepik District, 3° 22' S, 143° 33' E, on rotting log with numerous mosses, hepatics and lichens, leg. W. BORRELL 12, September 1979 (JE!, det. R. GROLLE 1981 as *Telaranea wallichiana*, duplicate: CANB).

Etymology:

The variety is named after the Kairuru Island where the species was discovered.

Neolepidozia wallichiana (GOTTSCHE, LINDENB. & NEES) FULFORD ET J. TAYLOR. Brittonia 11(2): 84. 1959.

≡ *Lepidozia wallichiana* GOTTSCHE in GOTTSCHE, LINDENB. & NEES. Synopsis Hepaticarum 2: 204. 1845.

≡ *Mastigophora wallichiana* (GOTTSCHE, LINDENB. & NEES) TREV. *Memorie del Reale Istituto Lombardo di Scienze e Lettere, Serie 3, Classe di Scienze Matematiche e Naturali.* 4: 416. 1877.

≡ *Telaranea wallichiana* (GOTTSCHE, LINDENB. & NEES) R.M. SCHUSTER. *Phytologia* 45: 419. 1980.

Type:

Habitat in Nepalia inter *Mastigobryum inaequilaterum* (Hb. L., Lg. & G.; Dr. Scouler in Hb. Gourlieno). – *fide* GOTTSCHE, LINDENBERG & NEES (1845).

Figures:

JOVET-AST (1947) fig. 3.; LINDENBERG & GOTTSCHE (1846) Tab. IV, *wallichiana*, fig. 1 – 6; PIIPPO (1984) Fig. 4 a, b, c, e, f, h, j; SHARMA & SRIVASTAVA (1993) Plate 7; STEPHANI (1985) Icones 5286.

Plate 343, Plate 344, Plate 345, Plate 346, Plate 347 (from GLM-B-0006484 – isotype).

Comparison Plate 2 – F.

Remarks on available figures and pictures:

Figures from JOVET-AST (1947), LINDENBERG (1839), PIIPPO (1984), SHARMA & SRIVASTAVA (1993), and STEPHANI (1985), Icones no. 5285 are drawn from the holotype. The differences of the drawings are very likely explained by the variability of different plants from the same specimen.

STEPHANI (1985) Icones 5285 shows plants from Ceylon with short leaf disc cells. We studied similar plants collected by ONRAEDT in Ceylon (no. 76.L.2414 in JE) that we included into our concept of *N. papulosa*. They certainly do not belong to *N. wallichiana*.

Based on the description and drawings it is not possible to decide if Fig. 34 in DEL ROSARIO (1975) belongs to *N. wallichiana.* The drawings of MAJUMDAR & SINGH (2015) – fig. 1 – 19 do not resemble *N. wallichiana* neither. The rather asymmetric leaves, the large stem underleaves, and the branch leaf lobes that are partially more than 3 cells wide, point to a different, very likely undescribed species. The same applies to plants that are depicted in Fig. 4 by VON KONRAT et al. (2014). In particular the disc cells of the stem and branch leaves are too short for *N. wallichiana*. They somehow resemble plants from Samoa, stored in JE, which are not treated in this article.

The drawings from HATTORI & MIZUTANI (1958) fig. III 1-15 show plants that we would place under *N. schaefer-verwimpii*. Even in this case the disc cells in particular of the branch leaves are too short, indicating a closer relationship to *N. papulosa*.

Description (based on the isotype of *L. wallichiana*, GLM-B-0006484):

Plants yellowish green, medium sized, up to 2 cm long, stem with leaves up to 0.9 mm wide, leaves not fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 3 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 4 mm long. **Rhizoids** originating from the dorsal side of underleaf cells, dorsal cortical cells elongated polygonal, 27 – 35 × 43 – 95 µm, 1.5 – 2.7 as long as wide, cell walls moderately thickened, trigones lacking to small, cuticle smooth. **Stem leaves** distant, longitudinally inserted, spreading at an angle of 60° – 80°, leaves rectangular to trapezoid, symmetric to asymmetric, flat, 180 – 310 µm wide, 230 – 320 µm long, 0.7 – 1.8 as long as wide, divided by 0.4 – 0.6 of the leaf length, margin entire, disc 6 – 8 cells wide, 1.5 – 2.5 cells long, 140 – 230 µm wide, 90 – 180 µm long, 0.5 – 1.3 as long as wide, median cells elongated polygonal, 25 – 33 × 44 – 66 µm, 1.3 – 2.2 as long as wide, cell walls weakly thickened, trigones lacking, cuticle smooth, basal cells elongated polygonal, 21 – 52 × 48 – 75 µm, 1.1 – 2.4 as long as wide, leaf lobes 3 – 4, upright to divergent, 2.5 – 3.5 cells long, straight, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, 16 – 28 × 29 – 57 µm, 1.7 – 2 as long as wide, cell walls weakly thickened, trigones small, cuticle smooth, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, appressed to the stem, 0.8 – 0.9 times as wide as the stem, underleaves trapezoid, 120 – 180 µm wide, 95 – 125 µm long, 0.7 – 1 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 6 – 8 cells wide, 2.5 cells long, 85 – 130 µm wide, 55 – 85 µm long, 0.5 – 0.9 as long as wide, basal cells elongated polygonal, 17 – 22 × 34 – 55 µm, 1.8 – 2.8 as long as wide, leaf lobes 3 – 4, upright to divergent, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 17 – 23 × 32 – 53 µm, 1.9 – 2.5 as long as wide, cell walls thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 60° – 80°, leaves rectangular, symmetric, flat, 220 – 230 µm wide, 410 – 500 µm long, 1.9 – 2.2 as long as wide, divided by 0.3 – 0.4 of the leaf length, divided by 0.3 on the ventral side, margin entire, disc 6 – 8 cells wide, 3.5 – 5.5 cells long, 180 – 230 µm wide, 270 – 330 µm long, 1.2 – 1.8 as long as wide, median cells elongated polygonal, 37 – 52 × 48 – 75 µm, 1.3 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 38 – 49 × 55 – 82 µm, 1.1 – 1.9 as long as wide, leaf lobes 3, upright, 3.5 – 4.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 3 – 4 cells long, cells elongated polygonal, not constricted at the transversal walls, cells 26 – 45 × 37 – 61 µm, 1.3 – 1.5 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch underleaves** distant, transversely attached, appressed, 0.6 – 0.7 times as wide as the branch, underleaves square to trapezoid, 50 – 60 µm wide, 45 – 65 µm long, 0.9 – 1.3 as long as wide, divided by 0.5 – 0.7 of the leaf length, disc 4 cells wide, 0.5 cells long, 40 – 55 µm wide, 20 – 30 µm long, 0.4 – 0.8 as long as wide, basal cells elongated polygonal, 11 – 20 × 19 – 30 µm, 1.4 – 1.8 as long as wide, leaf lobes 2, upright, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 12 – 19 × 23 – 41 µm, 1.5 – 2.2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. wallichiana is characterised by (1) elongated cells of the stem and branch leaf disc that can reach up to 70 µm, (2) the remote, longitudinally attached stem leaves, (3) the disc of the stem underleaves that is only 1.5 cells high, (4) the small branch underleaves, and (5) the tendency to create secondary cell divisions in the branch leaf disc.

Similar species:

A species that resembles *N. wallichiana* is *Neolepidozia dinagatensis.* The latter species however, is a larger plant, has less obliquely inserted branch leaves, basal cells of the branch leaves that can even reach 100 µm, and a lanceolate, instead of a bilobate stem leaf near the origin of the branches.

N. panayensis also has larger branch leaf disc cells. Although the depicted branch underleaves of the *N. wallichiana* isotype are similar in size to those of *N. panayensis*, they usually grow larger, as indicated in the drawings.

As already mentioned by KITAGAWA (1973), the branch leaf disc cells of *N. wallichiana* are larger than those of *N. papulosa*. They reach up to 40 µm in length in *N. papulosa* and often more than 50 µm in *N. wallichiana*. *N. wallichiana* has furthermore larger branch leaves and thinner cell walls.

Distribution:

Nepal.

None of the specimens we studied matched the characteristics of *N. wallichiana*. Until further material is available we consider this species to be endemic to Nepal. Specimens, labelled as *N. wallichiana* need to be restudied to check their identity.

Specimen studied:

Nepal: Nepal. Ex Herb. Lehmannianum. 1853 (Isotype *L. wallichiana*, GLM-B-0006484!).

Remark:

Many Asian *Neolepidozia* specimens have been identified as *N. wallichiana*, creating the impression that this species is by far the most common and widely distributed in the region. However, as KITAGAWA (1973) pointed out, *N. wallichiana* is rather rare, a fact that most researchers have overlooked. As he only studied the type material from BM and G, he did not provide any information about occurrences outside Nepal.

Neolepidozia winteri U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Indonesia: Java, Jawa Barat Province, Rim of Tangkuban Peraku (volcano) north of Lembang (Bandung), 6° 45' 34.4" S, 107° 36' 41.5" E, 1830 m, fine soil on rodden wood of *Erica* trees at crater rim, leg. GERHARD WINTER 671, 14 January 1987 (herbarium SCHÄFER-VERWIMP!, duplicate: FR 0153253).

Figures:

Plate 348, Plate 349, Plate 350, Plate 351, Plate 352.

Comparison Plate 4 – H.

Description:

Plants yellowish green, small, up to 8 mm long, stem with leaves up to 0.5 mm wide, leaves not fragile. **Branching** 1- to bipinnate, of *Frullania*-type. **Branches** up to 3 mm long, not flagelliform at the end. **Flagelliform branches** sparse, up to 3 mm long. **Rhizoids** not seen. **Stem** in cross section 190 µm wide and 160 µm high, cortical cells 12, 30 – 54 × 25 – 34 µm, cell walls moderately thickened, medullary cells up to 35, 17 – 28 × 14 – 25 µm, cell walls thin to moderately thickened, trigones small, dorsal cortical cells isodiametric to elongated polygonal, 30 – 46 × 32 – 54 µm, 0.7 – 1.5 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Stem leaves** imbricate, obliquely inserted, spreading at an angle of 40° – 60°, leaves rectangular to trapezoid, symmetric to weakly asymmetric, lobes bent down ventrally, 190 – 400 µm wide, 240 – 340 µm long, 0.8 – 1.3 as long as wide, divided by 0.5 – 0.6 of the leaf length, margin entire, disc 8 cells wide, 2.5 – 4.5 cells long, 160 – 240 µm wide, 90 – 160 µm long, 0.4 – 1 as long as wide, median cells isodiametric to elongated polygonal, 24 – 31 × 26 – 45 µm, 0.9 – 1.5 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells ovate to elongated polygonal, 22 – 36 × 34 – 54 µm, 1.3 – 2.3 as long as wide, leaf lobes 4, upright to divergent, 4.5 – 7.5 cells long, straight to weakly falcate, 2 – 4 cells wide at base, multiseriate part 3 – 5 cells long, uniseriate part 1 – 3 cells long, cells elongated polygonal, not constricted at the transversal walls, 15 – 25 × 26 – 36 µm, 1.2 – 2.1 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to elliptical papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** approximate, transversely attached, upright, 1.1 – 1.4 times as wide as the stem, underleaves square, 180 – 270 µm wide, 170 – 250 µm long, 0.9 – 1.1 as long as wide, divided by 0.4 – 0.6 of the leaf length, disc 8 cells wide, 2.5 – 4.5 cells long, 140 – 200 µm wide, 80 – 130 µm long, 0.4 – 0.8 as long as wide, median cells ovate to elongated polygonal, 23 – 32 × 21 – 36 µm, 0.8 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated polygonal, 20 – 35 × 30 – 47 µm, 1 – 1.7 as long as wide, leaf lobes 4, upright to hooked, 3.5 – 8.5 cells long, 2 – 3 cells wide at base, multiseriate part 2 – 3 cells long, uniseriate part 2 – 6 cells long, cells 14 – 26 × 18 – 29 µm, 0.7 – 1.8 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** imbricate, obliquely inserted, spreading at an angle of 50° – 60°, leaves rectangular, ovate to trapezoid, straight to weakly asymmetric, lobes bent ventrally, 140 – 280 µm wide, 215 – 260 µm long, 0.9 – 1.5 as long as wide, divided by

0.4 – 0.6 of the leaf length, margin entire, disc 6 cells wide, 2.5 – 3.5 cells long, 105 – 220 µm wide, 100 – 135 µm long, 0.5 – 1.1 as long as wide, median cells isodiametric polygonal, 23 – 41 × 29 – 40 µm, 0.9 – 1.3 as long as wide, cell walls thin to moderately thickened, trigones lacking, cuticle with striate papillae, basal cells elongated polygonal, 21 – 34 × 29 – 53 µm, 1.1 – 2 as long as wide, leaf lobes 3, upright to weakly divergent, 4.5 – 6.5 cells long, 2 – 4 cells wide at base, multiseriate part 3 – 5 cells long, uniseriate part 2 – 3 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, cells 19 – 31 × 19 – 40 µm, 0.8 – 1.8 as long as wide, cell walls thin to moderately thickened, trigones lacking, cuticle with round to elliptical papillae. **Branch underleaves** approximate, transversely attached, appressed, 1 – 1.5 times as wide as the branch, underleaves square, ovate to trapezoid, 120 – 170 µm wide, 130 – 180 µm long, 0.8 – 1.4 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 4 – 6 cells wide, 1.5 – 3.5 cells long, 75 – 170 µm wide, 80 – 110 µm long, 0.5 – 1.3 as long as wide, median cells isodiametric polygonal, 25 – 33 × 24 – 38 µm, 0.9 – 1.2 as long as wide, cell walls moderately thickened, trigones lacking or small, cuticle smooth, basal cells elongated polygonal, 24 – 28 × 30 – 57 µm, 1.3 – 2 as long as wide, leaf lobes 2 – 3, upright, lobes bent towards the stem, 2.5 – 4.5 cells long, 2 – 3 cells wide at base, multiseriate part 2 – 4 cells long, uniseriate part 1 – 2 cells long, cells 17 – 28 × 21 – 34 µm, 1 – 1.8 as long as wide, cell walls moderately thickened, trigones lacking or small, cuticle smooth.

Distinguishing characters:

N. winteri is characterised by (1) the large stem underleaves with lobes that are up to 8.5 cells long, for several rows biseriate and falcate in well-developed plants. It has furthermore (2) obliquely attached branch leaves with lobes bent down ventrally, (3) deeply divided stem and branch leaves, (4) branch and stem leaf lobes that are up to 4 cells wide at the base, and (5) coarsely papillose branch leaf lobes.

Similar species:

The only other species with symmetric branch leaves and large branch underleaves is *N. beckeri*. However, the stem and branch leaves are of a different shape and less deeply divided. The stem underleaf lobes are shorter and only up to 3.5 cells longs.

N. massartiana with obliquely inserted branch leaves has shorter underleaf lobes that are very rarely wider than 2 cells at the base.

N. lembangensis from the same location has somehow flexuous leaf lobes that occasionally develop a tooth at their base and has very thin cell walls.

Distribution:

Indonesia (Java). Only known from the type collection.

Etymology:

The species is named after G. WINTER who detected this species.

Neolepidozia yorongii U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Philippines: Mindanao Island, Bukidnon Province, Quezon, Barangay Luminato, Sitio Sto. Domingo, Mount Pinamantawan, Tangkulan Range, 7° 45' 56.1" N, 125° 13' 43.6" E, 1673 m, Slope trail, mossy forest, just 25 meters to summit of Mt. Pinamantawan, with ferns and tree ferns as dominant understory plant, on fallen hardwood branch, in filtered light, leg. AIMANUELZON P. YORONG 931a, 29 August 2022 (herbarium SCHÄFER-VERWIMP!, duplicate: CAS). This specimen is a mix of the following 3 species: YORONG 931a (holotype of *Neolepidozia yorongii*, YORONG 931b (holotype of *Neolepidozia philippinensis*), and YORONG 931c (holotype of *Neolepidozia tangkulanensis*).

Figures:

Plate 353, Plate 354, Plate 355, Plate 356, Plate 357.

Comparison Plate 1 – D.

Description:

Several characters could not be observed due to the fragility of the leaves and underleaves.

Plants pale yellowish green, small, up to 1.5 cm long, leaves fragile. **Branching** 1-pinnate, of *Frullania*-type. **Branches** up to 2 mm long, occasionally flagelliform at the end. **Flagelliform branches** sparse, up to 5 mm long. **Rhizoids** not seen. **Stem** in cross section 110 µm wide and 80 µm high, cortical cells 9, 19 – 32 × 13 – 25 µm, cell walls thickened, medullary cells up to 20, 9 – 17 × 9 – 17 µm, cell walls thickened, trigones moderately enlarged, dorsal cortical cells elongated polygonal, 24 – 30 × 56 – 65 µm, 1.9 – 2.7 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Stem leaves** distant, longitudinally to obliquely inserted, spreading at an angle of 60° – 80°, leaves trapezoid, symmetric to weakly asymmetric, flat, 150 – 160 µm wide, margin entire, disc 6 cells wide, 2.5 cells long, 110 – 150 µm wide, 85 – 100 µm long, 0.6 – 0.9 as long as wide, median cells square, hexagonal to short rectangular, 23 – 28 × 24 – 33 µm, 1 – 1.3 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells ovate to elongated polygonal, 21 – 29 × 34 – 43 µm, 1.2 – 2 as long as wide, leaf lobes 3, upright, 2 cells wide at base, multiseriate part 1 cells long, cells round, constricted at the transversal walls, 25 – 31 × 25 – 30 µm, 0.9 – 1.1 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to elliptical papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, upright, 0.9 times as wide as the stem, underleaves transversely linear, 80 – 120 µm wide, disc 4 – 6 cells wide, 1.5 – 2.5 cells long, 50 – 120 µm wide, 50 – 80 µm long, 0.5 – 1.3 as long as wide, median cells square to hexagonal, 17 – 21 × 19 – 26 µm, 1 – 1.2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells elongated ovate to polygonal, 16 – 25 × 26 – 32 µm, 1 – 1.9 as long as wide, leaf lobes 2 – 3, upright, 2 cells wide at base, multiseriate part 1 cells long, cell walls moderately thickened, trigones small, cuticle smooth. **Branch leaves** approximate, longitudinally inserted, spreading at an angle of 50° – 80°, leaves rectangular to trapezoid, symmetric, flat, 115 – 180 µm wide, margin entire, disc 4 – 6 cells wide, 2.5 – 3.5 cells long, 90 – 165 µm wide, 80 – 120 µm long, 0.6 – 1.3 as long as wide, median cells square to hexagonal, 25 – 32 × 26 – 29 µm, 0.8 – 1 as long as wide, cell walls moderately thickened, trigones small, cuticle with striate papillae, basal cells ovate to elongated polygonal, 24 – 33 × 25 – 40 µm, 1 – 1.3 as long as wide, leaf lobes 2 – 3, upright, 2 cells wide at base, multiseriate part 1 cells long, cells round, constricted at the transversal walls, cells 23 – 28 × 21 – 28 µm, 0.9 – 1.1 as long as wide, cell walls moderately thickened, trigones small, cuticle with round to elliptical papillae. **Branch underleaves** distant, transversely attached, upright, 1.2 – 1.3 times as wide as the branch, underleaves square to trapezoid, 95 – 110 µm wide, disc 4 cells wide, 1.5 – 2.5 cells long, 60 – 100 µm wide, 50 – 85 µm long, 0.5 – 1.4 as long as wide, median cells square to hexagonal, 25 – 28 × 22 – 24 µm, 0.8 – 0.9 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth, basal cells ovate to elongated polygonal, 18 – 25 × 27 – 42 µm, 1.3 – 1.8 as long as wide, leaf lobes 2, upright, 2 cells wide at base, multiseriate part 1 cells long, cells 19 – 25 × 18 – 28 µm, 0.9 – 1.2 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

The species is characterised by (1) the fragile leaves, (2) the trapezoid stem leaf disc that is 2.5 cells high, (3) the almost round leaf lobe cells, and (4) the small underleaves.

Similar species:

On the one hand, the species resembles *N. arauluensis* which has a higher stem leaf disc (up to 4.5 cells) and larger, imbricate underleaves. On the other hand, it shows similarities to *N. schusteri* which also has a higher (up to 4.5 cells) branch leaf disc that is rectangular rather than trapezoial. *N. schusteri* seems to have less fragile leaves.

N. mamillosa, another species with constricted transversal walls of the leaf lobes does not have fragile leaves, but has a rather irregular branch leaf shape and bulging hyalodermis cells of the stem.

It somehow also resembles *Ceramanus perfragilis* (J.J. ENGEL et G.L. MERR.) E.D. COOPER from New Zealand but differs in the basal disc cells and the stem underleaves. We also did not observe any whitish to bluish green, water repellent cell surface.

Distribution:

Philippines (Mindanao). Only known from the type collection.

Etymology:

The species is named after A.P. YORONG who detected this species in the Philippines.

Neolepidozia zantenii U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK *spec. nov.*

Holotype:

Indonesia: New Guinea, W-Neuguinea. Tanah-Merah, 8 km along the road to Mindiptana, 50 m, leg. VAN ZANTEN 105, 1959 (JE!, det. M. MIZUTANI as *Lepidozia augustana*).

Figures:

Plate 358, Plate 359, Plate 360, Plate 361, Plate 362.

Comparison Plate 3 – B.

Description:

Plants pale yellowish green, medium sized, up to 2 cm long, stem with leaves up to 0.8 mm wide, leaves not fragile. **Branching** 1- to bipinnate, of *Frullania*-type. **Branches** up to 3 mm long, not flagelliform at the end. **Flagelliform branches** scattered, up to 2 mm long. **Rhizoids** originating from the dorsal side of underleaf cells. **Stem** in cross section 220 µm wide and 170 µm high, cortical cells 12, 37 – 64 × 22 – 38 µm, cell walls thickened, medullary cells up to 35, 18 – 30 × 13 – 32 µm, cell walls moderately thickened, trigones moderately enlarged, dorsal cortical cells elongated polygonal, 30 – 50 × 58 – 96 µm, 1.3 – 2.5 as long as wide, cell walls thin, trigones small, cuticle smooth. **Stem leaves** approximate, longitudinally inserted, spreading at an angle of 50° – 80°, leaves square to rhombic, asymmetric, flat, 340 – 480 µm wide, 340 – 420 µm long, 0.8 – 1.1 as long as wide, divided by 0.4 – 0.5 of the leaf length, margin entire, disc 6 – 8 cells wide, 2.5 – 4.5 cells long, 250 – 350 µm wide, 160 – 260 µm long, 0.6 – 1 as long as wide, median cells elongated polygonal, 38 – 54 × 55 – 74 µm, 1.3 – 1.7 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 45 – 58 × 60 – 88 µm, 1.3 – 1.9 as long as wide, leaf lobes 3 – 4, upright to divergent, 3.5 – 4.5 cells long, straight to weakly falcate, 2 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 3 – 4 cells long, cells ovate to elongated polygonal, not constricted at the transversal walls, 20 – 47 × 39 – 58 µm, 1.2 – 2 as long as wide, cell walls thin, trigones small, cuticle with round to elliptical papillae, half stem leaf near branch base 2-lobate, otherwise similar to the stem leaves. **Stem underleaves** distant, transversely attached, spreading away from the stem, 0.8 – 0.9 times as wide as the stem, underleaves square to trapezoid, 100 – 155 µm wide, 85 – 110 µm long, 0.6 – 0.9 as long as wide, divided by 0.2 – 0.4 of the leaf length, disc 6 – 8 cells wide, 1.5 cells long, 85 – 120 µm wide, 50 – 80 µm long, 0.4 – 0.9 as long as wide, basal cells elongated polygonal, 15 – 31 × 33 – 46 µm, 1.3 – 2.6 as long as wide, leaf lobes 3 – 4, upright to divergent, 1.5 – 2.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 – 2 cells long, cells 15 – 26 × 20 – 28 µm, 1 – 1.8 as long as wide, cell walls thin, trigones lacking, cuticle smooth. **Branch leaves** imbricate, longitudinally inserted, spreading at an angle of 60° – 70°, leaves rectangular to trapezoid, asymmetric, flat, 230 – 330 µm wide, 430 – 500 µm long, 1.4 – 2.1 as long as wide, divided by 0.2 – 0.6 of the leaf length, margin entire, disc 6 – 9 cells wide, 3.5 – 5.5 cells long, 160 – 240 µm wide, 190 – 350 µm long, 1 – 1.6 as long as wide, median cells elongated polygonal, 38 – 48 × 54 – 75 µm, 1.2 – 1.6 as long as wide, cell walls thin, trigones lacking, cuticle smooth, basal cells elongated polygonal, 31 – 52 × 64 – 86 µm, 1.5 – 2.1 as long as wide, leaf lobes 3, upright to weakly falcate, 3.5 – 4.5 cells long, 2 – 3 cells wide at base, multiseriate part 1 – 2 cells long, uniseriate part 2 – 3 cells long, cells rectangular to elongated polygonal, not constricted at the transversal walls, cells 27 – 48 × 41 – 57 µm, 1.2 – 1.8 as long as wide, cell walls thin, trigones lacking, cuticle with round to elliptical papillae. **Branch underleaves** distant, transversely attached, spreading away from the stem, 0.6 – 0.7 times as wide as the branch, underleaves square, 60 – 75 µm wide, 60 – 65 µm long, 0.9 – 1.1 as long as wide, divided by 0.3 – 0.5 of the leaf length, disc 4 cells wide, 0.5 – 1.5 cells long, 50 – 70 µm wide, 30 – 45 µm long, 0.5 – 0.7 as long as wide, basal cells elongated polygonal, 20 – 25 × 26 – 33 µm, 1.1 – 1.7 as long as wide, leaf lobes 2, upright, 1.5 cells long, 2 cells wide at base, multiseriate part 1 cells long, uniseriate part 1 cells long, cells 15 – 21 × 21 – 36 µm, 1.1 – 1.9 as long as wide, cell walls moderately thickened, trigones small, cuticle smooth.

Distinguishing characters:

N. zantenii is characterised by (1) the weakly asymmetric branch leaves, (2) the large branch leaf disc cells that can reach up to 75 µm in length, (3) the small branch underleaves, consisting of fewer than 10 cells, and (4) the thin-walled cells without trigones.

Similar species:

N. cuneifolia also has asymmetric leaves, thin-walled cells and rather small branch underleaves. Its branch leaves are, however, more asymmetric than those of *N. zantenii*, and the branch leaf disc cells are only up to 40 µm long. The above-mentioned distinguishing characters of *N. zantenii* are quite unique amongst the *Neolepidozia* species with asymmetric leaves.

The only other species with very long branch leaf disc cells and small branch underleaves is *N. panayensis*. This species has symmetrical branch leaves that are less than 200 µm long.

MIZUTANI identified the holotype of *N. zantenii* as *L. augustana*. However, *N. augustana* has larger branch underleaves, less asymmetric branch leaves, and very thin cell walls.

Distribution:

Indonesia (New Guinea). Only known from the type collection.

Etymology:

The species is named after BERNARD O. VAN ZANTEN (1927 – 2025) who detected this species.

7. *Neolepidozia* species that have not been studied

During our studies we were not able to get a certain number of specimens for loan or could otherwise clarify the identity of particular species. The respective material has to be restudied to verify its identity.

Lepidozia augustana var. ? STEPH. Species Hepaticarum 6: 321. 1922.

Type:

Nova Guinea (*Ledermann* legit). Respective specimen not yet identified.

Remarks:

The editor of the *Bulletin de l'Herbier Boissier* made a footnote that the manuscript of the author, i.e. STEPHANI, did not include a name.

With a length of 6 cm, this variety is a rather large form. Even though there is a description it might not be possible to pinpoint to the right specimen for additional studies.

Lepidozia expansa STEPH. Species Hepaticarum 6: 346. 1922.

Type:

There are two specimens of *L. expansa* in G labeled as "TYPUS". The first one, G00113451, origin from the Herbarium Bureau of Science No. 17008 additionally mentioning "on dead wood, 660 m", whereas the second, G00112365, origin from the Herbarium Bureau of Science No. 17081 mentioning "on trees, 1000 m". Both were collected by C.B. ROBINSON on Mt. Maquiling, Province of Laguna, Luzon, Dec. 6 – 9, 1912.

As STEPHANI (1917-1924) stated in his original description "Sterilis pusilla, flavo-rufescens, corticola, …" it is more likely that G00112365 is the type of *L. expansa*. This is supported by the fact, that G00113451 does not seem to be sterile. If *L. expansa* can be maintained as a valid species a lectotype has to be selected.

Figures:

DEL ROSARIO (1975) Fig. 81 a-d, STEPHANI (1985) Icones 5227.

The drawings of DEL ROSARIO depict a different species, as he distinguishes *L. expansa* by its trilobate stem leaves, which are not shown on STEPHANIs drawings.

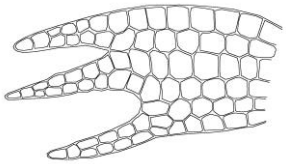

Fig. 158: *Lepidozia expansa,* branch leaf (redrawn from STEPHANI [1985])

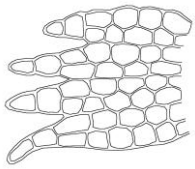

Fig. 159: *Lepidozia expansa,* stem leaf (redrawn from STEPHANI [1985])

Remarks:

Since *Lepidozia expansa* has asymmetric branch leaves as depicted by STEPHANI (1985), it is more likely that *L. expansa* belongs to species related to *Lepidozia variifolia*.

Only MITZUTANI studied both of the specimens in G and labelled them as "Syntype". There is no label by KITAGAWA or ENGEL on G00112365 giving the impression that they only studied G00113451 from dead wood. As these plants are larger and look on the scans similar to *Lepidozia tenera*, KITAGAWAs conclusion that *L. expansa* should be treated as a synonym of *L. tenera* is comprehensible. ENGEL & MERRILL (2004) put *L. tenera* as a synonym to *Telaranea wallichiana*. It also explains why they treat L. *expansa* in a similar way.

A duplicate of the Herbarium Bureau of Science No. 17008 (= G00113451) is located in E as E00304521. On the label RAE followed the judgement of ENGEL indicating that it is the isotype of *Lepidozia expansa*.

The respective specimens have still to be studied in detail to clarify the identity of *L. expansa*.

Lepidozia hainanensis **K.C. CHANG in K.C. CHANG & C. GAO.** *Bulletin of Botanical Research, Harbin* 4(3): 84. f. 2. 1984.

Type:

China: Guangdong: Hainan Dao, Mt. Dialuoshan, ad truncos prostratos putrescentes saepe cum aliis hepaticis muscesque, 15. X. 1974, *Gao Chien* 2899 (Typus in ISPH).

Figures:

CHANG & GAO (1984) Fig. 2.

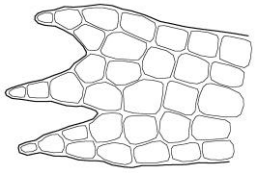

Fig. 160: *Lepidozia hainanensis,* branch leaf (redrawn from CHANG & GAO [1984])

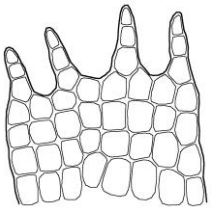

Fig. 161: *Lepidozia hainanensis,* branch leaf (redrawn from CHANG & GAO [1984])

Remarks:

MIZUTANI & CHANG (1986) synonymised *L. hainanensis* with *Lepidozia wallichiana*. However, as the figures show small stem and branch leaf disc cells, it is very unlikely that *L. hainanensis* is a synonym of *L. wallichiana*. Instead, it shows similarities with *Neolepidozia papulosa* and its varieties. As we were unable to study the type of *L. hainanensis*, this topic has to be revisited at a later date.

Lepidozia massartiana **var.** ***laxa*** **SCHIFFN.** *Hedwigia*. 39: 196. 1900. *nom. ill.*

Type:

Java. Urwald von Tjibodas, an faulem Holze; ♂ Pfl. I. 1895 (No. 1417), leg. *J. Massart*. (G00281054).

Remarks:

SCHIFFNER did not provide a description or drawings of this variety making it illegitimate. This was not corrected in later publications. Without studying the type material, we are not able to confirm its identity.

Lepidozia paucidens **STEPH.** Species Hepaticarum 6: 337. 1922.

Type:

Java [*Fleischer* legit] (G0069685, note "Type" by M. MIZUTANI July 1965; det. N. KITAGAWA, 1969 "*Lepidozia paucidens* St. → *L. papulosa* St.").

Figures:

STEPHANI (1985) Icones 5262.

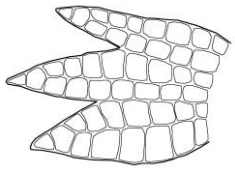

Fig. 162: *Lepidozia paucidens,* stem leaf (redrawn from STEPHANI [1985])

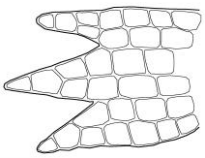

Fig. 163: *Lepidozia paucidens,* stem underleaf (redrawn from STEPHANI [1985])

Remarks:

STEPHANI (1917-1924) described *L. paucidens* as a plant with trilobate stem leaves, that are 330 µm long, having a disc 6 cells high. He also mentions stem underleaves with for lobes. His description differs from his drawings.

Amongst the specimens we studied, only *Neolepidozia cameronensis* and *Neolepidozia kasudsuranensis* developed trilobate stem leaves. They have, however, shorter stem leaves and a shorter disc with larger cells.

Until the type could be studied we therefore follow KITAGAWA (1973) who mentions that "*L. paucidens* corresponds well with *L. papulosa.*".

Neolepidozia planifolia (STEPH.) E.D. COOPER. *Phytotaxa* 97(2): 57. 2013.

≡ *Lepidozia planifolia* STEPH. Species Hepaticarum. 3: 629. 1909.

Type:

Japan. Tsurugisan. *Faurie* 654. Juin 1900. (G0069689). Lectotype. *fide* HATTORI & MIZUTANI (1958).

Isotypes are also located in FI (FI084174, FI084175) and PC (PC 0102354).

Figures:

STEPHANI (1985) Icones 5344.

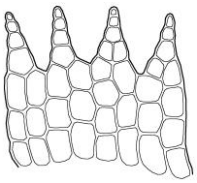

Fig. 164: *Lepidozia planifolia,* stem leaf (redrawn from STEPHANI [1985])

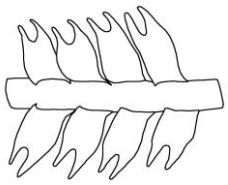

Fig. 165: *Lepidozia planifolia,* branch dorsal (redrawn from STEPHANI [1985])

Remarks:

HATTORI & MIZUTANI (1958) synonymized *L. planifolia* with *L. wallichiana* but did not depict the holotype. As they compare *L. planifolia* with their own collections from Malacca and Ceylon, they obviously had a very broad species concept of *N. wallichiana*.

TAYLOR studied the type in G in 1959 stating "*Neolepidozia* FULFORD + J. TAYLOR". Interestingly they did not include *L. planifolia* in the list of *Neolepidozia* species in FULFORD & TAYLOR (1968).

KITAGAWA noted on the type in G (G00069689) "HATTORI & MIZUTANI regarded this species as synonym of *L. wallichiana* Gott. (Journ. Hattori Bot. Lab. 19: 86, 1958). But both are not conspecific! N. KITAGAWA, determ. Anno 1969)". His further note "Type of *Lepidozia planifolia* St." indicates that he was convinced at this point in time that *L. planifolia* is a well-defined species. In KITAGAWA (1973) he just indicated that *L. planifolia*, *L. leratii* and L. *aubertii* "are all closely related and may be conspecific with *L. papulosa*".

ENGEL & MERRILL (2004) assigned certain *Neolepidozia* material from Japan and Taiwan to *Telaranea planifolia*, based on its lectotype (FAURIE 654, G) from Japan.

As the scanned image of the type of *Lepidozia planifolia* in G (G00069689) also shows bilobate branch leaves that correspond to STEPHANI (1985) Icones no. 5259 and his initial description in STEPHANI (1906-1909), therefore, we do not consider *L. planifolia* to be conspecific with any of the *Neolepidozia* species that we studied.

Since the type of *L. planifolia* was not available for loan this topic has to be clarified at a later point of time.

***Lepidozia wallichiana* var. *gracilis* SANDE LAC.** Synopsis hepaticarum javanicarum. 37. 1856.

Type: [Java] Ad craterem Tjiwidei. Herb. Jungh. (Isotype PC0102565).

Type:

[Java] Ad craterem Tjiwidei. Herb. Jungh. (G00265670).

Remarks:

KITAGAWA studied the type specimen in 1969 and identified it as *Lepidozia wallichiana*. If KITAGAWA already stabalized his understanding of *L. wallichiana* that he published in KITAGAWA (1973) it is likely that the plants are somehow related to *N. sarawakensis*. Without studying the material, it is hard to judge to which species it belongs.

8. Erroneous Asian records of *Neolepidozia* species

***Neolepidozia capilligera* (SCHÄGR.) FULFORD ET J. TAYLOR.** *Brittonia* 11(2): 84. 1959.

≡ *Jungermannia capilligera* SCHWÄGR. Historiae muscorum hepaticorum prodromus. 21. 1814.

≡ *Lepidozia capilligera* (SCHWÄGR.) LINDENB. in GOTTSCHE, LINDENB. & NEES. Synopsis Hepaticarum 2: 204. 1845.

≡ *Mastigophora capilligera* (SCHWÄGR.) TREVIS. *Memorie del Reale Istituto Lombardo de Scienze e Lettere. Serie 3, Classe di Scienze Matematiche e Naturali.* 4: 416. 1877.

≡ *Telaranea capilligera* (SCHWÄGR.) R.M. SCHUST. *Journal of the Hattori Botanical Laboratory* 26: 256. 1963.

Figures:

ENGEL & MERRILL (2004) Fig. 3; PIIPPO (1984) Fig. 4 l-q; STEPHANI (1985) Icones no. 5077, 5078.

Remarks:

The following specimen from high elevations in New Guinea, kept in JE were identified by Mizutani as *N. capilligera*: HEWSON 121, HEWSON 284, R.M. SCHUSTER 67-5957, R.M. SCHUSTER 67-6608/b, R.M. SCHUSTER 67-6623/a, R.M. SCHUSTER 67-6638, R.M. SCHUSTER 67-6758, R.M. SCHUSTER 67-6759, VAN ZANTEN 68-3082/bis-a, VAN ZANTEN 68-3116/a, VAN ZANTEN 68-316/f1, VAN ZANTEN 68-560/a2, VAN ZANTEN 68-809/a, W. VINK 17388B. All these specimens belong to a *Lepidozia* species as the hyalodermis is lacking and the dorsal base of branch and stem leaves is often extended, a feature that cannot be found in *Neolepidozia*. We leave it open for the time being to which *Lepidozia* species the specimens belong.

The following *Lepidozia* specimen, collected in New Guinea and identified as *L. capilligera* is depicted on Plate 364 and Plate 365.

[Papua New Guinea]: NO-Neuguinea. W. Highlands, Mt. Hagen, 3700 – 4000 m, alpine tussock, in densely shaded hole on peaty soil, leg. VAN ZANTEN 68-3116/a, 1968 (JE!, det. M. MIZUTANI as *Lepidozia capilligera*).

It was stated by ENGEL & MERRILL (2004) that *N. capilligera* might be an endemic species to Tasmania. Considering the distribution of the different species studied it is very unlikely that this species can be found in Asia.

Further records of *N. capilligera* provided by the Consortium of Bryophyte Herbaria, as from New Guinea (BELLAMY 1559, NY 05087660) and Sarawak (coll. MEIJER, H 3245482) are doubtful and have to be verified.

***Neolepidozia heterotexta* (STEPH.) E.D. COOPER.** *Phytotaxa* 97(2): 55. 2013.

≡ *Lepidozia heterotexta* STEPH. Species Hepaticarum 6: 329. 1922.

≡ *Telaranea heterotexta* (STEPH.) J.J. ENGEL & G.L. MERR. *Fieldiana: Botany, New Series* 44: 160. 2004.

= *Lepidozia aubertii* JOVET-AST. *Candollea*. 11: 35. 1948. *fide* HÜRLIMANN (1985).

= *Neolepidozia aubertii* (JOVET-AST) E.D. COOPER. *Phytotaxa*. 97(2): 55. 2013.

= *Lepidozia theriotii* STEPH. Species Hepaticarum 6: 343. 1922. *fide* HÜRLIMANN (1985).

= *Lepidozia wallichiana* var. *theriotii* (STEPH.) Herzog *in sched*.

Figures:

JOVET-AST (1947) fig. 2 (as *L. aubertii)*; STEPHANI (1985) Icones no. 5239, 5281 (as *L. theriotii*).

Plate 78, Plate 80 (from SELLING 118).

Specimen studied:

New Caledonia: Montagnes des Sources, 800 m, humid *Auracaria muelleri* forest, leg. OLAF SELLING 118, 1949 (JE!, identified by HERZOG as *Lepidozia wallichiana* var. *theriotii* [ST.] HERZ.).

Remarks:

HÜRLIMANN (1985) mentions a specimen in G from the North Moluccas ("Insel Batjen bei Halmaheira" = Pulau Bacan) that was collected 1888 by WARBURG and identified by STEPHANI as *L. theriotii*. Already W. MEIJER revised the identification to *L.* cf. *massartiana*.
None of the Asian specimens that we studied show the conspicuous cell pattern with enlarged inner disc cells surrounded by smaller marginal cells, a very characteristic feature mentioned by HÜRLIMANN for *N. heterotexta*. According to him this species can only be found in New Caledonia and the New Hebrides.
If *L. aubertii* is a distinct species or conspecific with *N. heterotexta* as proposed by HÜRLIMANN (1985) has to be verified in future studies.

9. Distribution and Frequency

The knowledge of the distribution of the different *Neolepidozia* species is still very fragmentary. On the one hand, this is due to the fact that many of the specimens were identified as *N. wallichiana* up to now. On the other hand, we limited our studies to material we collected ourselves and to specimens from selected herbaria. Furthermore, the tropical areas in the region in particular have only been studied to a limited extent.

Neolepidozia is distributed in Asia from Nepal and Sri Lanka in the west, southern China and southern Japan in the north, to New Guinea and the Solomon Islands in the east (Table 2). The diversity is highest in the tropical areas, whereas it becomes lower in the subtropical regions.

N. mamillosa is one of the most widely distributed species. It is found from southern Japan in the north to Singapore, Borneo, and as far as New Guinea. Although there are areas where it has not been found, the species is likely to appear wherever mangrove forests exist. A similar distribution can be observed in *N. massartiana*, even though the species grows at higher altitudes in tropical rain forests.

AS KITAGAWA (1973) pointed out, *N. papulosa* is widely distributed in the region. We agree with this assessment. Its distribution range extends all the way to Sri Lanka, but it appears to be absent from New Guinea. Both *N. shevockii* and *N. variifolia* are also widely distributed, ranging from the Malay Peninsula to the Philippines.

On the contrary, *N. wallichiana* is a very rare species. As far as we can tell, it only occurs in Nepal, where it seems to be endemic.

The high diversity in the Philippines indicates a potential diversity centre, which partially is due to the fact that almost one-third of the samples examined originate from the Philippines. As with distribution of other bryophytes, the Philippines often play a mediating role between Taiwan and Borneo on the one hand and New Guinea on the other. For *Neolepidozia*, this applies for instance to *N. cuneifolia* and *N. sarawakensis* var. *grandistipula*.

There is significant number of well-defined species that is only known from the type collection (Table 3). One reason for this is that those that grow intermixed with other bryophytes can easily be overlooked.

Nevertheless, we are convinced that there is a high degree of endemism within the genus *Neolepidozia*. This tendency can be observed primarily in Mindanao, Borneo, the Malay Peninsula, New Guinea, and the Solomon Islands. Whether this tendency will continue once the exploration of these areas advances, remains to be seen in future studies.

Cambodia (1)
- *Neolepidozia* spec.

China (1)
- *hainanensis*

India (1)
- *Neolepidozia* spec.

Indonesia (13)
- *cuneifolia* var. *luxurians*
- *kolombangaraensis*
- *lembangensis*
- *mamillosa*
- *massartiana*
- *papulosa*
- *papulosa* var. *apoensis*
- *papulosa* var. *uniseriata*
- *shevockii*
- *tenera*
- *variifolia*
- *winteri*
- *zantenii*

Japan (2)
- *mamillosa*
- *schaefer-verwimpii*

Malaysia (19)
- *beckeri*
- *bickeri*
- *cameronensis*
- *cuneifolia* var. *luxurians*
- *dulitensis*
- *ingekarolae*
- *katrinae*
- *larutensis*
- *mamillosa*
- *massartiana*
- *ophiria*
- *papulosa*
- *reichardsii*
- *sarawakensis*
- *sarawakensis* var. *grandistipula*
- *sarawakensis* var. *rajaensis*
- *shevockii*
- *tenera*
- *variifolia*

Nepal (1)
- *wallichiana*

Papua New Guinea (12)
- *arauluensis*
- *augustana*
- *cuneifolia*
- *cuneifolia* var. *luxurians*
- *kaindiensis*
- *mamillosa*
- *morobensis*
- *novoguineensis*
- *panayensis*
- *schusteri*
- *streimannii*
- *variifolia* var. *kairuruensis*

Philippines (25)
- *cuneifolia*
- *cuneifolia* fo. *biloba*
- *dinagatensis*
- *hamiguitanensis*
- *kasudsuranensis*
- *larutensis*
- *limbawonensis*
- *lungaensis*
- *massartiana*
- *ophiria*
- *palawanensis*
- *panayensis*
- *papulosa*
- *papulosa* var. *apoensis*
- *papulosa* var. *kalatunganensis*
- *papulosa* var. *uniseriata*
- *philippinensis*
- *salasii*
- *sarawakensis* var. *grandistipula*
- *richardsii*
- *shevockii*
- *tangkulanensis*
- *tenera*
- *variifolia*
- *yorongii*

Singapore (1)
- *mamillosa*

Solomon Islands (2)
- *kolombangaraensis*
- *solomonensis*

Sri Lanka (2)
- *papulosa*
- *papulosa* var. *plumula*

Taiwan (5)
- *schaefer-verwimpii*
- *massartiana*
- *panayensis*
- *papulosa* var. *sakuraii*
- *sarawakensis* var. *grandistripula*

Thailand (5)
- *bickeri*
- *cameronensis*
- *schaefer-verwimpii*
- *parvula*
- *shevockii*

Vietnam (1)
- *Neolepidozia* spec.

Table 2: Distribution of *Neolepdiozia* species in East, South, and South East Asia based on our current studies

- *variifolia* (18)
- *papulosa* (16)
- *massartiana* (10)
- *shevockii* (10)
- *cuneifolia* var. *luxurians* (8)
- *papulosa* var. *sakuraii* (8)
- *mamillosa* (7)
- *tenera* (7)
- *variifolia* var. *kairuruensis* (7)
- *panayensis* (6)
- *cuneifolia* (5)
- *bickeri* (4)
- *sarawakensis* var. *grandistipula* (4)
- *schaefer-verwimpii* (4)
- *ophiria* (4)
- *dulitensis* (3)
- *morobensis* (3)
- *papulosa* var. *uniseriata* (3)
- *arauluensis* (2)
- *augustana* (2)
- *cameronensis* (2)
- *cuneifolia* fo. *biloba* (2)
- *hamiguitanensis* (2)
- *kolombangaraensis* (2)
- *larutensis* (2)
- *novoguineensis* (2)
- *papulosa* var. *apoensis* (2)
- *papulosa* var. *kalatunganensis* (2)
- *parvula* (2)
- *richardsii* (2)
- *samoaensis* (2)
- *sarawakensis* var. *rajaensis* (2)
- *schusteri* (2)
- *streimannii* (2)
- *beckeri* (1)
- *dinagatensis* (1)
- *ingekarolae* (1)
- *kaindiensis* (1)
- *kasudsuranensis* (1)
- *katrinae* (1)
- *lembangensis* (1)
- *limbawonensis* (1)
- *lungaensis* (1)
- *palawanensis* (1)
- *papulosa* var. *plumula* (1)
- *philippinensis* (1)
- *salasii* (1)
- *sarawakensis* (1)
- *richardsii* (1)
- *solomonensis* (1)
- *tangkulanensis* (1)
- *wallichiana* (1)
- *winteri* (1)
- *yorongii* (1)
- *zantenii* (1)

Table 3: Number of studied specimens per taxon

10. Conclusion

As already mentioned above the genus *Neolepidozia* is by far much more diverse as it was understood before and further new species are expected to be found.

Even the examination of previously identified specimens considerably expanded the range of species. One of the most important findings is that *N. wallichiana* is an extremely rare species. Existing identifications as *N. wallichiana* need to be reviewed. New identifications as *N. wallichiana* require a thorough comparison with the type material and descriptions.

Genetic studies are recommended to verify the proposed species concept, both to improve the circumscription of the species and to better understand the relationships between them. Previous sequencing, especially of *N. wallichiana*, should only be used after the relevant specimens have been revised.

Based on morphological characteristics, at least some relationships have become clear. *N. mamillosa* stands alone among the *Neolepidozia* species. The mamillose cells of the perianth, the strongly constricted cells of the leaf lobes, the bulging cells of the stem hyalodermis, but also its specific environment in mangrove forests where this species can be found, make it unique. The future establishment of a new genus is not unlikely.

As mentioned above, *N. dulitensis* mediates towards *Tricholepidozia*, e.g. to *T. fissifolia* or *T. lindenbergii* var. *complanata*. The strongly flattened growth form, the uniseriate branch leaf lobes, and the leaves divided almost to the middle are characteristic of this. HÜRLIMANN (1985) already pointed out similarities to certain *Neolepidozia* forms.

The position of *N. yorongii* is equally isolated. The rounded, fragile cells have not been observed in this form in any of the other *Neolepidozia* species. Fragile leaves with similar cell pattern can also be observed in the genus *Ceramanus*. Species of this genus develop a granular layer on their cell surface that will give the plants a whitish appearance. Even though we did not observe a granular layer on the cells in *N. yorongii*, there might be relations to *Ceramanus*.

There are also species that are similar to *Kurzia*, e.g., *N. katrinae*, *N. parvula*, and *N. richardsii*. Even though the morphological characteristics show some similarities, it is currently not possible to make any statements about the relationship between these species or to *Kurzia*.

It is difficult to find further groupings within the genus. Although species can be distinguished morphologically by symmetrical and asymmetrical branch leaves, it is not possible to draw any conclusions about the relationship between and within these groups. The variability of individual species tends to point against leaf symmetry representing phylogenetic relationships.

Future research should focus on studying the remaining types, reviewing the numerous specimens still available in various herbaria, and conducting genetic studies. Based on these studies, as well as those by ENGEL & MERRILL (2004), a study of American species of this genus is recommended.

11. Acknowledgments

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Plates

Comparison plate species with fragile branch leaves

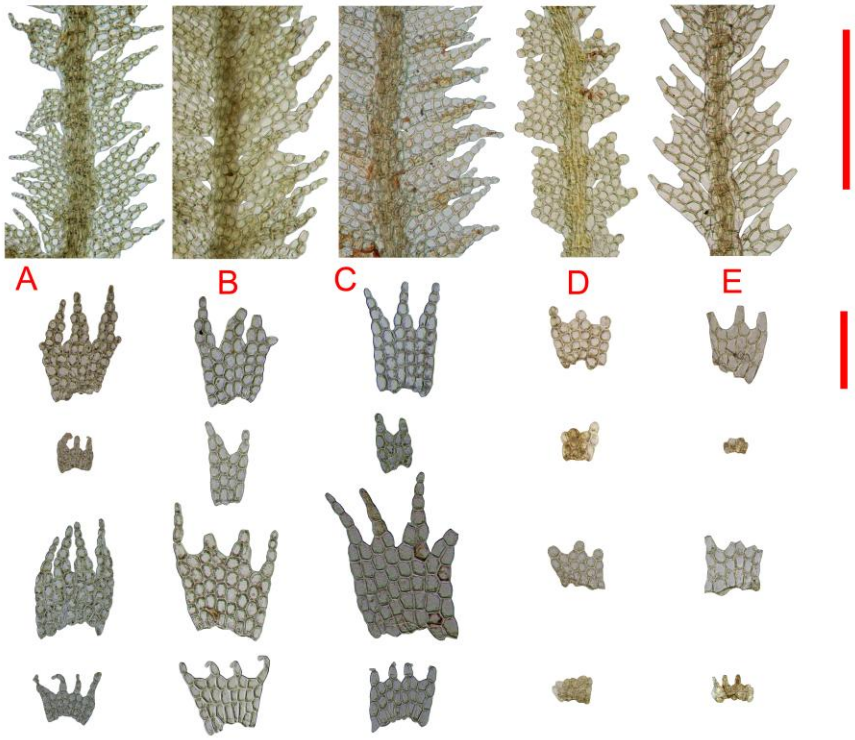

Plate 1: From top to bottom – branch ventral, branch leaf, branch underleaf, stem leaf, stem underleaf of A – *N. streimannii*, B – *N. arauluensis*, C – *N. schusteri,* D – *N. yorongii*, E – *N. philippinensis*; Scales: for ventral branches – 0.5 mm; for all leaves – 0.2 mm (from the specimen mentioned at the respective plates)

Comparison plate *Kurzia* habitus (A – C), uniseriate branch leaf lobes (D – I), irregular branch leaves (J – P)

Plate 2: From top to bottom – branch ventral, branch leaf, branch underleaf, stem leaf, stem underleaf of A – *N. parvula*, B – *N. katrinae*, C – *N. richardsii,* D – *N. ophiria*, E – *N. dulitensis*, F – *N. wallichiana*, G – *N. dinagatensis,* H – *N. papulosa* var. *uniseriata*, I – *N. papulosa* var. *kalatunganensis*, J – *N. lungaensis*, K – *N. lembangensis*, L – *N. novoguineensis*, M – *N. shevockii*, N – *N. limbawonensis*, O – *N. massartiana*, P – *N. cuneifolia* fo. *biloba*; Scales: for ventral branches – 0.5 mm; for all leaves – 0.2 mm (from the specimen mentioned at the respective plates)

Comparison plate of species with asymmetric branch leaves

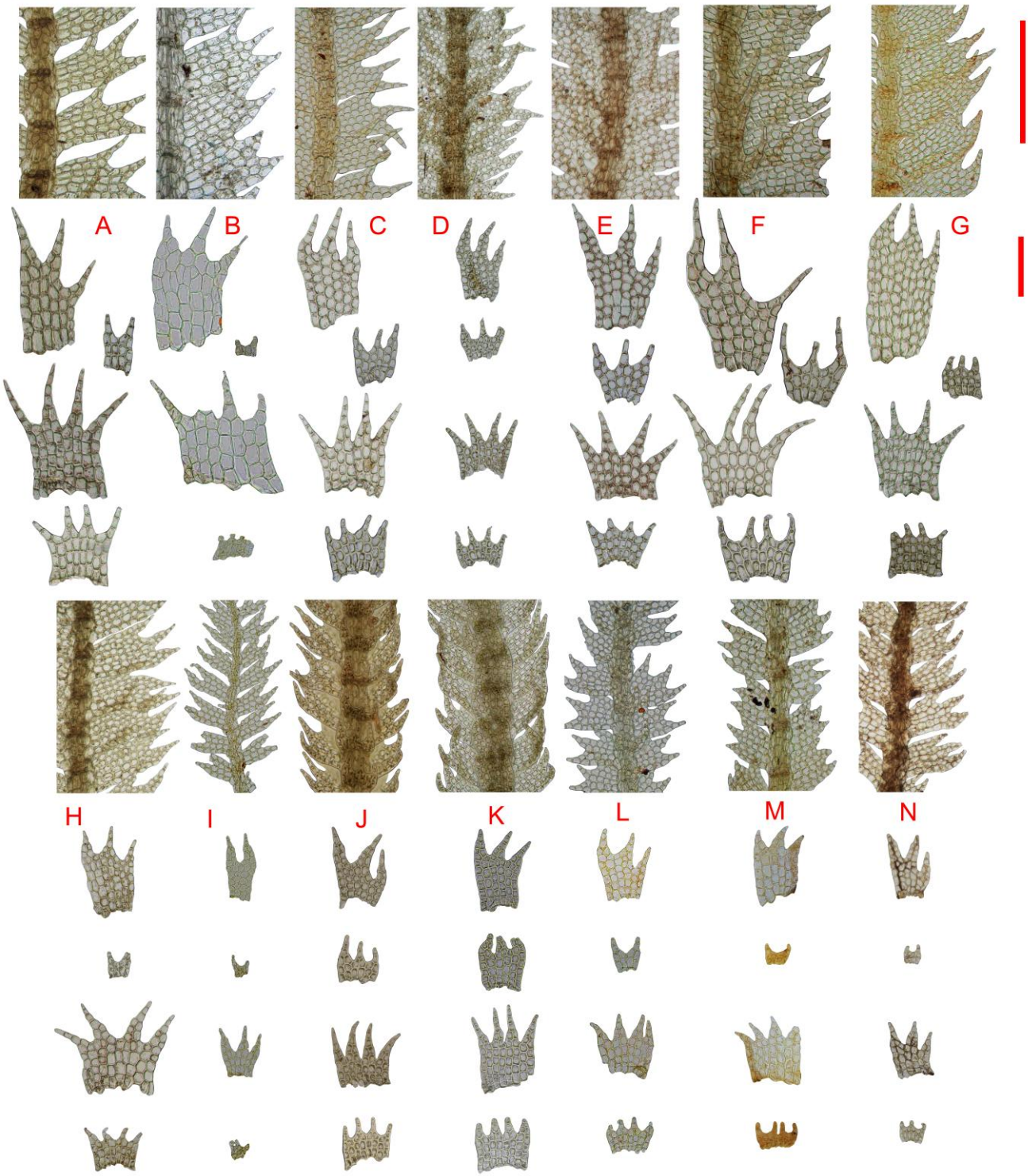

Plate 3: From top to bottom – branch ventral, branch leaf, branch underleaf, stem leaf, stem underleaf of A – *N. augustana*, B – *N. zantenii*, C – *N. palawanensis,* D – *N. variifolia*, E – *N. variifolia* var. *kairuruensis*, F – *N. solomonensis*, G – *N. cuneifolia* var. *luxurians*, H – *N. cuneifolia*, I – *N. cuneifolia* fo. *biloba*, J – *N. hamiguitanensis*, K – *N. beckeri*, L – *N. kolombangaraensis*, M – *N. schaefer-verwimpii*, N – *N. kasudsuranensis*; Scales: for ventral branches – 0.5 mm; for all leaves – 0.2 mm (from the specimen mentioned at the respective plates)

Comparison plate of species with bilobate leaves (A – C), deeply divided leaves (D – H), and large branch leaves (I – O)

Plate 4: From top to bottom – branch ventral, branch leaf, branch underleaf, stem leaf, stem underleaf of A – *N. cuneifolia* fo. *biloba*, B – *N. ingekarolae*, C – *N. cameronensis,* D – *N. streimannii*, E – *N. lembangensis*, F – *N. novoguineensis*, G – *N. shevockii*, H – *N. winteri*, I – *N. kaindiensis*, J – *N. papulosa* var. *plumula*, K – *N. papulosa* var. *sakurai*, L – *N. sarawakensis* var. *rajaensis*, M – *N. sarawakensis*, N – *N. sarawakensis* var. *grandistipula*, O – *N. larutensis*; Scales: for ventral branches – 0.5 mm; for all leaves – 0.2 mm (from the specimen mentioned at the respective plates)

Comparison plate of species with symmetric, shallowly divided branch leaves

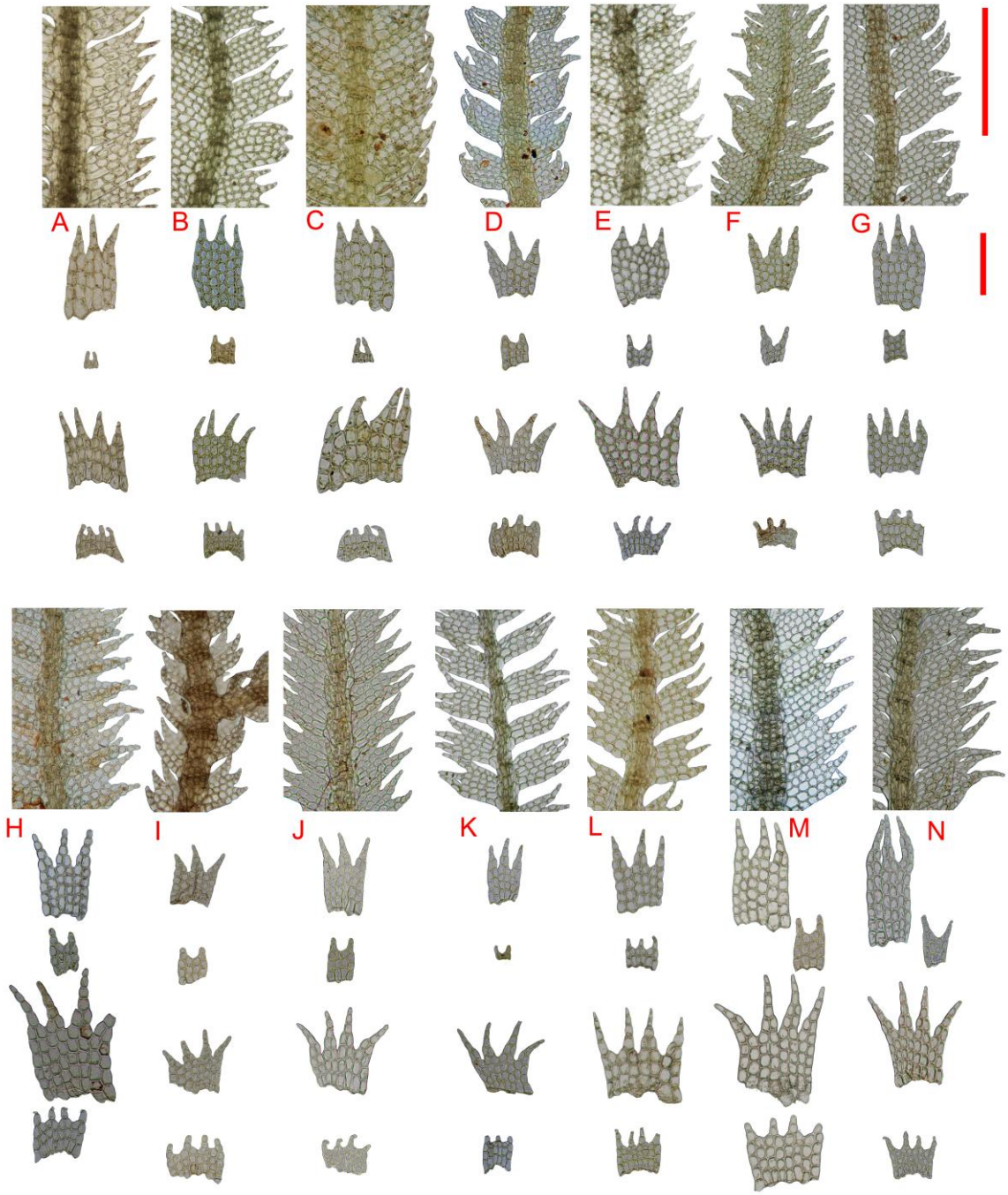

Plate 5: From top to bottom – branch ventral, branch leaf, branch underleaf, stem leaf, stem underleaf of A – *N. panayensis*, B – *N. bickeri*, C – *N. salasii,* D – *N. limbawonensis*, E – *N. schaefer-verwimpii*, F – *N. morobensis*, G – *N. tangkulanensis*, H – *N. schusteri*, I – *N. massartiana*, J – *N. papulosa*, K – *N. papulosa* var. *apoensis*, L – *N. papulosa* var. *sakuraii*, M – *N. tenera*, N – *N. larutensis*; Scales: for ventral branches – 0.5 mm; for all leaves – 0.2 mm (from the specimen mentioned at the respective plates)

***Neolepidozia arauluensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

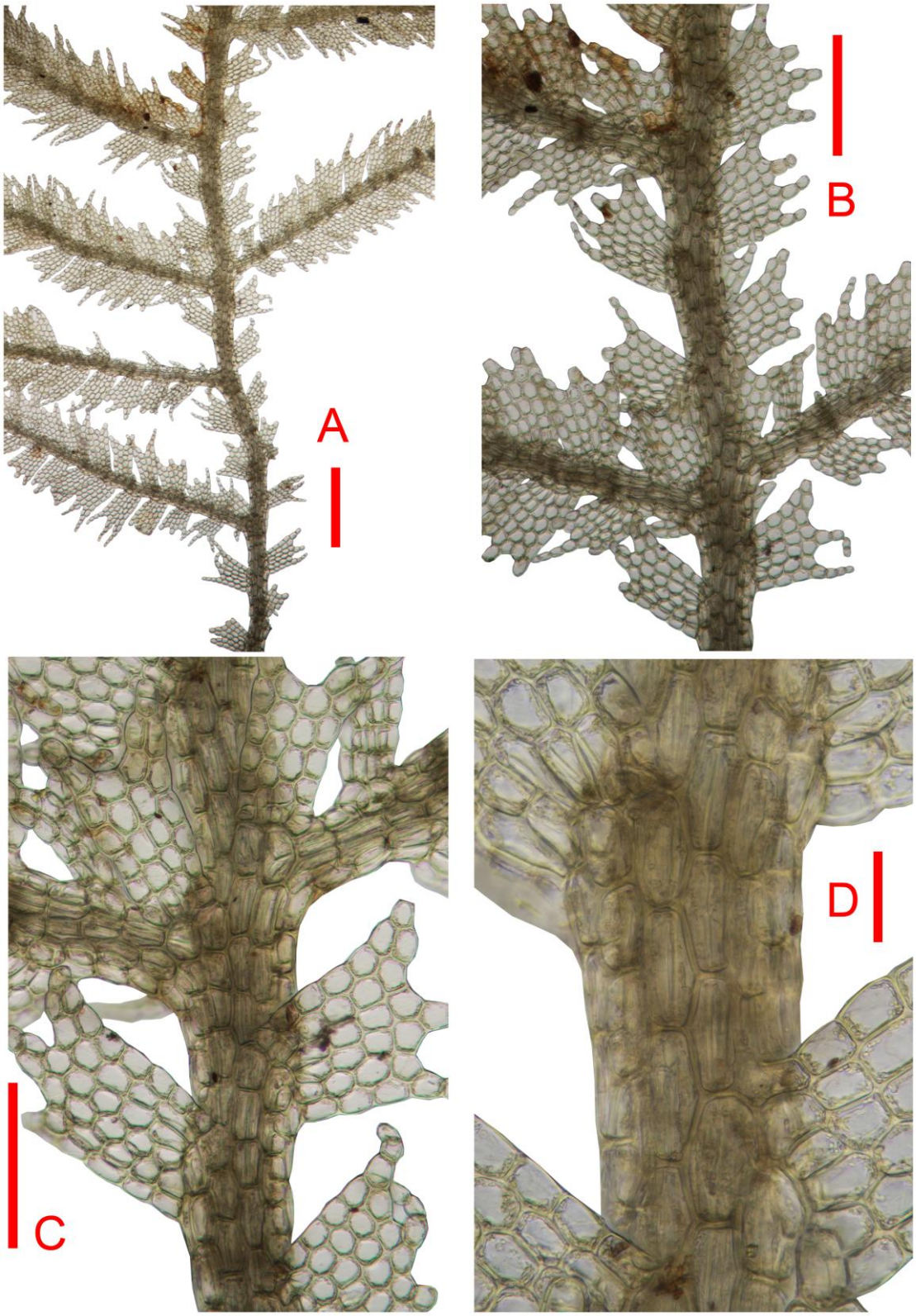

Plate 6: *Neolepidozia arauluensis*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from STREIMANN 13611, JE – holotype)

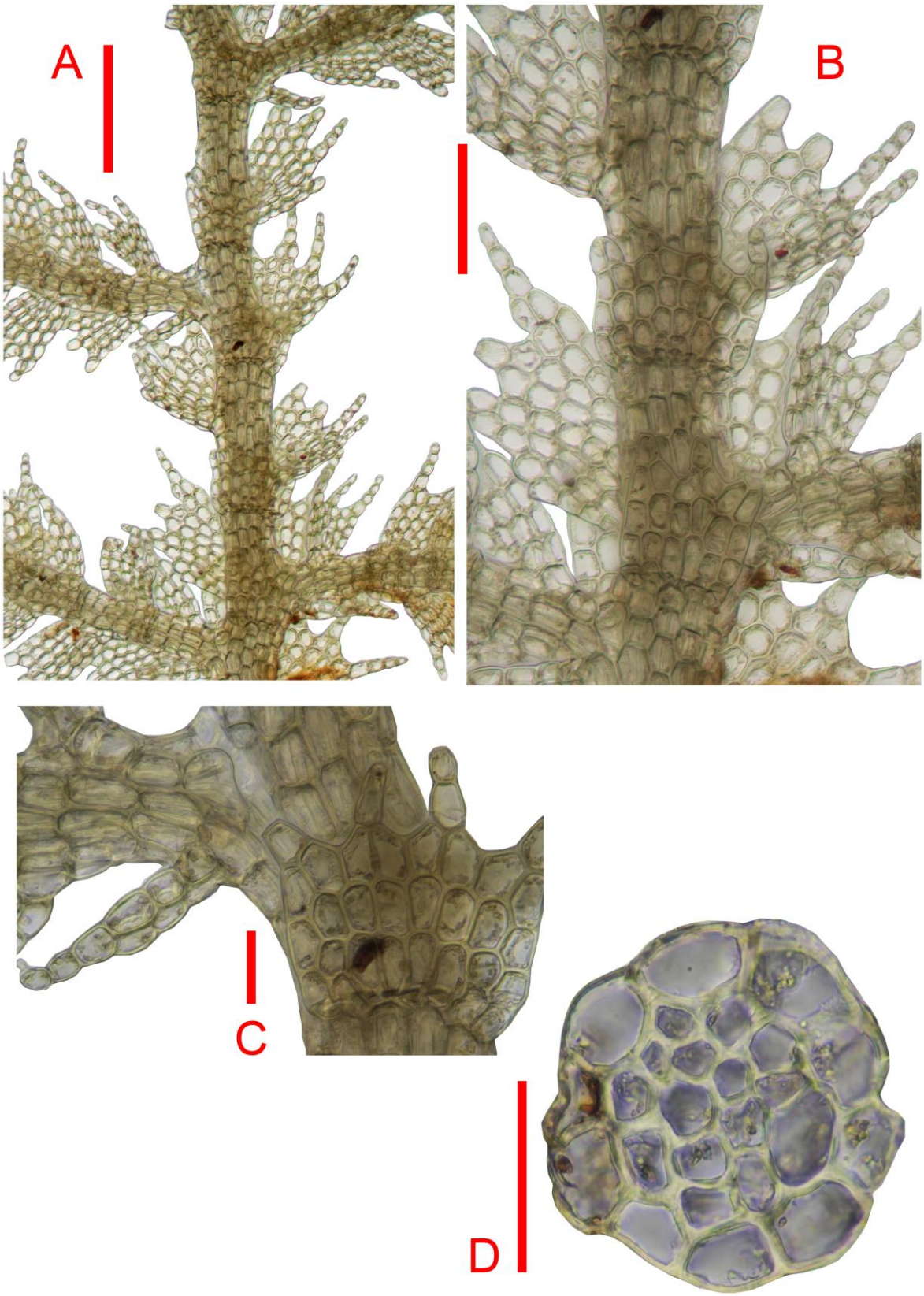

Plate 7: *Neolepidozia arauluensis*: A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from STREIMANN 13611, JE - holotype)

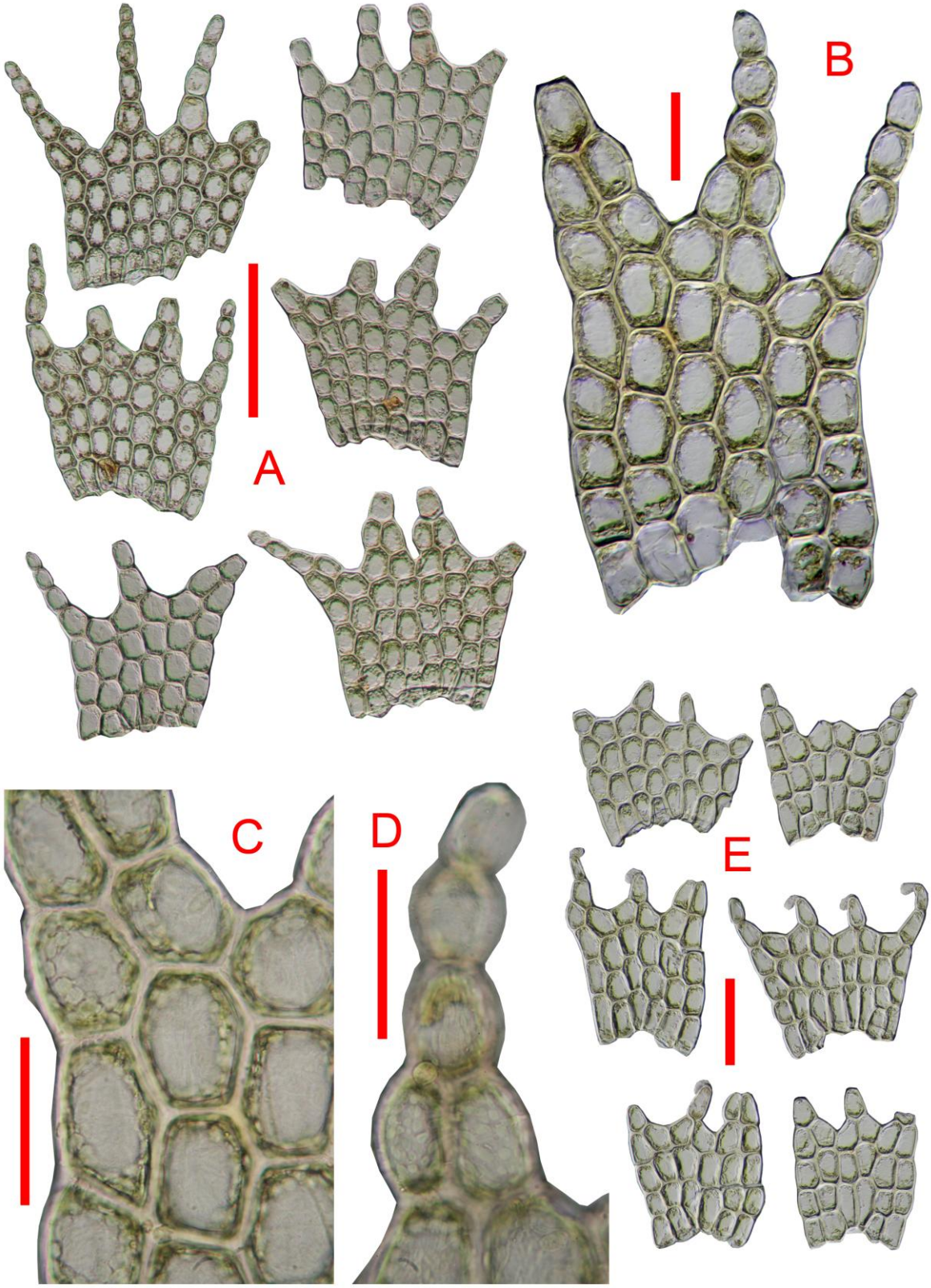

Plate 8: *Neolepidozia arauluensis*: A, B – Stem leaves, C – Stem leaf disc, D – Stem leaf lobe, E – Stem underleaves; Scales: A – 0.2 mm; B, C, D – 50 µm; E – 0.1 mm (from STREIMANN 13611, JE - holotype)

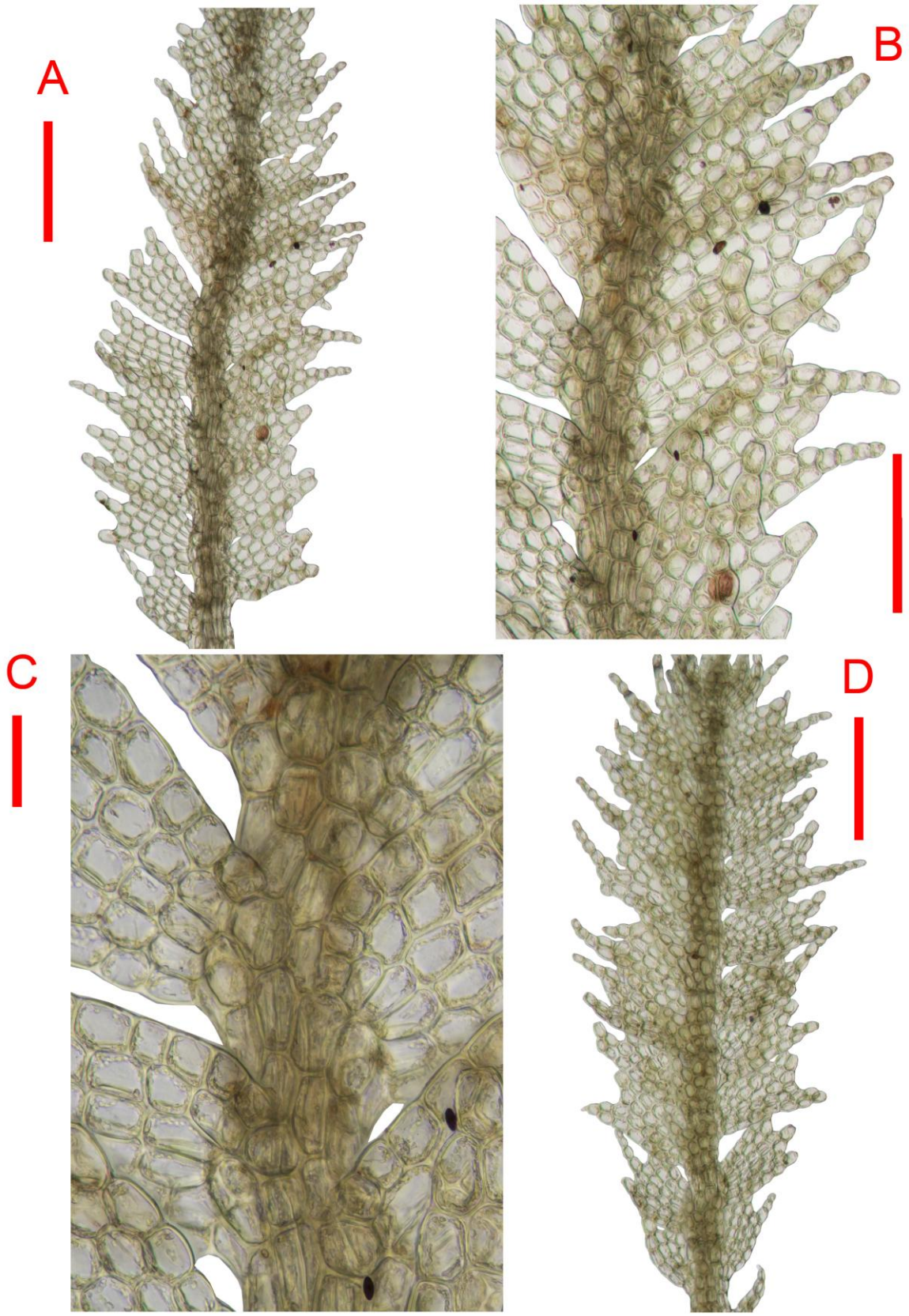

Plate 9: *Neolepidozia arauluensis*: A, B, C – Branch dorsal, D – Branch ventral; Scales: A, D – 0.3 mm; B – 0.2 mm, C – 50 µm (from STREIMANN 13611, JE - holotype)

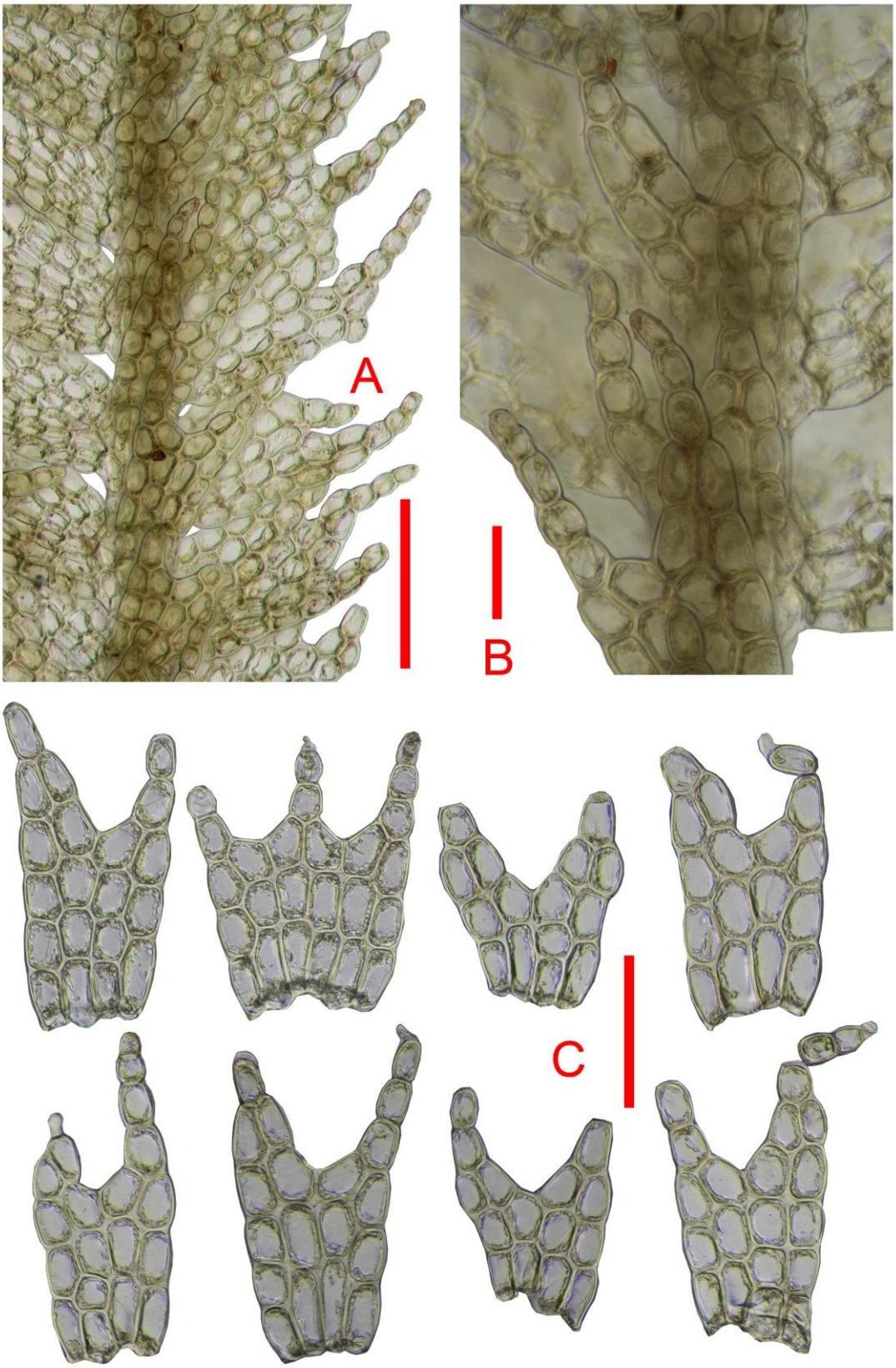

Plate 10: *Neolepidozia arauluensis*: A, B – Branch ventral, C – Branch underleaves; Scales: A – 0.2 mm; B – 50 µm, C – 0.1 mm (from STREIMANN 13611, JE - holotype)

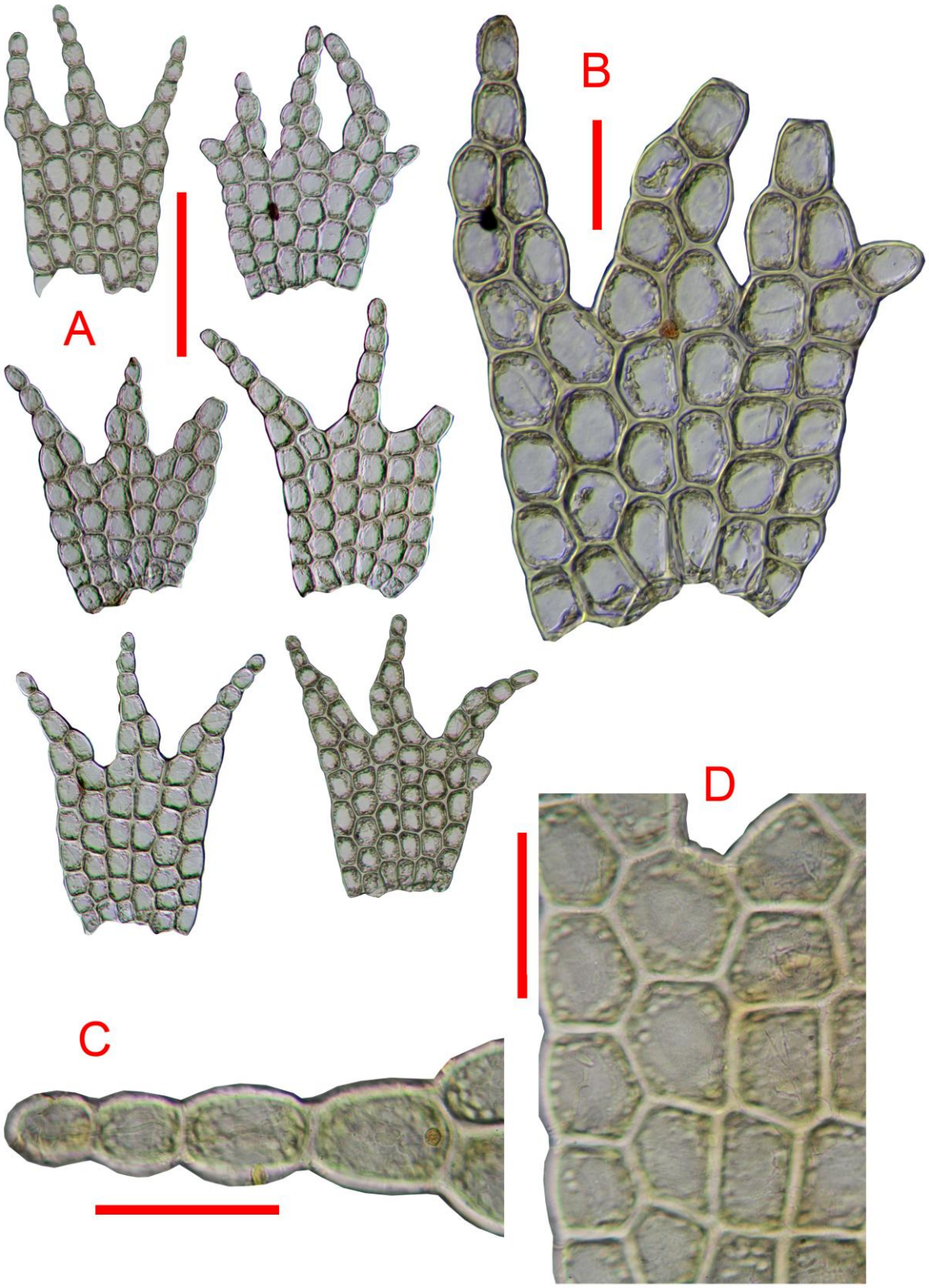

Plate 11: *Neolepidozia arauluensis*: A, B – Branch leaves, C – Branch leaf lobe, D – Branch leaf disc; Scales: A – 0.2 mm; B, C, D – 50 µm (from STREIMANN 13611, JE - holotype)

Neolepidozia augustana (STEPH.) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

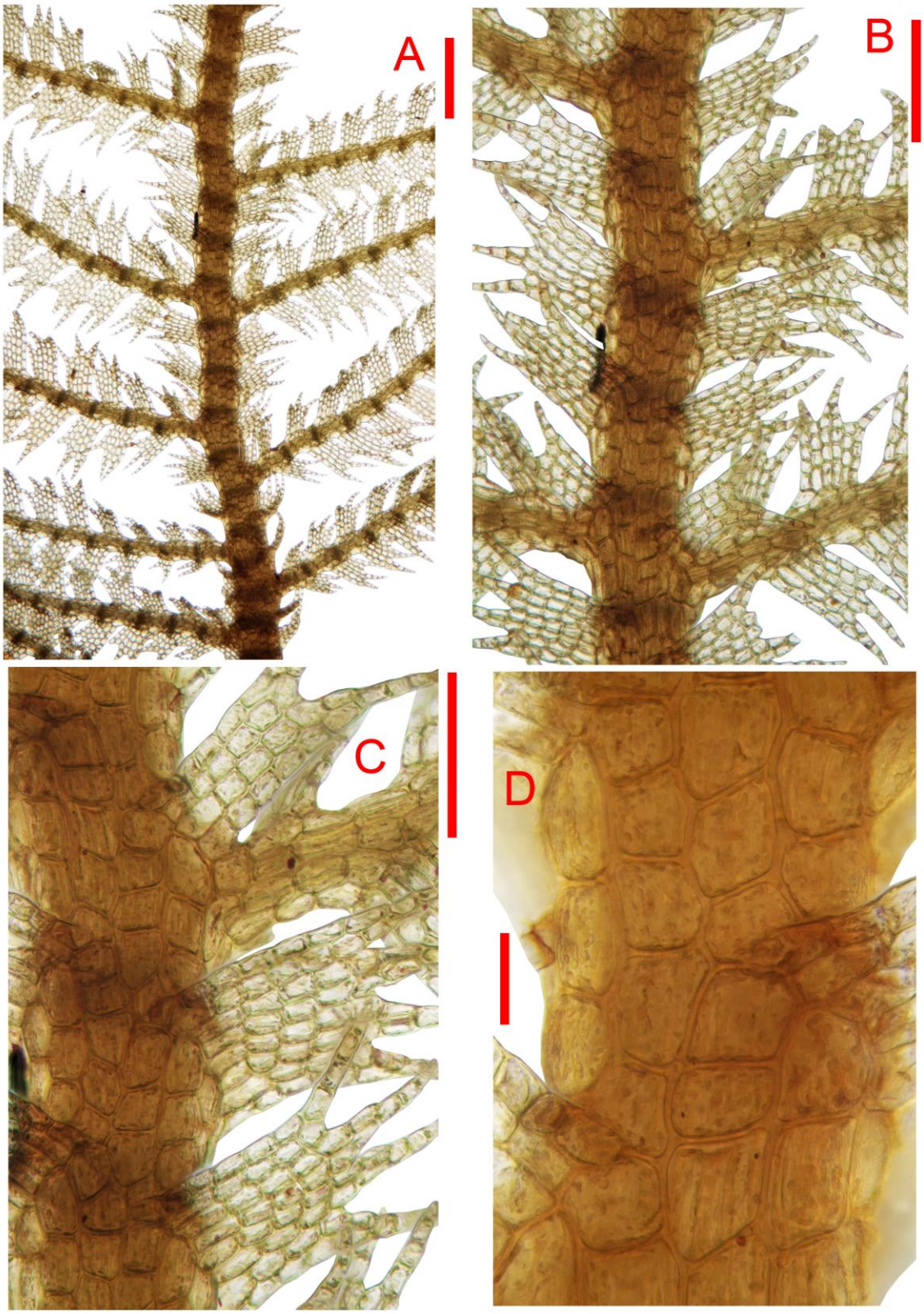

Plate 12: *Neolepidozia augustana*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHULTZE, G 00113399 - holotype)

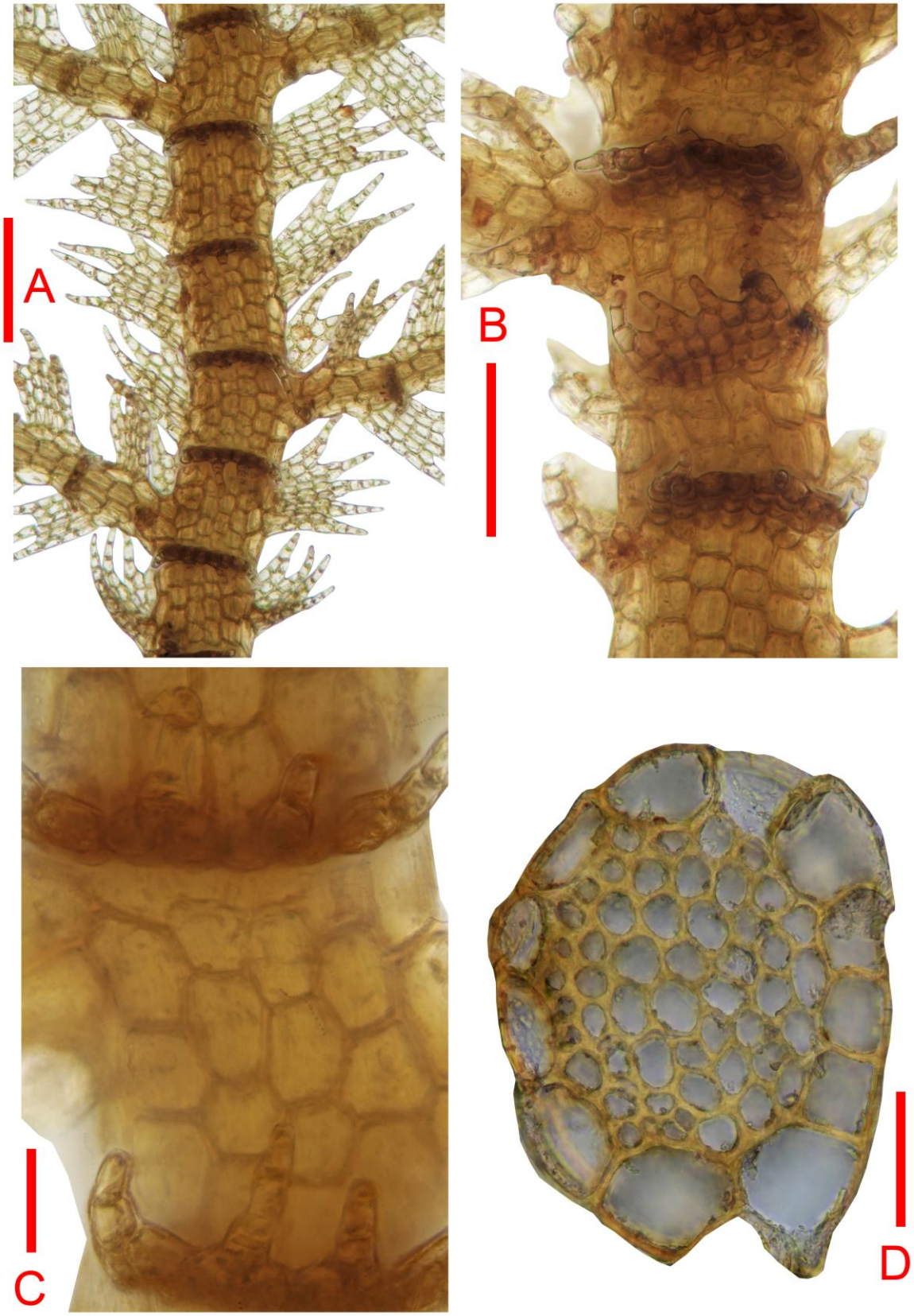

Plate 13: *Neolepidozia augustana*: A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SCHULTZE, G 00113399 - holotype)

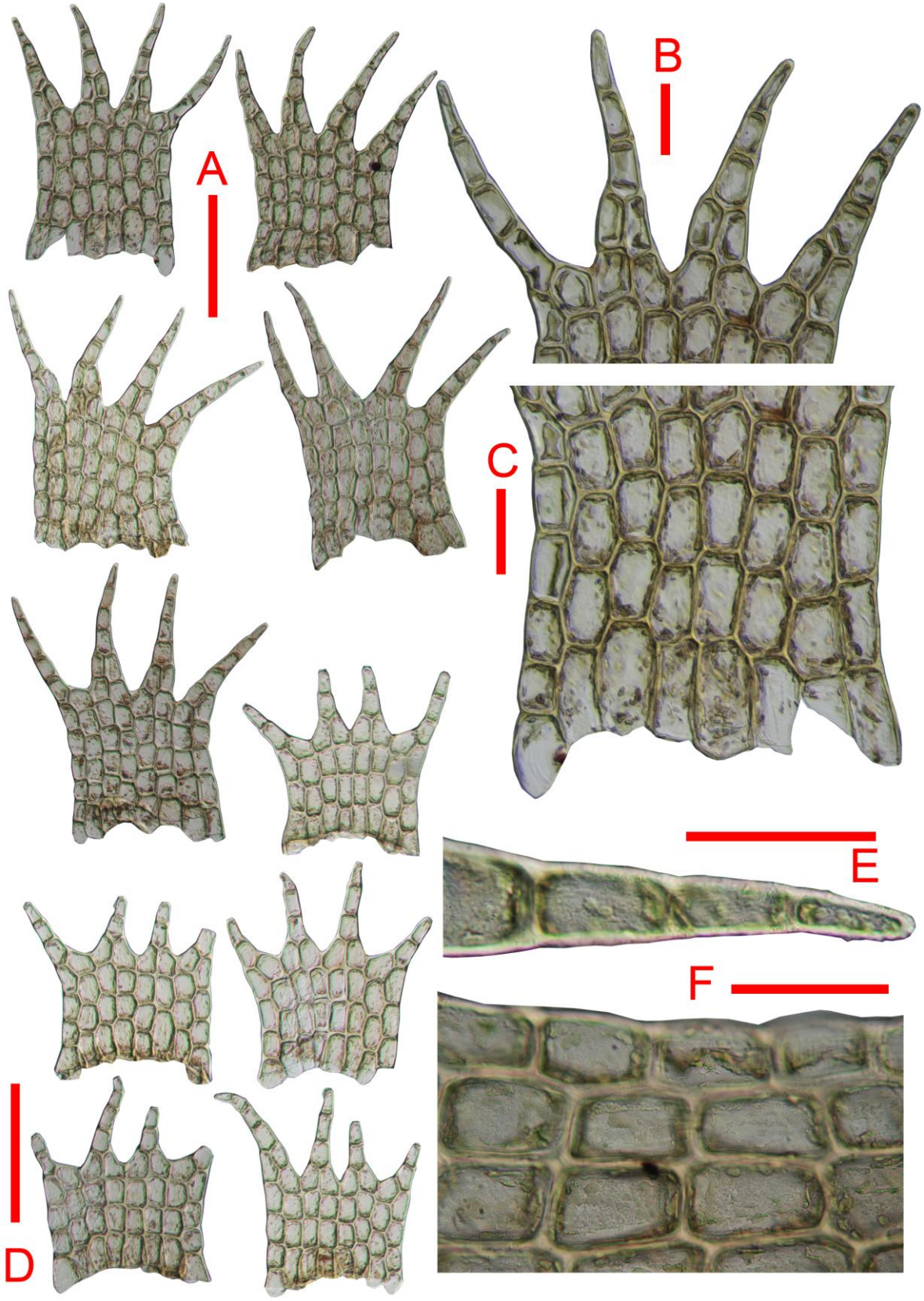

Plate 14: *Neolepidozia augustana*: A – Stem leaves, B, E – Stem leaf lobes, C, F – Stem leaf disc, D – Stem underleaves; Scales: A, D – 0.2 mm; B, C, E, F – 50 µm (from SCHULTZE, G 00113399 - holotype)

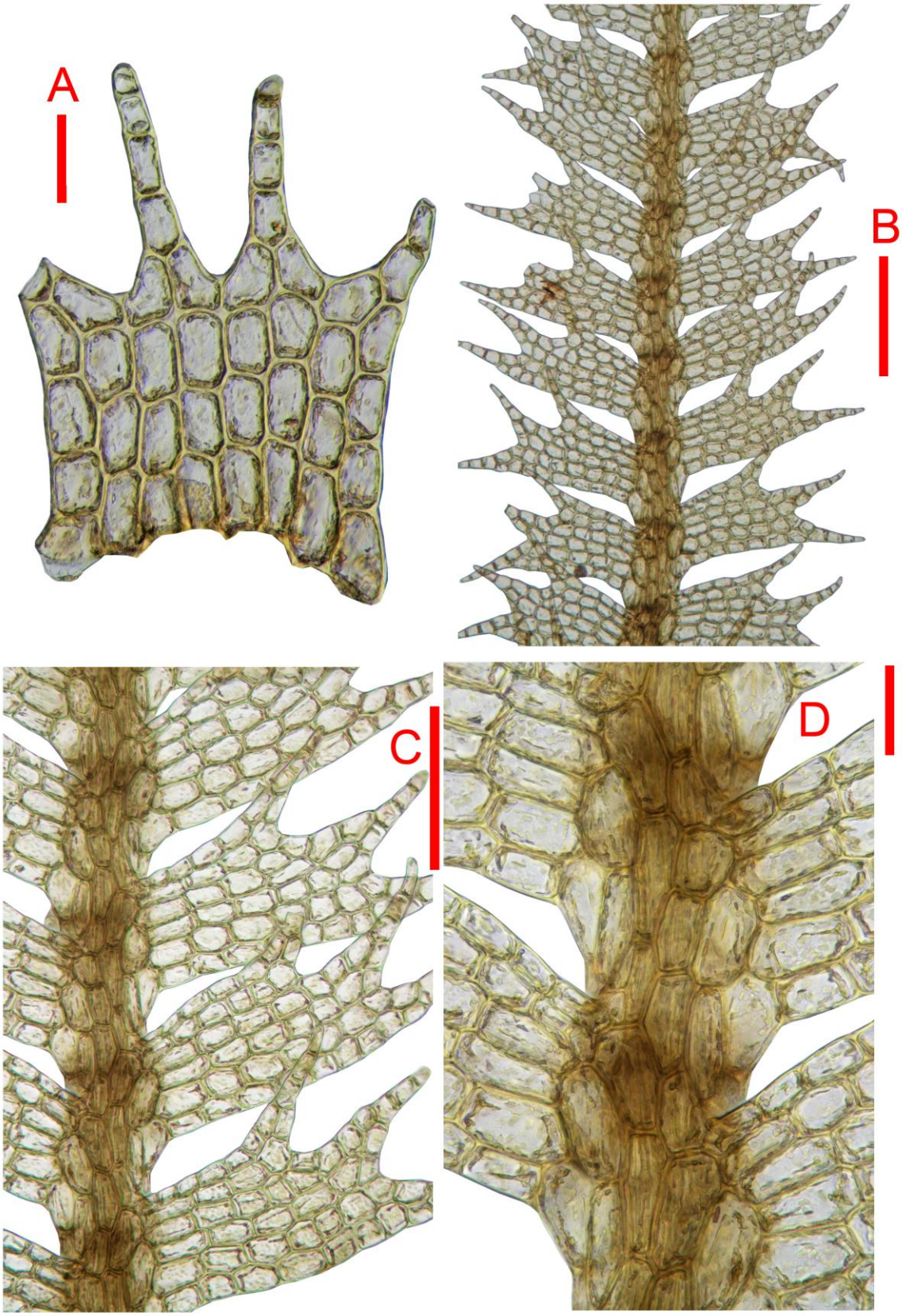

Plate 15: *Neolepidozia augustana*: A – Stem underleaf, B, C, D – Branch dorsal; Scales: B – 0.3 mm; C – 0.2 mm; A, D – 50 µm (from SCHULTZE, G 00113399 - holotype)

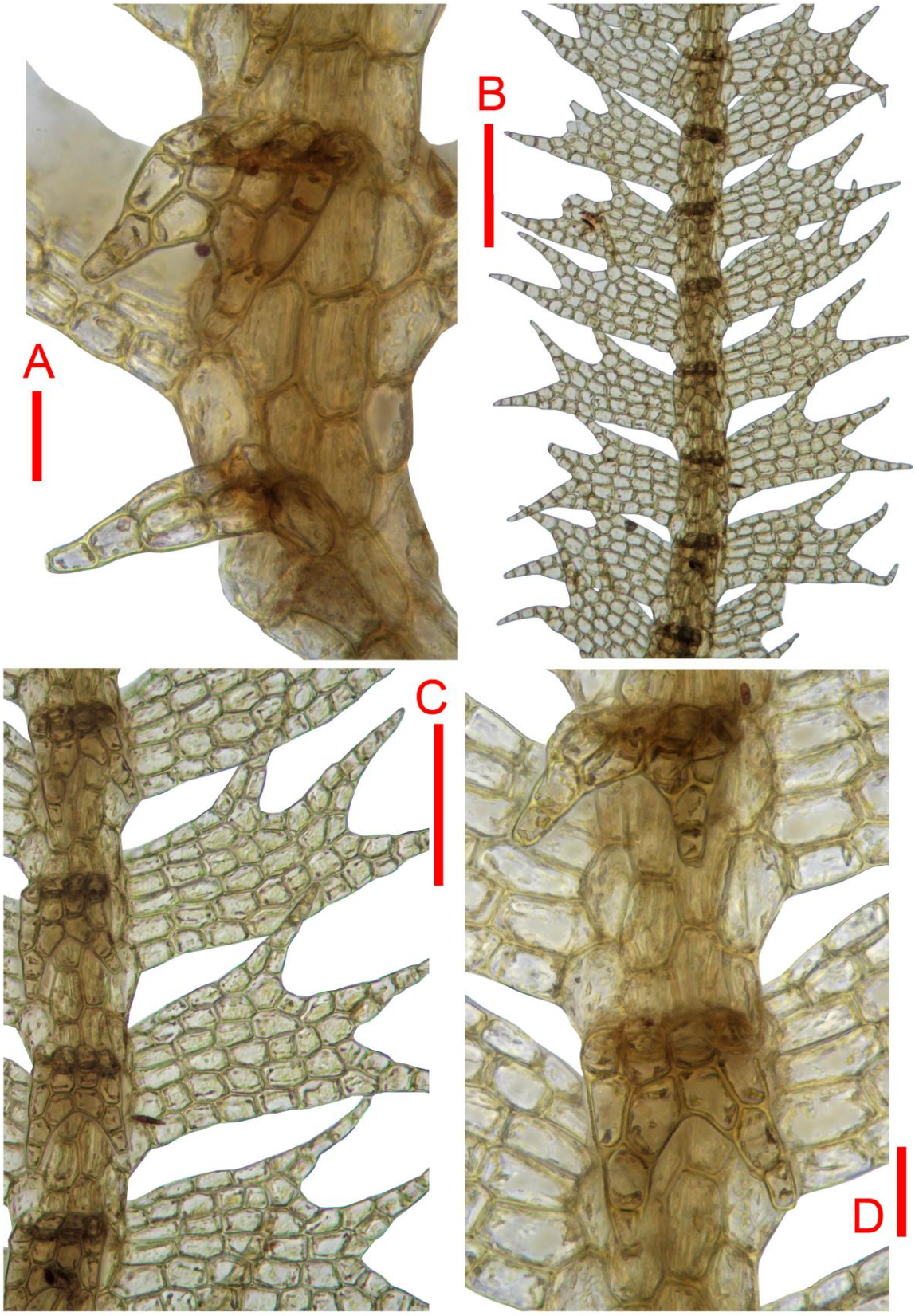

Plate 16: *Neolepidozia augustana*: A – Branch base, B, C, D – Branch ventral; Scales: B – 0.3 mm; C – 0.2 mm; A, D – 50 µm (from SCHULTZE, G 00113399 - holotype)

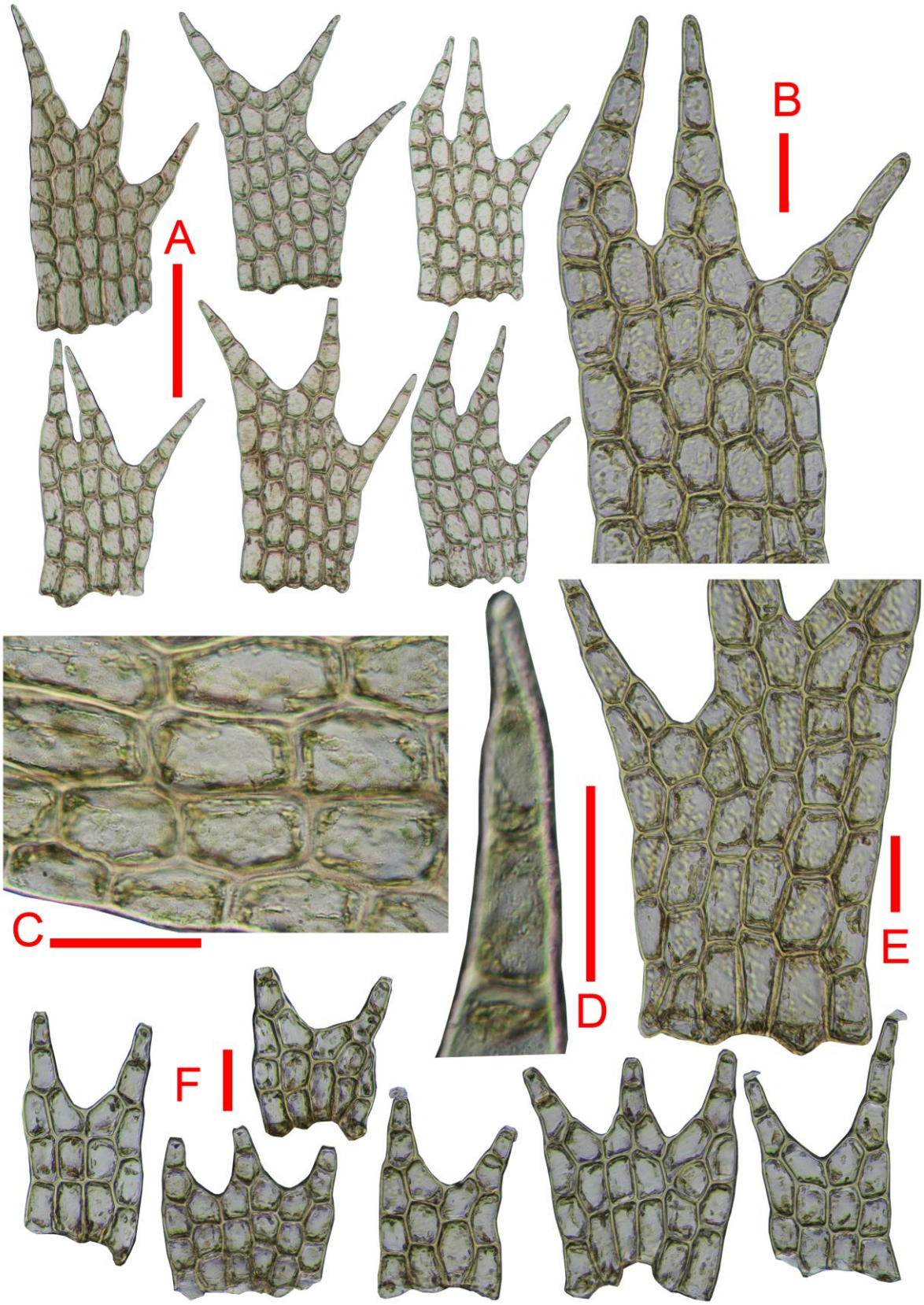

Plate 17: *Neolepidozia augustana*: A – Branch leaf, B, D – Branch leaf lobe, C, E – Branch leaf disc, F – Branch underleaves; Scales: A – 0.2 mm; B, C, D, E, F – 50 µm (from SCHULTZE, G 00113399 - holotype)

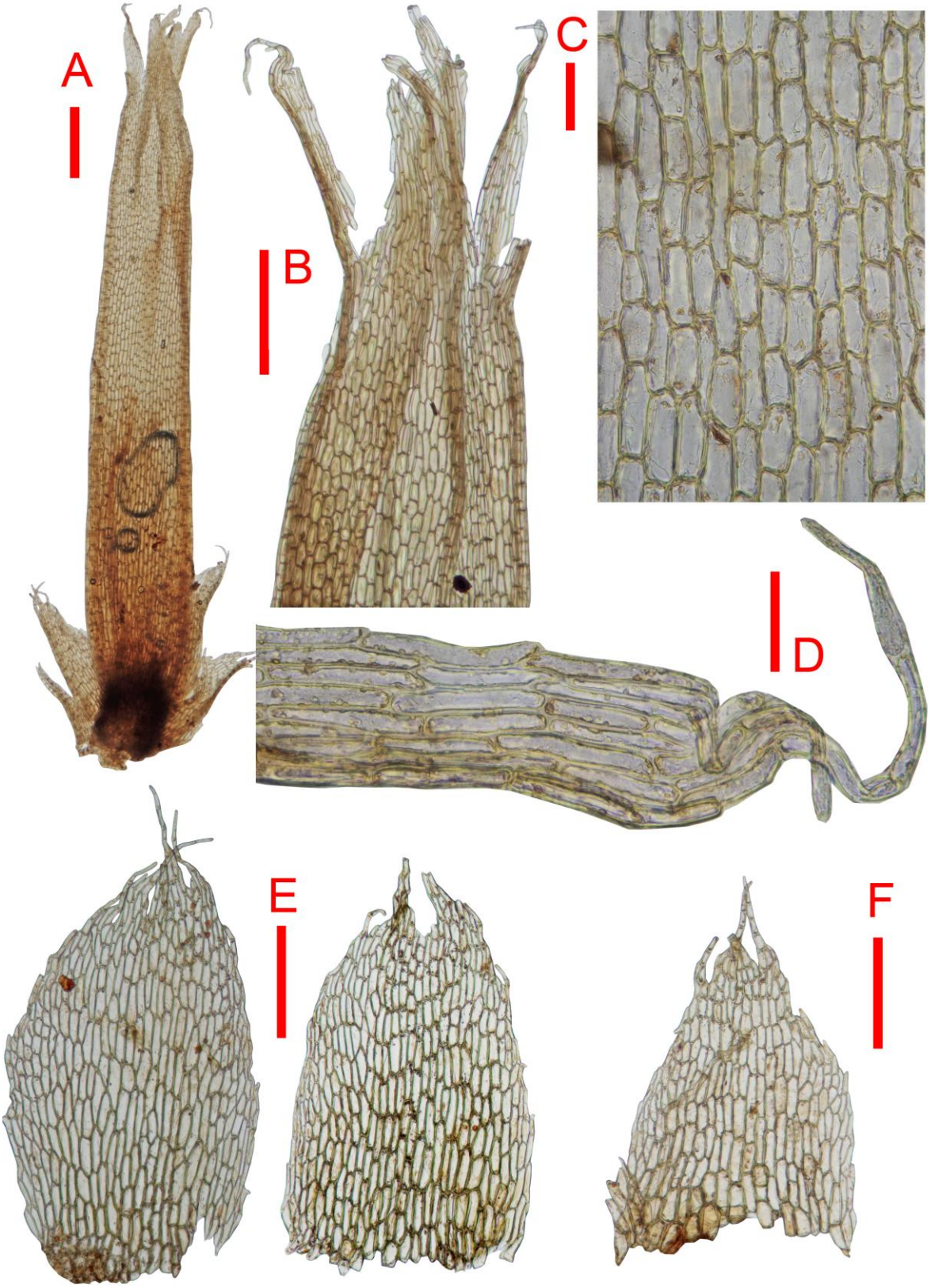

Plate 18: *Neolepidozia augustana*: A – Perianth, B, D – Perianth mouth, C – Median perianth cells, E – Bracts, F - Bracteole; Scales: A – 0.5 mm; B, E, F – 0.3 mm, C, D – 50 µm (from SCHULTZE, G 00113399 - holotype)

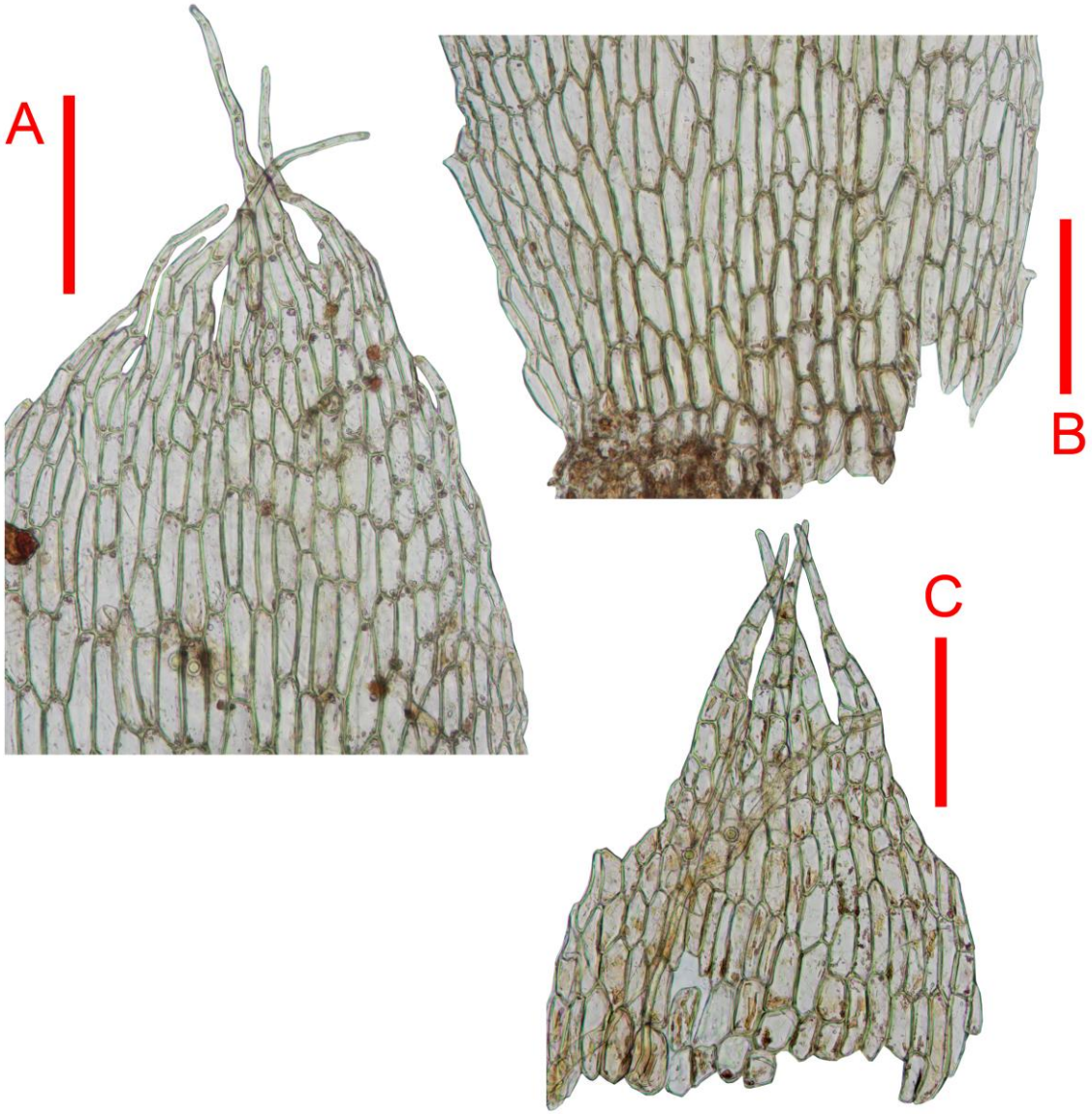

Plate 19: *Neolepidozia augustana*: A – Female bract apex, B – Female bract base, C – Female bracteole; Scales: A, B, C – 0.2 mm (from SCHULTZE, G 00113399 - holotype)

***Neolepidozia beckeri* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

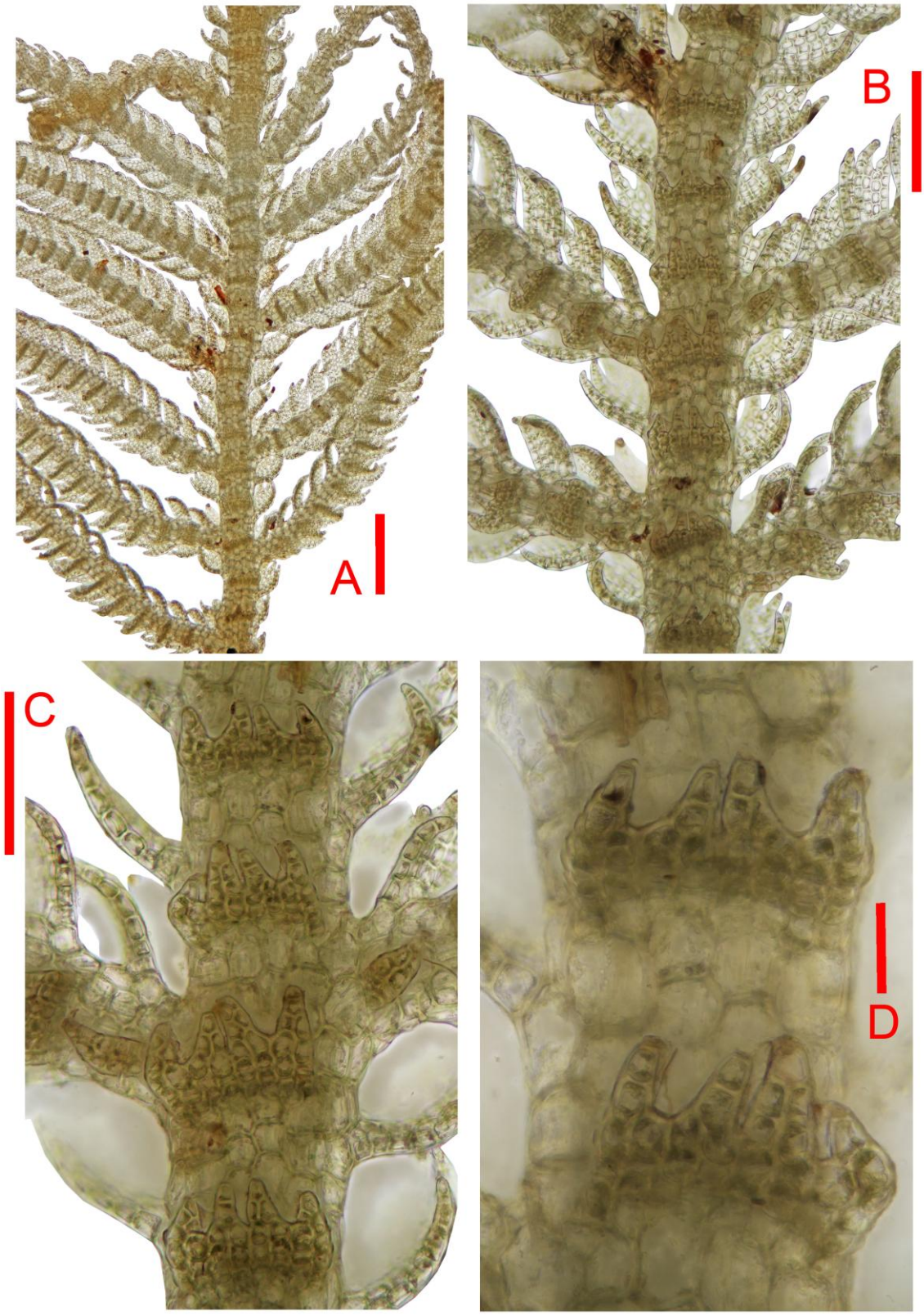

Plate 20: *Neolepidozia beckeri*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from NULL 610 - holotype)

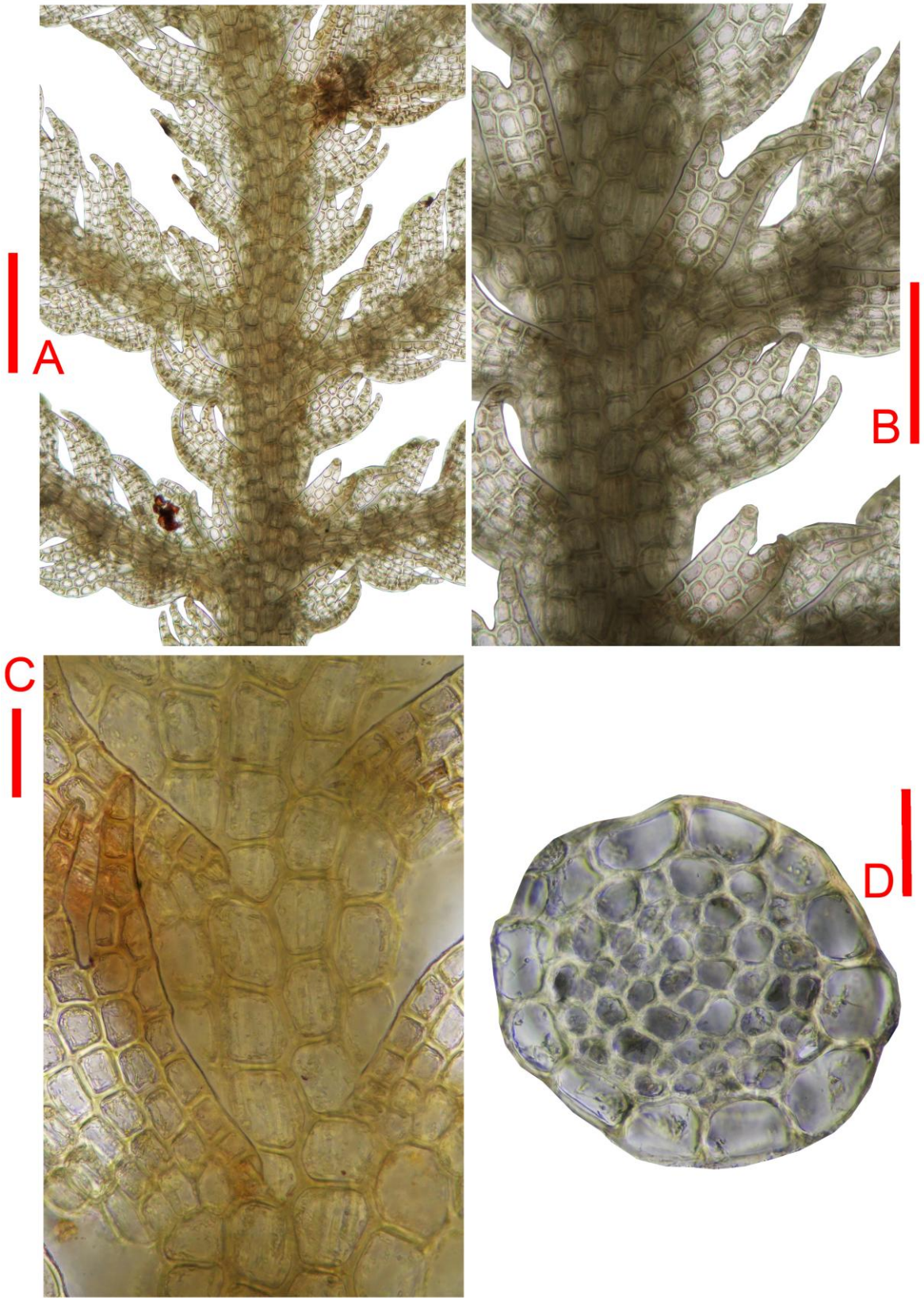

Plate 21: *Neolepidozia beckeri*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from NULL 610 - holotype)

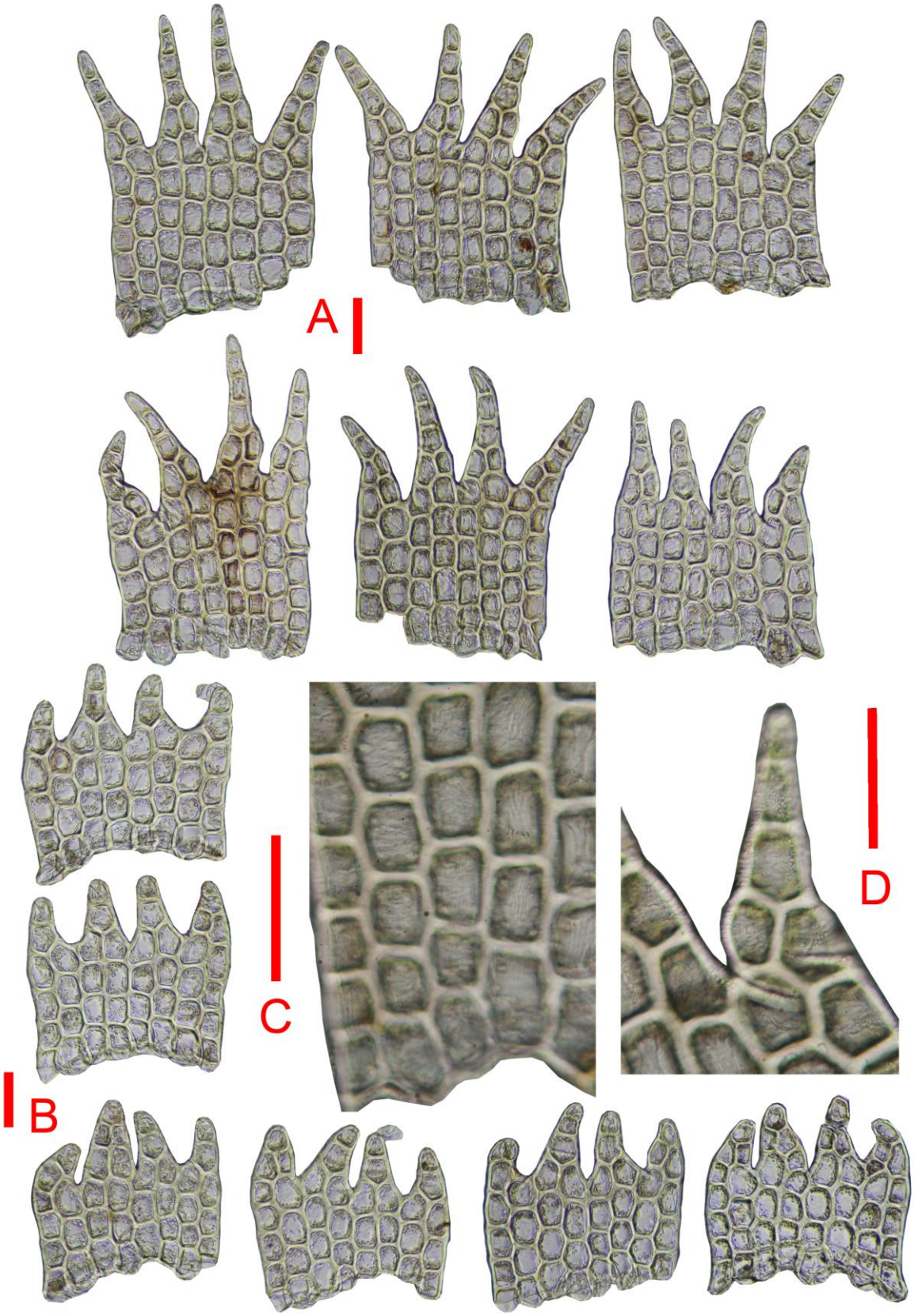

Plate 22: *Neolepidozia beckeri*: A – Stem leaves, B – Stem underleaves, C – Stem leaf disc, D – Stem leaf lobe; Scales: A, B, C, D – 50 µm (from NULL 610 - holotype)

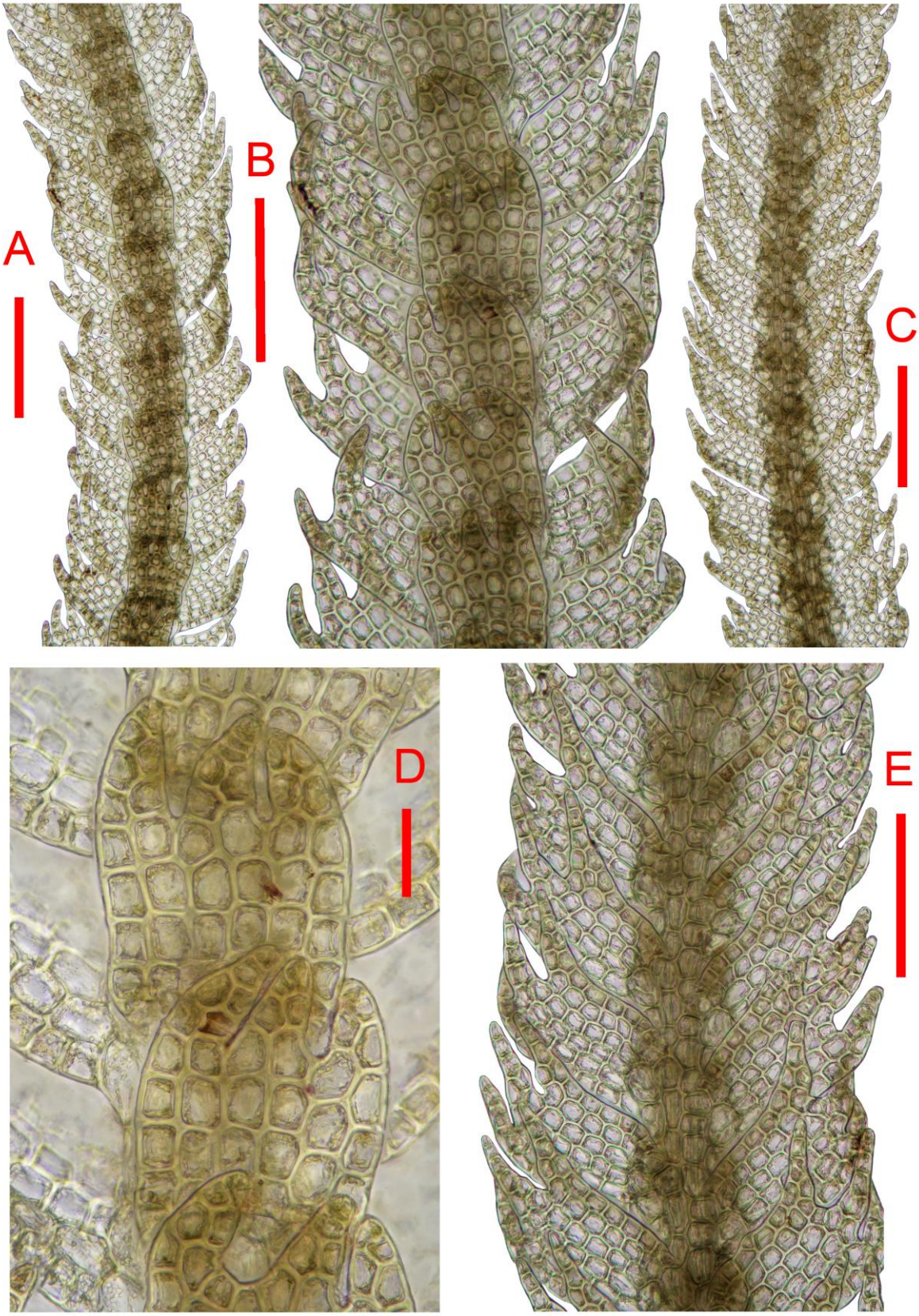

Plate 23: *Neolepidozia beckeri*: A, B, D – Branch ventral, C, E – Branch dorsal; Scales: A, C – 0.3 mm, B, E – 0.2 mm, E – 50 µm (from NULL 610 - holotype)

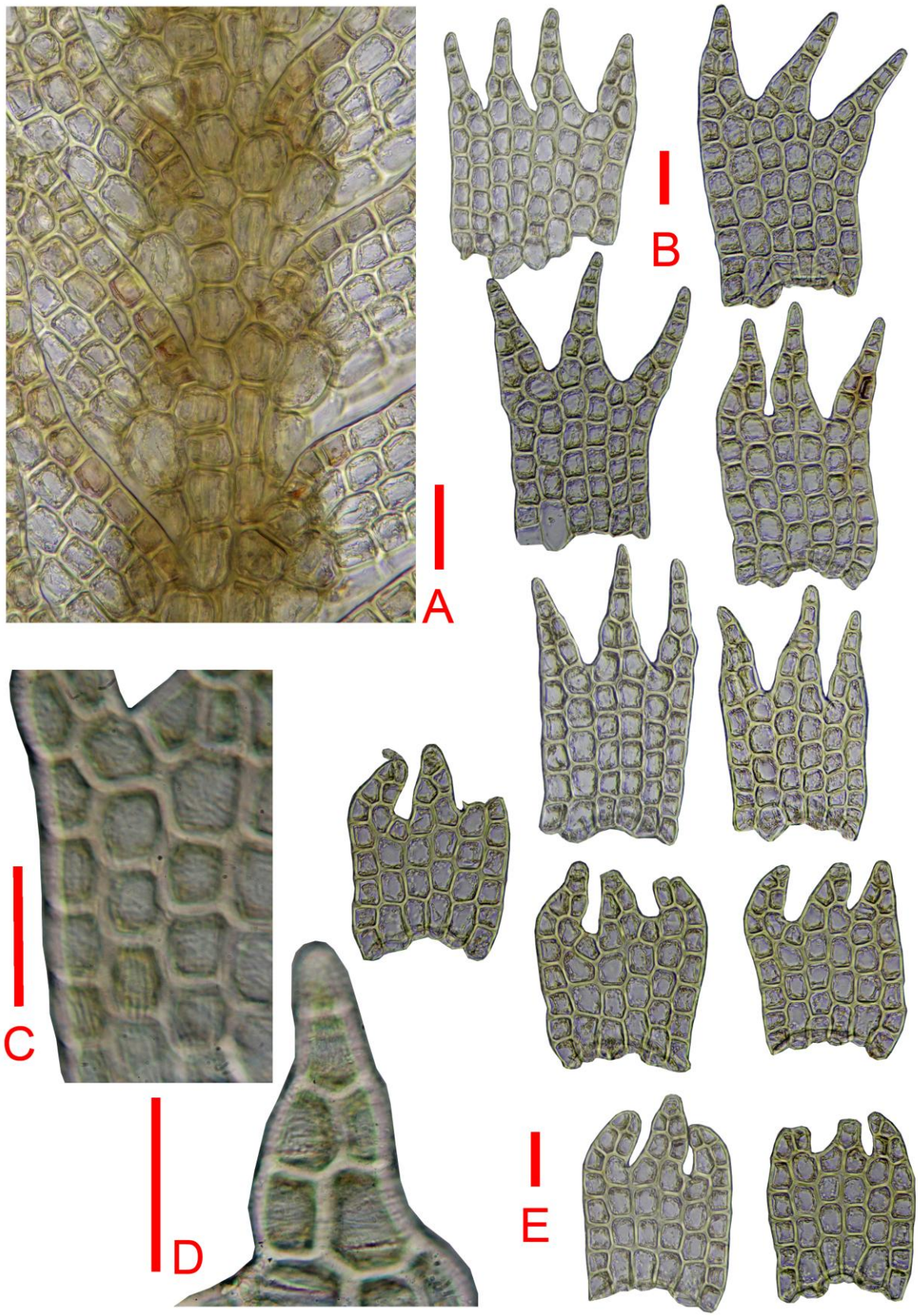

Plate 24: *Neolepidozia beckeri*: A – Branch dorsal, B – Branch leaves, C Branch leaf disc, D – Branch leaf lobe, E – Branch underleaves; Scales: A, B, C, D, E – 50 µm (from NULL 610 - holotype)

Neolepidozia bickeri **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

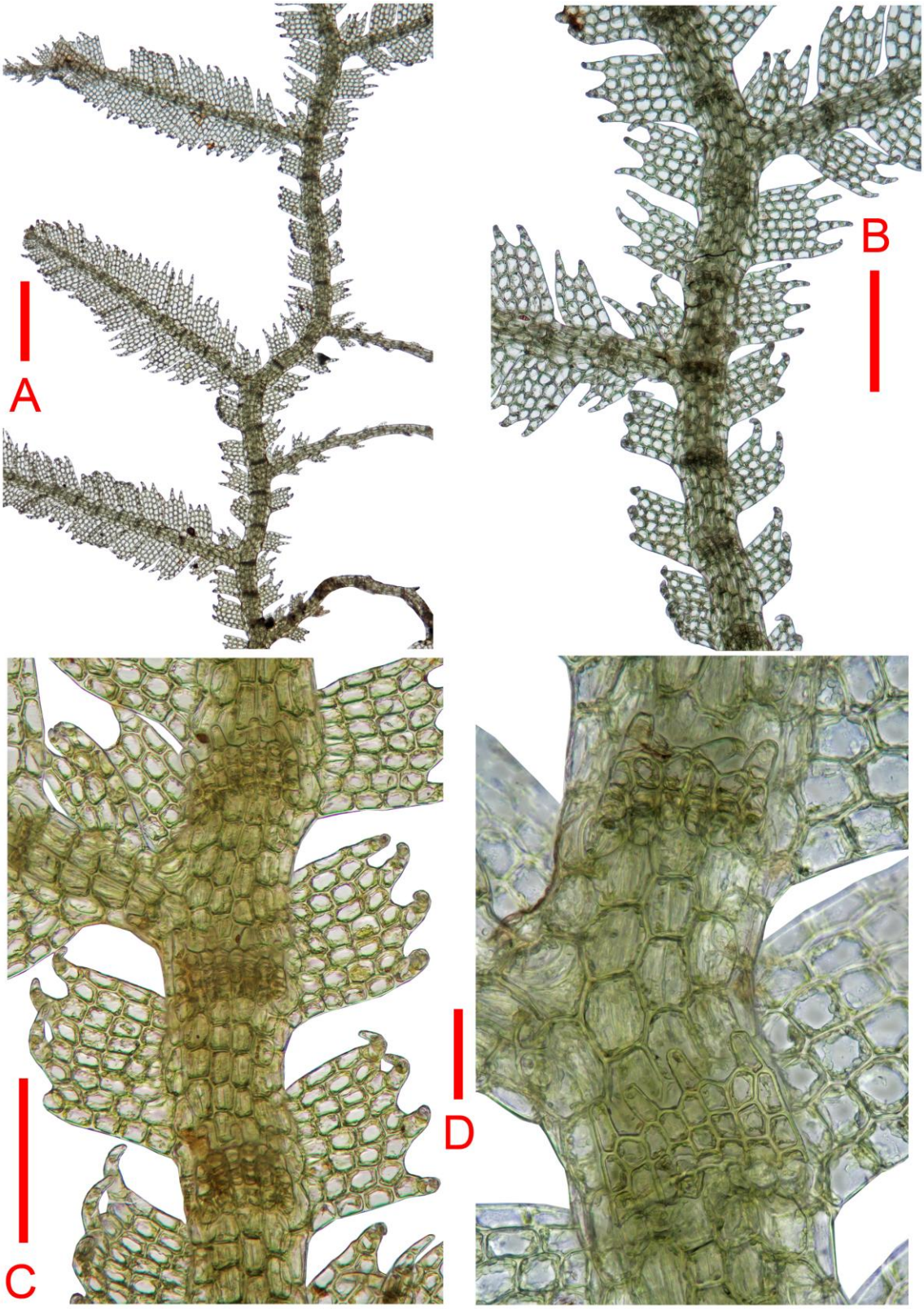

Plate 25: *Neolepidozia bickeri*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHÄFER-VERWIMP 18594/A - holotype)

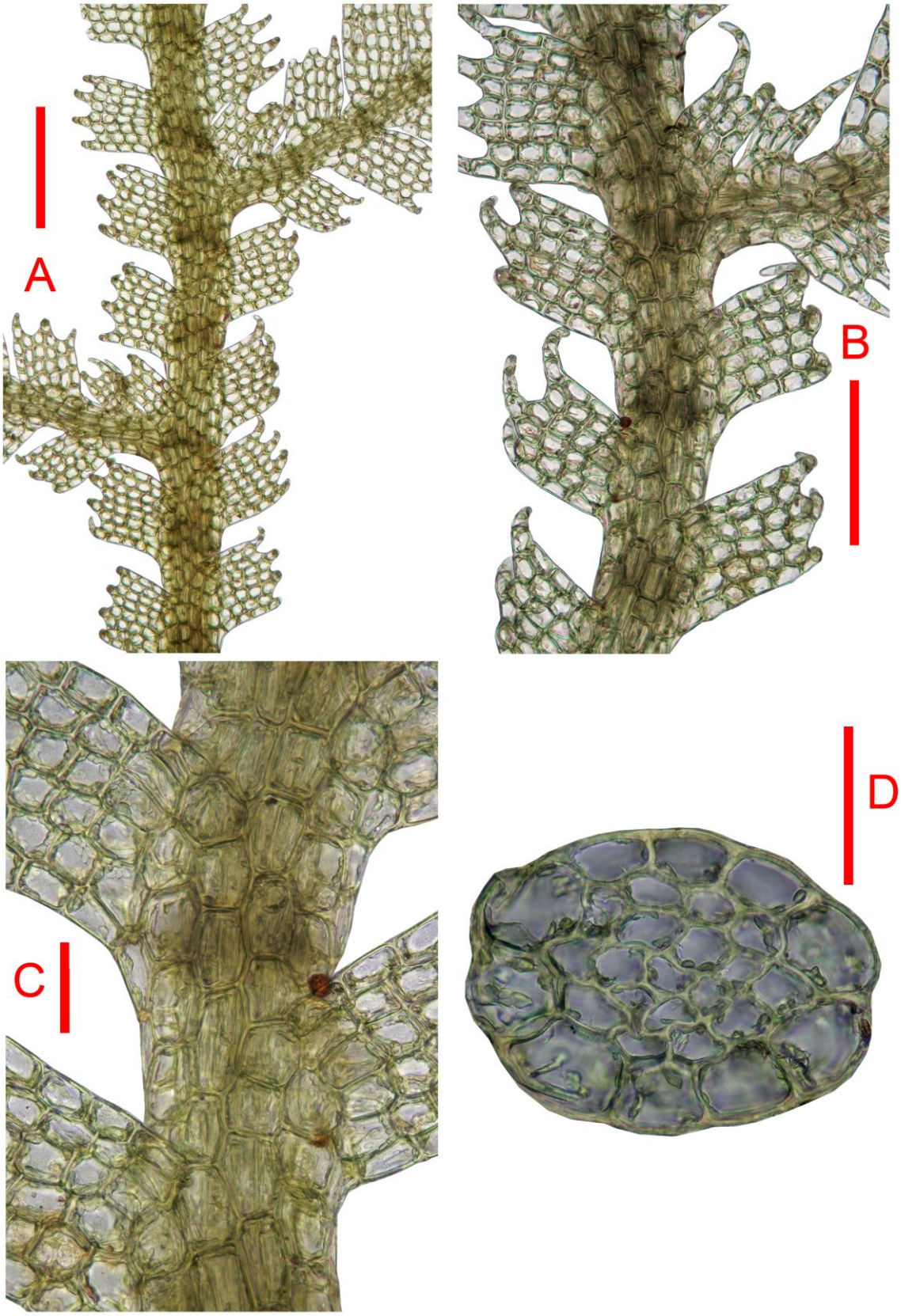

Plate 26: *Neolepidozia bickeri*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SCHÄFER-VERWIMP 18594/A - holotype)

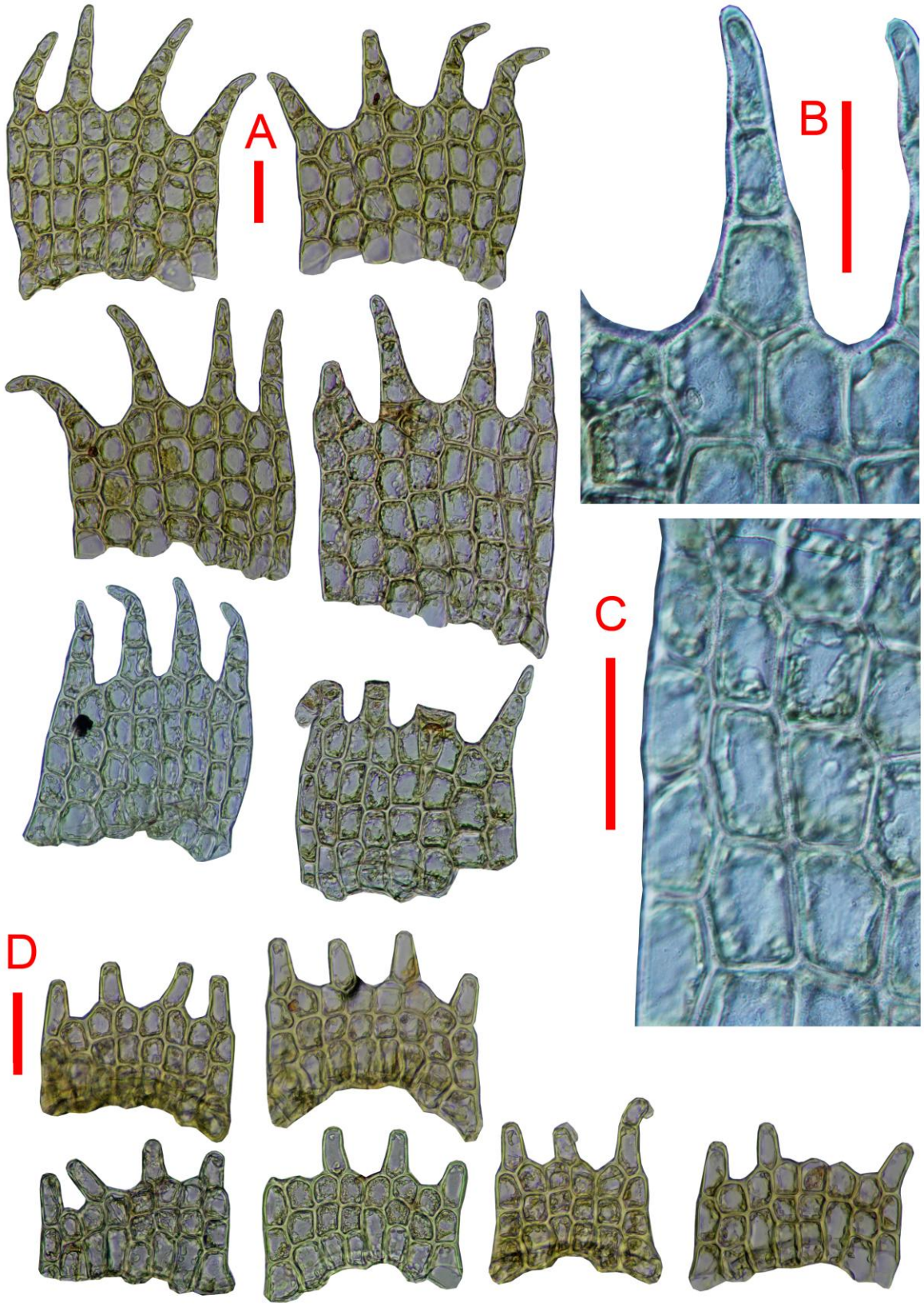

Plate 27: *Neolepidozia bickeri*: A – Stem leaves, B – Stem leaf lobe, C – Stem leaf disc, D – Stem underleaves; Scales: A, B, C, D – 50 µm (from SCHÄFER-VERWIMP 18594/A - holotype)

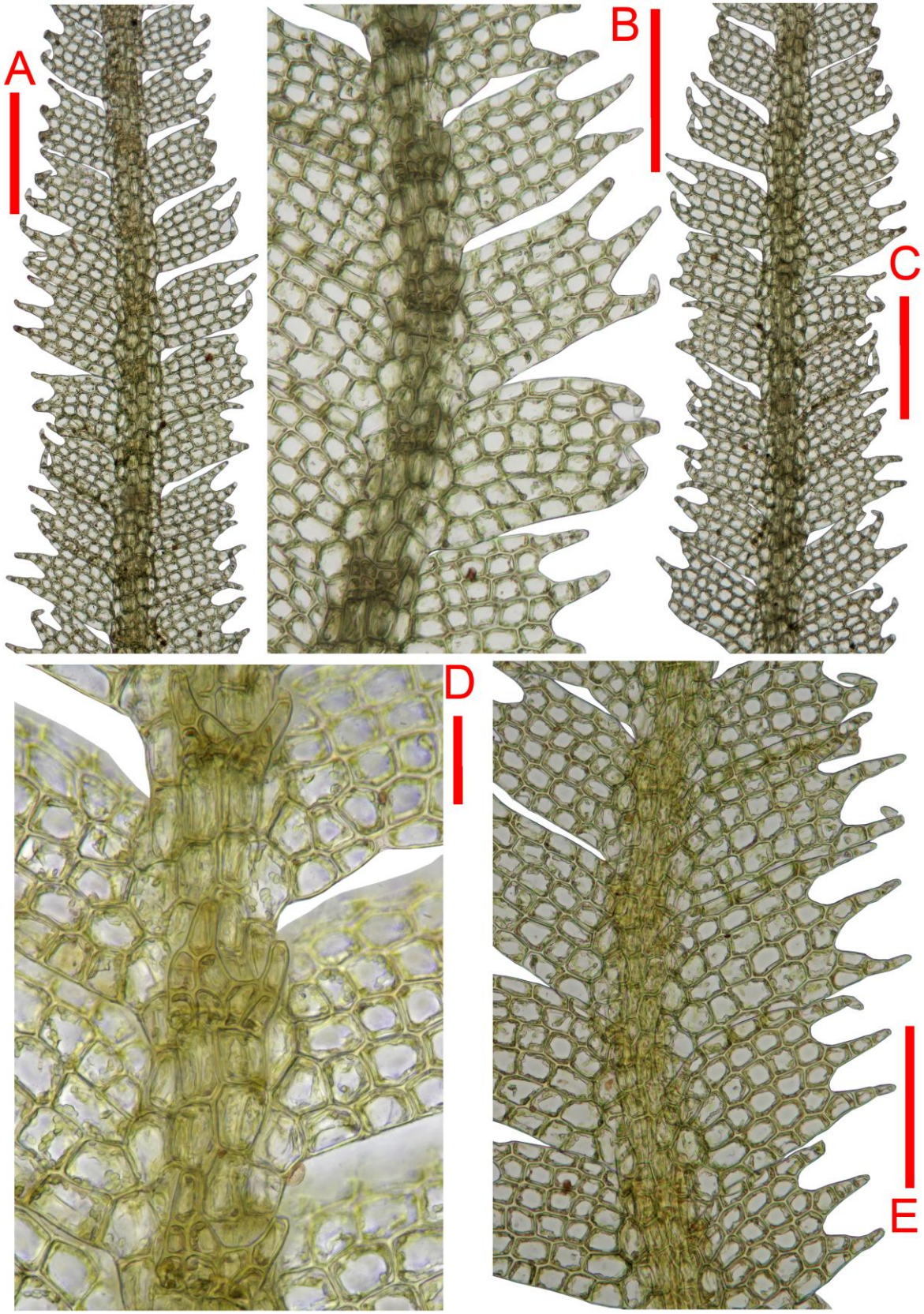

Plate 28: *Neolepidozia bickeri*: A, B, D – Branch ventral, C, E – Branch dorsal; Scales: A, C – 0.3 mm; B, E – 0.2 mm; D – 50 µm (from SCHÄFER-VERWIMP 18594/A - holotype)

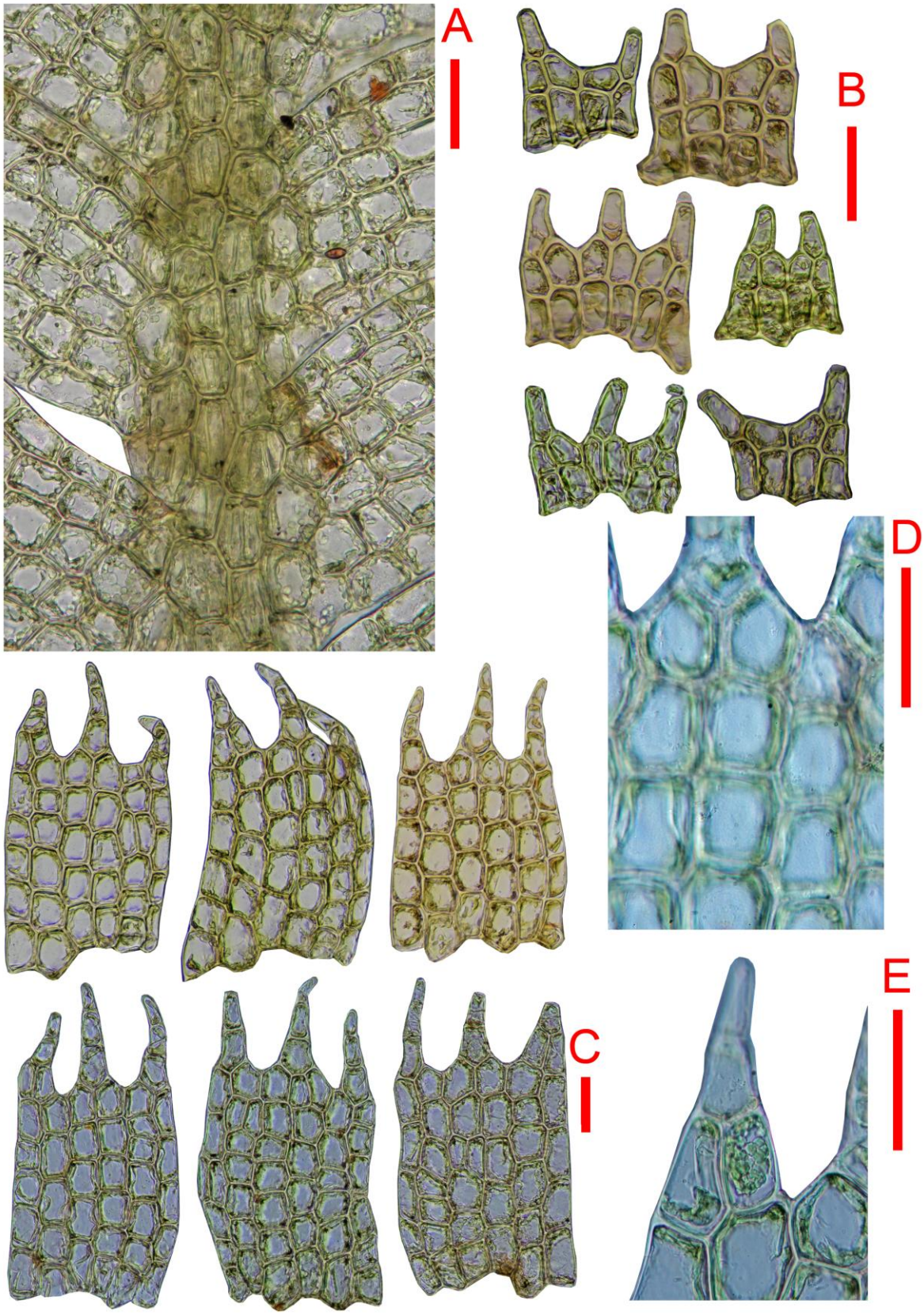

Plate 29: *Neolepidozia bickeri*: A – Branch dorsal, B – Branch underleaves, C – Branch leaves, D – Branch leaf disc, E – Branch leaf lobe; Scales: A, B, C, D, E – 50 µm (from SCHÄFER-VERWIMP 18594/A - holotype)

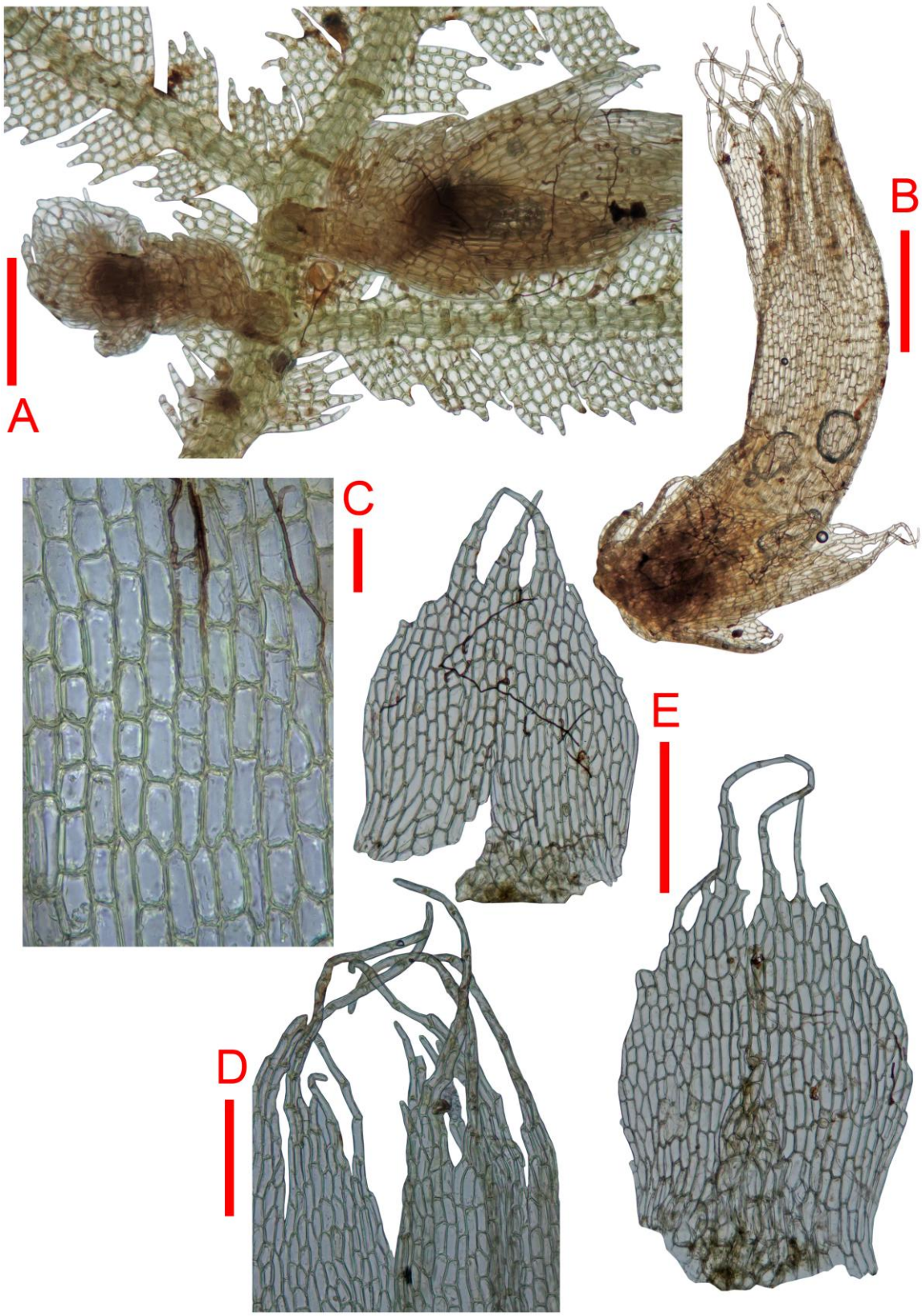

Plate 30: *Neolepidozia bickeri*: A – Stem dorsal (with perianth and male branch), B – Perianth, C – Perianth middle, D – Perianth mouth, E – Female bract; Scales: B – 0.5 mm; A, E – 0.3 mm; D – 0.2 mm; C – 50 µm (from SCHÄFER-VERWIMP 18594/A - holotype)

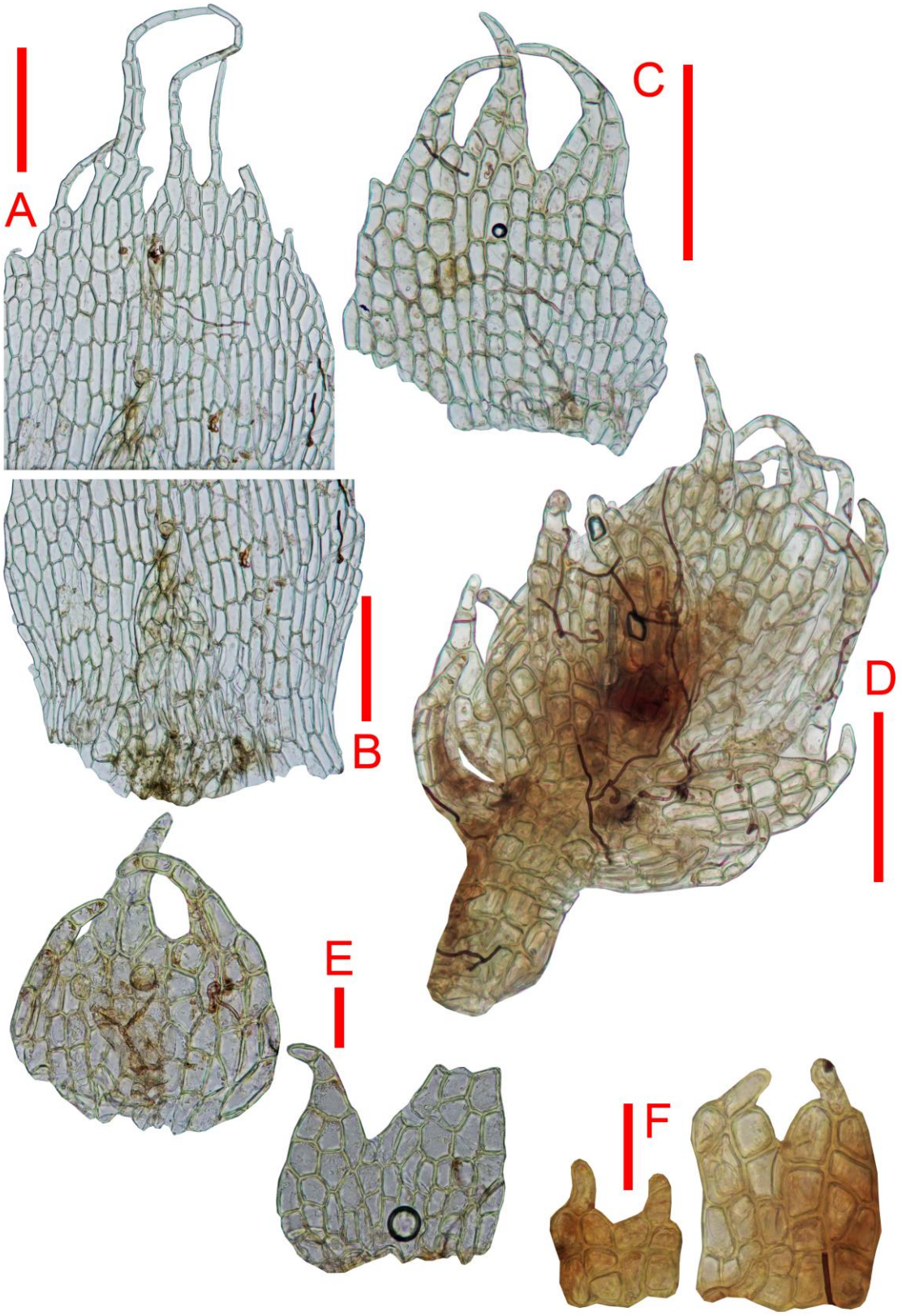

Plate 31: *Neolepidozia bickeri*: A – Female bract apex, B – Female bract base, C – Female bracteole, D – Male branch, E – Male bract, F – Underleaves of male branch; Scales: A, B, C, D – 0.2 mm; E, F – 50 µm (from SCHÄFER-VERWIMP 18594/A - holotype)

Neolepidozia cameronensis **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

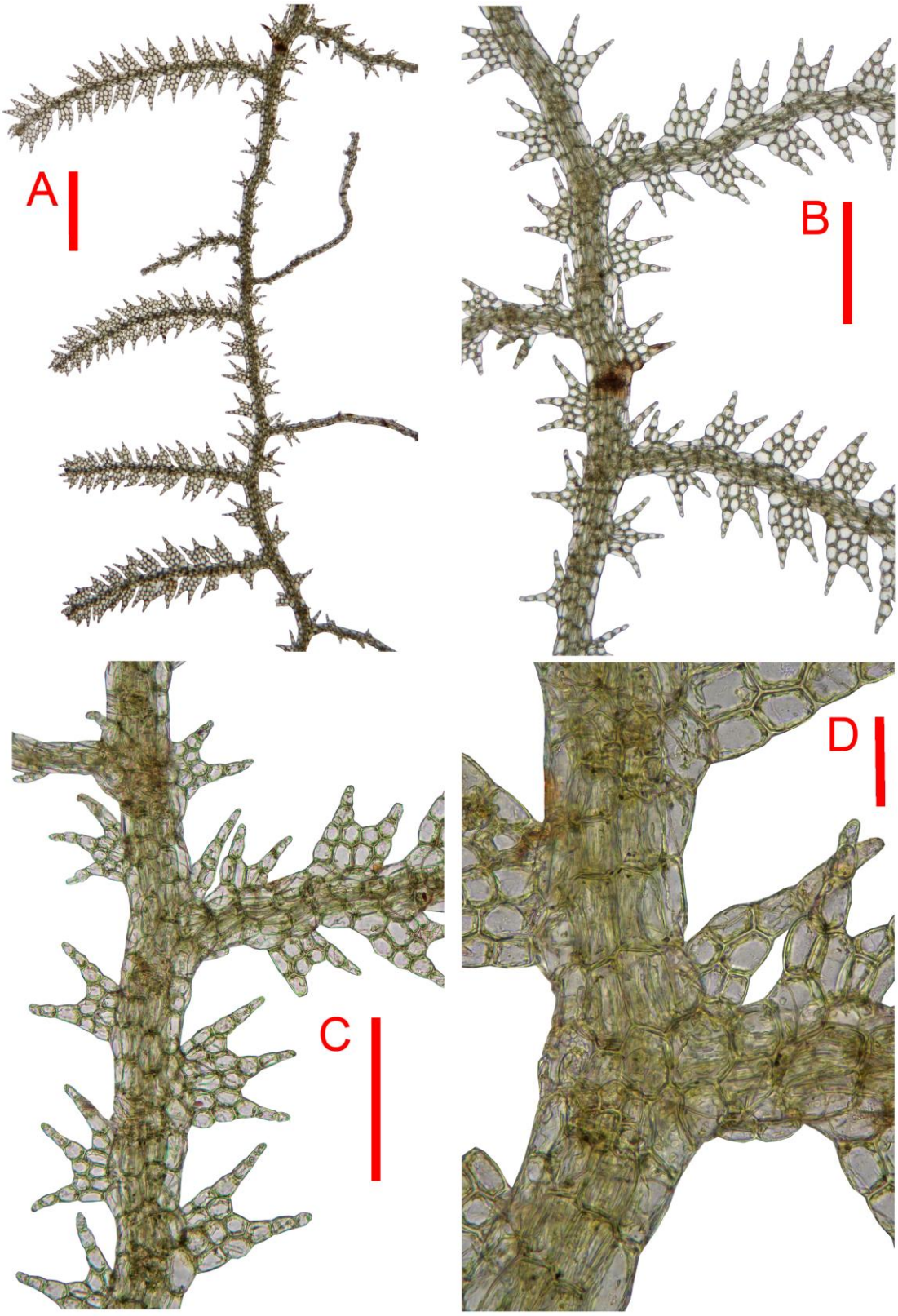

Plate 32: *Neolepidozia cameronensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHÄFER-VERWIMP 18705b – holotype)

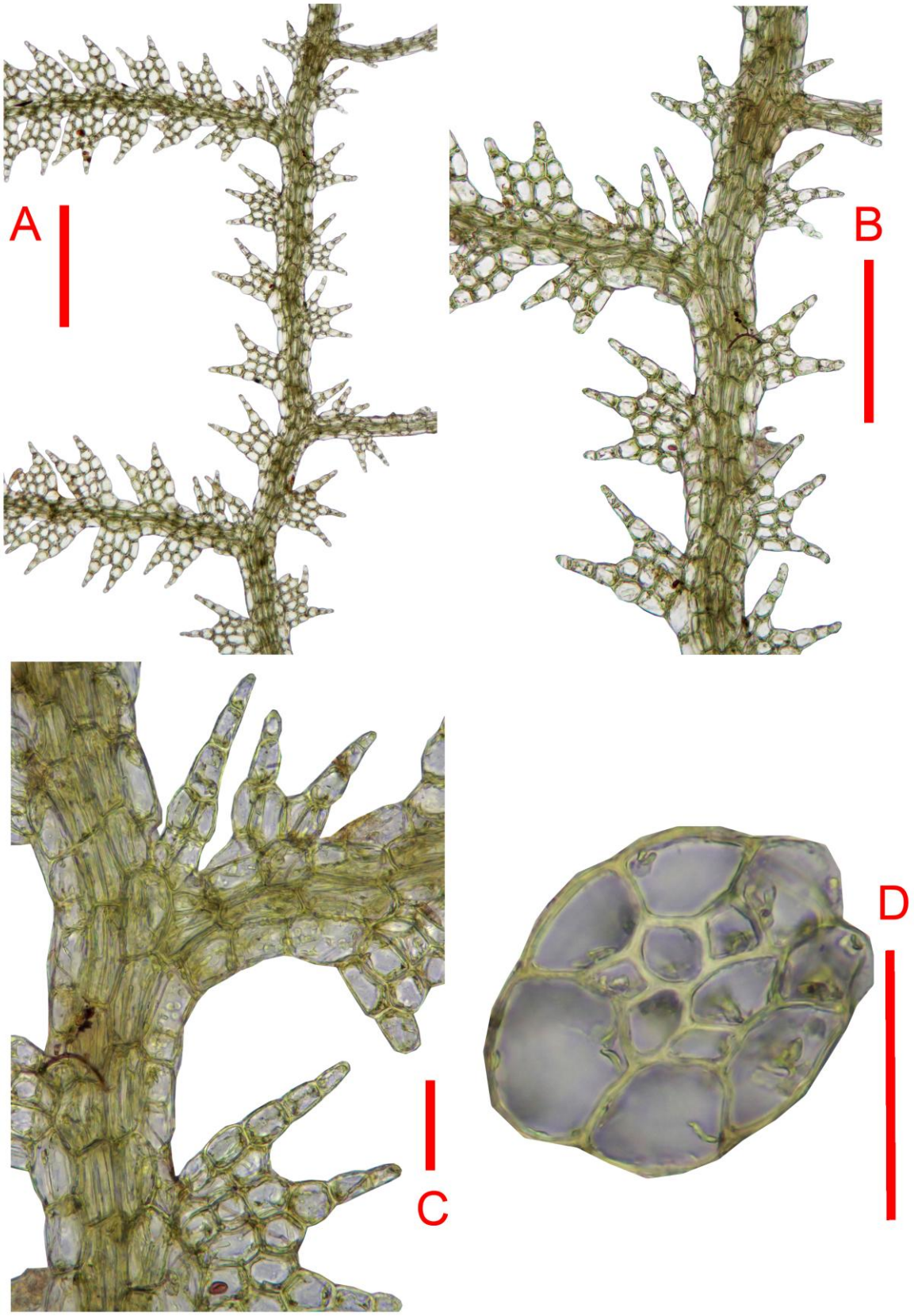

Plate 33: *Neolepidozia cameronensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SCHÄFER-VERWIMP 18705b – holotype)

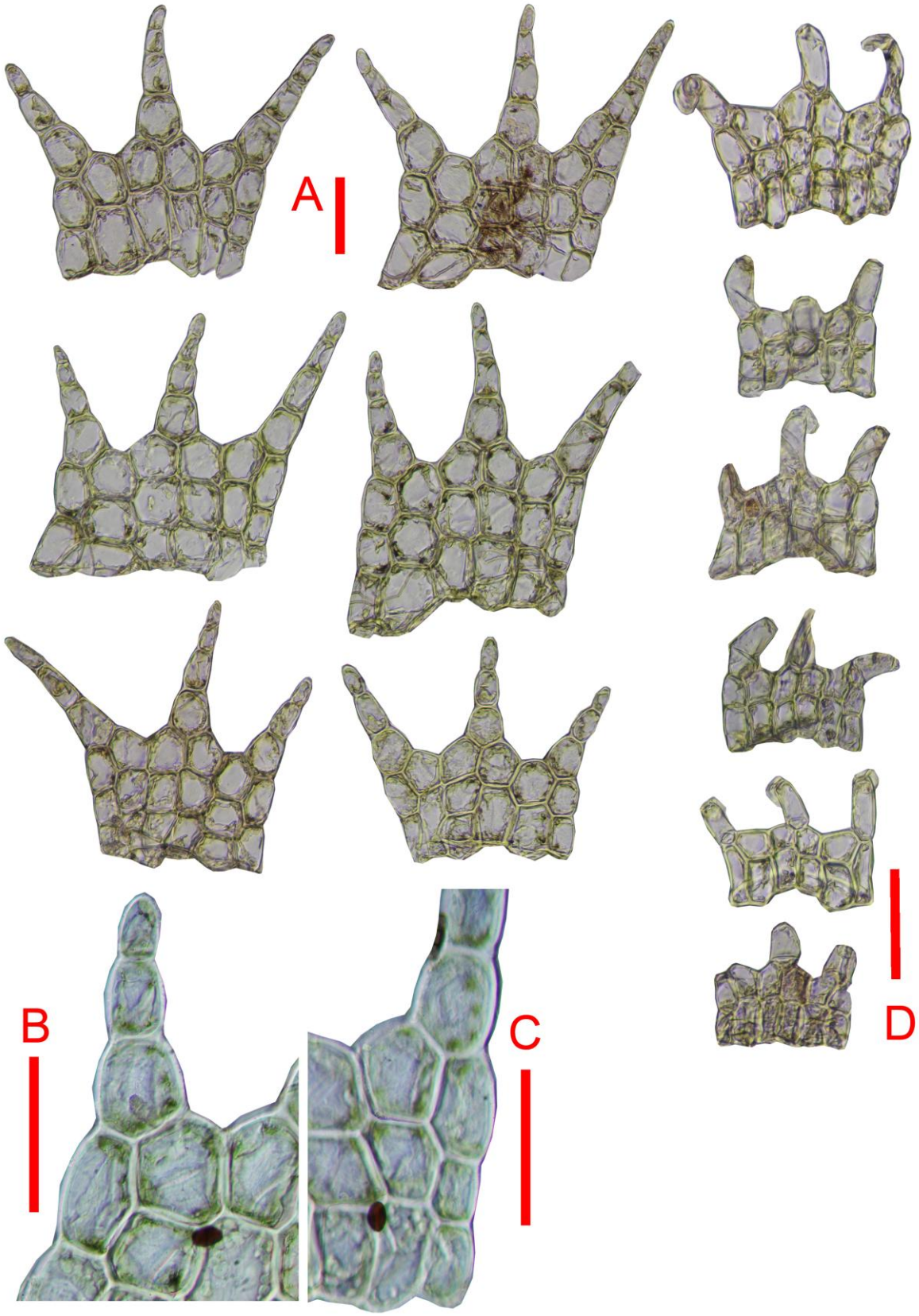

Plate 34: *Neolepidozia cameronensis*: A – Stem leaves, B – Stem leaf lobe, C – Stem leaf disc, D – Stem underleaves; Scales: A, B, C, D – 50 µm (from SCHÄFER-VERWIMP 18705b – holotype)

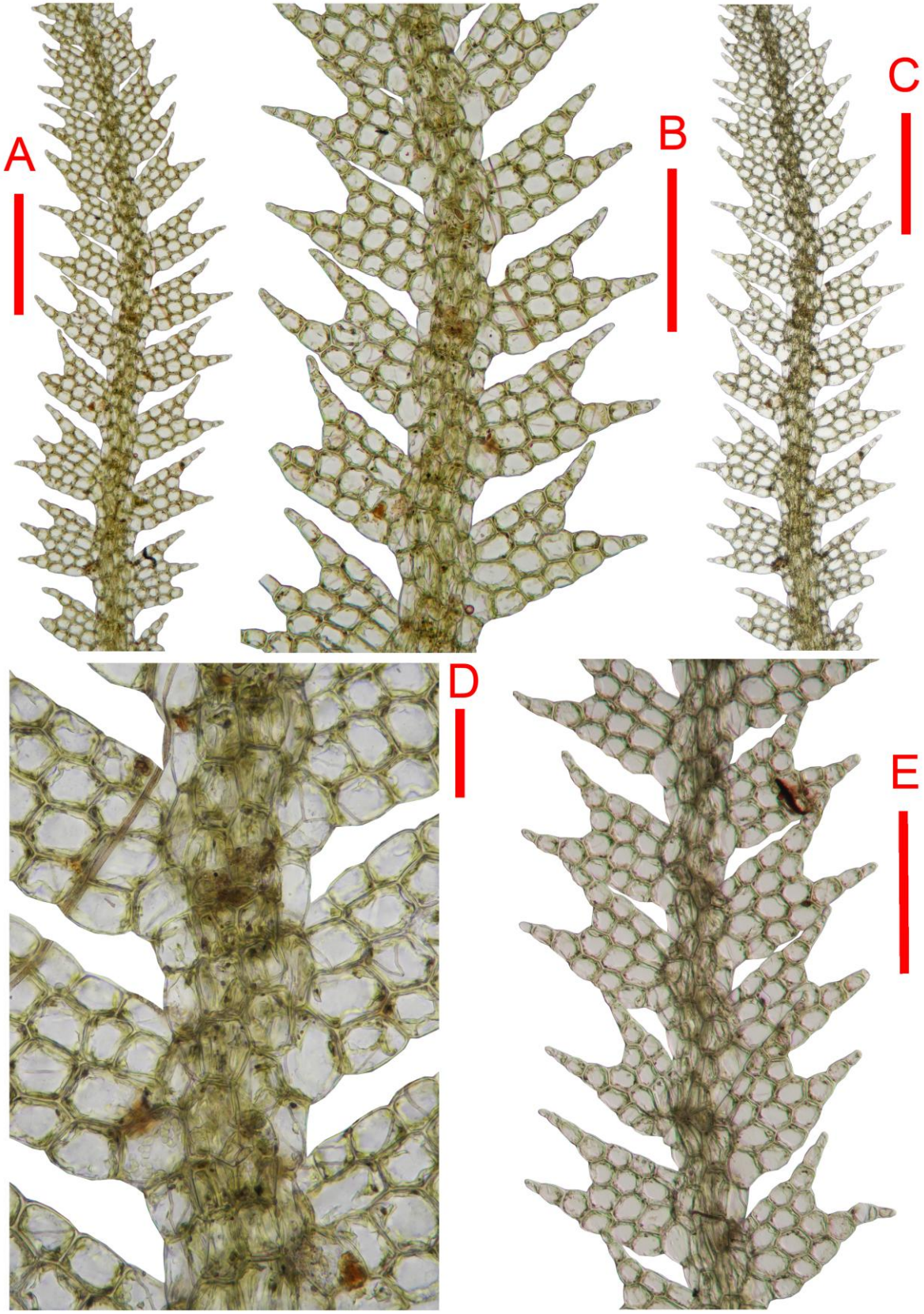

Plate 35: *Neolepidozia cameronensis*: A, B, D – Branch ventral, C, E – Branch dorsal; Scales: A, C – 0.3 mm, B, E – 0.2 mm; D – 50 µm (from SCHÄFER-VERWIMP 18705b – holotype)

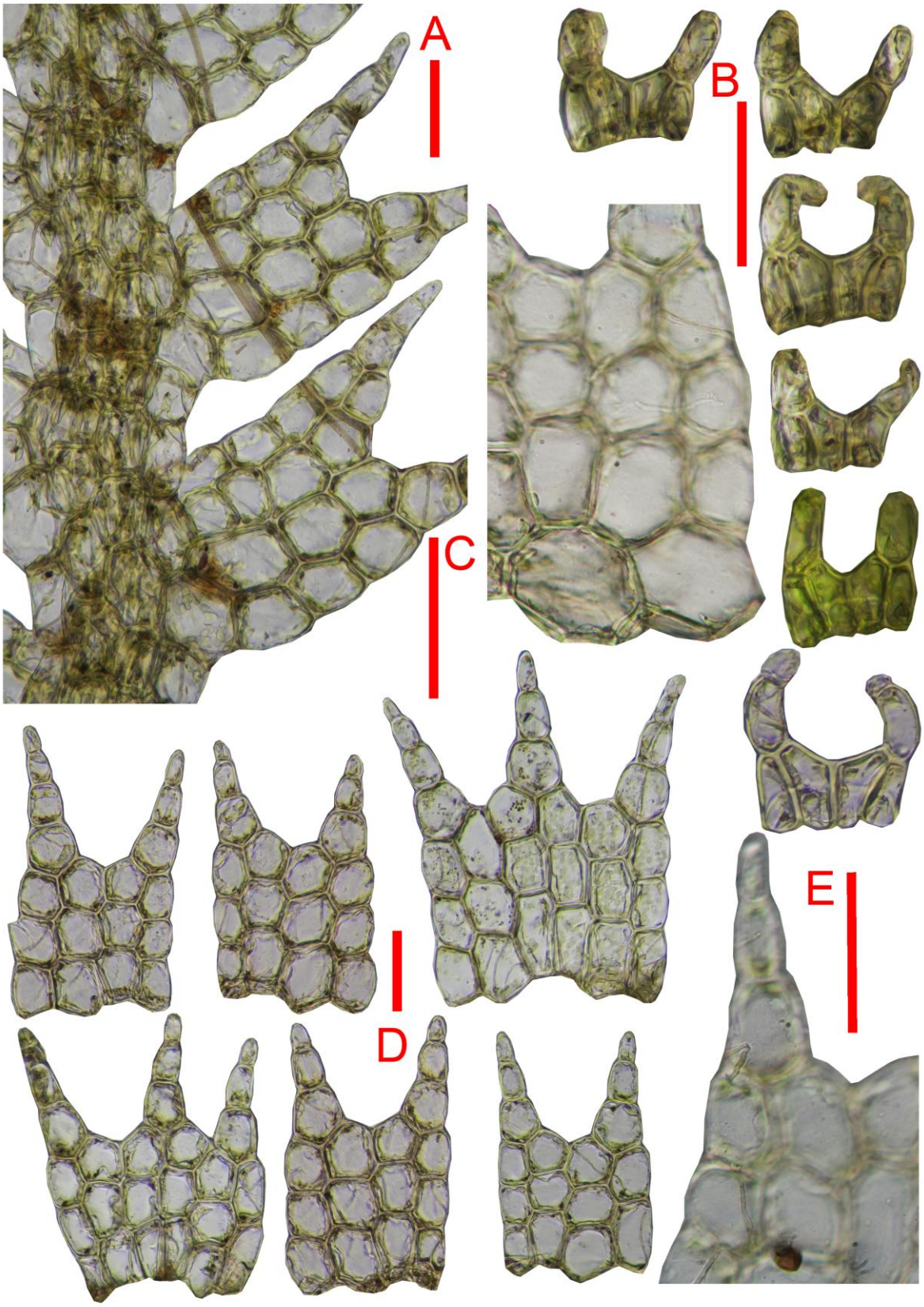

Plate 36: *Neolepidozia cameronensis*: A – Branch dorsal, B – Branch underleaves, C – Branch leaf disc, D – Branch leaves, E – Branch leaf lobe; Scales: A, B, C, D, E – 50 µm (from SCHÄFER-VERWIMP 18705b – holotype)

Neolepidozia cuneifolia **(STEPH.) FULFORD ET J. TAYLOR**

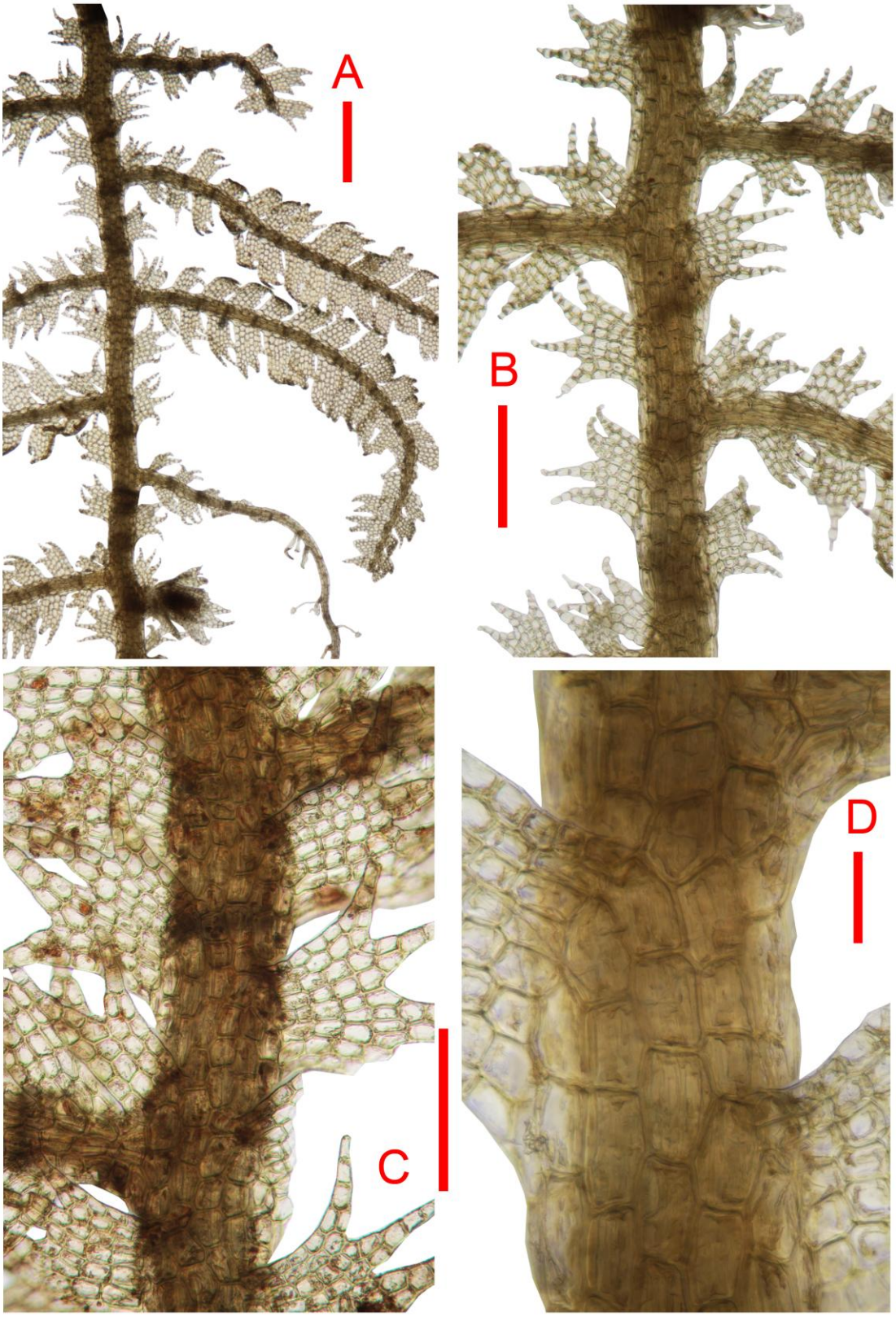

Plate 37: *Neolepidozia cuneifolia*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from LORIA, JE - Isotype)

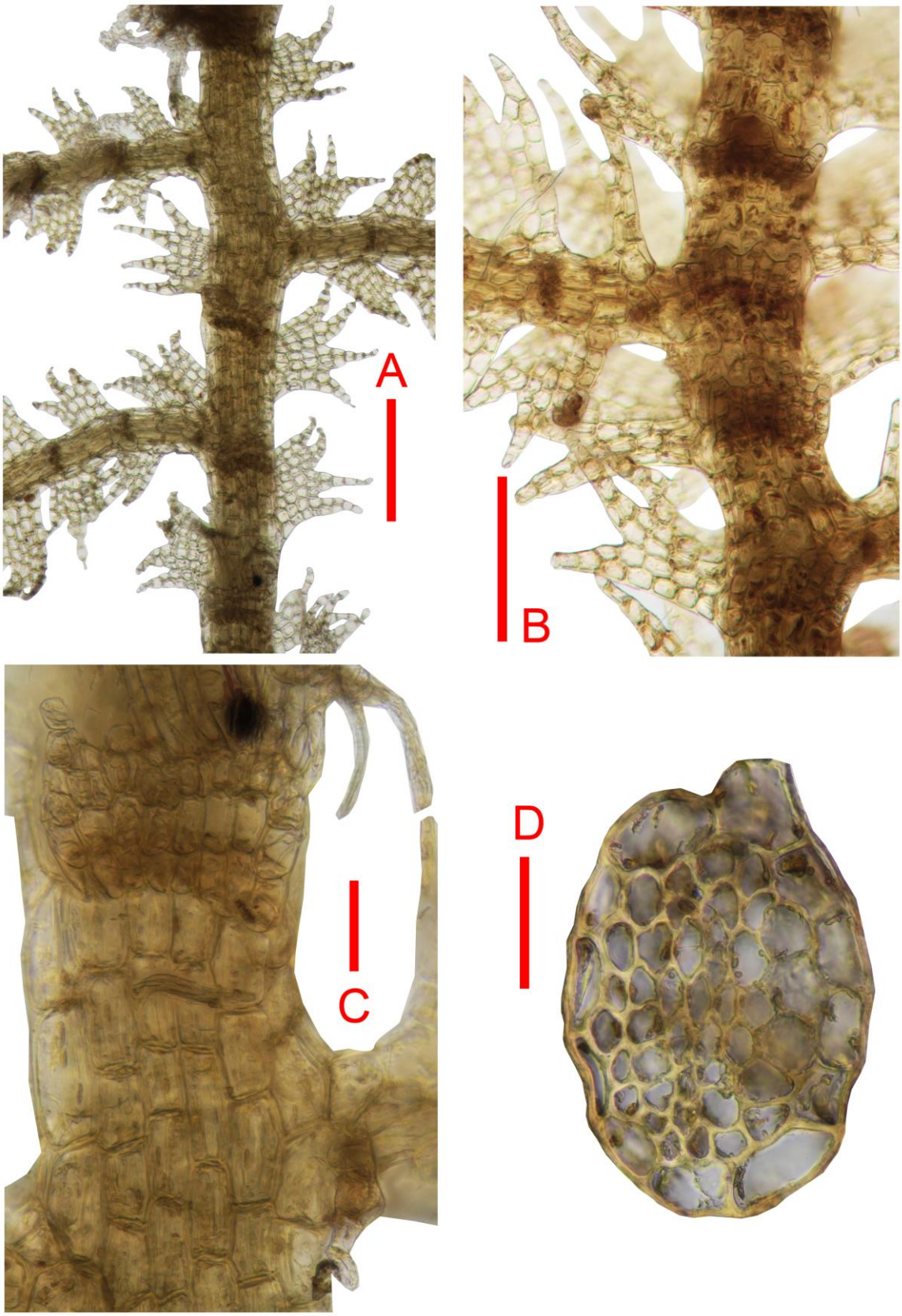

Plate 38: *Neolepidozia cuneifolia*: A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from LORIA, JE - Isotype)

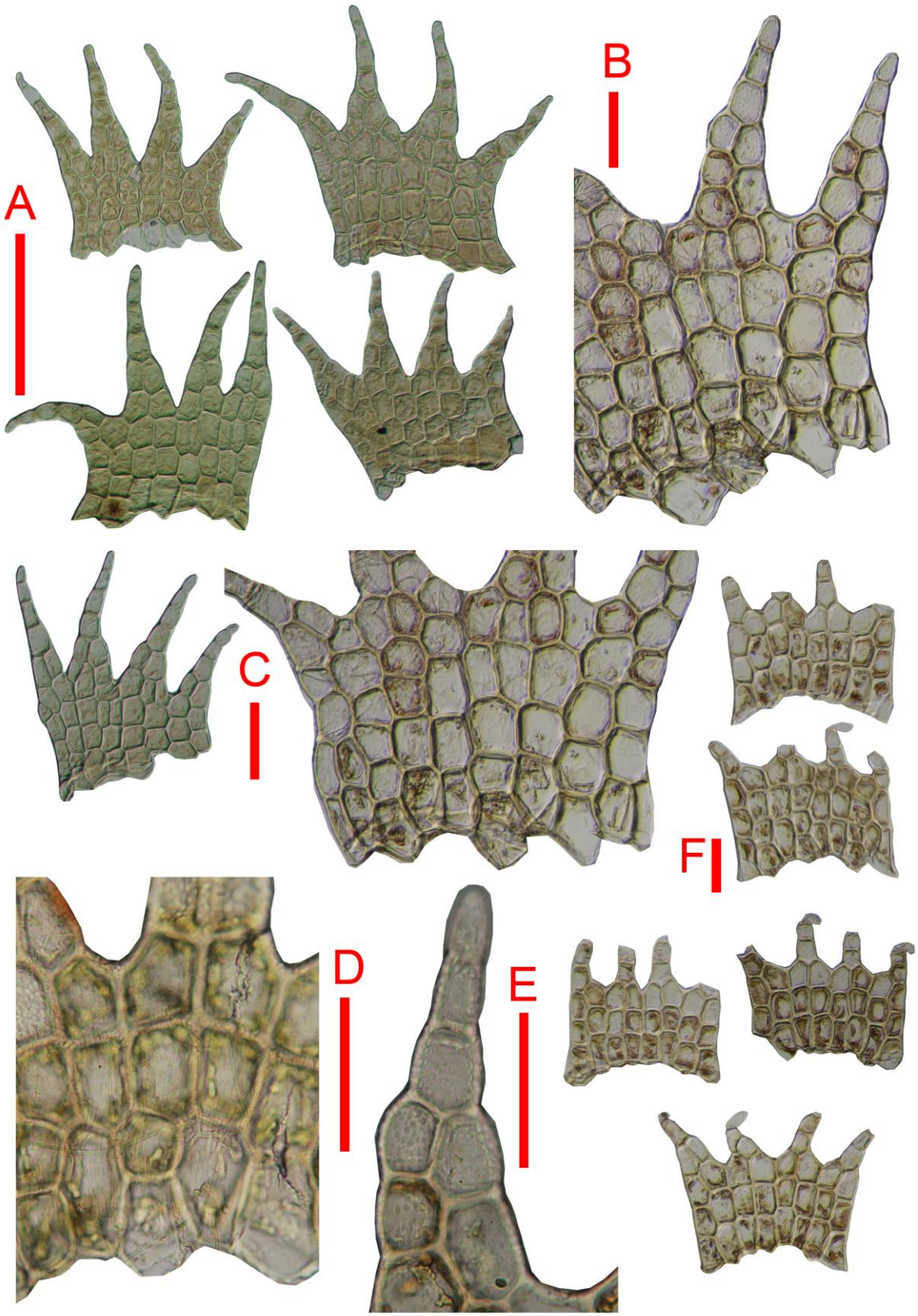

Plate 39: *Neolepidozia cuneifolia*: A – Stem leaves, B, E – Stem leaf lobes, C, D – Stem leaf disc, F – Underleaves; Scales: A – 0.2 mm; B, C, D, E, F – 50 µm (from LORIA, JE - Isotype)

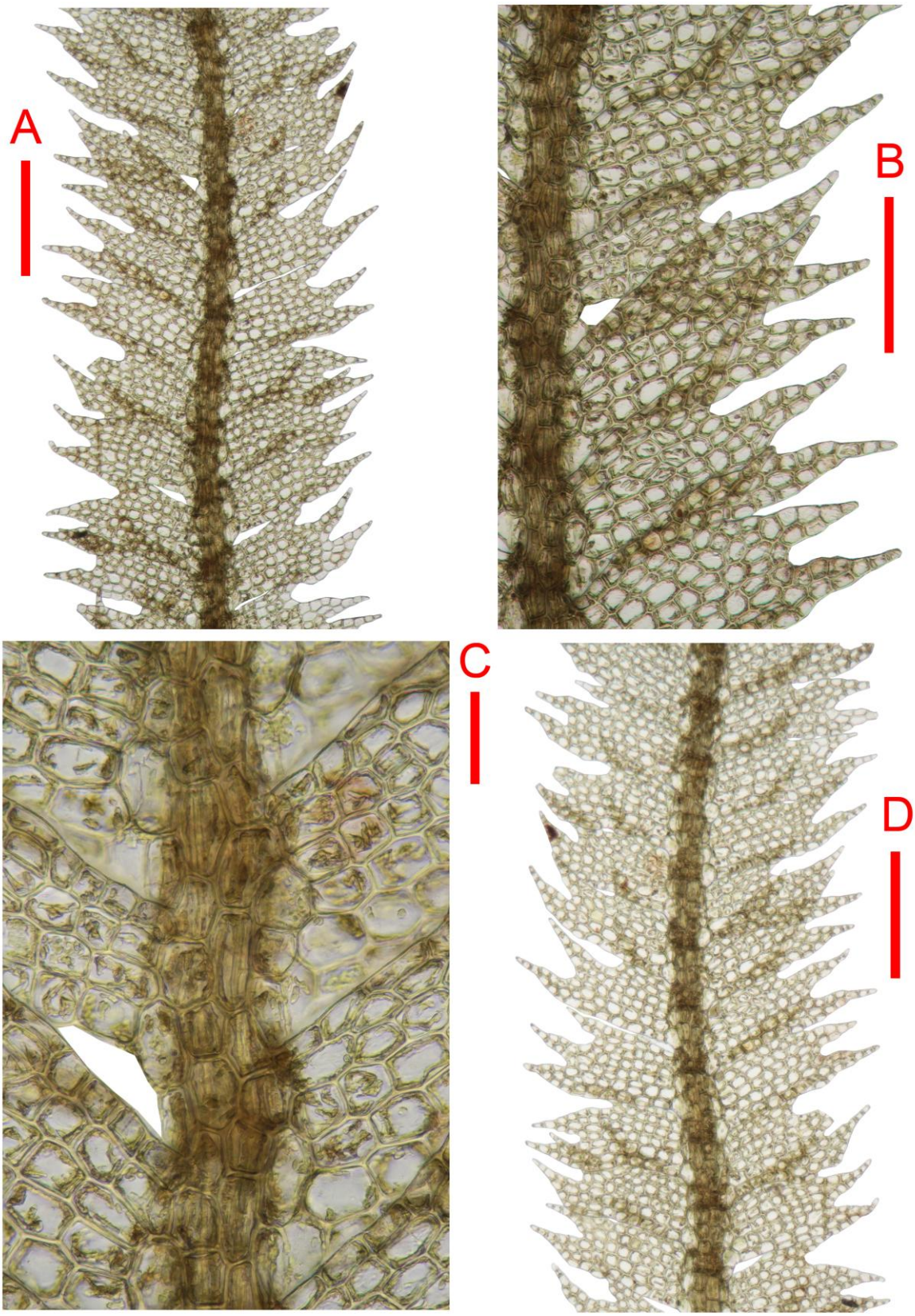

Plate 40: *Neolepidozia cuneifolia*: A, B, C – Branch dorsal, D – Branch ventral; Scales: A, D – 0.3 mm; B – 0.2 mm; C – 50 µm (from LORIA, JE - Isotype

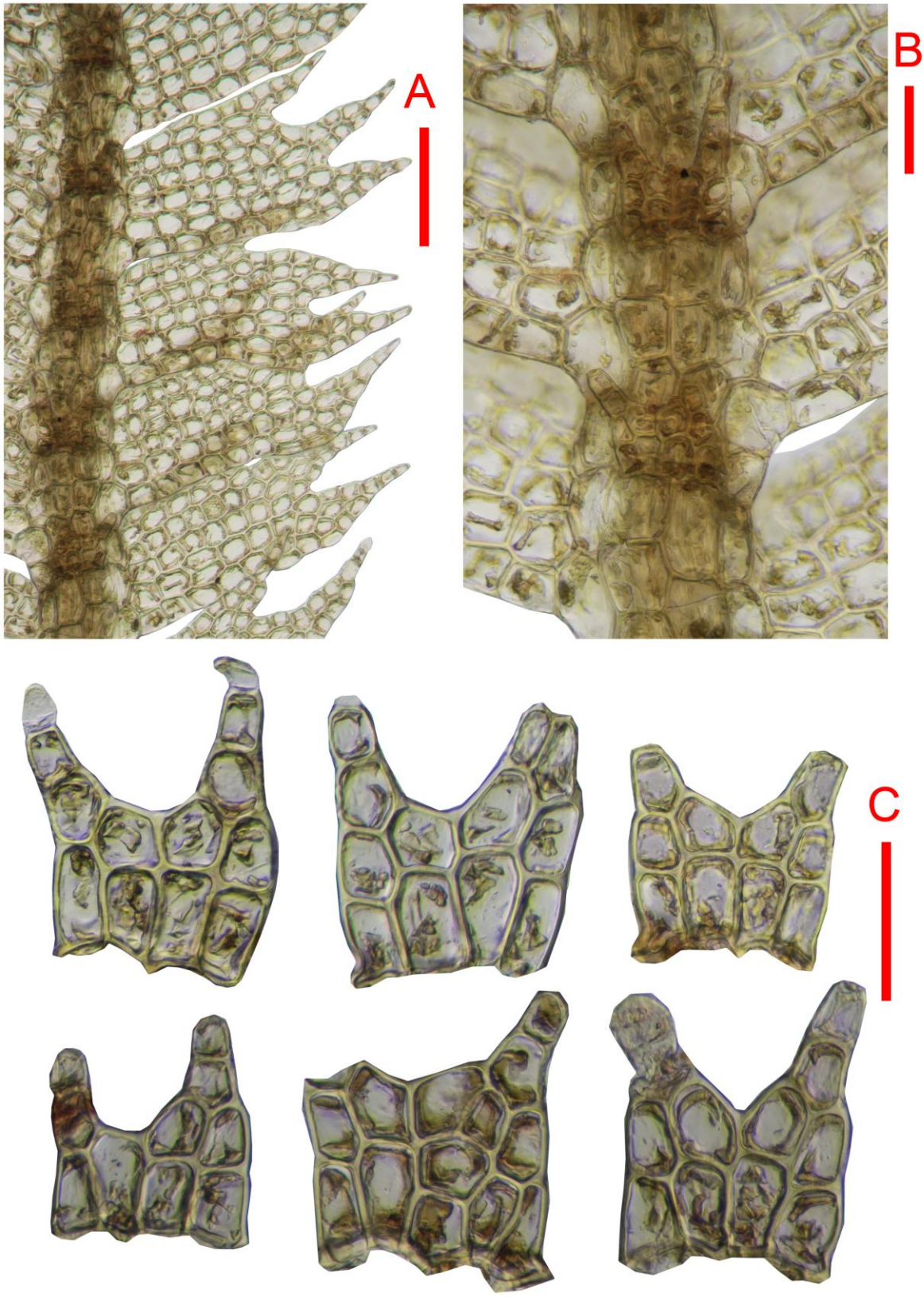

Plate 41: *Neolepidozia cuneifolia*: A, B – Branch ventral, C – Branch underleaves; Scales: A – 0.2 mm, B, C – 50 µm (from LORIA, JE - Isotype)

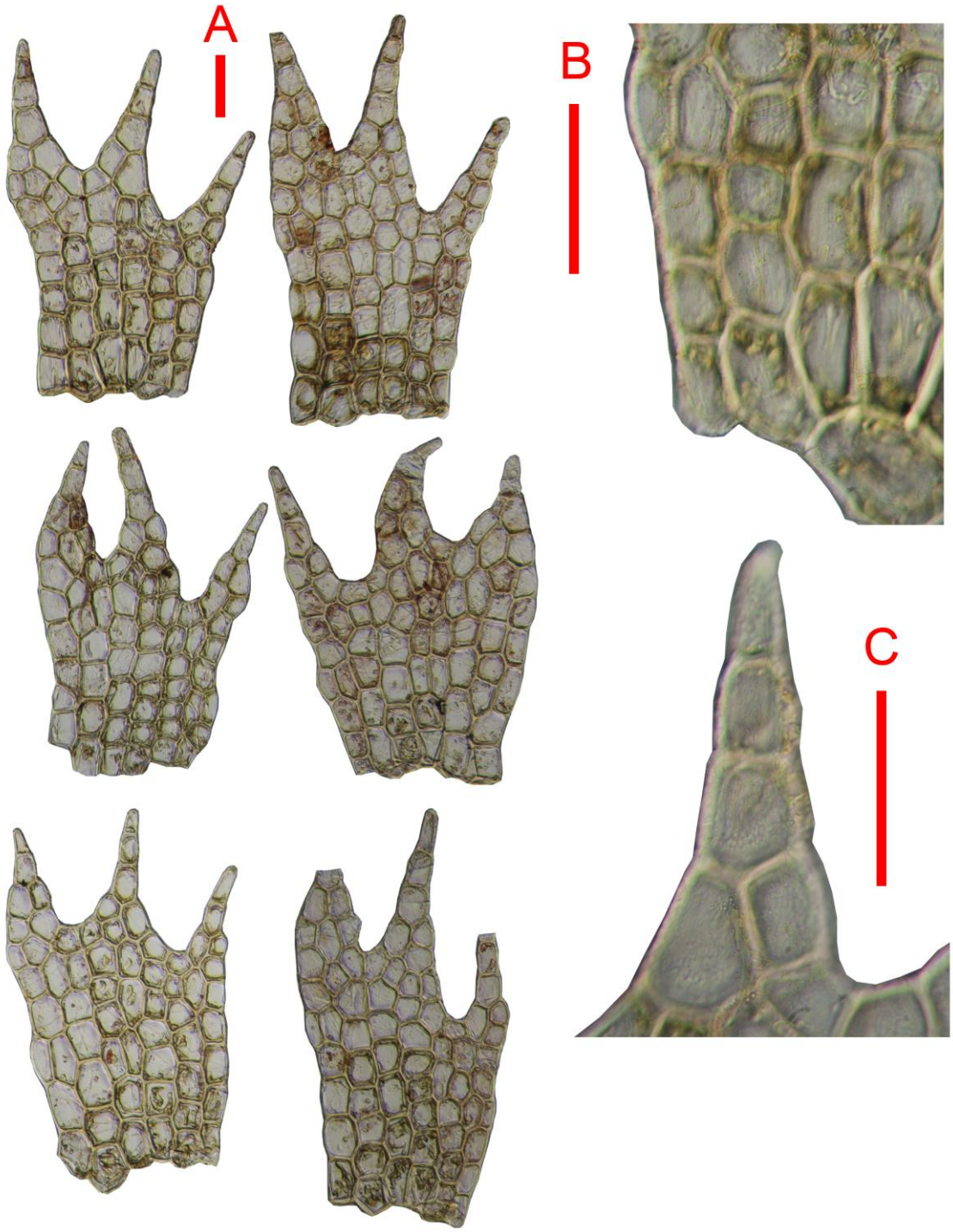

Plate 42: *Neolepidozia cuneifolia*: A – Branch leaves, B – Branch leaf disc, C – Branch leaf lobe; Scales: A, B, C – 50 µm (from LORIA, JE - Isotype)

***Neolepidozia cuneifolia* fo. *biloba* (Herzog) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

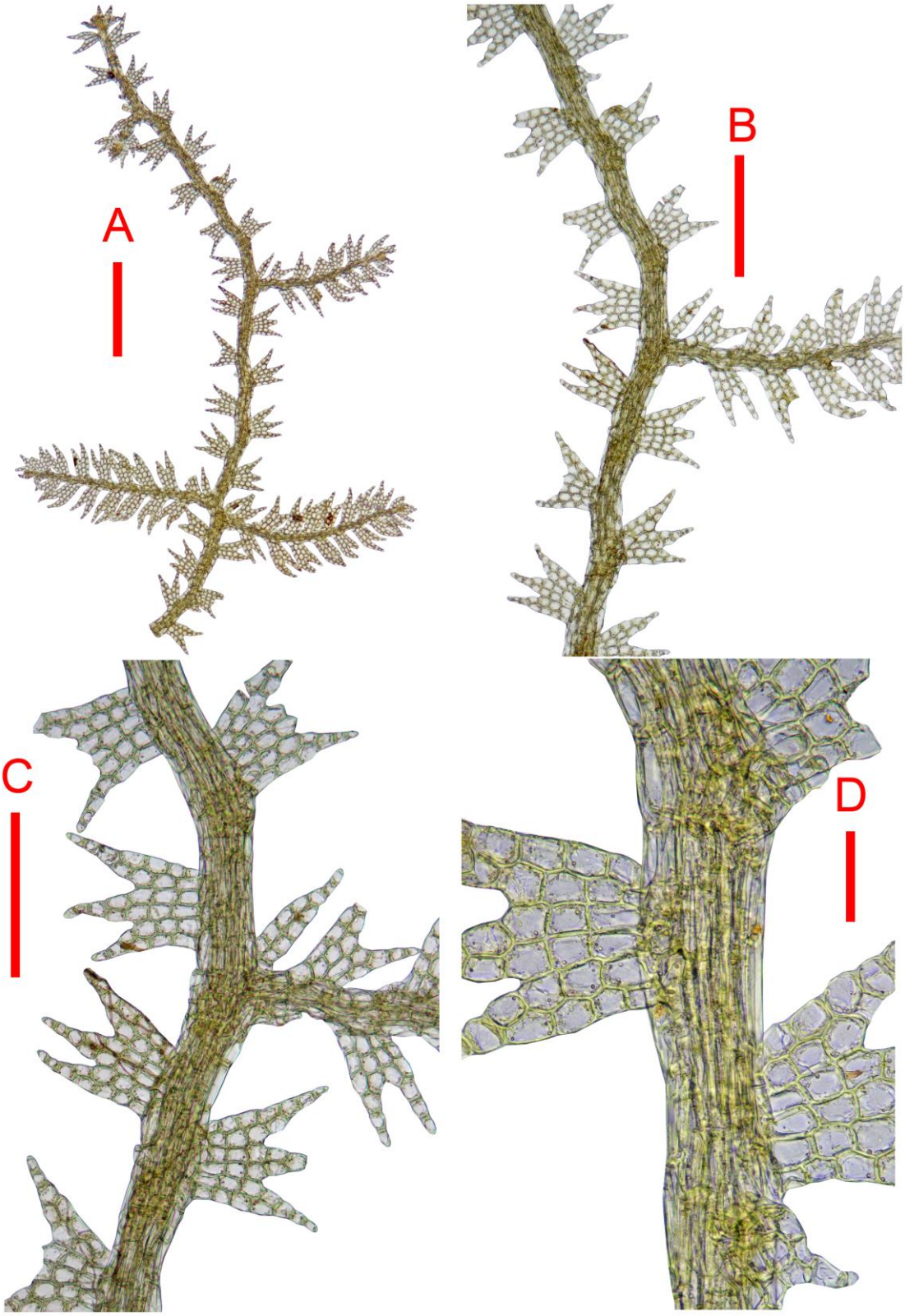

Plate 43: *Neolepidozia cuneifolia* fo. *biloba*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from BAKER 7020, JE 04010503 – holotype *Lepidozia bifida*)

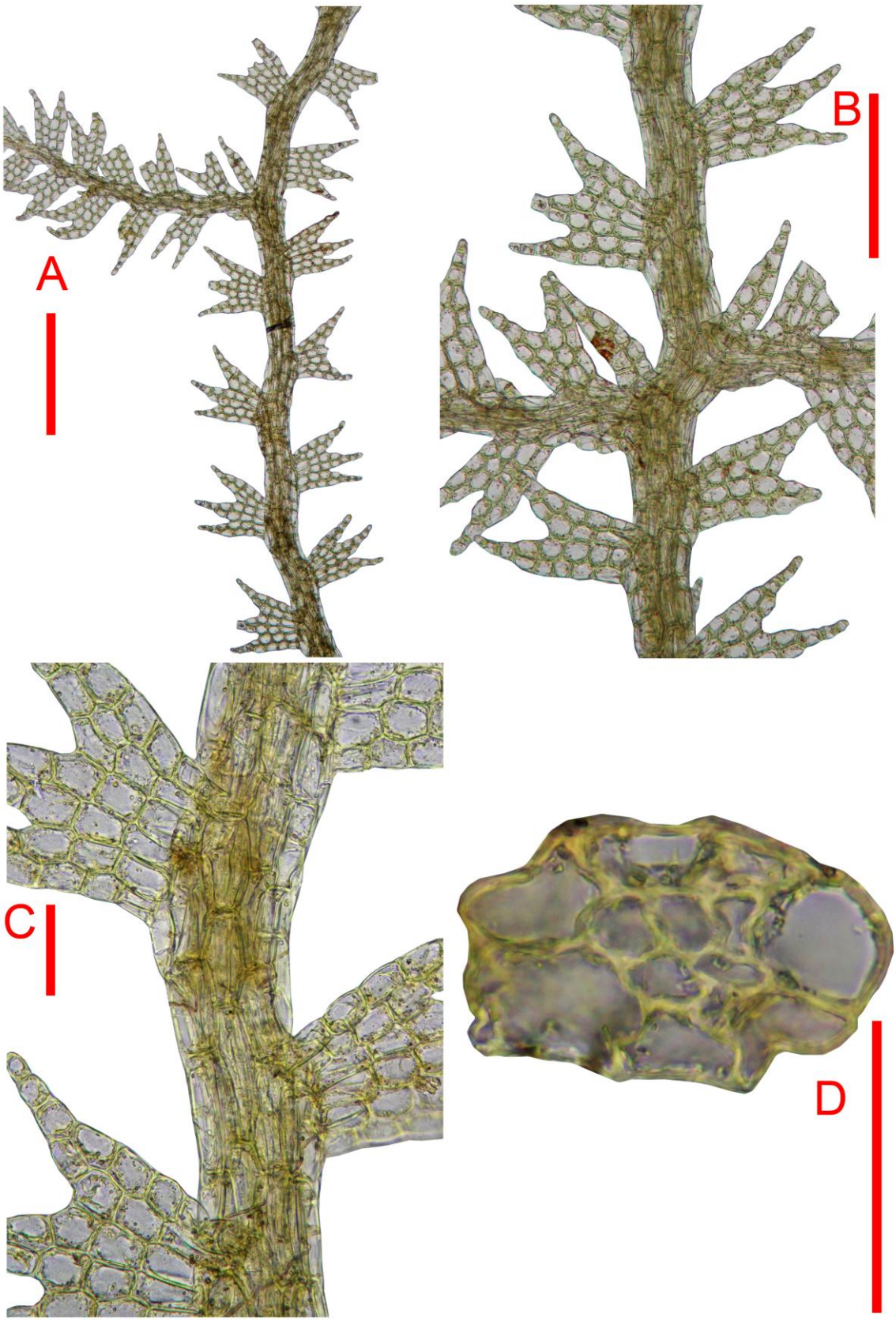

Plate 44: *Neolepidozia cuneifolia* fo. *biloba*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from BAKER 7020, JE 04010503 – holotype *Lepidozia bifida*)

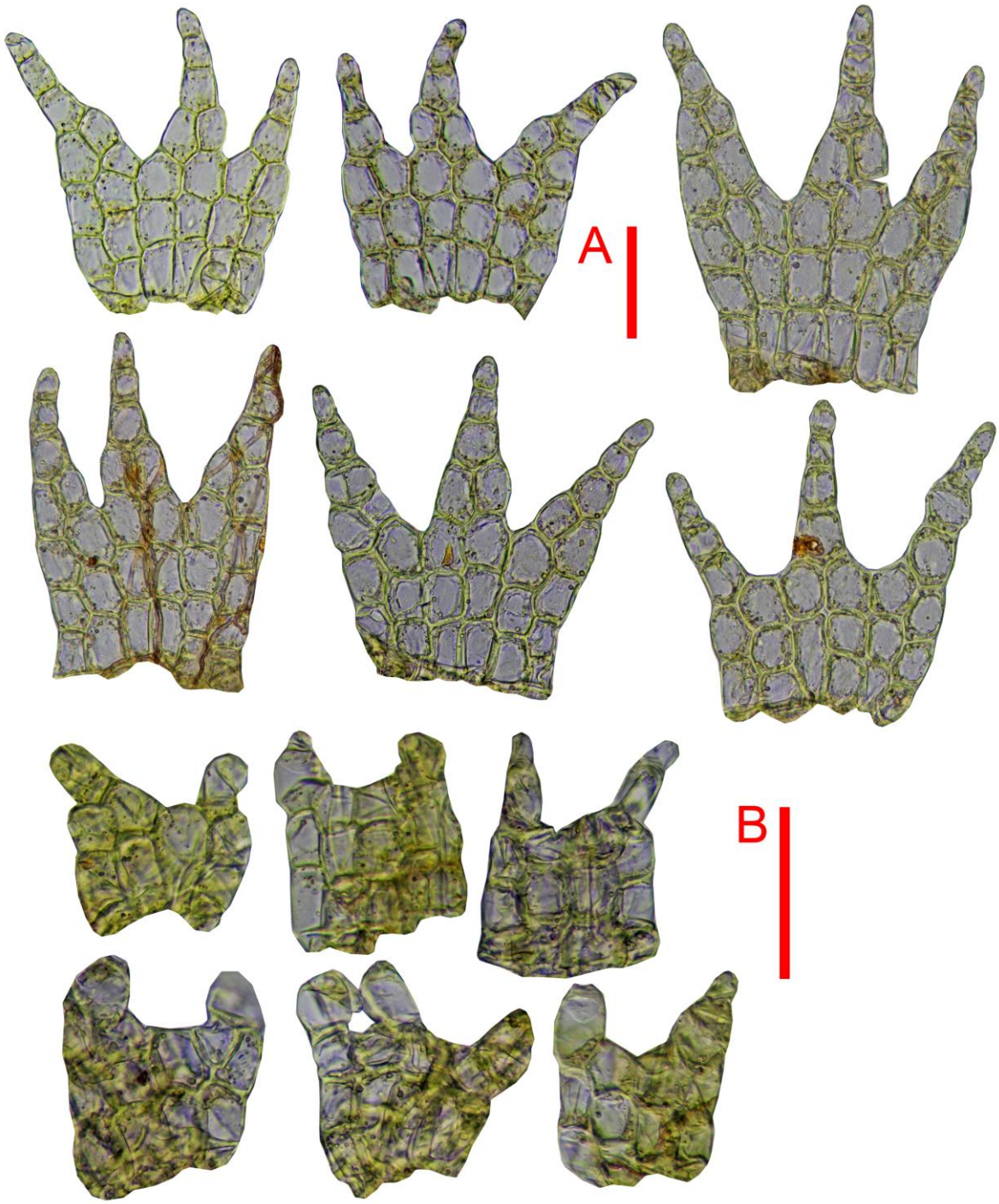

Plate 45: *Neolepidozia cuneifolia* fo. *biloba*: A – Stem leaves, B – Stem underleaves; Scales: A, B – 50 µm (from BAKER 7020, JE 04010503 – holotype *Lepidozia bifida*)

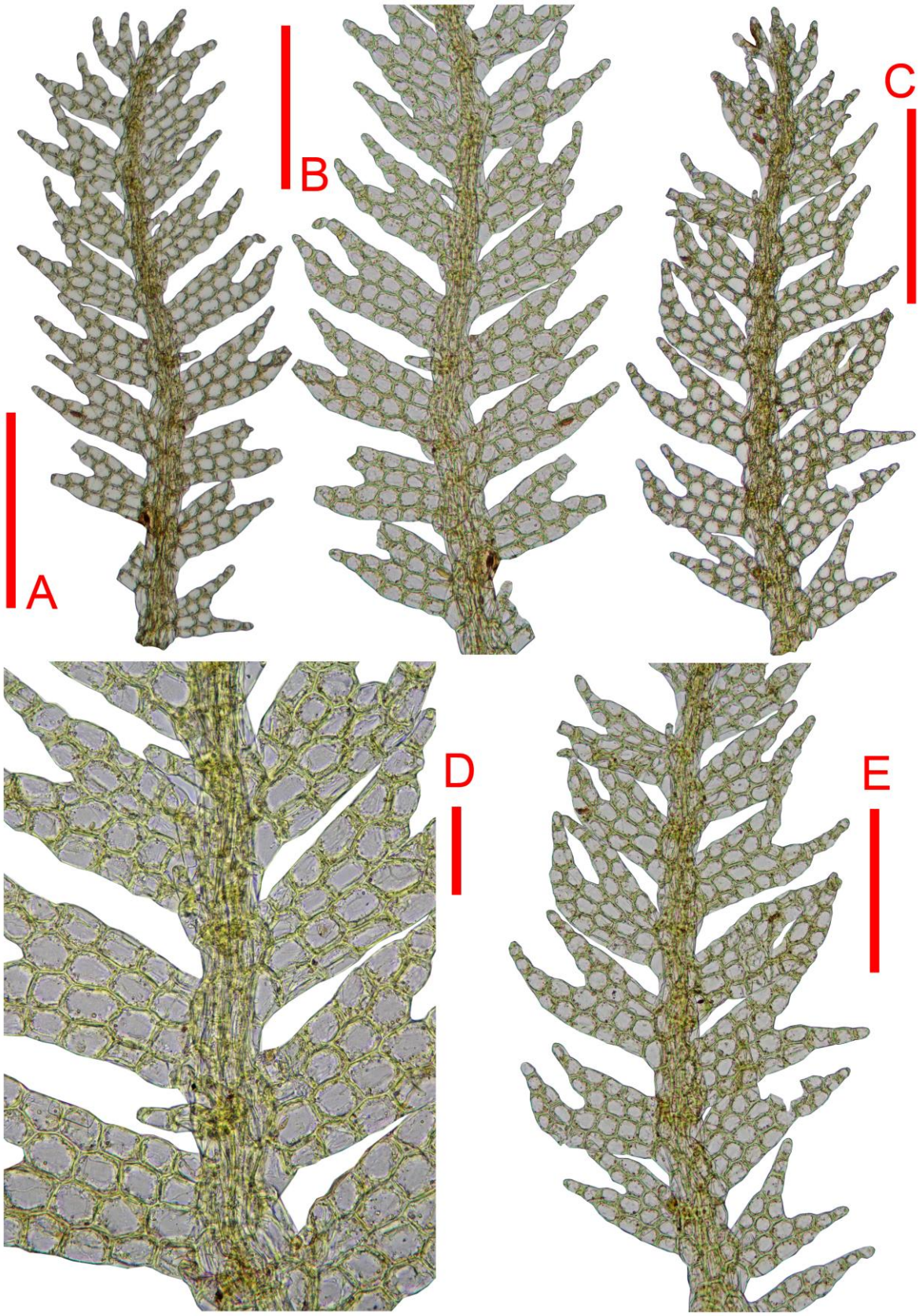

Plate 46: *Neolepidozia cuneifolia* fo. *biloba*: A, B, D – Branch ventral, C, E – Branch dorsal; Scales: A, C – 0.3 mm; B, D – 0.2 mm; C – 50 µm (from BAKER 7020, JE 04010503 – holotype *Lepidozia bifida*)

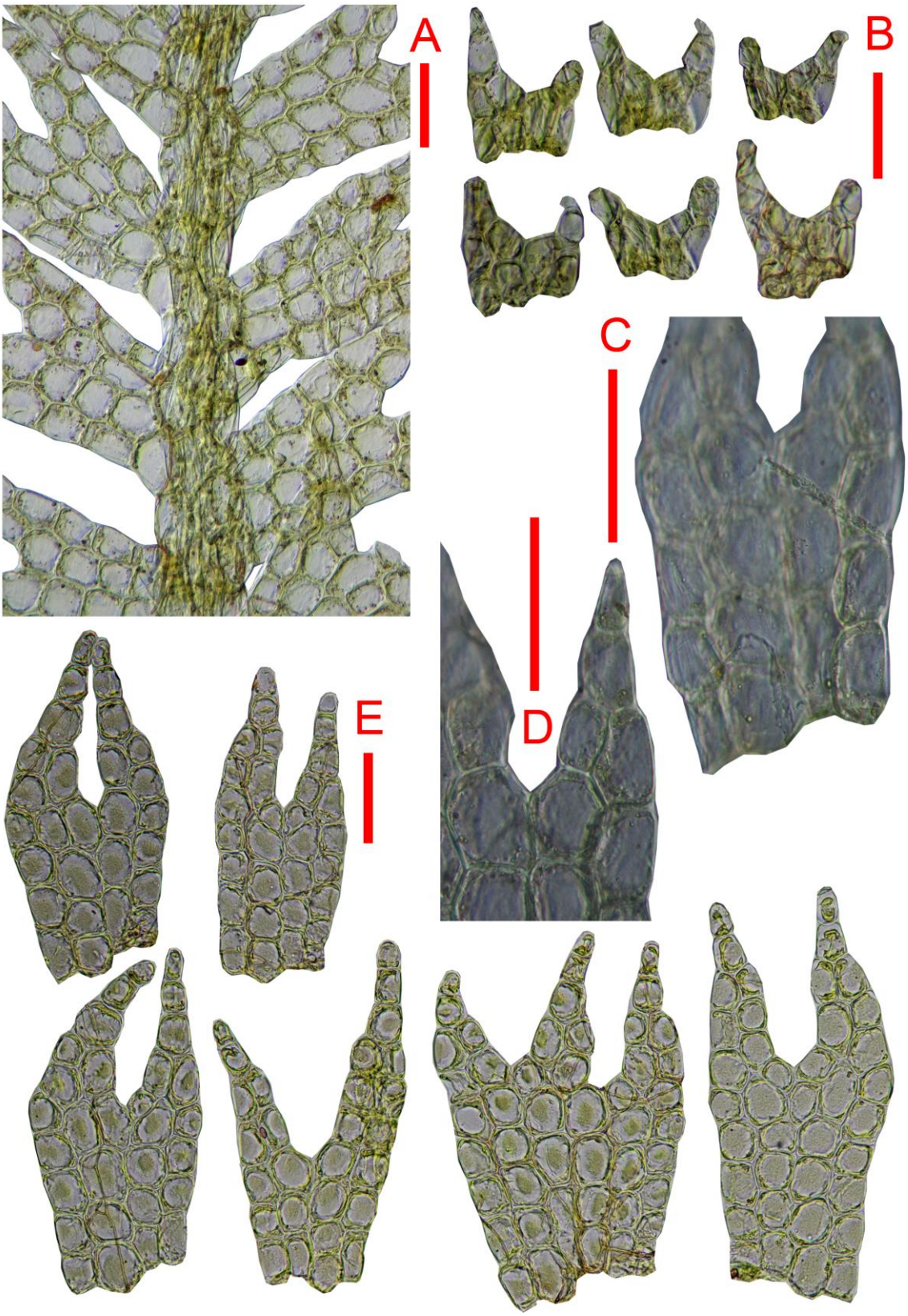

Plate 47: *Neolepidozia cuneifolia* fo. *biloba*: A – Branch ventral, B – Branch underleaves, C – Branch leaf disc, D – Branch leaf lobe, E – Branch leaves; Scales: A, B, C, D, E – 50 µm (from BAKER 7020, JE 04010503 – holotype *Lepidozia bifida*)

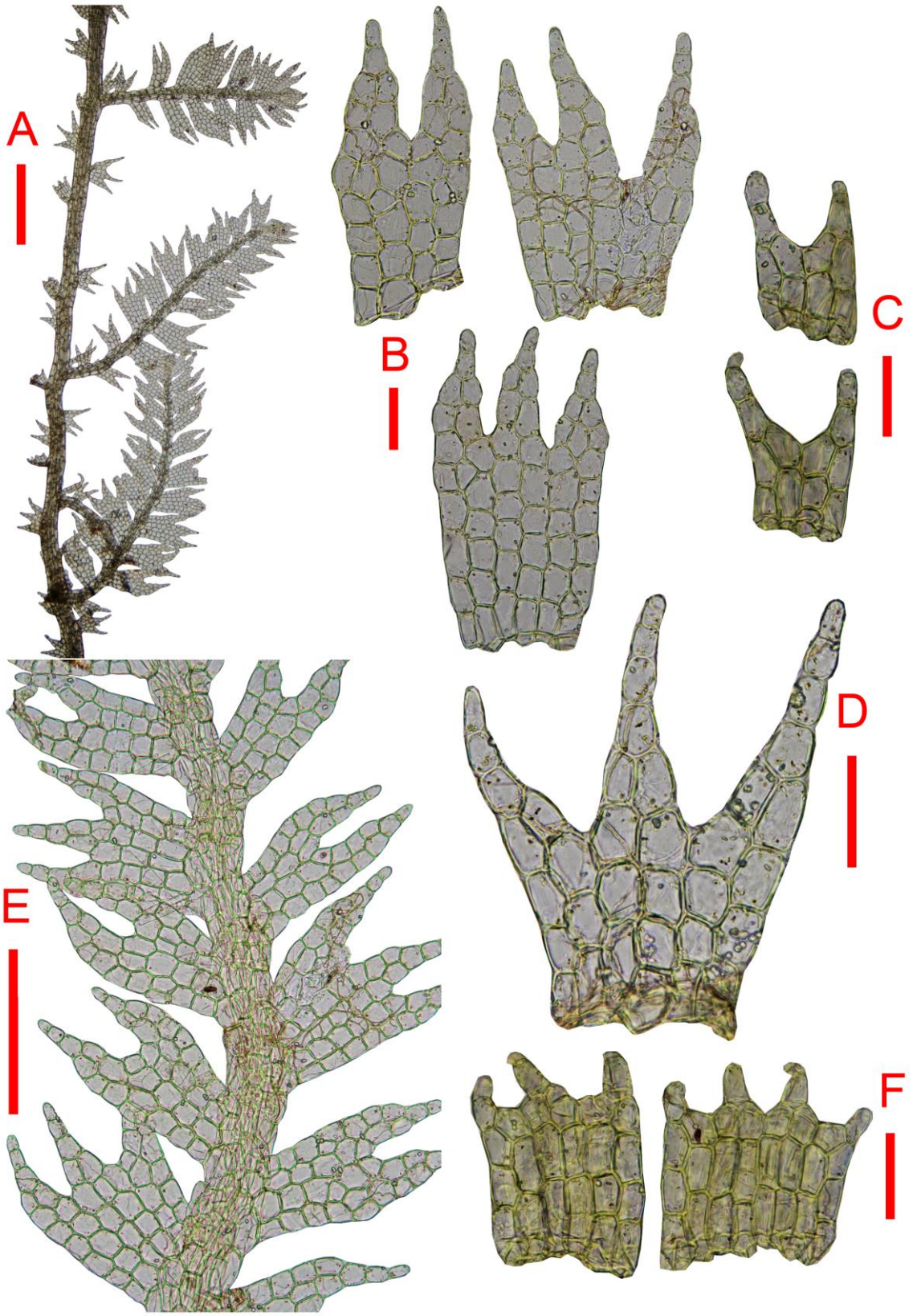

Plate 48: *Neolepidozia cuneifolia* fo. *biloba*: A – Stem ventral, B – Branch leaves, C – Branch underleaves, D – Stem leaf, E – Branch dorsal, F – Stem underleaves; Scales: A – 0.5 mm; E – 0.2 mm; B, C, D, F – 50 µm (from BAKER 7020a, JE 04010502)

***Neolepidozia cuneifolia* var. *luxurians* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

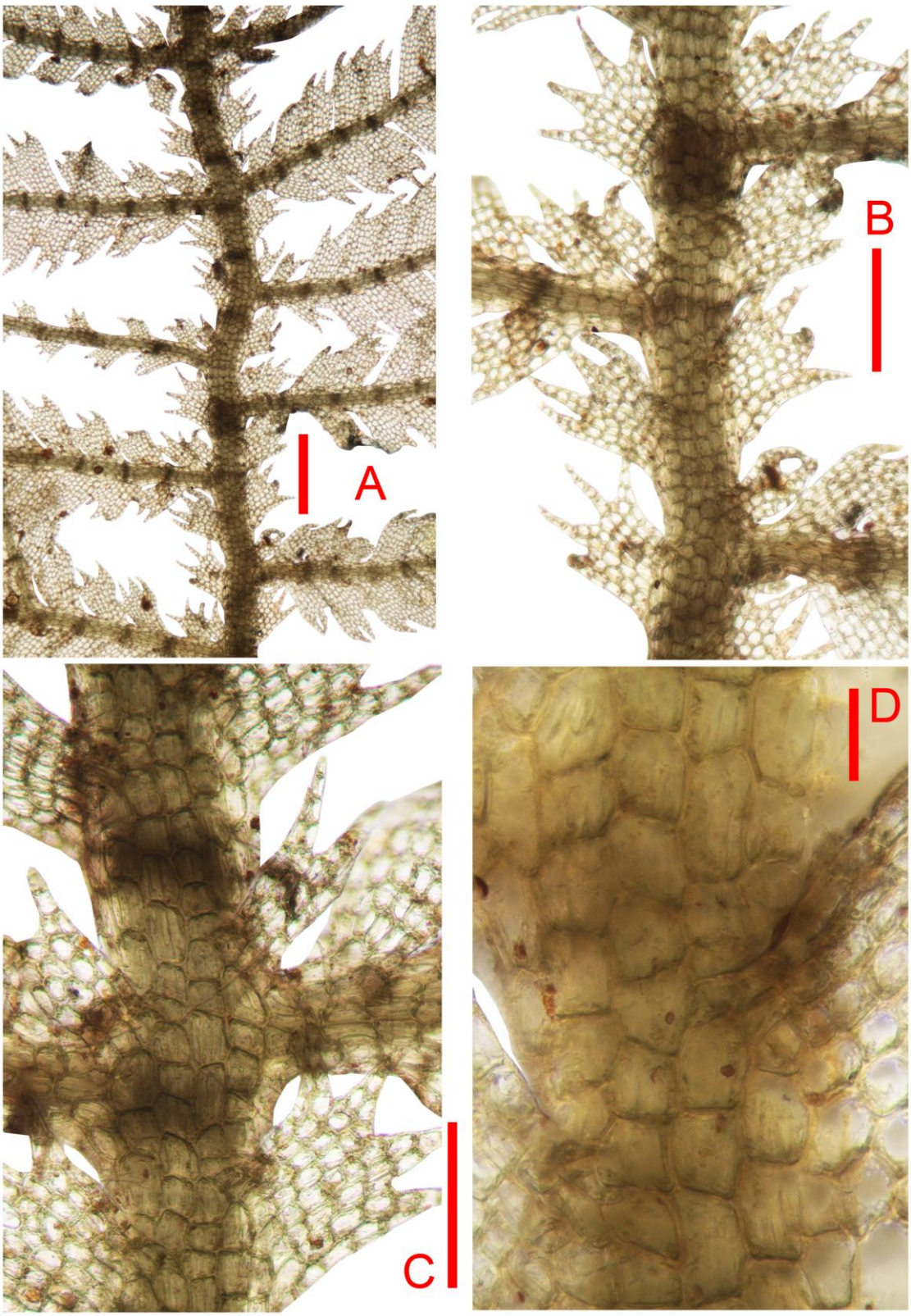

Plate 49: *Neolepidozia cuneifolia* var. *luxurians*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from KOPONEN 35359, JE – holotype)

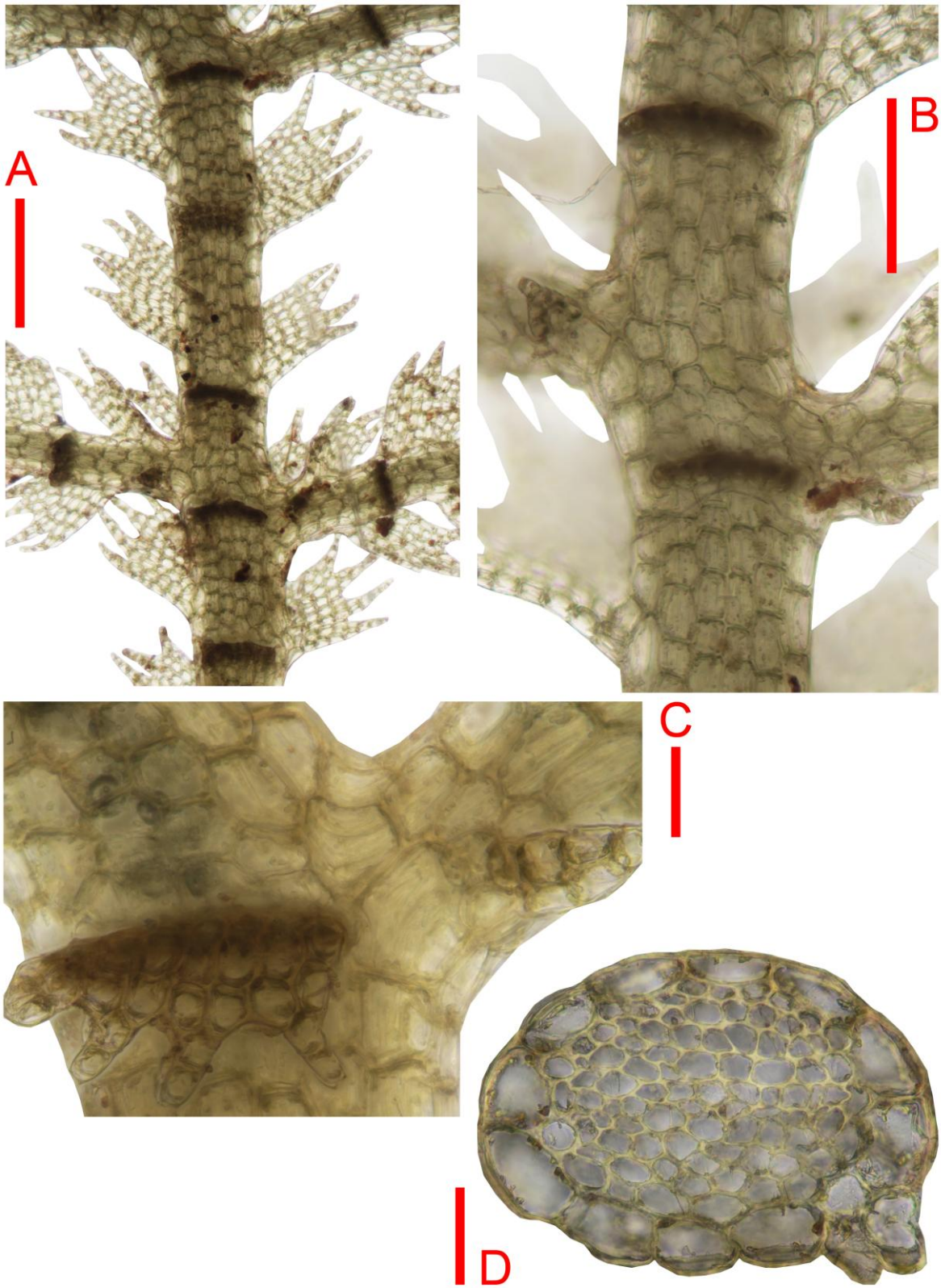

Plate 50: *Neolepidozia cuneifolia* var. *luxurians*: A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from KOPONEN 35359, JE – holotype)

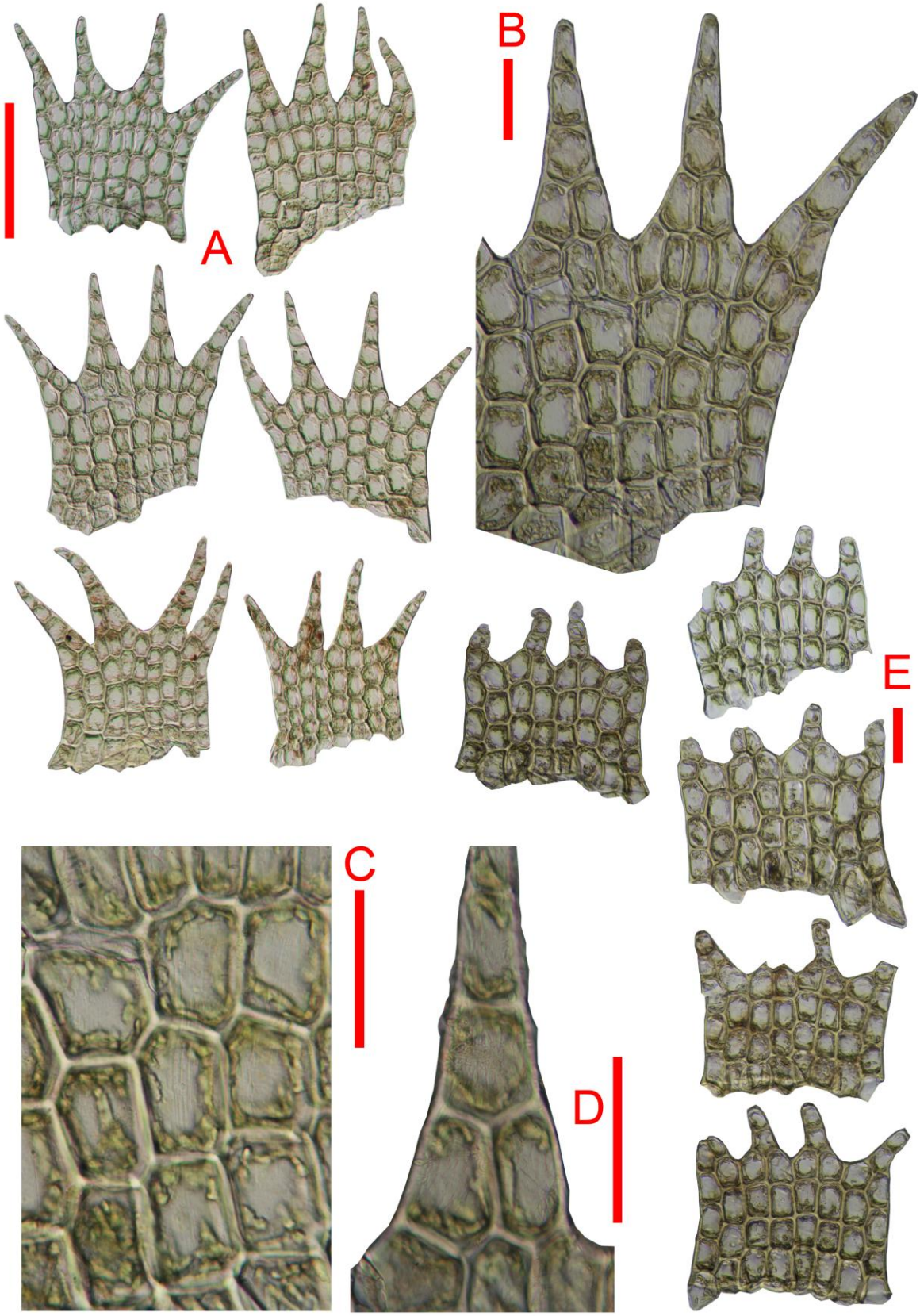

Plate 51: *Neolepidozia cuneifolia* var. *luxurians*: A, B – Stem leaves, C – Stem leaf disc, D – Stem leaf lobe, E – Stem underleaves; Scales: A – 0.2 mm; B, C, D, E – 50 µm (from KOPONEN 35359, JE – holotype)

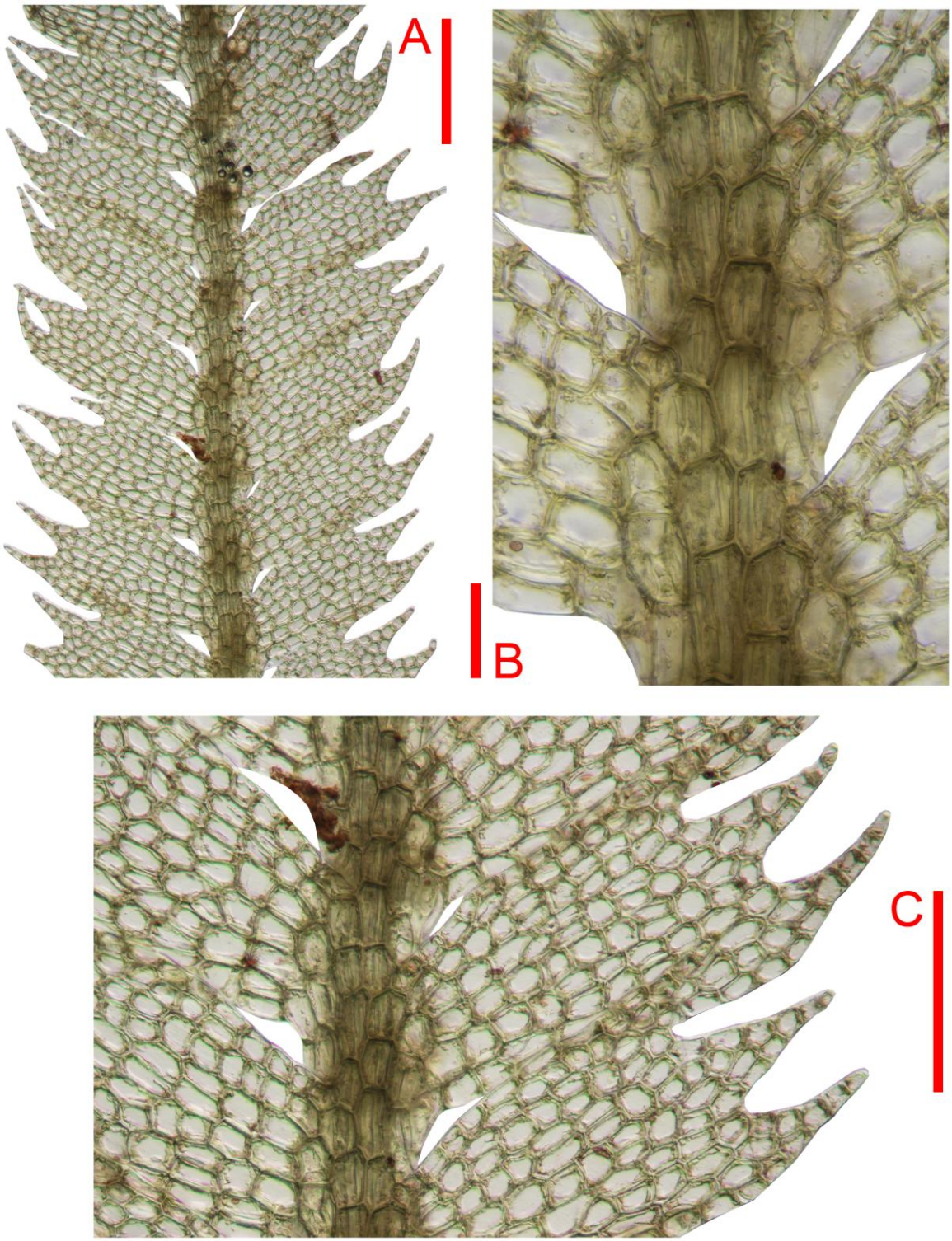

Plate 52: *Neolepidozia cuneifolia* var. *luxurians*: A, B, C – Branch dorsal; Scales: A – 0.3 mm; B – 0.2 mm, C – 50 µm (from KOPONEN 35359, JE – holotype)

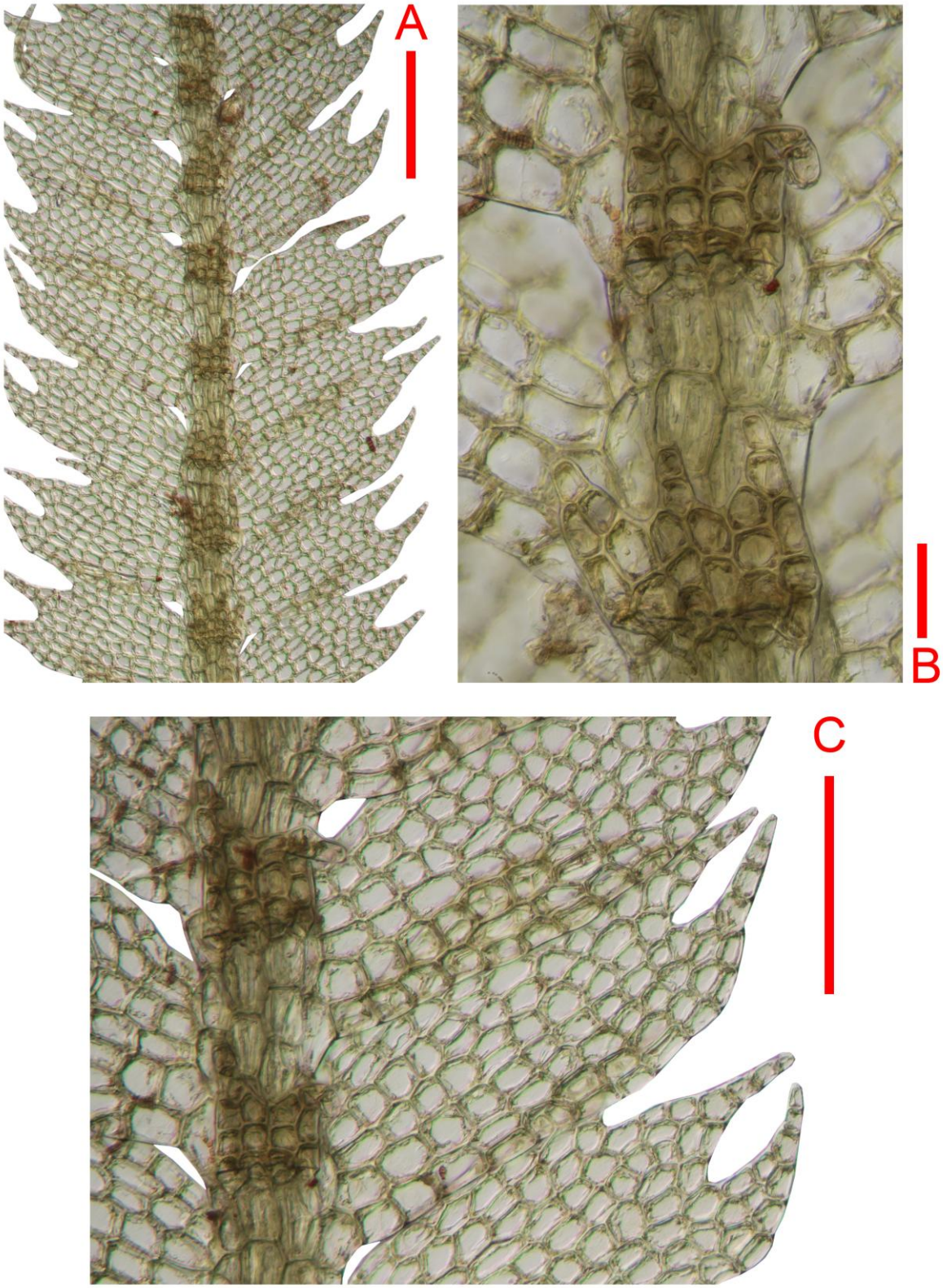

Plate 53: *Neolepidozia cuneifolia* var. *luxurians*: A, B, C – Branch ventral; Scales: A – 0.3 mm; B – 0.2 mm, C – 50 µm (from KOPONEN 35359, JE – holotype)

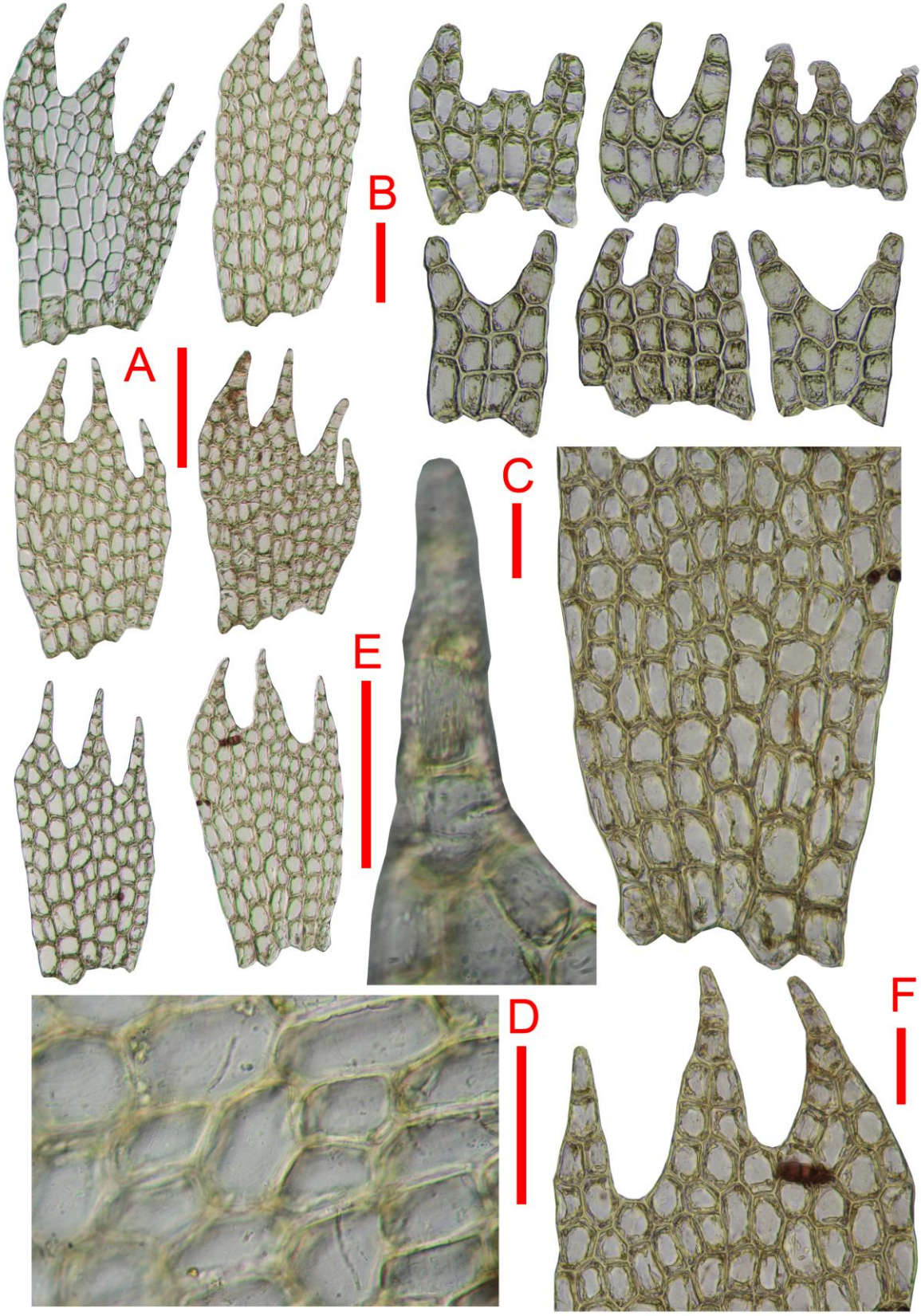

Plate 54: *Neolepidozia cuneifolia* var. *luxurians*: A – Branch leaves, B – Branch underleaves, C, D – Branch leaf disc, E, F – Branch leaf lobe; Scales: A – 0.2 mm; B, C, D, E, F – 50 µm (from KOPONEN 35359, JE – holotype)

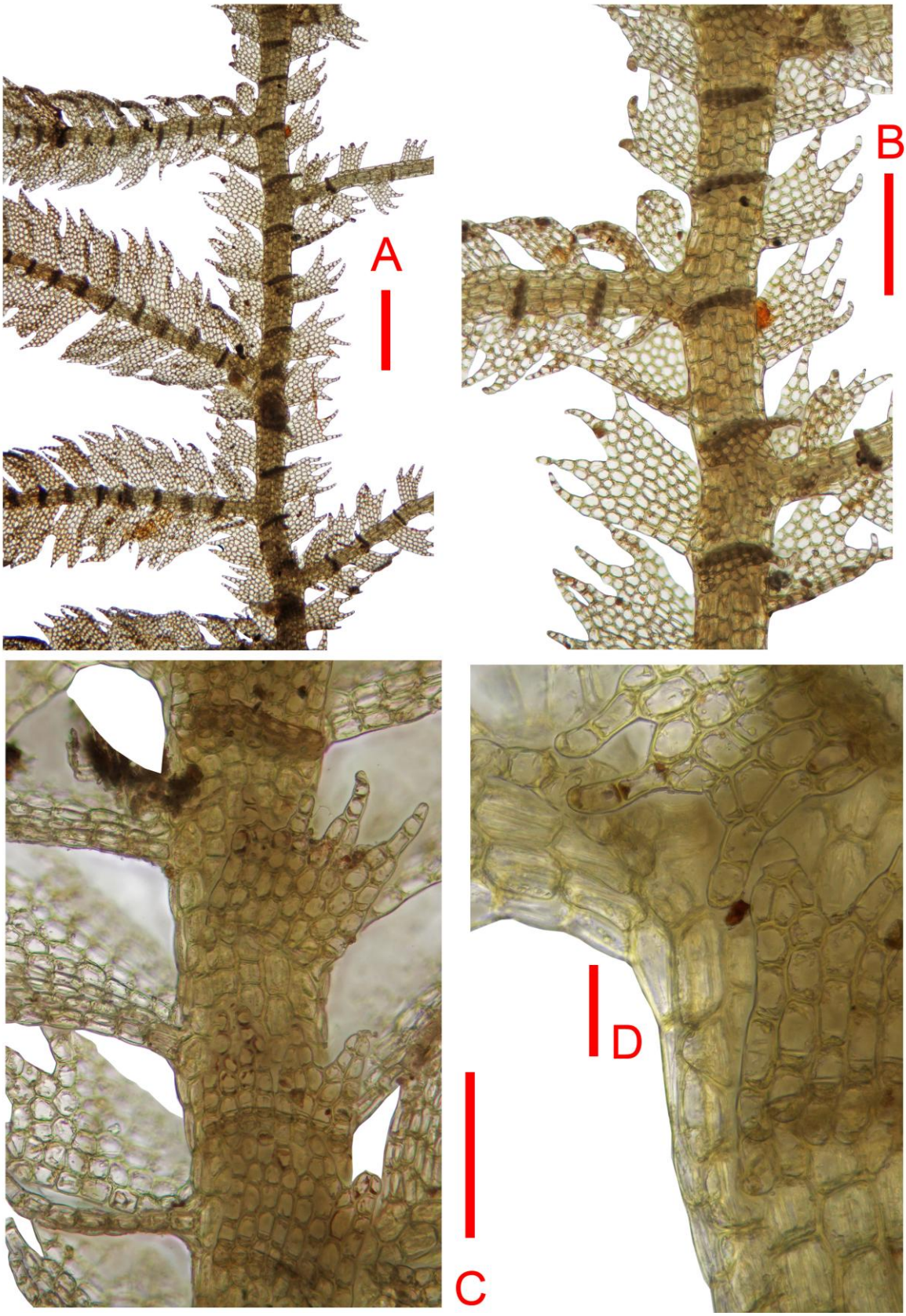

Plate 55: *Neolepidozia cuneifolia* var. *luxurians*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from WINKLER 3094)

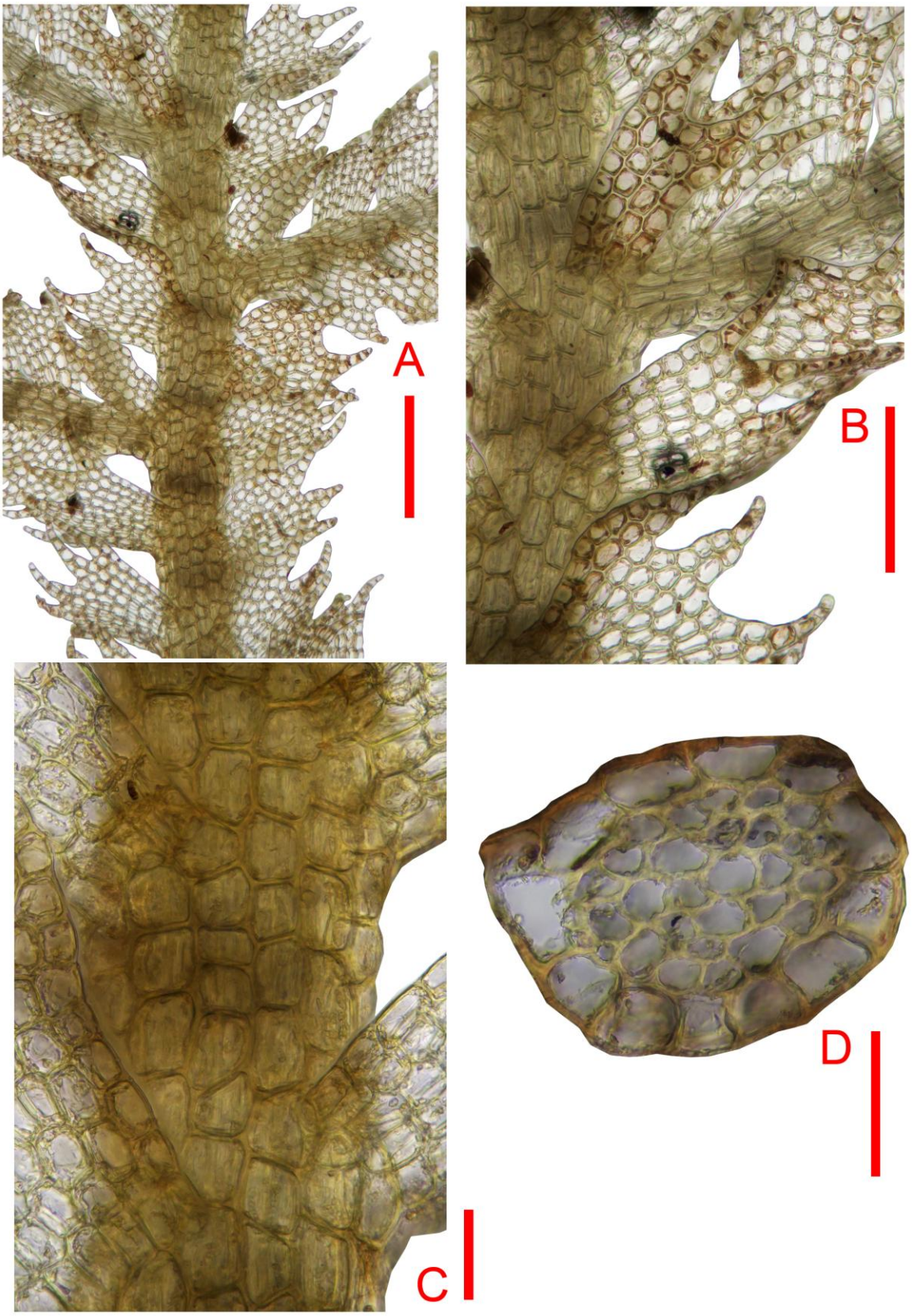

Plate 56: *Neolepidozia cuneifolia* var. *luxurians*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from WINKLER 3094)

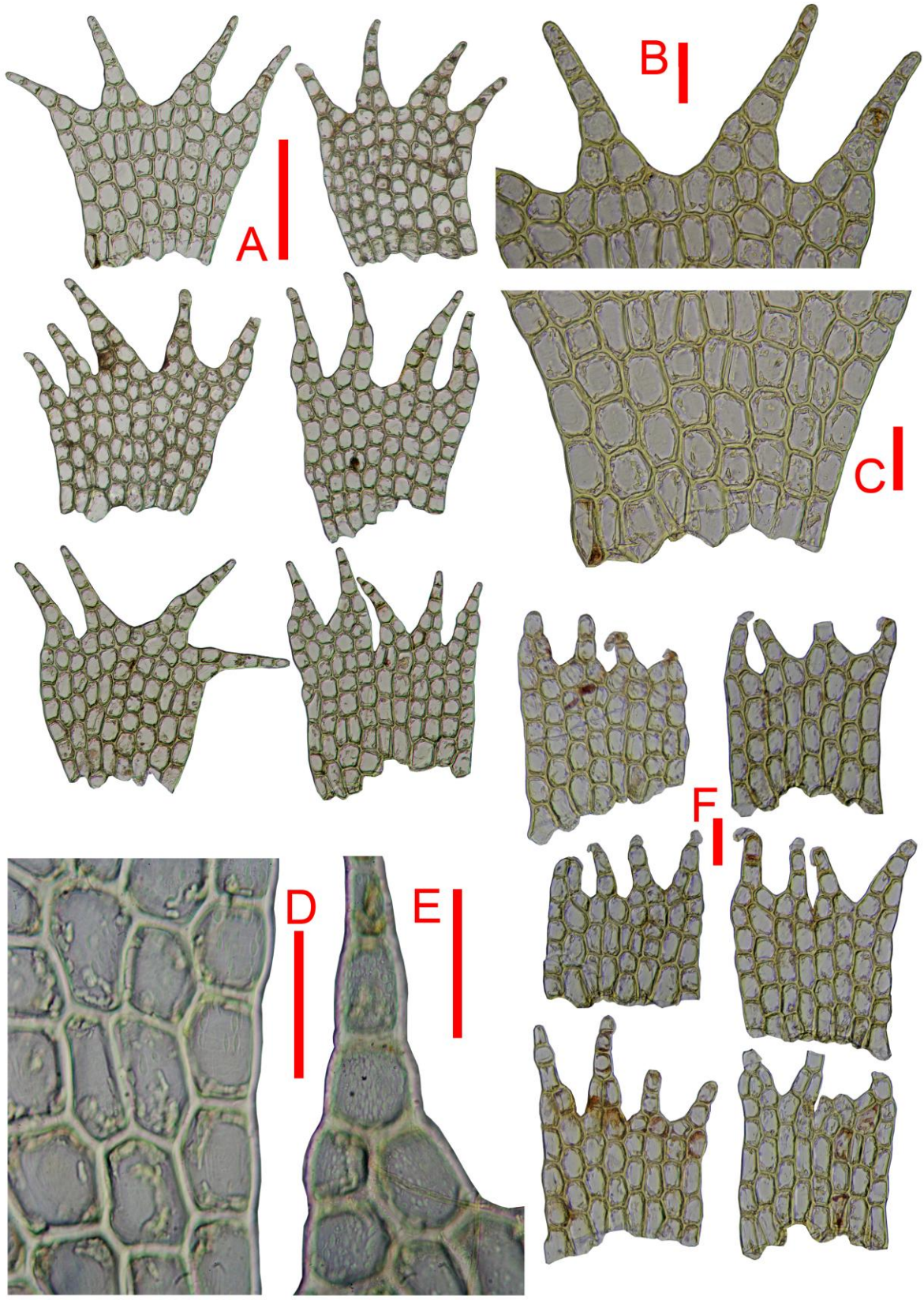

Plate 57: *Neolepidozia cuneifolia* var. *luxurians*: A – Stem leaves, B, E – Stem leaf lobes, C, D – Stem leaf disc, F – Stem underleaves; Scales: A – 0.2 mm; B, C, D, E, F – 50 µm (from WINKLER 3094)

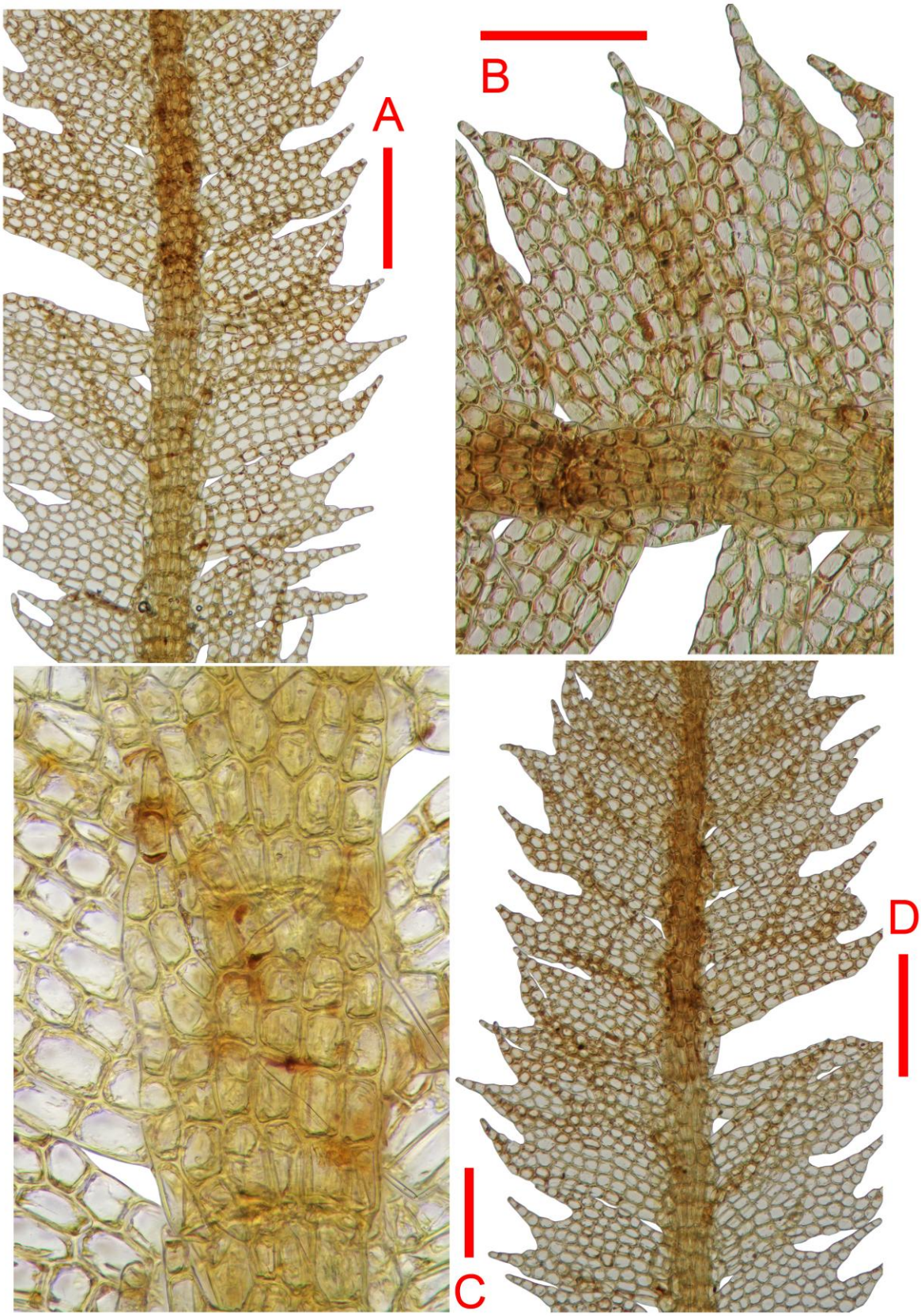

Plate 58: *Neolepidozia cuneifolia* var. *luxurians*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm; B – 0.2 mm; C – 50 µm (from WINKLER 3094)

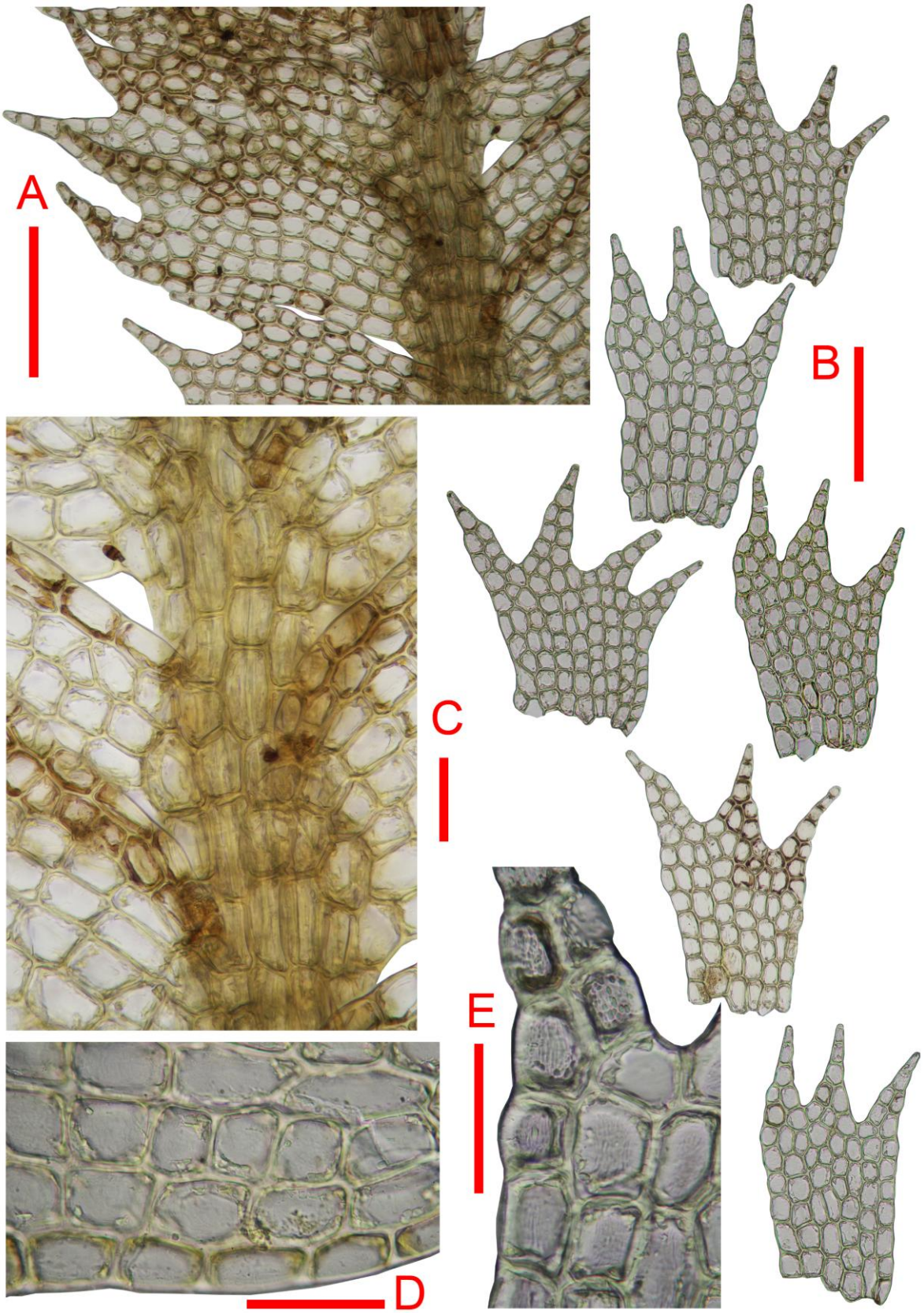

Plate 59: *Neolepidozia cuneifolia* var. *luxurians*: A, C – Branch dorsal, B – Branch leaves, D – Branch leaf disc, E – Branch leaf lobe; Scales: A, B – 0.2 mm; C, D, E – 50 µm (from WINKLER 3094)

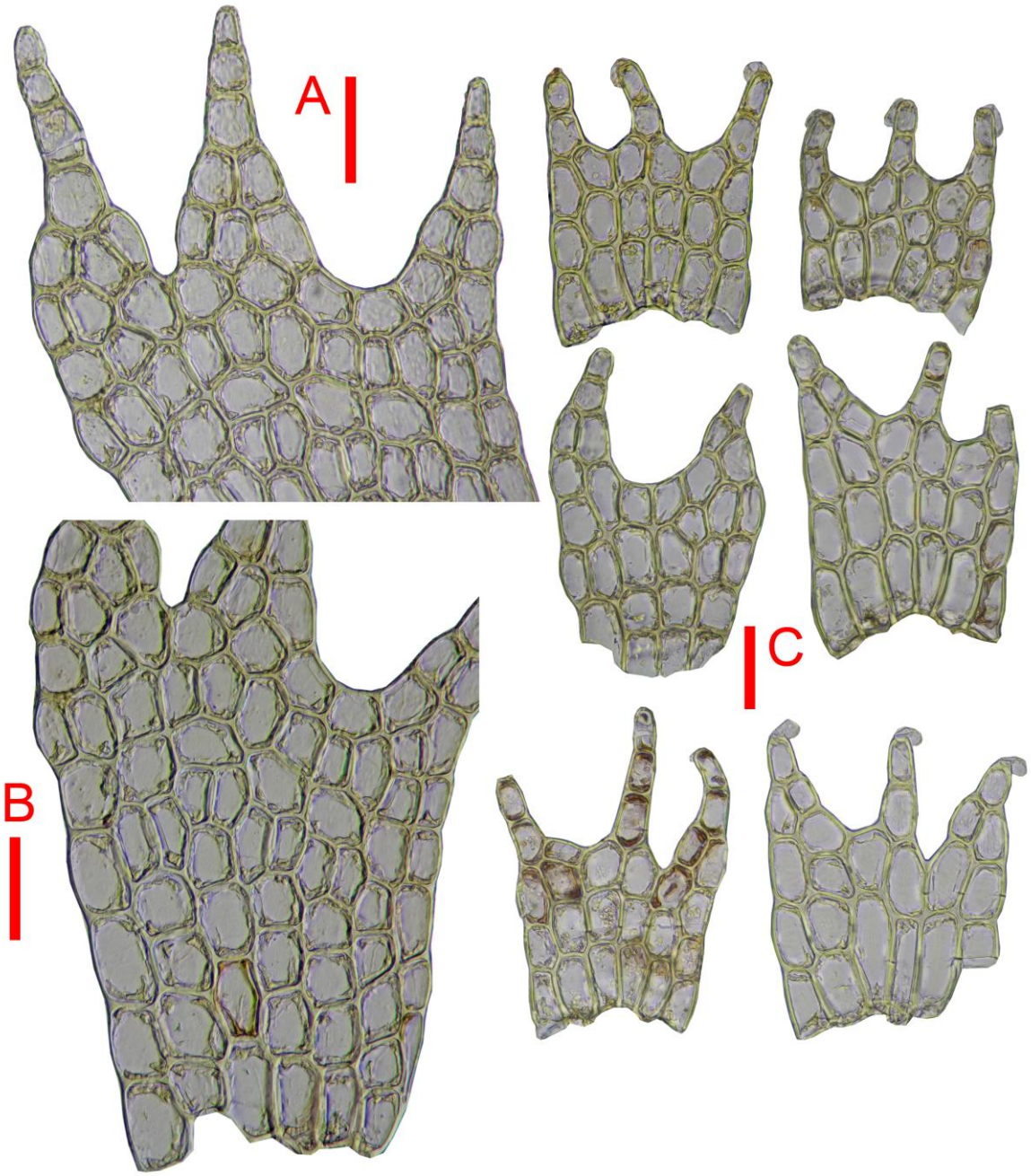

Plate 60: *Neolepidozia cuneifolia* var. *luxurians*: A – Branch leaf lobes, B – Branch leaf disc, C – Branch underleaves; Scales: A, B, C – 50 µm (from WINKLER 3094)

Neolepidozia dinagatensis **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

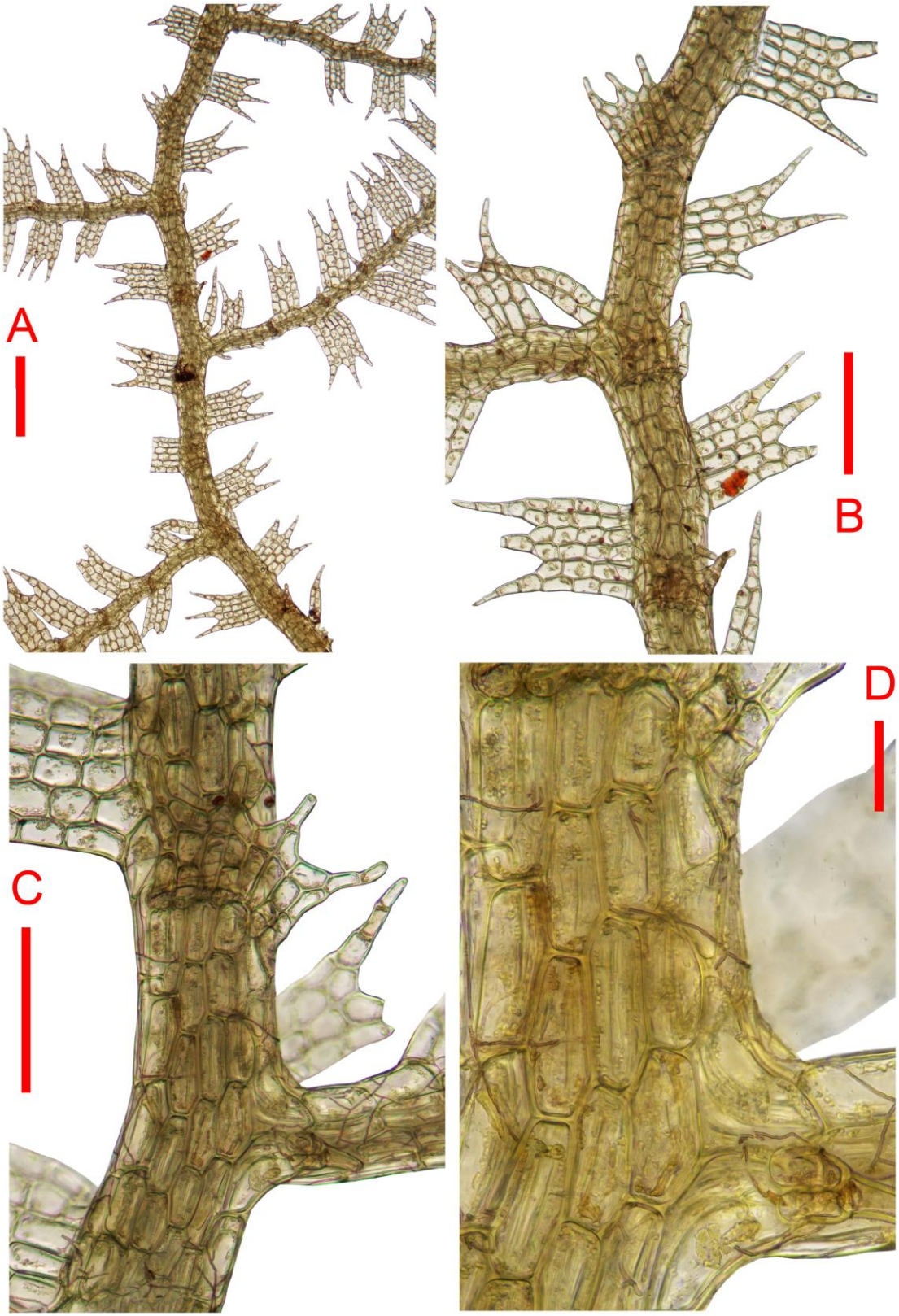

Plate 61: *Neolepidozia dinagatensis* : A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SHEVOCK 63846A - holotype)

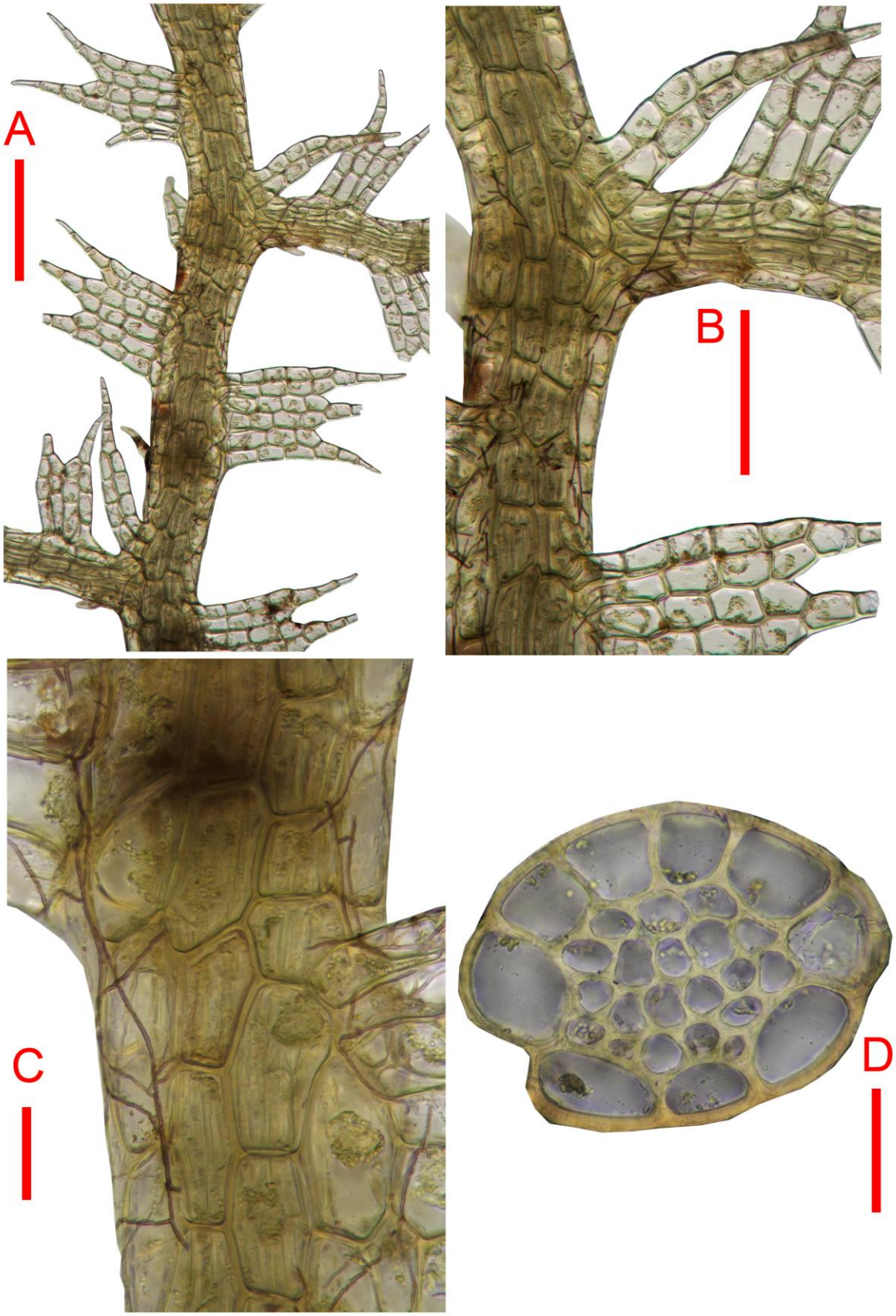

Plate 62: *Neolepidozia dinagatensis* : A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SHEVOCK 63846A - holotype)

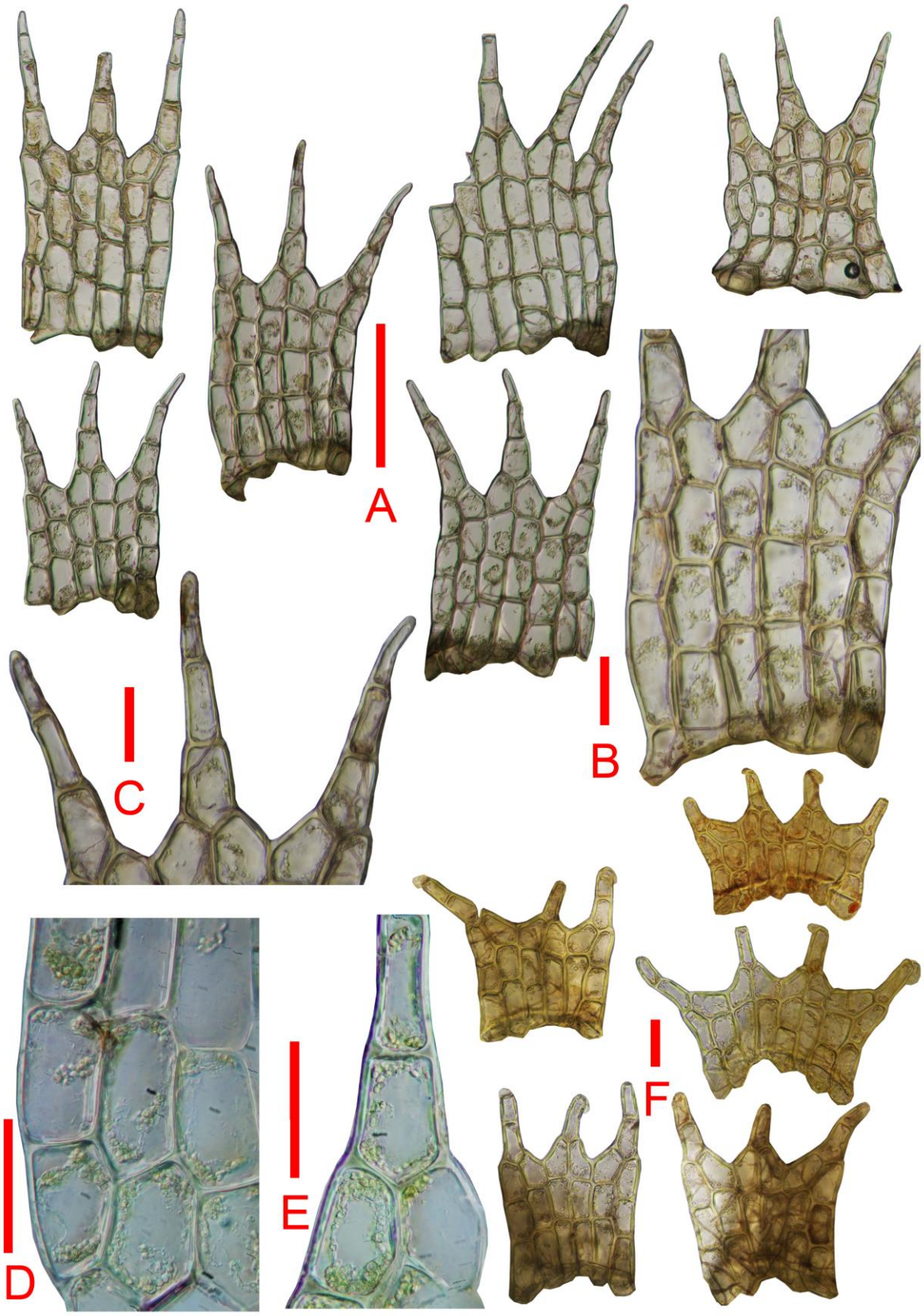

Plate 63: *Neolepidozia dinagatensis* : A – Stem leaves, B, D – Stem leaf disc, C, E – Stem leaf lobes, F – Stem underleaves; Scales: A – 0.2 mm; B, C, D, E, F – 50 µm (from SHEVOCK 63846A - holotype)

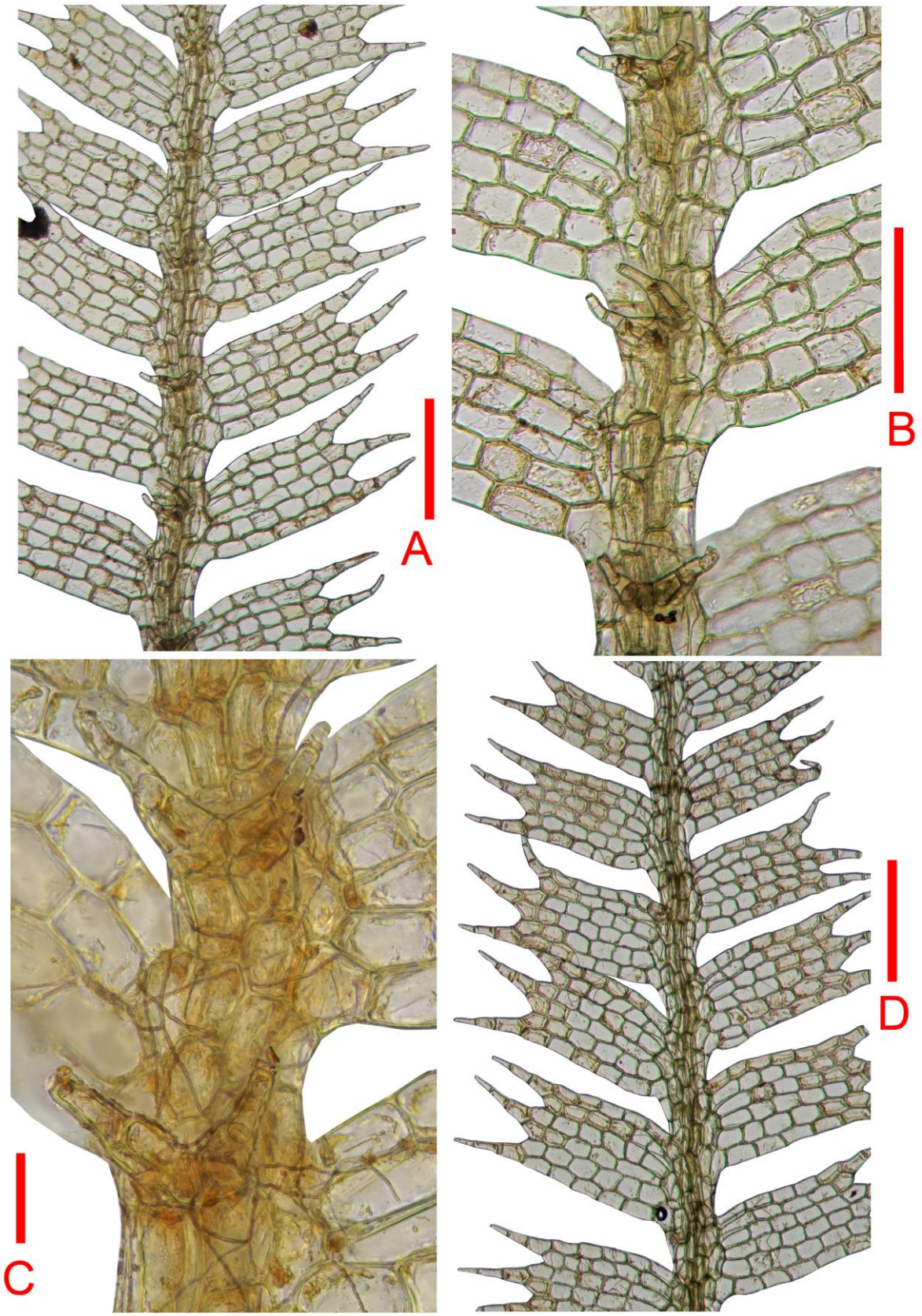

Plate 64: *Neolepidozia dinagatensis* : A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm; B – 0.2 mm; C – 50 µm (from SHEVOCK 63846A - holotype)

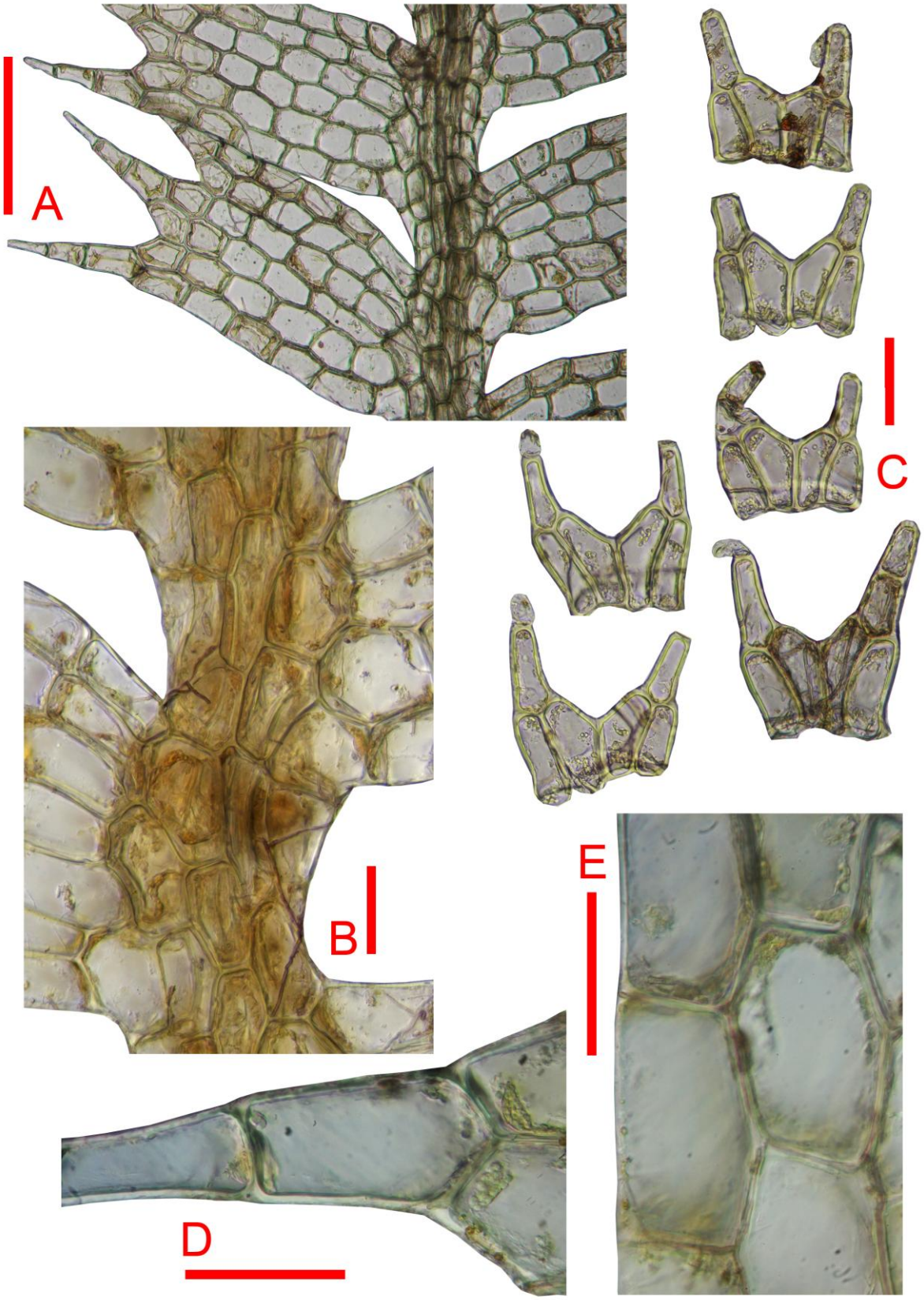

Plate 65: *Neolepidozia dinagatensis* : A, B – Branch dorsal, C – Branch underleaves, D – Branch leaf lobe, E – Branch leaf disc; Scales: A – 0.3 mm; B – 0.2 mm; C, D, E – 50 µm (from SHEVOCK 63846A - holotype)

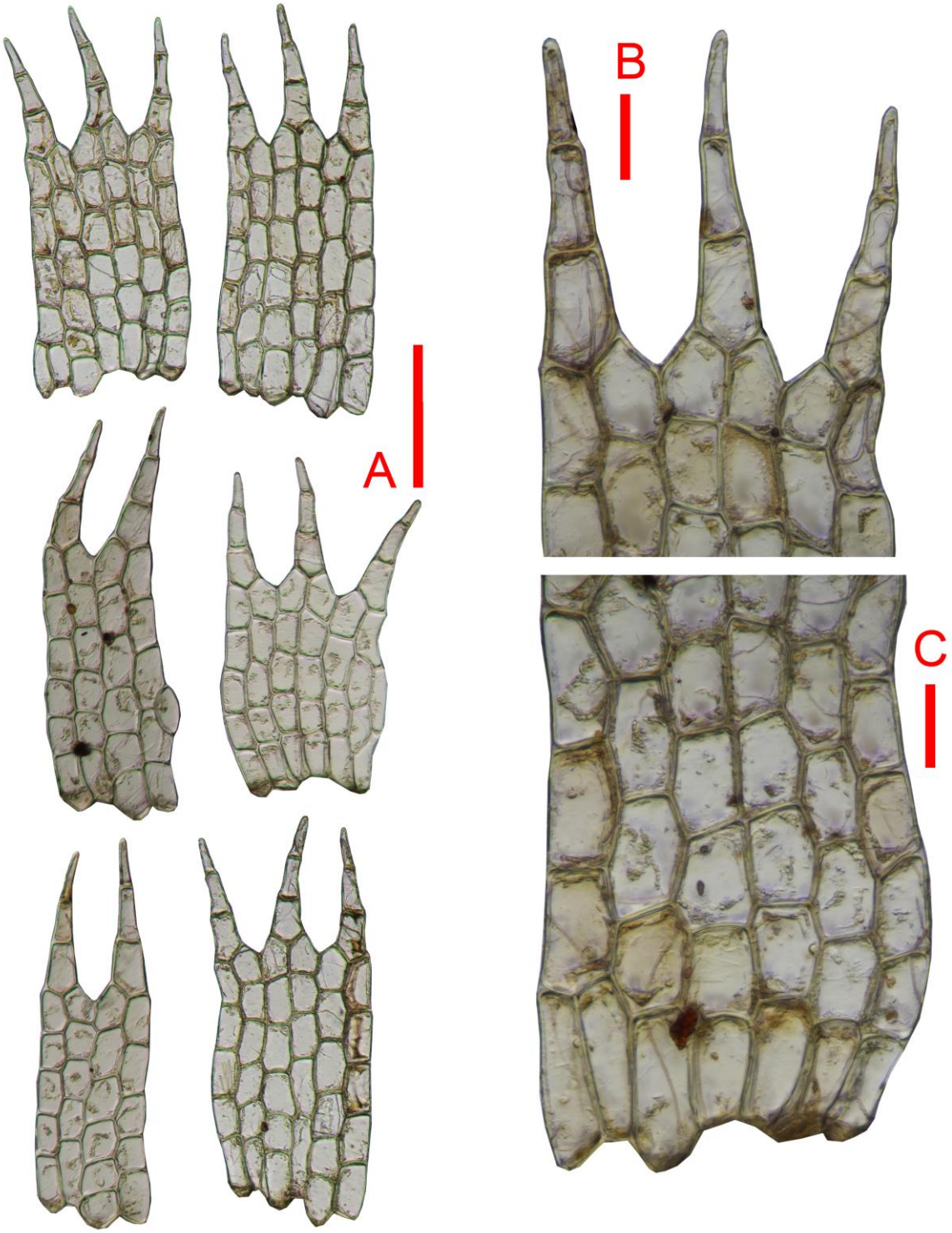

Plate 66: *Neolepidozia dinagatensis* : A – Branch leaves, B – Branch leaf lobes, C – Branch leaf disc; Scales: A – 0.2 mm; B, C – 50 µm (from SHEVOCK 63846A - holotype)

Neolepidozia dulitensis **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

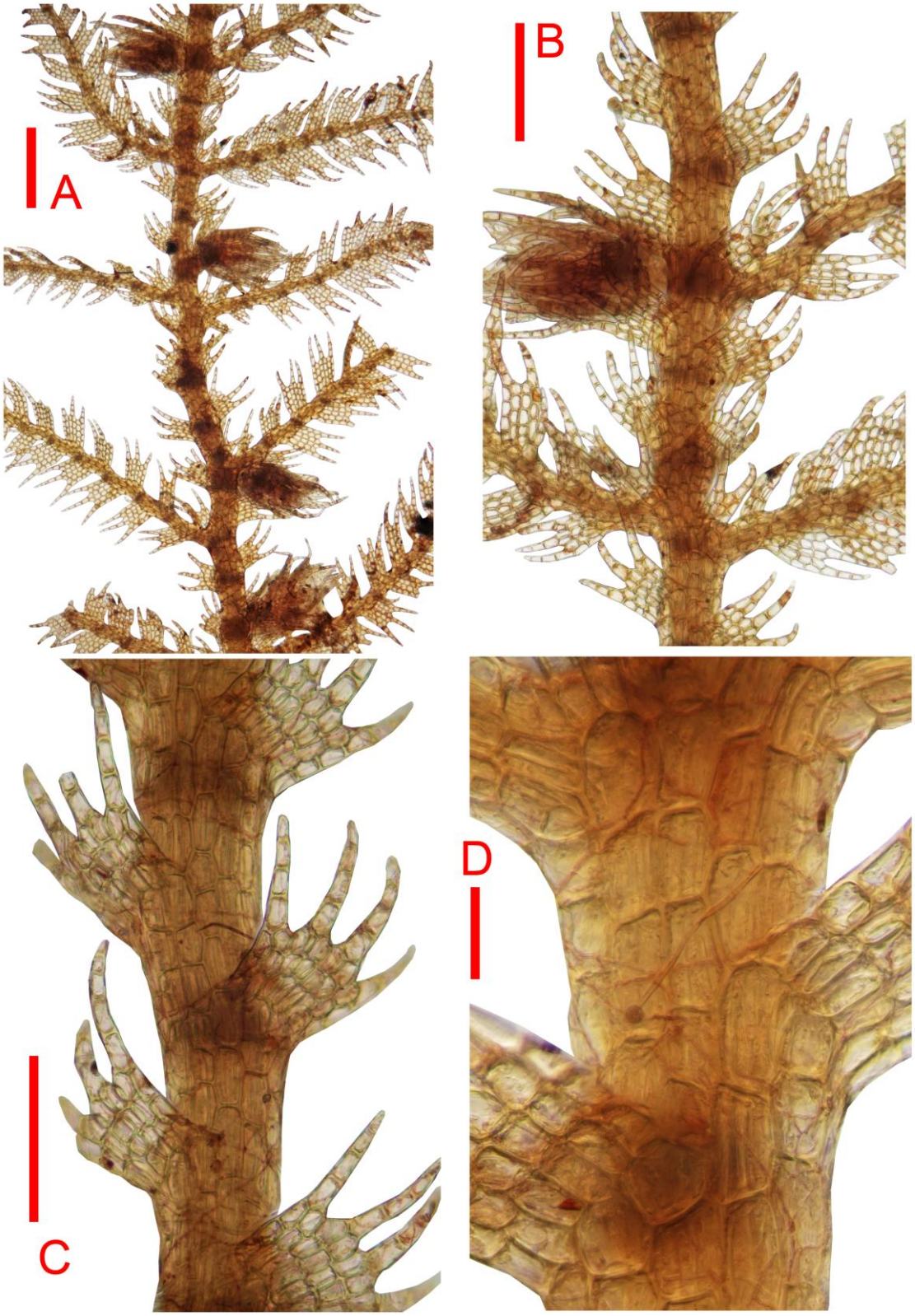

Plate 67: *Neolepidozia dulitensis*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from RICHARDS 1974a, JE - holotype)

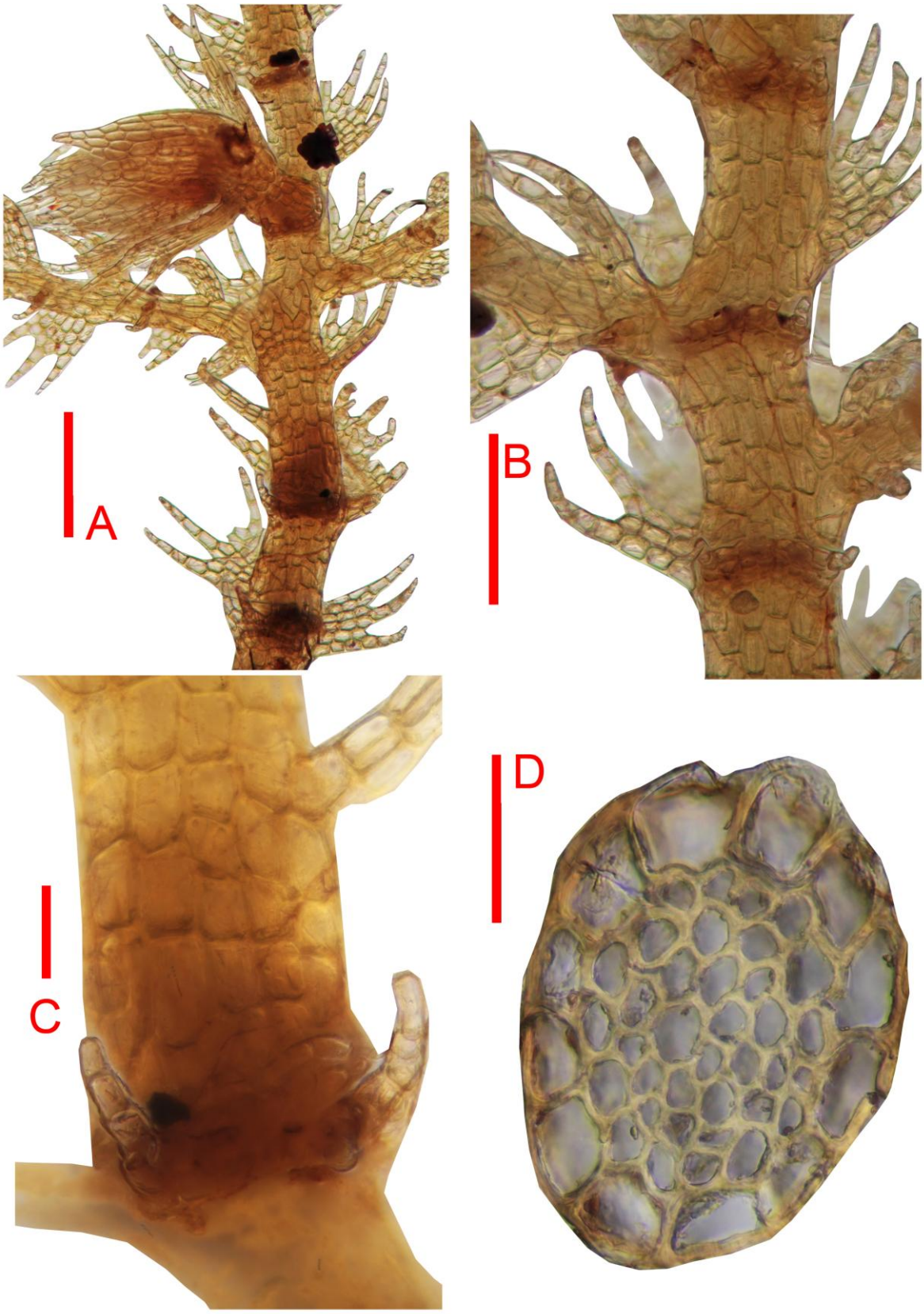

Plate 68: *Neolepidozia dulitensis*: A, B, C – Plant ventral, D Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from RICHARDS 1974a, JE - holotype)

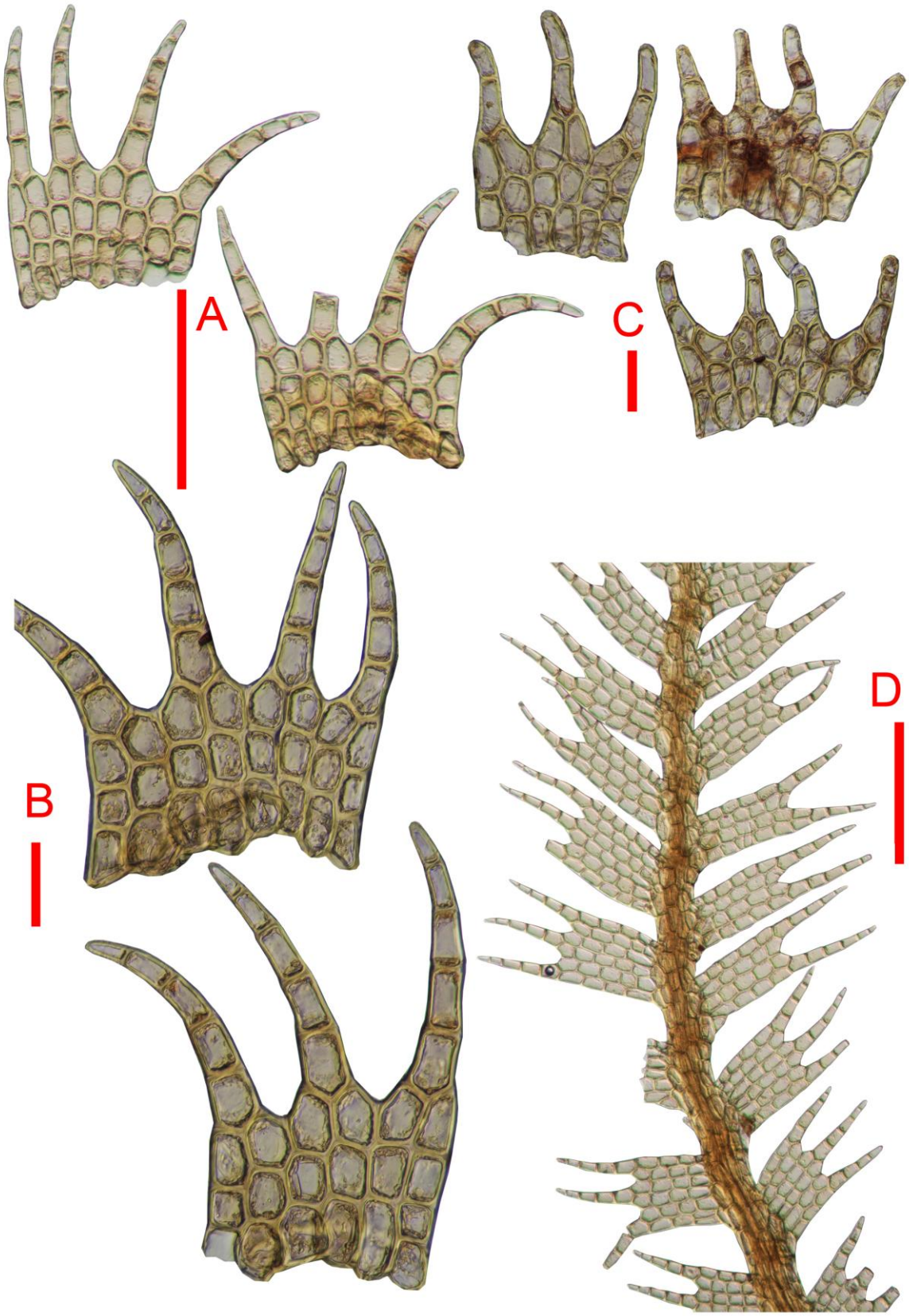

Plate 69: *Neolepidozia dulitensis*: A, B – Stem leaves, C – Stem underleaves, D – Branch dorsal; Scales: A – 0.2 mm; B, C – 50 µm, D – 0.3 mm (from RICHARDS 1974a, JE - holotype)

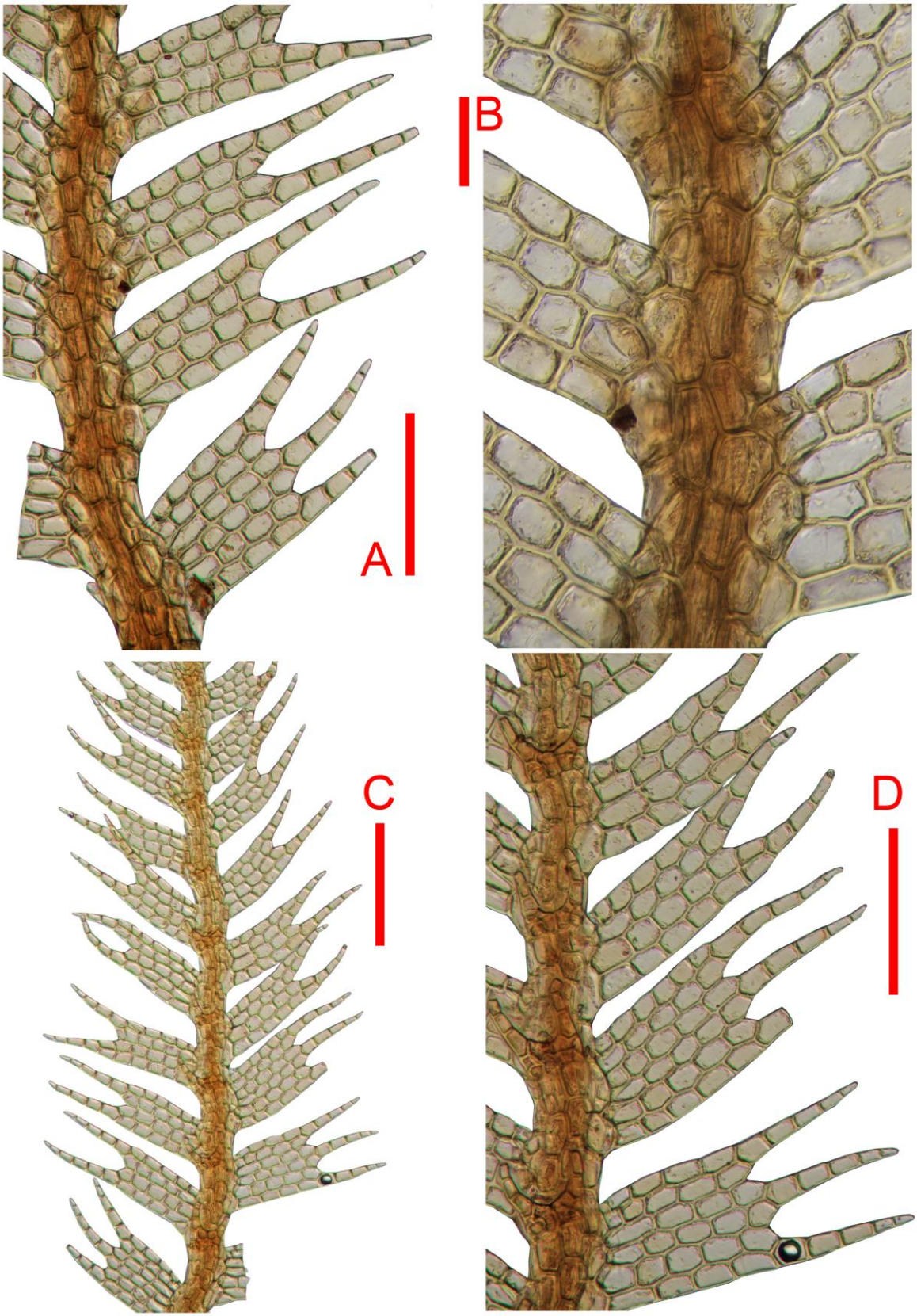

Plate 70: *Neolepidozia dulitensis*: A, B – Branch dorsal, C, D – Branch ventral; Scales: A, D – 0.2 mm; B – 50 µm, C – 0.3 mm (from RICHARDS 1974a, JE - holotype)

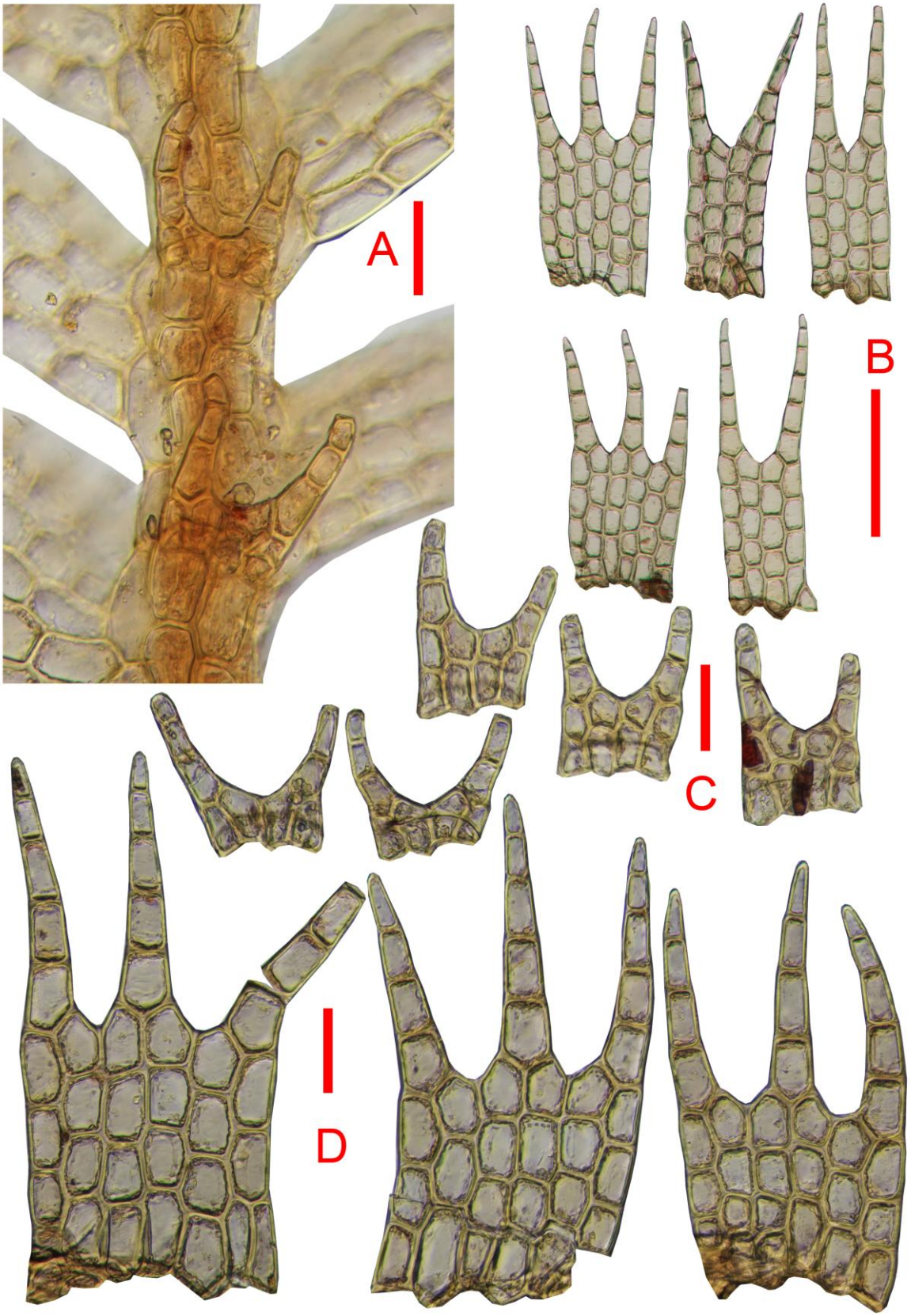

Plate 71: *Neolepidozia dulitensis*: A – Branch ventral, B, D – Branch leaves, C – Branch underleaves; Scales: B – 0.2 mm; A, C, D – 50 µm (from RICHARDS 1974a, JE - holotype)

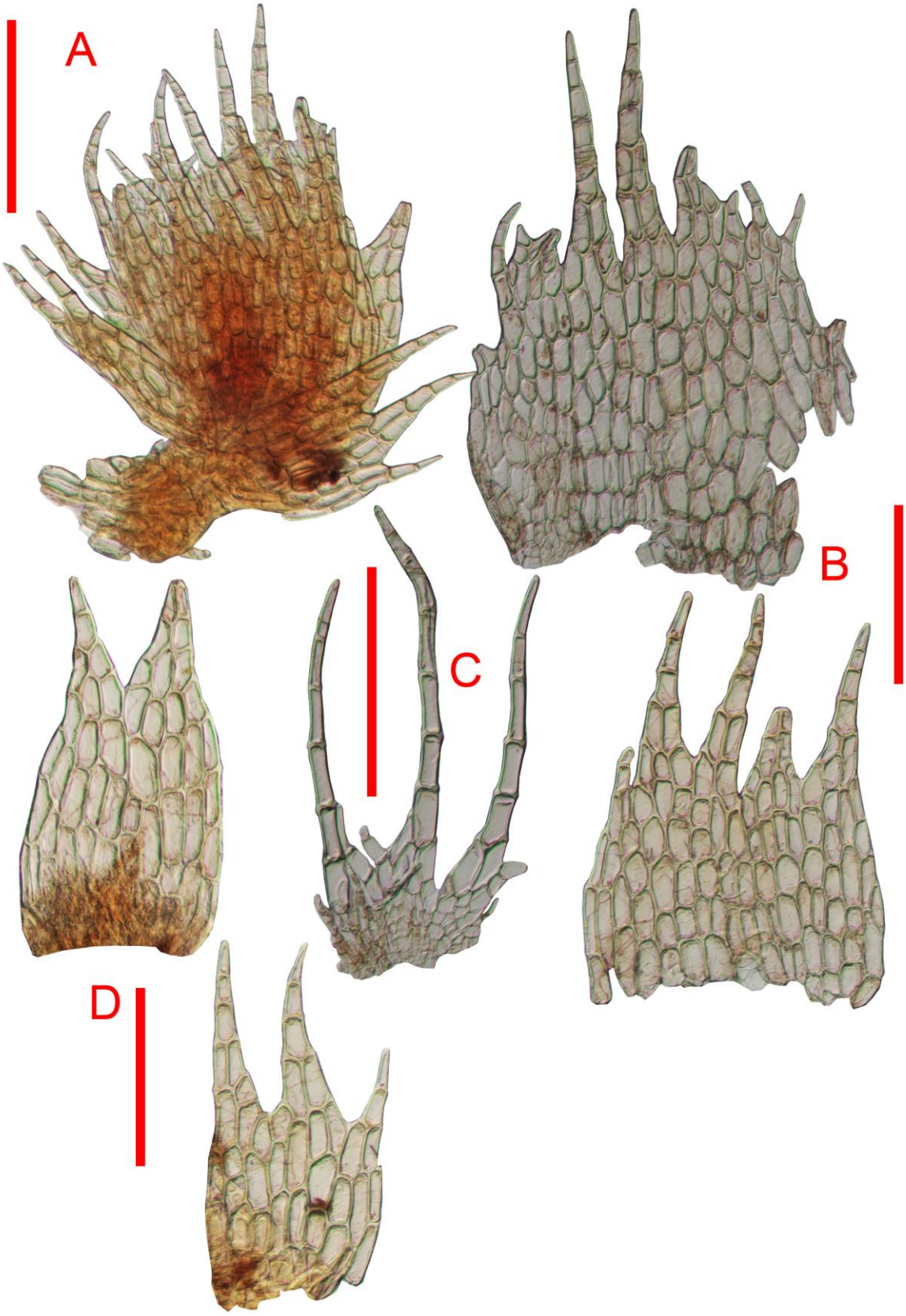

Plate 72: *Neolepidozia dulitensis*: A – Female inflorescense, B – Female bracts, C – Female bracteole, D – Female outer bracts; Scales: A – 0.3 mm, B, C, D – 0.2 mm (from RICHARDS 1974a, JE - holotype)

Neolepidozia hamiguitanensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

Plate 73: *Neolepidozia hamiguitanensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SHEVOCK 46951 – holotype)

Plate 74: *Neolepidozia hamiguitanensis*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SHEVOCK 46951 – holotype)

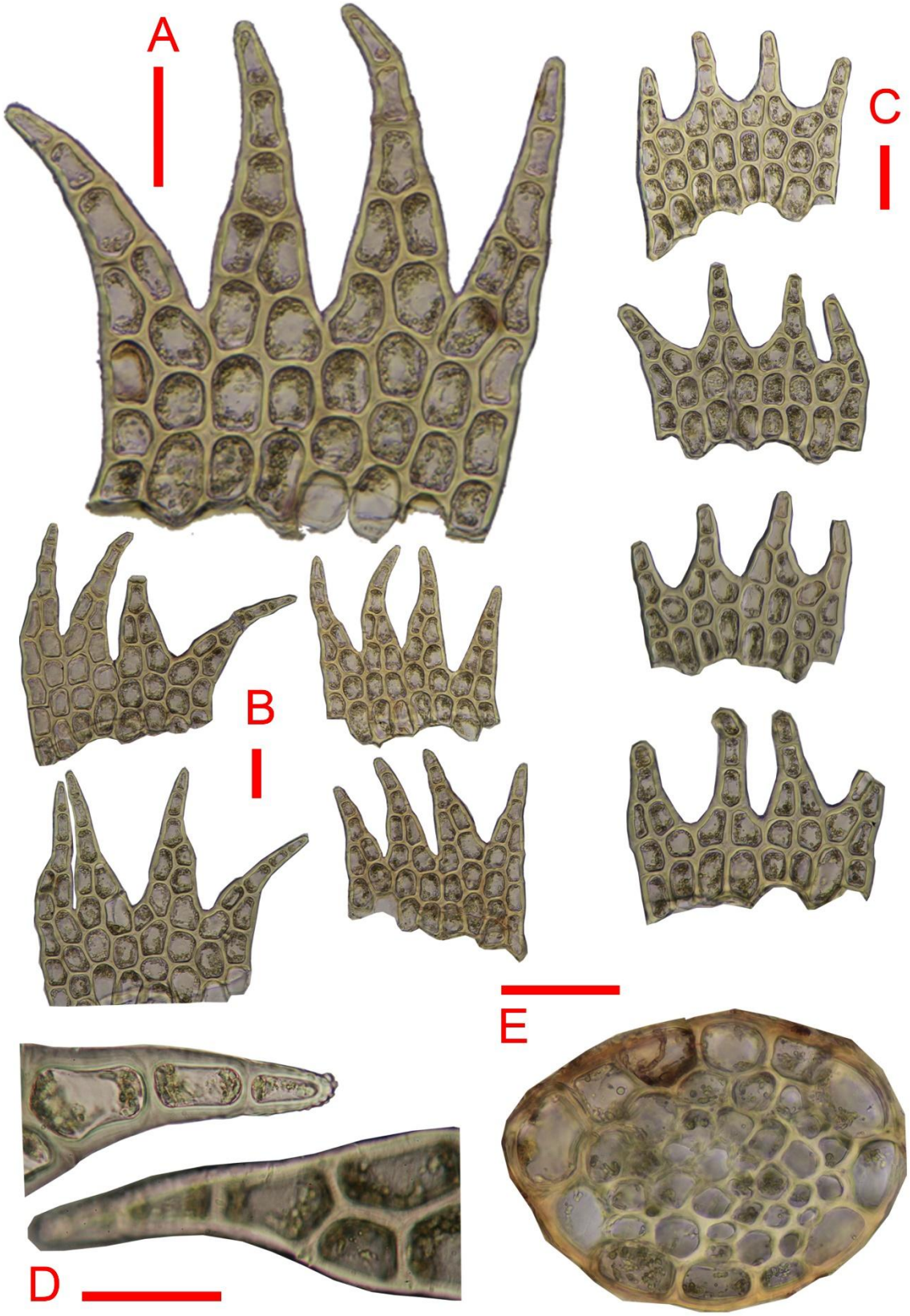

Plate 75: *Neolepidozia hamiguitanensis*: A, B – Stem leaves; C – Stem underleaves; D – Stem leaf lobe; E – Stem cross section Scales: A, B, C, D, E – 50 µm (from SHEVOCK 46951 – holotype)

Plate 76: *Neolepidozia hamiguitanensis*: A, B, D – Branch dorsal; C, E – Branch ventral; Scales: A, C – 0.3 mm; B, E – 0.2 mm; D – 50 µm (from SHEVOCK 46951 – holotype)

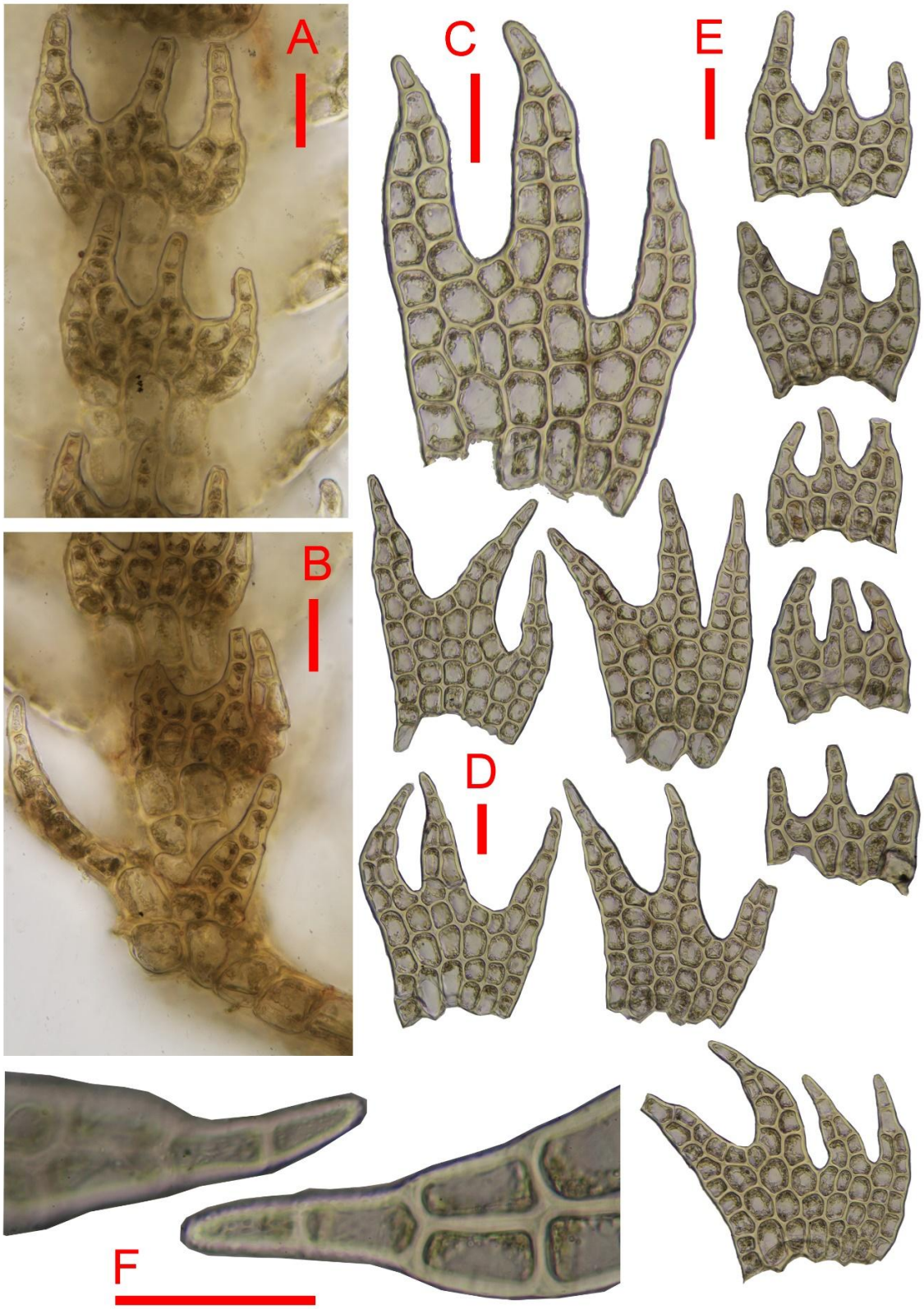

Plate 77: *Neolepidozia hamiguitanensis*: A – Branch ventral; B – Branch base with first amphigastrium; C, D – Branch leaves; E – Branch underleaves; F – Branch leaf lob apex; Scales: A, B, C, D, E, F – 50 µm (from SHEVOCK 46951 – holotype)

Neolepidozia heterotexta (STEPH.) E.D. COOPER

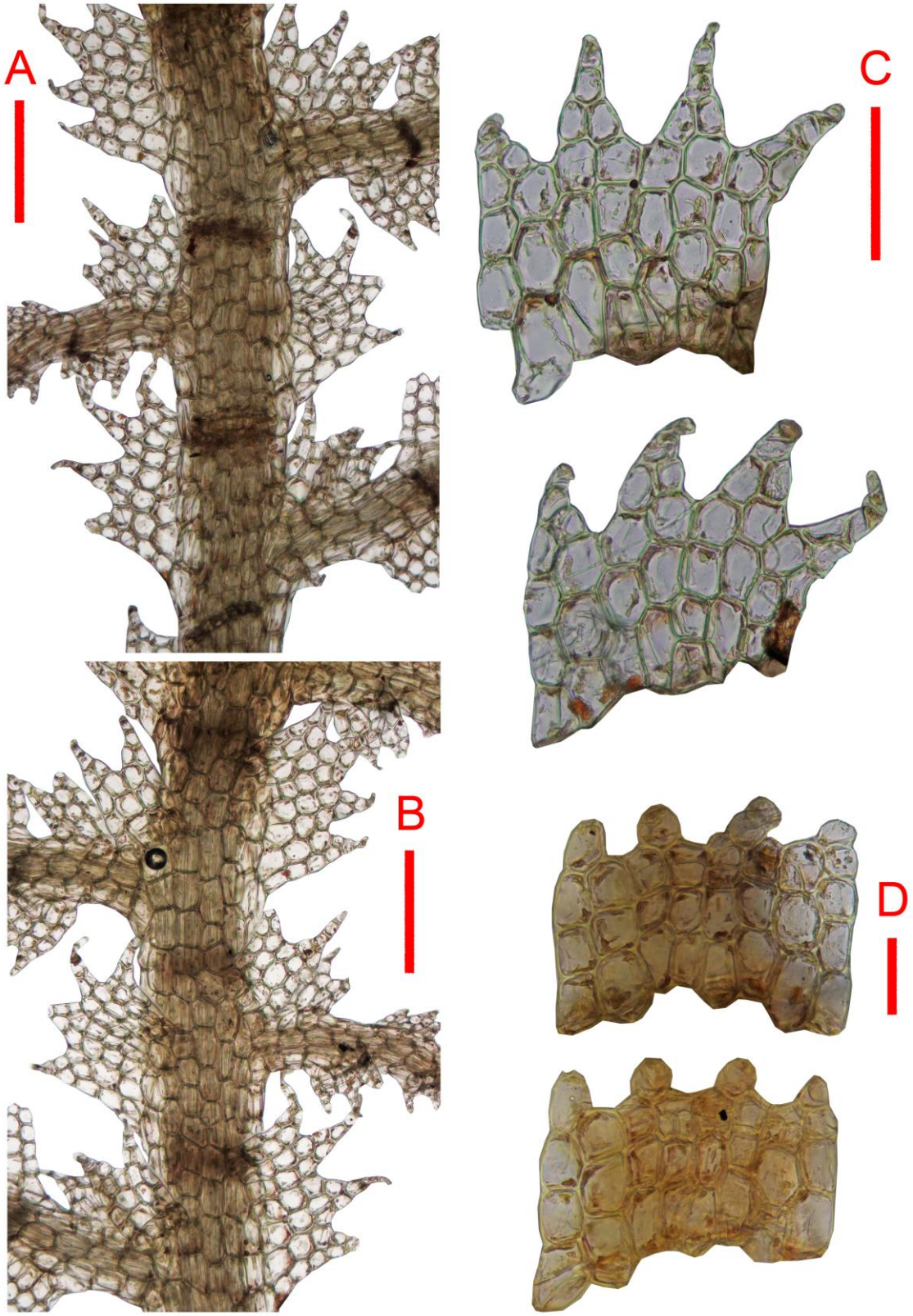

Plate 78: *Neolepidozia heterotexta*: A – Stem ventral, B – Stem dorsal, C – Stem leaves, D – Stem underleaves; Scales: A, B – 0.3 mm, C – 0.2 mm, D – 50 µm (from SELLING 118)

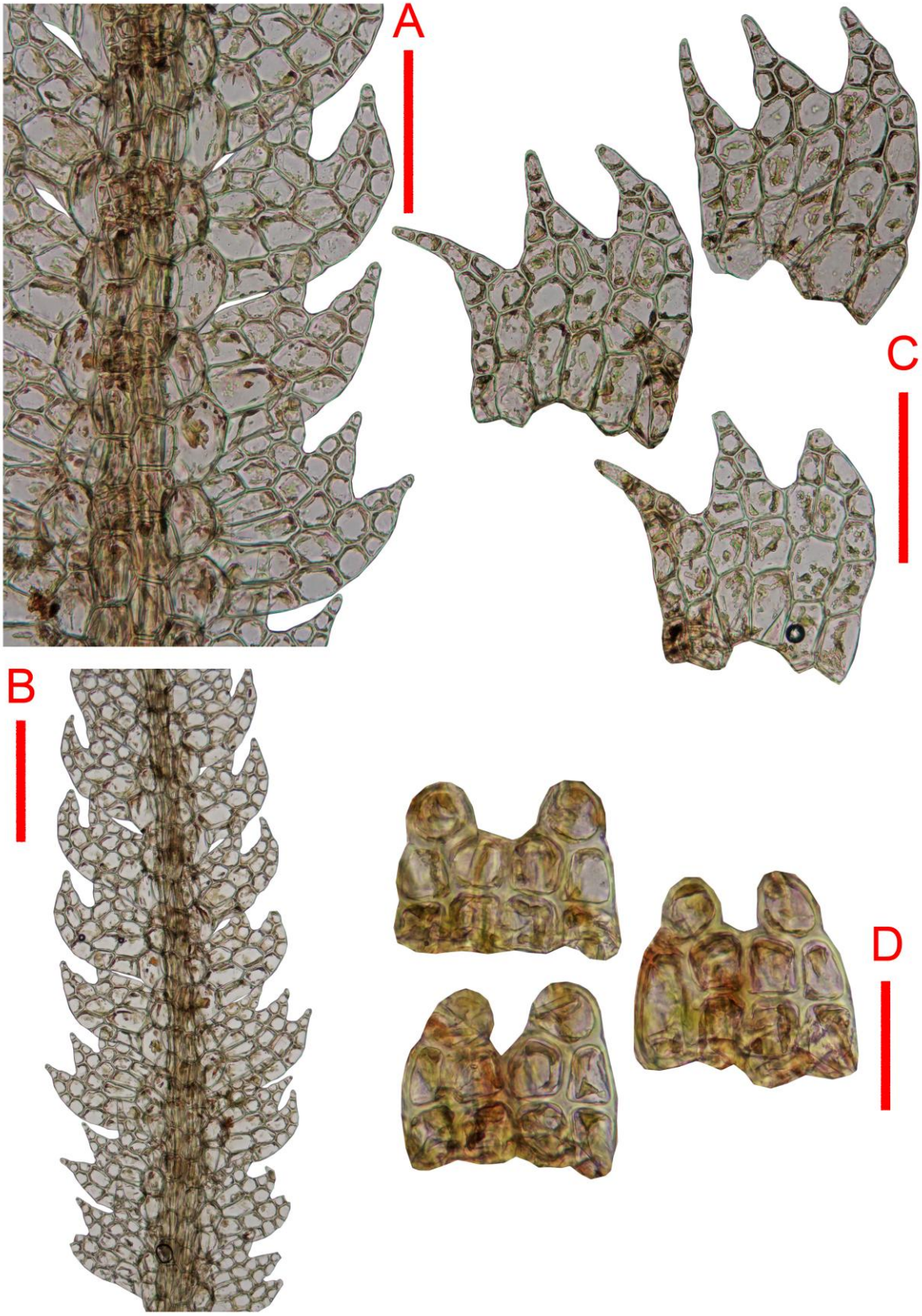

Plate 79: *Neolepidozia heterotexta*: A – Branch ventral, B – Branch dorsal, C – Branch leaves, D – Branch underleaves; Scales: B – 0.3 mm, A, C – 0.2 mm, D – 50 µm (from SELLING 118)

Neolepidozia ingekarolae **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

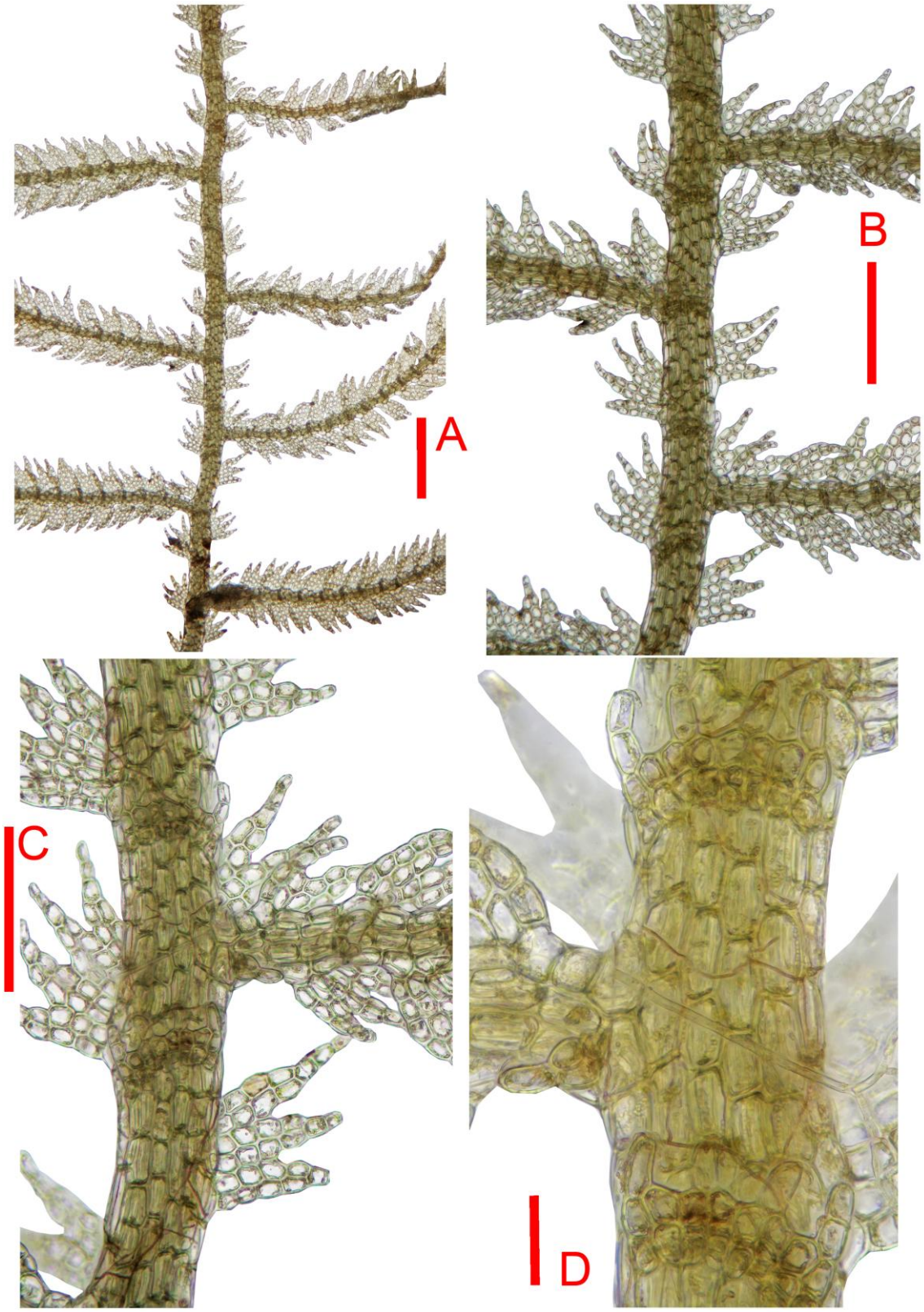

Plate 80: *Neolepidozia ingekarolae*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHÄFER-VERWIMP 18558 – holotype)

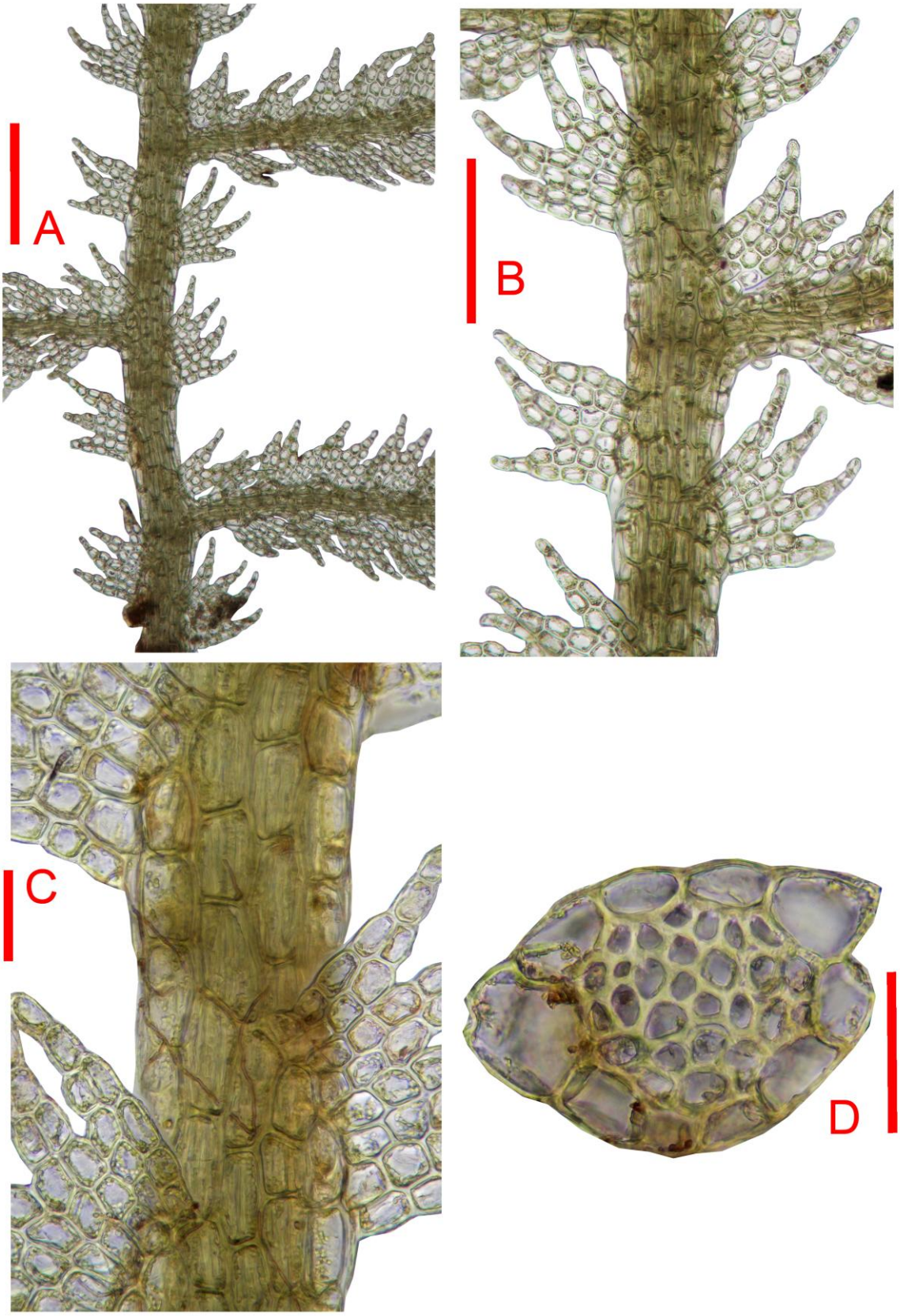

Plate 81: *Neolepidozia ingekarolae*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SCHÄFER-VERWIMP 18558 – holotype)

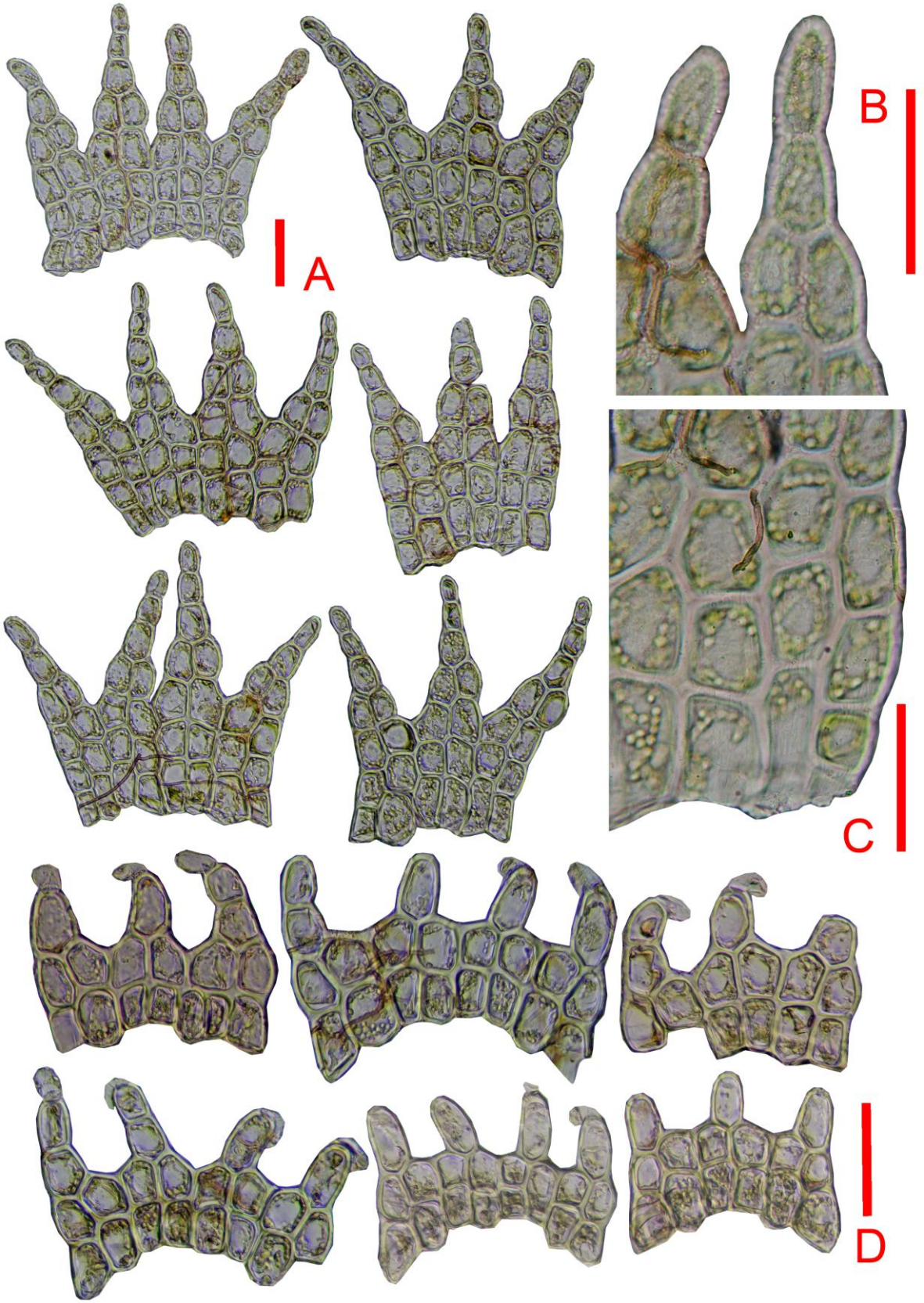

Plate 82: *Neolepidozia ingekarolae*: A – Stem leaves, B – Stem leaf lobes, C – Stem leaf disc, D – Stem underleaves; Scales: A, B, C, D – 50 µm (from SCHÄFER-VERWIMP 18558 – holotype)

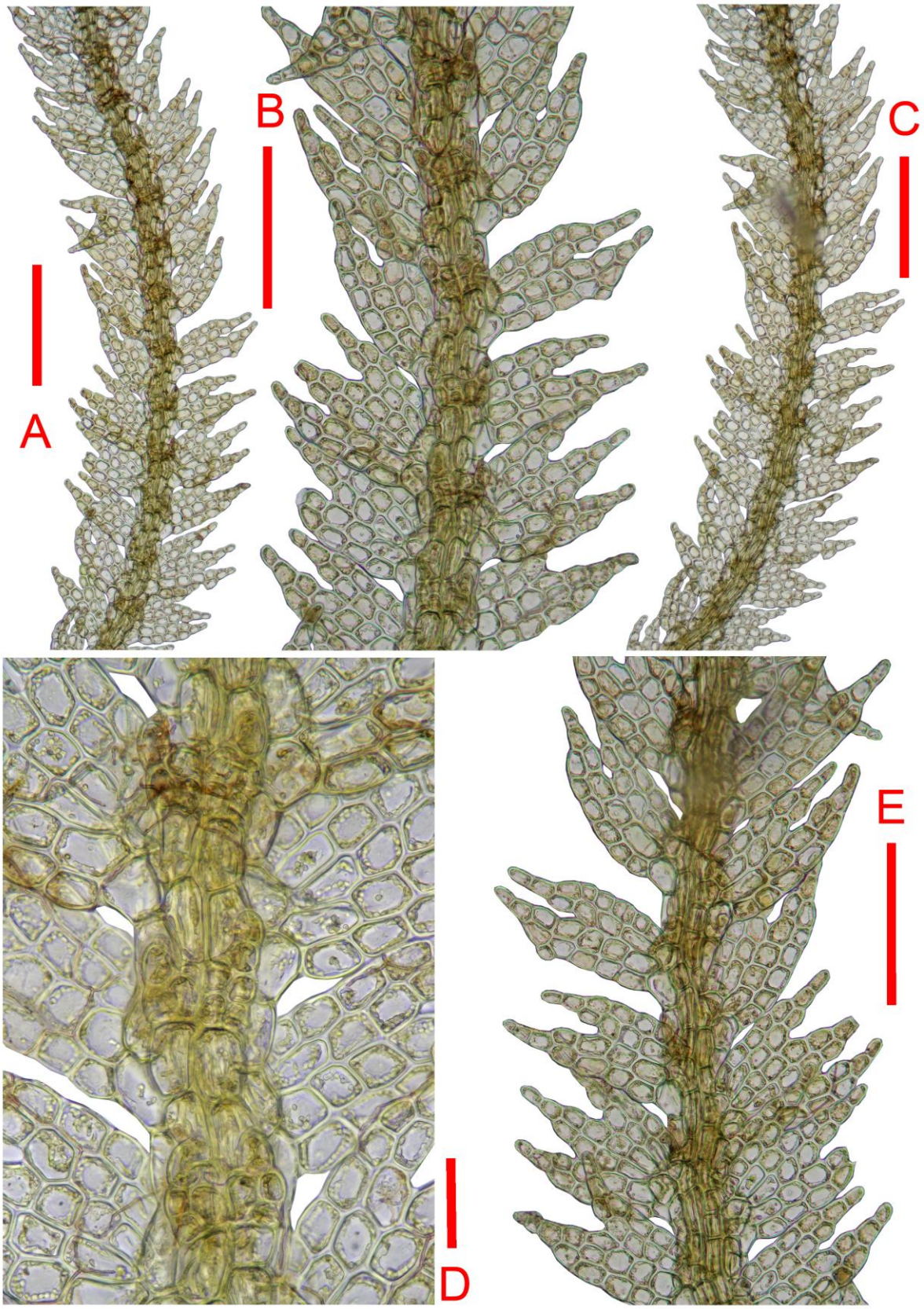

Plate 83: *Neolepidozia ingekarolae*: A, B, D – Branch ventral, C, E – Branch dorsal; Scales: A, C – 0.3 mm, B, E – 0.2 mm, D – 50 µm (from SCHÄFER-VERWIMP 18558 – holotype)

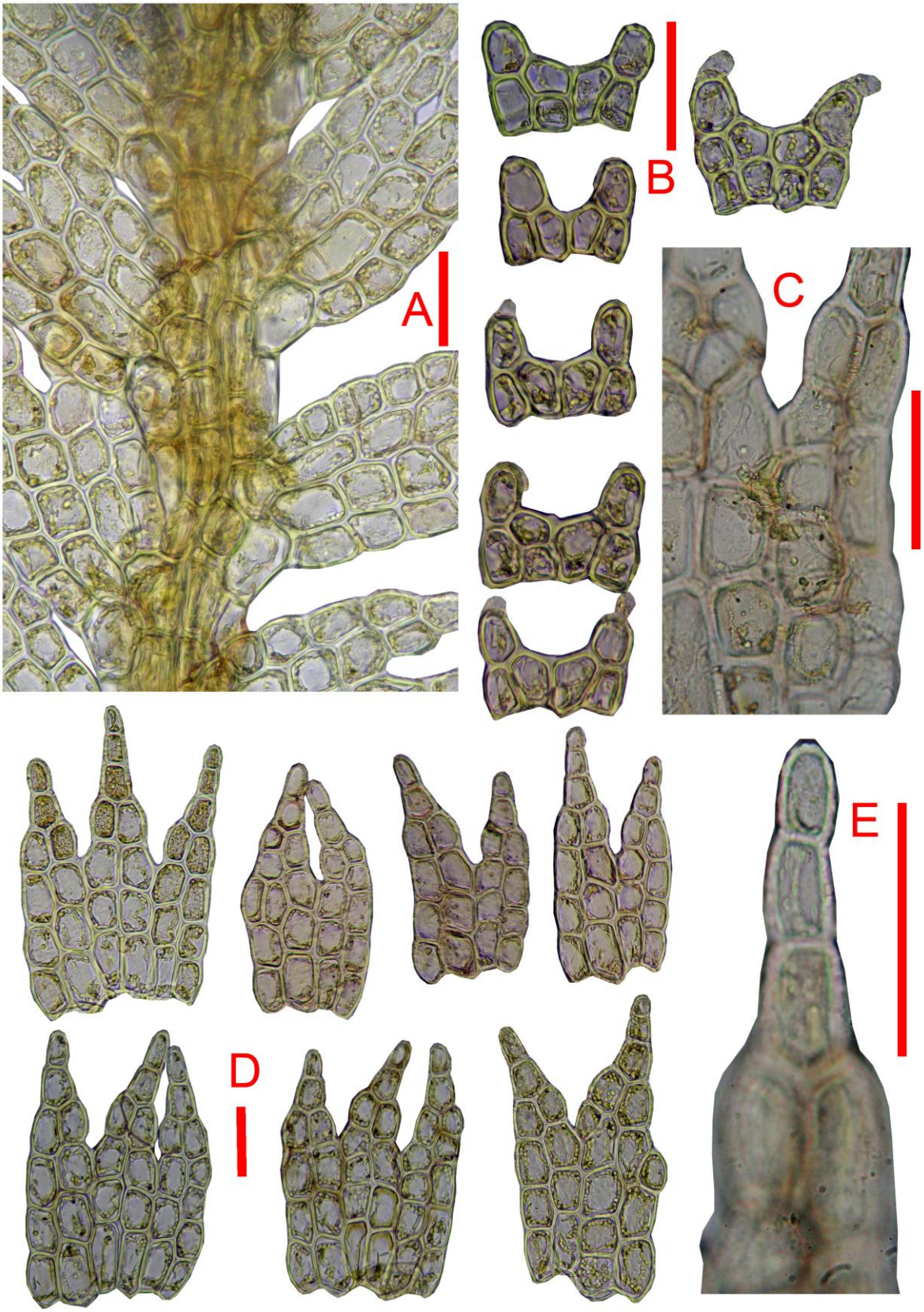

Plate 84: *Neolepidozia ingekarolae*: A – Branch dorsal, B – Branch underleaves, C – Branch leaf disc, D – Branch leaves, E – Branch leaf lobe; Scales: A, B, C, D, E – 50 µm (from SCHÄFER-VERWIMP 18558 – holotype)

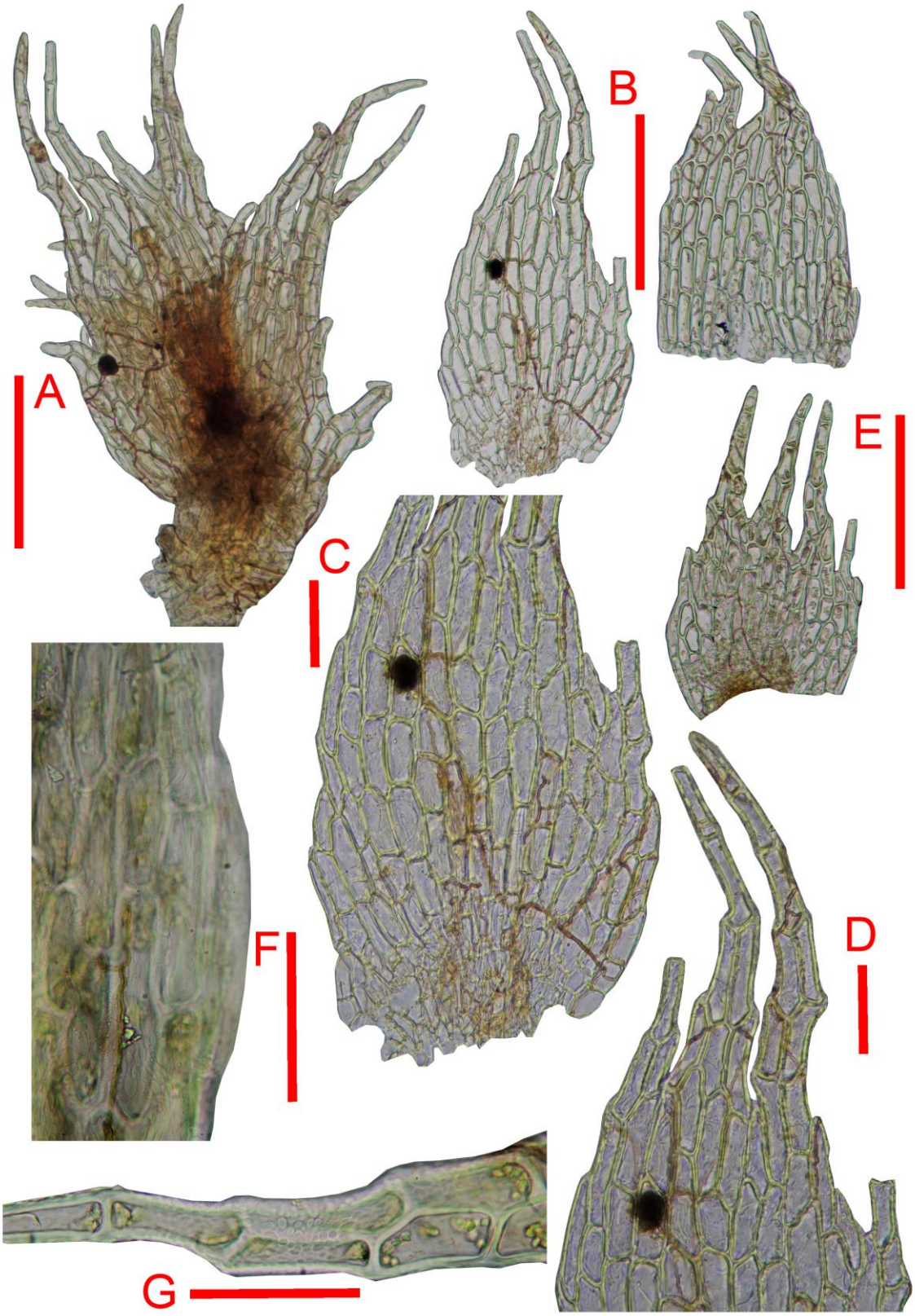

Plate 85: *Neolepidozia ingekarolae*: A – Female inflorescense, B – Female bract, C – Female bract base, D – Female bract apex, E – Female bracteole, F – Female bract disc, G – Female bract lobe; Scales: A, B, E – 0.2 mm, C, D, F, G – 50 µm (from SCHÄFER-VERWIMP 18558 – holotype)

Neolepidozia kaindiensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

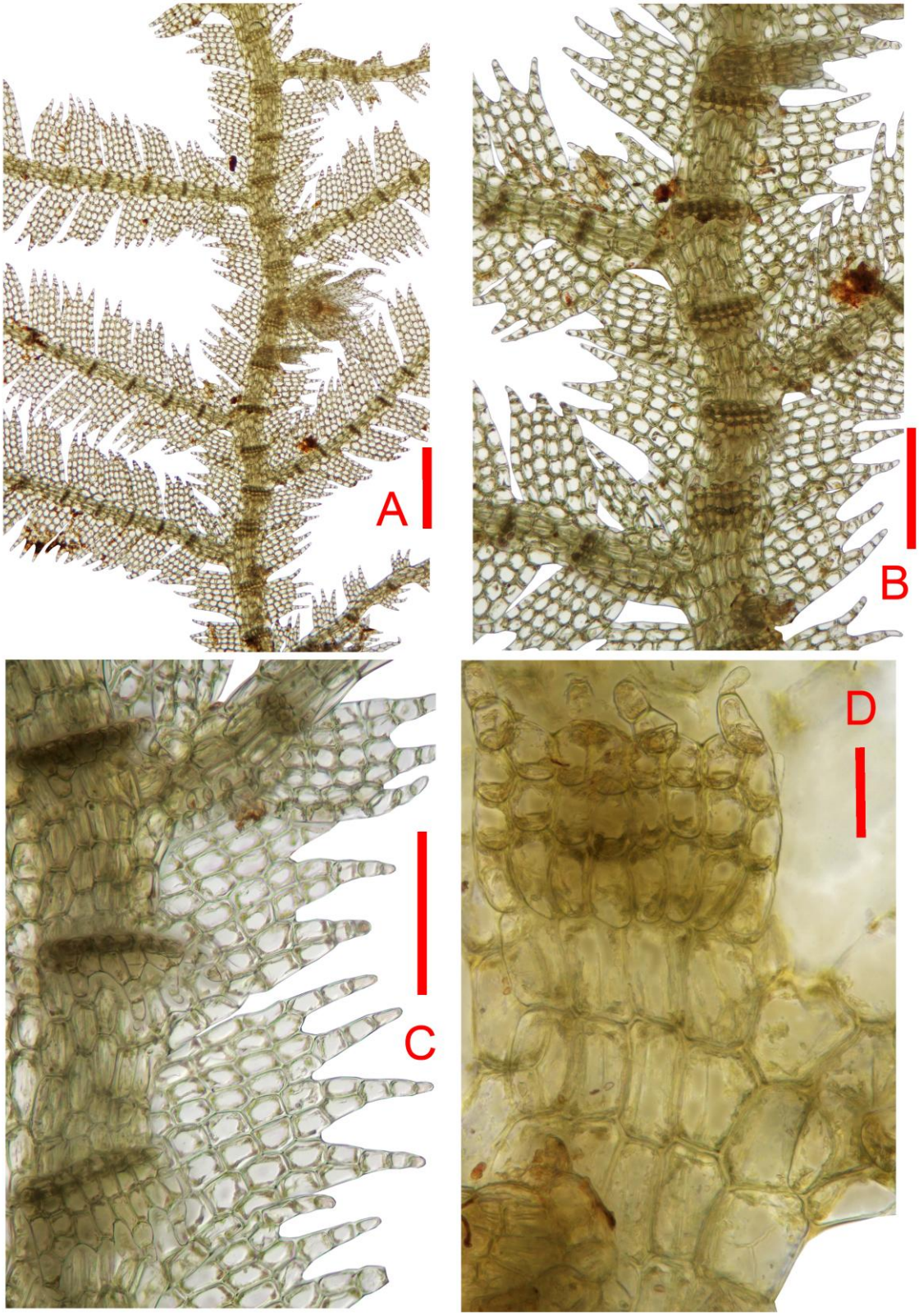

Plate 86: *Neolepidozia kaindiensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHUSTER 67-6247 – holotype)

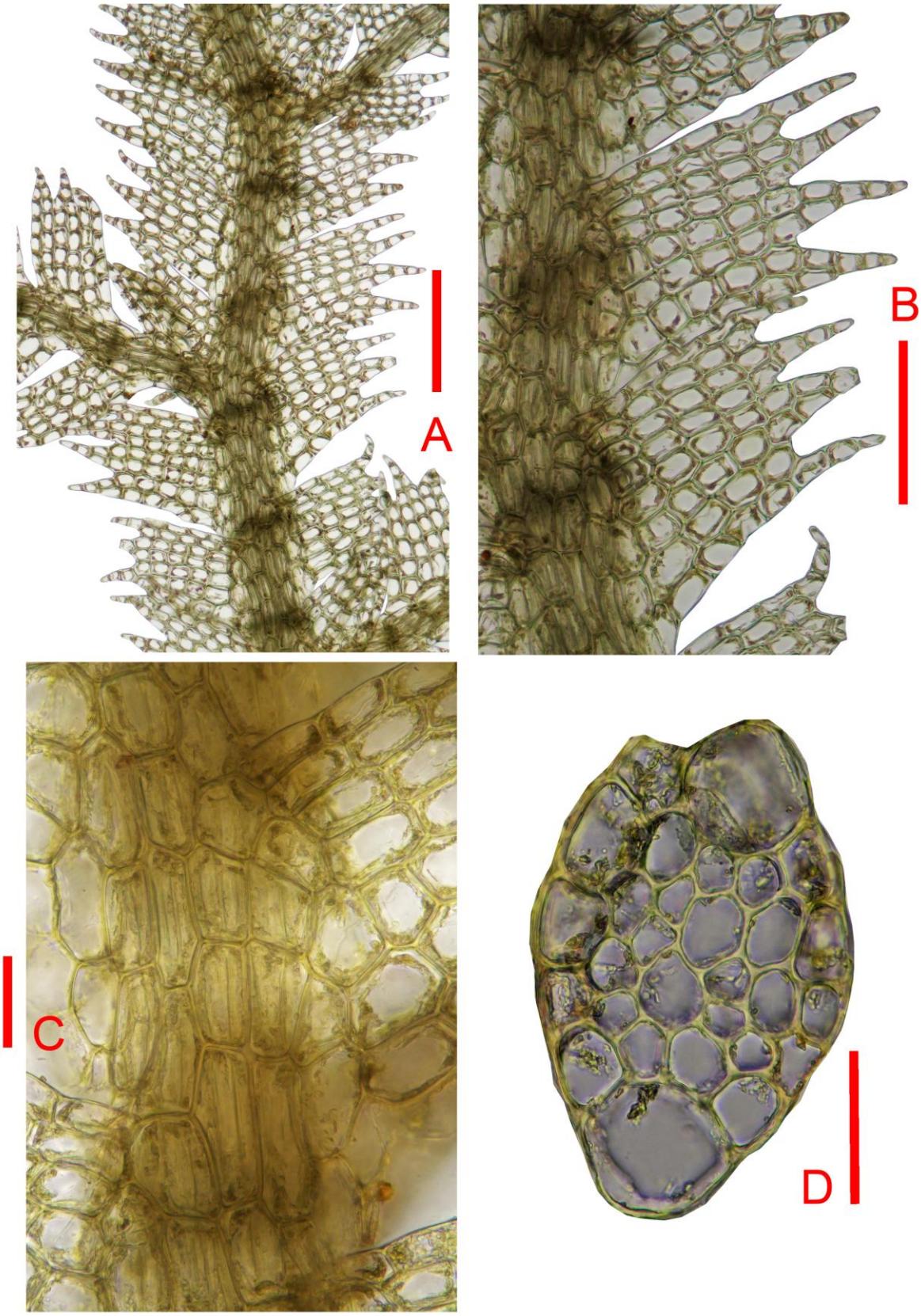

Plate 87: *Neolepidozia kaindiensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SCHUSTER 67-6247 – holotype)

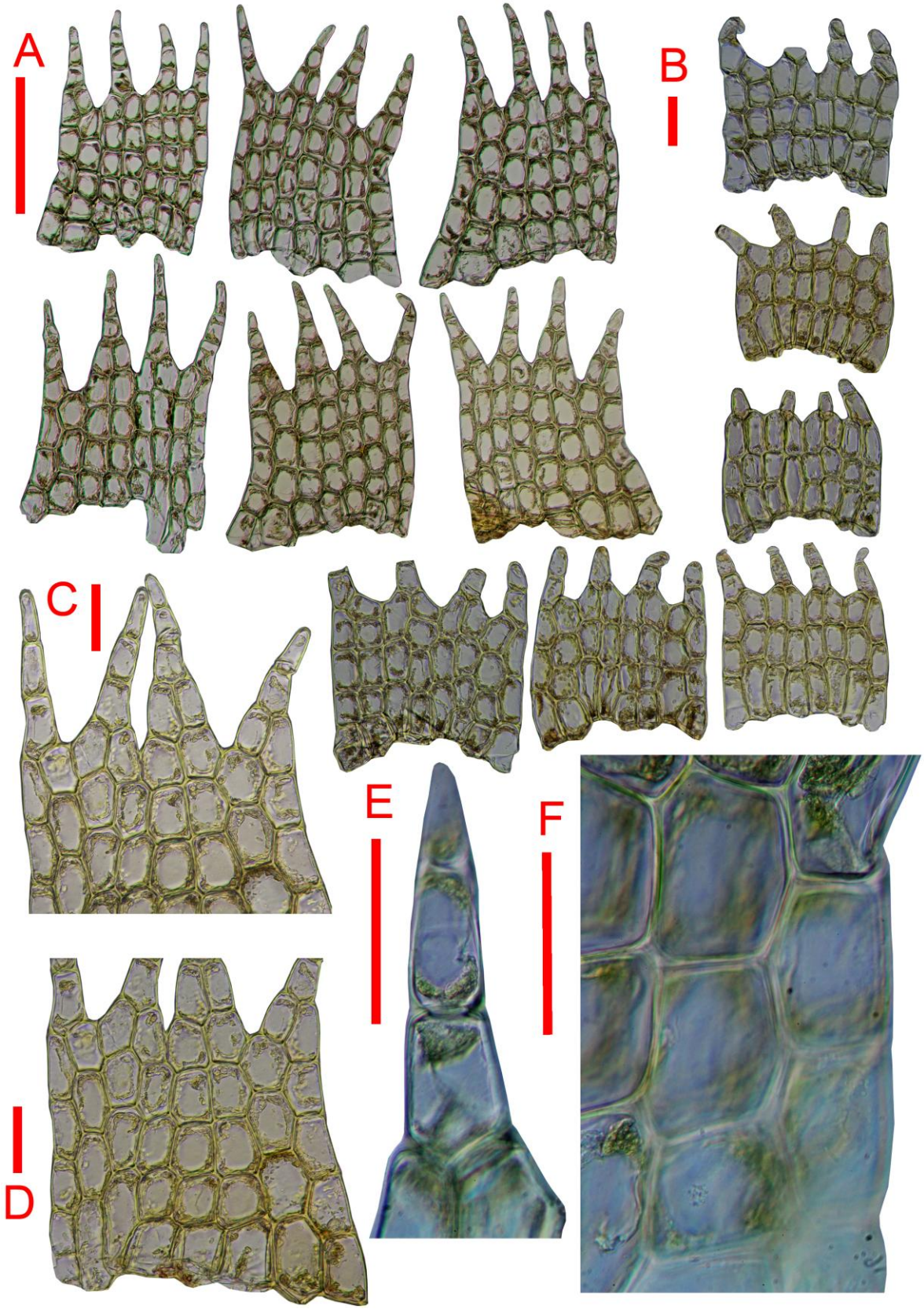

Plate 88: *Neolepidozia kaindiensis*: A – Stem leaves, B – Stem underleaves, C, E – Stem leaf lobes, D, F – Stem leaf disc; Scales: A – 0.2 mm; B, C, D, E, F – 50 µm (from SCHUSTER 67-6247 – holotype)

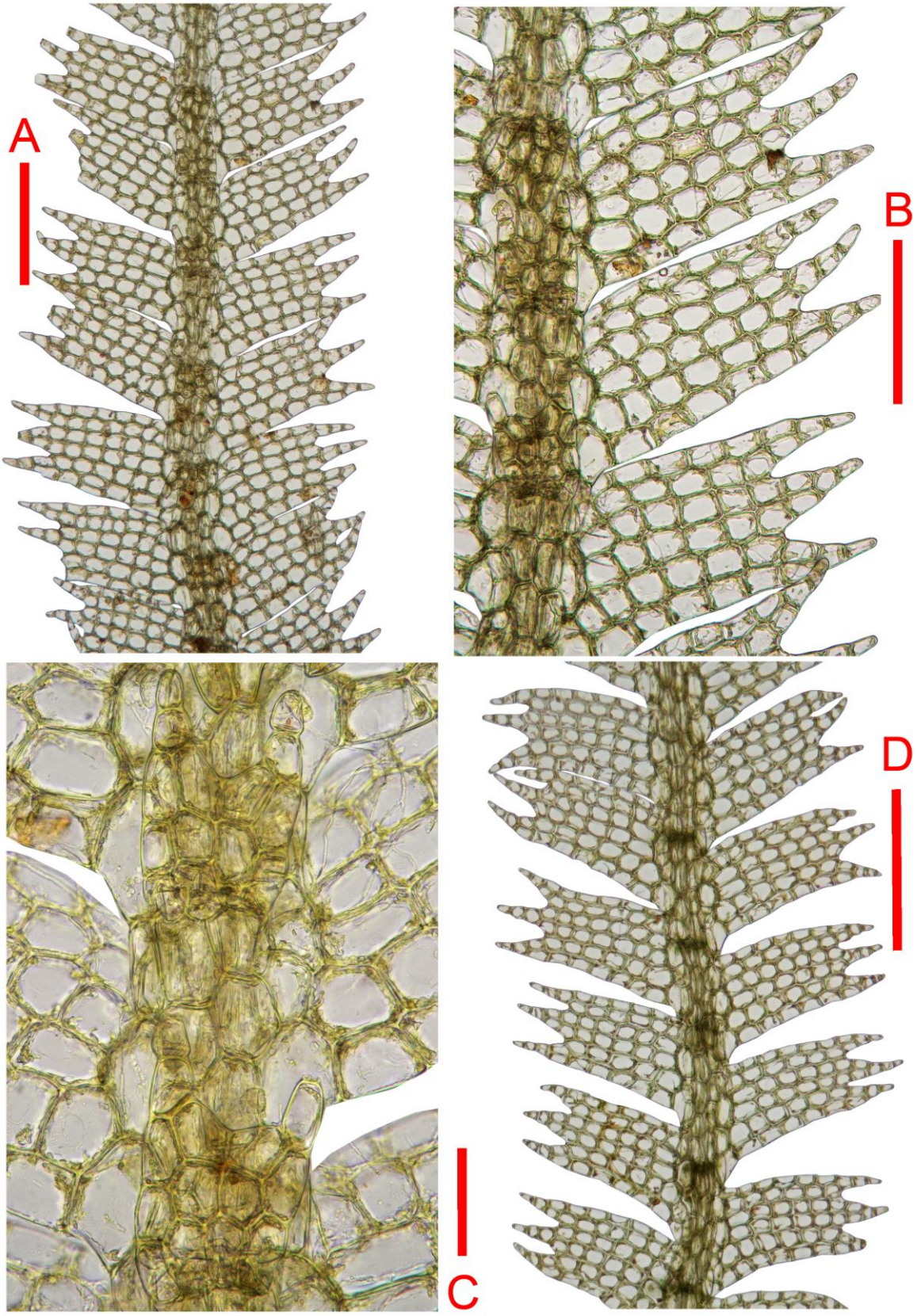

Plate 89: *Neolepidozia kaindiensis*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm, B – 0.2 mm; C – 50 µm (from SCHUSTER 67-6247 – holotype)

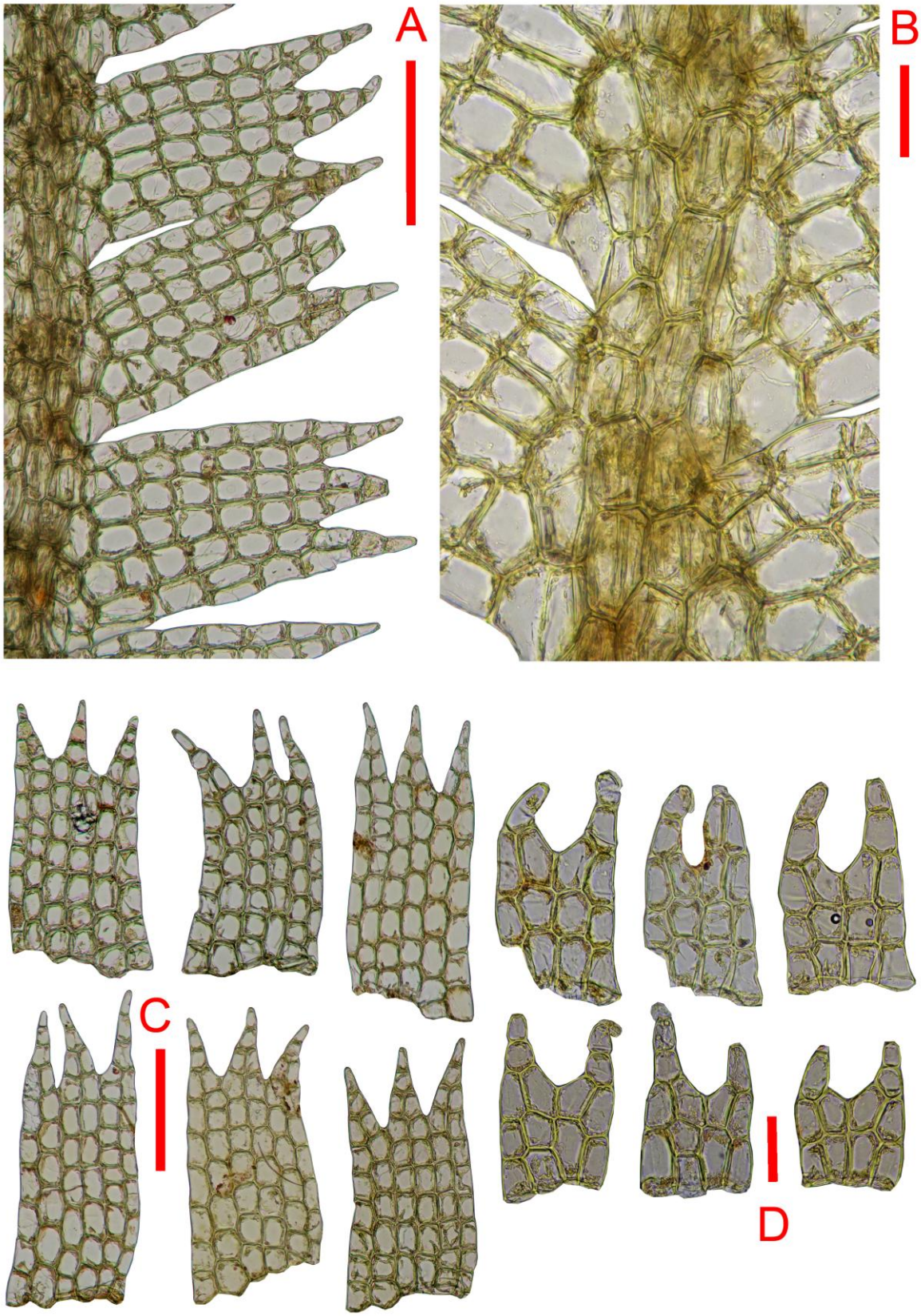

Plate 90: *Neolepidozia kaindiensis*: A, B – Branch dorsal, C – Branch leaves, D – Branch underleaves; Scales: A, C – 0.2 mm; B, D – 50 µm (from SCHUSTER 67-6247 – holotype)

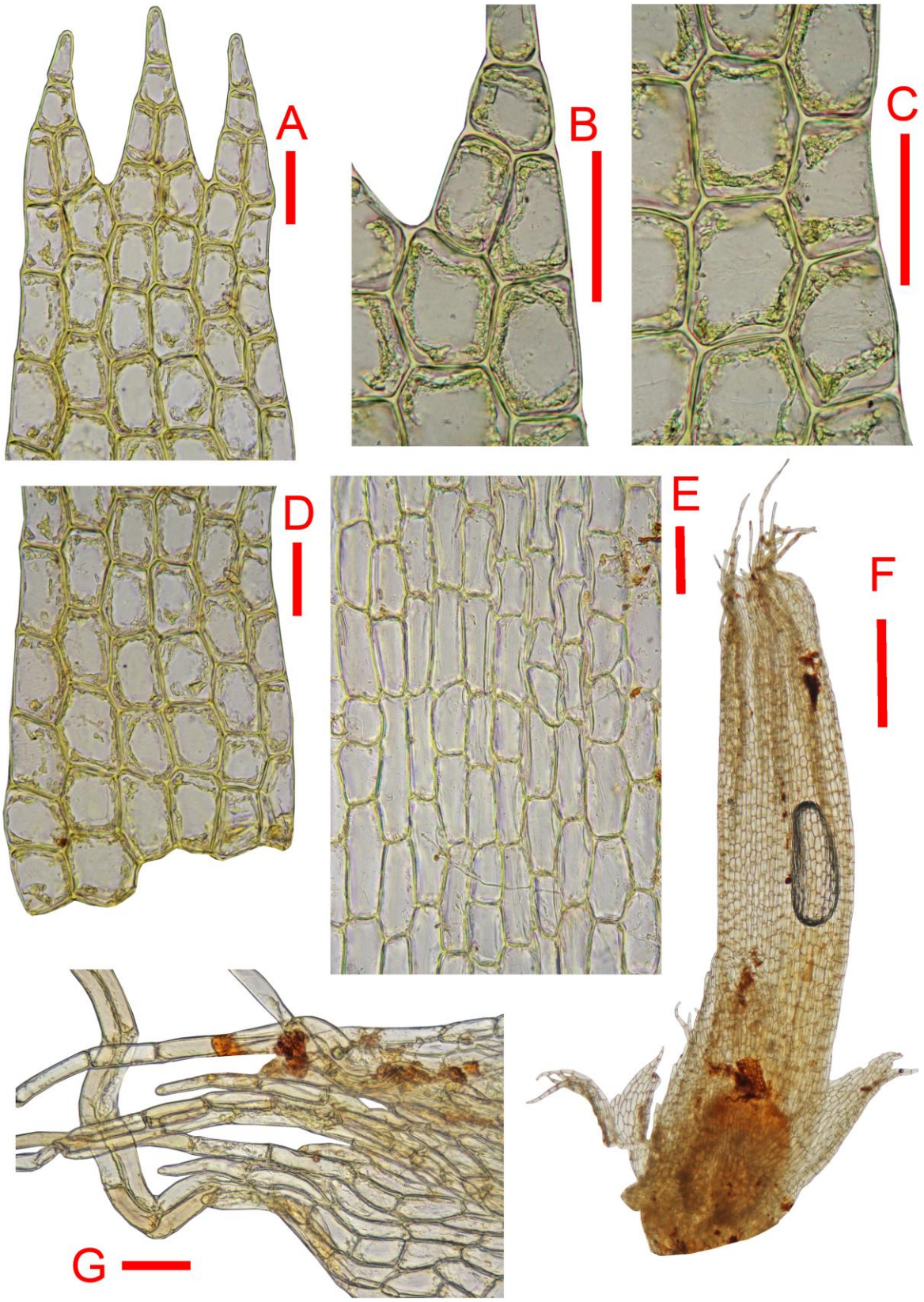

Plate 91: *Neolepidozia kaindiensis*: A, B – Branch leaf lobes, C, D – Branch leaf disc, E – Median perianth cells, F – Perianth, G – Perianth mouth; Scales: A, B, C, D, E, G – 50 µm; F – 0.5 mm (from SCHUSTER 67-6247 – holotype)

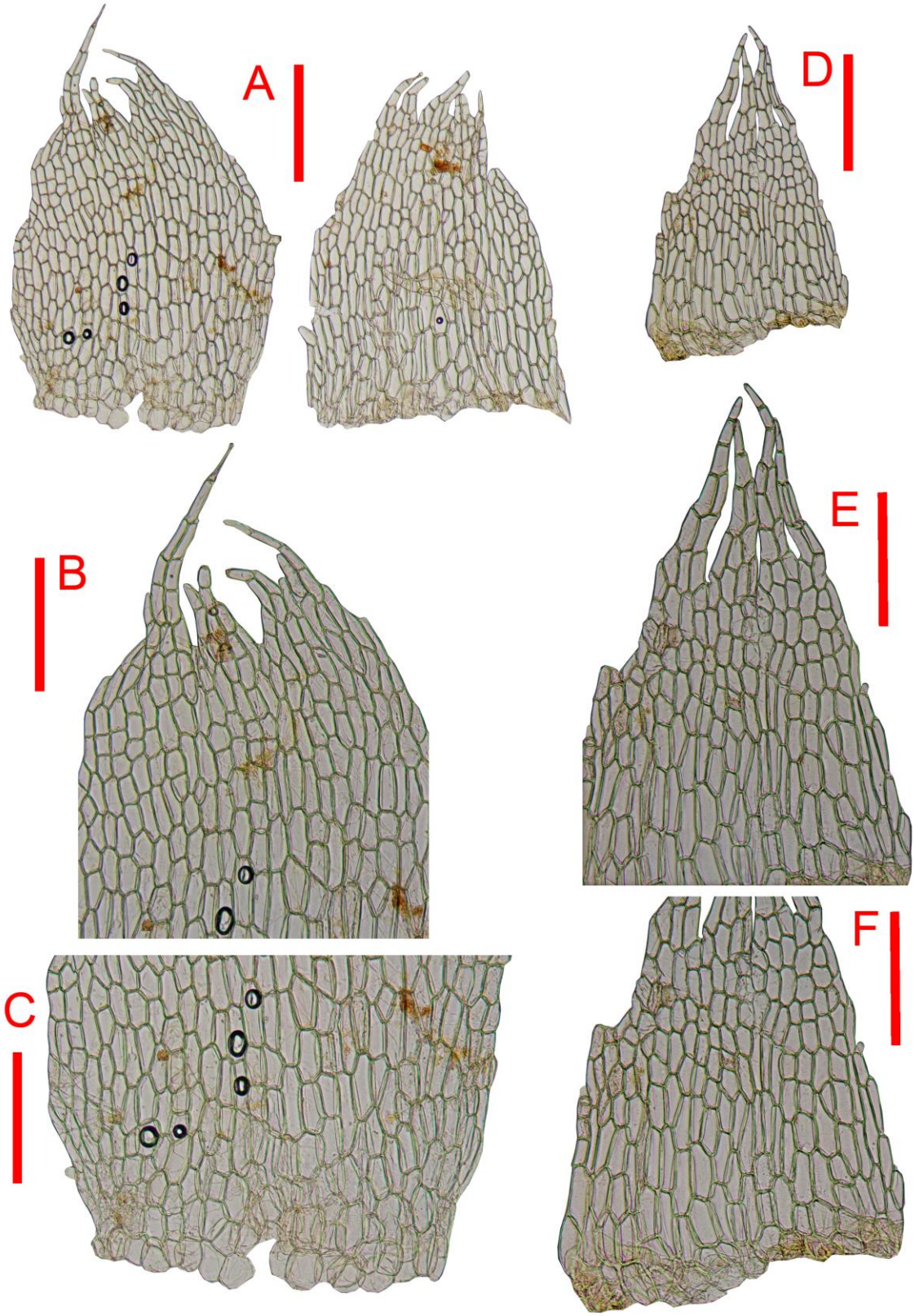

Plate 92: *Neolepidozia kaindiensis*: A – Female bracts, B – Female bract apex, C – Female bract base, D – Female bracteole, E – Female bracteole apex, F – Female bracteole base; Scales: A, D – 0.3 mm; B, C, E, F – 0.2 mm (from SCHUSTER 67-6247 – holotype)

Neolepidozia kasudsuranensis **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

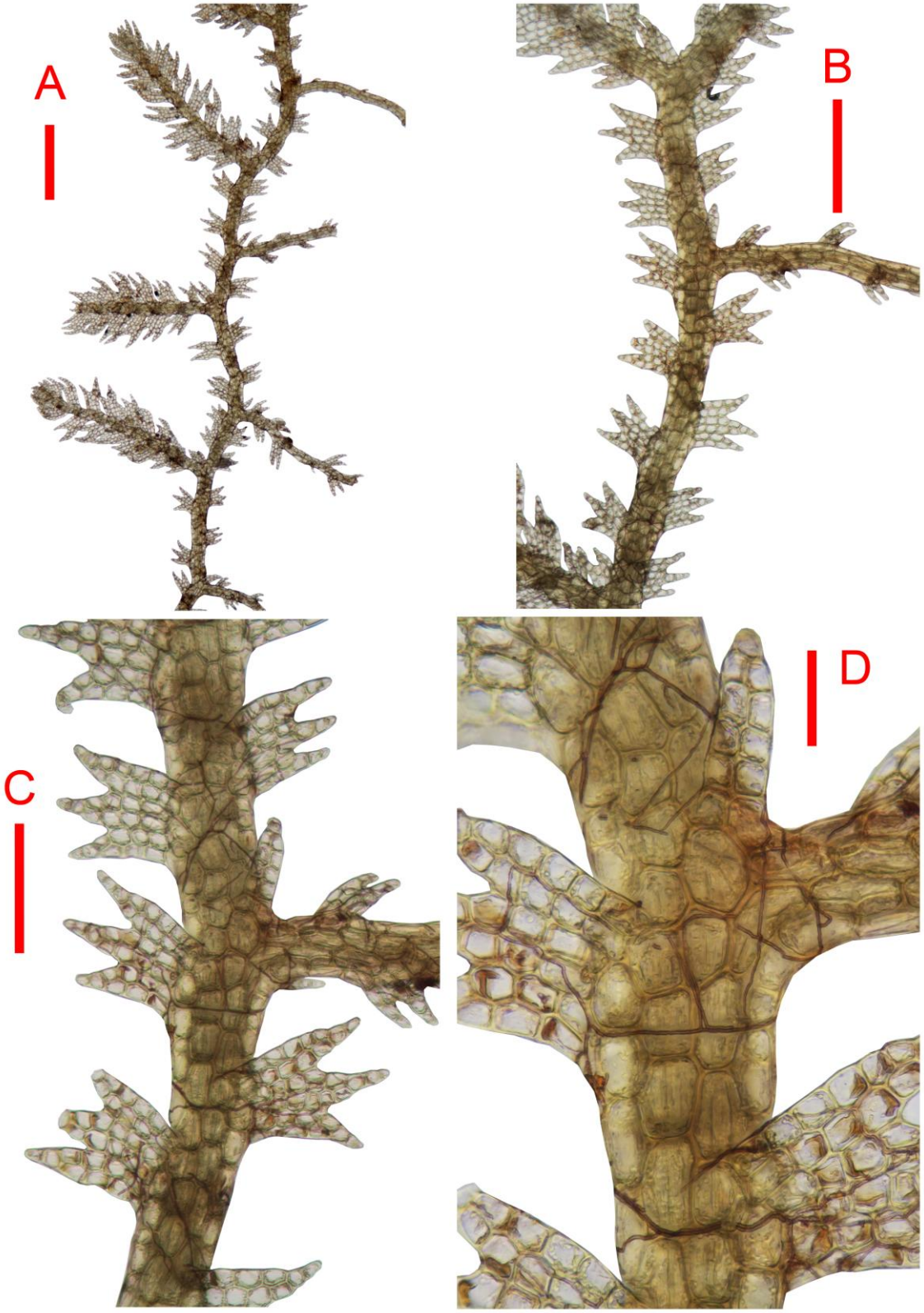

Plate 93: *Neolepidozia kasudsuranensis*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHWARZ 16978 – holotype)

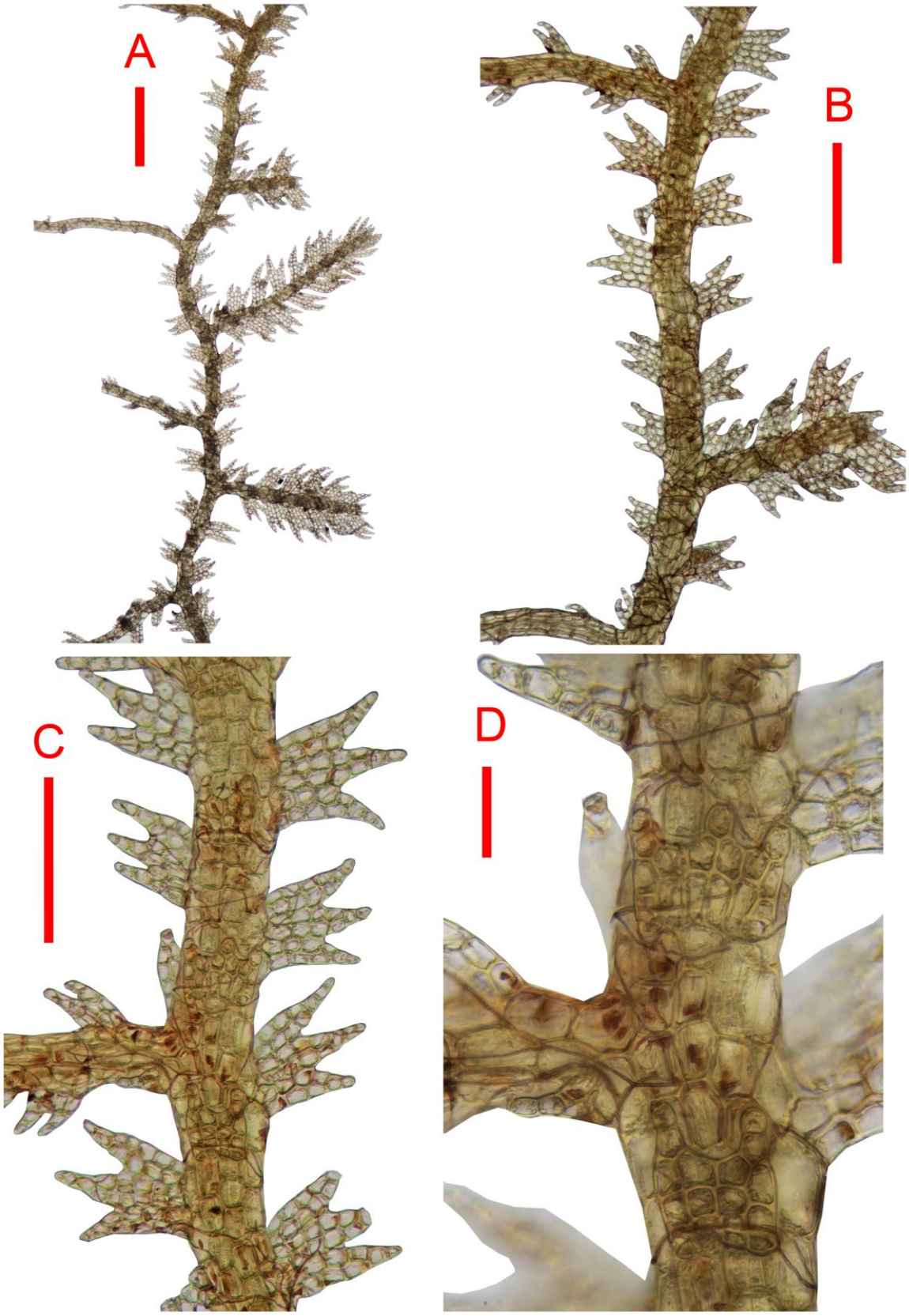

Plate 94: *Neolepidozia kasudsuranensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHWARZ 16978 – holotype)

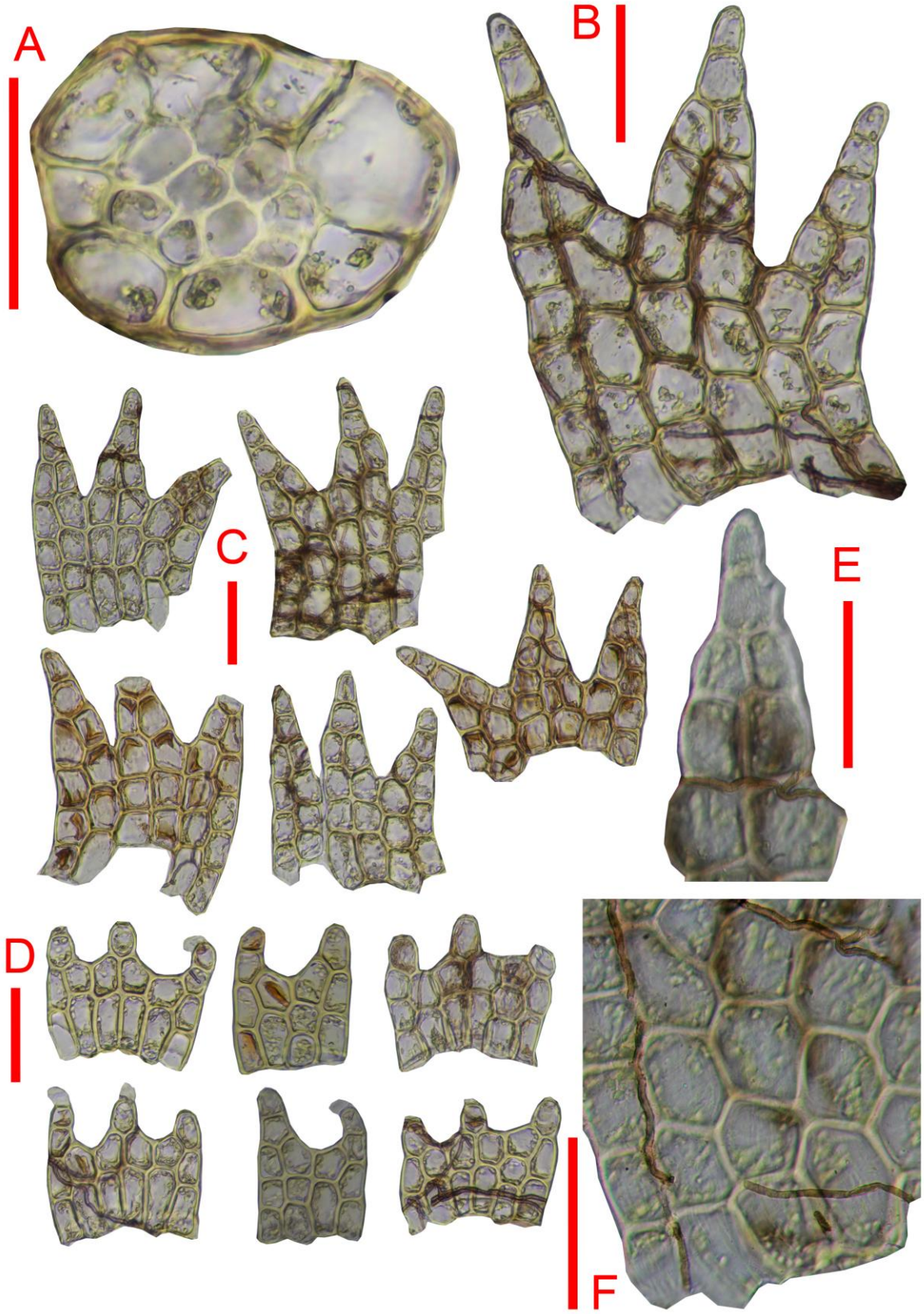

Plate 95: *Neolepidozia kasudsuranensis* A – Stem cross section, B, C – Stem leaves, D – Stem underleaves, E – Stem leaf lobe, F – Stem leaf disc; Scales: A, B, C, D, E, F – 50 µm (from SCHWARZ 16978 – holotype)

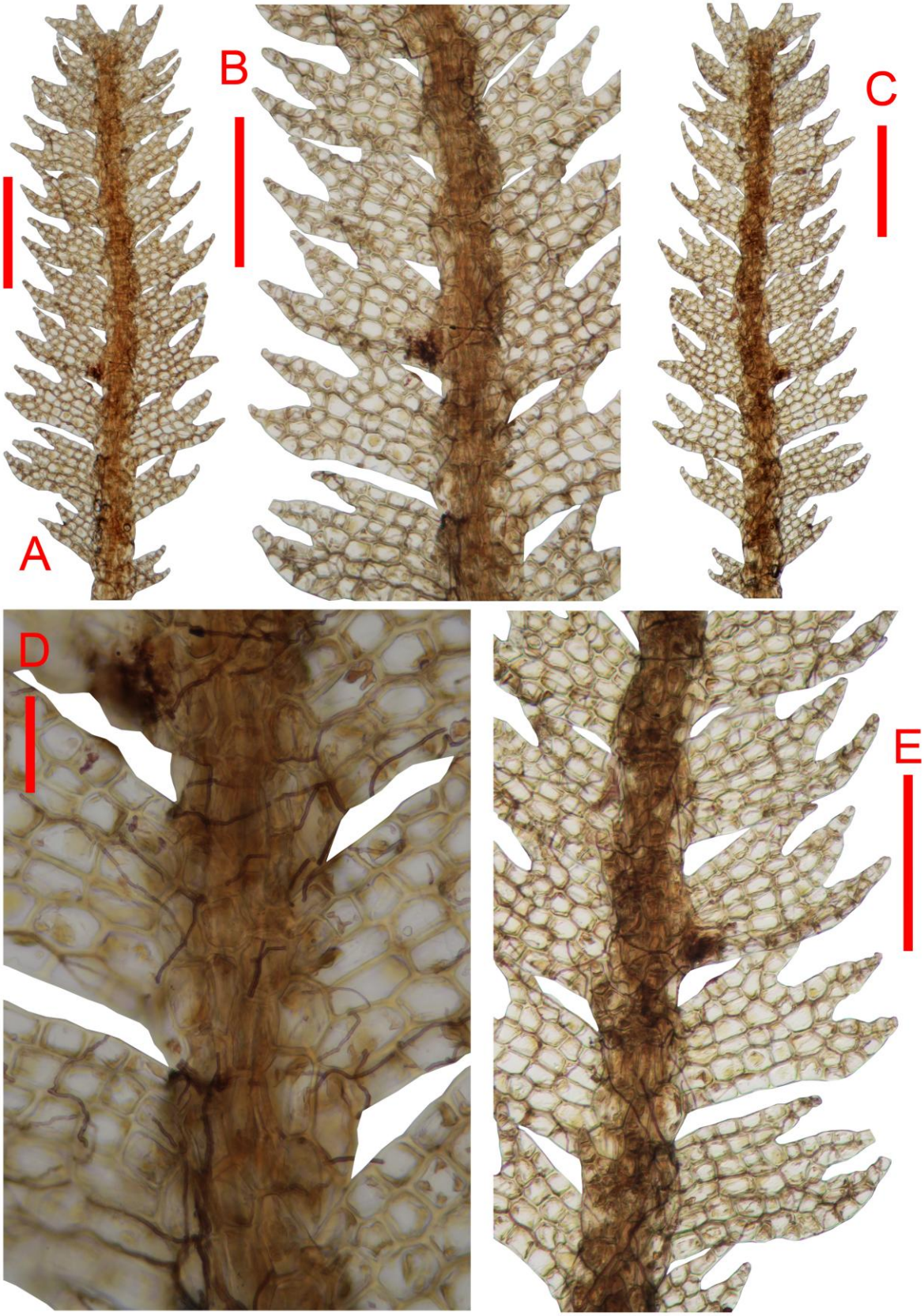

Plate 96: *Neolepidozia kasudsuranensis*: A, B, D – Branch dorsal, C, E – Branch ventral; Scales: A, C – 0.3 mm, B, E – 0.2 mm, D – 50 µm (from SCHWARZ 16978 – holotype)

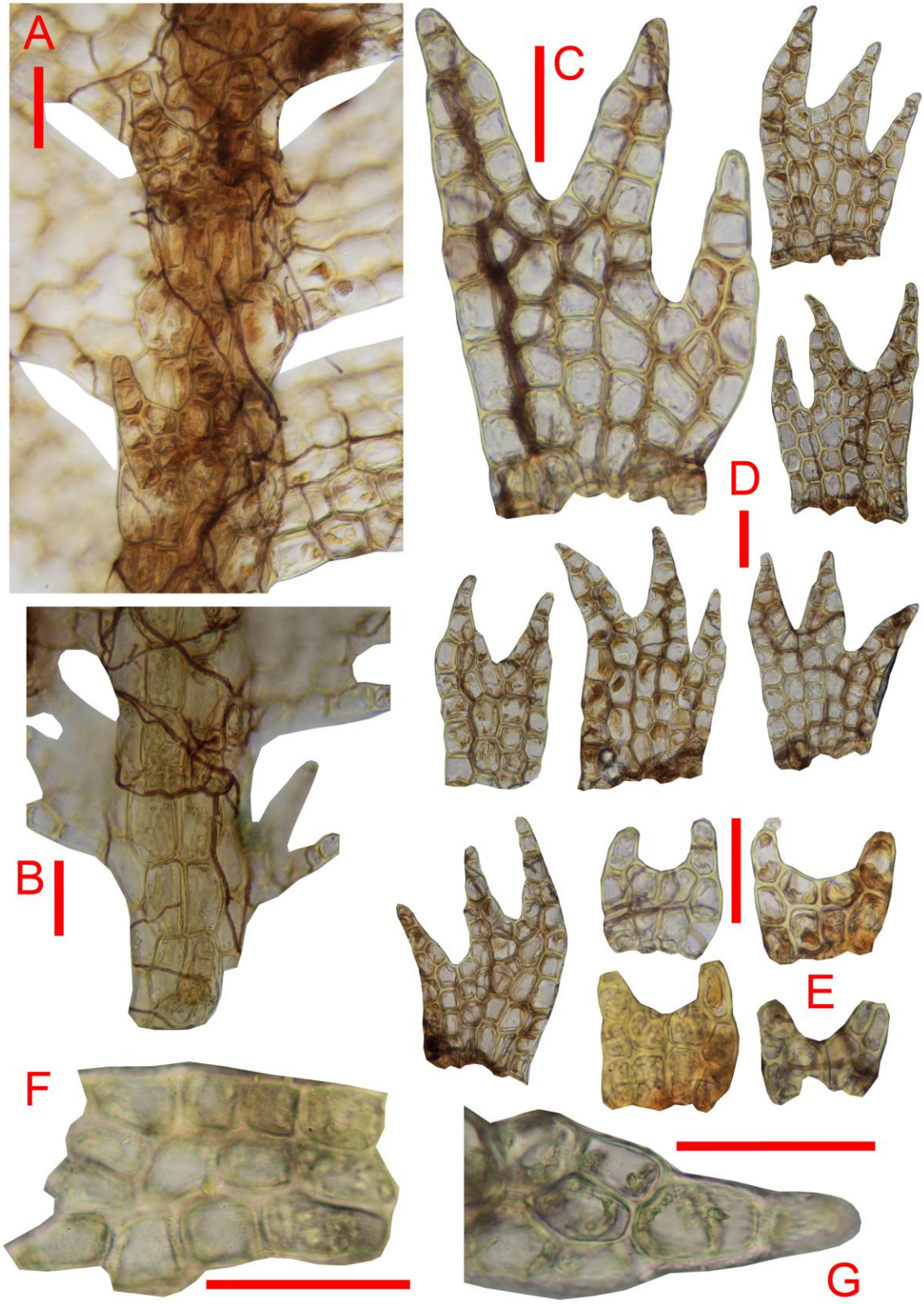

Plate 97: *Neolepidozia kasudsuranensis* A – Branch ventral, B – Branch base, C, D – Branch leaves, E – Branch underleaves, F – Branch leaf disc, G – Branch leaf lobe; Scales: A, B, C, D, E, F, G – 50 µm (from SCHWARZ 16978 – holotype)

Neolepidozia katrinae **(GOTTSCHE EX STEPH.) E.D. COOPER**

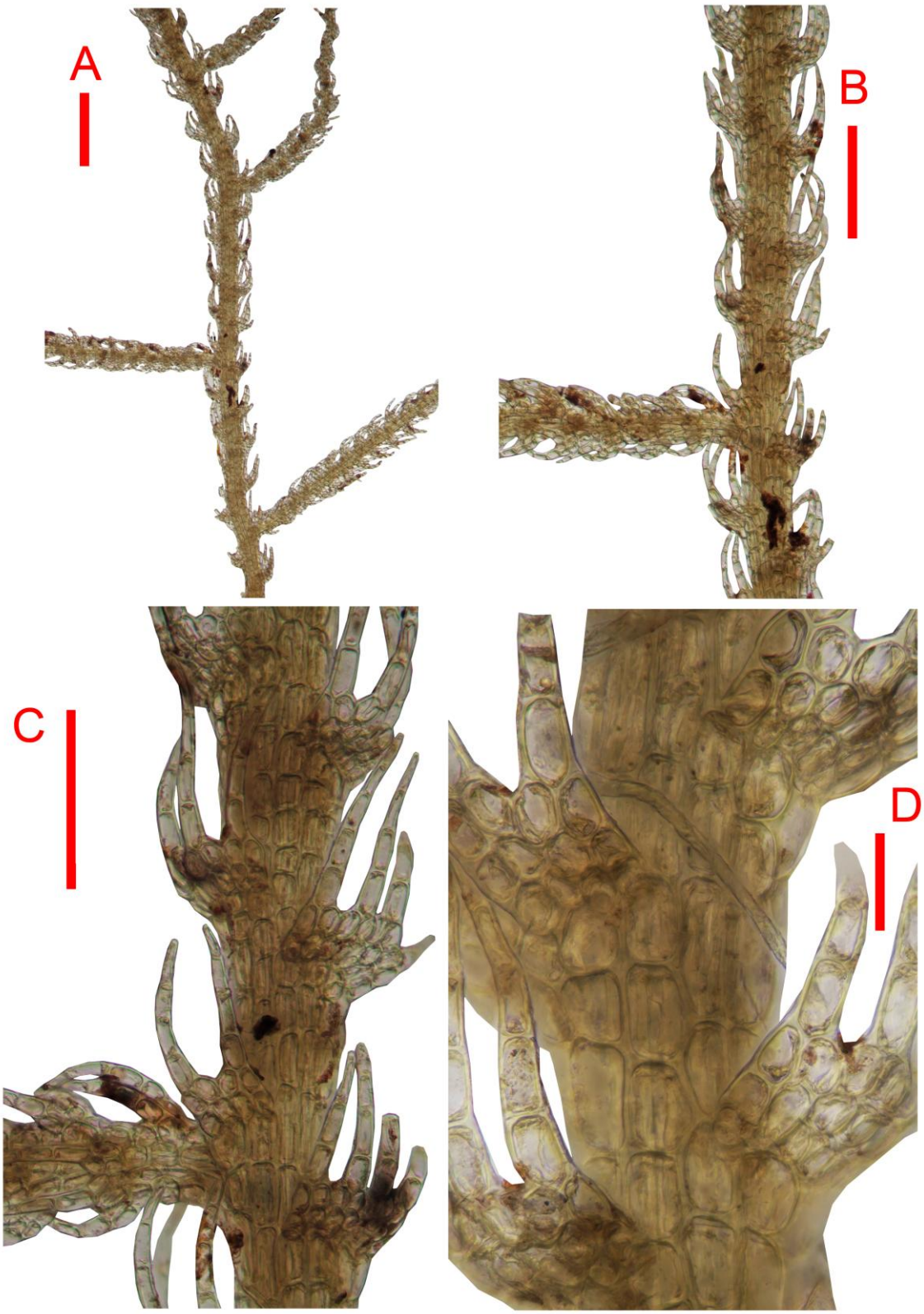

Plate 98: *Neolepidozia katrinae*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from PANG H2654, JE – holotype)

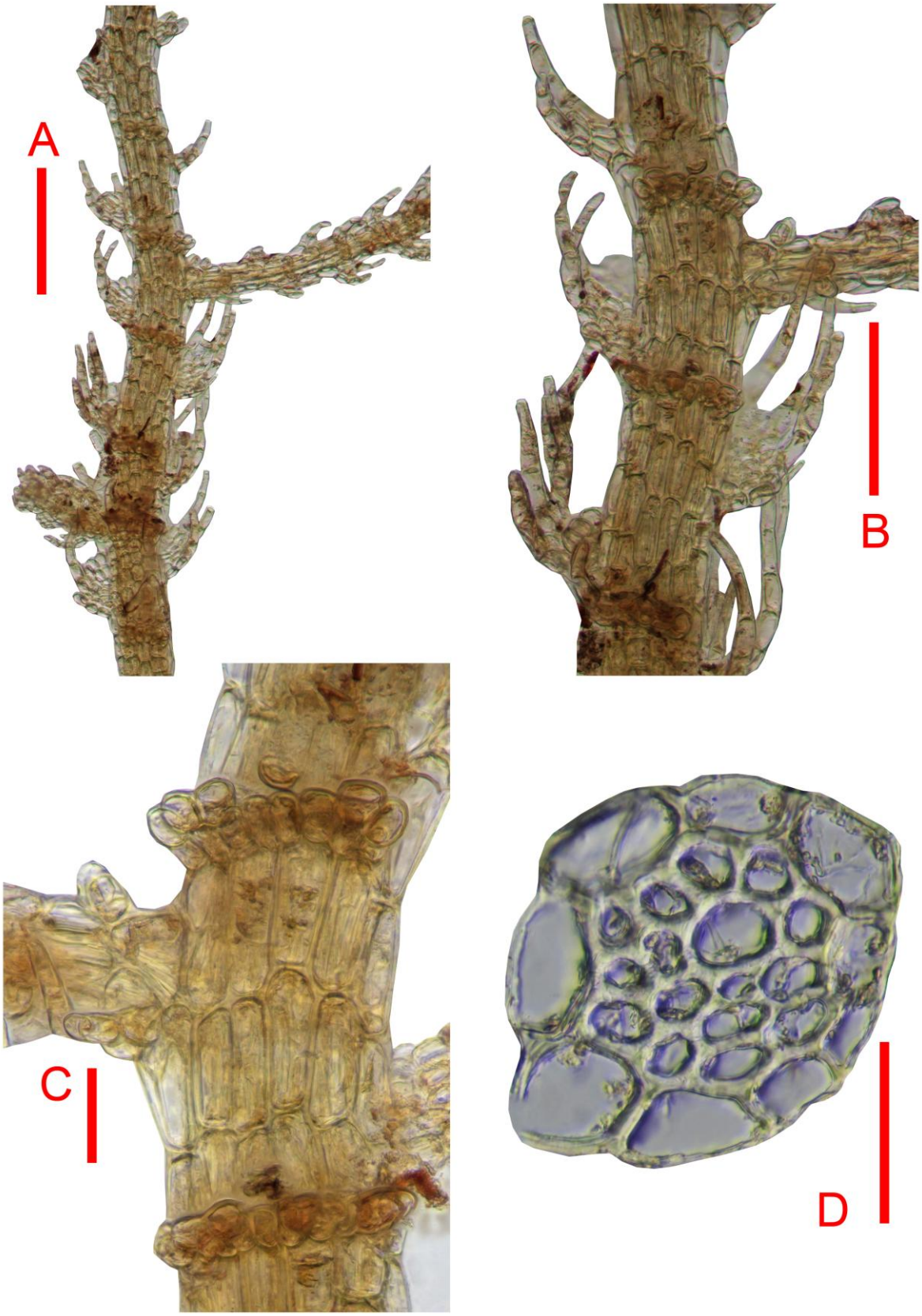

Plate 99: *Neolepidozia katrinae*: A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from PANG H2654, JE – holotype)

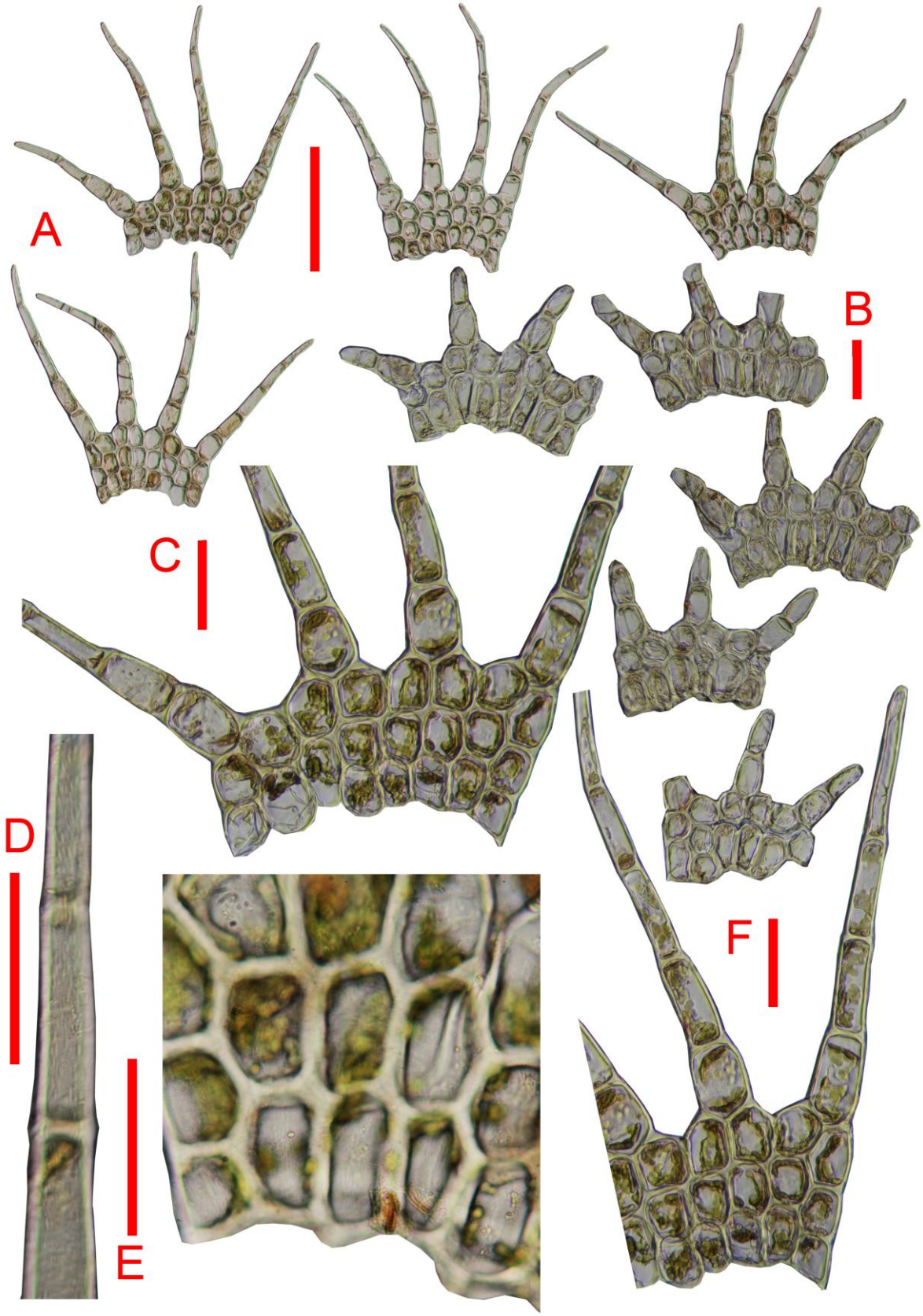

Plate 100: *Neolepidozia katrinae*: A – Stem leaves, B – Stem underleaves, C, E – Stem leaf disc, D, F – Stem leaf lobes; Scales: A – 0.2 mm; B, C, D, E, F – 50 µm (from PANG H2654, JE – holotype)

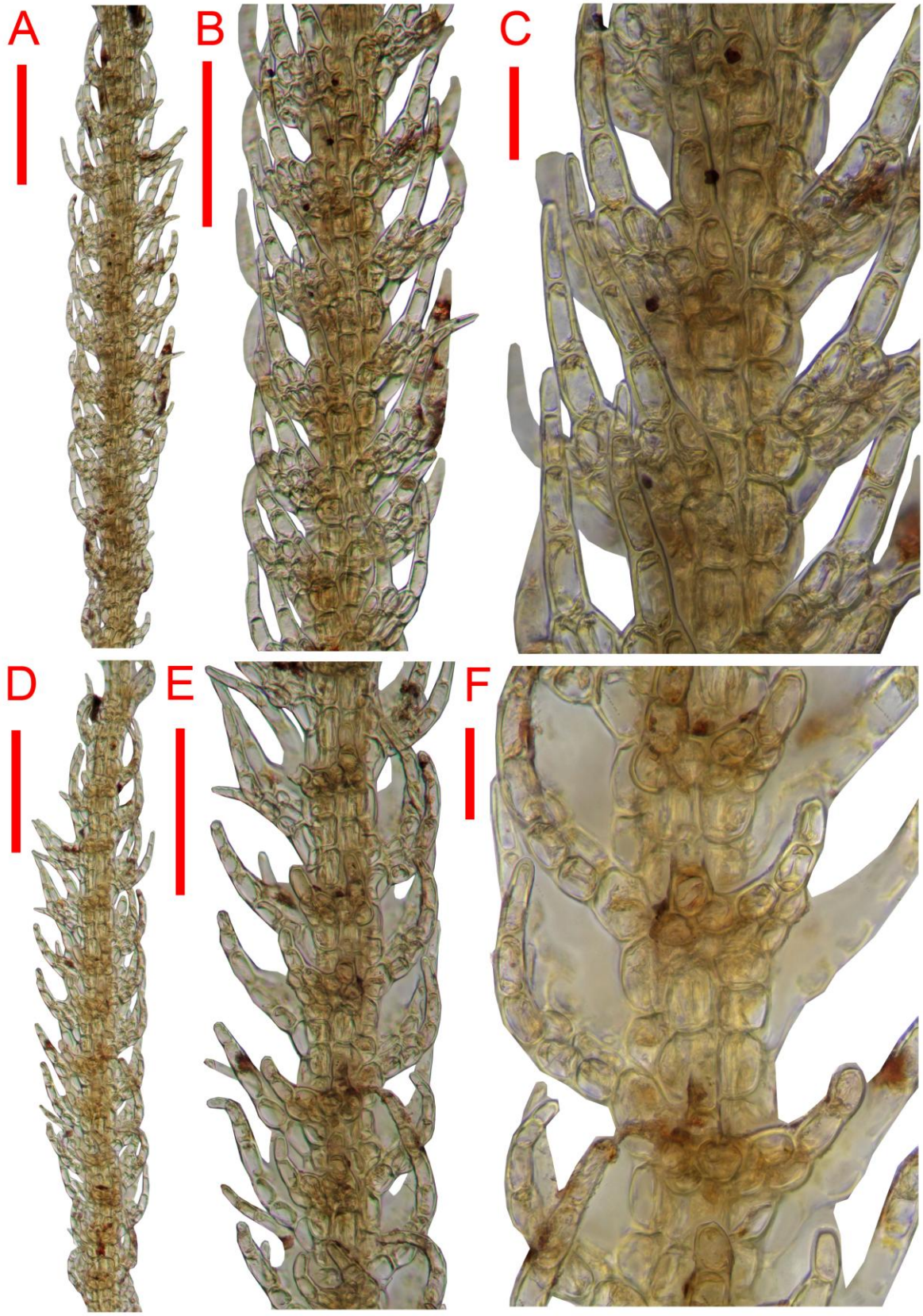

Plate 101: *Neolepidozia katrinae*: A, B, C – Branch dorsal, D, E, F – Branch ventral; Scales: A, D – 0.3 mm; B, E – 0.2 mm; C, F – 50 µm (from PANG H2654, JE – holotype)

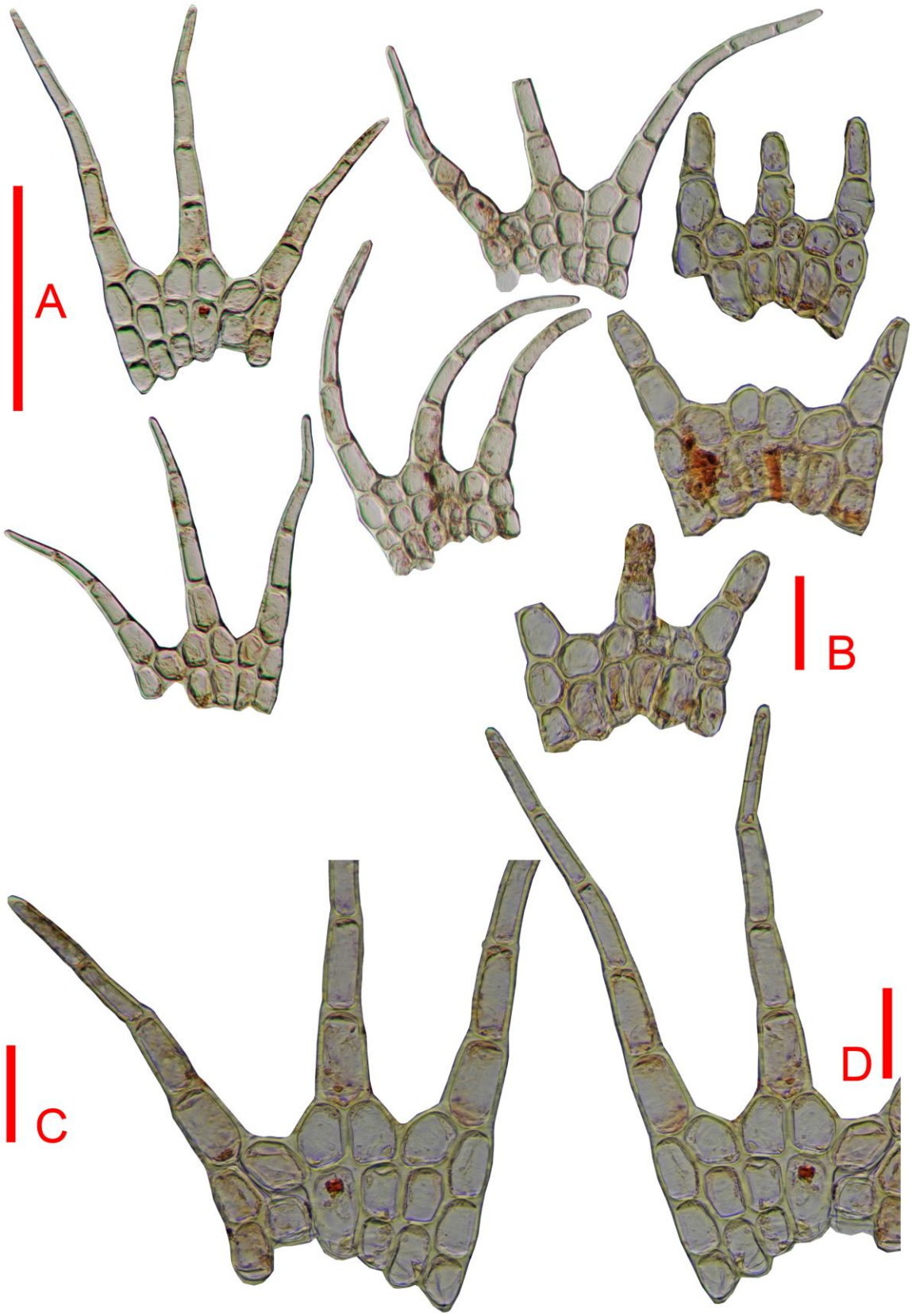

Plate 102: *Neolepidozia katrinae*: A – Branch leaves, B – Branch underleaves, C – Branch leaf disc, D – Branch leaf lobes; Scales: A – 0.2 mm; B, C, D – 50 µm (from PANG H2654, JE – holotype)

Neolepidozia kolombangaraensis **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

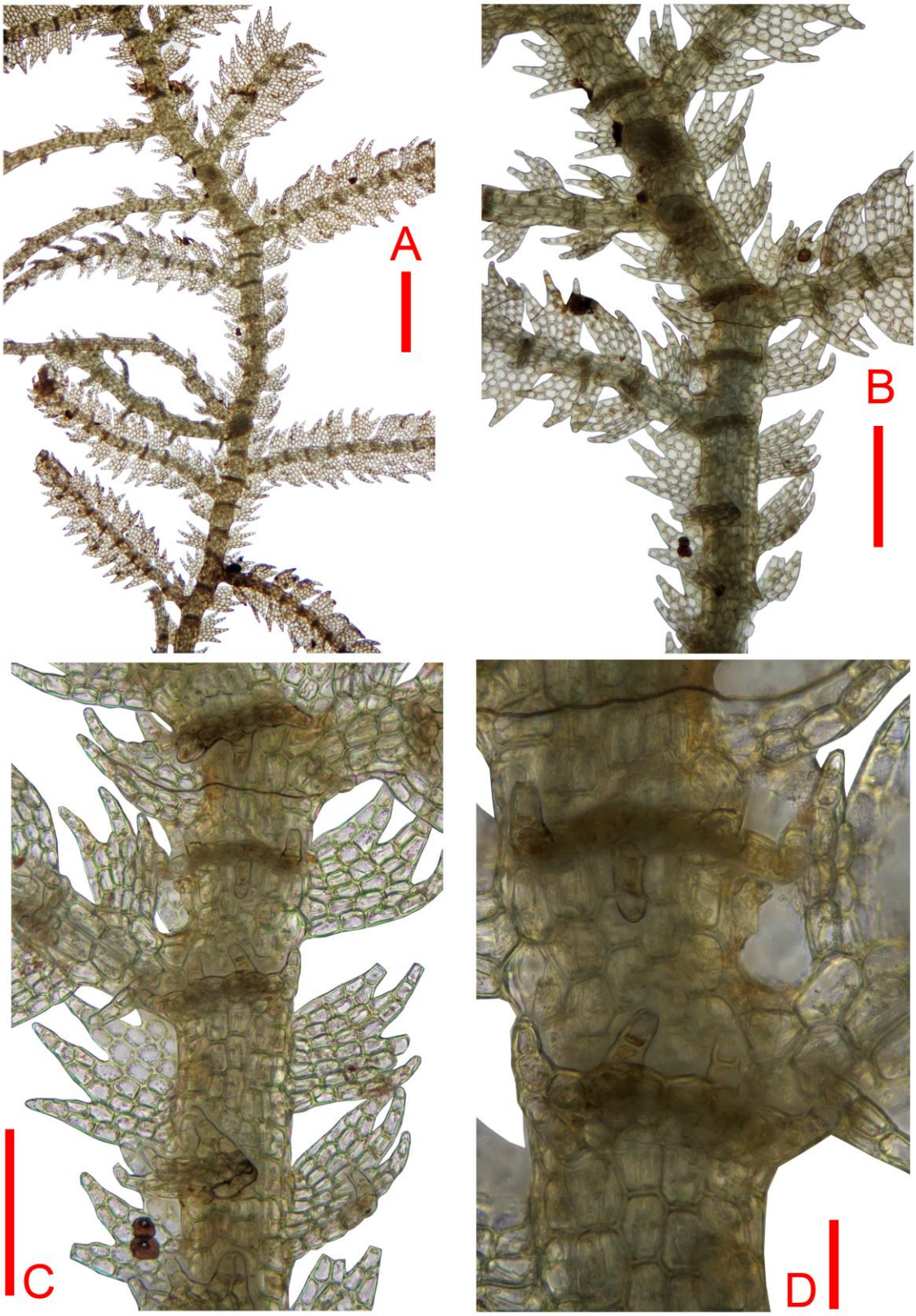

Plate 103: *Neolepidozia kolombangaraensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from NORRIS & ROBERTS 49712 – holotype)

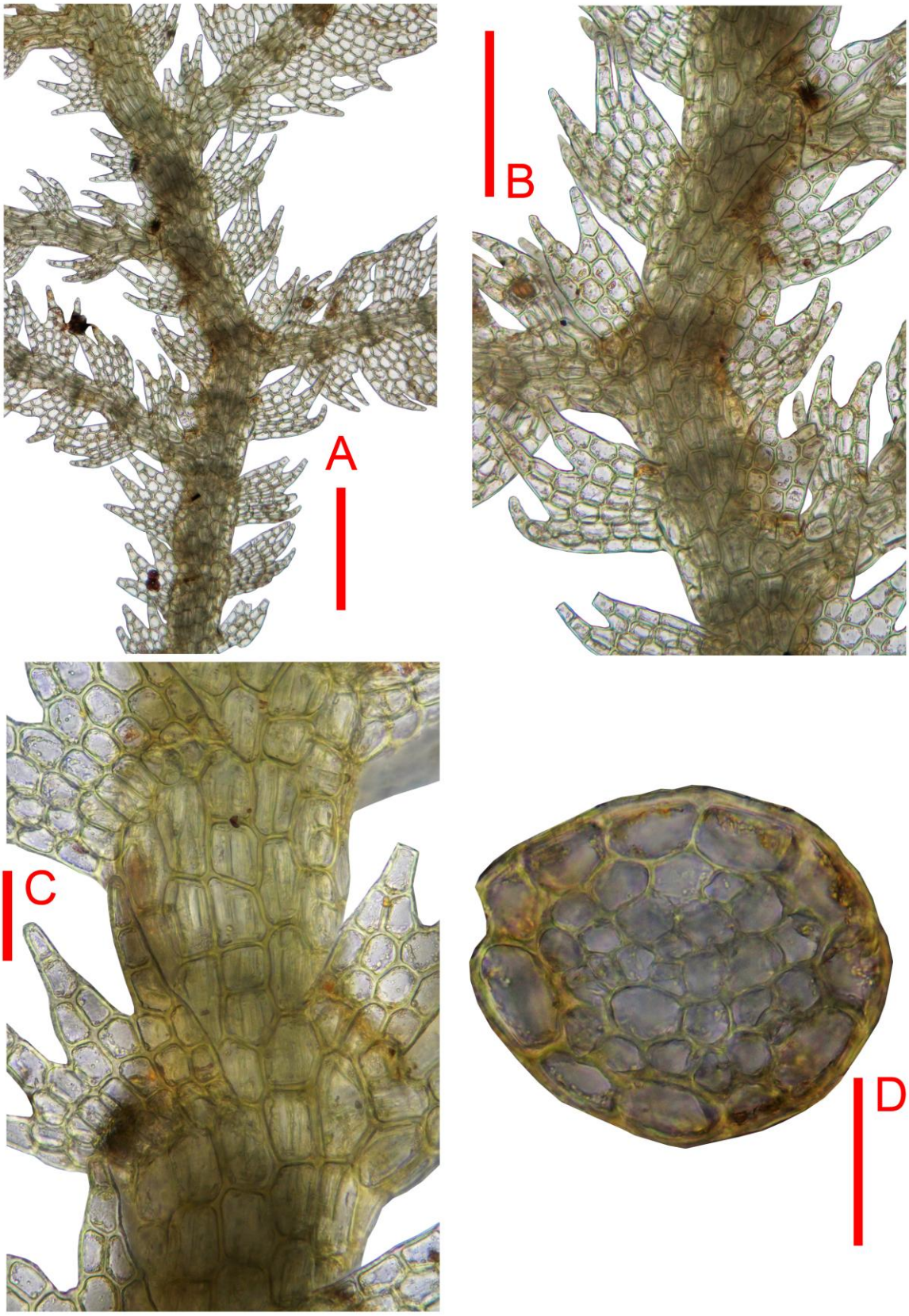

Plate 104: *Neolepidozia kolombangaraensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from NORRIS & ROBERTS 49712 – holotype)

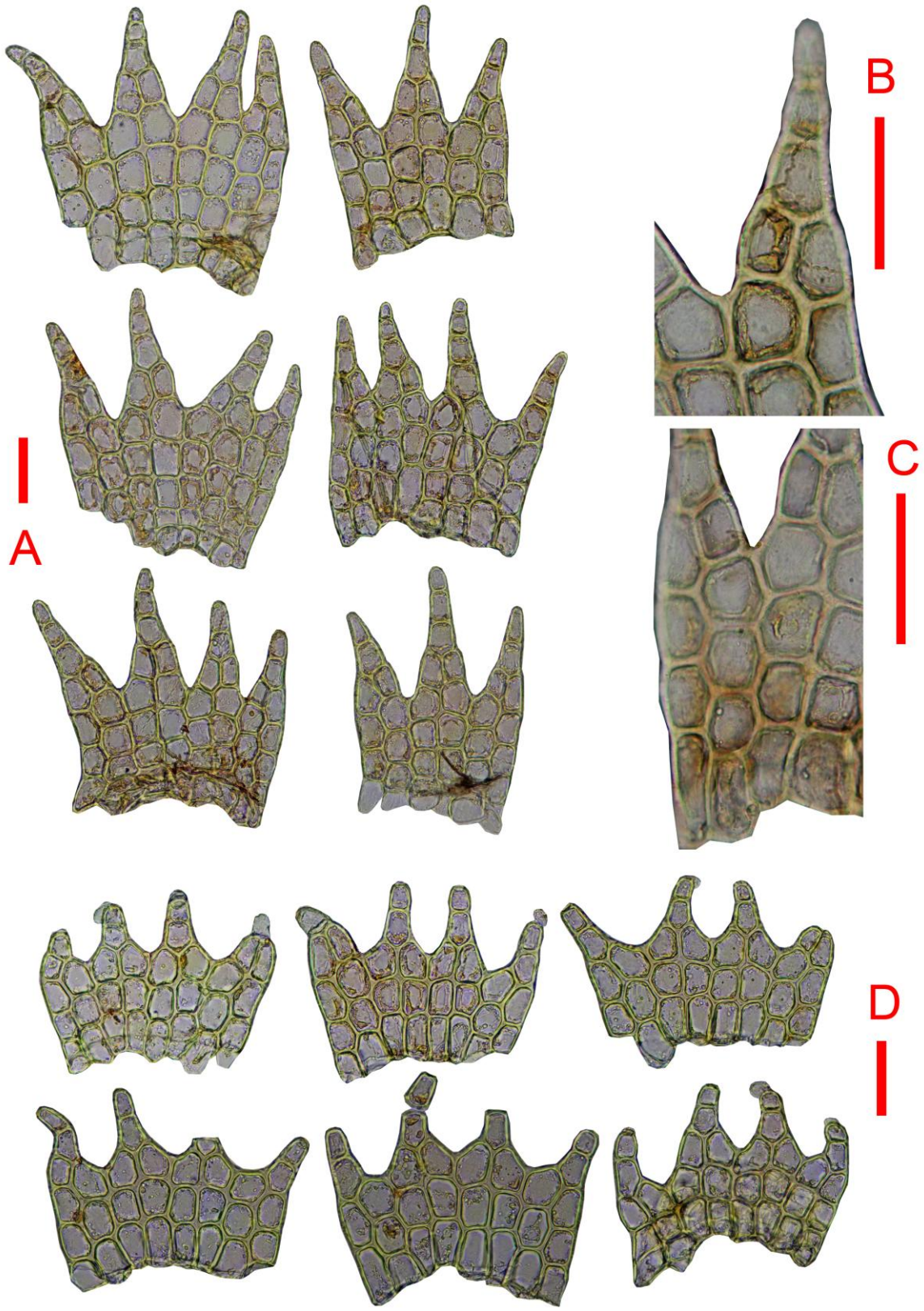

Plate 105: *Neolepidozia kolombangaraensis*: A – Stem leaves, B – Stem leaf lobe, C – Stem leaf disc, D – Stem underleaves; Scales: A, B, C, D – 50 µm (from NORRIS & ROBERTS 49712 – holotype)

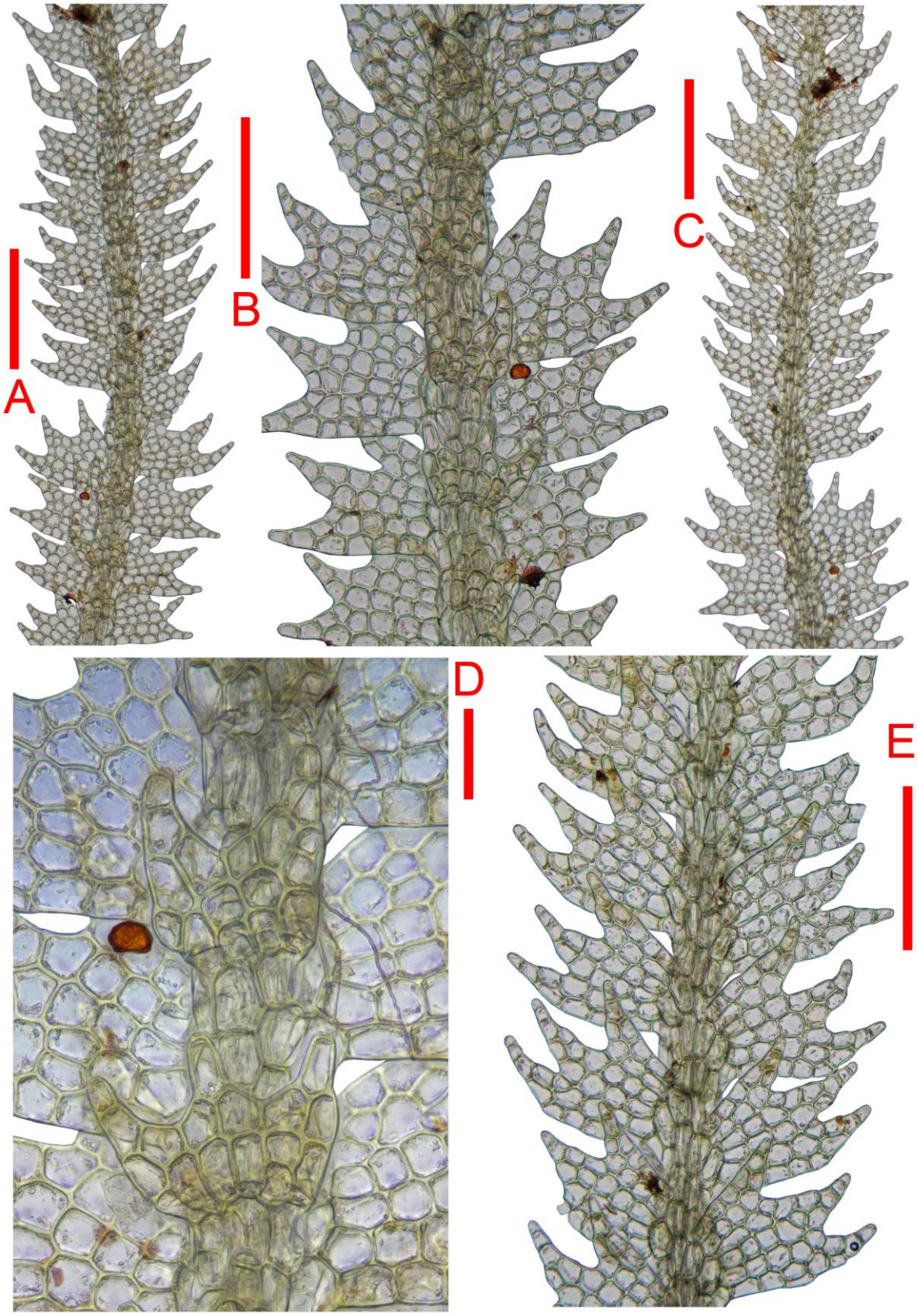

Plate 106: *Neolepidozia kolombangaraensis*: A, B, D – Branch ventral, C, E – Branch dorsal; Scales: A, C – 0.3 mm, B, E – 0.2 mm, E – 50 µm (from NORRIS & ROBERTS 49712 – holotype)

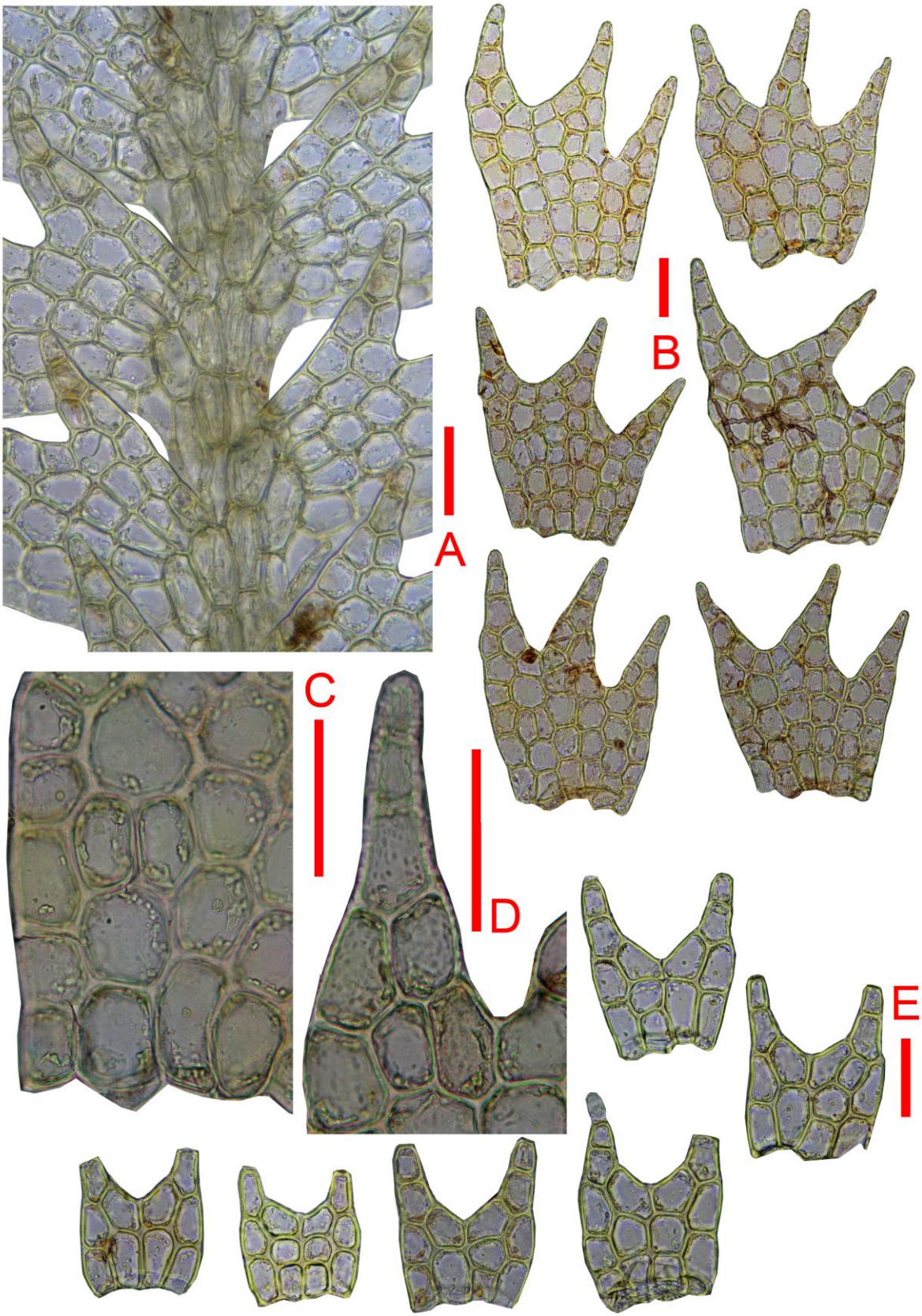

Plate 107: *Neolepidozia kolombangaraensis*: A – Branch dorsal, B – Branch leaves, C – Branch leaf disc, D – Branch leaf lobe, E – Branch underleaves; Scales: A, B, C, D, E – 50 µm (from NORRIS & ROBERTS 49712 – holotype)

Neolepidozia larutensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

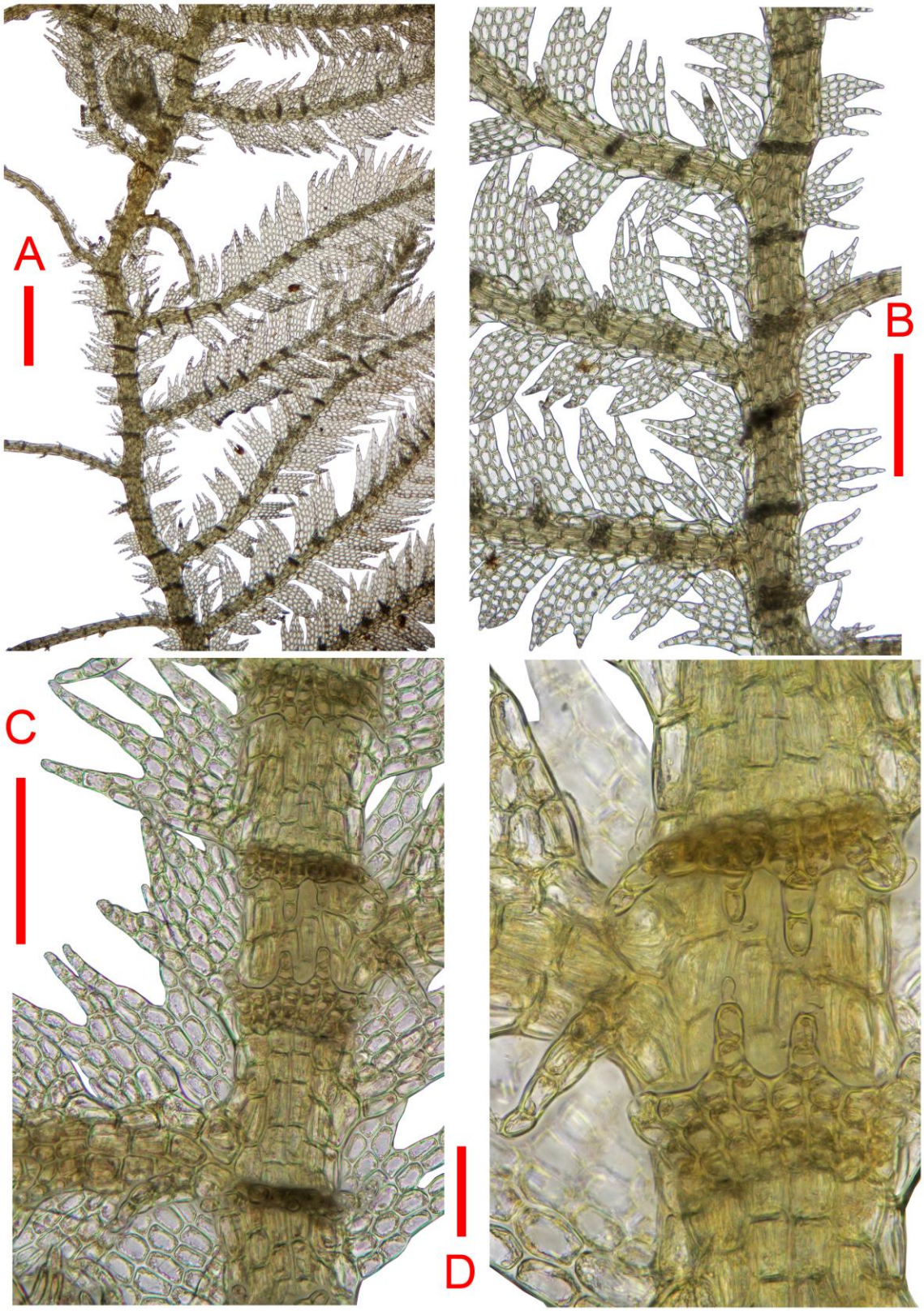

Plate 108: *Neolepidozia larutensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHÄFER-VERWIMP 19009/A – holotype)

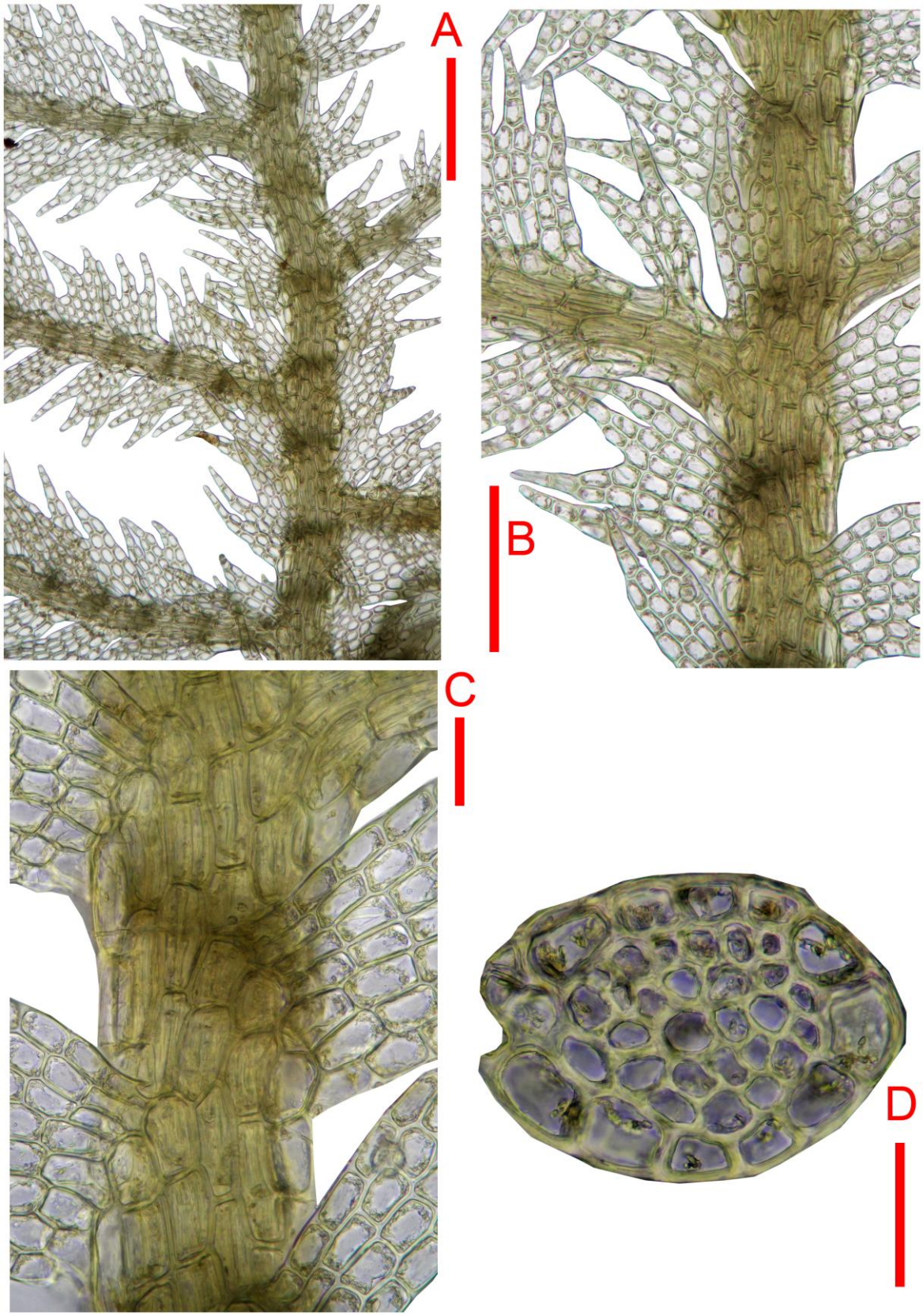

Plate 109: *Neolepidozia larutensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SCHÄFER-VERWIMP 19009/A – holotype)

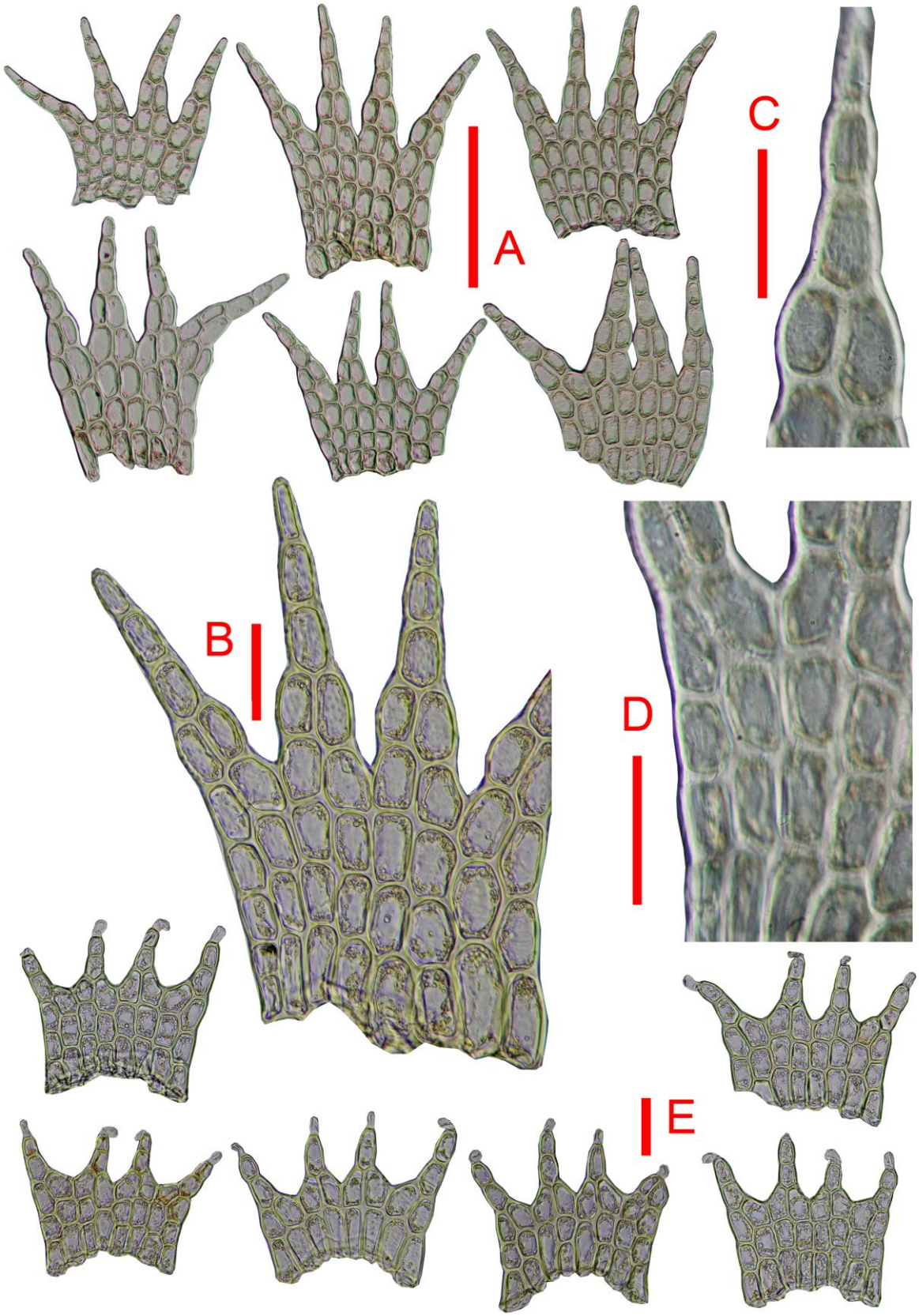

Plate 110: *Neolepidozia larutensis*: A, B – Stem leaves, C – Stem leaf lobe, D – Stem leaf disc, E – Stem underleaves; Scales: A – 0.2 mm; B, C, D, E – 50 µm (from SCHÄFER-VERWIMP 19009/A – holotype)

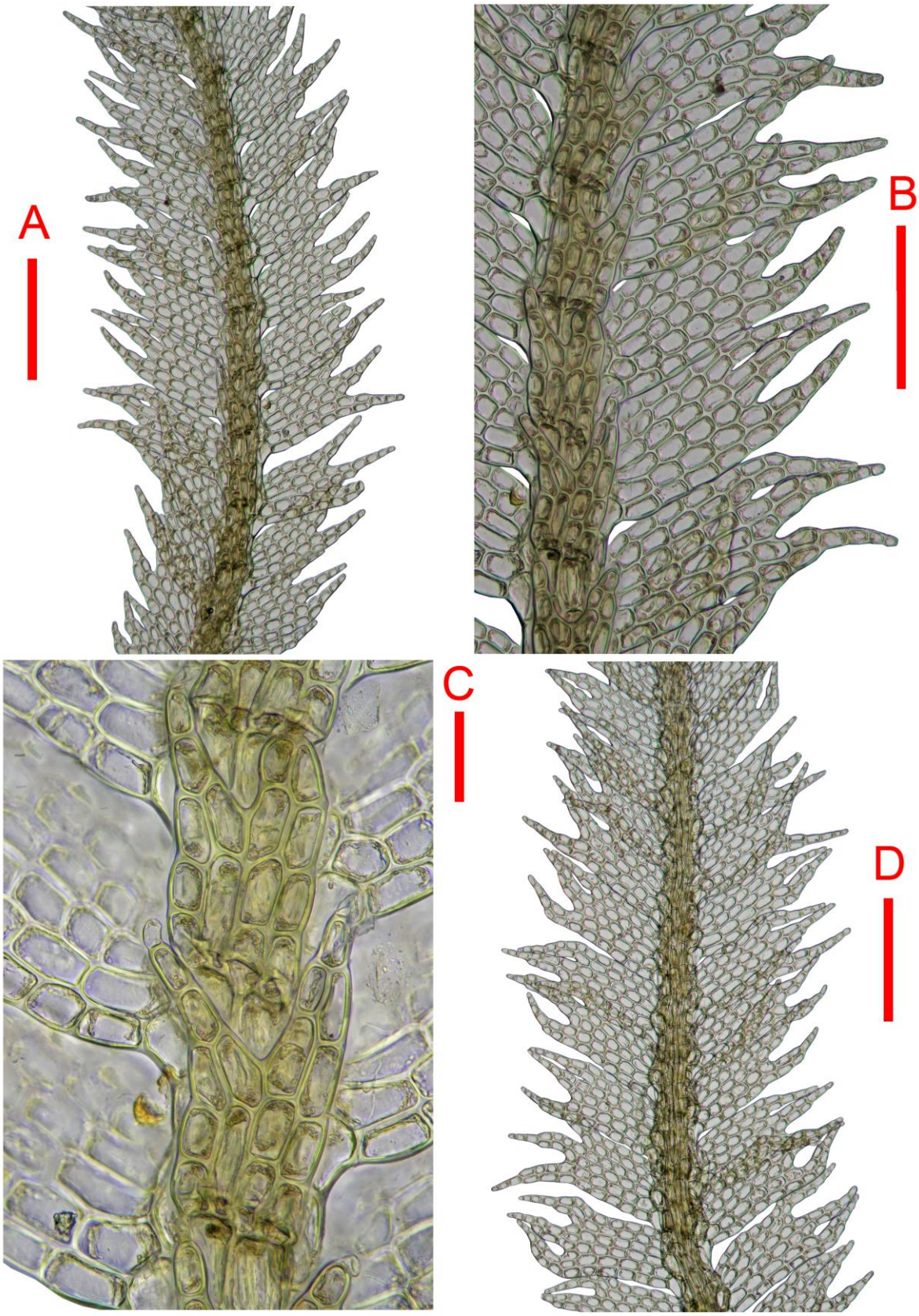

Plate 111: *Neolepidozia larutensis*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm; B – 0.2 mm, C – 50 µm (from SCHÄFER-VERWIMP 19009/A – holotype)

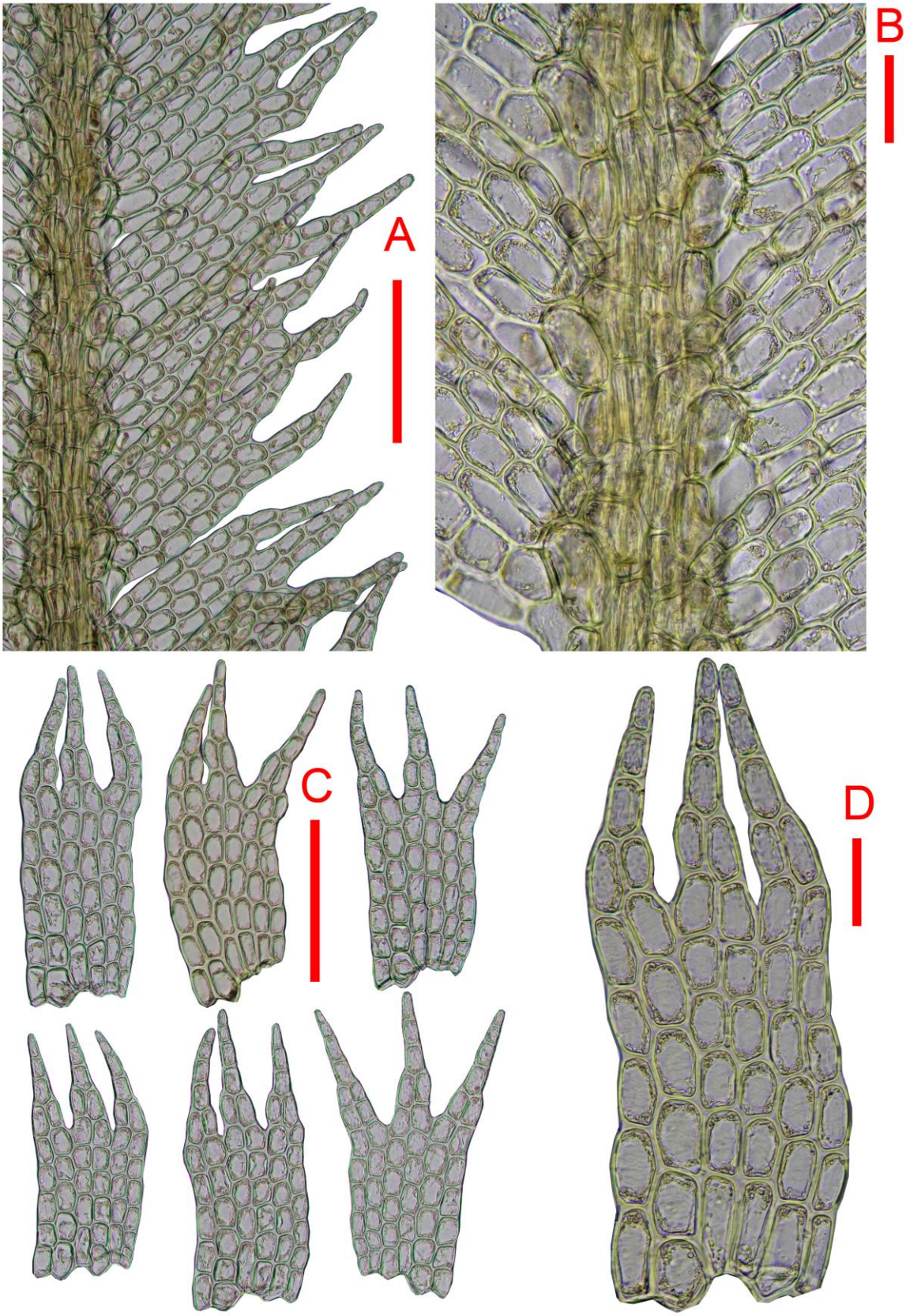

Plate 112: *Neolepidozia larutensis*: A, B – Branch dorsal, C, D – Branch leaves; Scales: A, C – 0.2 mm; B, D – 50 µm (from SCHÄFER-VERWIMP 19009/A – holotype)

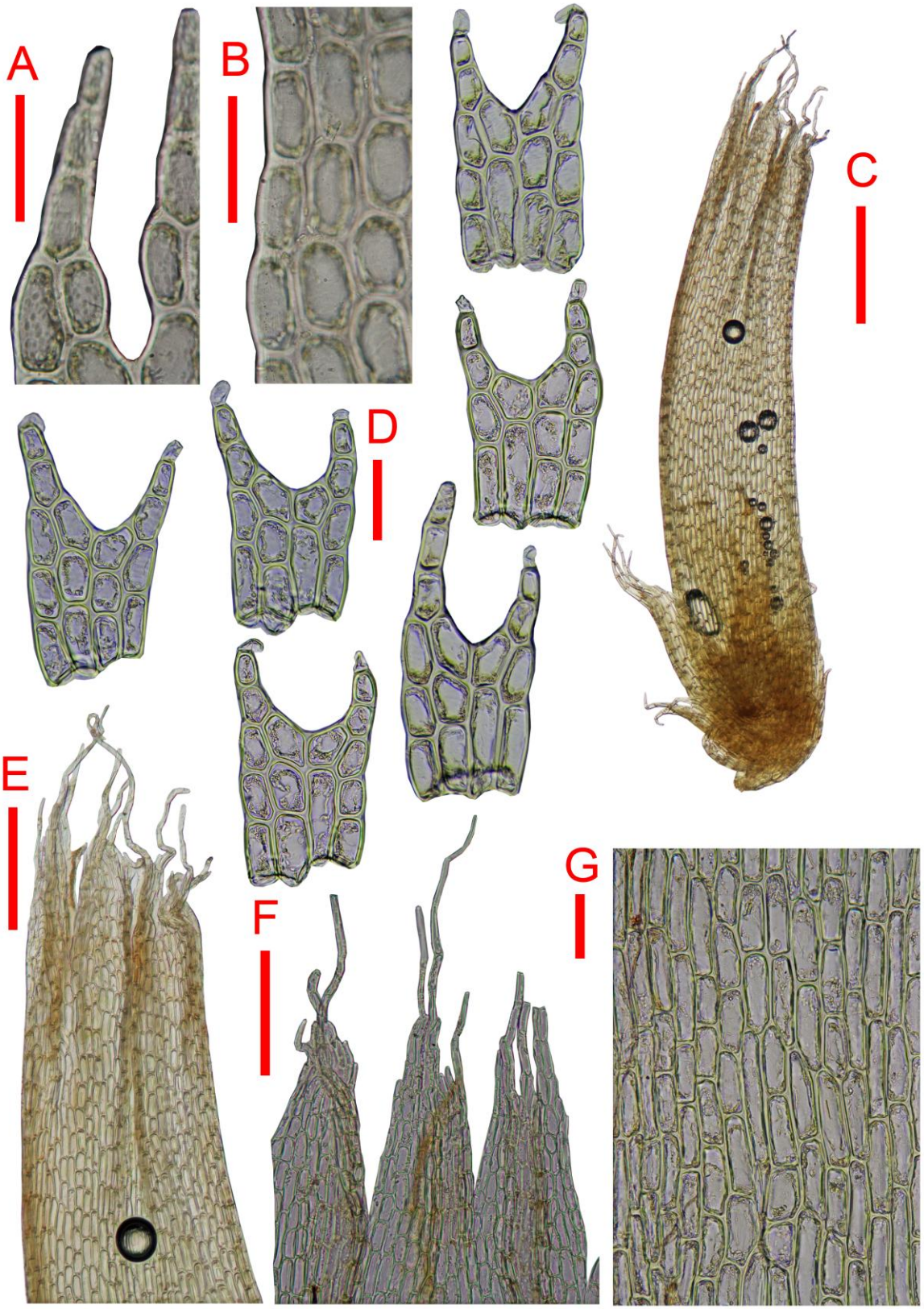

Plate 113: *Neolepidozia larutensis*: A – Branch leaf lobe, B – Branch leaf disc, C – Perianth, D – Branch underleaves, E, F – Perianth mouth, G – Perianth middle; Scales: C – 0.5 mm; E – 0.3 mm; F – 0.2 mm; A, B, D, G – 50 µm (from SCHÄFER-VERWIMP 19009/A – holotype)

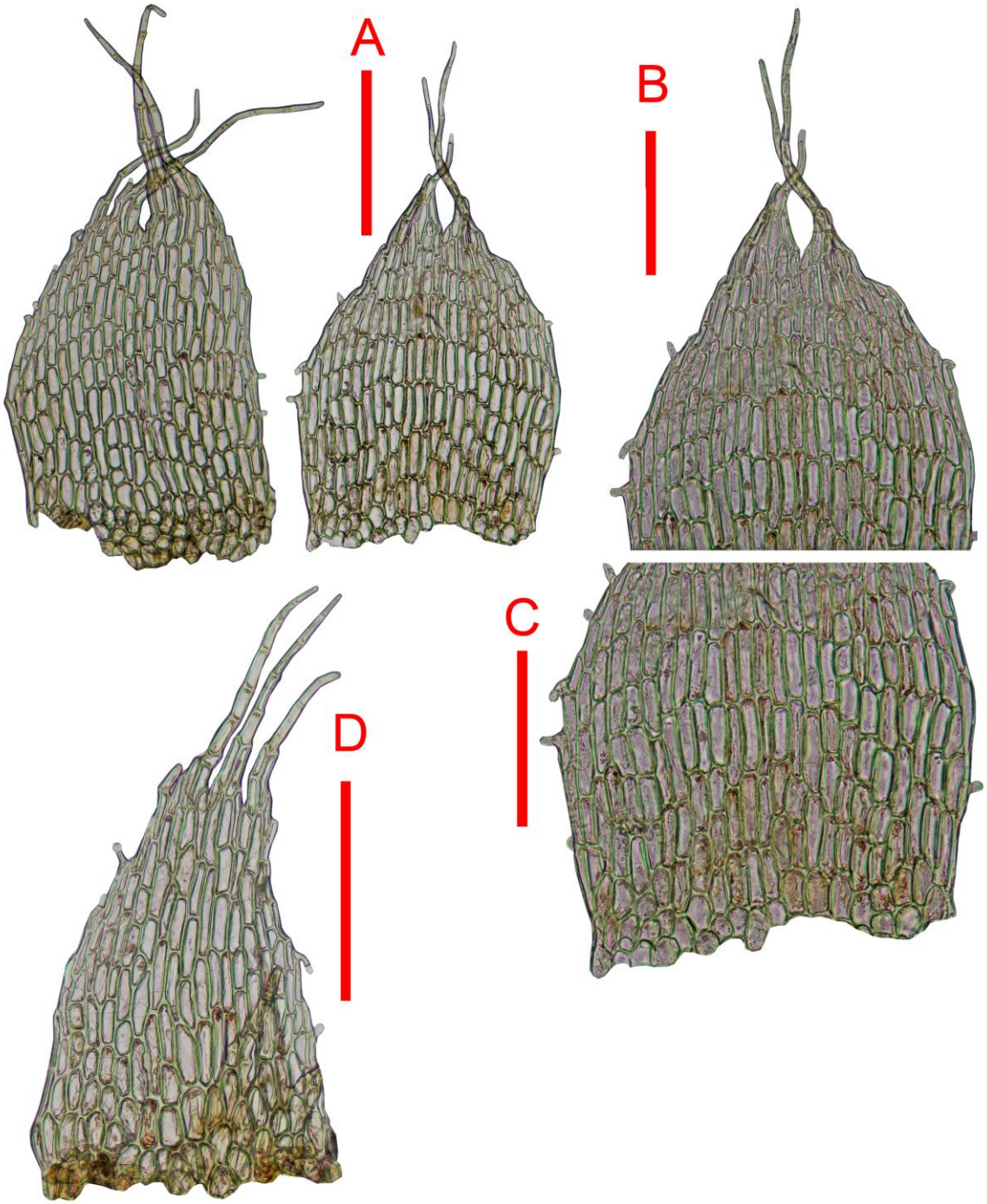

Plate 114: *Neolepidozia larutensis*: A – Female bract, B – Female bract apex, C – Female bract disc, D – Female bracteole; Scales: A, D – 0.3 mm; C, D – 0.2 mm (from SCHÄFER-VERWIMP 19009/A – holotype)

Neolepidozia lembangensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

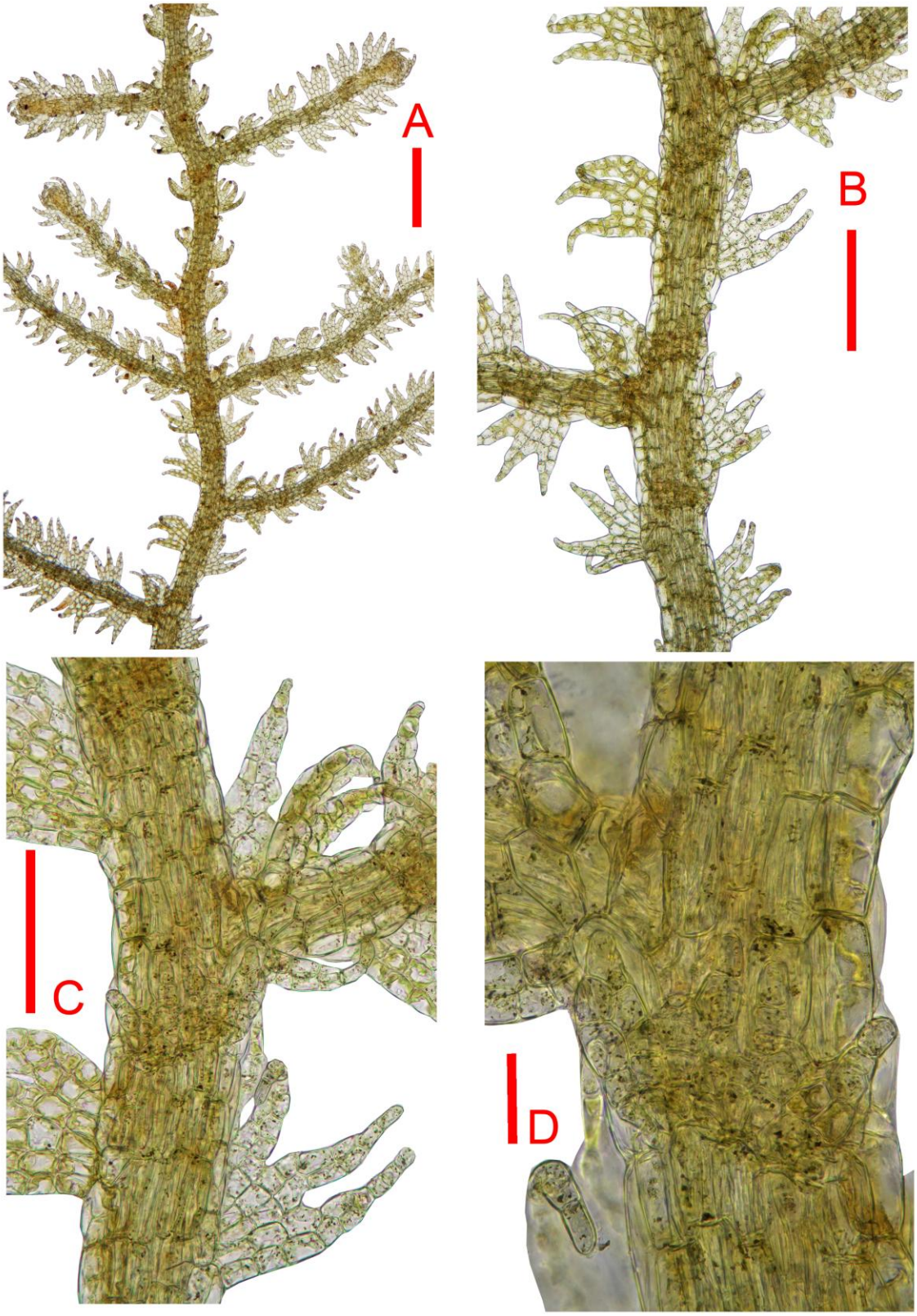

Plate 115: *Neolepidozia lembangensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from WINTER 669 – holotype)

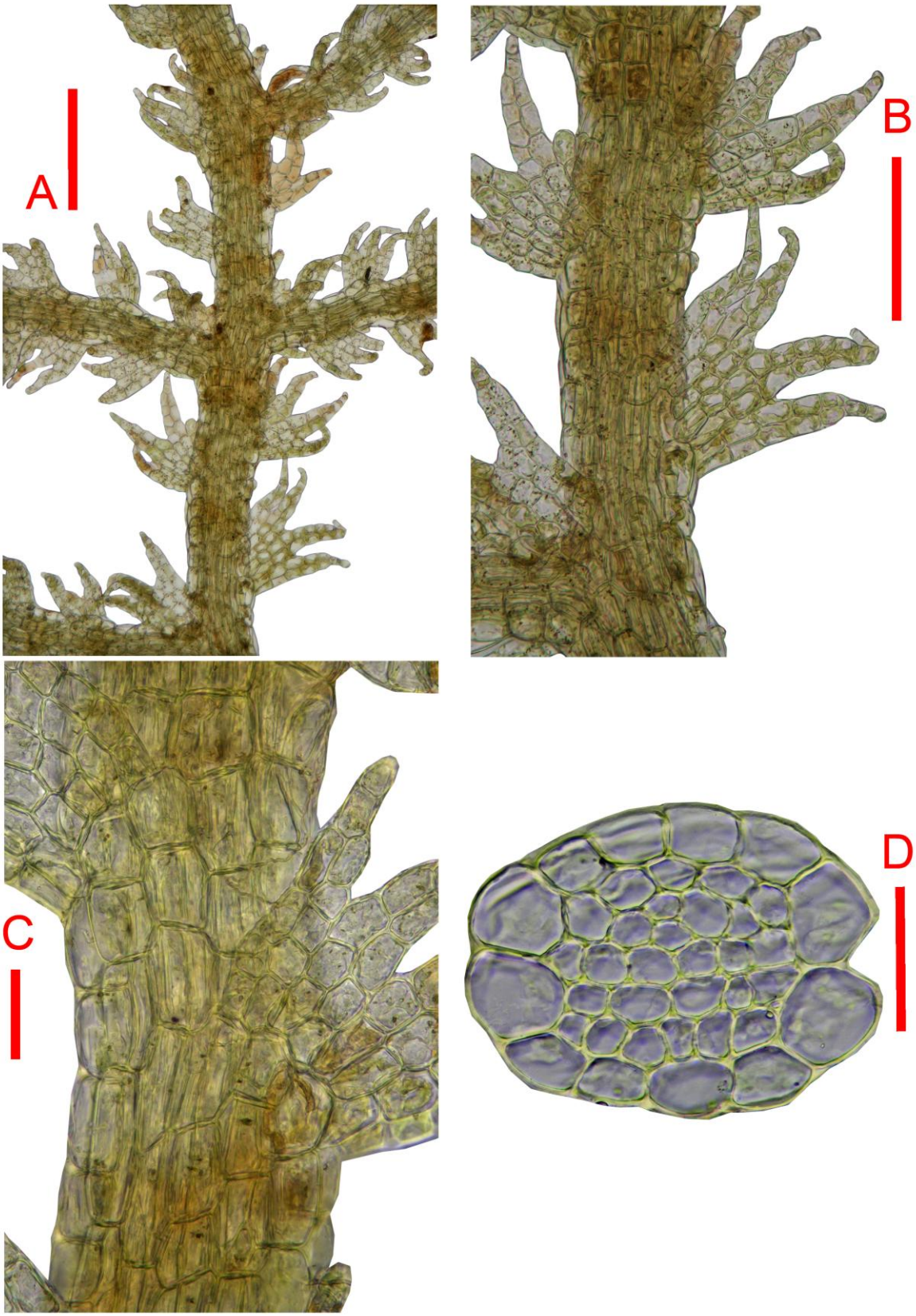

Plate 116: *Neolepidozia lembangensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from WINTER 669 – holotype)

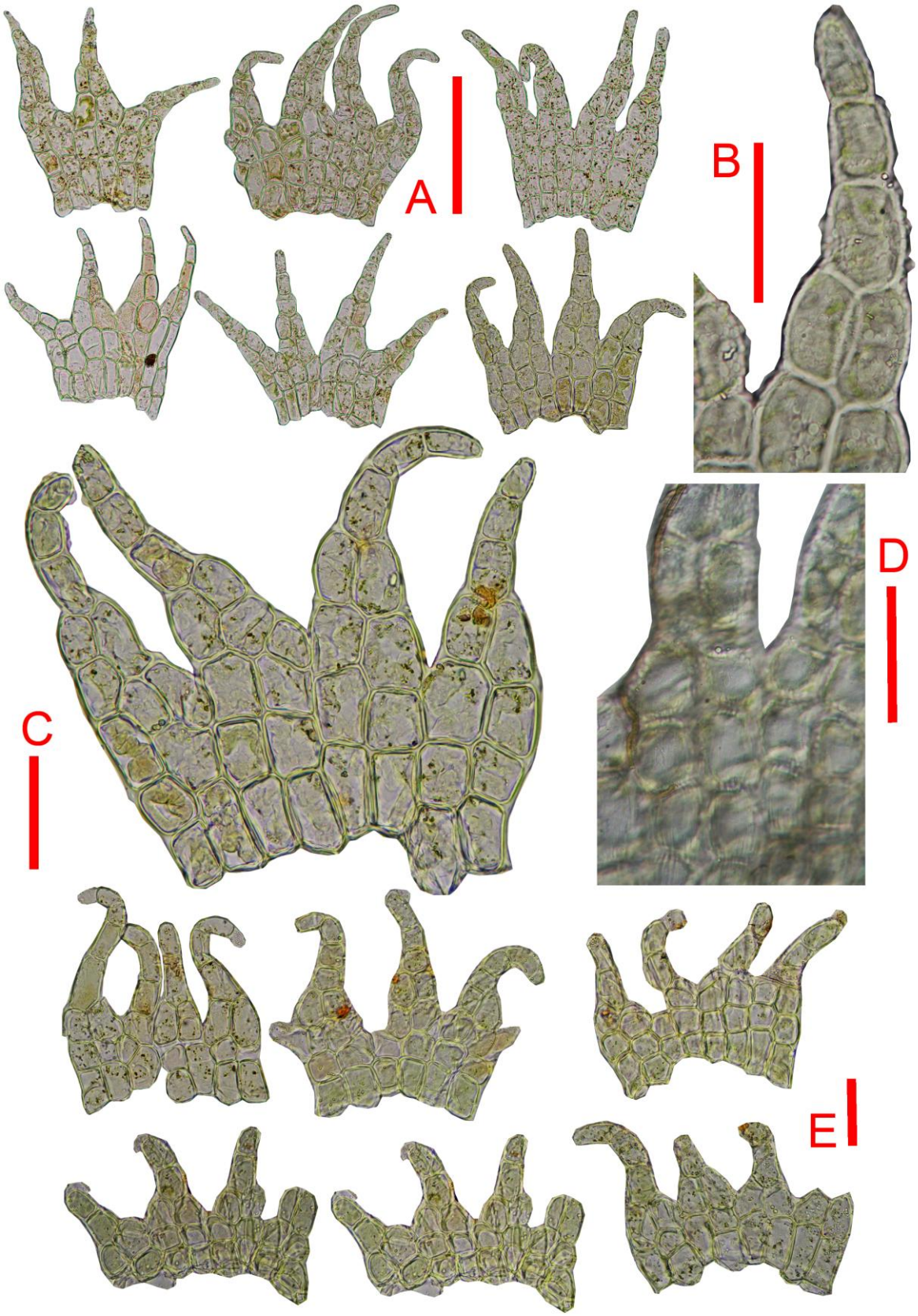

Plate 117: *Neolepidozia lembangensis*: A, C – Stem leaves, B – Stem leaf lobe, D – Stem leaf disc, E – Stem underleaves; Scales: A – 0.2 mm; B, C, D, E – 50 µm (from WINTER 669 – holotype)

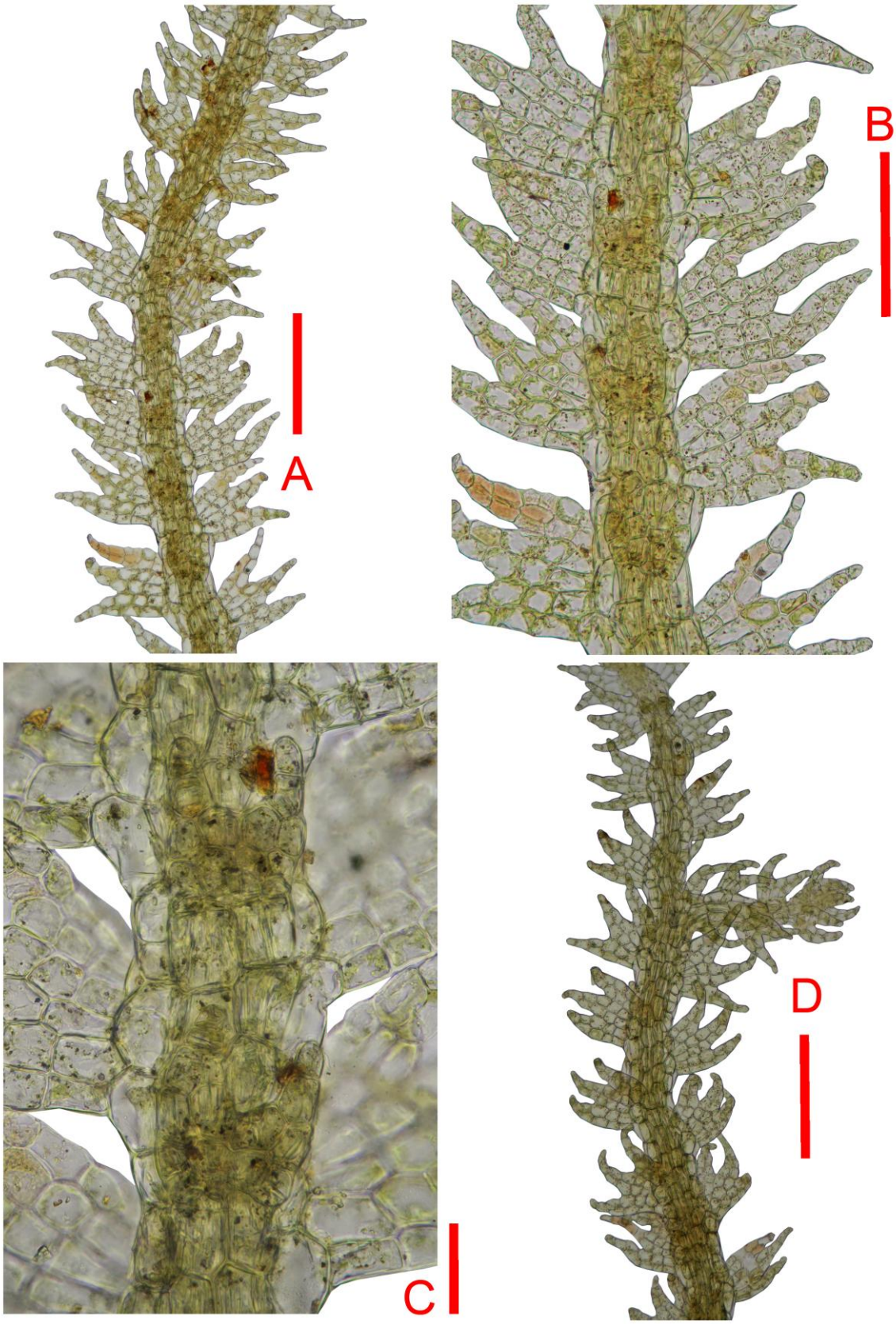

Plate 118: *Neolepidozia lembangensis*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm; B – 0.2 mm, C – 50 µm (from WINTER 669 – holotype)

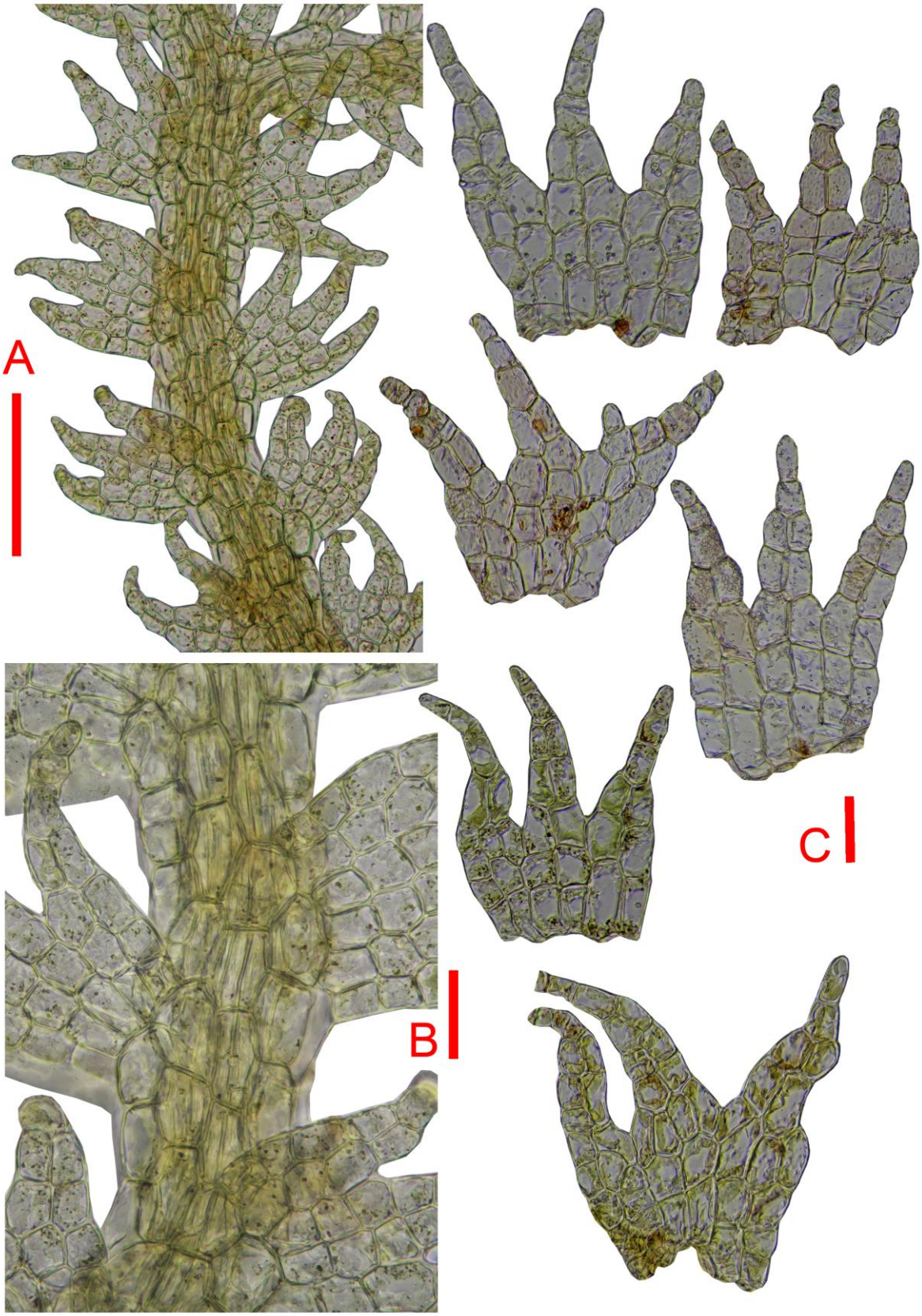

Plate 119: *Neolepidozia lembangensis*: A, B – Branch dorsal, C – Stem leaves; Scales: A – 0.2 mm; B, C – 50 µm (from WINTER 669 – holotype)

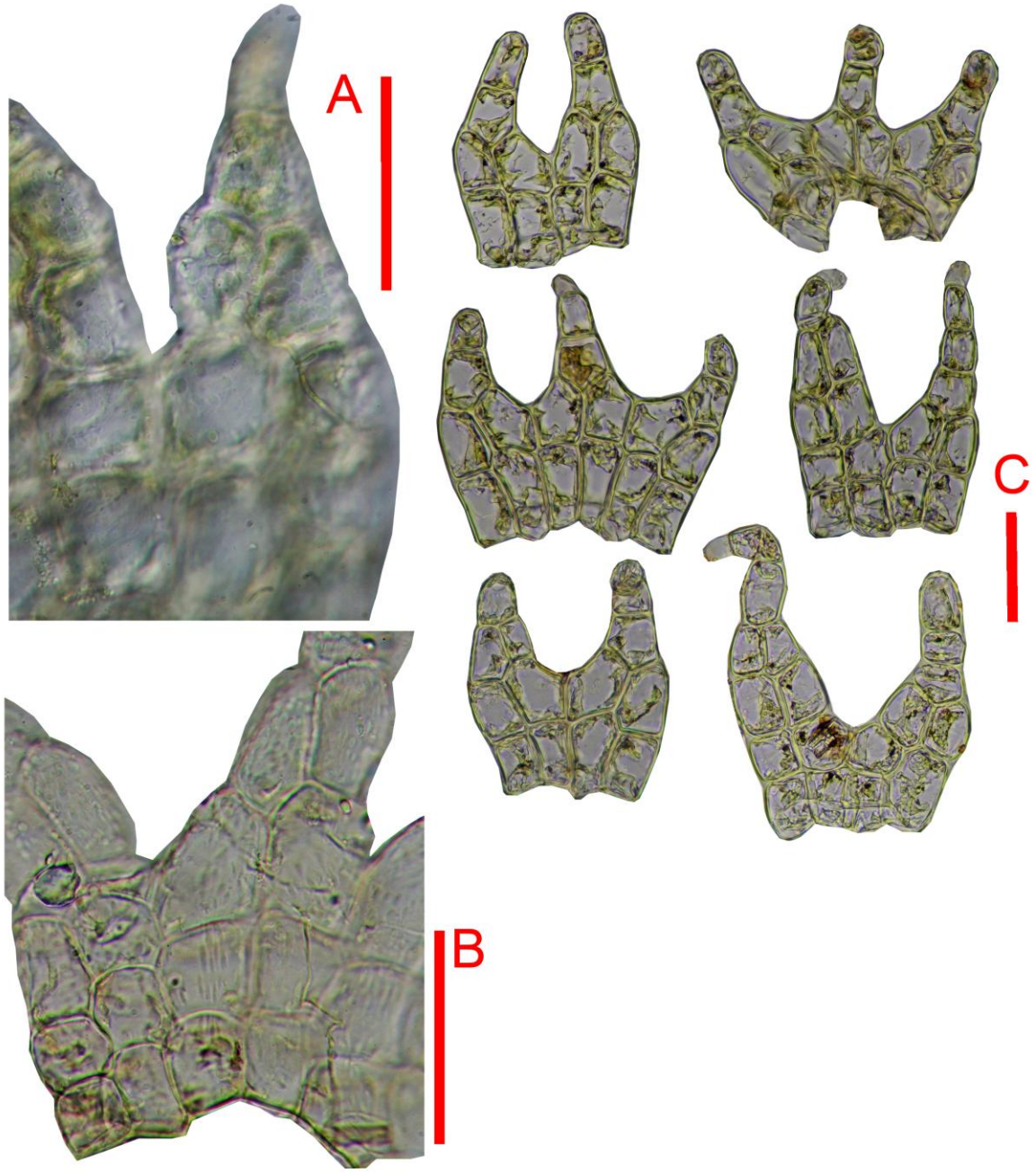

Plate 120: *Neolepidozia lembangensis*: A – Branch leaf lobe, B – Branch leaf disc, C – Branch underleaves; Scales: A, B, C – 50 µm (from WINTER 669 – holotype)

Neolepidozia limbawonensis **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

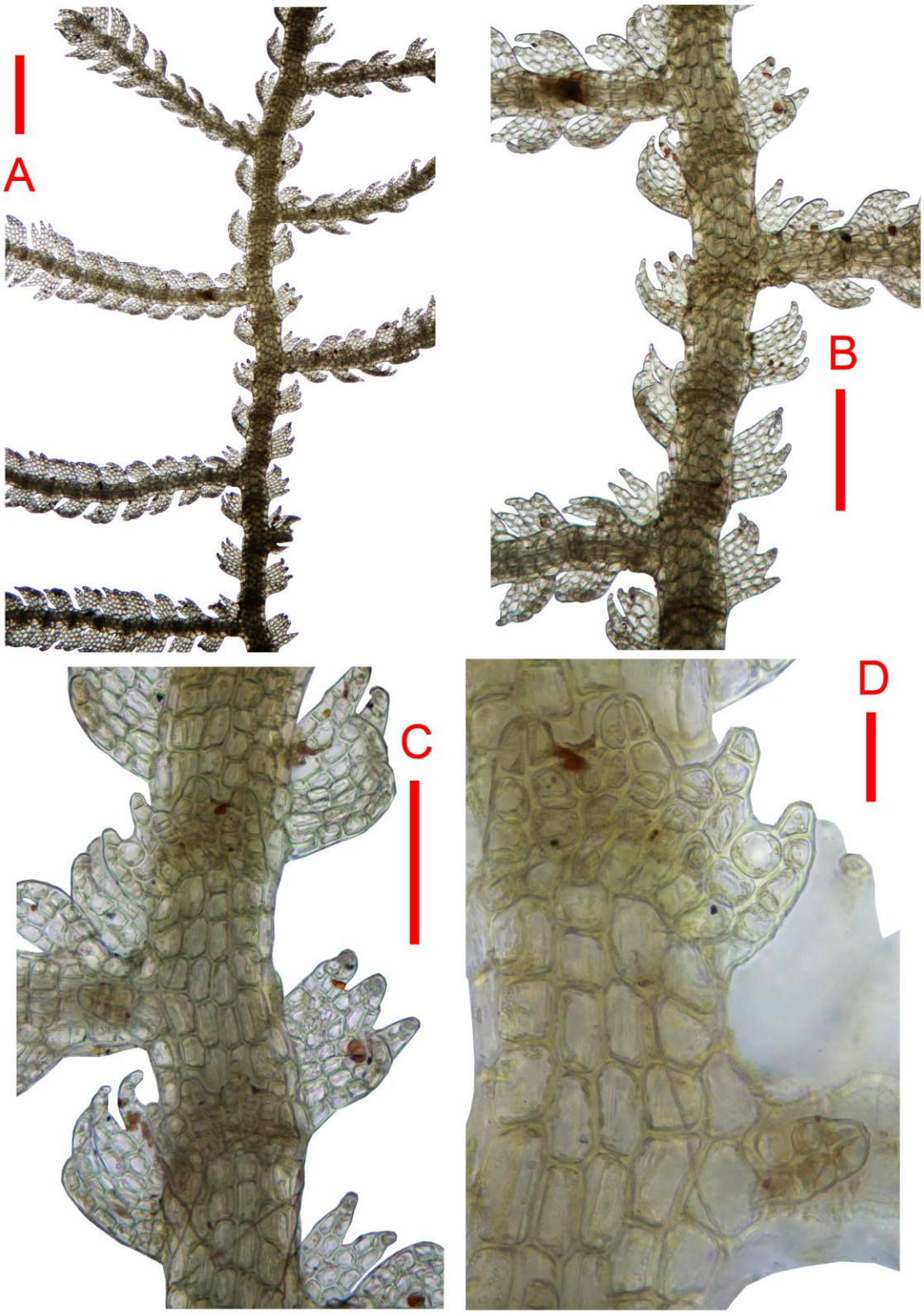

Plate 121: *Neolepidozia limbawonensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SHEVOCK 54633 – holotype)

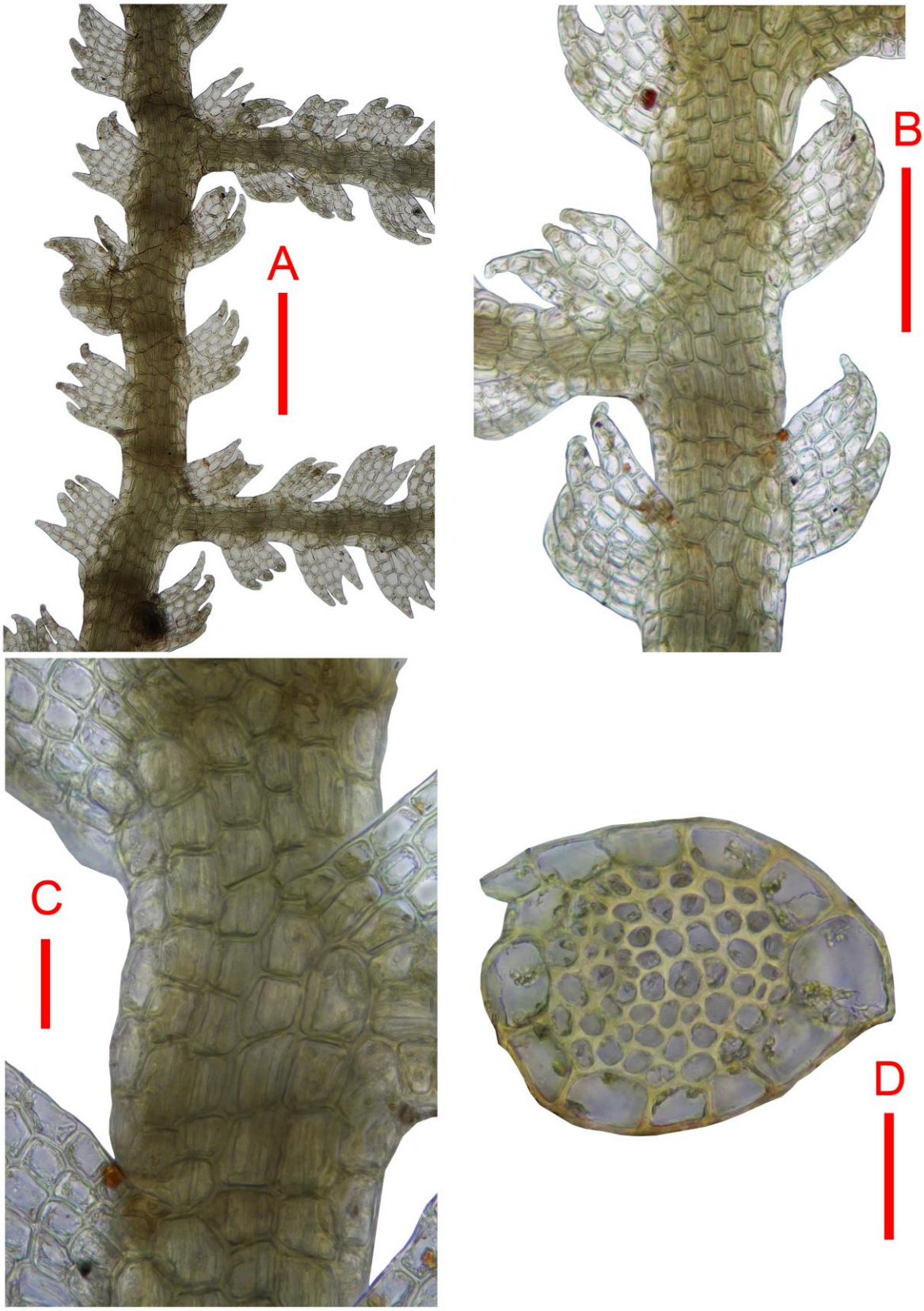

Plate 122: *Neolepidozia limbawonensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SHEVOCK 54633 – holotype)

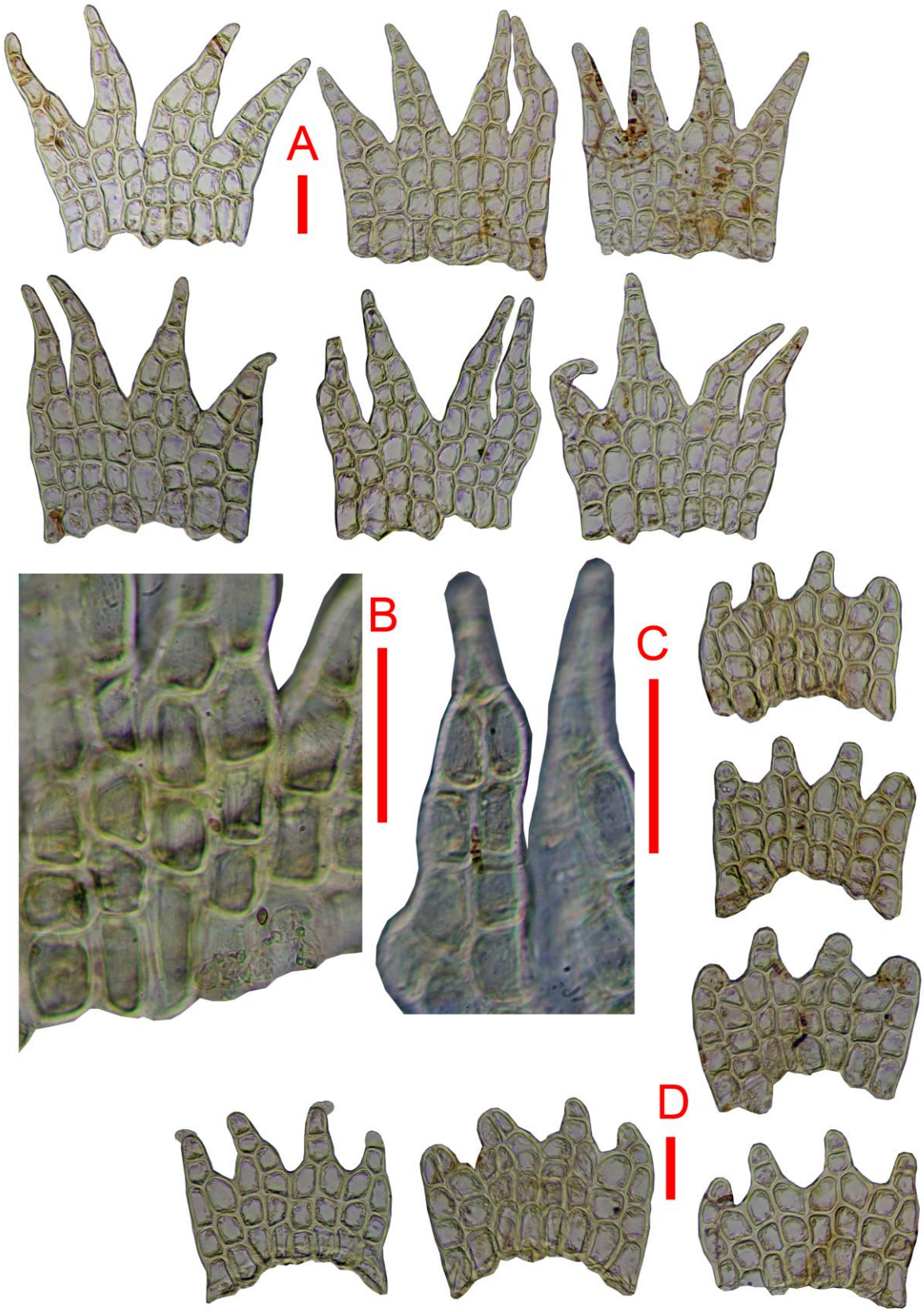

Plate 123: *Neolepidozia limbawonensis*: A – Stem leaves, B – Stem leaf disc, C – Stem leaf lobe, D – Stem underleaves; Scales: A, B, C, D – 50 µm (from SHEVOCK 54633 – holotype)

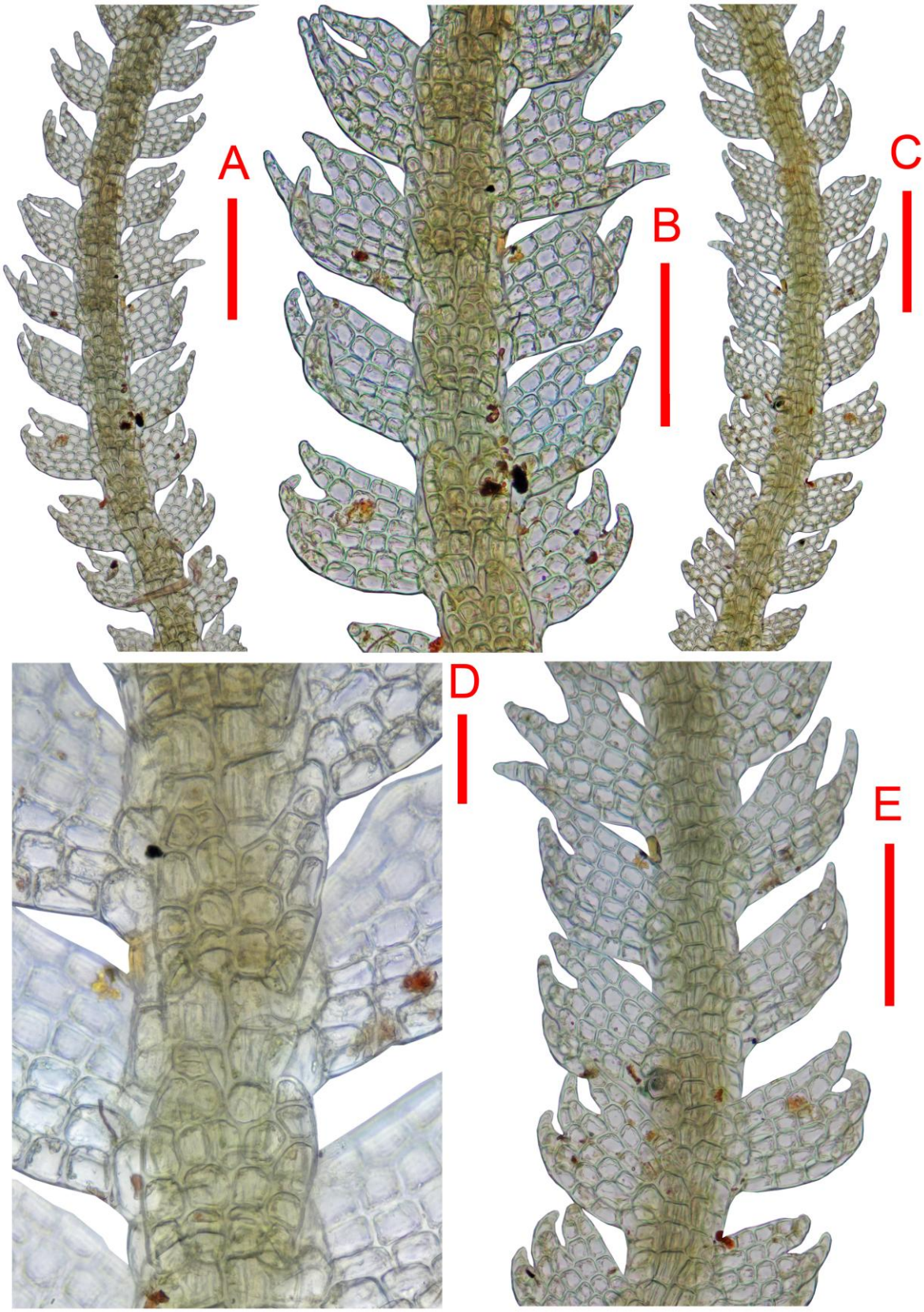

Plate 124: *Neolepidozia limbawonensis*: A, B, D – Branch ventral, C, E – Branch dorsal; Scales: A, C – 0.3 mm; B, E – 0.2 mm; D – 50 µm (from SHEVOCK 54633 – holotype)

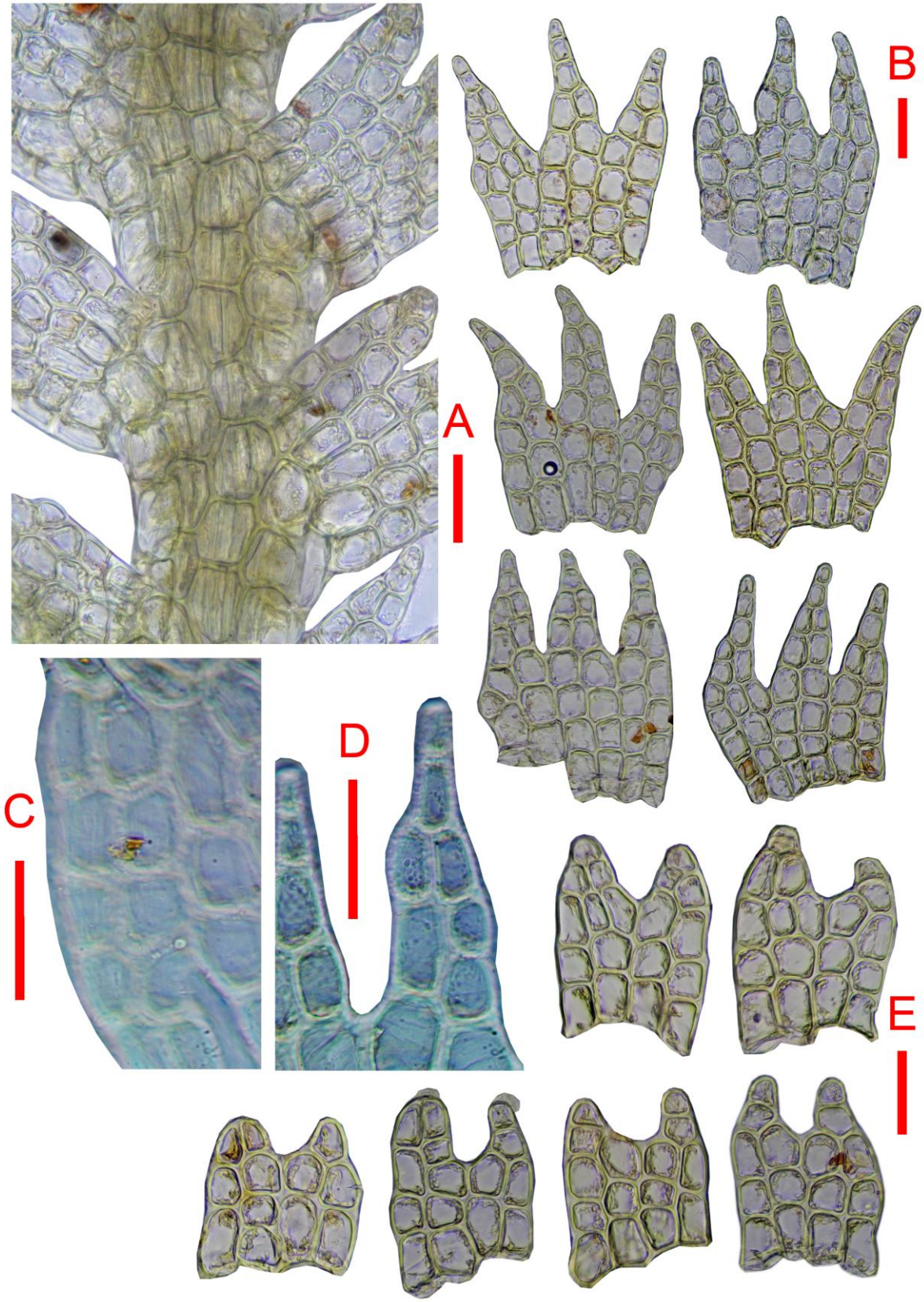

Plate 125: *Neolepidozia limbawonensis*: A – Branch dorsal, B – Branch leaves, C – Branch leaf disc, D – Branch leaf lobe, E – Branch underleaves; Scales: A, B, C, D, E – 50 µm (from SHEVOCK 54633 – holotype)

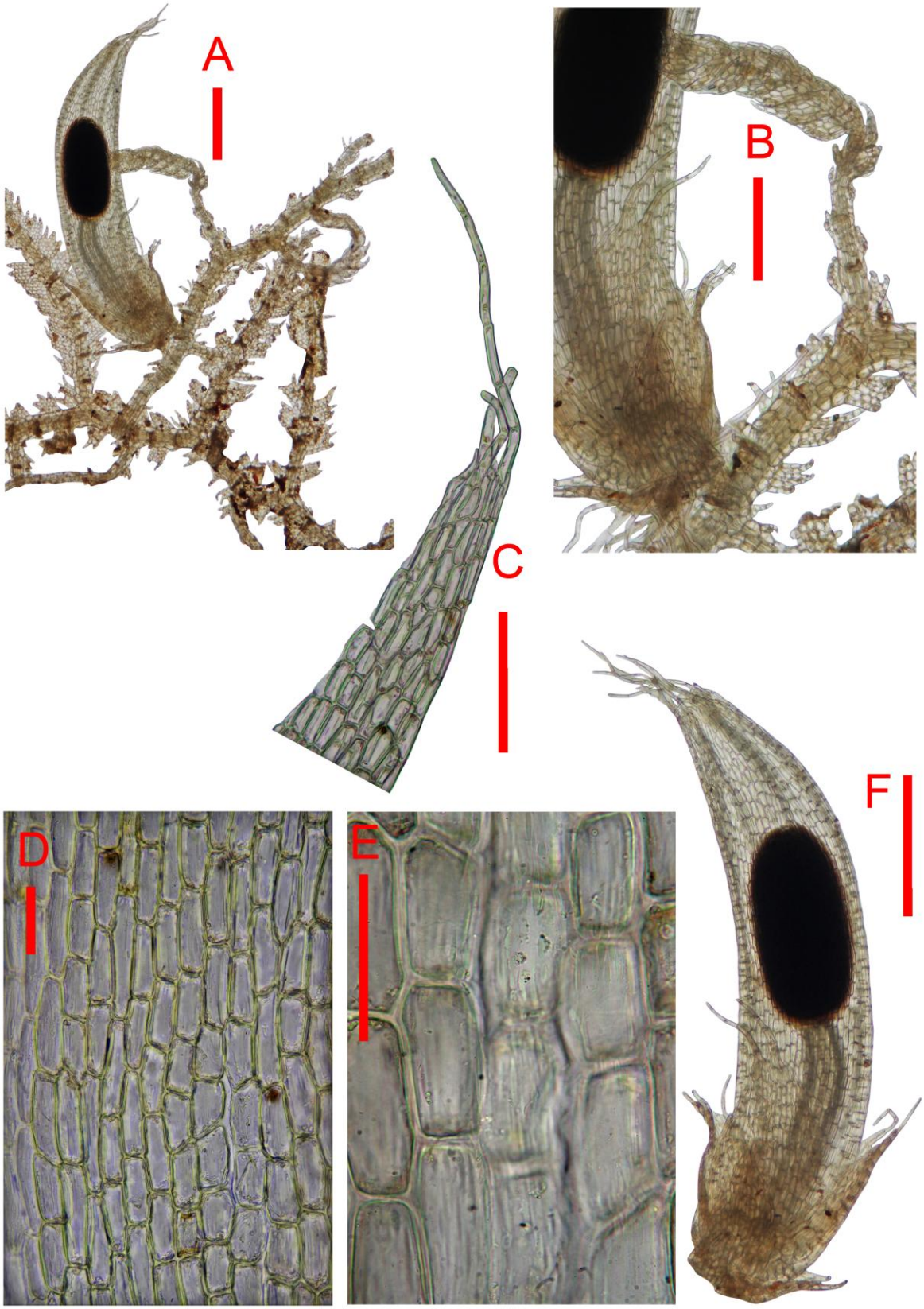

Plate 126: *Neolepidozia limbawonensis*: A, B – Plant ventral, C – Perianth mouth, D, E – Perianth middle, F - Perianth; Scales: A, F – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D, E – 50 µm (from SHEVOCK 54633 – holotype)

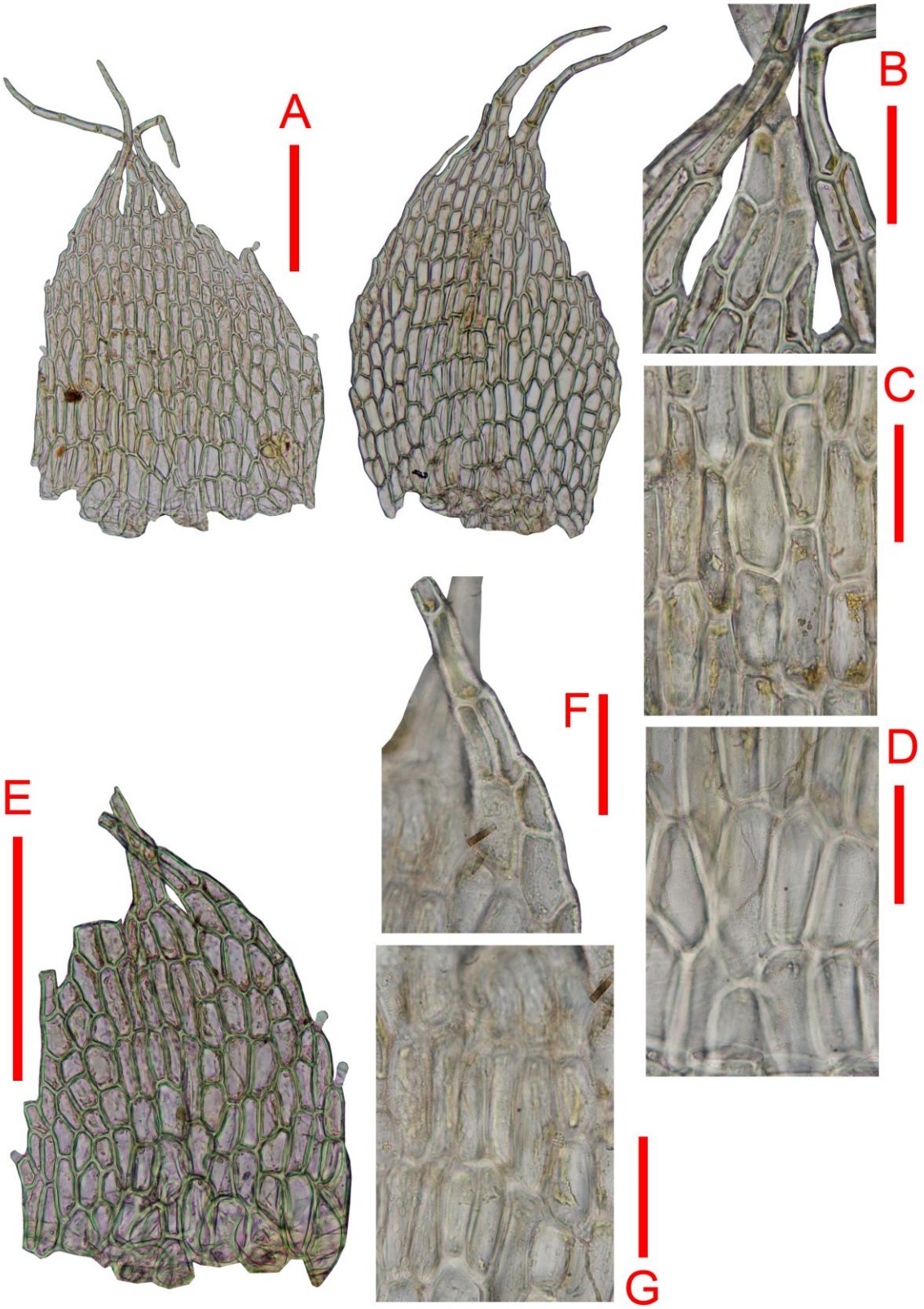

Plate 127: *Neolepidozia limbawonensis*: A – Female bracts, B – Female bract lobe, C – Female bract middle, D – Female bract base, E – Female bracteole, F – Female bracteole lobe, G – Female bracteole base; Scales: A, E – 0.2 mm, B, C, D, F, G – 50 µm (from SHEVOCK 54633 – holotype)

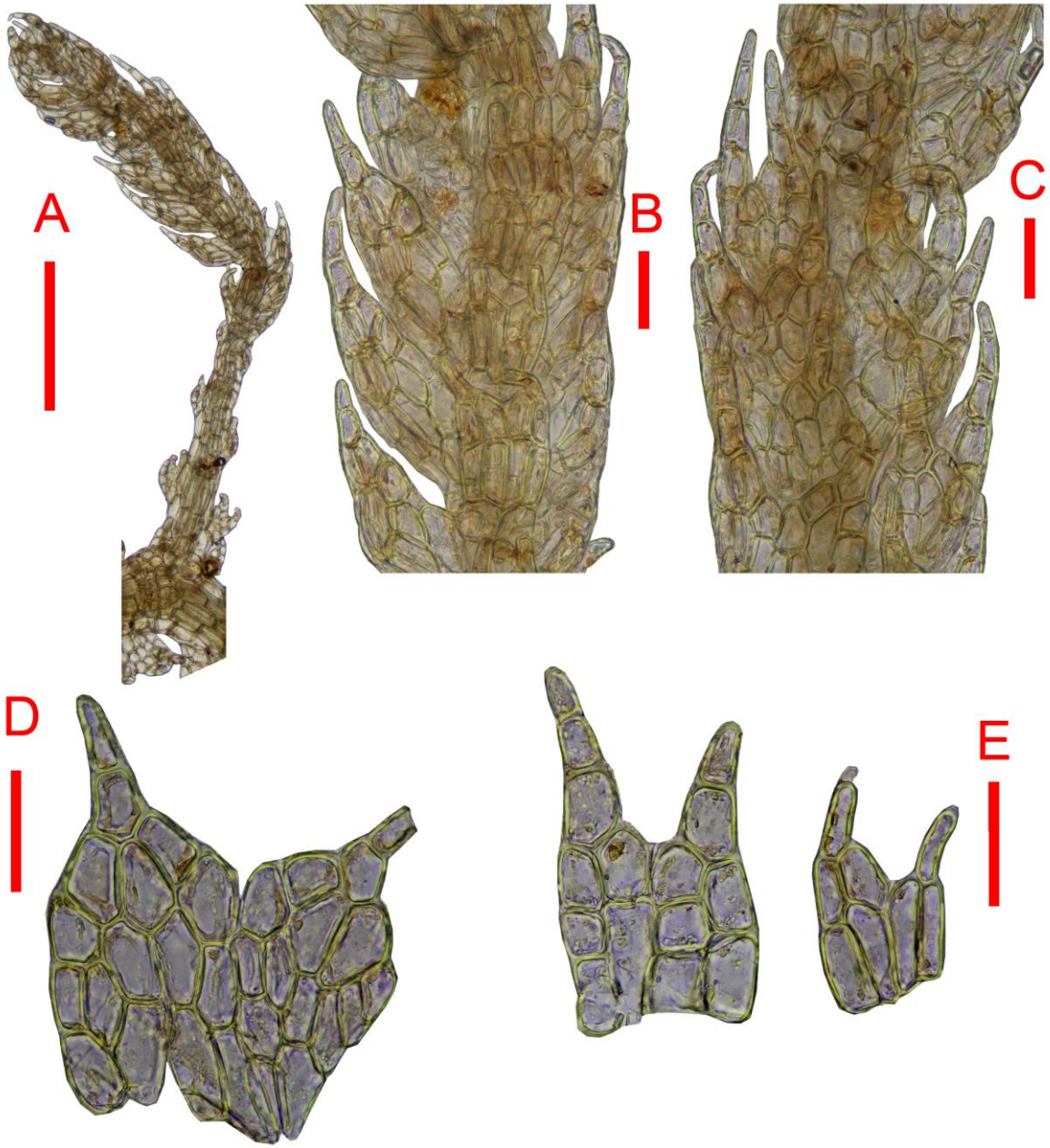

Plate 128: *Neolepidozia limbawonensis*: A, B – Male branch ventral, C – Male branch dorsal, D – Male branch leaf, E – Male branch unerleaves; Scales: A – 0.3 mm, B, C, D, E – 50 µm (from SHEVOCK 54633 – holotype)

***Lepidozia longitudinalis* HERZOG**

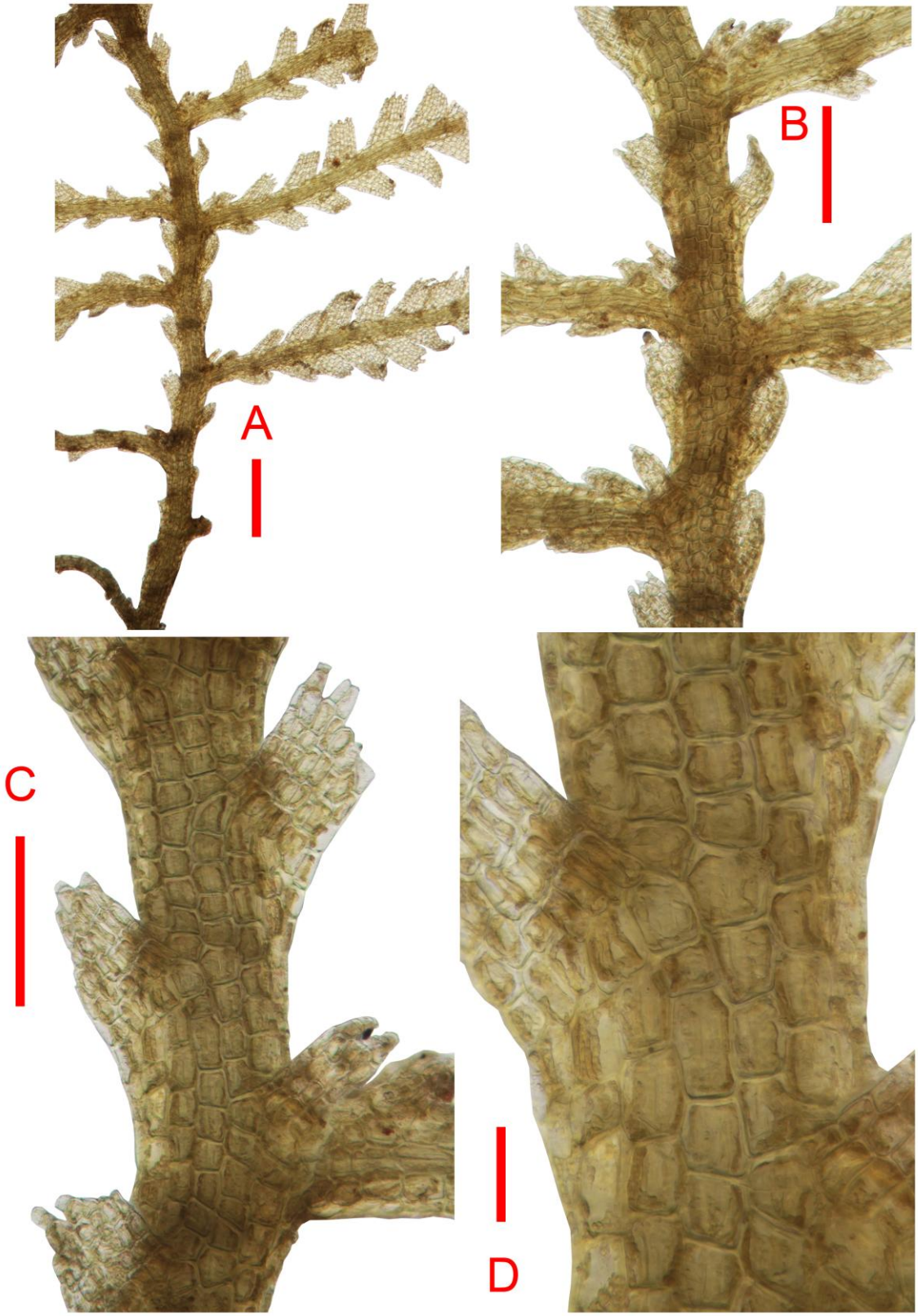

Plate 129: *Lepidozia longitudinalis*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from RICHARDS 2047, JE 04000714 – holotype)

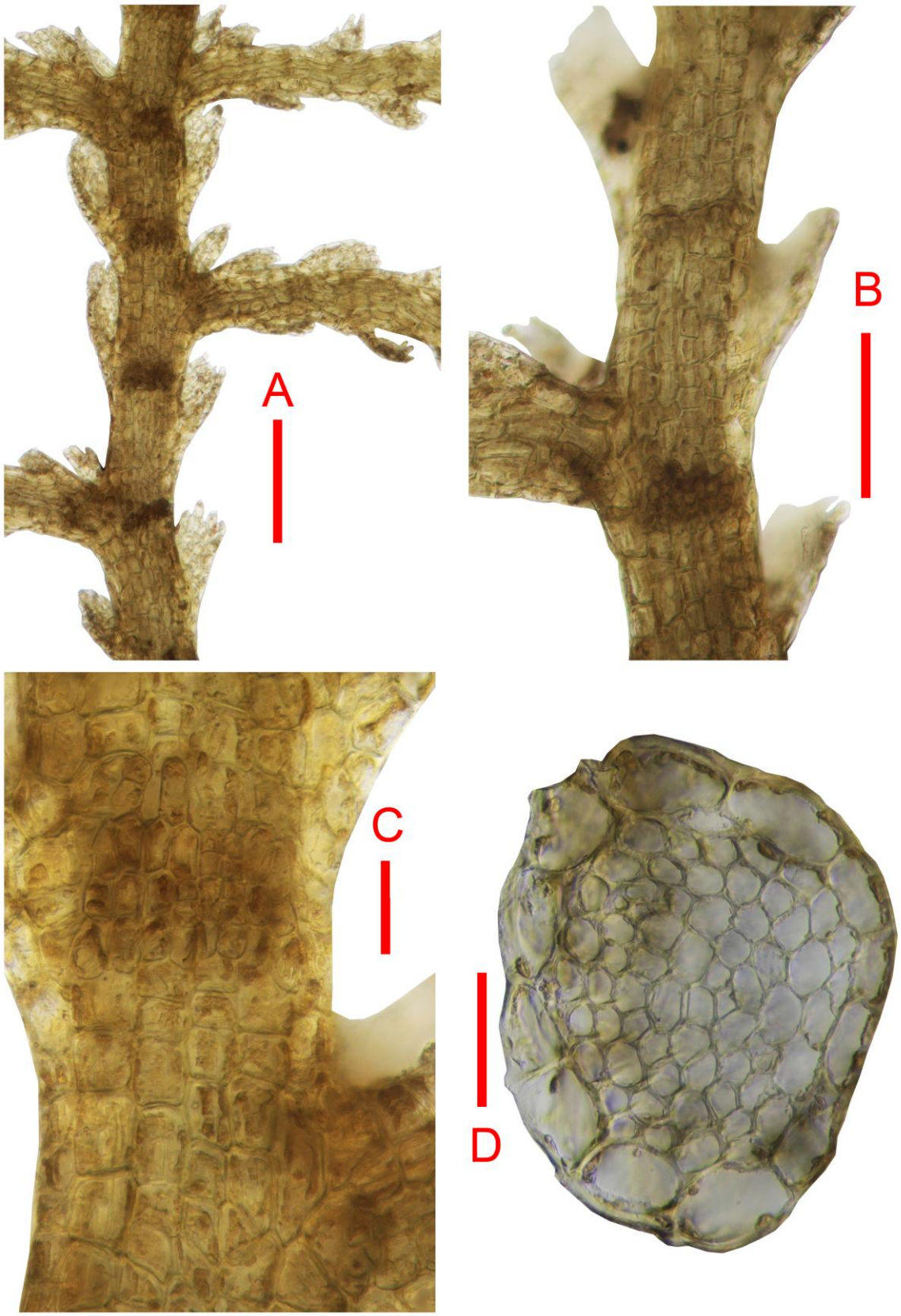

Plate 130: *Lepidozia longitudinalis*: A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from RICHARDS 2047, JE 04000714 – holotype)

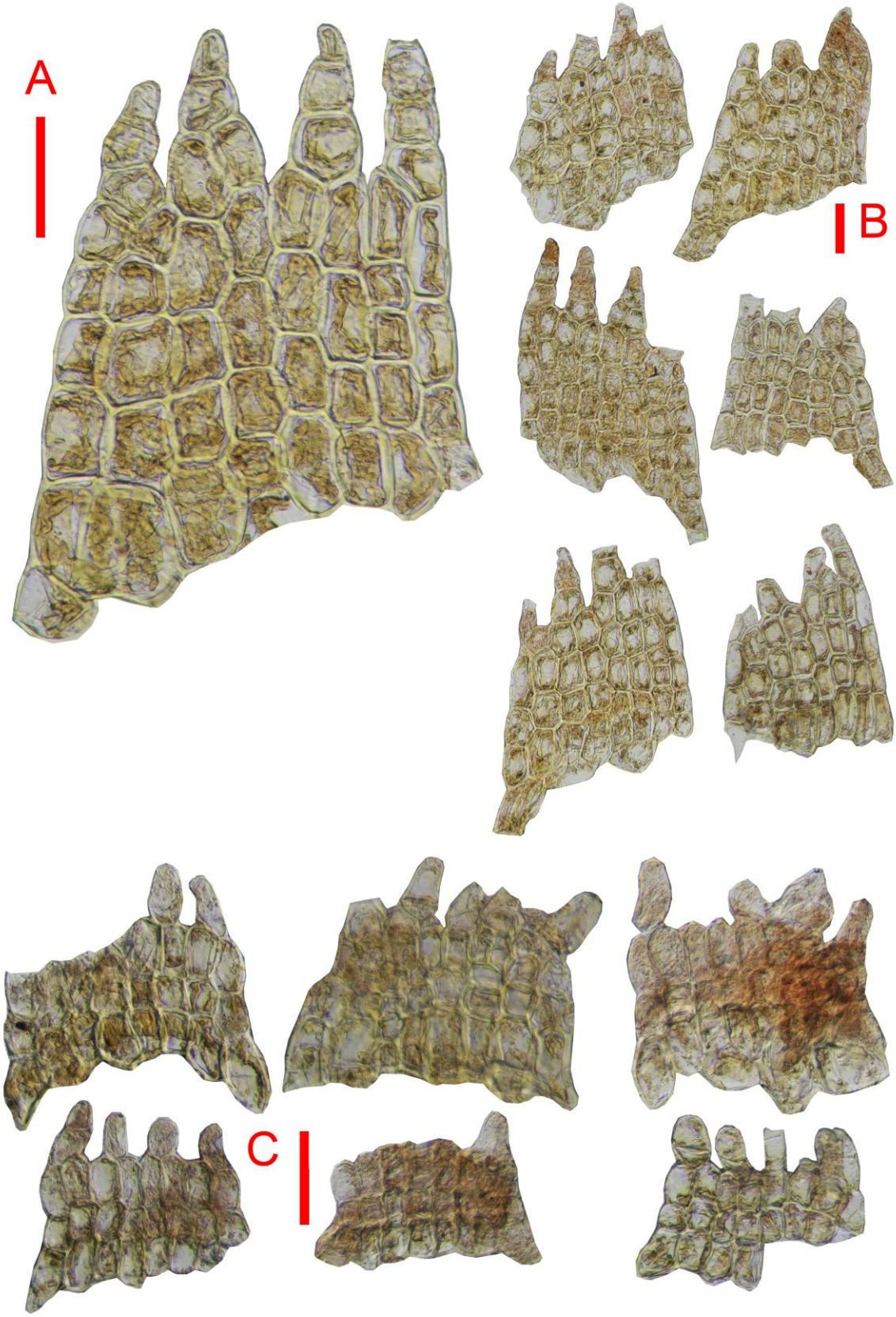

Plate 131: *Lepidozia longitudinalis*: A, B – Stem leaves, C – Stem underleaves; Scales: A, B, C – 50 µm (from RICHARDS 2047, JE 04000714 – holotype)

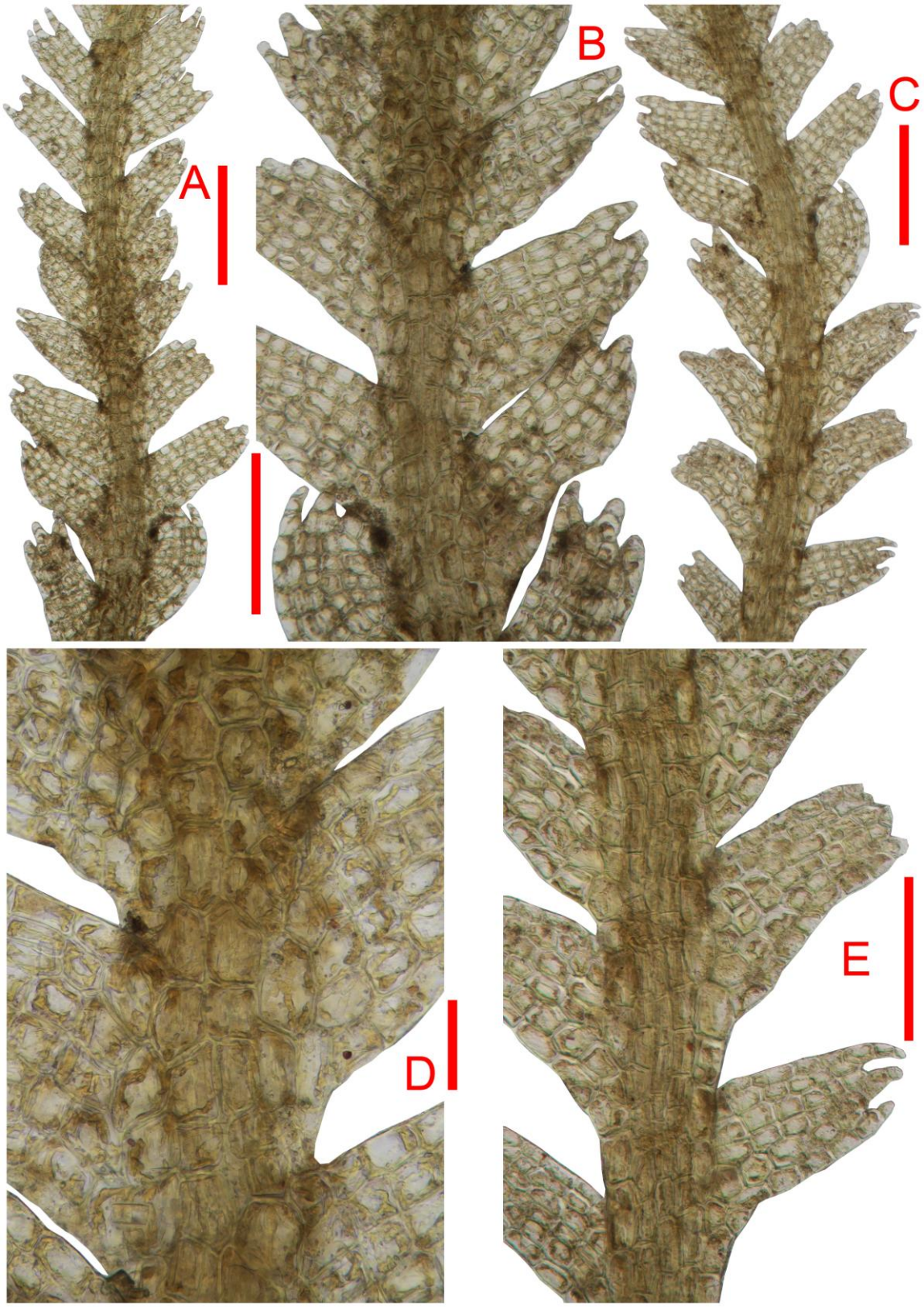

Plate 132: *Lepidozia longitudinalis*: A, B, D – Branch dorsal, C, E – Branch ventral; Scales: A, C – 0.3 mm; B, E – 0.2 mm; D – 50 µm (from RICHARDS 2047, JE 04000714 – holotype)

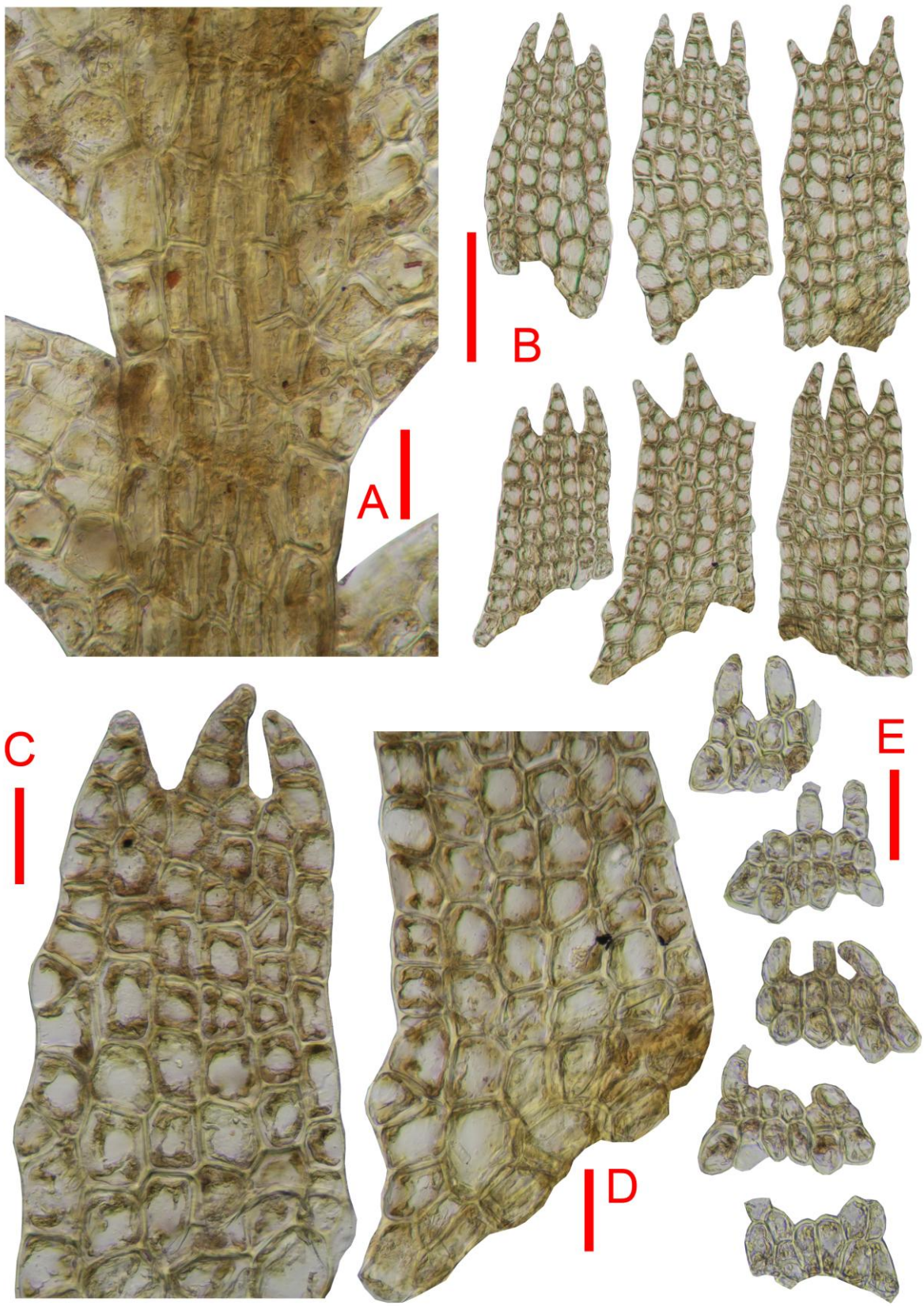

Plate 133: *Lepidozia longitudinalis*: A – Branch ventral, B – Branch leaves, C – Branch leaf apex, D – Branch leaf base, E – Branch underleaves; Scales: A, C, D, E – 50 µm; B – 0.2 mm (from RICHARDS 2047, JE 04000714 – holotype)

Neolepidozia lungaensis **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

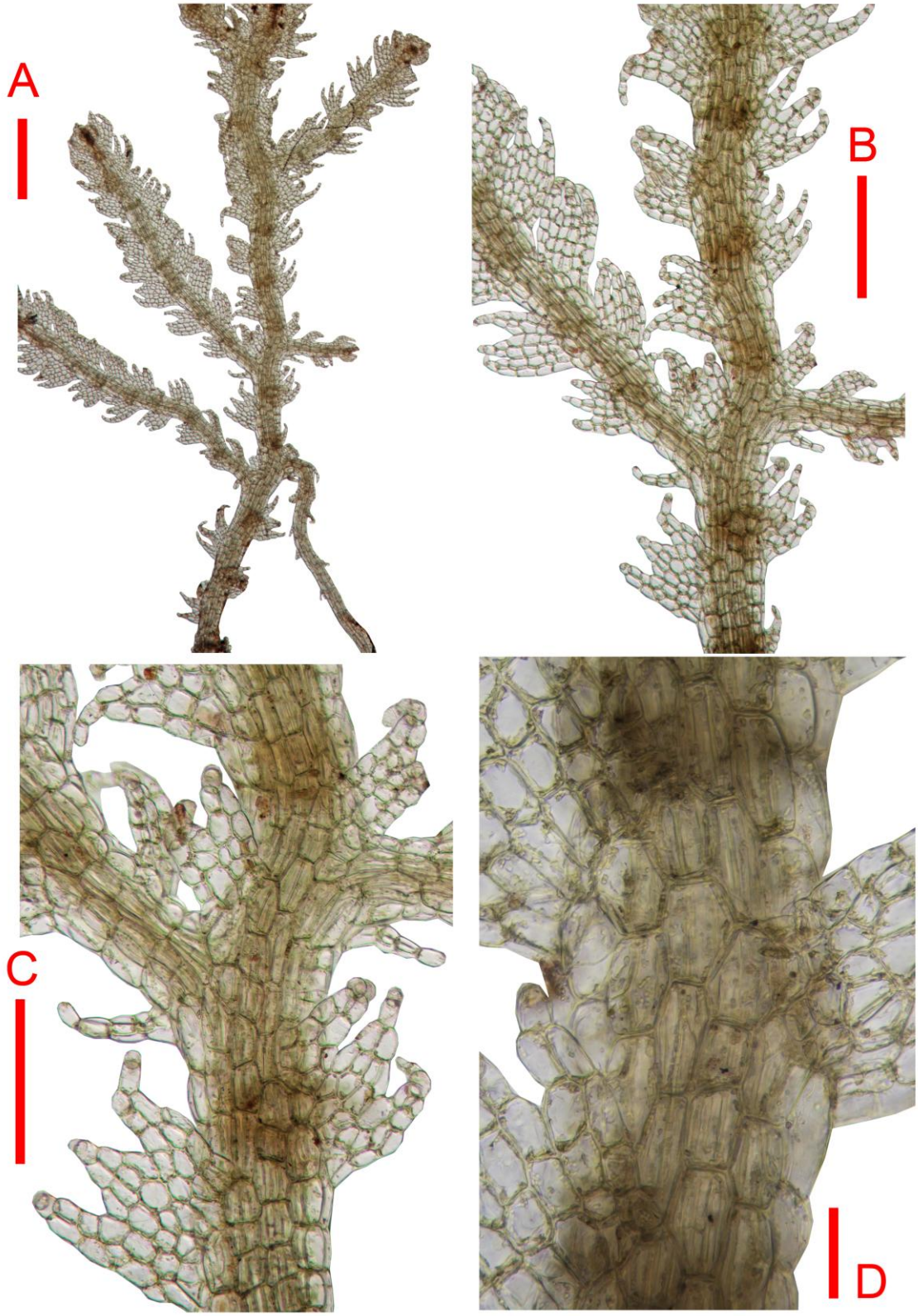

Plate 134: *Neolepidozia lungaensis*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHWARZ 5829 – holotype)

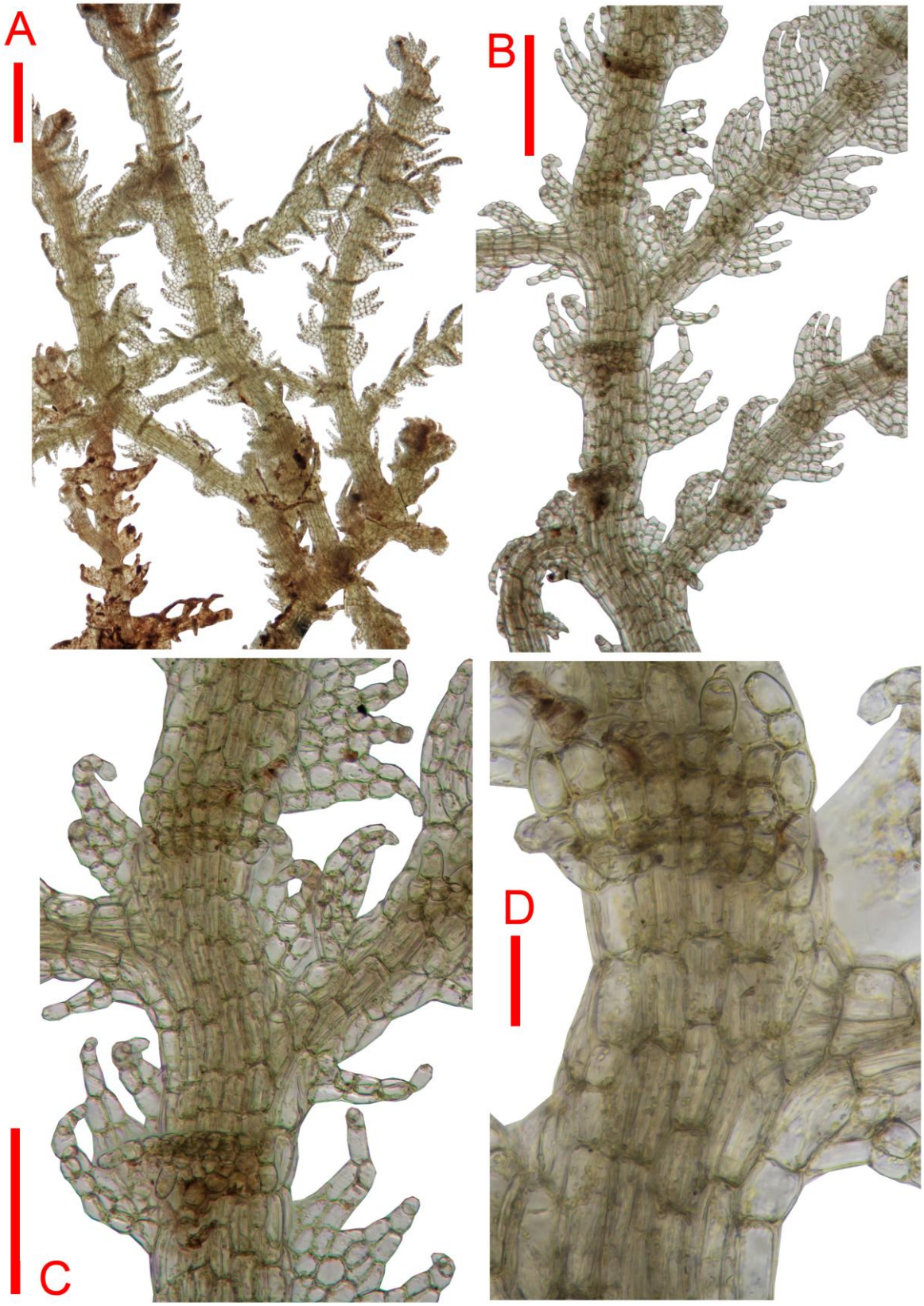

Plate 135: *Neolepidozia lungaensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHWARZ 5829 – holotype)

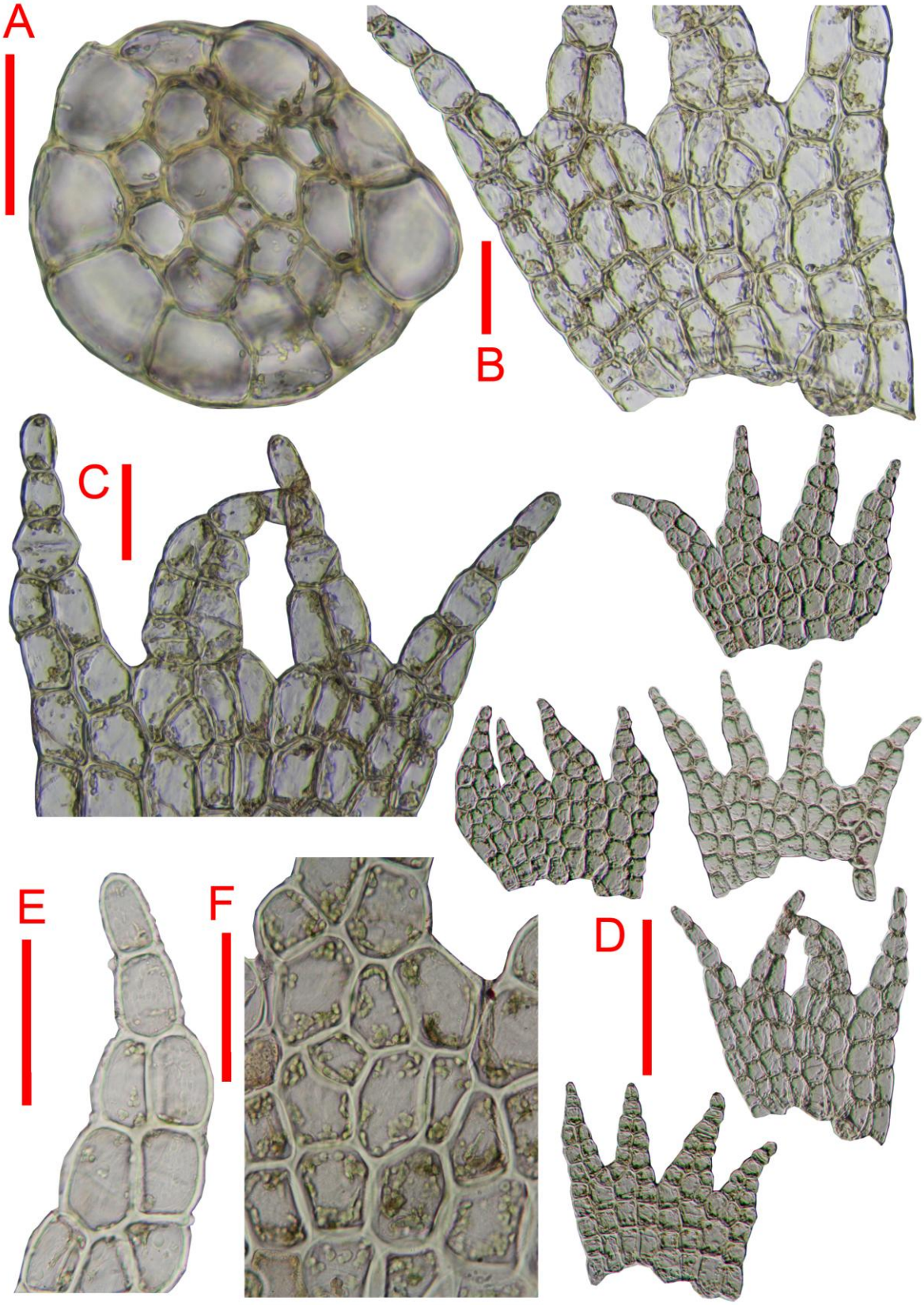

Plate 136: *Neolepidozia lungaensis*: A – Stem cross section, B, F – Stem leaf disc, C, E – Stem leaf lobes, D – Stem leaves; Scales: A, B, C, E, F – 50n µm; D – 0.2 mm (from SCHWARZ 5829 – holotype)

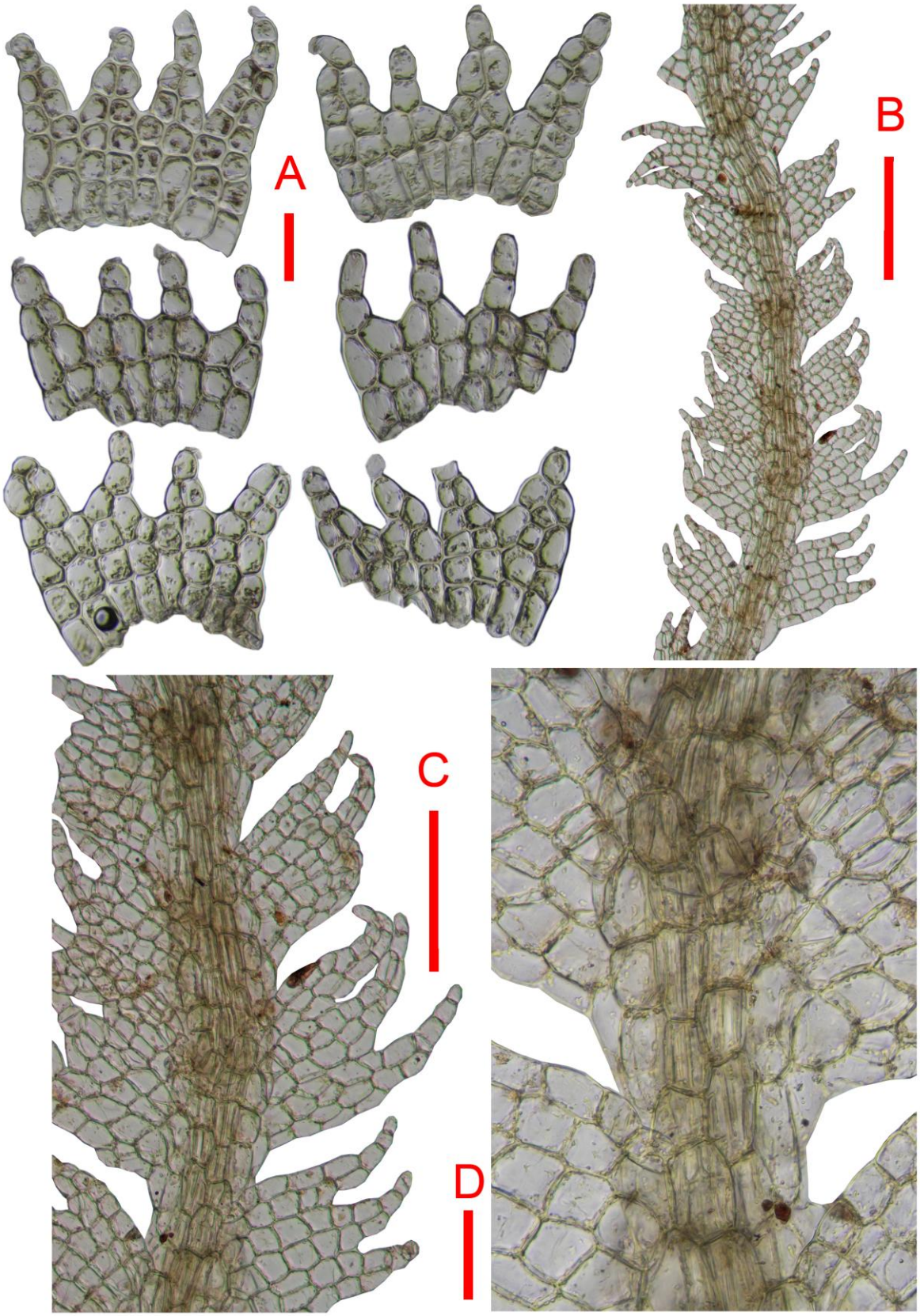

Plate 137: *Neolepidozia lungaensis*: A – Stem underleaves, B, C, D – Branch dorsal; Scales: A, D – 50 µm; B – 0.3 mm, C – 0.2 mm (from SCHWARZ 5829 – holotype)

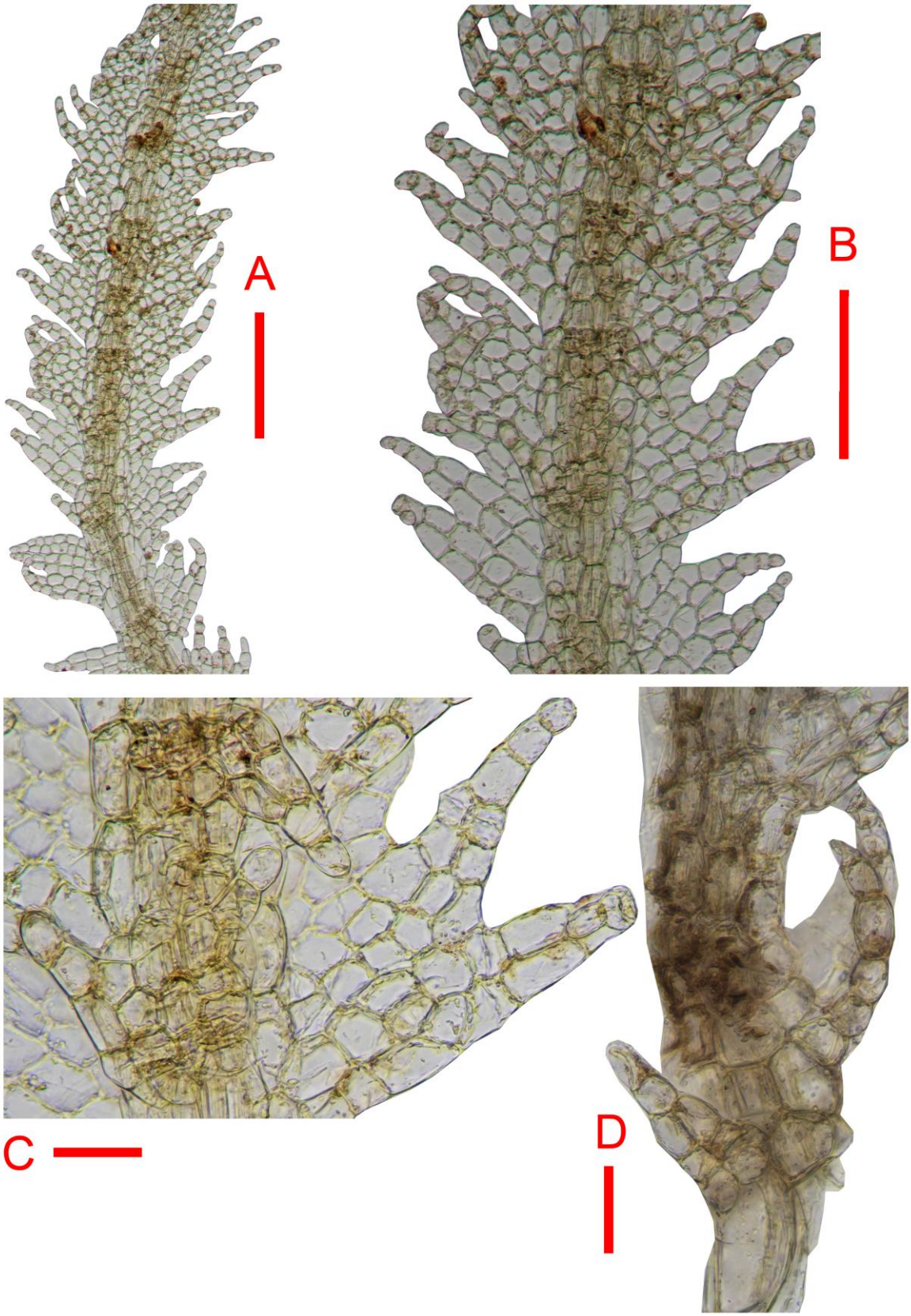

Plate 138: *Neolepidozia lungaensis*: A, B, C – Branch ventral, D – Branch base; Scales: A – 0.3 mm, B – 0.2 mm, C, D – 50 µm (from SCHWARZ 5829 – holotype)

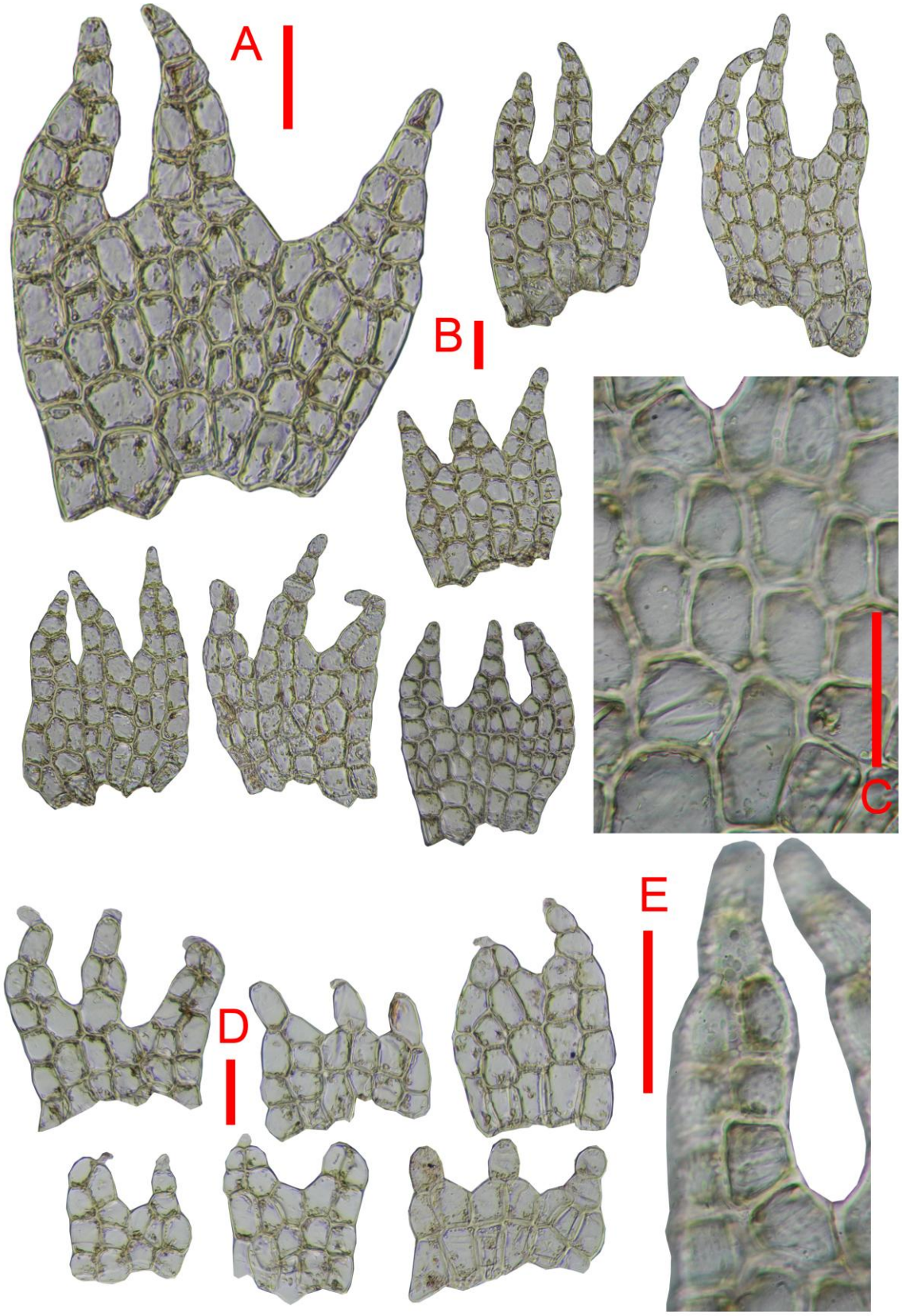

Plate 139: *Neolepidozia lungaensis*: A, B – Branch leaves, C – Branch leaf disc, D – Branch underleaves, E – Branch leaf lobes; Scales: A, B, C, D, E – 50 µm (from SCHWARZ 5829 – holotype)

Neolepidozia mamillosa (SCHIFFN.) E.D. COOPER

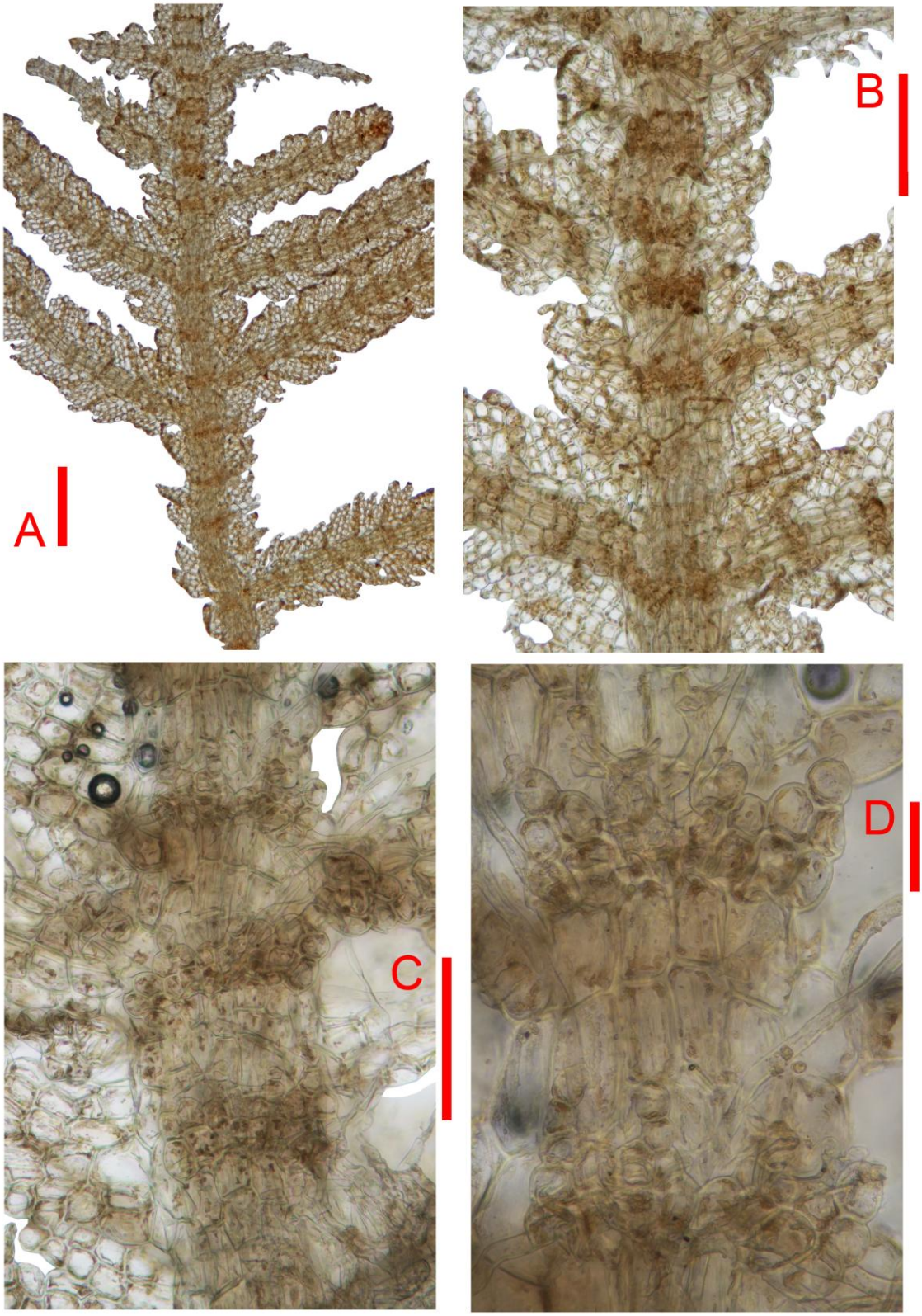

Plate 140: *Neolepidozia mamillosa*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from CARR 11532, JE)

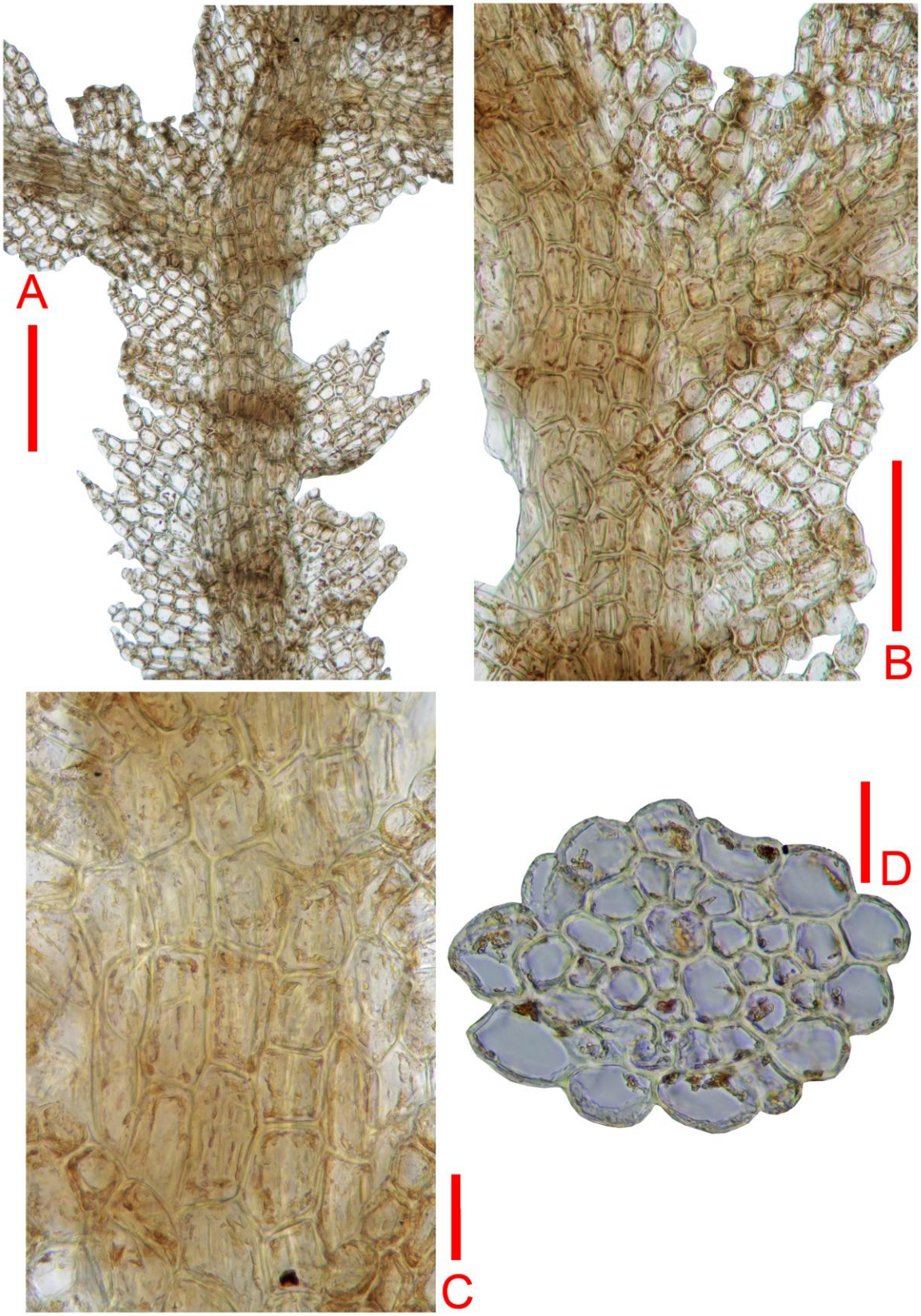

Plate 141: *Neolepidozia mamillosa*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from CARR 11532, JE)

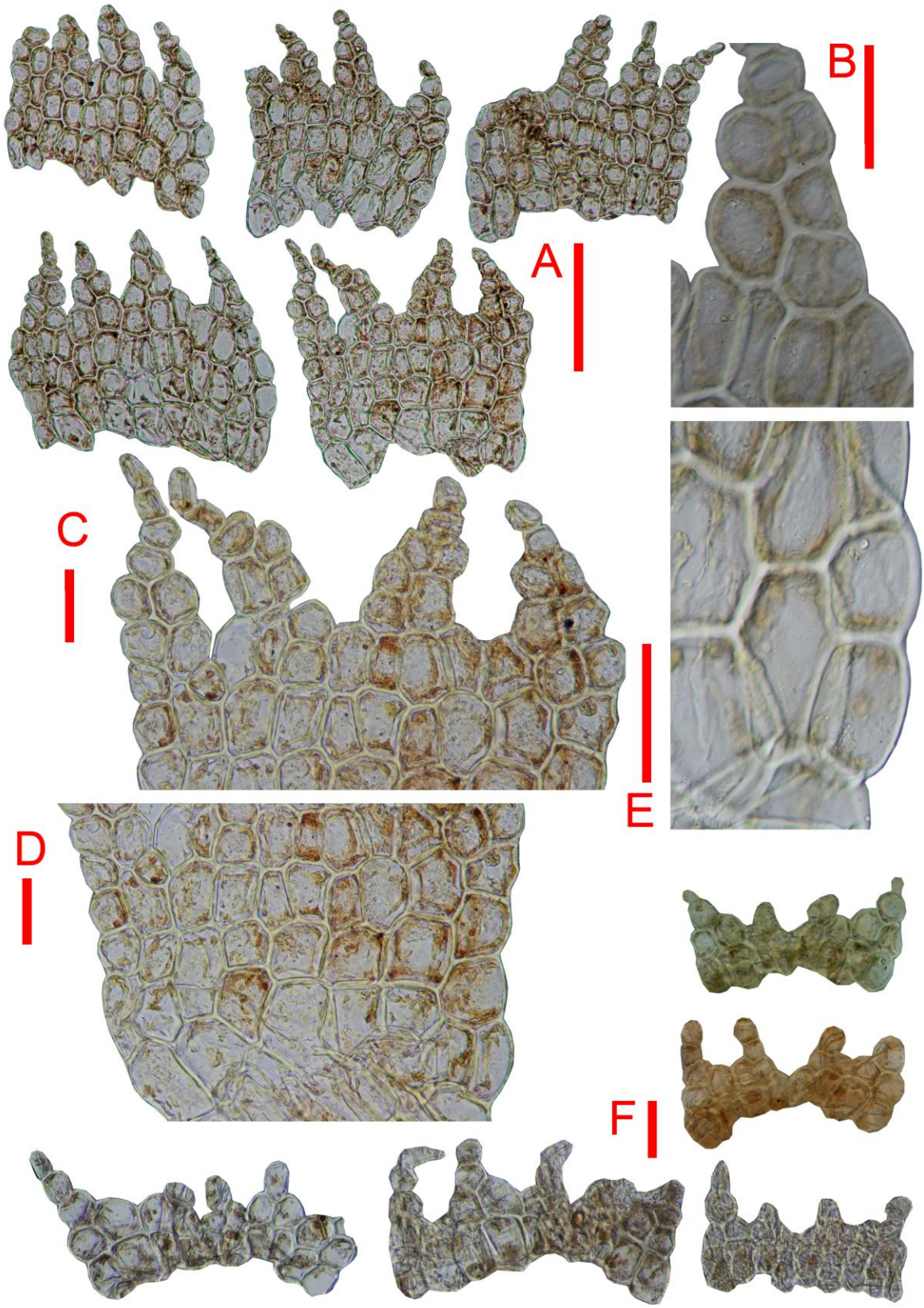

Plate 142: *Neolepidozia mamillosa*: A – Stem leaves, B, C – Stem leaf lobes, D, E – Stem leaf disc, F – Stem underleaves; Scales: A – 0.2 mm; B, C, D, E, F – 50 µm (from CARR 11532, JE)

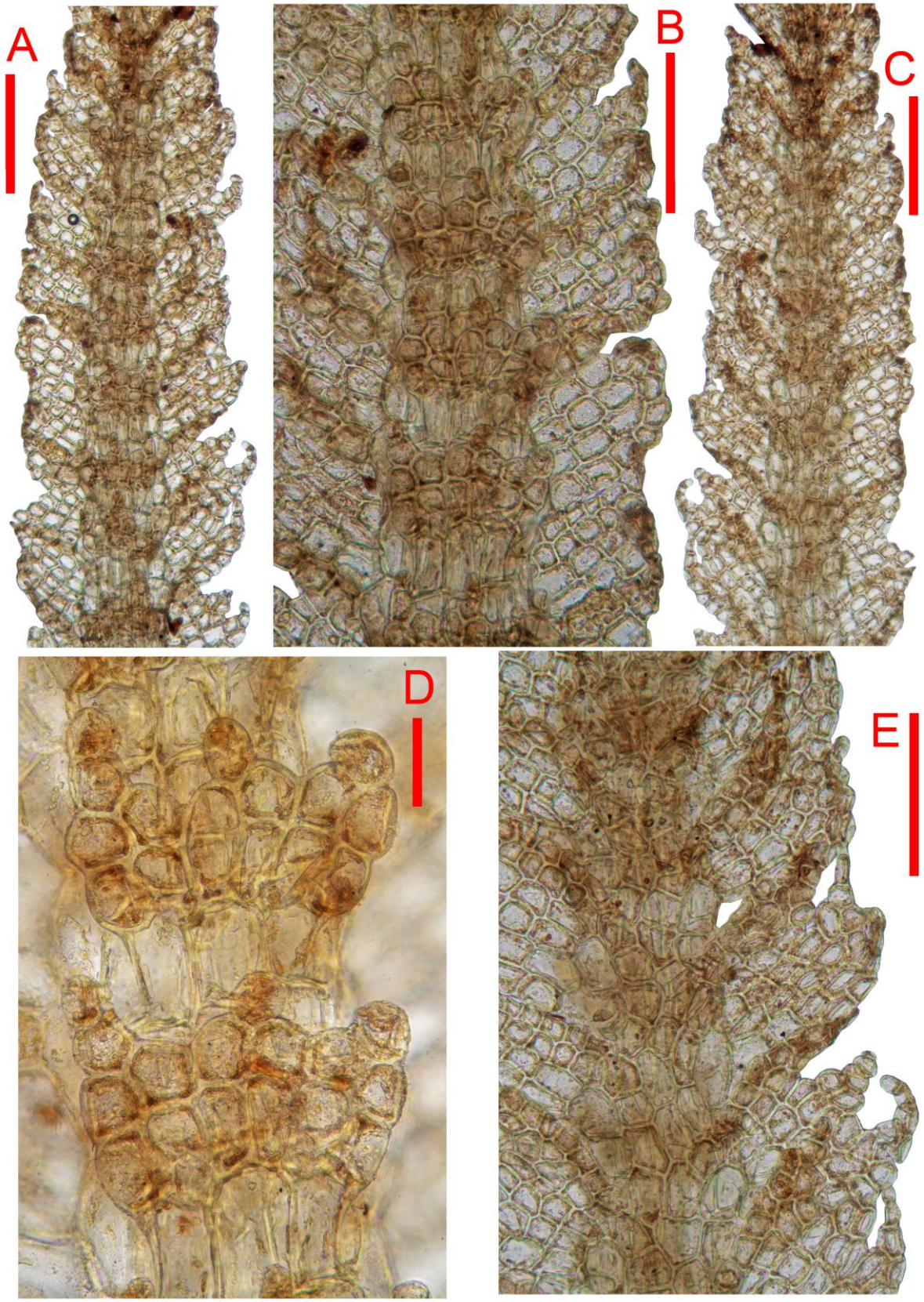

Plate 143: *Neolepidozia mamillosa*: A, B, D – Branch ventral, C, E – Branch dorsal; Scales: A, C – 0.3 mm; B, E – 0.2 mm; E – 50 µm (from CARR 11532, JE)

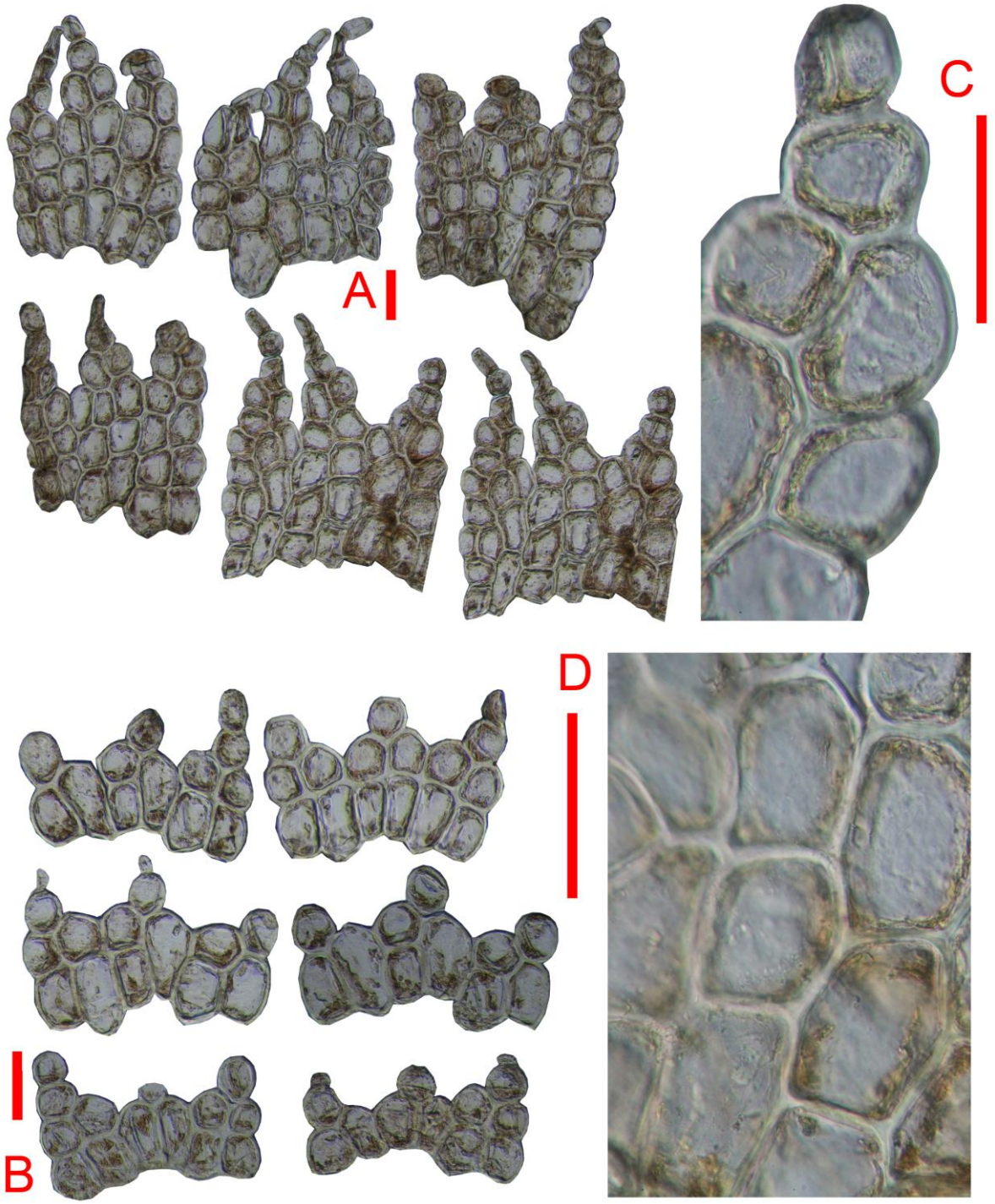

Plate 144: *Neolepidozia mamillosa*: A – Branch leaves, B – Branch underleaves, C – Branch leaf lobe, D – Branch leaf disc; Scales: A, B, C, D – 50 µm (from CARR 11532, JE)

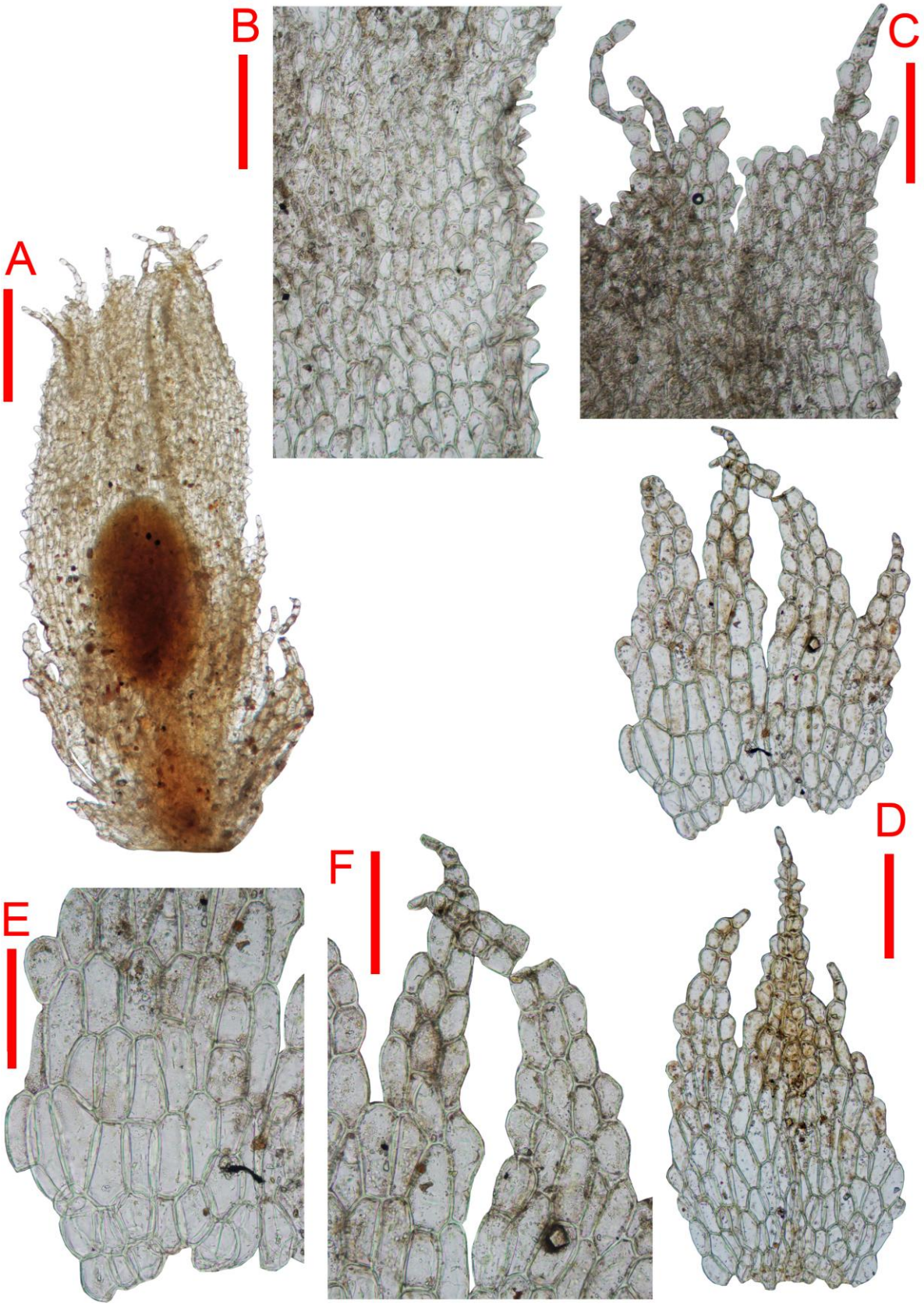

Plate 145: *Neolepidozia mamillosa*: A – Perianth, B – Perianth middle, C – Perianth mouth, D – Female bract, E – Female bract disc, F – Female bract lobe; Scales: A – 0.5 mm, D – 0.3 mm, B, C, E, F – 0.2 mm (from CARR 11532, JE)

Neolepidozia massartiana (SCHIFFN. ex STEPH.) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

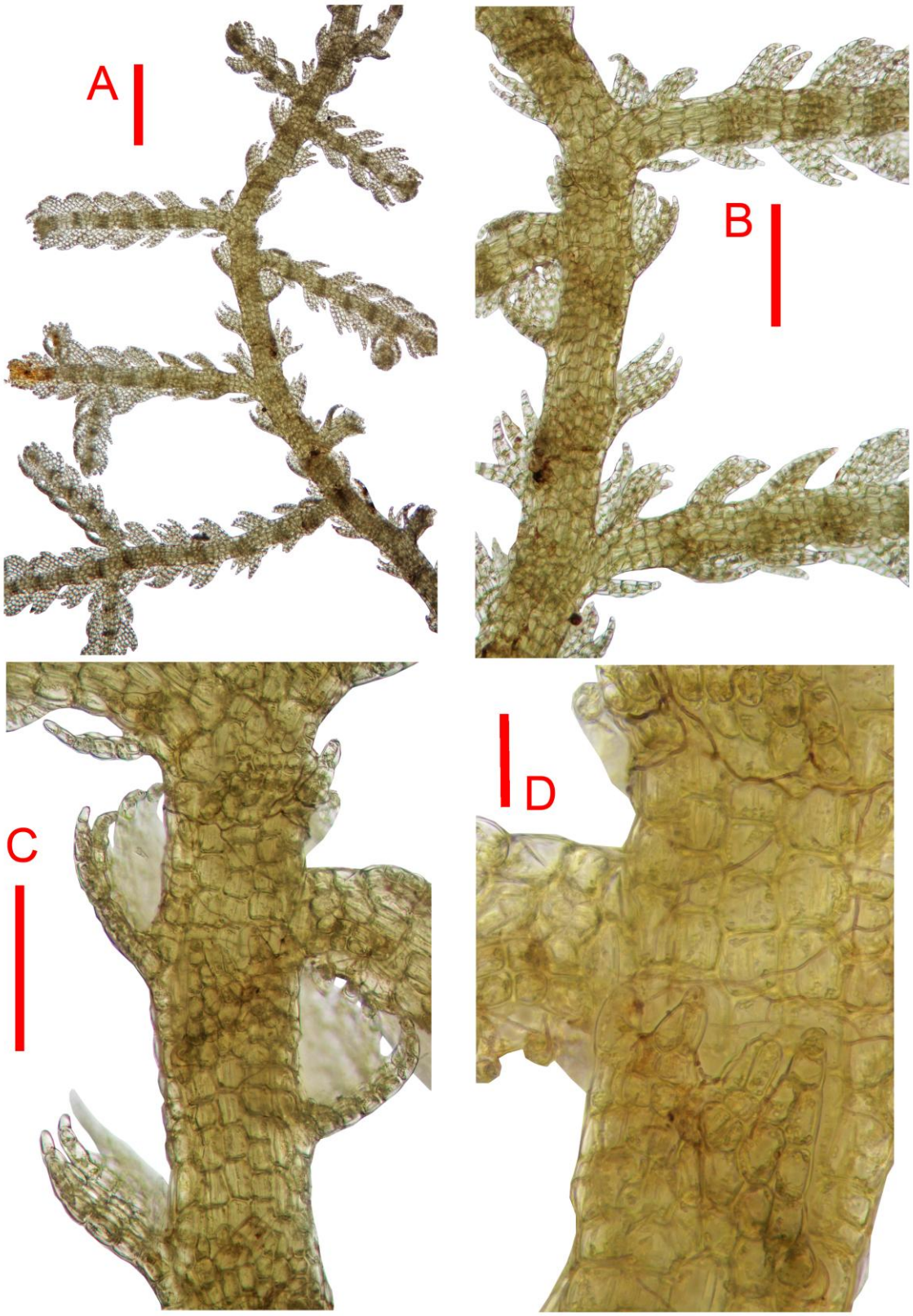

Plate 146: *Neolepidozia massartiana*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHÄFER-VERWIMP 24810a)

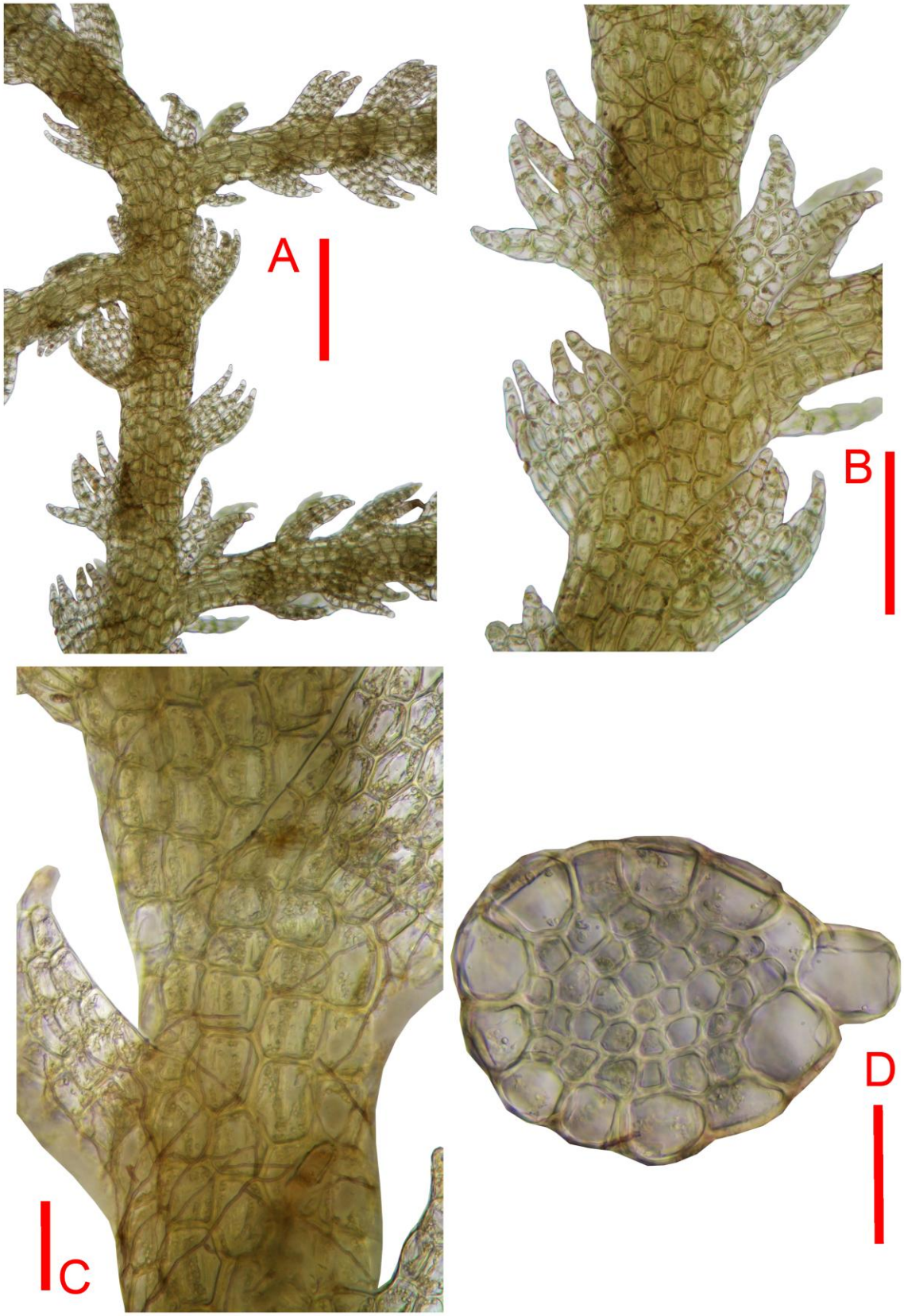

Plate 147: *Neolepidozia massartiana*: A, B, C – Plant dorsal, B – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SCHÄFER-VERWIMP 24810a)

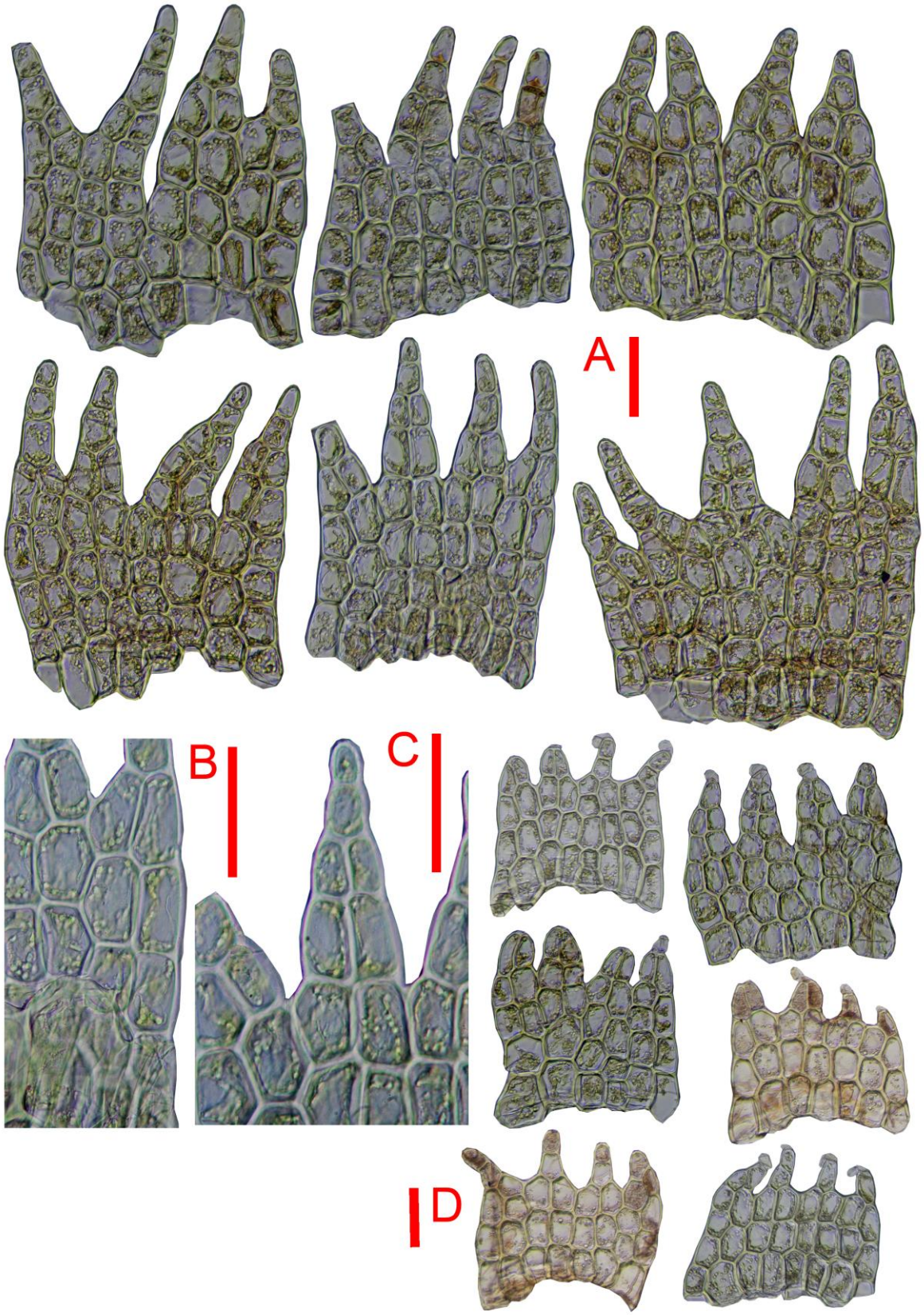

Plate 148: *Neolepidozia massartiana*: A – Stem leaves, B- Stem leaf disc, C – Stem leaf lobe, D – Stem underleaves; Scales: A, B, C, D – 50 µm (from SCHÄFER-VERWIMP 24810a)

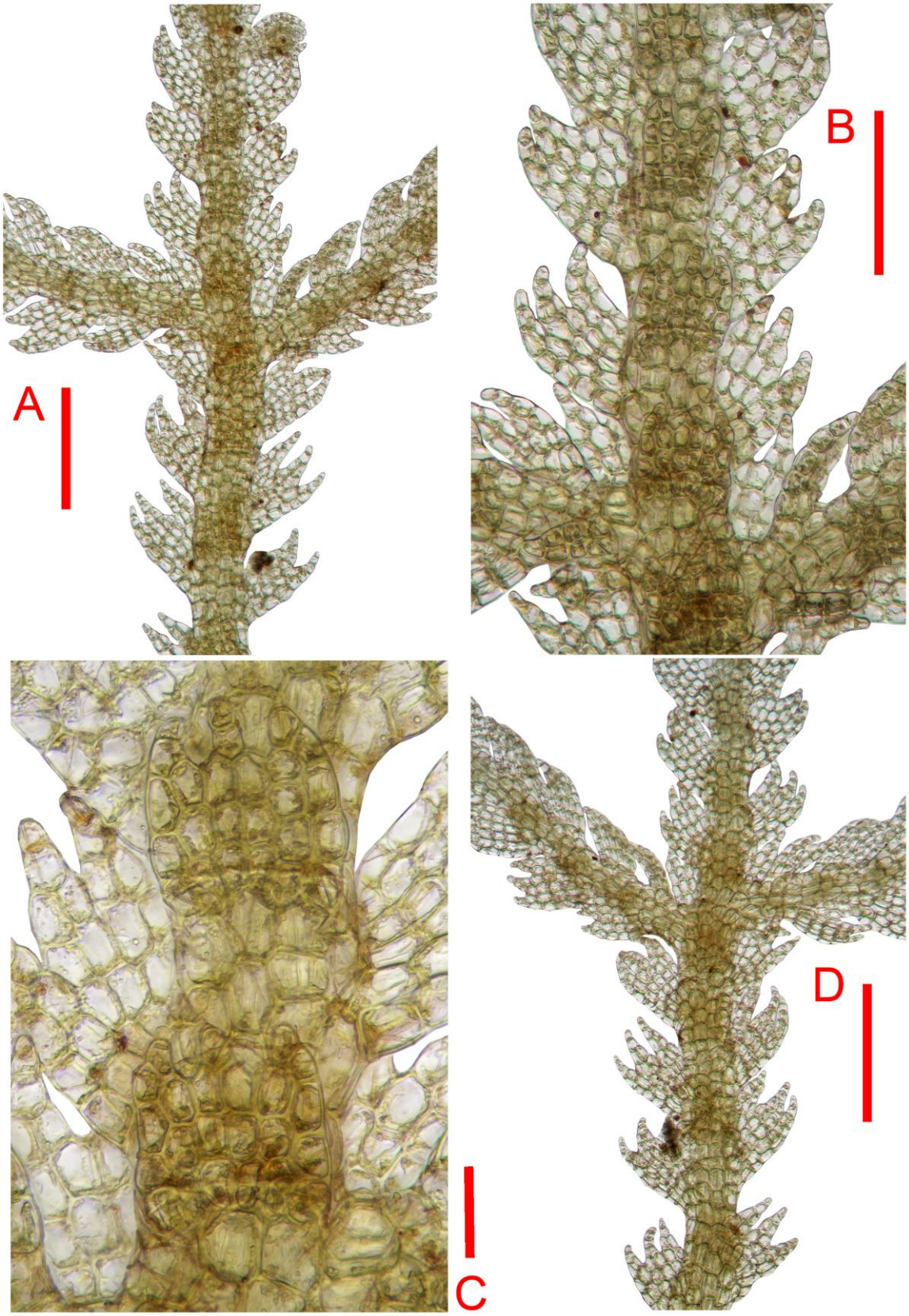

Plate 149: *Neolepidozia massartiana*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm; B – 0.2 mm, C – 50 µm (from SCHÄFER-VERWIMP 24810a)

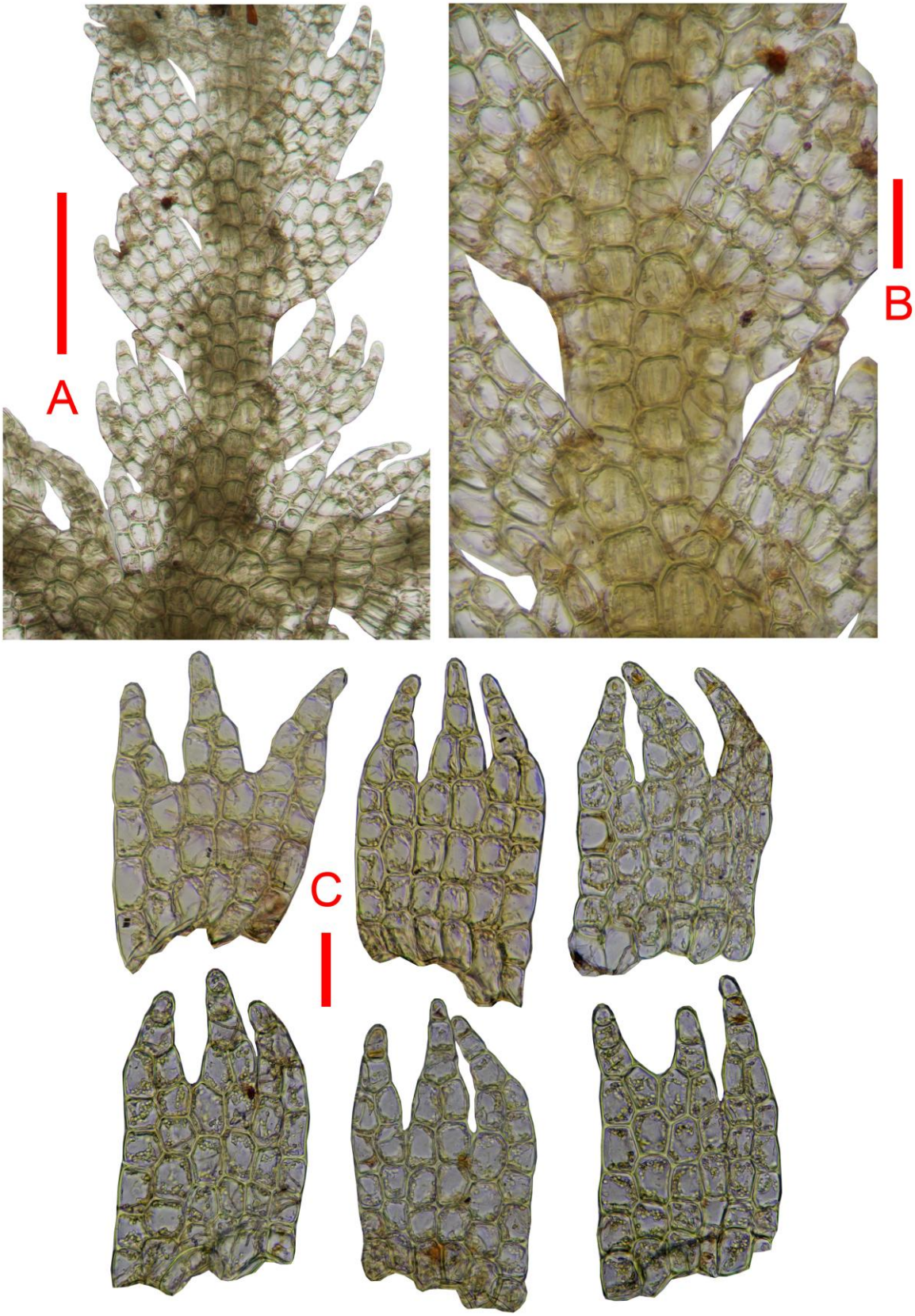

Plate 150: *Neolepidozia massartiana*: A, B – Branch dorsal, C – Branch leaves; Scales: A – 0.2 mm; B, C – 50 µm (from SCHÄFER-VERWIMP 24810a)

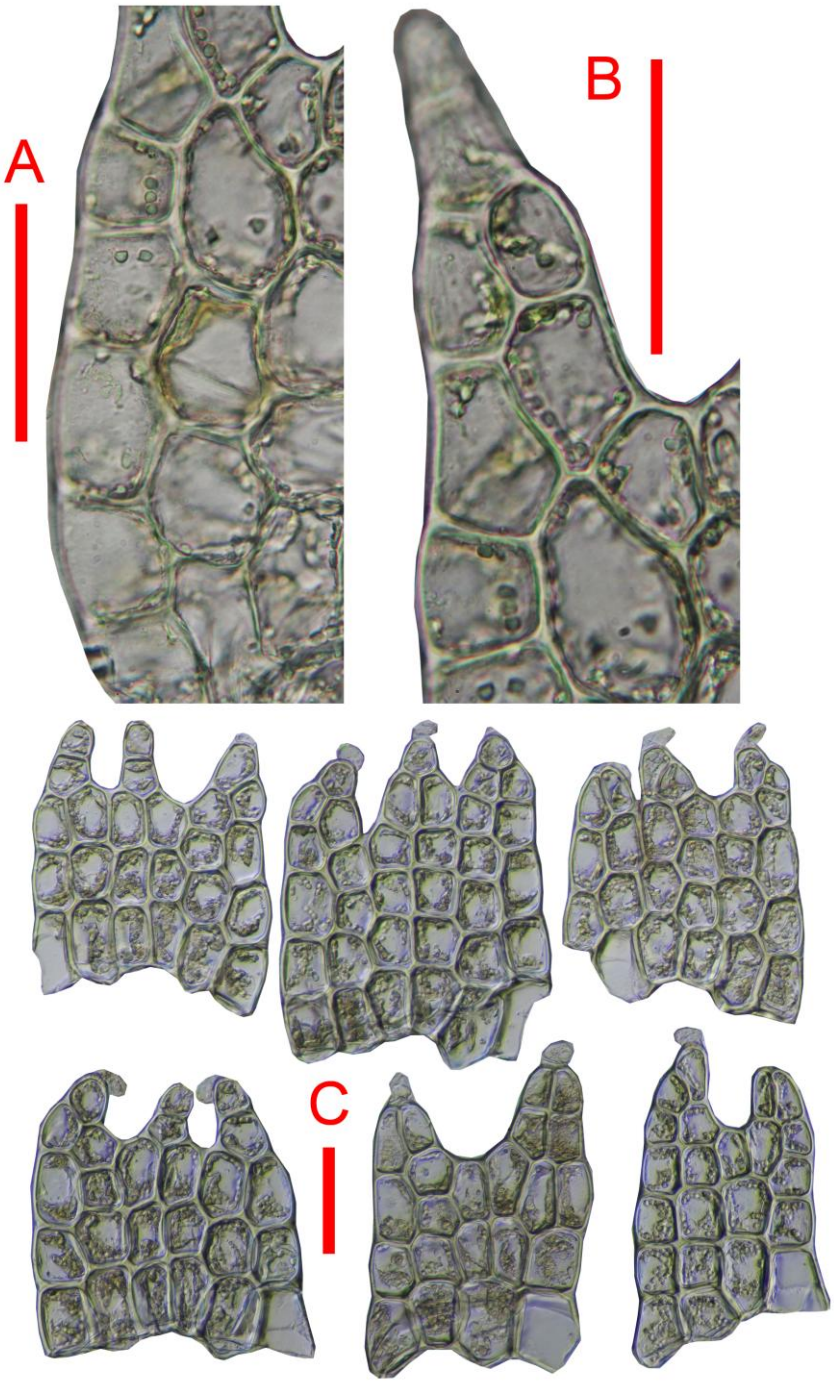

Plate 151: *Neolepidozia massartiana*: A – Branch leaf disc, B – Branch leaf lobe, C – Branch underleaves; Scales: A, B, C – 50 µm (from SCHÄFER-VERWIMP 24810a)

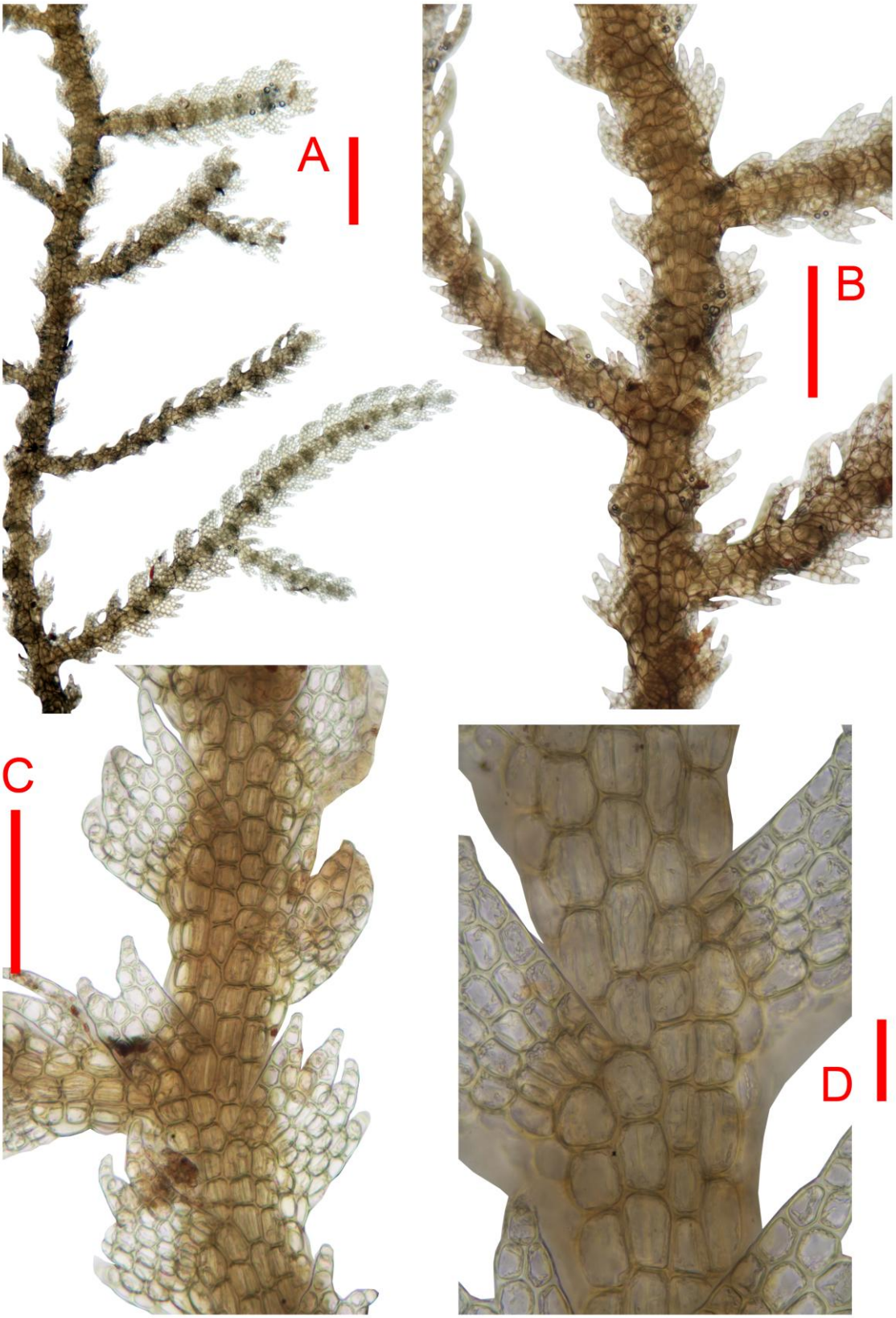

Plate 152: *Neolepidozia massartiana*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHWARZ 4776)

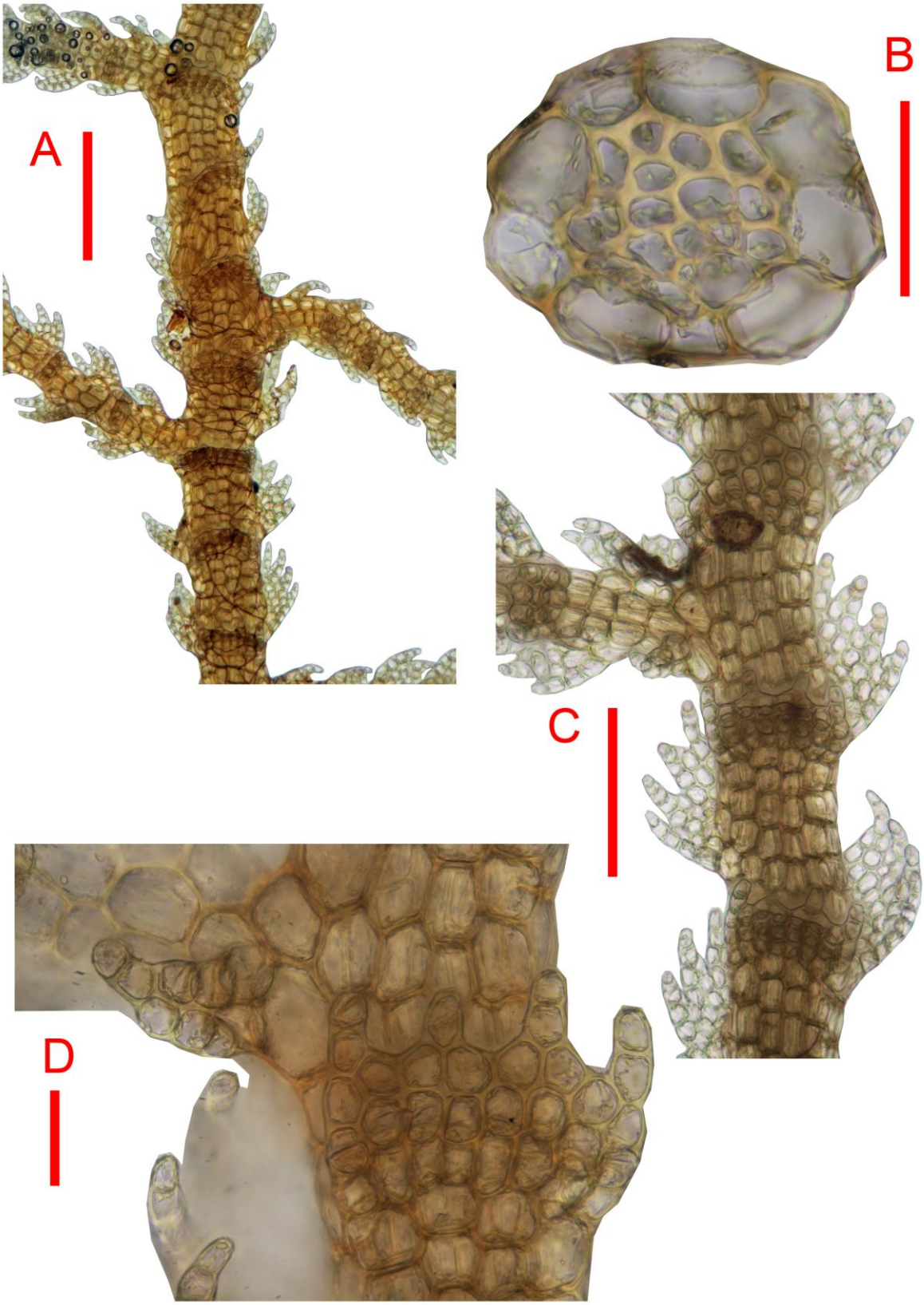

Plate 153: *Neolepidozia massartiana*: A, C, D – Plant ventral, B – Stem cross section; Scales: A – 0.3 mm; C – 0.2 mm; B, D – 50 µm (from SCHWARZ 4776)

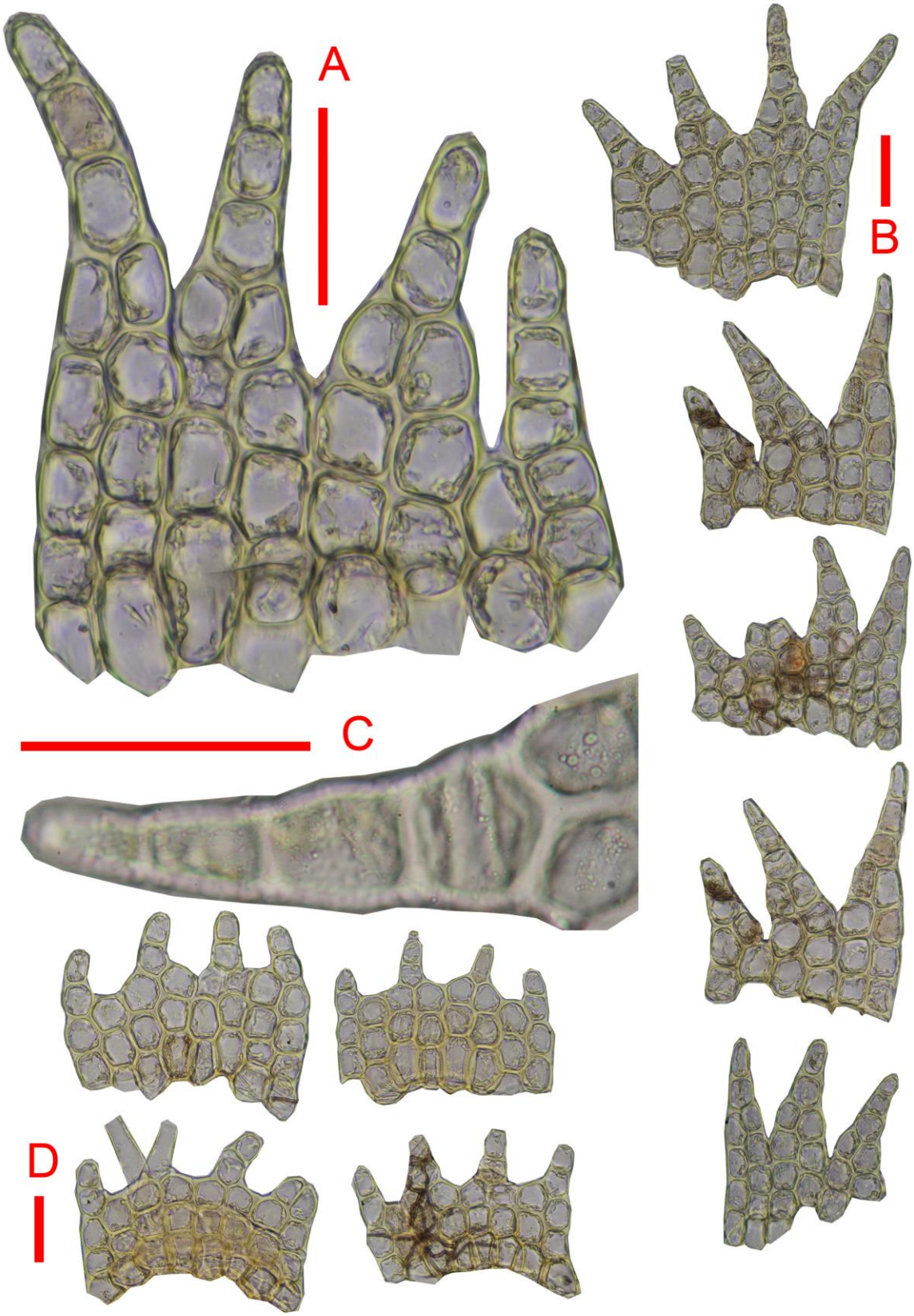

Plate 154: *Neolepidozia massartiana*: A, B – Stem leaves, C – Stem leaf lobe apex D – Stem underleaves; Scales: A, B, C, D – 50 µm (from SCHWARZ 4776)

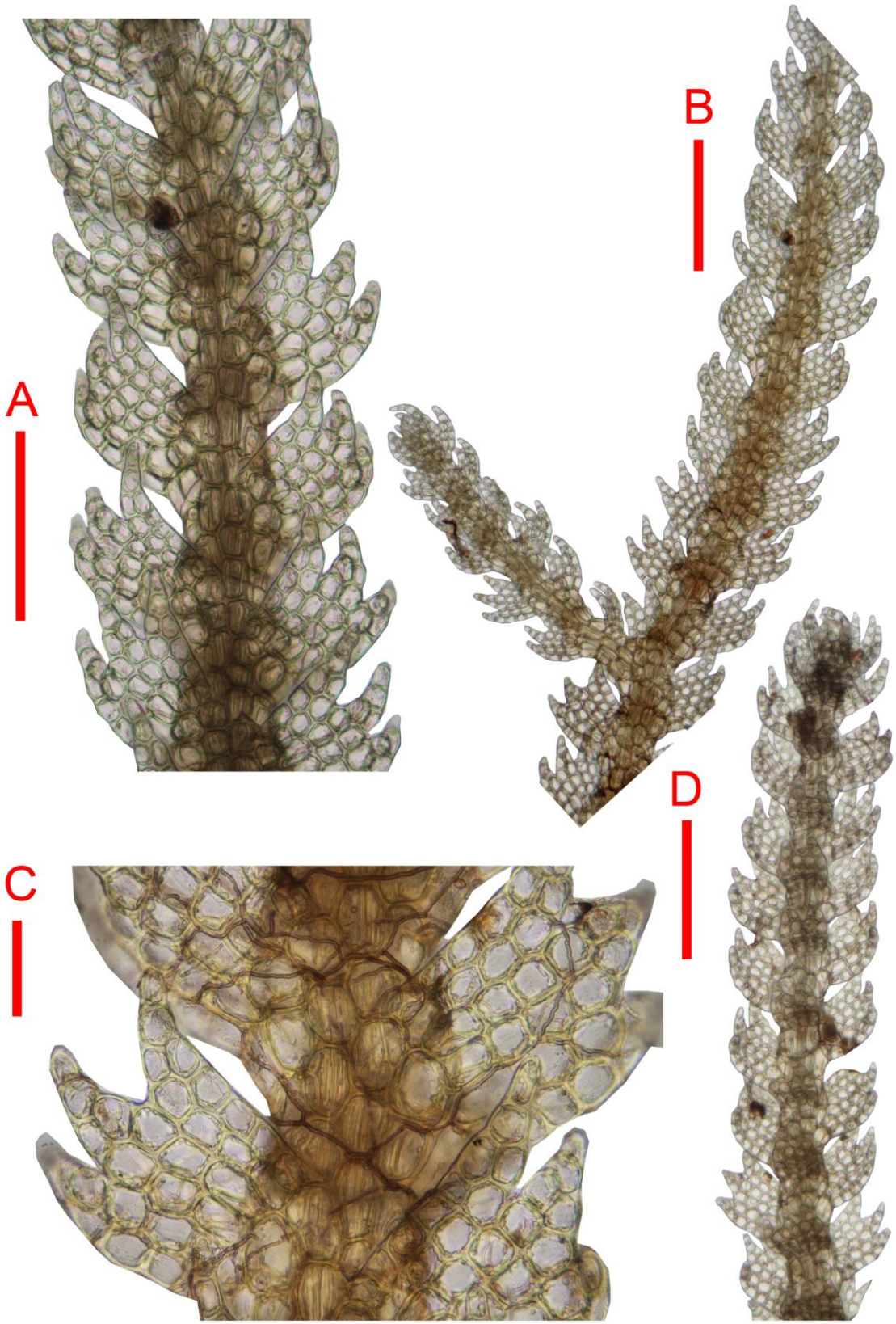

Plate 155: *Neolepidozia massartiana*: A, B, C – Branch dorsal, D – Branch ventral; Scales: A – 0.2 mm; B, D – 0.3 mm; C – 50 µm (from SCHWARZ 4776)

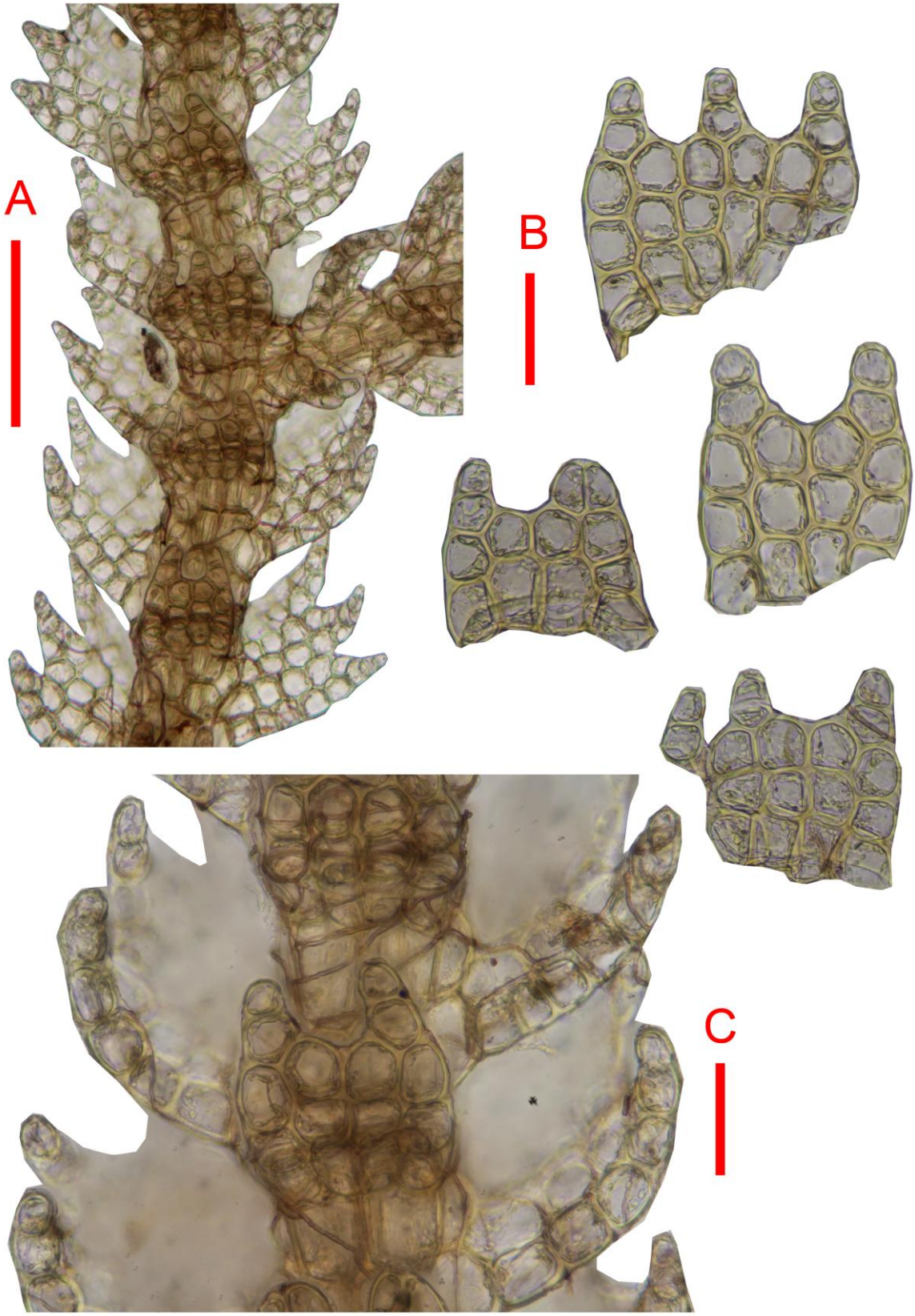

Plate 156: *Neolepidozia massartiana*: A, C – Branch ventral, B – Branch underleaves; Scales: A – 0.2 mm; B, C – 50 µm (from SCHWARZ 4776)

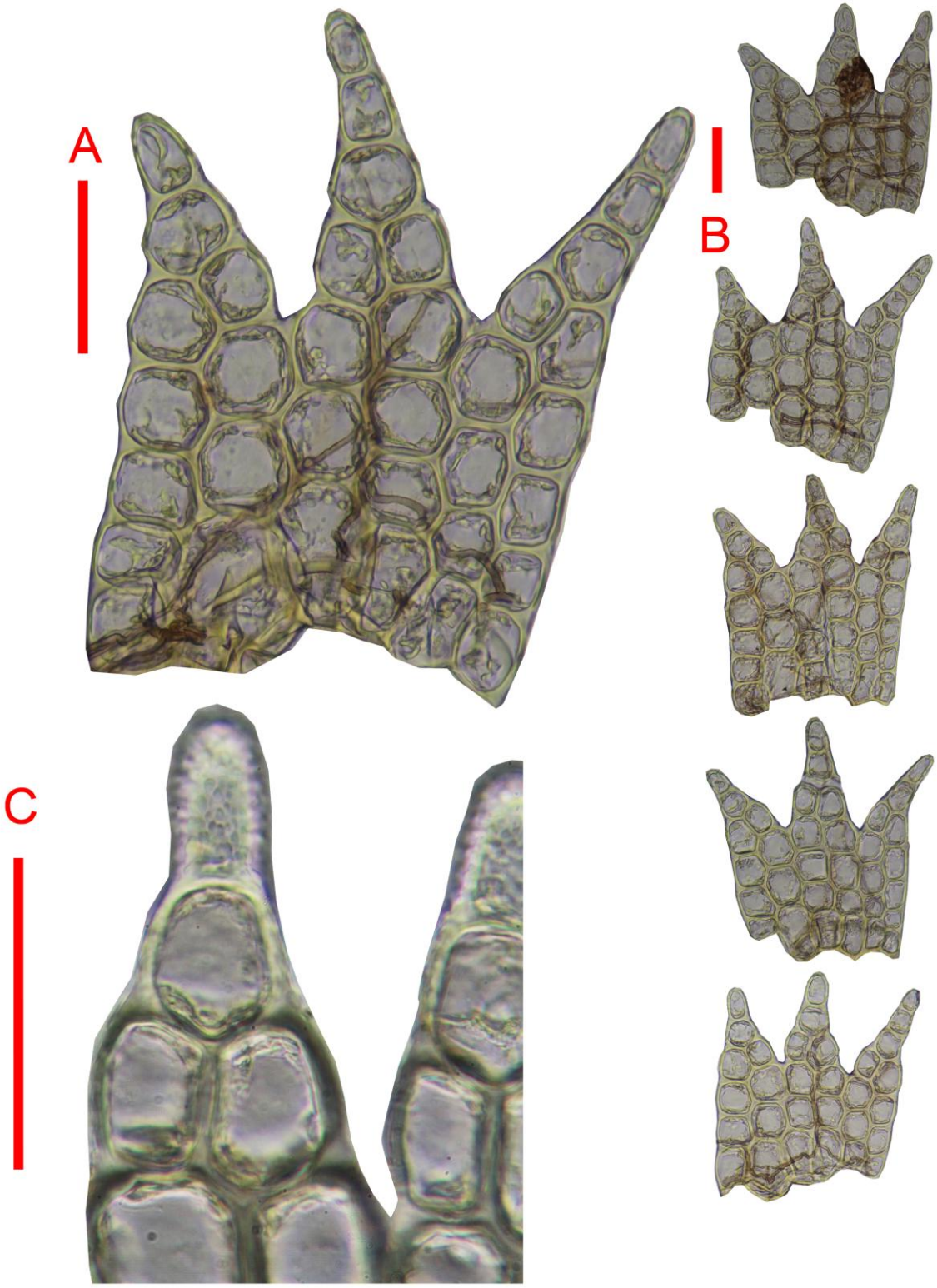

Plate 157: *Neolepidozia massartiana*: A, B – Branch leaves, C – Branch leaf lobe apex; Scales: A, B, C – 50 µm (from SCHWARZ 4776)

Neolepidozia morobensis **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

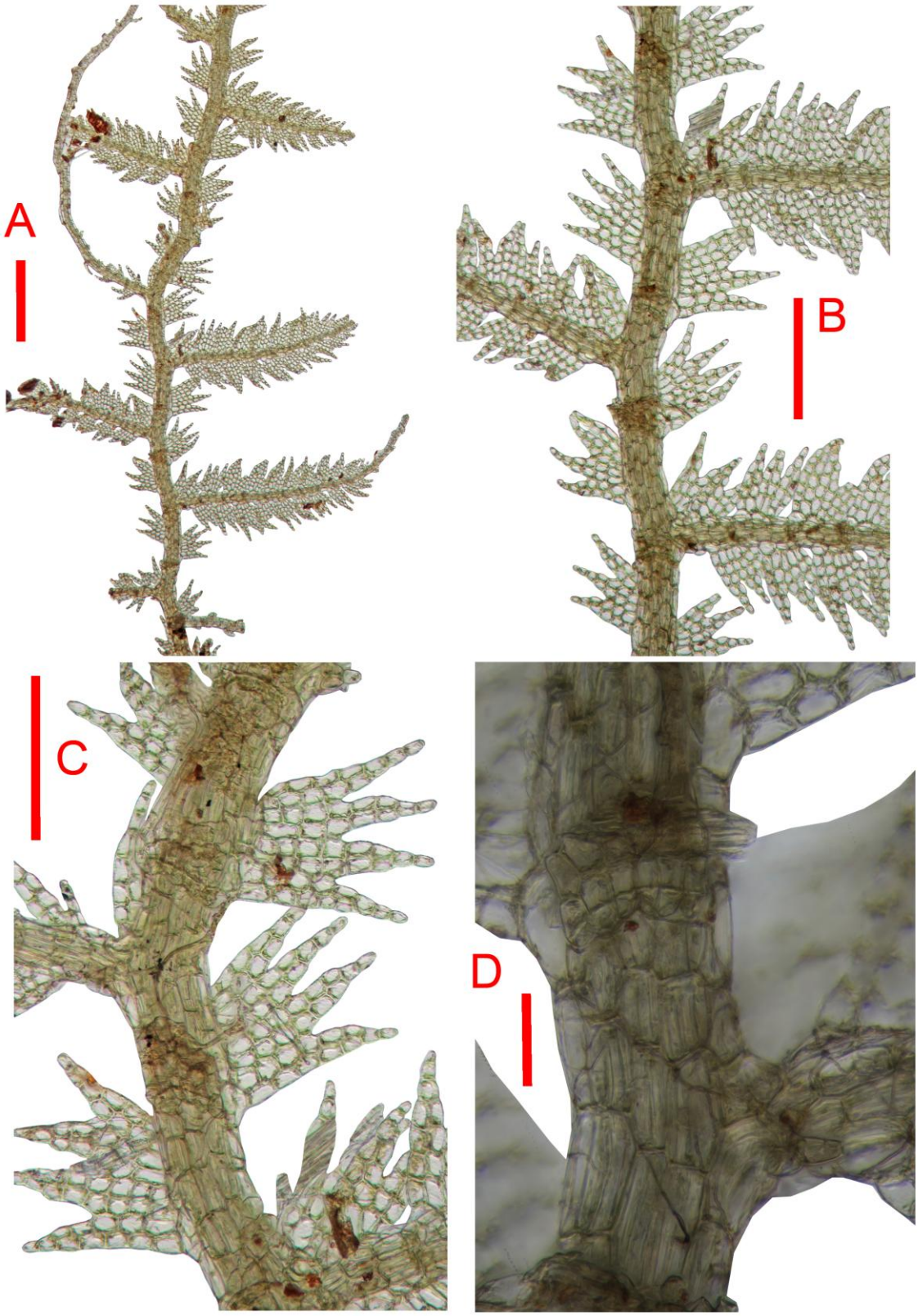

Plate 158: *Neolepidozia morobensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from STREIMANN; BELLAMY 12985 – holotype)

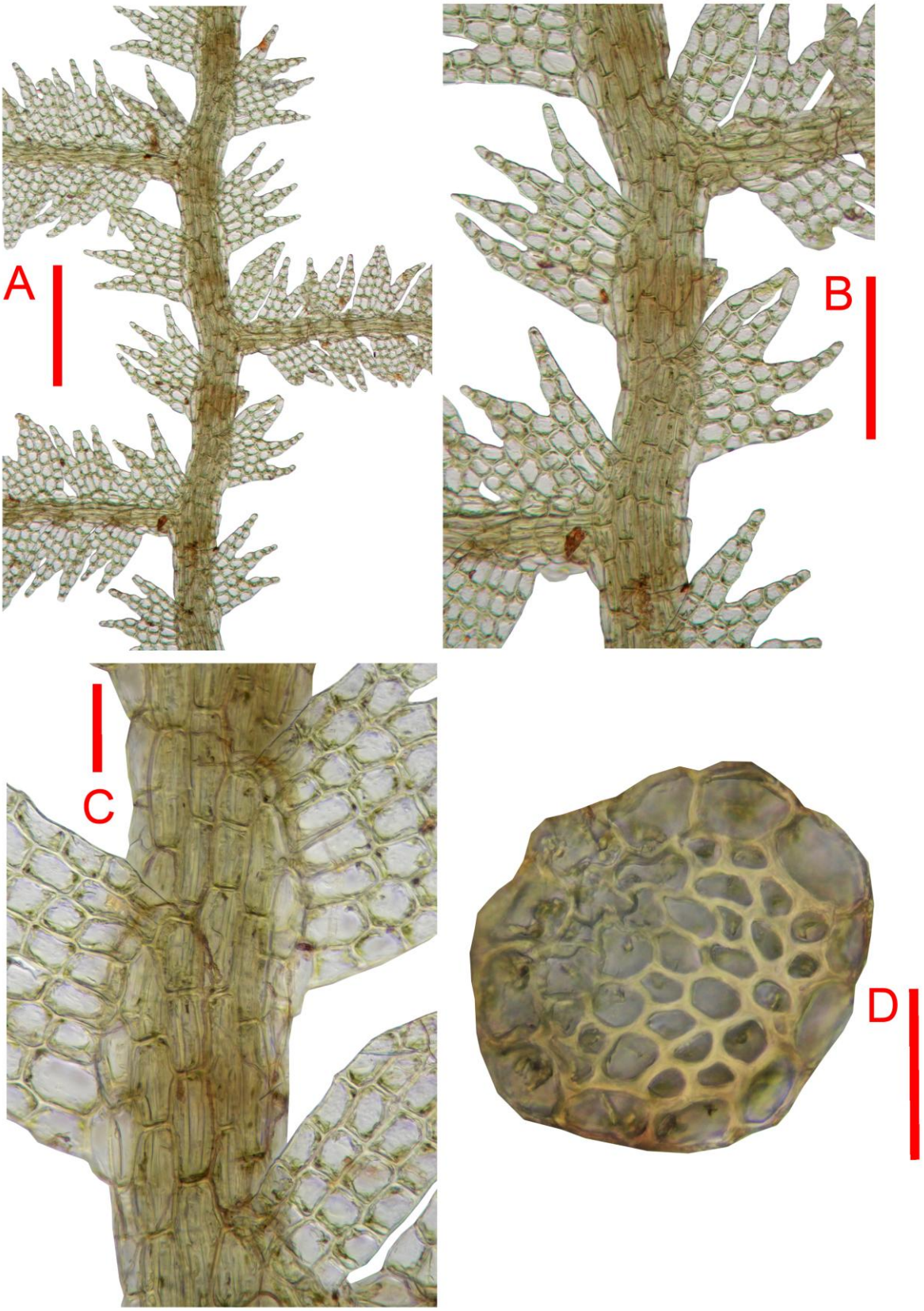

Plate 159: *Neolepidozia morobensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from STREIMANN; BELLAMY 12985 – holotype)

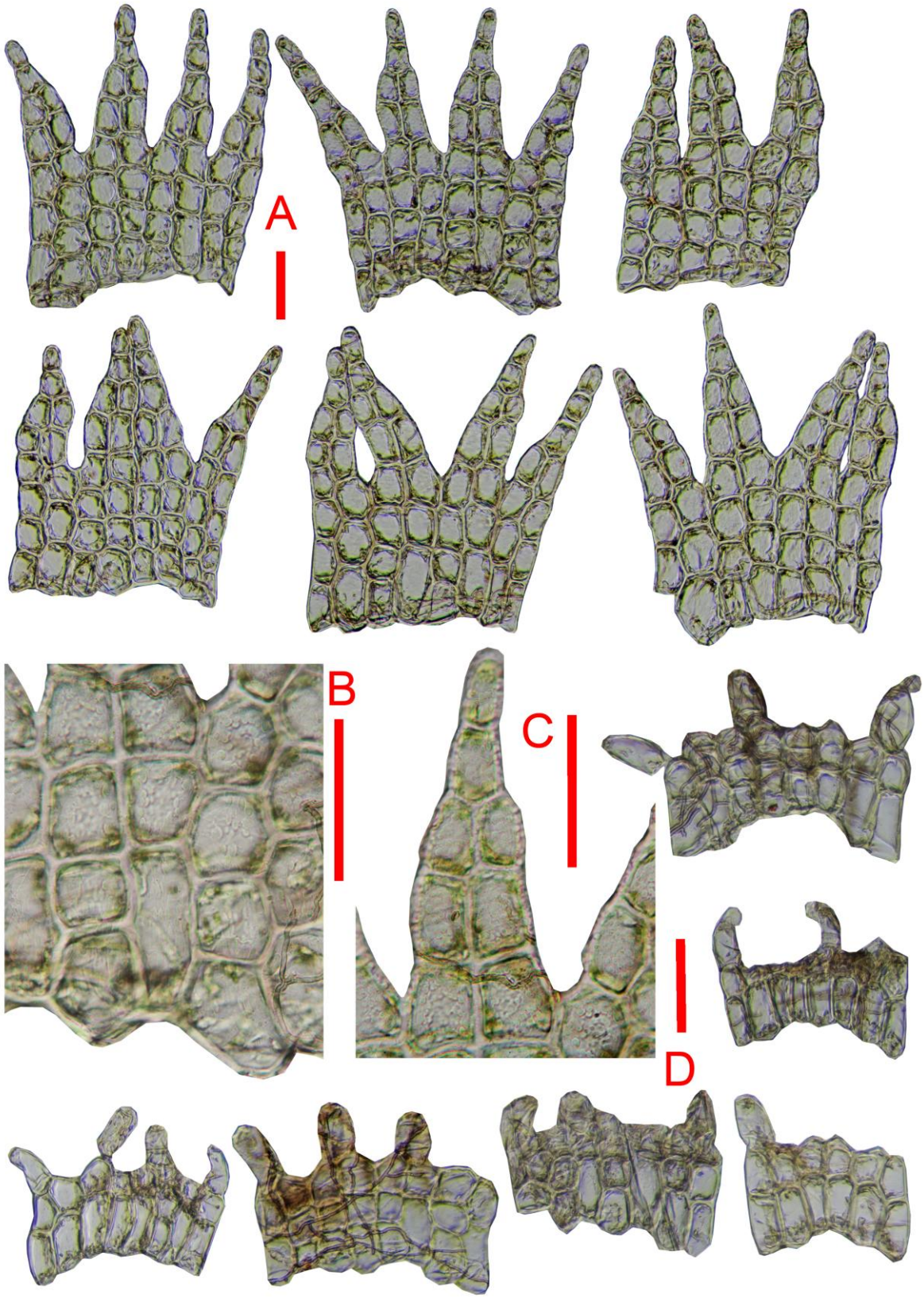

Plate 160: *Neolepidozia morobensis*: A – Stem leaves, B – Stem leaf disc, C – Stem leaf lobe, D – Stem underleaves; Scales: A, B, C, D – 50 µm (from STREIMANN; BELLAMY 12985 – holotype)

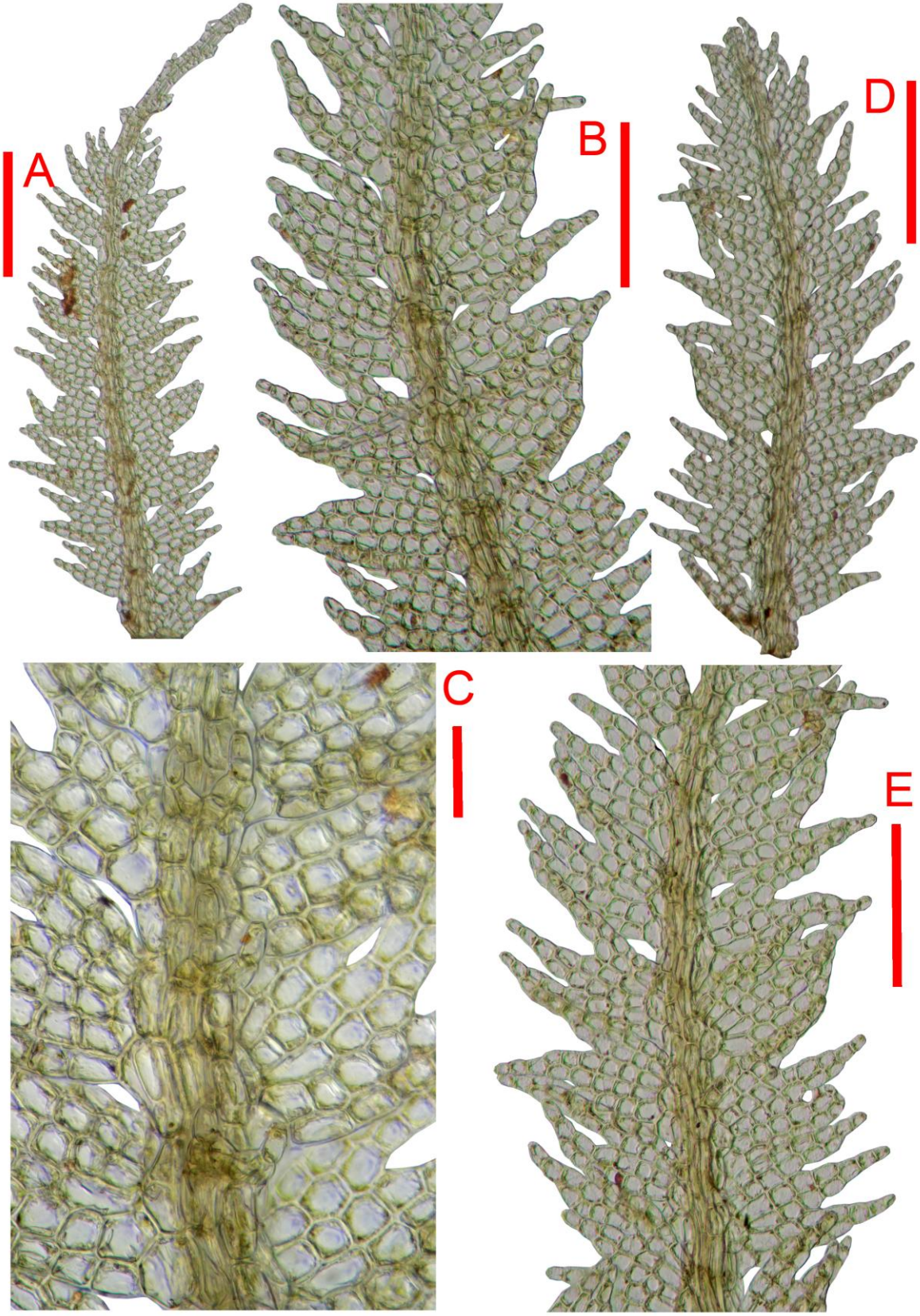

Plate 161: *Neolepidozia morobensis*: A, B, C – Branch ventral, D, E – Branch dorsal; Scales: A, D – 0.3 mm, B, E – 0.2 mm, E – 50 µm (from STREIMANN; BELLAMY 12985 – holotype)

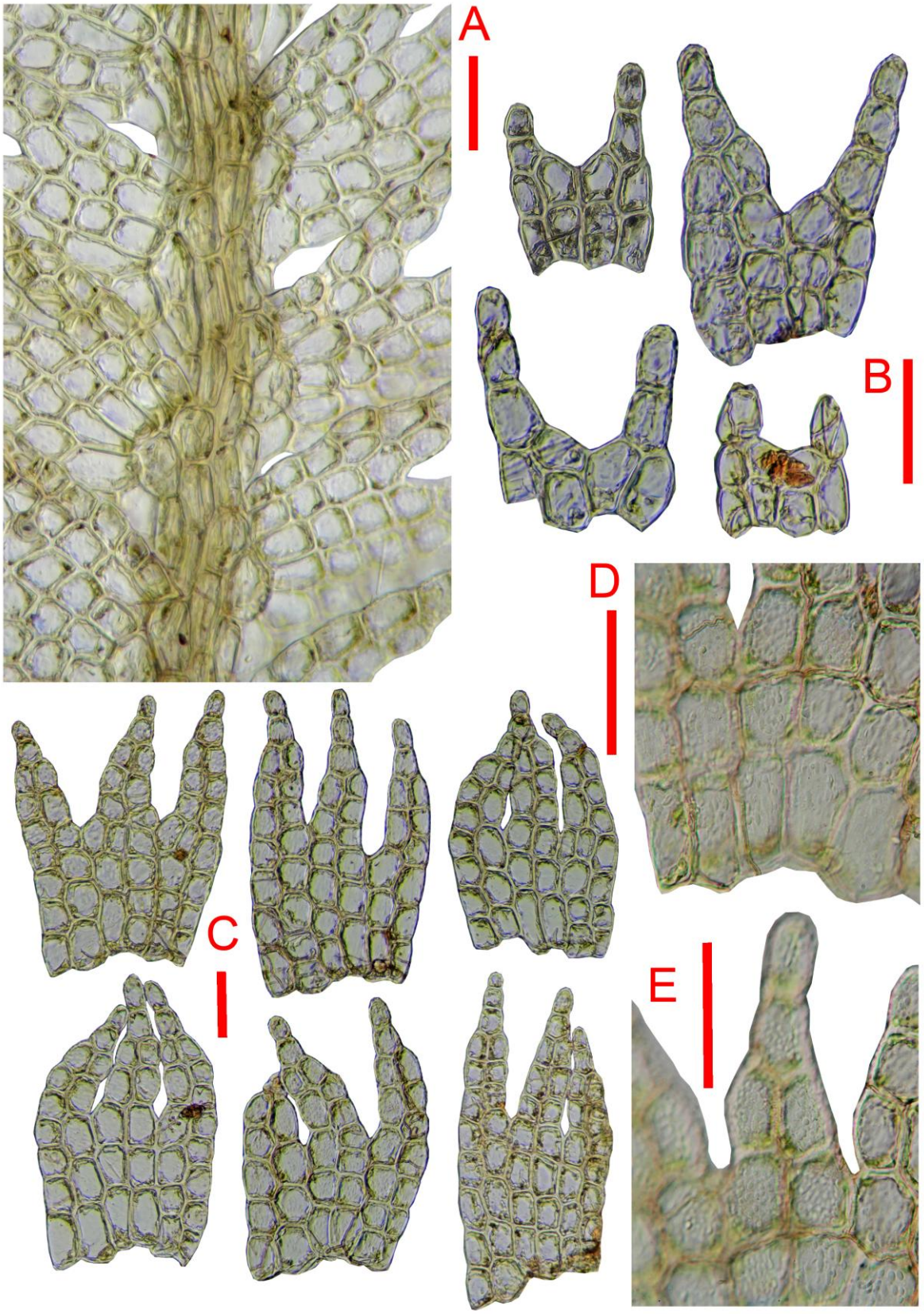

Plate 162: *Neolepidozia morobensis*: A – Branch dorsal, B – Branch underleaves, C – Branch leaves, D – Branch leaf disc, E – Branch leaf lobes; Scales: A, B, C, D, E – 50 µm (from STREIMANN; BELLAMY 12985 – holotype)

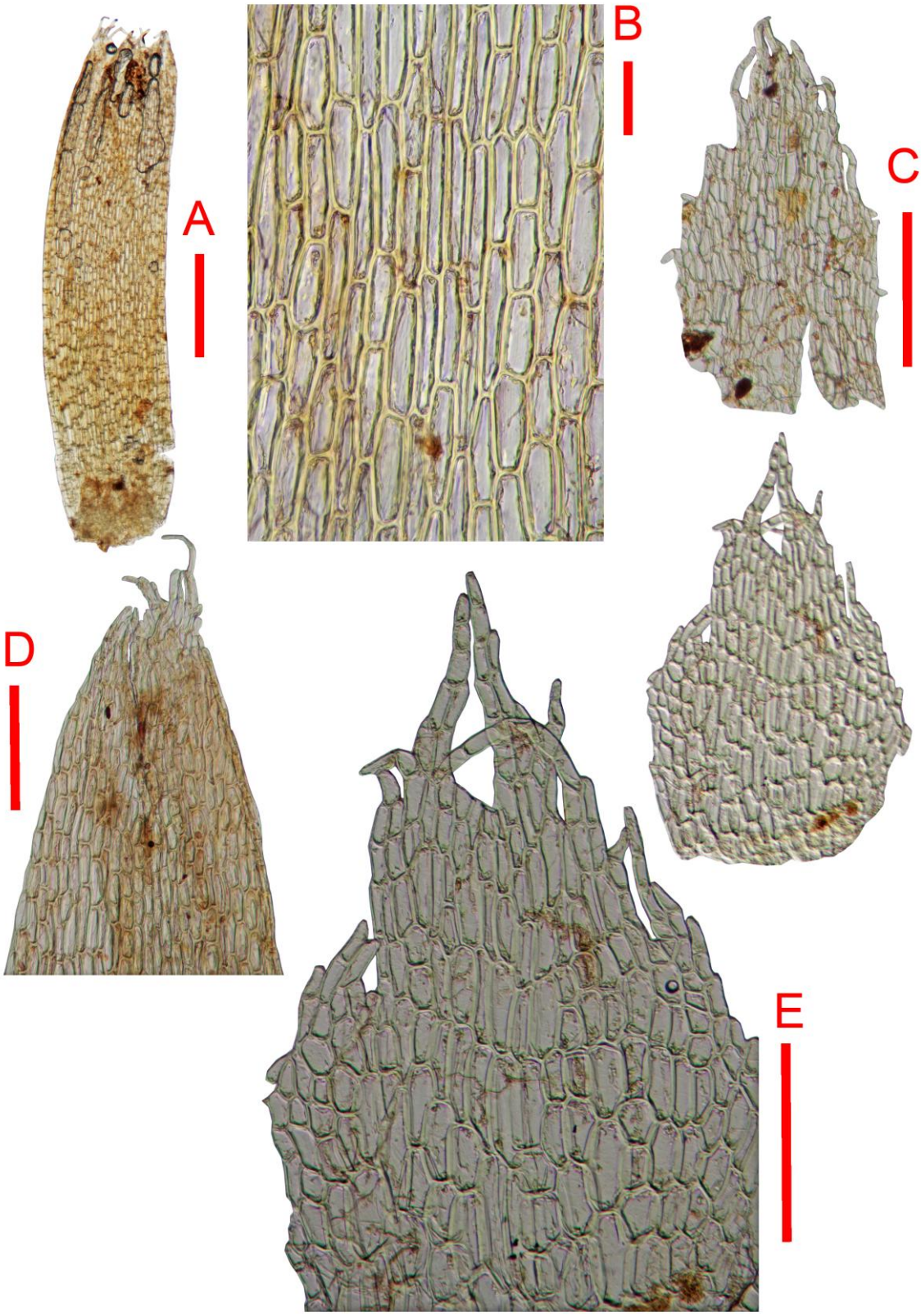

Plate 163: *Neolepidozia morobensis*: A – Perianth, B – Perianth middle, C – Female bracts, D – Perianth mouth, E – Female bract apex; Scales: A – 0.5 mm; C – 0.3 mm; D, E – 0.2 mm; B – 50 µm (from STREIMANN; BELLAMY 12985 – holotype)

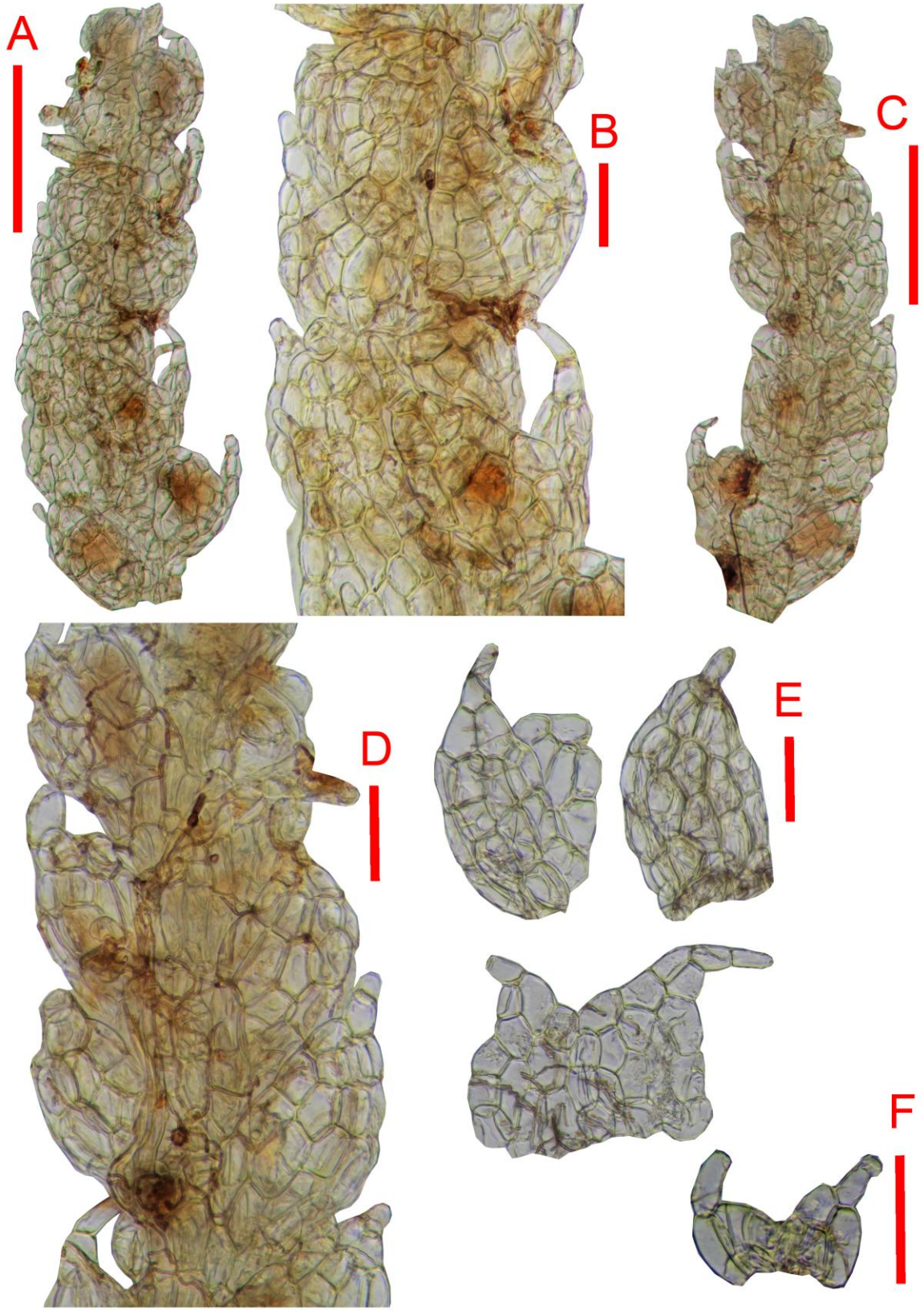

Plate 164: *Neolepidozia morobensis*: A, B – Male branch dorsal, C, D – Male branch ventral, E – Underleaves of male branch, F – Underleaf of male branch; Scales: A, C – 0.2 mm; B, D, E, F – 50 µm (from STREIMANN; BELLAMY 12985 – holotype)

Neolepidozia novoguineensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

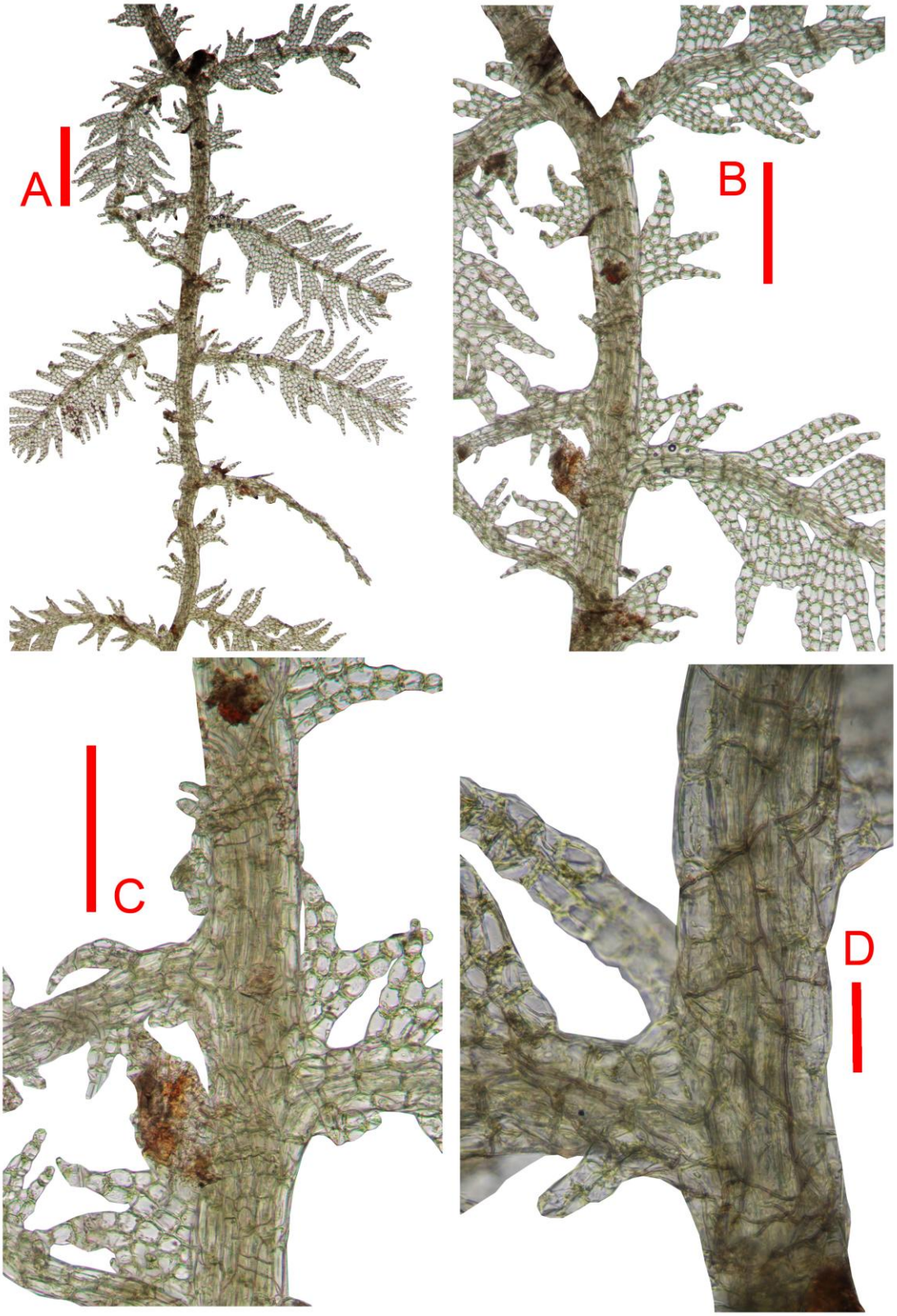

Plate 165: *Neolepidozia novoguineensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from STREIMANN; VINAS 14581 – holotype)

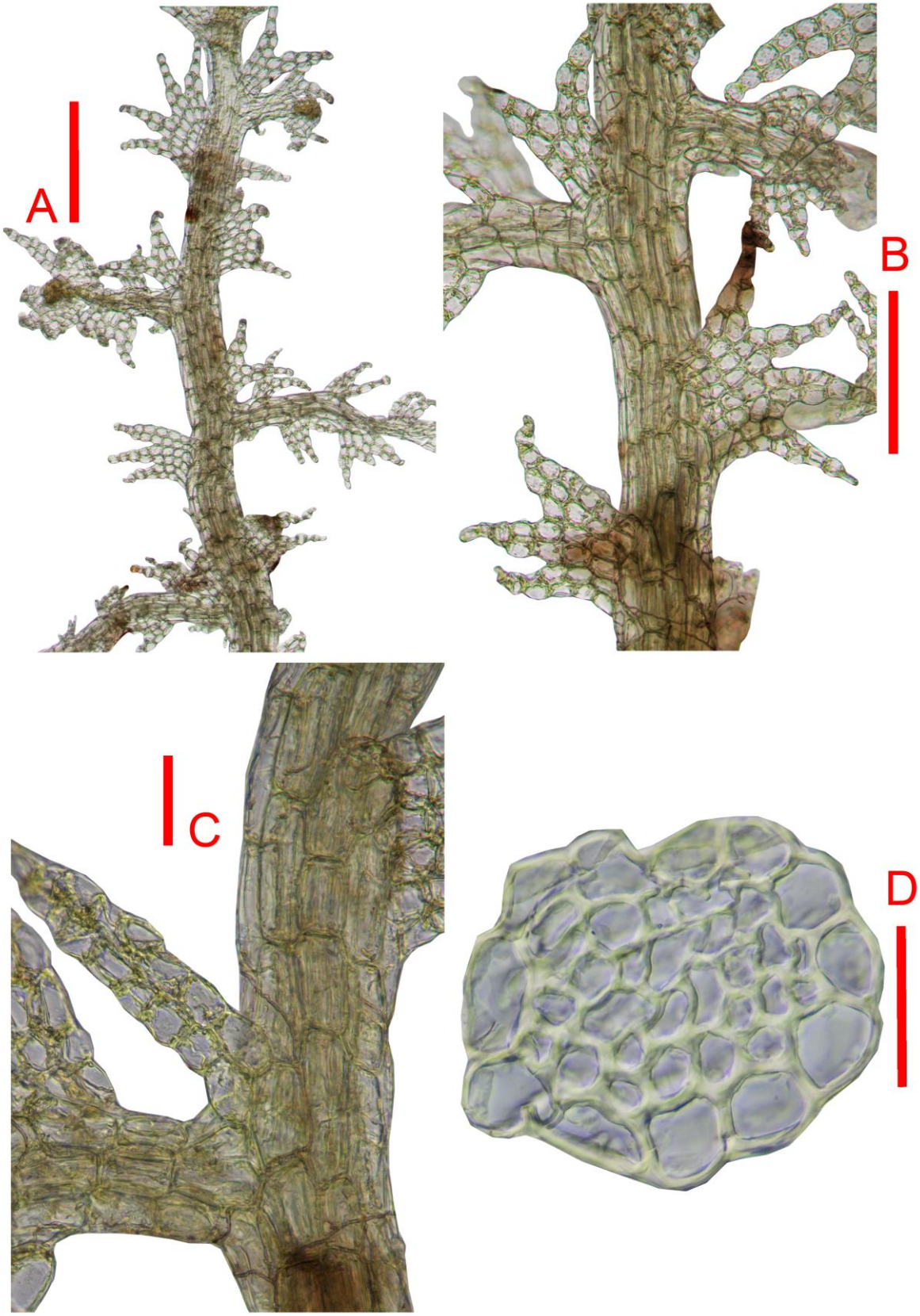

Plate 166: *Neolepidozia novoguineensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from STREIMANN; VINAS 14581 – holotype)

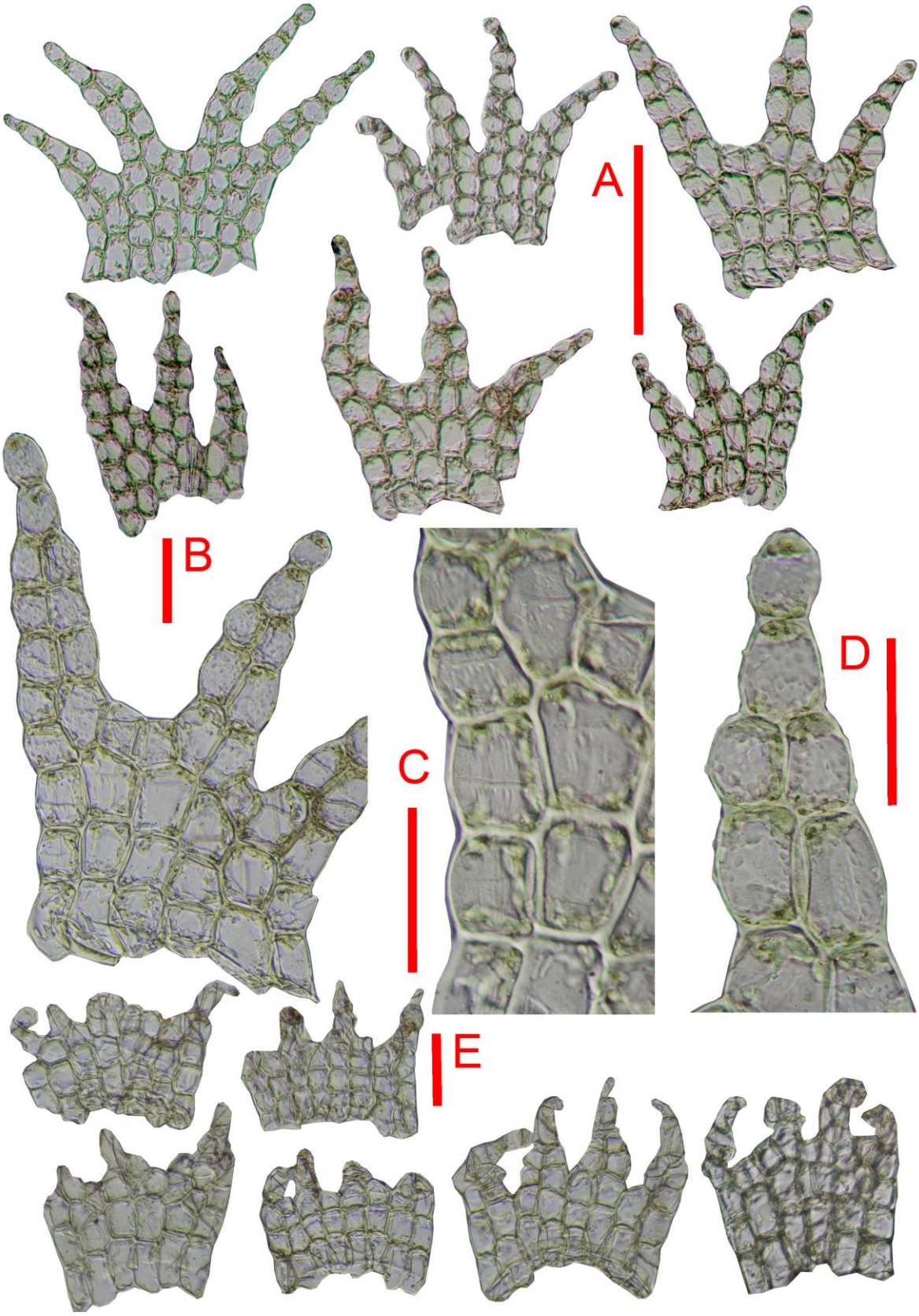

Plate 167: *Neolepidozia novoguineensis*: A, B – Stem leaves, C – Stem leaf disc, D – Stem leaf lobe, E – Stem underleaf; Scales: A – 0.2 mm; B, C, D, E – 50 µm (from STREIMANN; VINAS 14581 – holotype)

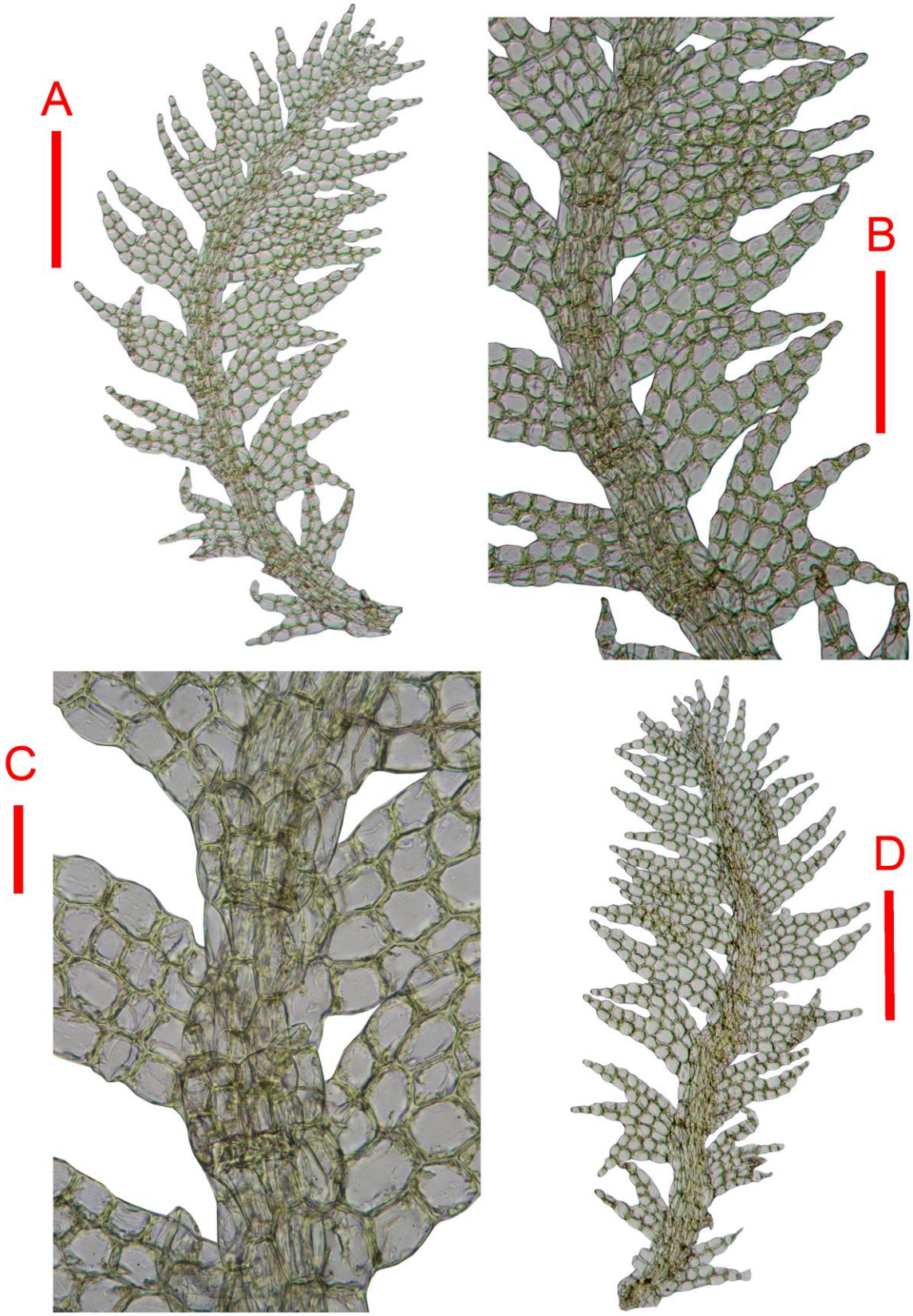

Plate 168: *Neolepidozia novoguineensis*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm; B – 0.2 mm; C – 50 µm (from STREIMANN; VINAS 14581 – holotype)

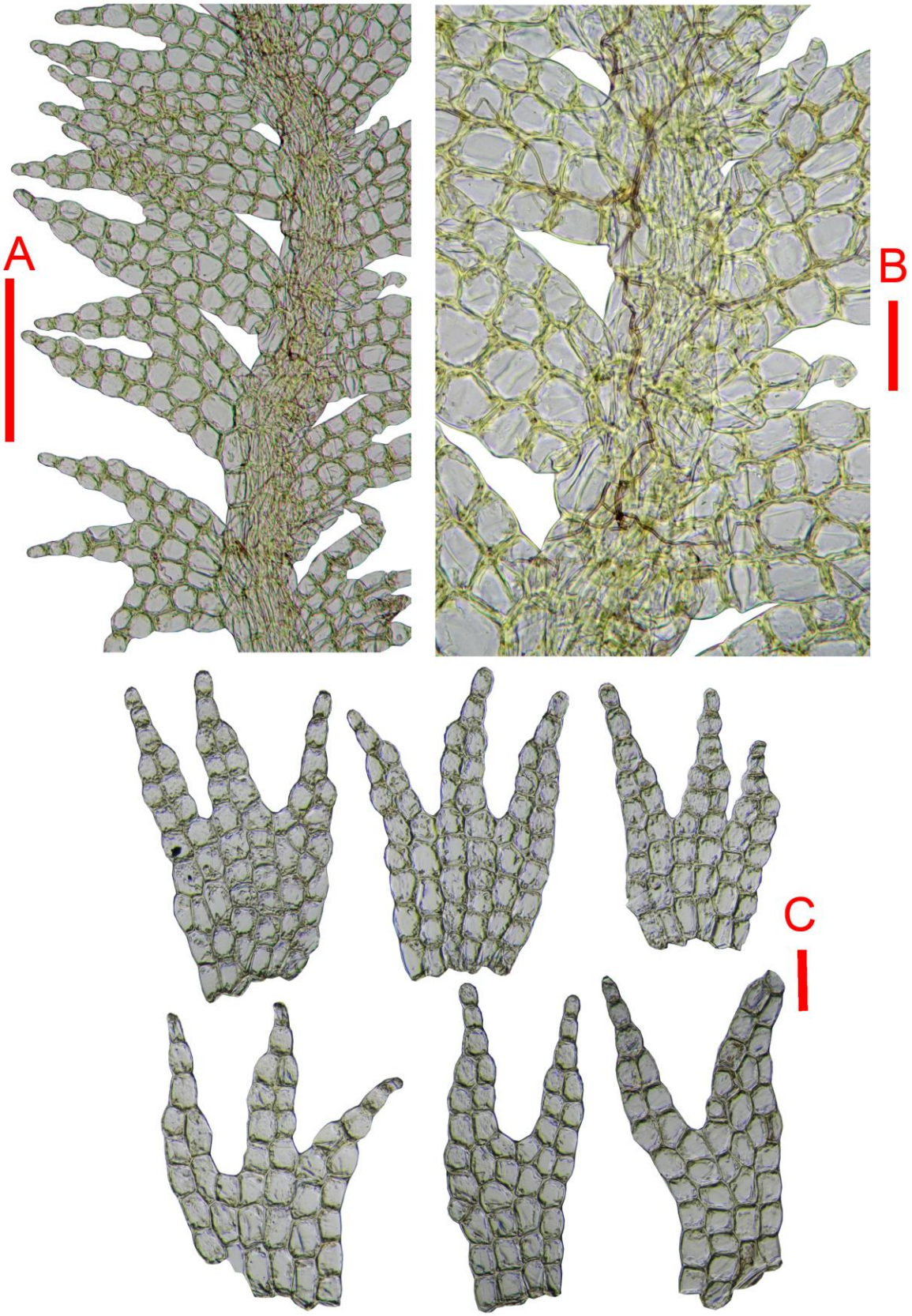

Plate 169: *Neolepidozia novoguineensis*: A, B – Branch dorsal, C – Branch leaves; Scales: A – 0.2 mm; B, C – 50 µm (from STREIMANN; VINAS 14581 – holotype)

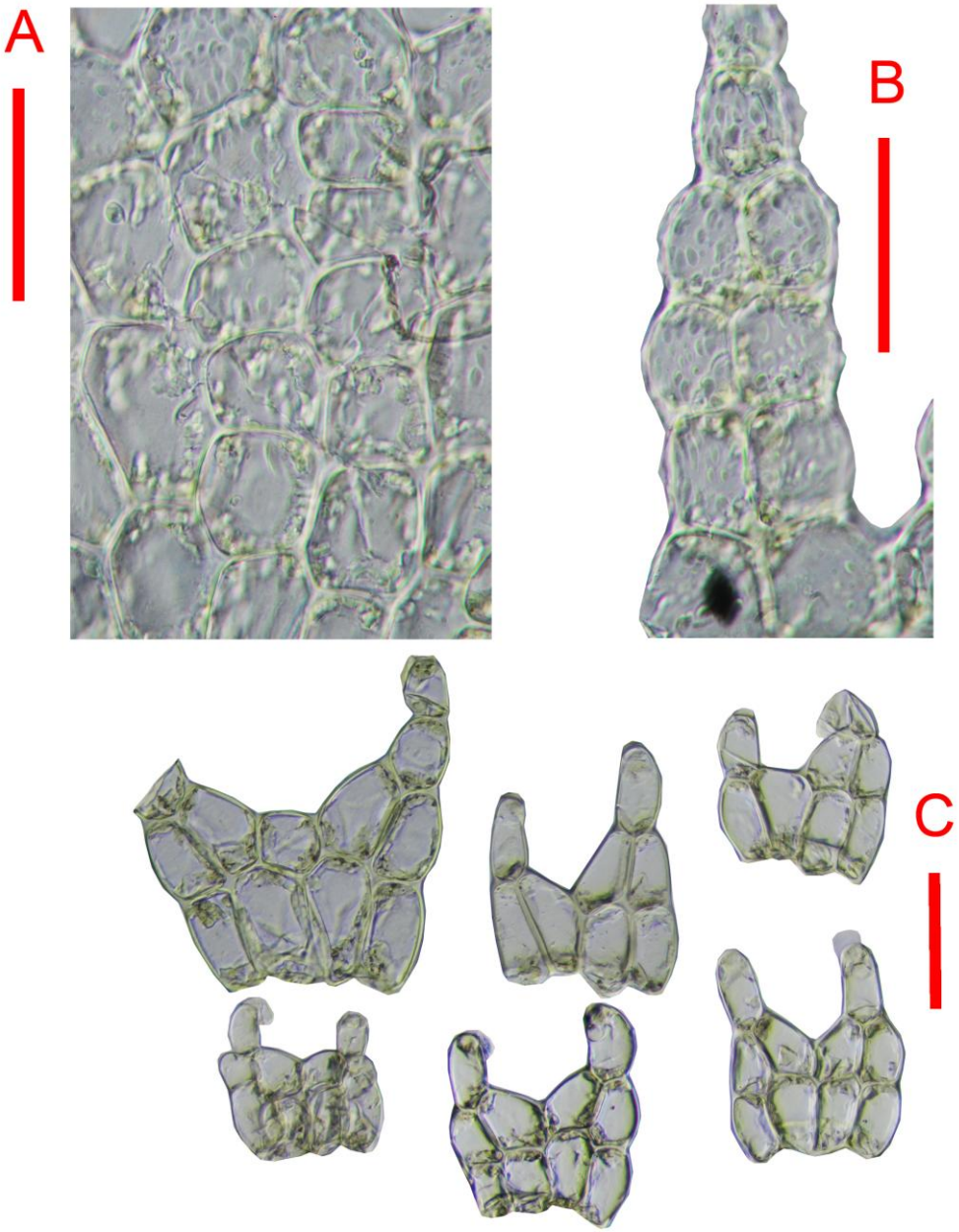

Plate 170: *Neolepidozia novoguineensis*: A – Branch leaf disc, B – Branch leaf lobe, C – Branch underleaves; Scales: A, B, C – 50 µm (from STREIMANN; VINAS 14581 – holotype)

Neolepidozia ophiria (GOTTSCHE EX STEPH.) E.D. COOPER

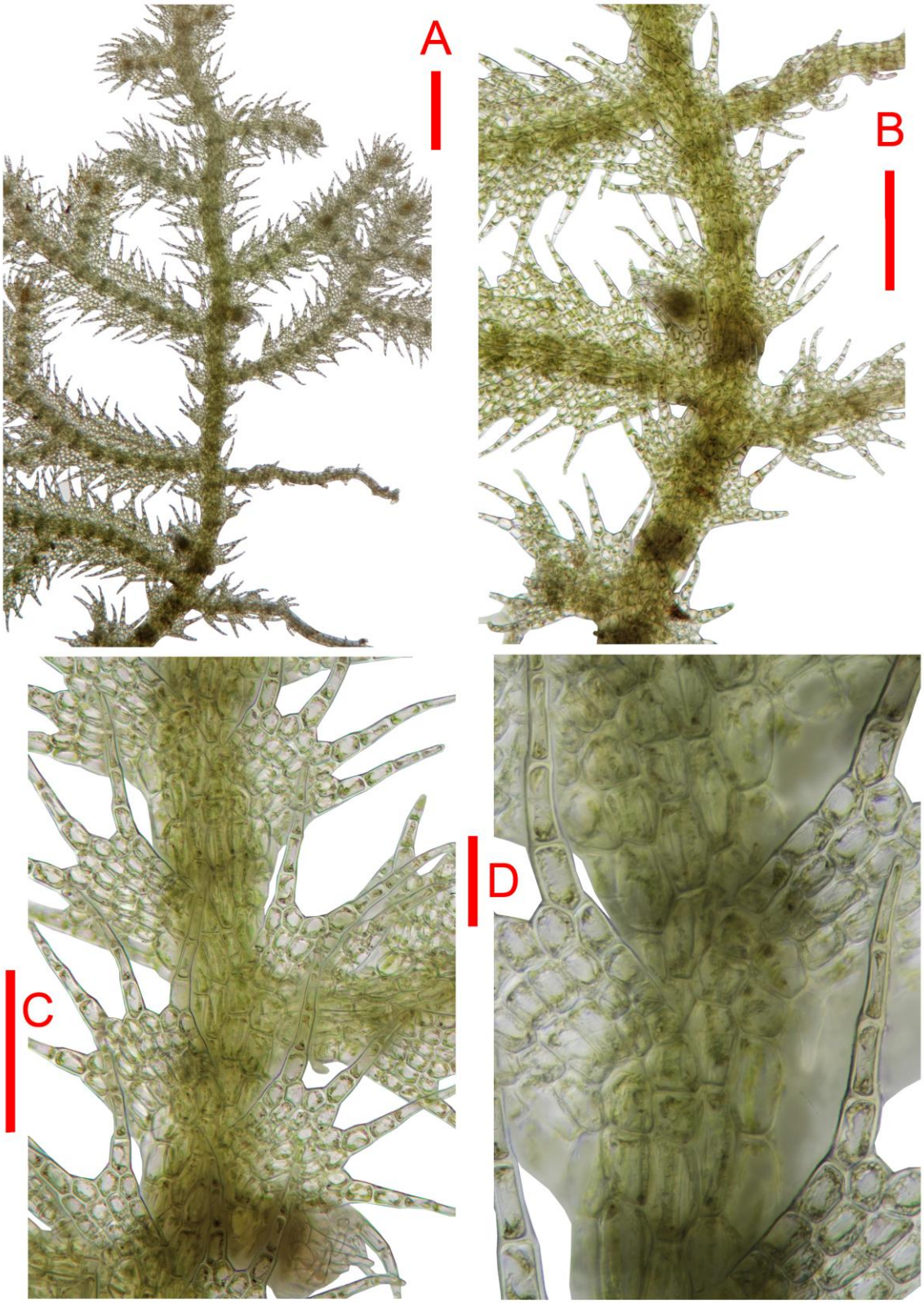

Plate 171: *Neolepidozia ophiria*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from YORONG 651)

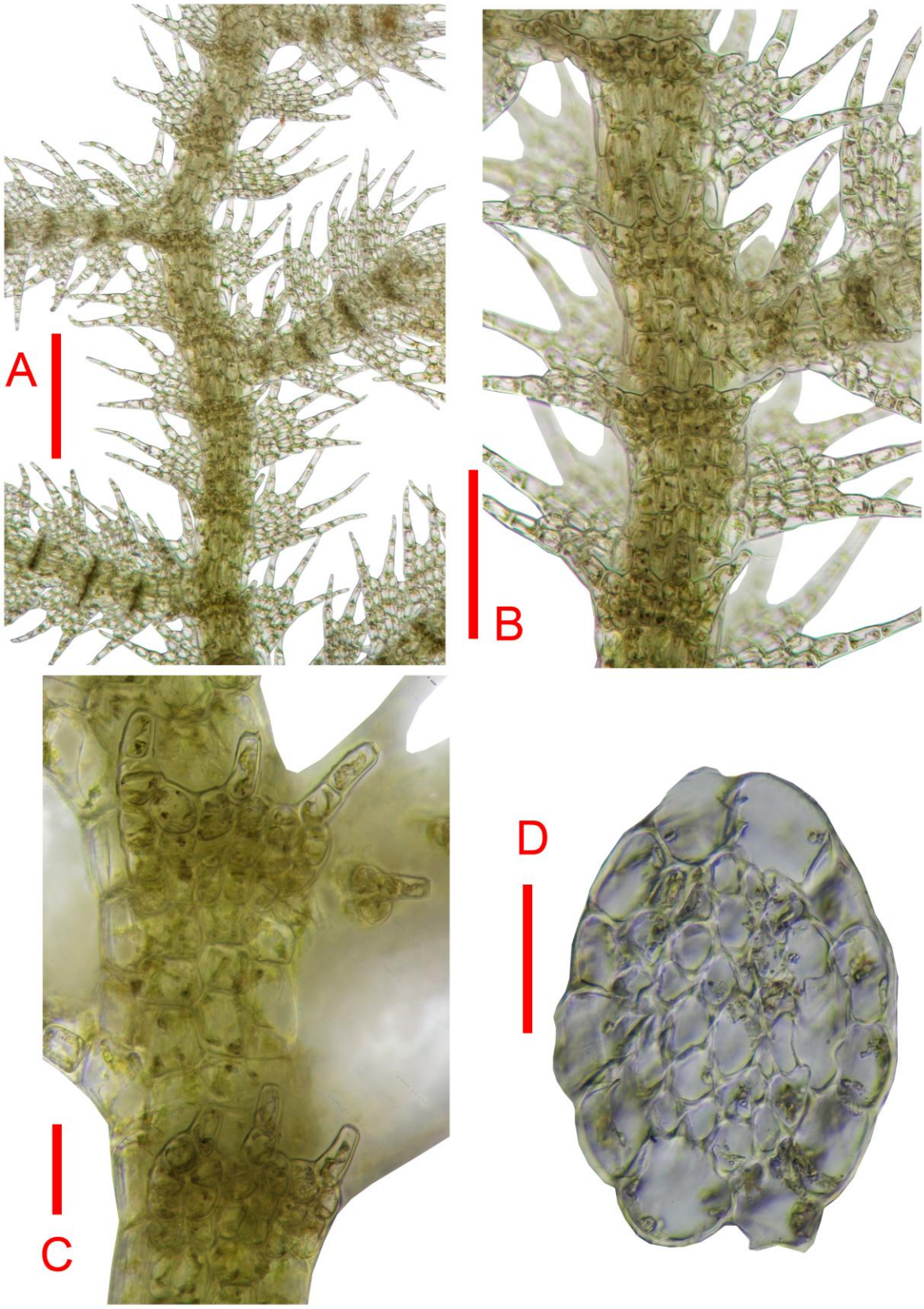

Plate 172: *Neolepidozia ophiria*: A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from YORONG 651)

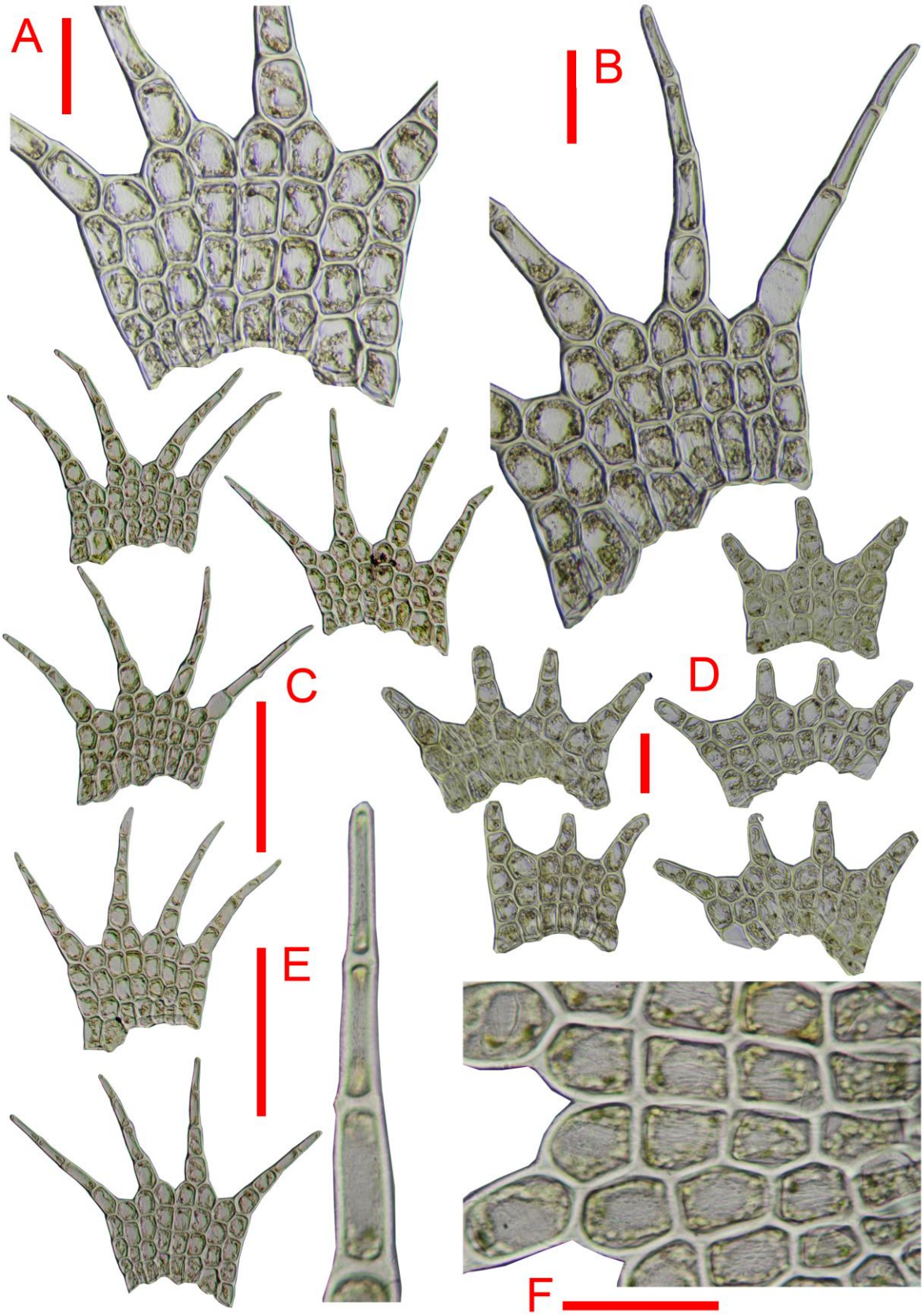

Plate 173: *Neolepidozia ophiria*: A, F – Stem leaf disc, B, E – Stem leaf lobes, C – Stem leaves, D – Stem underleaves; Scales: C – 0.2 mm; A, B, D, E, F – 50 µm (from YORONG 651)

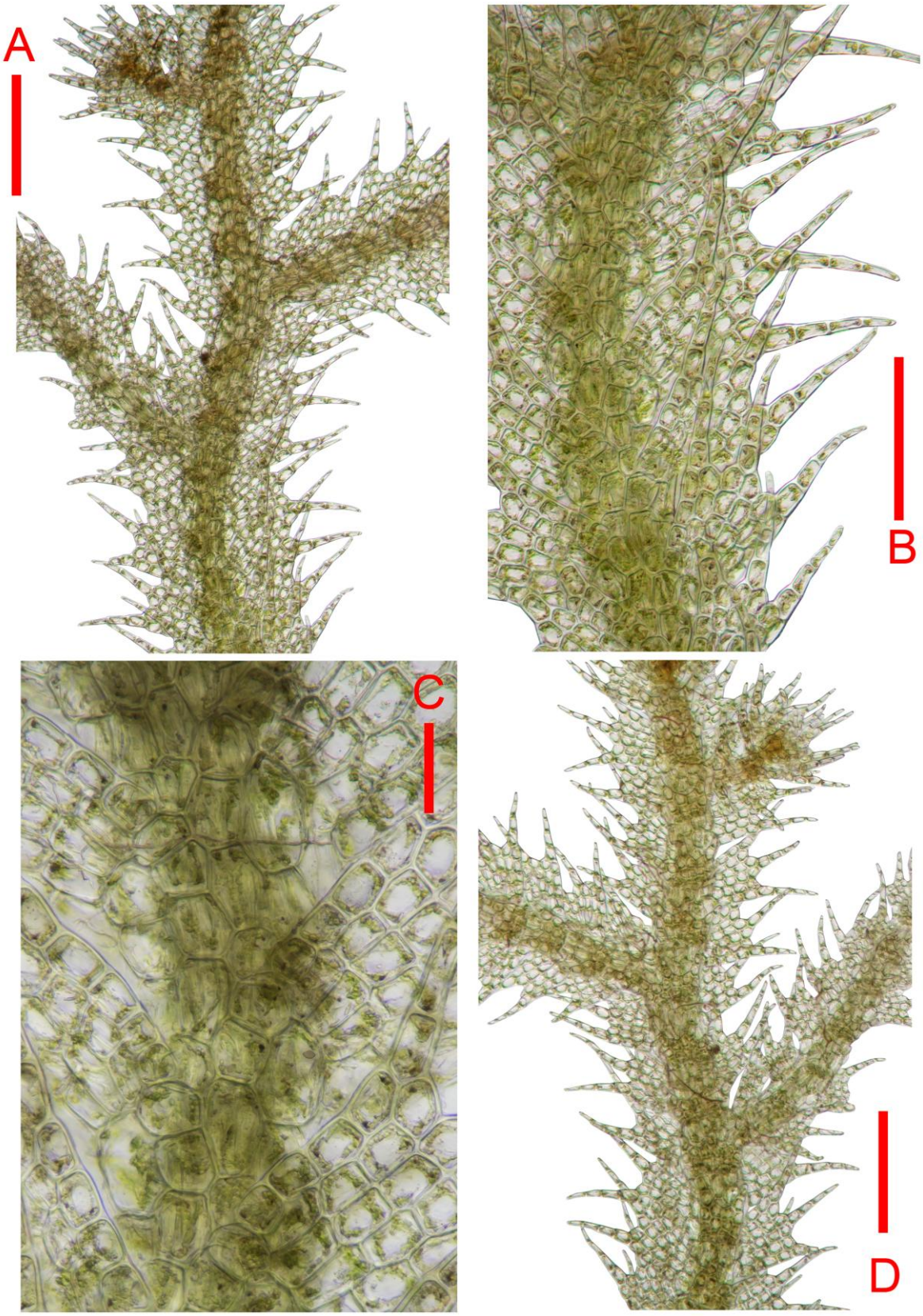

Plate 174: *Neolepidozia ophiria*: A, B, C – Branch dorsal, D – Branch ventral; Scales: A, D – 0.3 mm; B – 0.2 mm; C – 50 µm (from YORONG 651)

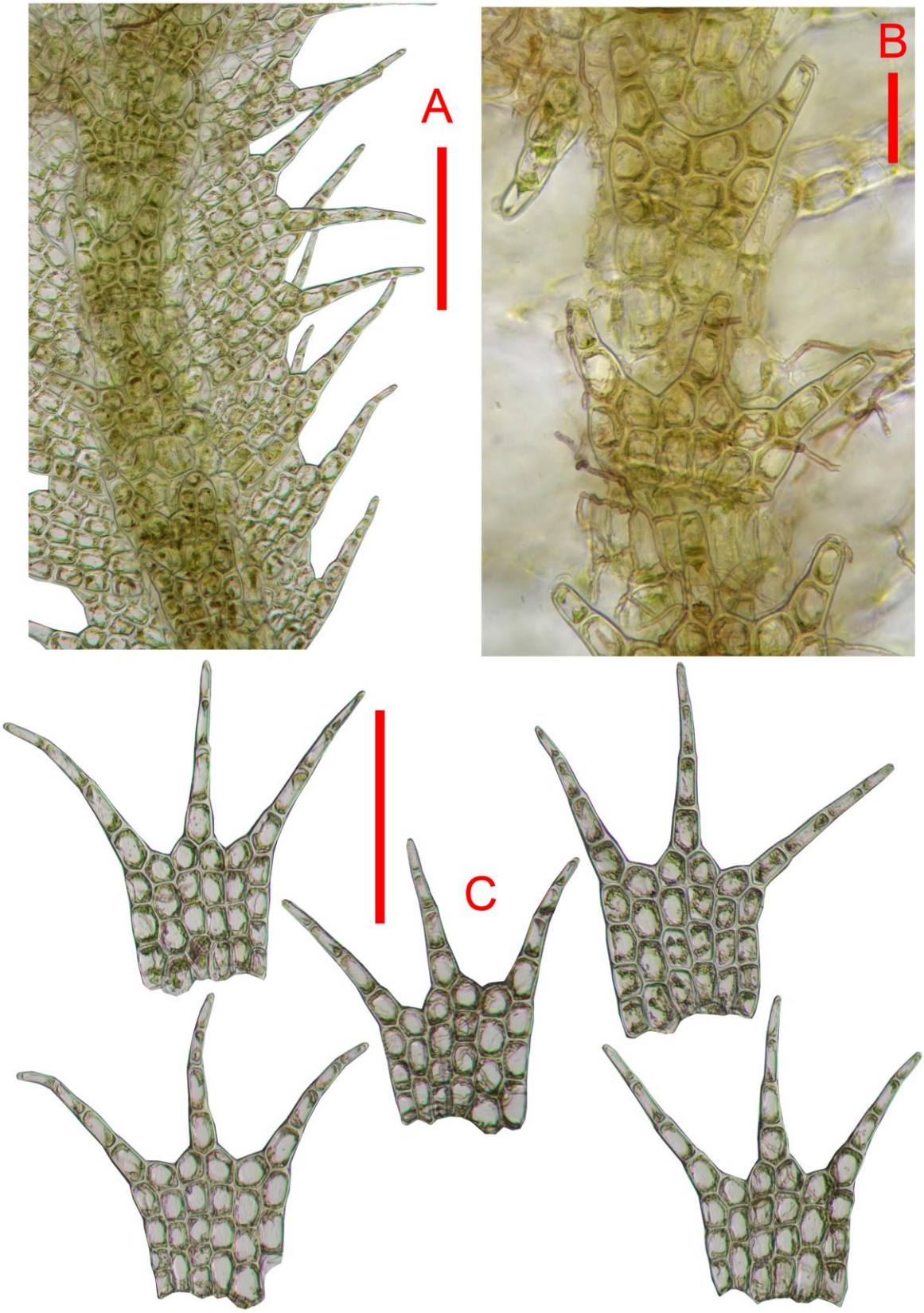

Plate 175: *Neolepidozia ophiria*: A, B – Branch ventral, C – Branch leaves; Scales: A, C – 0.2 mm; B – 50 µm (from YORONG 651)

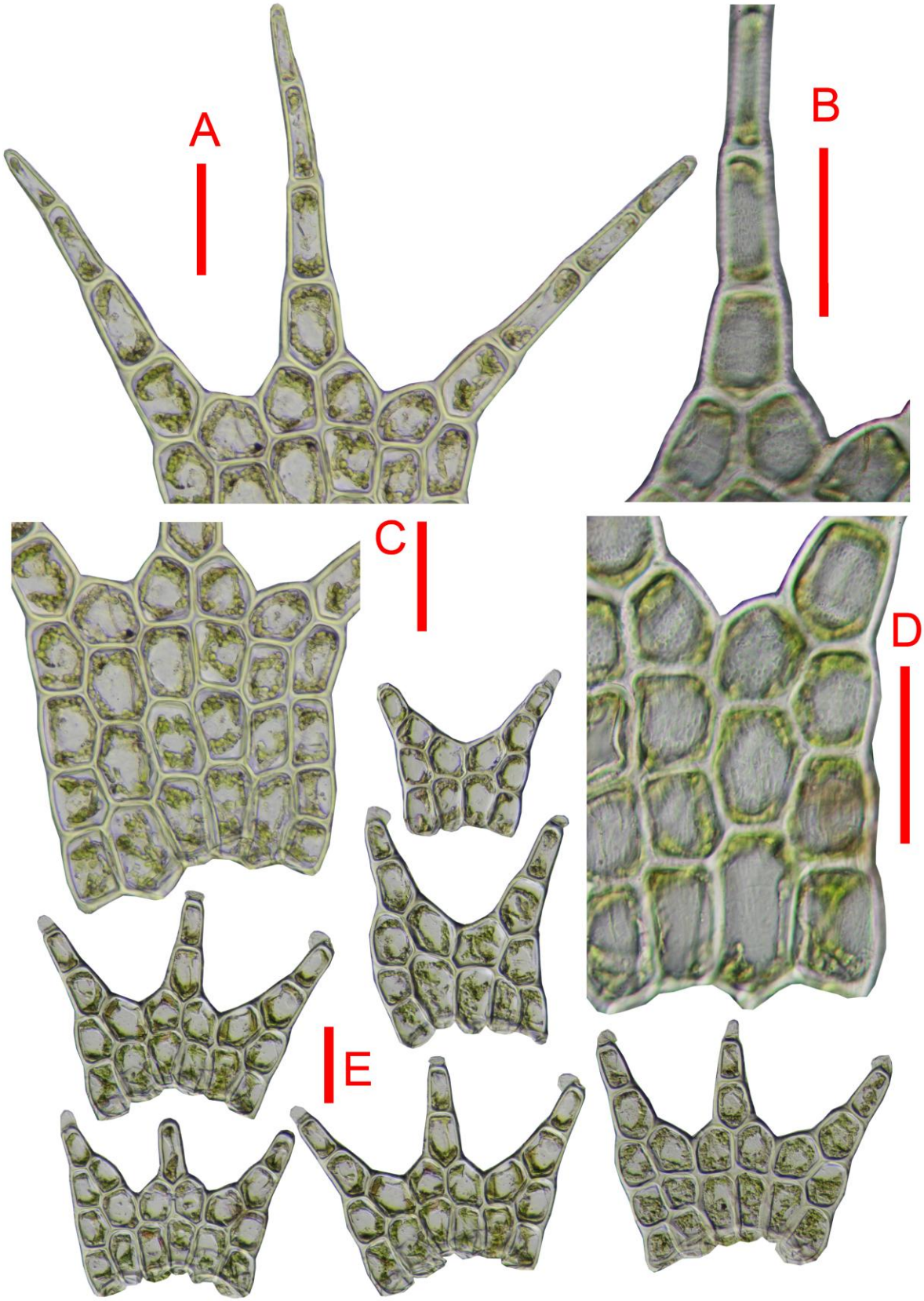

Plate 176: *Neolepidozia ophiria*: A, B – Branch leaf lobe, C, D – Branch leaf disc, E – Branch underleaves; Scales: A, B, C, D, E – 50 µm (from YORONG 651)

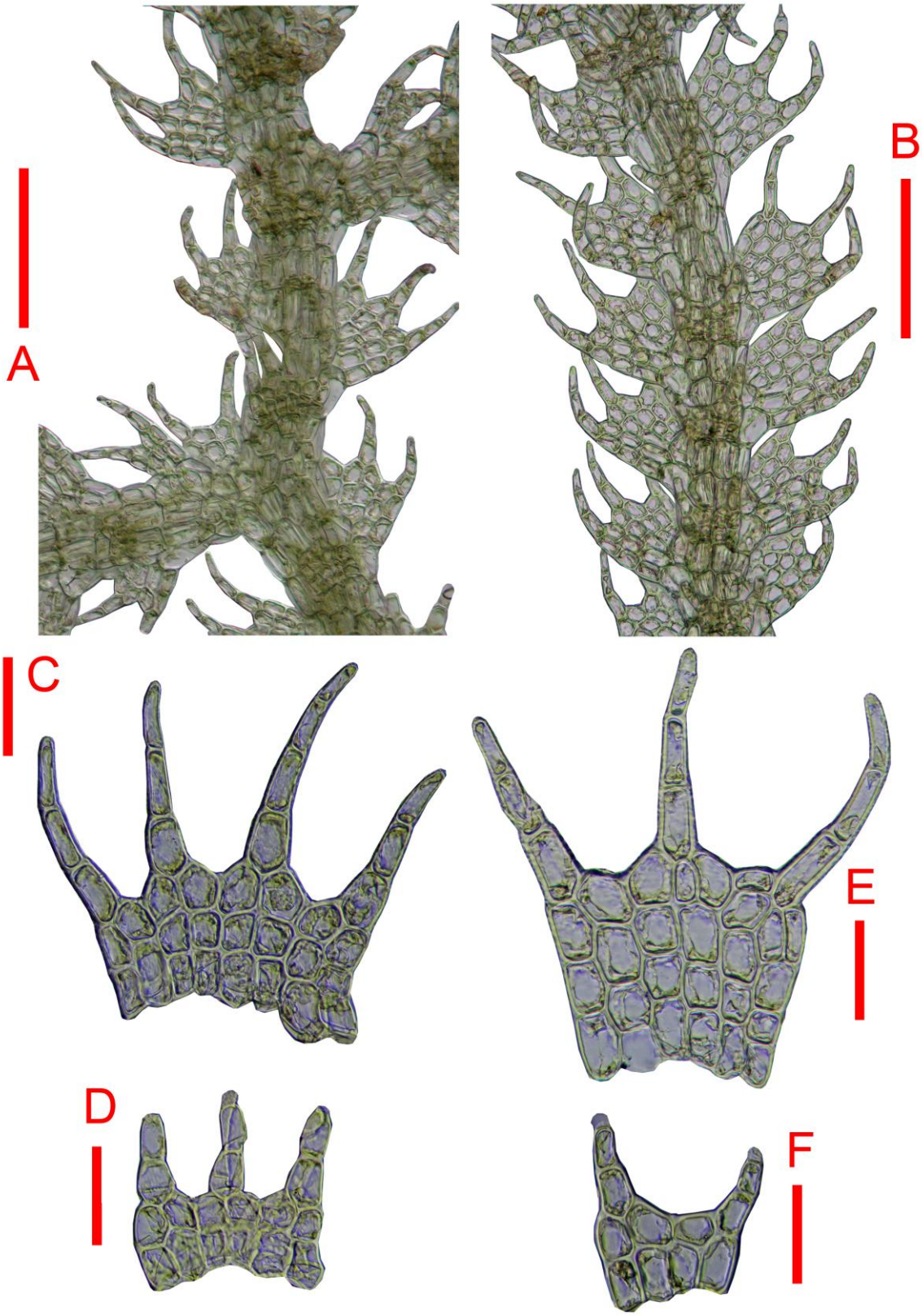

Plate 177: *Neolepidozia ophiria*: A – Stem ventral, B – Branch ventral, C – Stem leaf, D – Stem underleaf, E – Branch leaf, F – Branch underleaf; Scales: A, B – 0.2 mm, C, D, E, F – 50 µm (from SCHWARZ 4820b)

Neolepidozia palawanensis **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

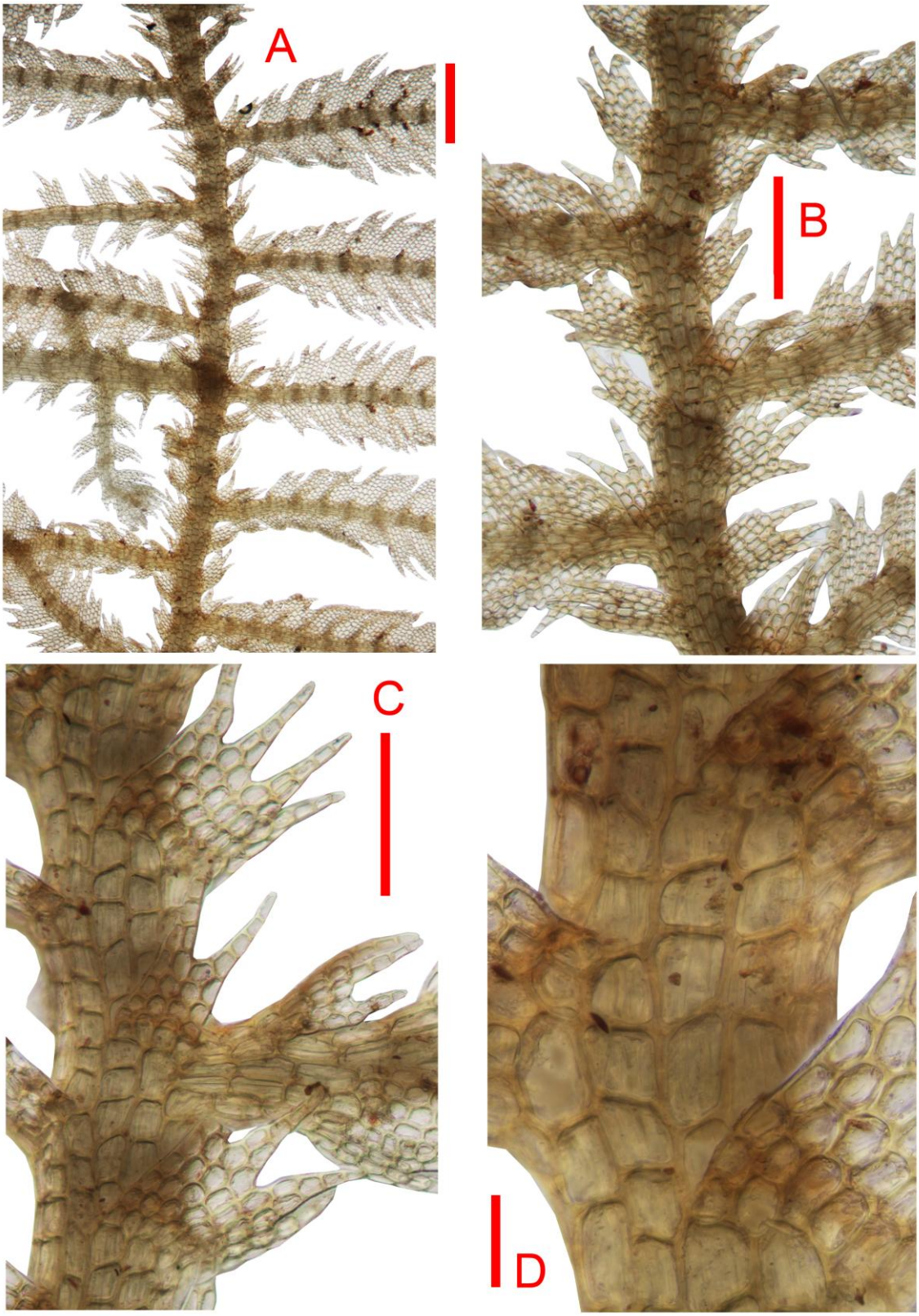

Plate 178: *Neolepidozia palawanensis*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from OLSEN 2165b, JE – holotype)

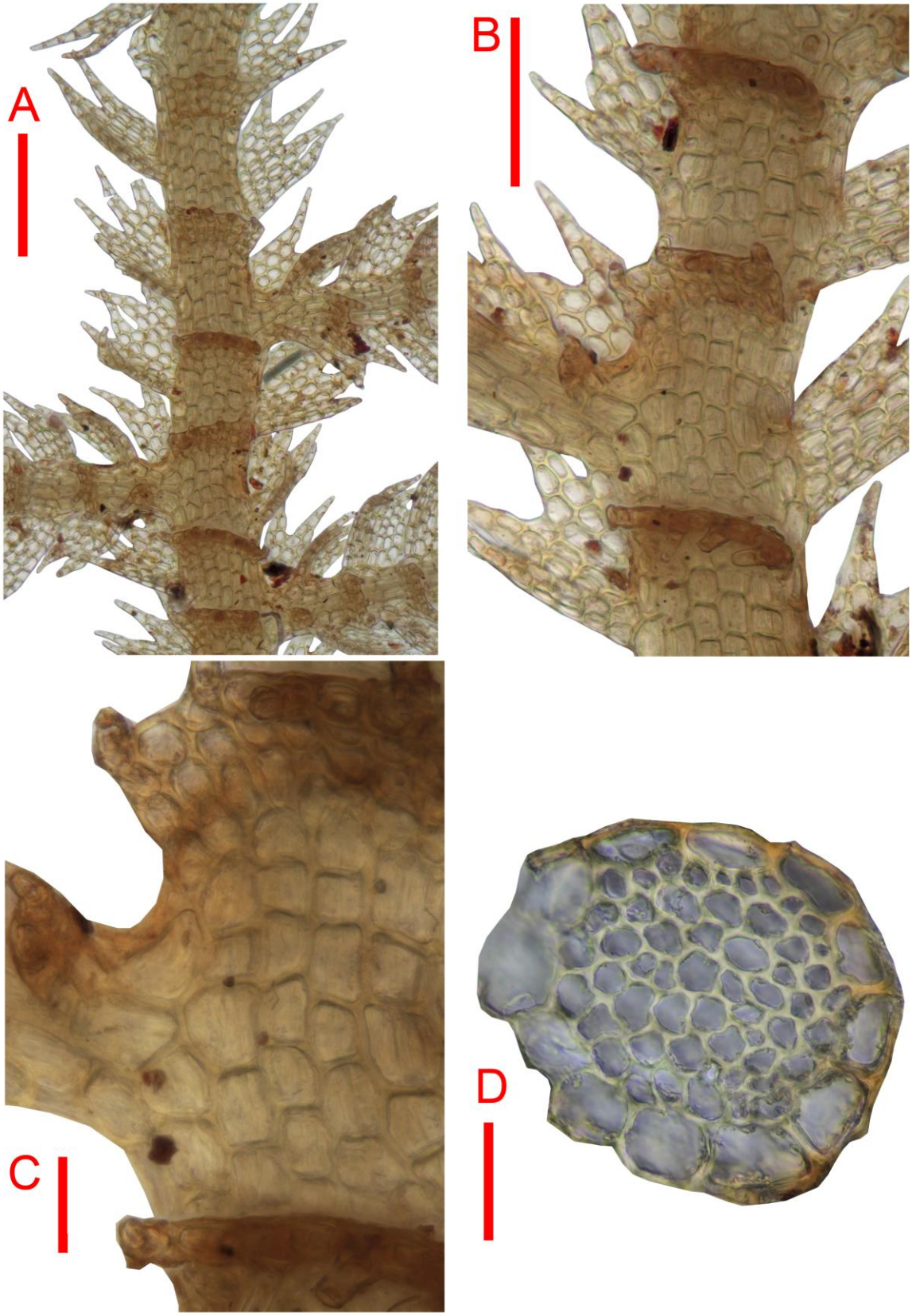

Plate 179: *Neolepidozia palawanensis*: A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from OLSEN 2165b, JE – holotype)

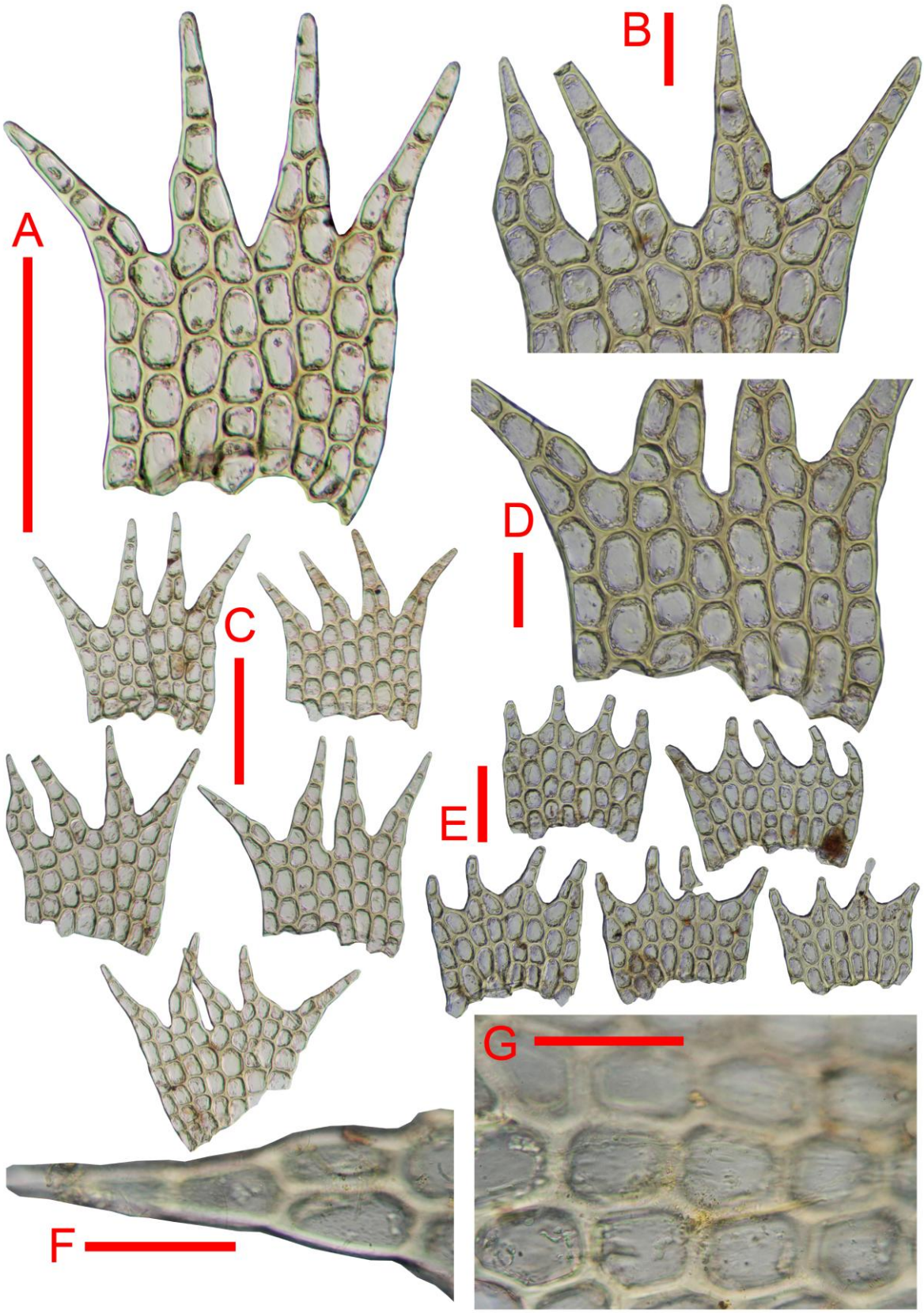

Plate 180: *Neolepidozia palawanensis*: A, C – Stem leaves, B, F – Stem leaf lobe, D, G – Stem leaf disc, E – Stem underleaves; Scales: A, C – 0.2 mm; E – 0.1 mm; B, D, F, G – 50 µm (from OLSEN 2165b, JE – holotype)

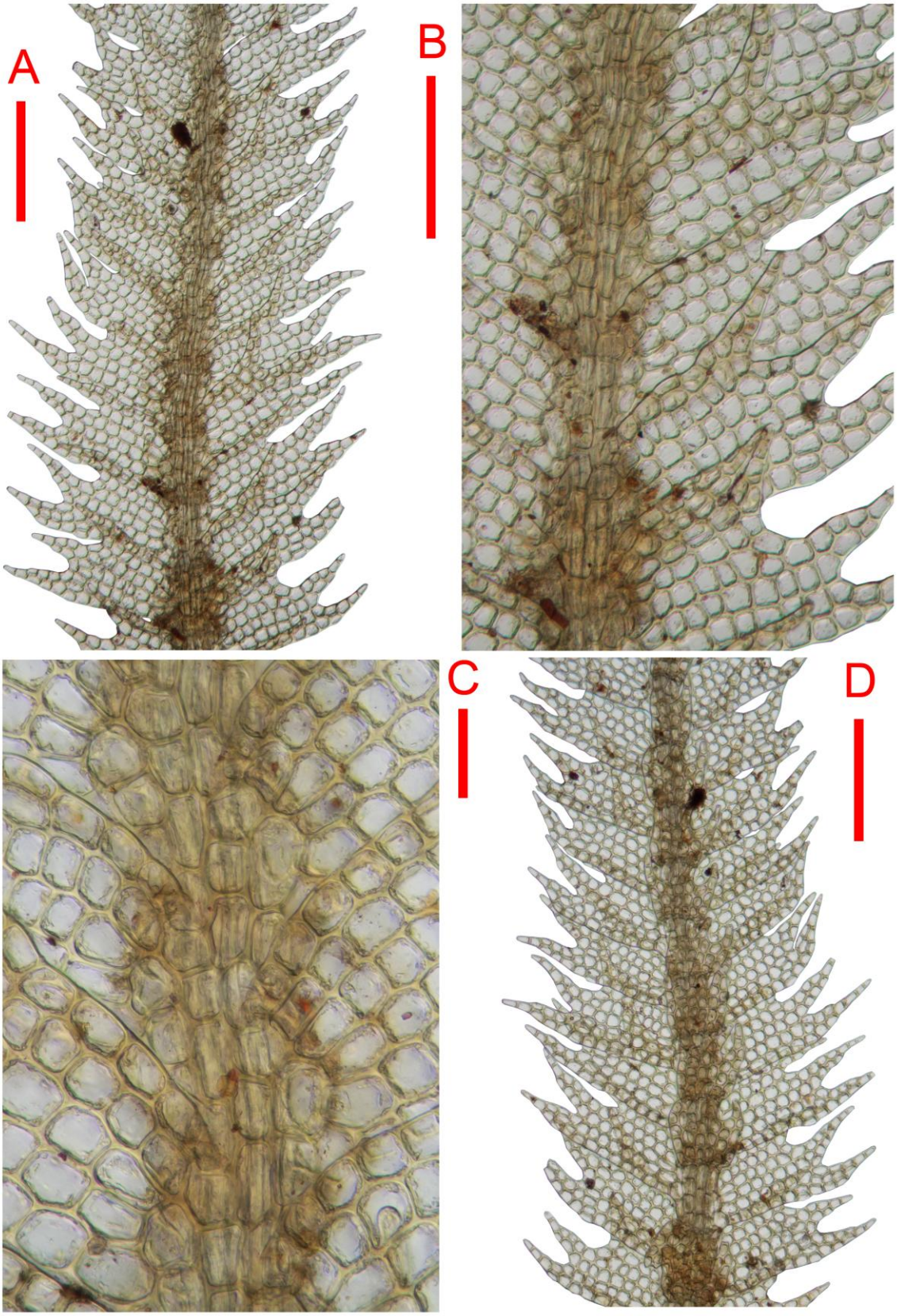

Plate 181: *Neolepidozia palawanensis*: A, B, C – Branch dorsal, D – Branch ventral; Scales: A, D – 0.3 mm; B – 0.2 mm; C – 50 µm (from OLSEN 2165b, JE – holotype)

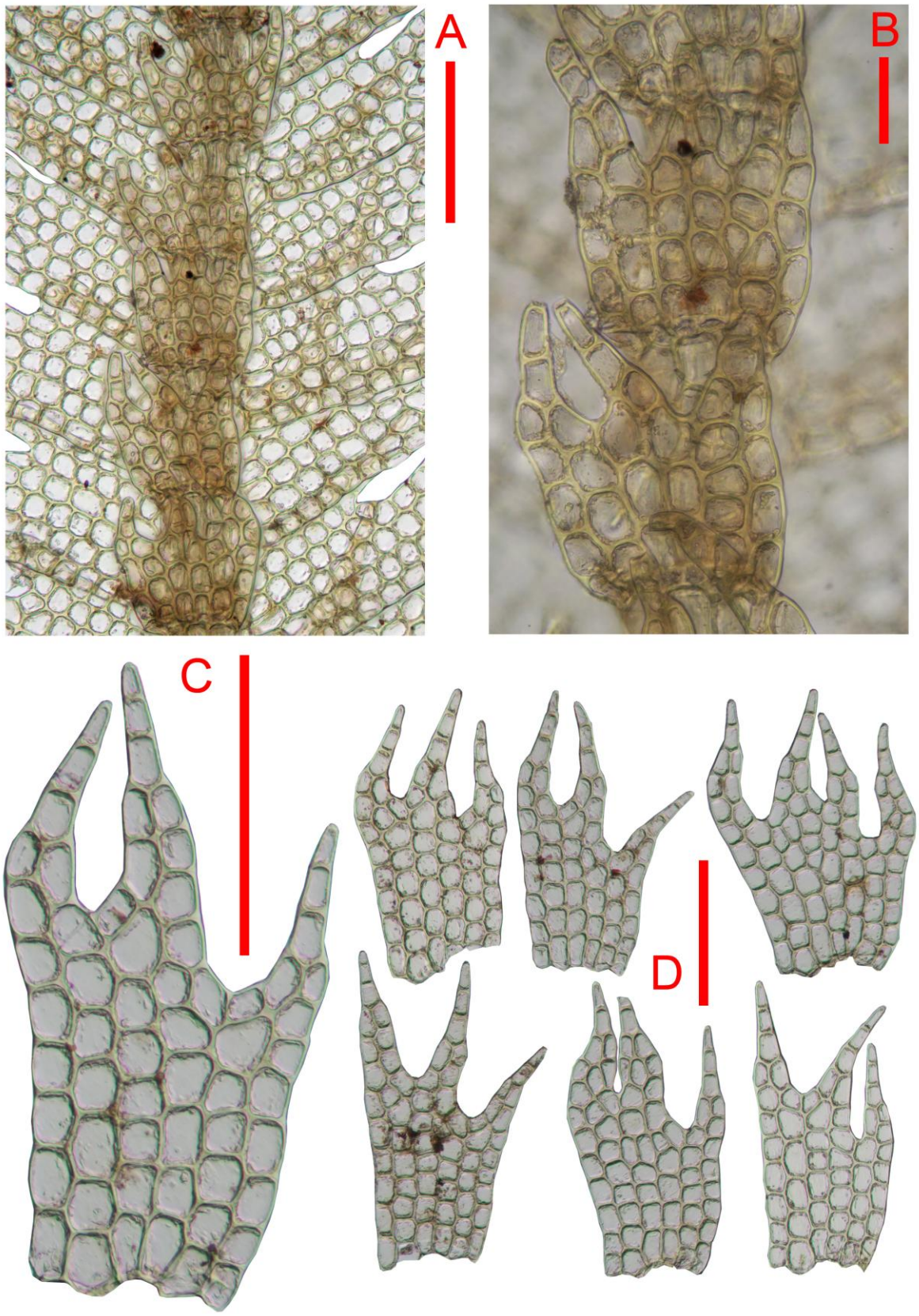

Plate 182: *Neolepidozia palawanensis*: A, B – Branch ventral, C, D – Branch leaves; Scales: A, C, D – 0.2 mm; B – 50 µm (from OLSEN 2165b, JE – holotype)

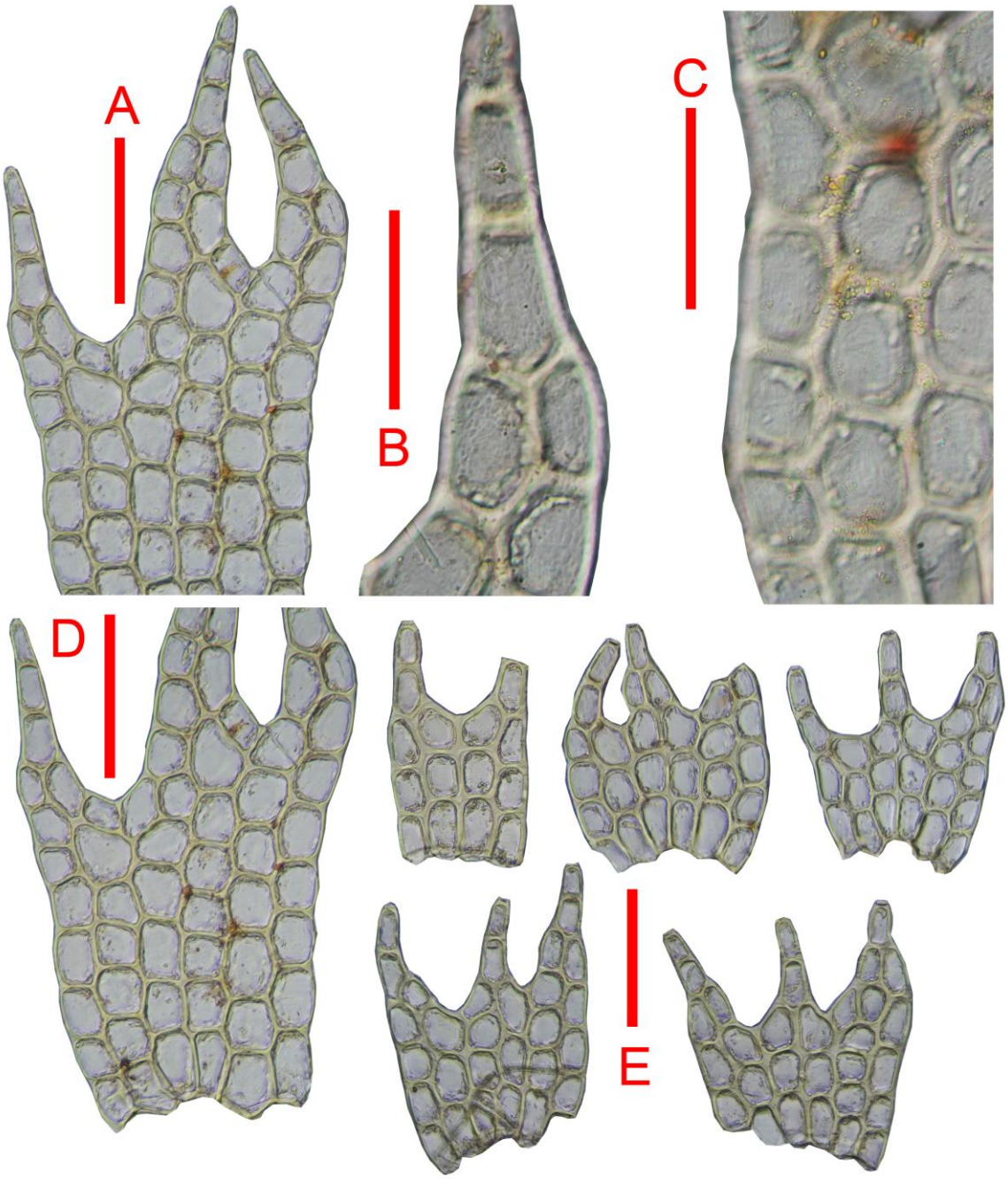

Plate 183: *Neolepidozia palawanensis*: A, B – Branch leaf lobes, C, D – Branch leaf disc, E – Branch underleaves; Scales: A, D, E – 0.1 mm; B, C – 50 µm (from OLSEN 2165b, JE – holotype)

Neolepidozia panayensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

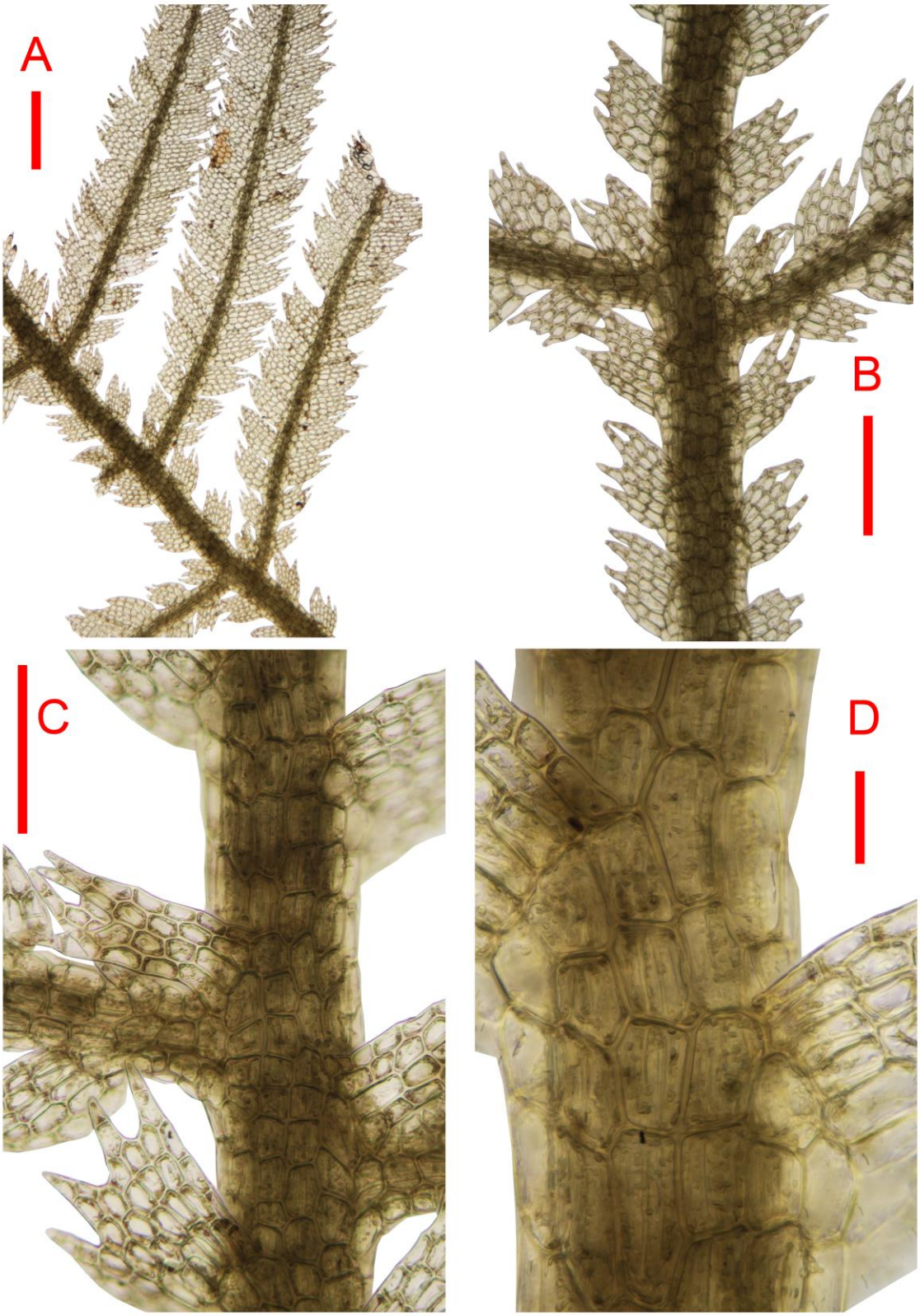

Plate 184: *Neolepidozia panayensis*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHWARZ 7180)

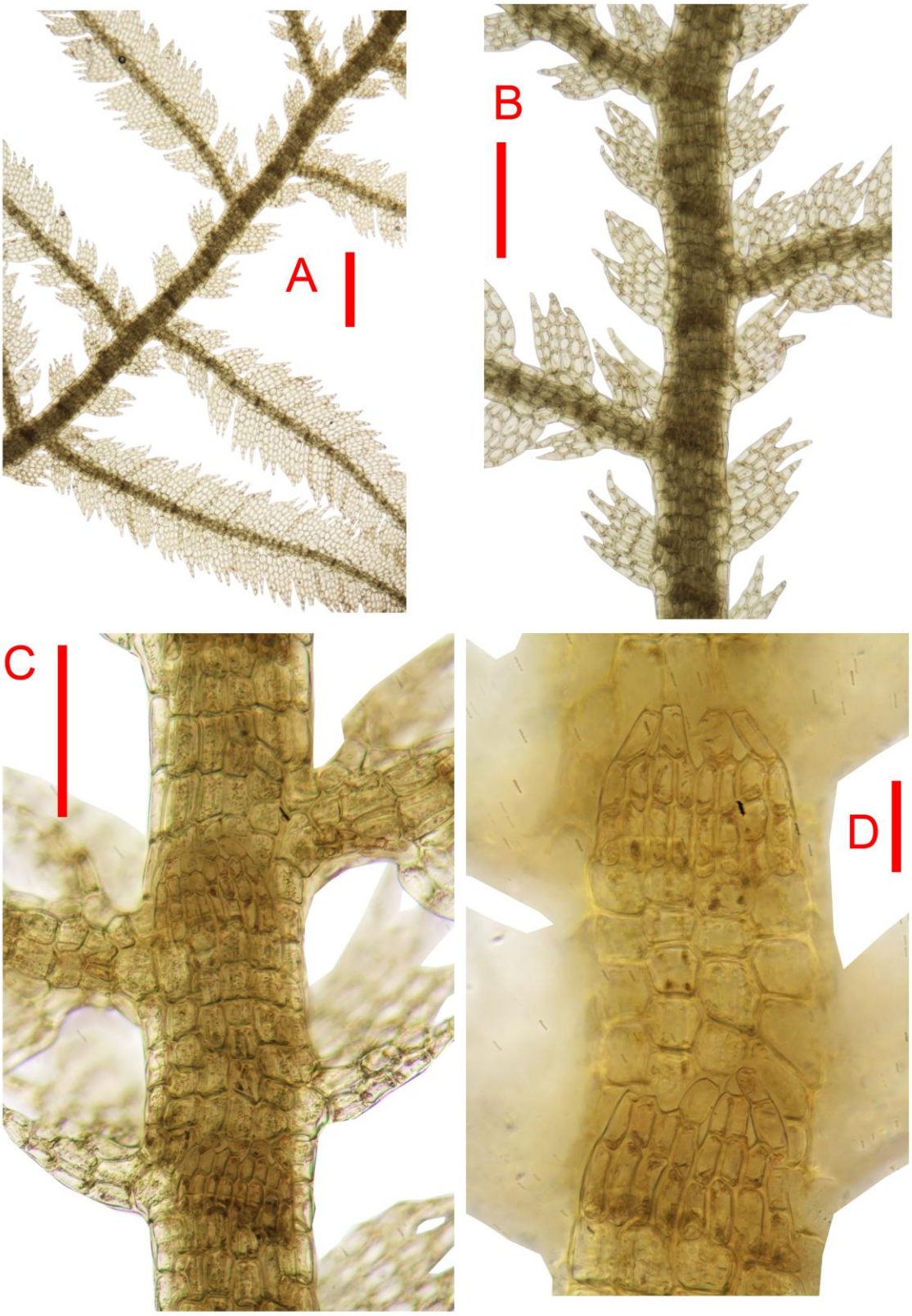

Plate 185: *Neolepidozia panayensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHWARZ 7180)

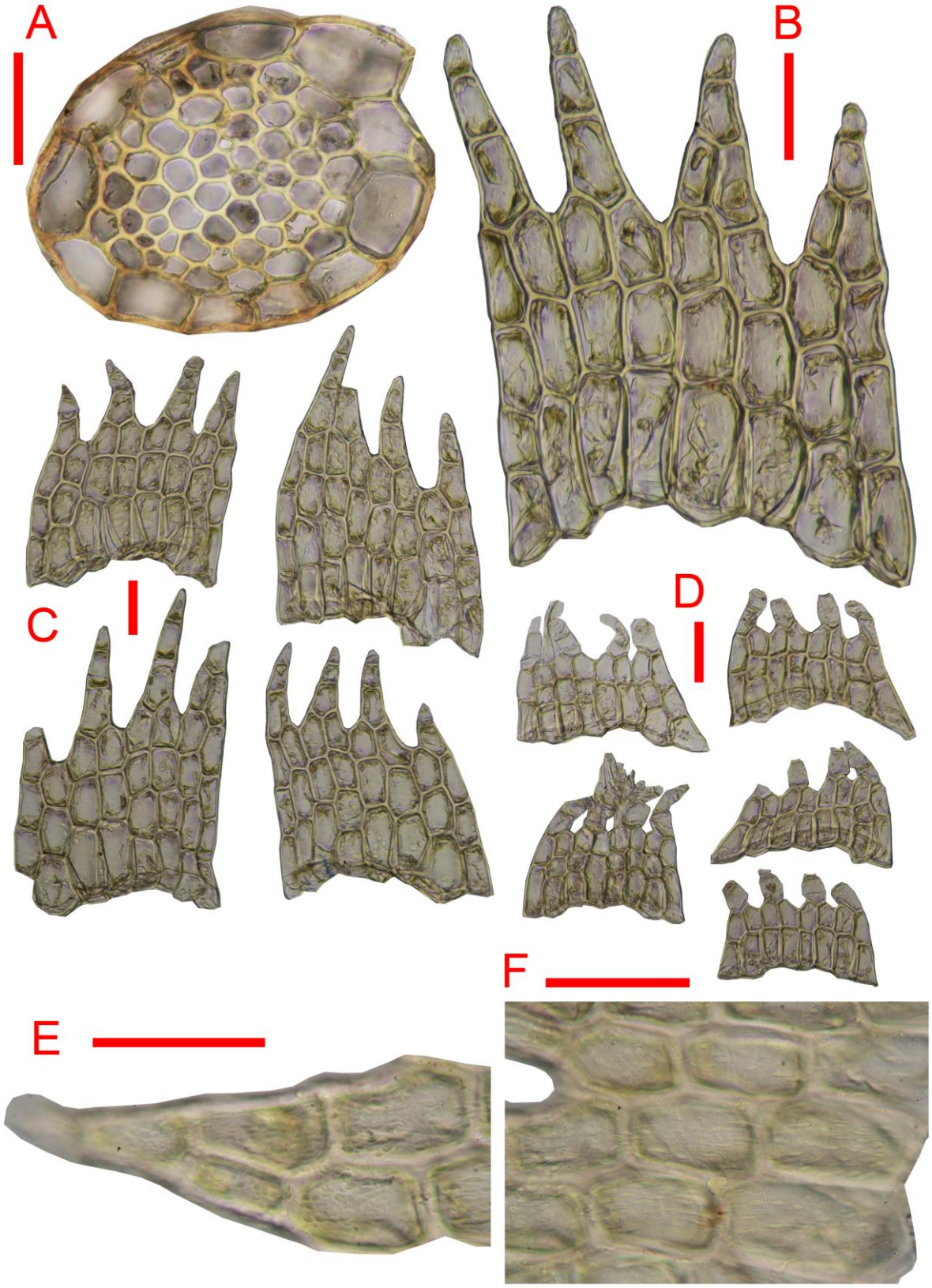

Plate 186: *Neolepidozia panayensis*: A – Stem cross section, B, C – Stem leaves, D – Stem underleaves, E – Stem leaf lobe apex, F – Stem leaf disc; Scales: A, B, C, D, E, F – 50 µm (from SCHWARZ 7180 – holotype)

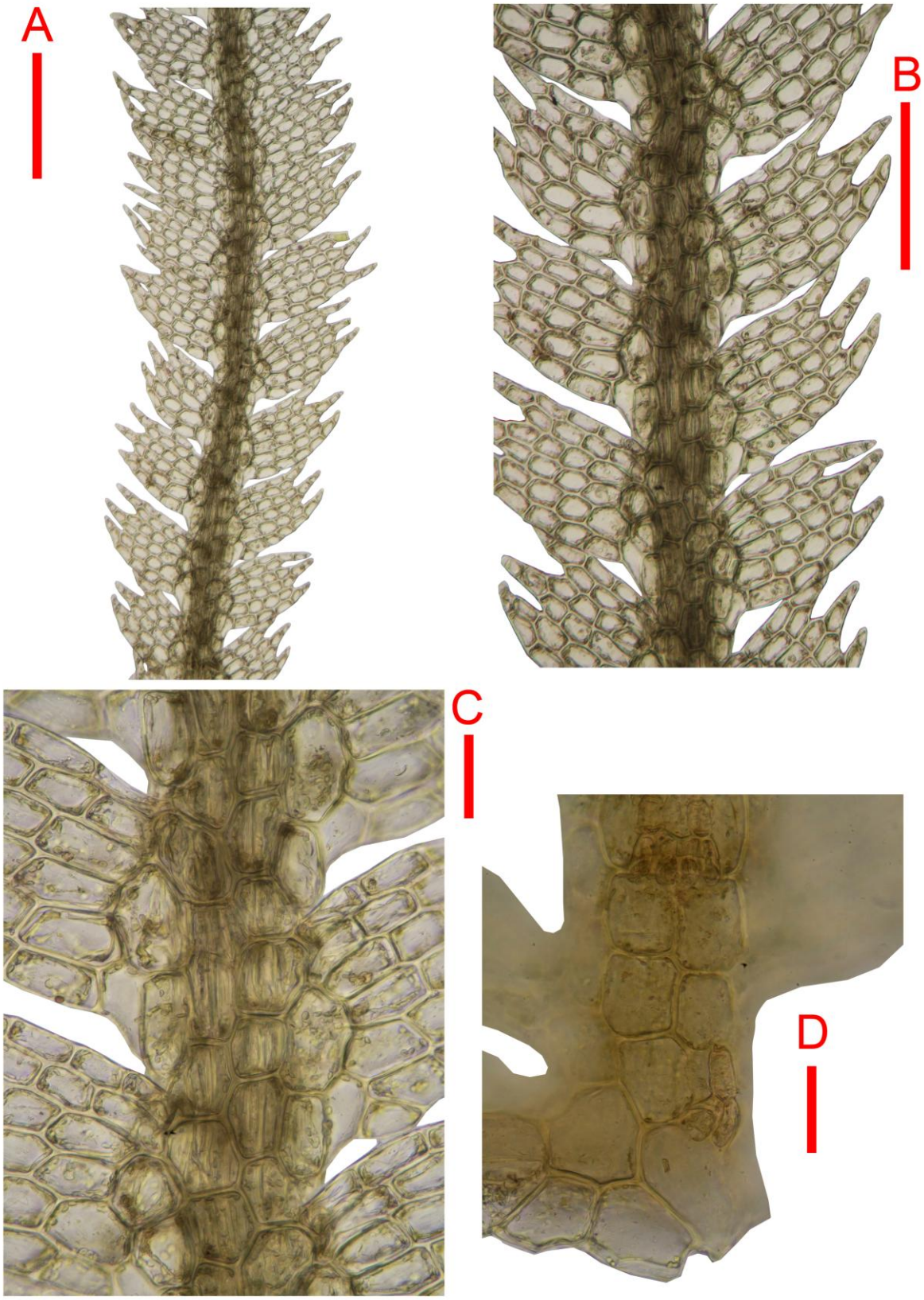

Plate 187: *Neolepidozia panayensis*: A, B, C – Branch dorsal, D – Branch base with first amphigastrium; Scales: A – 0.3 mm, B – 0.2 mm, C, D – 50 µm (from SCHWARZ 7180 – holotype)

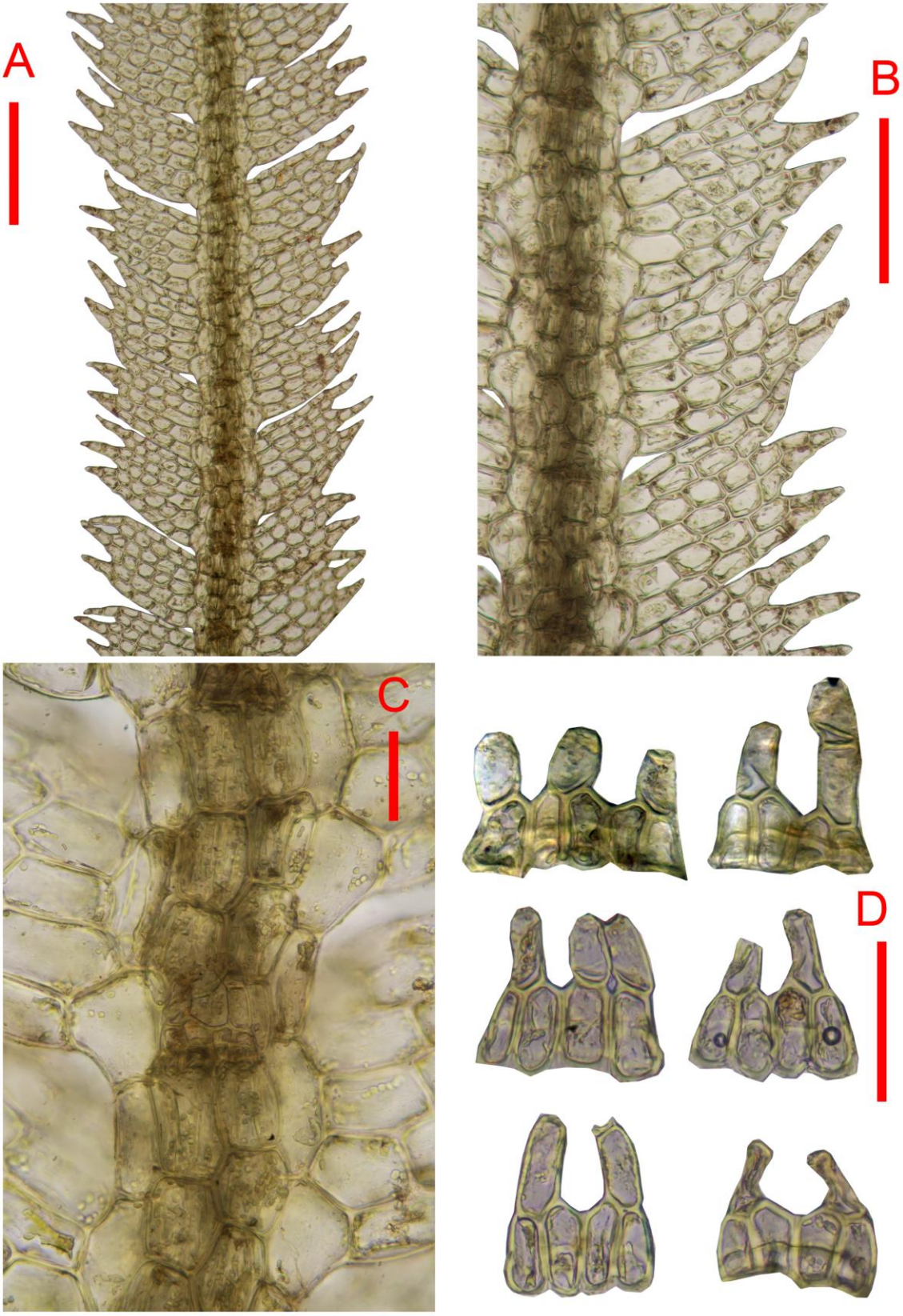

Plate 188: *Neolepidozia panayensis*: A, B, C – Branch ventral, D – Branch underleaves; Scales: A – 0.3 mm, B – 0.2 mm, C, D – 50 µm (from SCHWARZ 7180 – holotype)

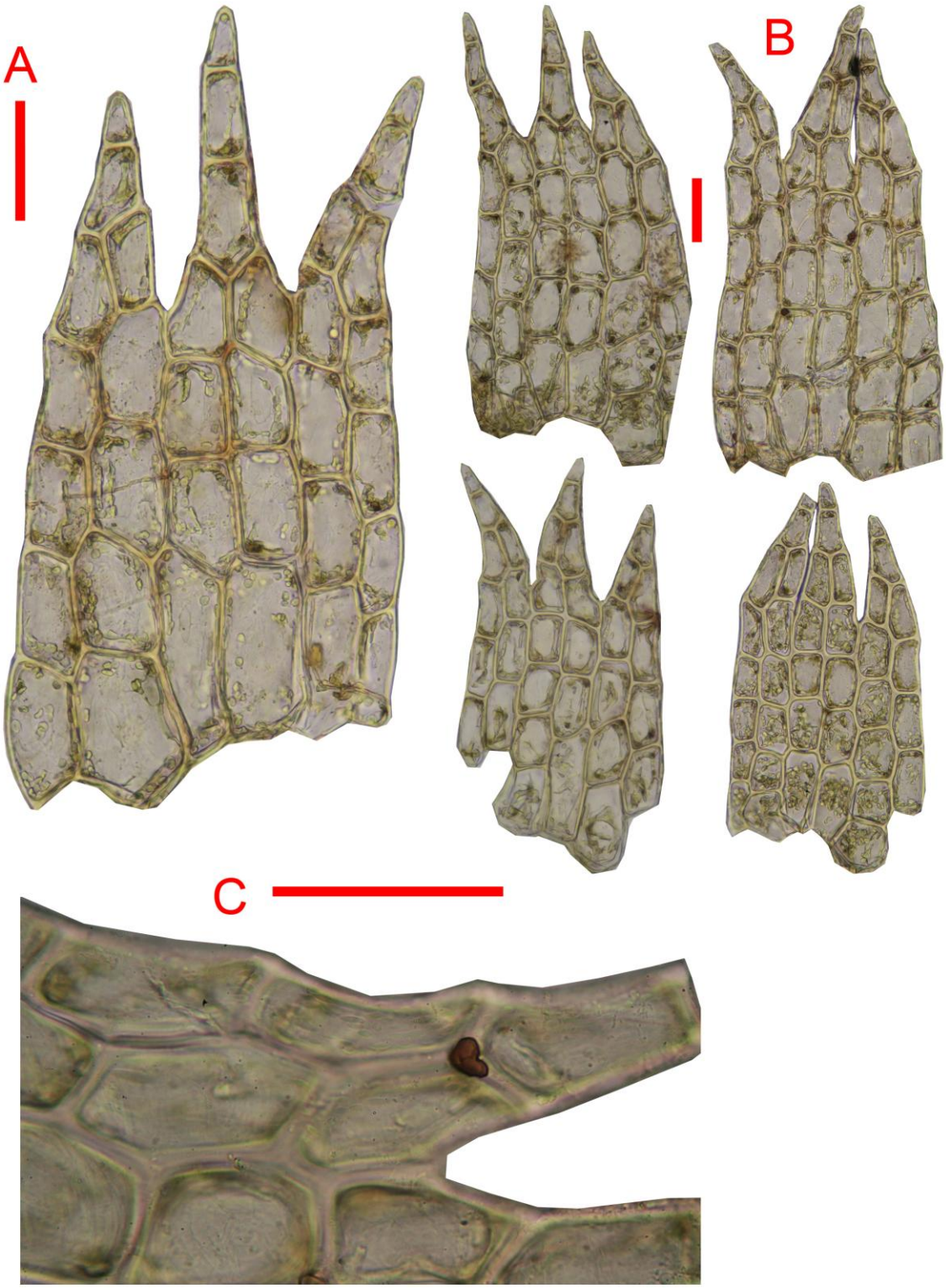

Plate 189: *Neolepidozia panayensis*: A, B – Branch leaves, C – Branch leaf lobe; Scales: A, B, C – 50 µm (from SCHWARZ 7180 – holotype)

Neolepidozia papulosa (STEPH.) FULFORD ET J. TAYLOR

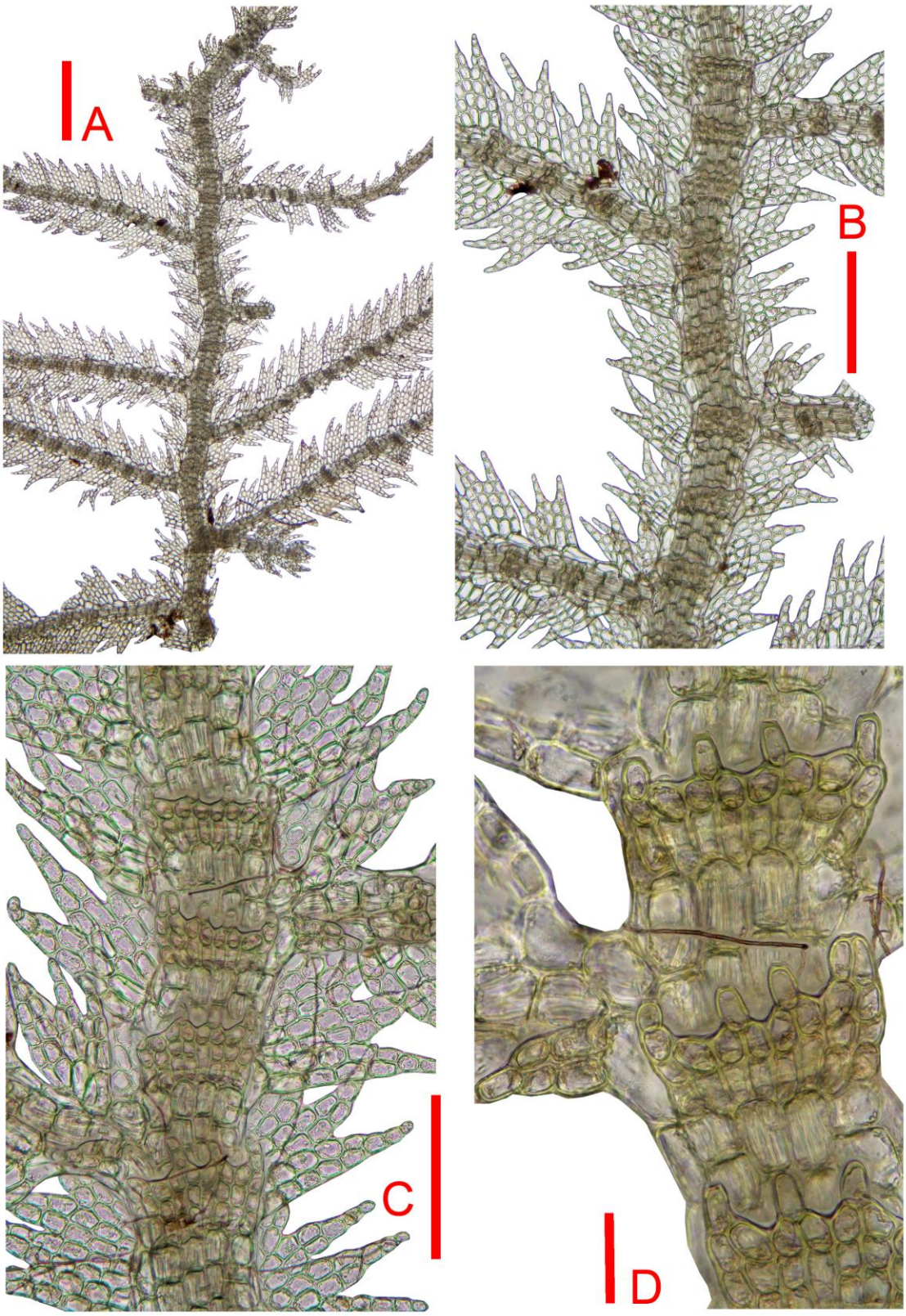

Plate 190: *Neolepidozia papulosa*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHÄFER-VERWIMP 18816b)

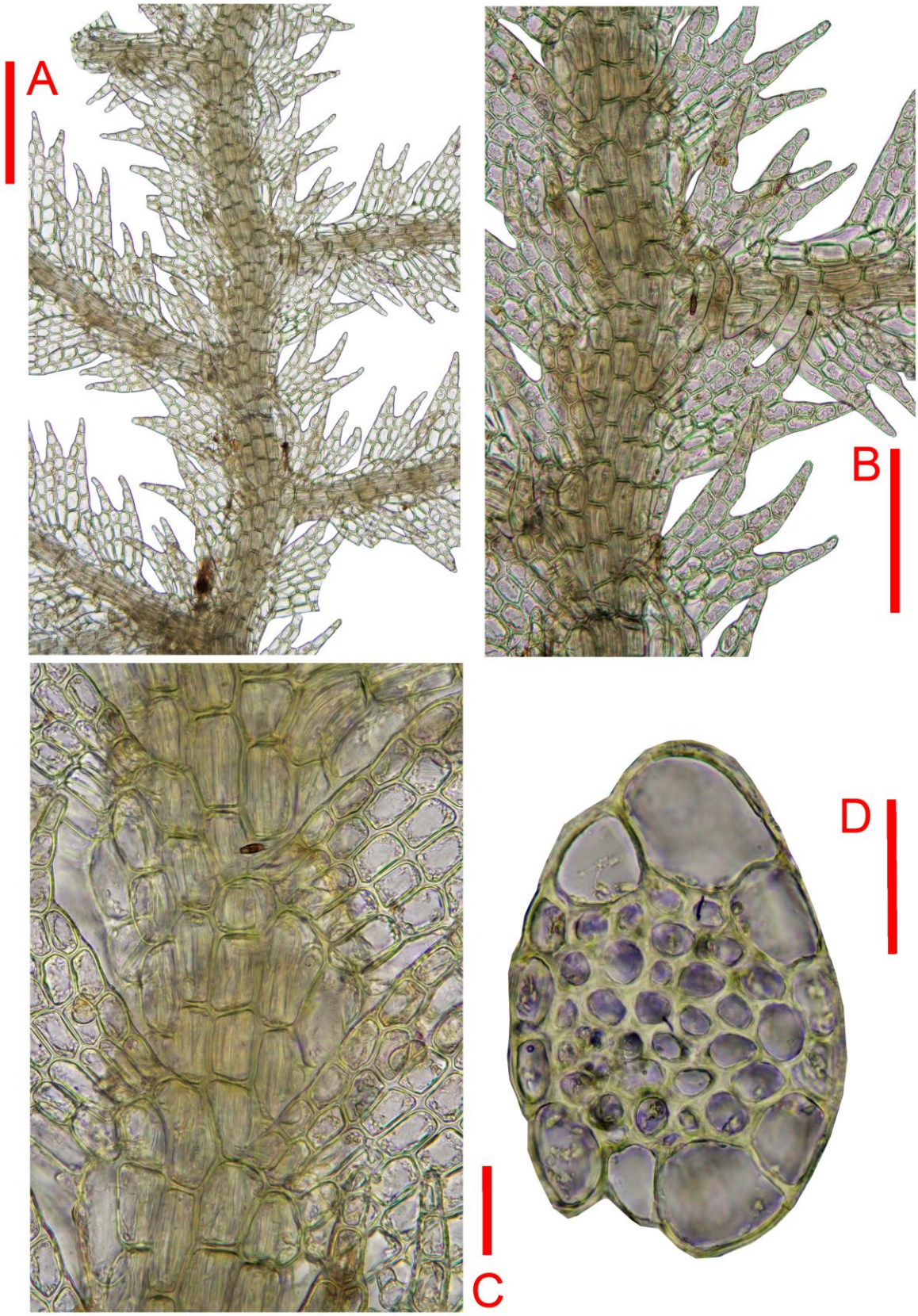

Plate 191: *Neolepidozia papulosa*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SCHÄFER-VERWIMP 18816b)

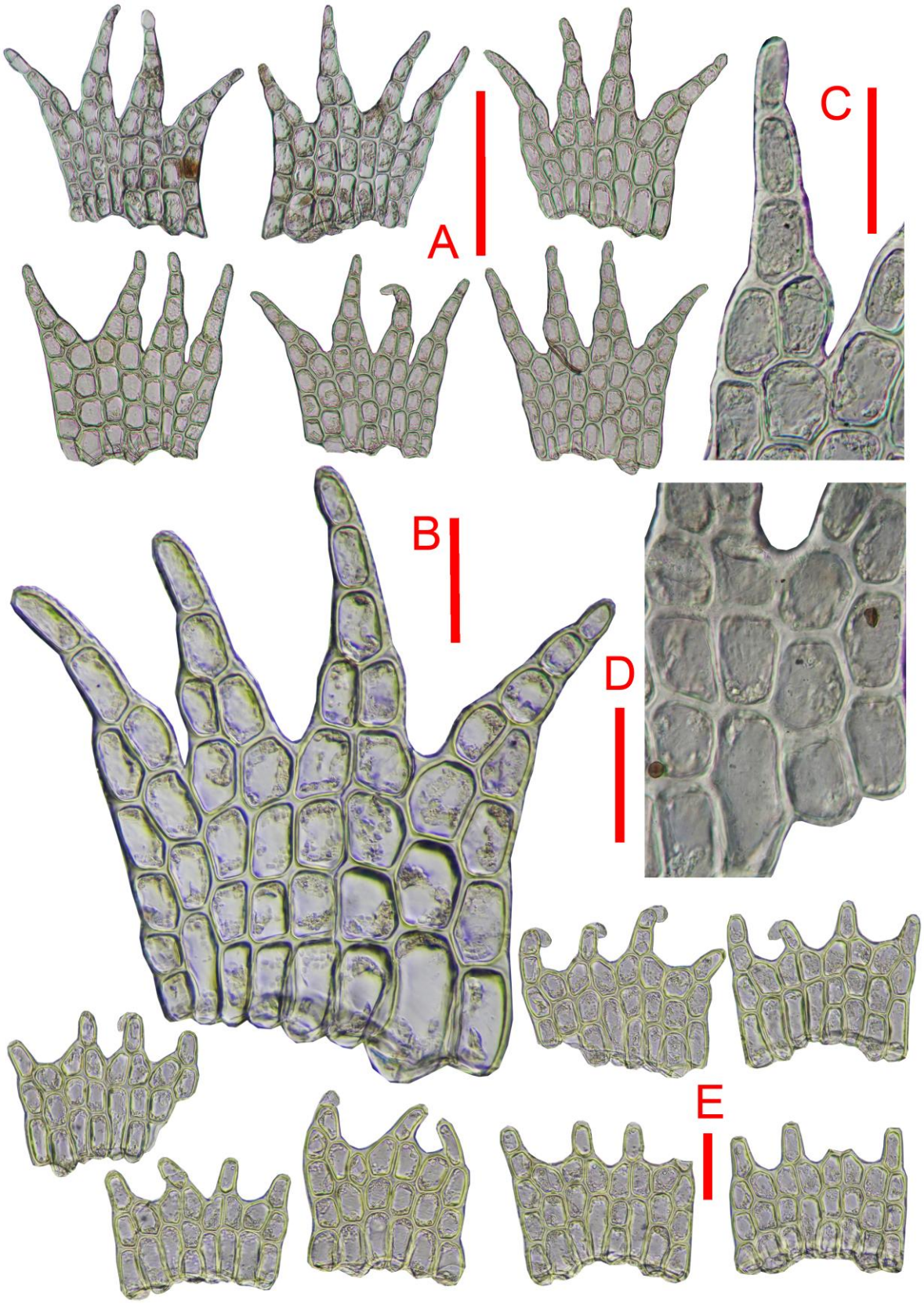

Plate 192: *Neolepidozia papulosa*: A, B – Stem leaves, C – Stem leaf lobe, D – Stem leaf disc, E – Stem underleaves; Scales: A, B, C, D, E– 50 µm (from SCHÄFER-VERWIMP 18816b)

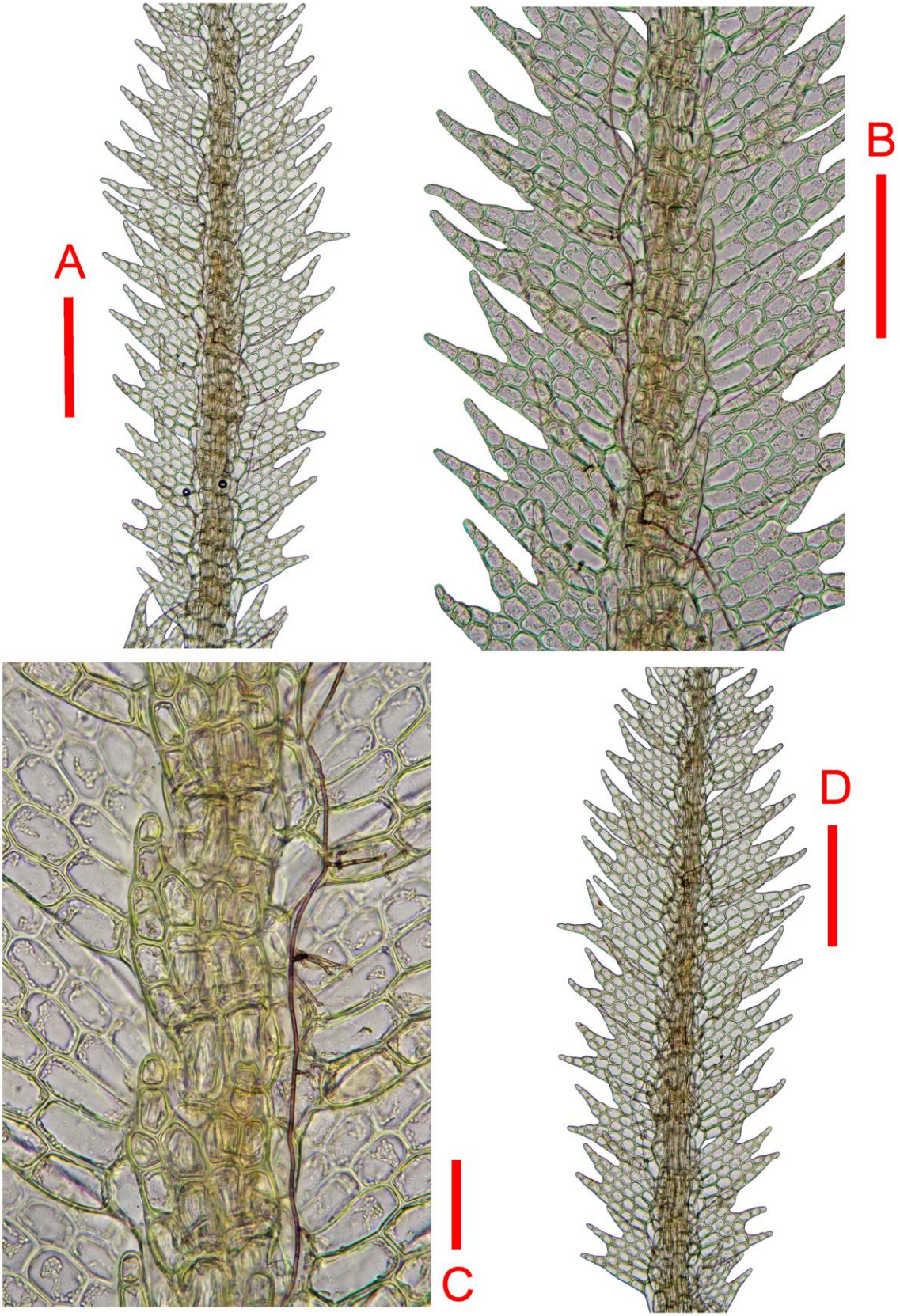

Plate 193: *Neolepidozia papulosa*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm, B – 0.2 mm, C – 50 µm (from SCHÄFER-VERWIMP 18816b)

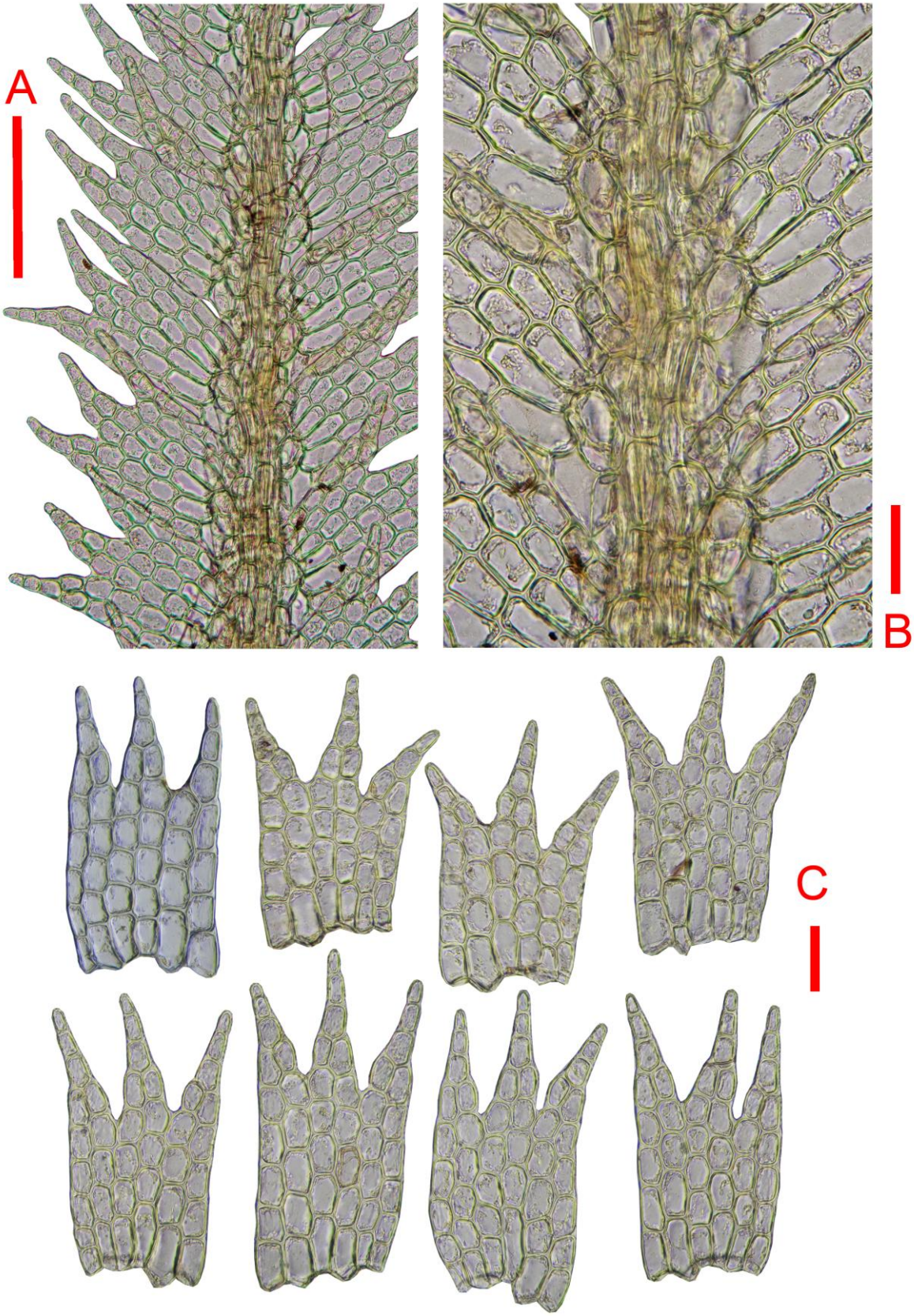

Plate 194: *Neolepidozia papulosa*: A, B – Branch dorsal, C – Branch leaves; Scales: A – 0.2 mm, B, C – 50 µm (from SCHÄFER-VERWIMP 18816b)

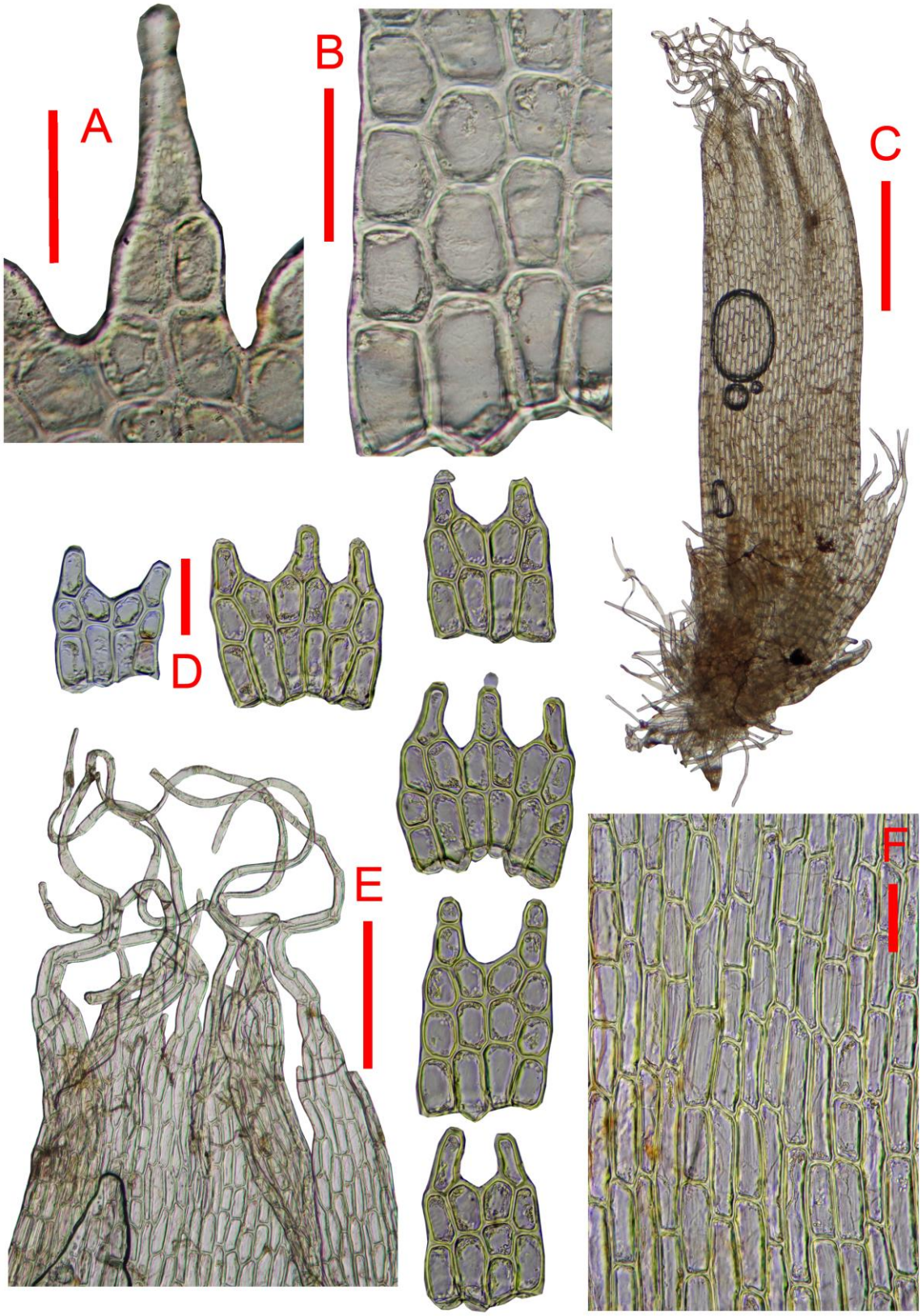

Plate 195: *Neolepidozia papulosa*: A – Branch leaf lobe, B – Branch leaf disc, C – Perianth, D – Branch underleaves, E – Perianth mouth, F – Perianth middle; Scales: C – 0.5 mm, E – 0.2 mm, A, B, D, F – 50 µm (from SCHÄFER-VERWIMP 18816b)

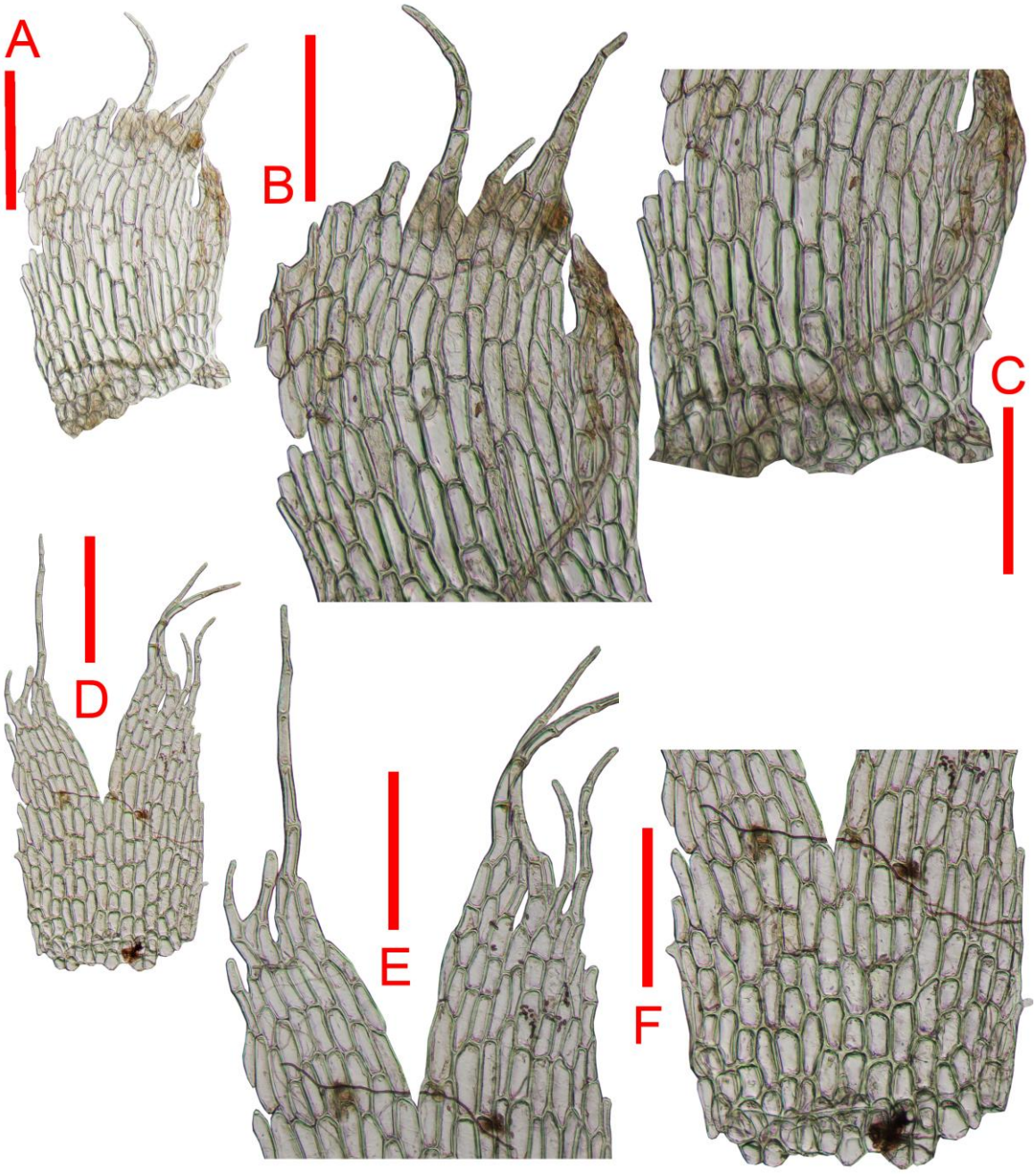

Plate 196: *Neolepidozia papulosa*: A – Female bract, B – Female bract apex, C – Female bract base, D – Female bracteole, E – Female bracteole apex, F – Female bracteole base; Scales: A, D – 0.3 mm, B, C, E, F – 0.2 mm (from SCHÄFER-VERWIMP 18816b)

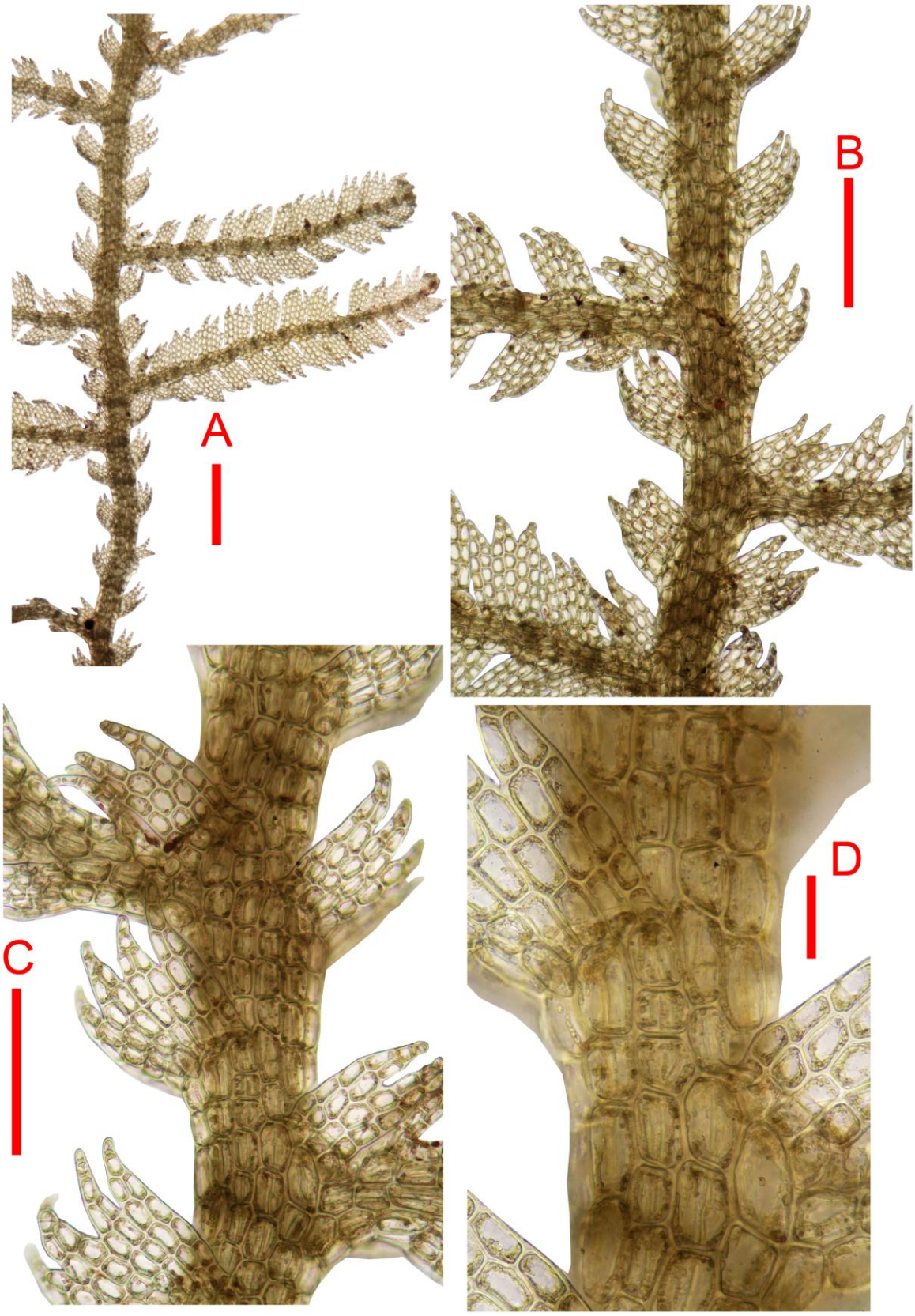

Plate 197: *Neolepidozia papulosa*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHWARZ 6199)

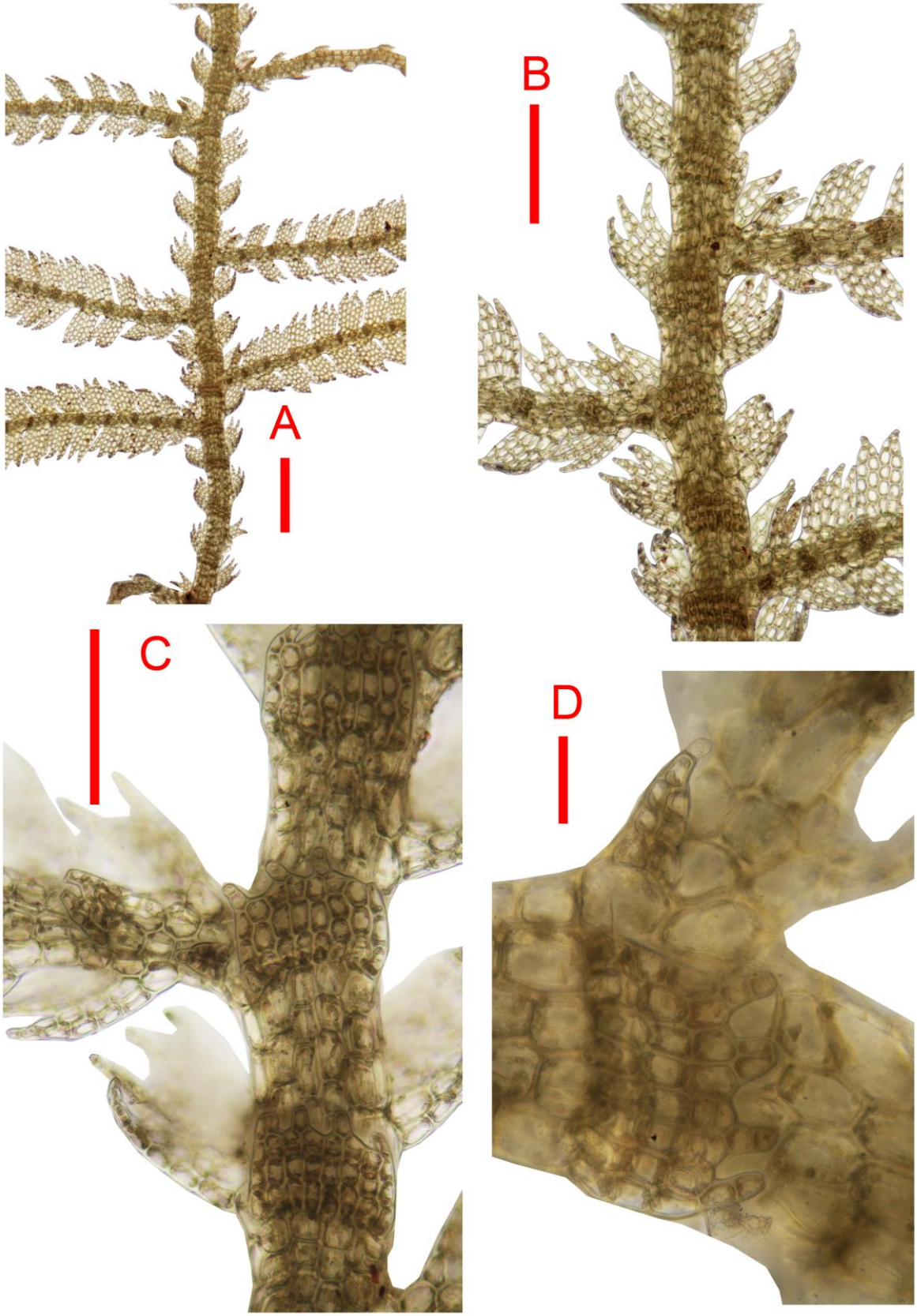

Plate 198: *Neolepidozia papulosa*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHWARZ 6199)

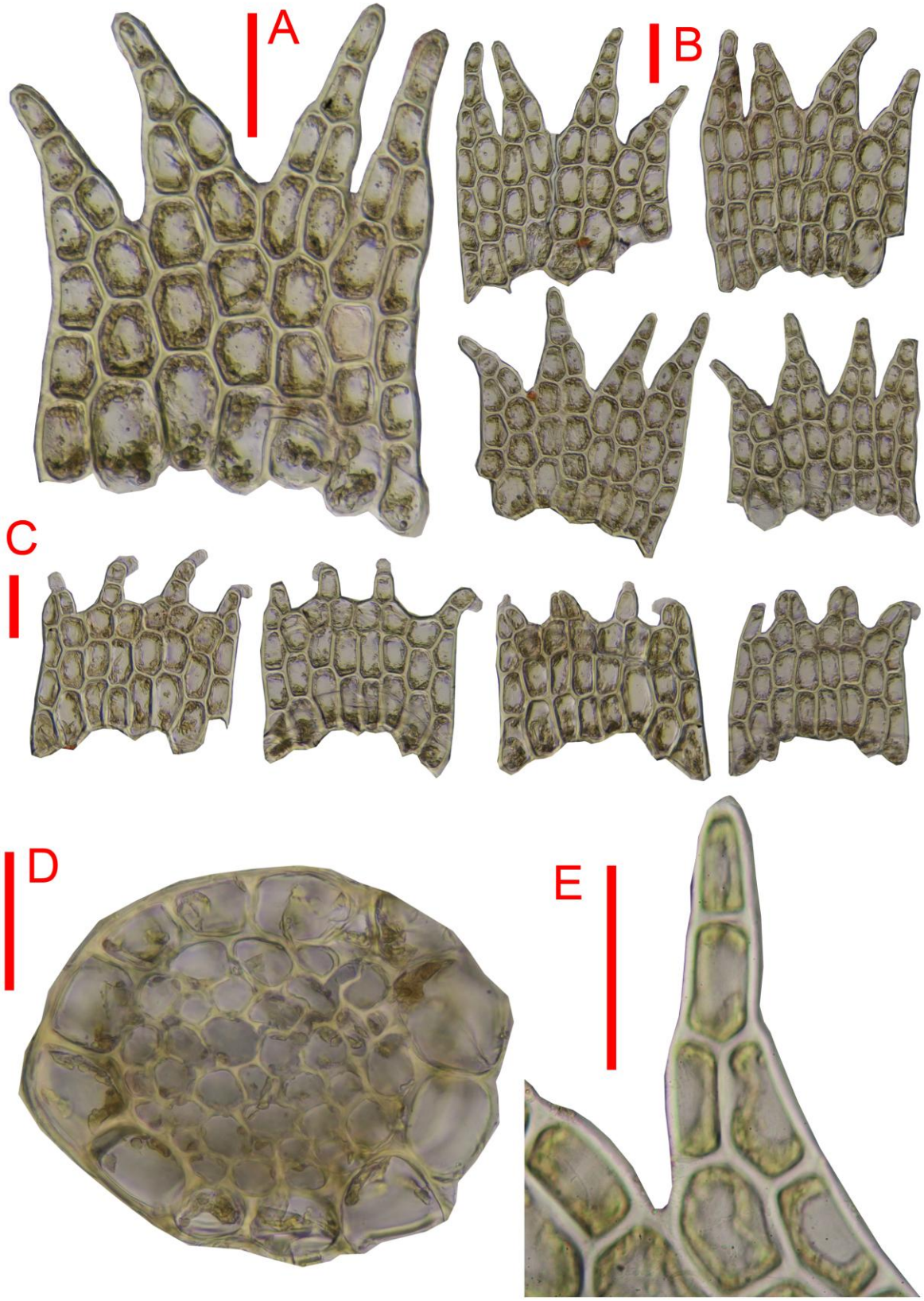

Plate 199: *Neolepidozia papulosa*: A, B – Stem leaves, C – Stem underleaves, D – Stem cross section, E – Stem leaf lobe; Scales: A, B, C, D, E – 50 µm (from SCHWARZ 6199)

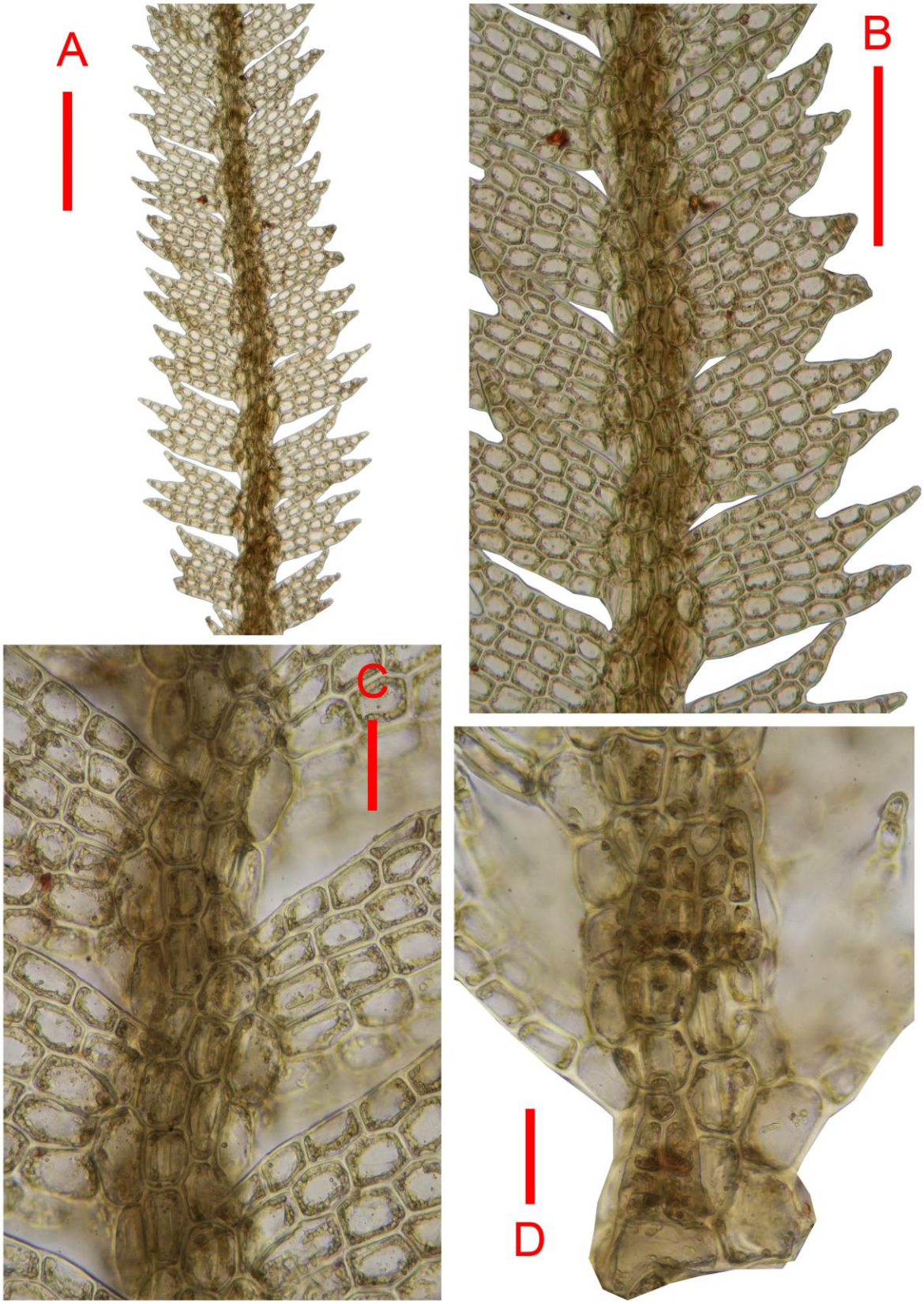

Plate 200: *Neolepidozia papulosa*: A, B, C – Branch dorsal, D – Branch base with first amphigastrium; Scales: A – 0.3 mm, B – 0.2 mm, C, D – 50 µm (from SCHWARZ 6199)

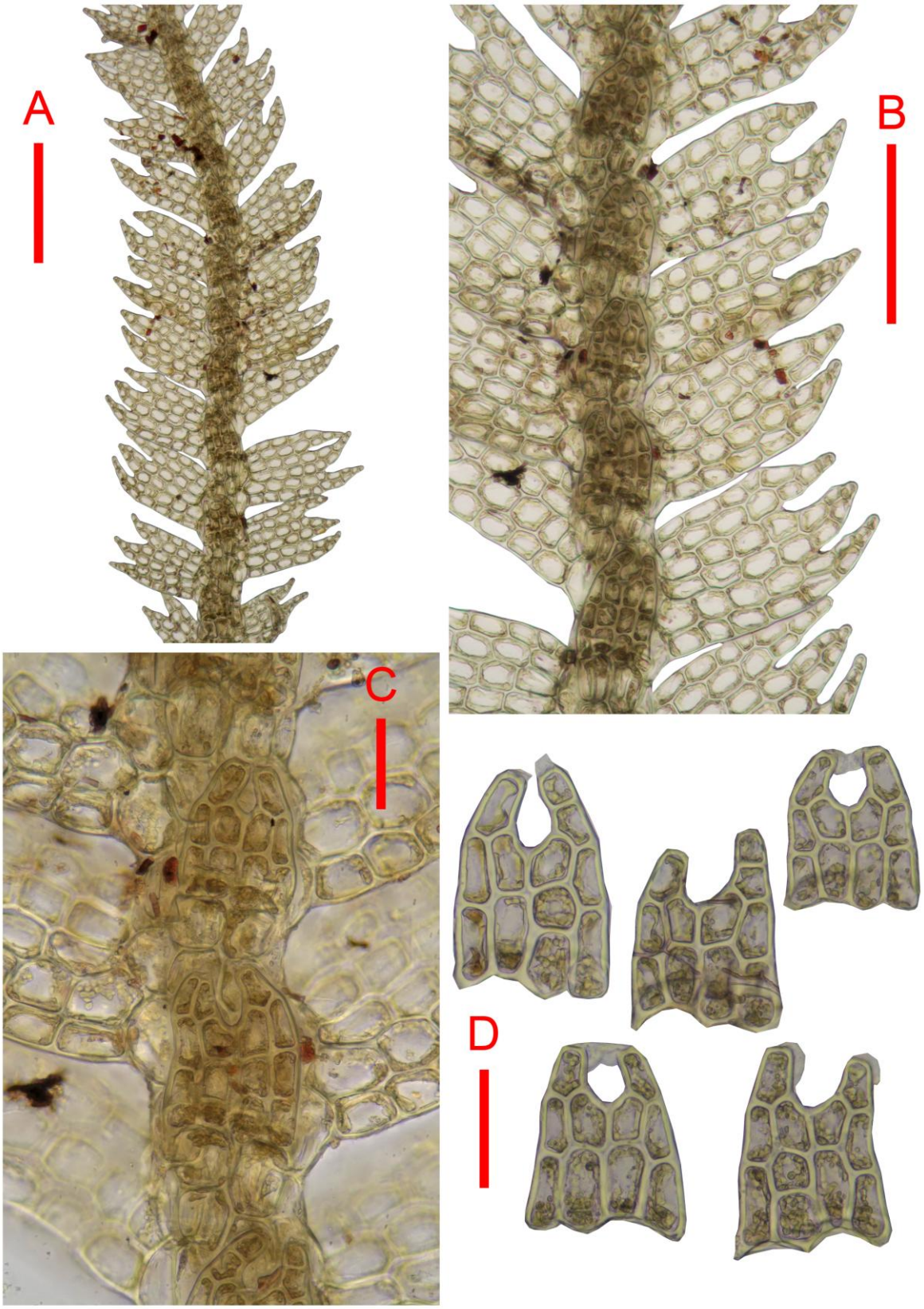

Plate 201: *Neolepidozia papulosa*: A, B, C – Branch ventral, D – Branch underleaves; Scales: A – 0.3 mm, B – 0.2 mm, C, D – 50 µm (from SCHWARZ 6199)

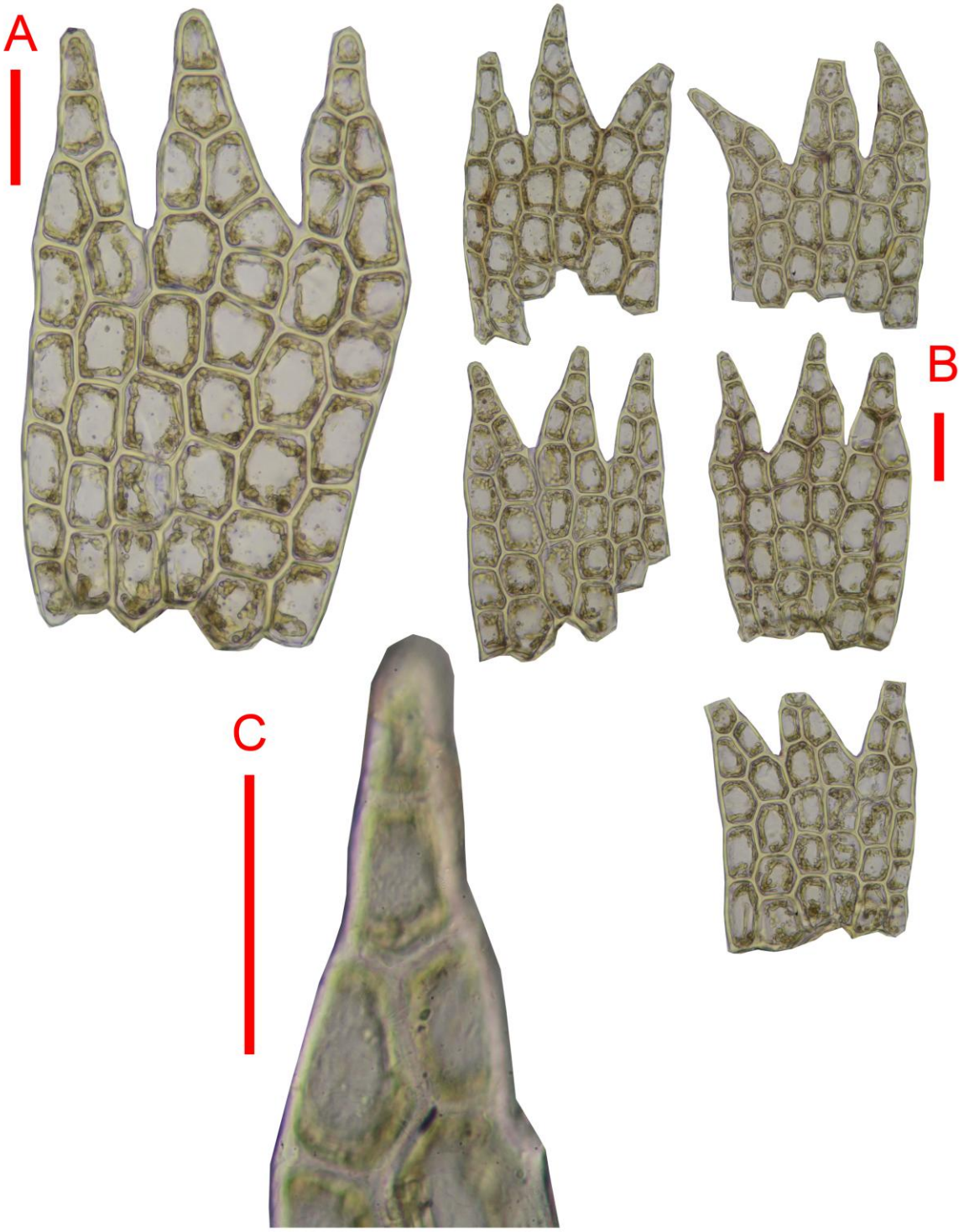

Plate 202: *Neolepidozia papulosa*: A, B – Branch leaves, C – Branch leaf lob apex; Scales: A, B, C – 50 µm (from SCHWARZ 6199)

***Neolepidozia papulosa* var. *apoensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

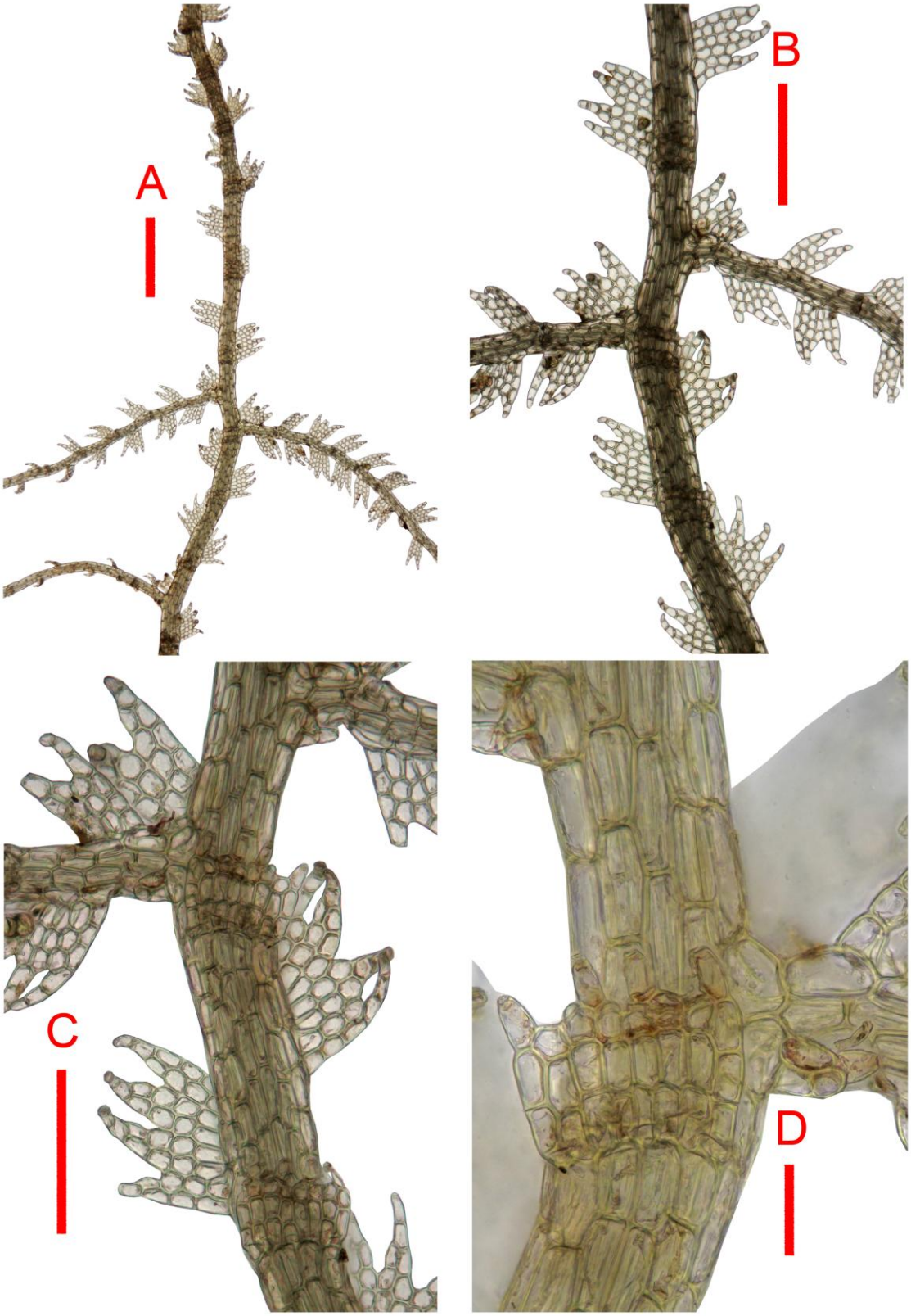

Plate 203: *Neolepidozia papulosa* var. *apoensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHWARZ 4684 – holotype)

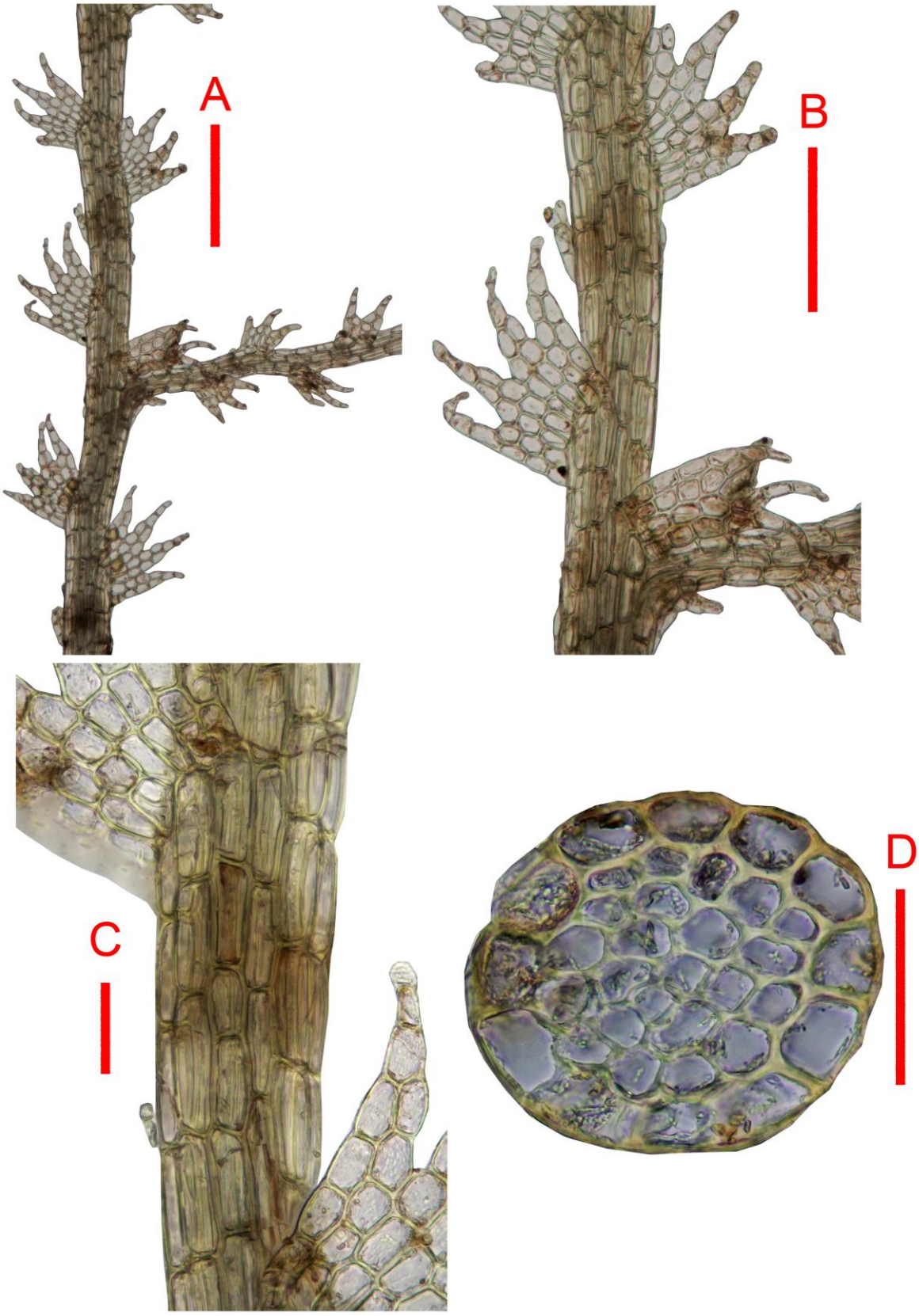

Plate 204: *Neolepidozia papulosa* var. *apoensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SCHWARZ 4684 – holotype)

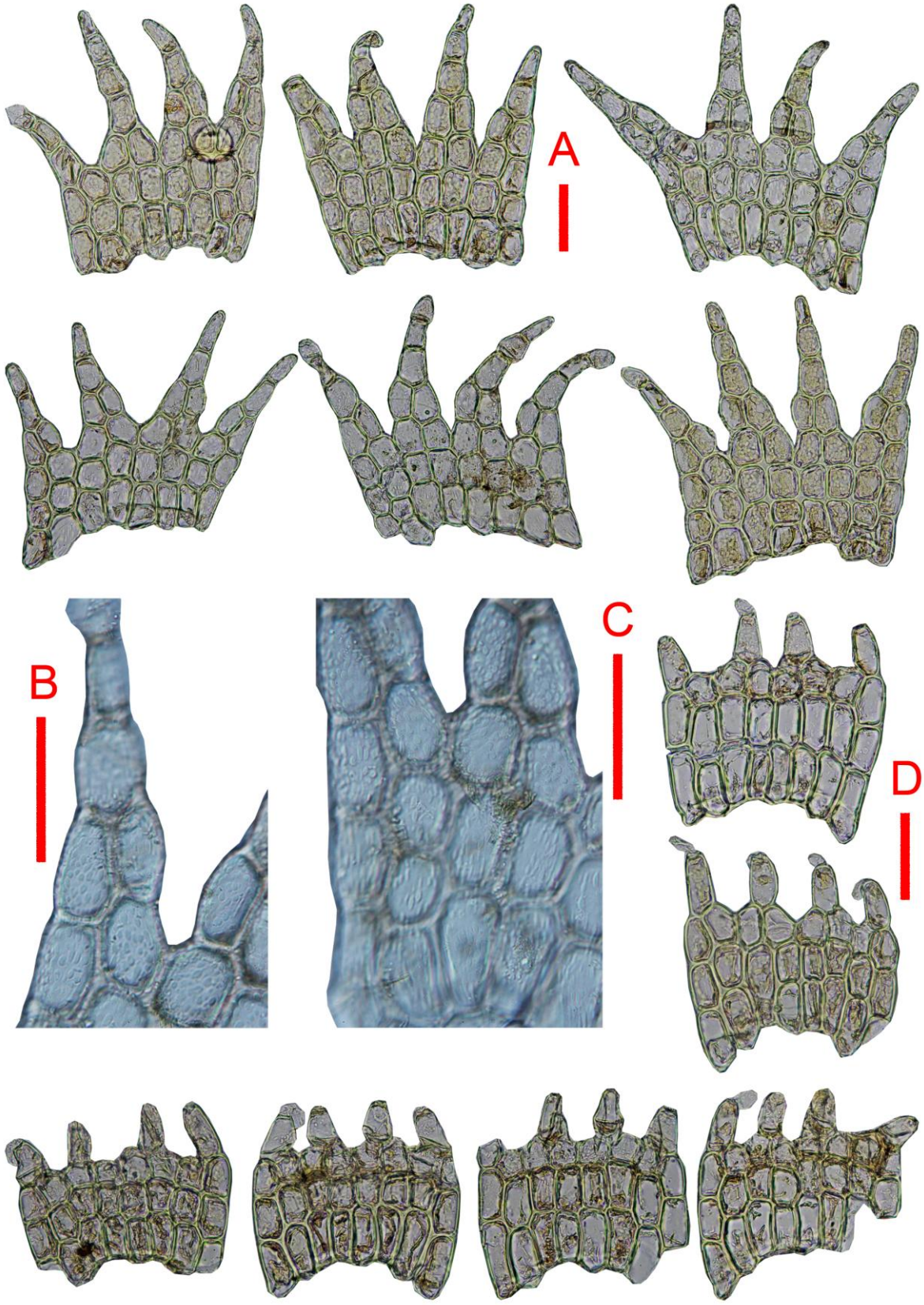

Plate 205: *Neolepidozia papulosa* var. *apoensis*: A – Stem leaf, B – Stem leaf disc, C – Stem leaf lobe, D – Stem underleaves; Scales: A, B, C, D – 50 µm (from SCHWARZ 4684 – holotype)

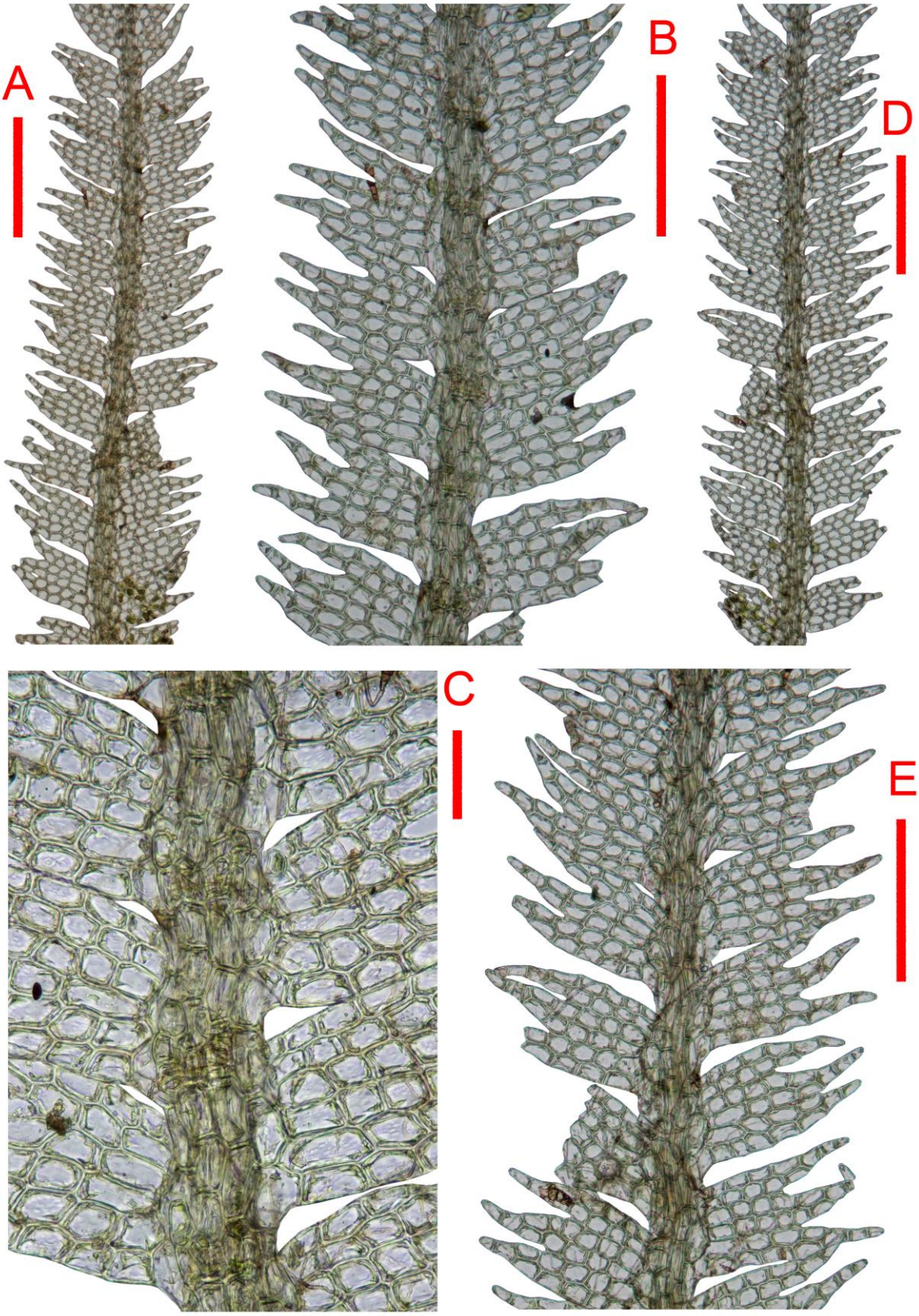

Plate 206: *Neolepidozia papulosa* var. *apoensis*: A, B, C – Branch ventral, D, E – Branch dorsal; Scales: A, D – 0.3 mm; B, E – 0.2 mm; C – 50 µm (from SCHWARZ 4684 – holotype)

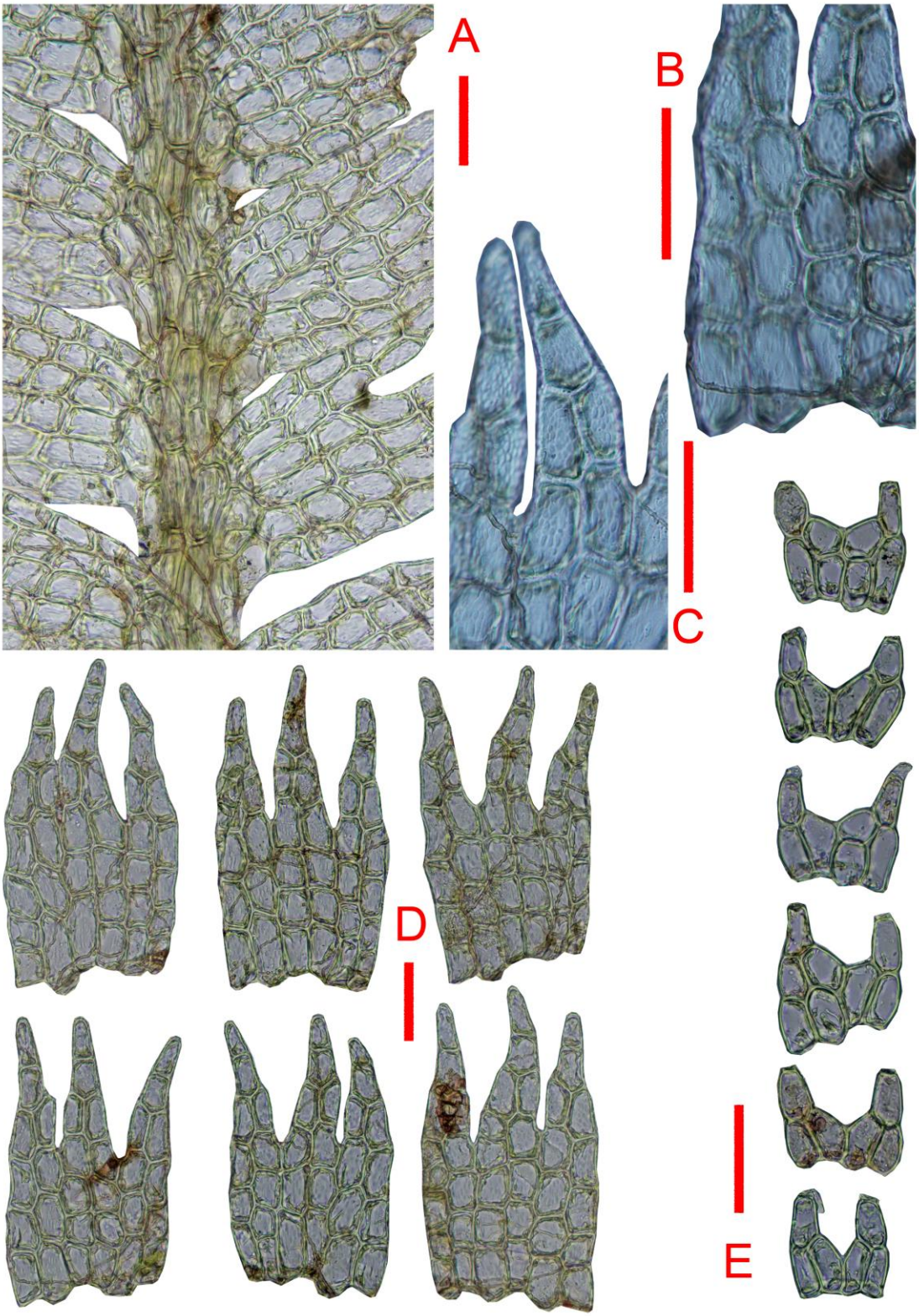

Plate 207: *Neolepidozia papulosa* var. *apoensis*: A – Branch dorsal, B – Branch leaf disc, C – Branch leaf lobe, D – Branch leaves, E – Branch underleaves; Scales: A, B, C, D, E – 50 µm (from SCHWARZ 4684 – holotype)

***Neolepidozia papulosa* var. *kalatunganensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

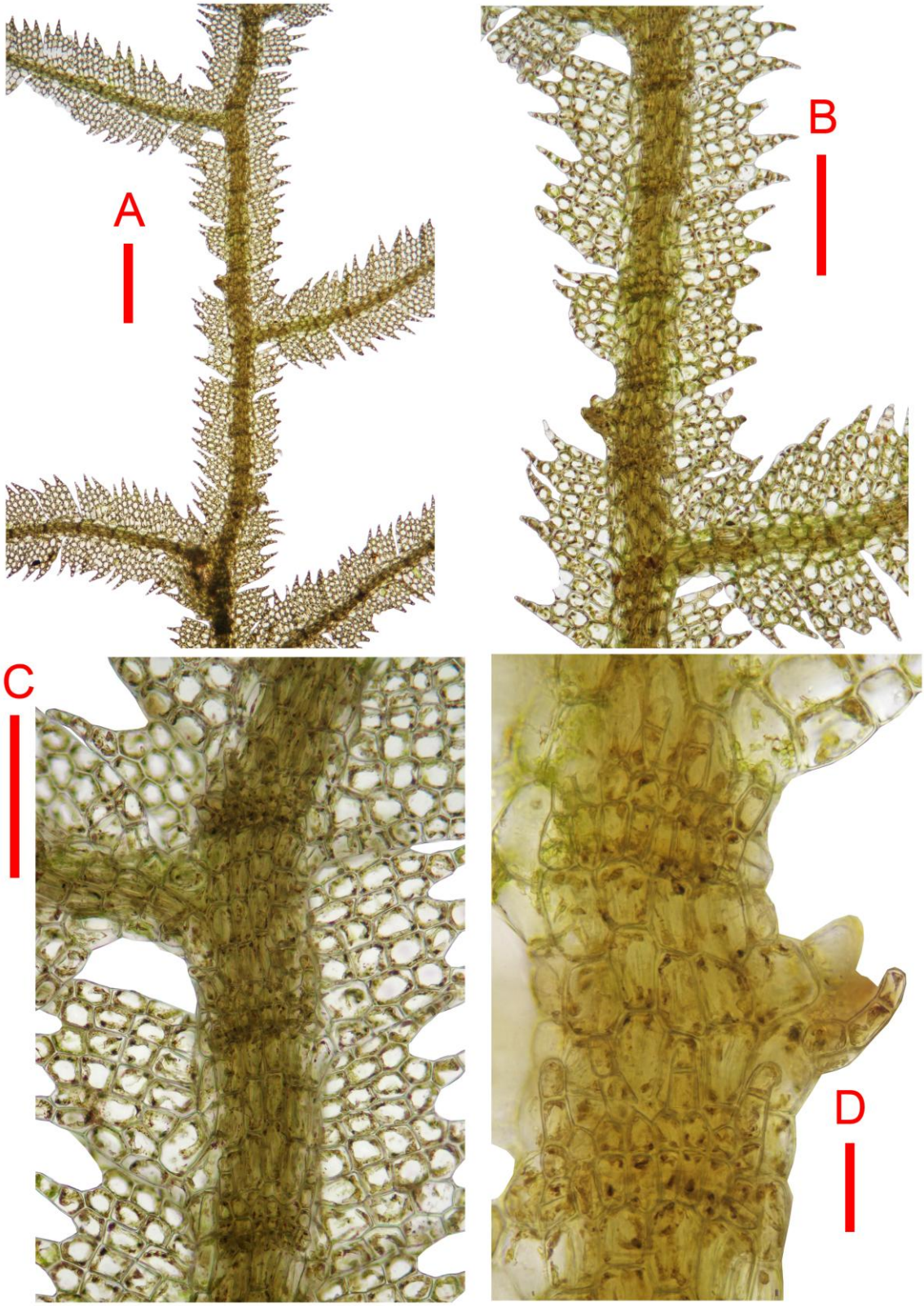

Plate 208: *Neolepidozia papulosa* var. *kalatunganensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SHEVOCK 61990 – holotype)

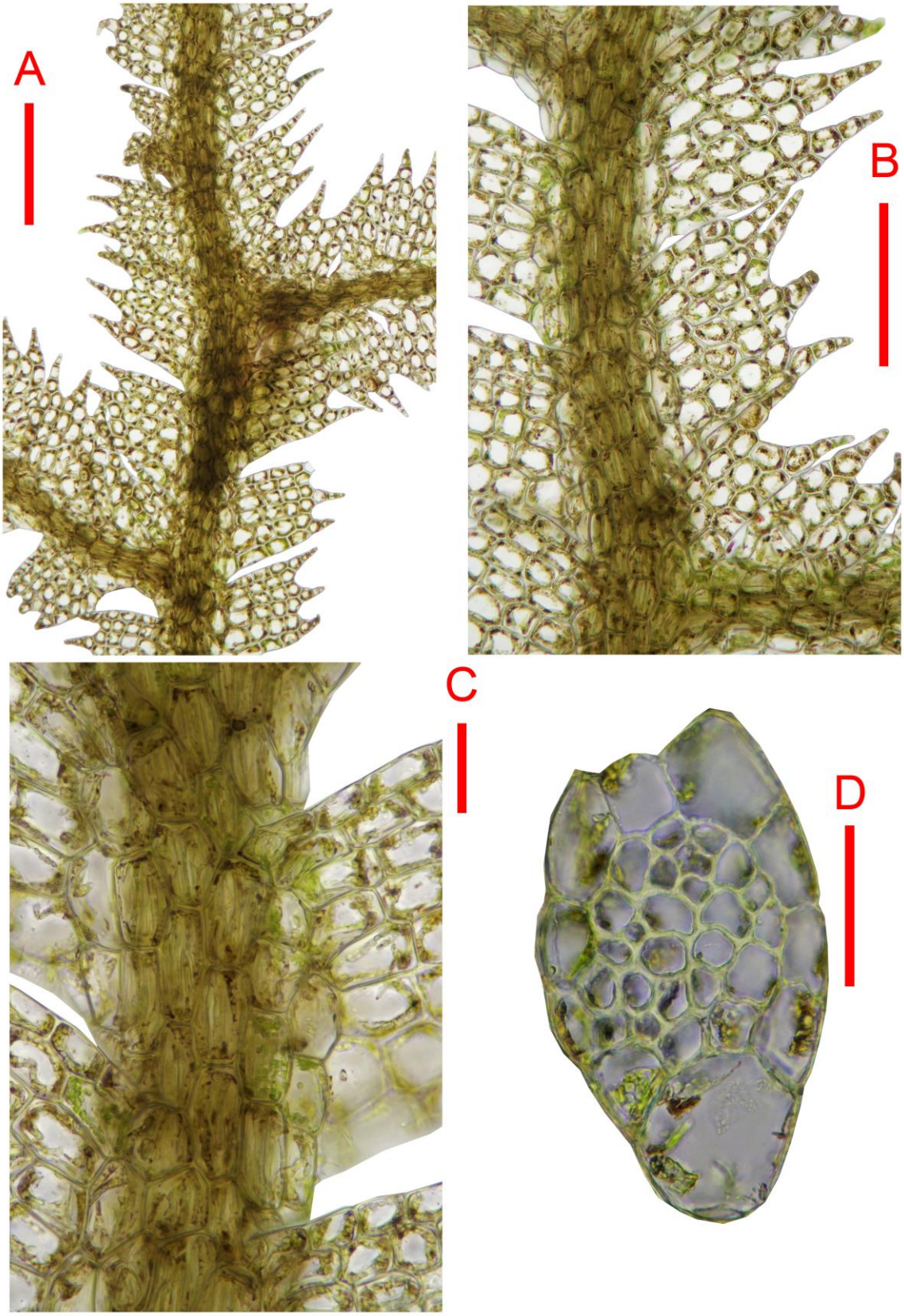

Plate 209: *Neolepidozia papulosa* var. *kalatunganensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SHEVOCK 61990 – holotype)

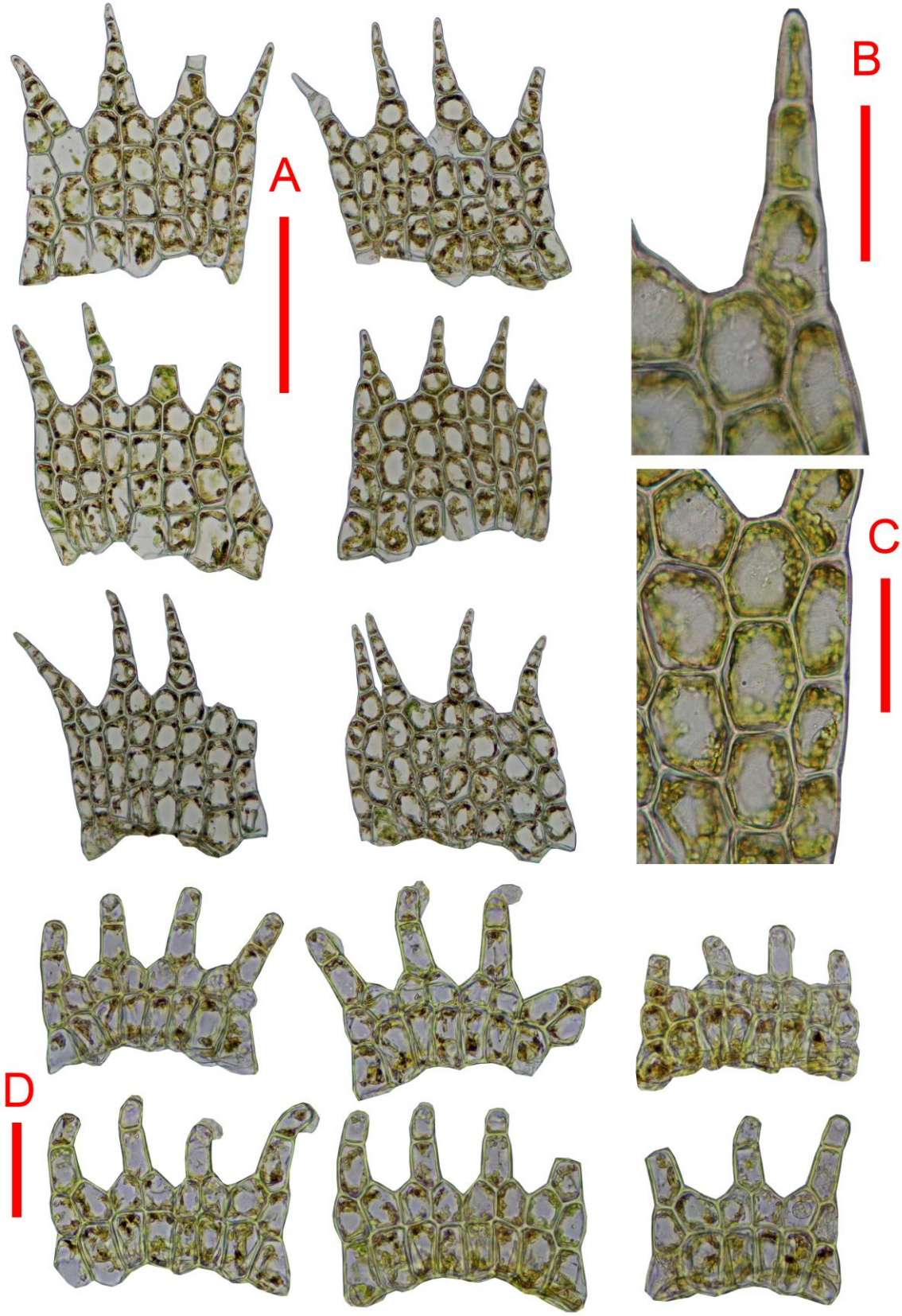

Plate 210: *Neolepidozia papulosa* var. *kalatunganensis*: A – Stem leaves, B – Stem leaf lobe, C – Stem leaf disc, D – Stem underleaves; Scales: A – 0.2 mm; B, C, D – 50 µm (from SHEVOCK 61990 – holotype)

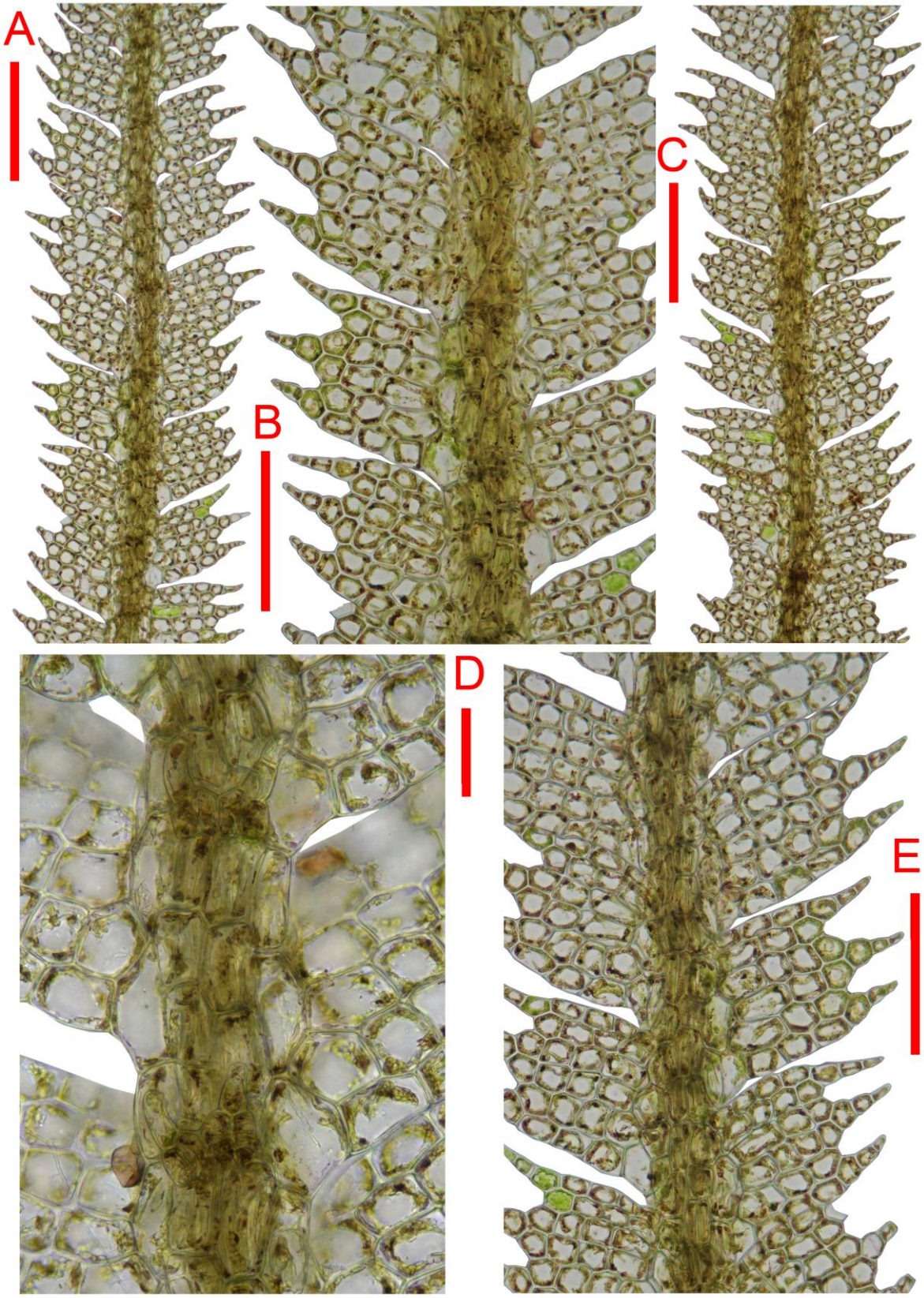

Plate 211: *Neolepidozia papulosa* var. *kalatunganensis*: A, B, D – Branch ventral, C, E – Branch dorsal; Scales: A, C – 0.3 mm; C, E – 0.2 mm; D – 50 µm (from SHEVOCK 61990 – holotype)

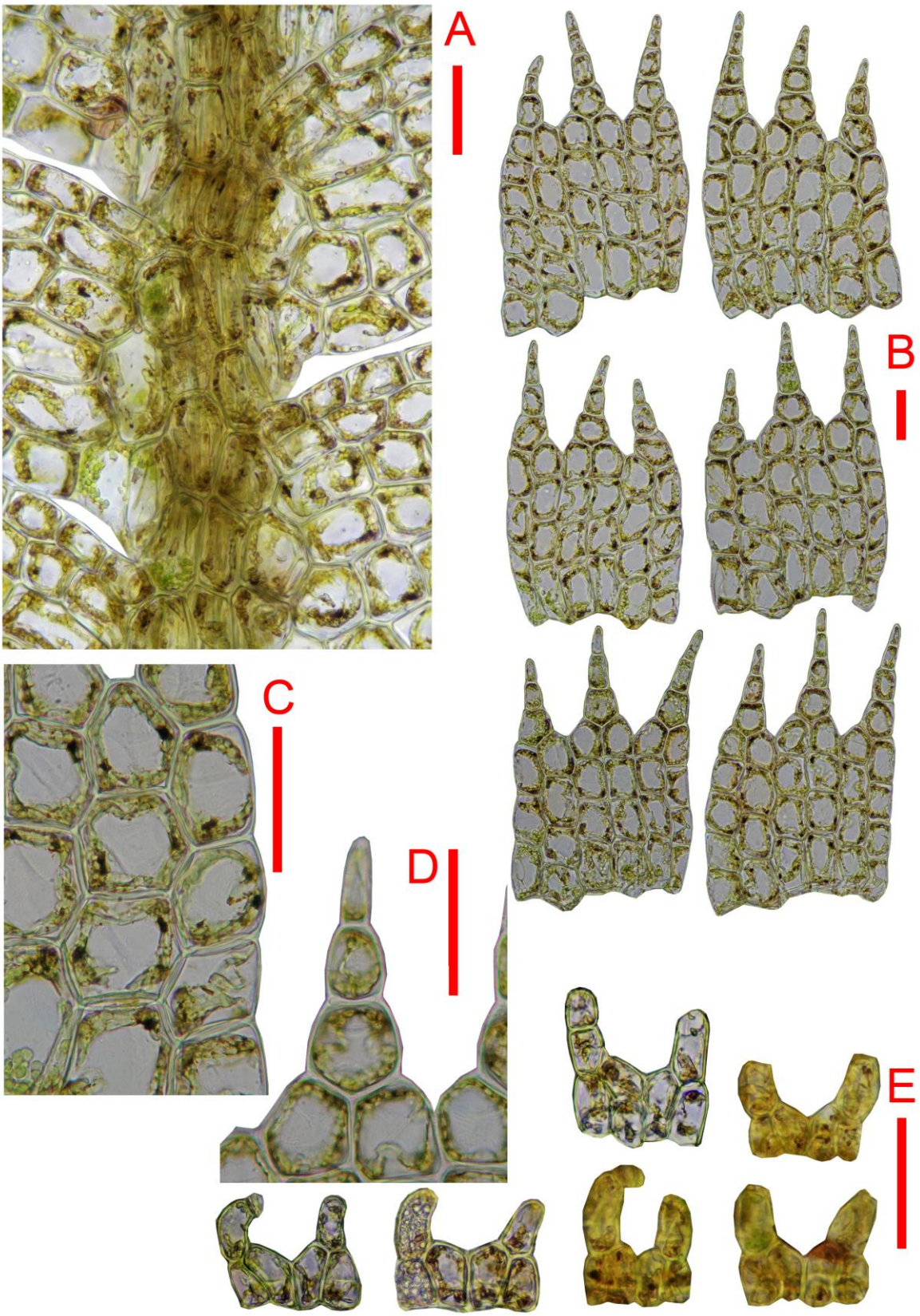

Plate 212: *Neolepidozia papulosa* var. *kalatunganensis*: A – Branch dorsal, B – Branch leaves, C – Branch leaf disc, D – Branch leaf lobe, E – Branch underleaves; Scales: A, B, C, D, E – 50 µm (from SHEVOCK 61990 – holotype)

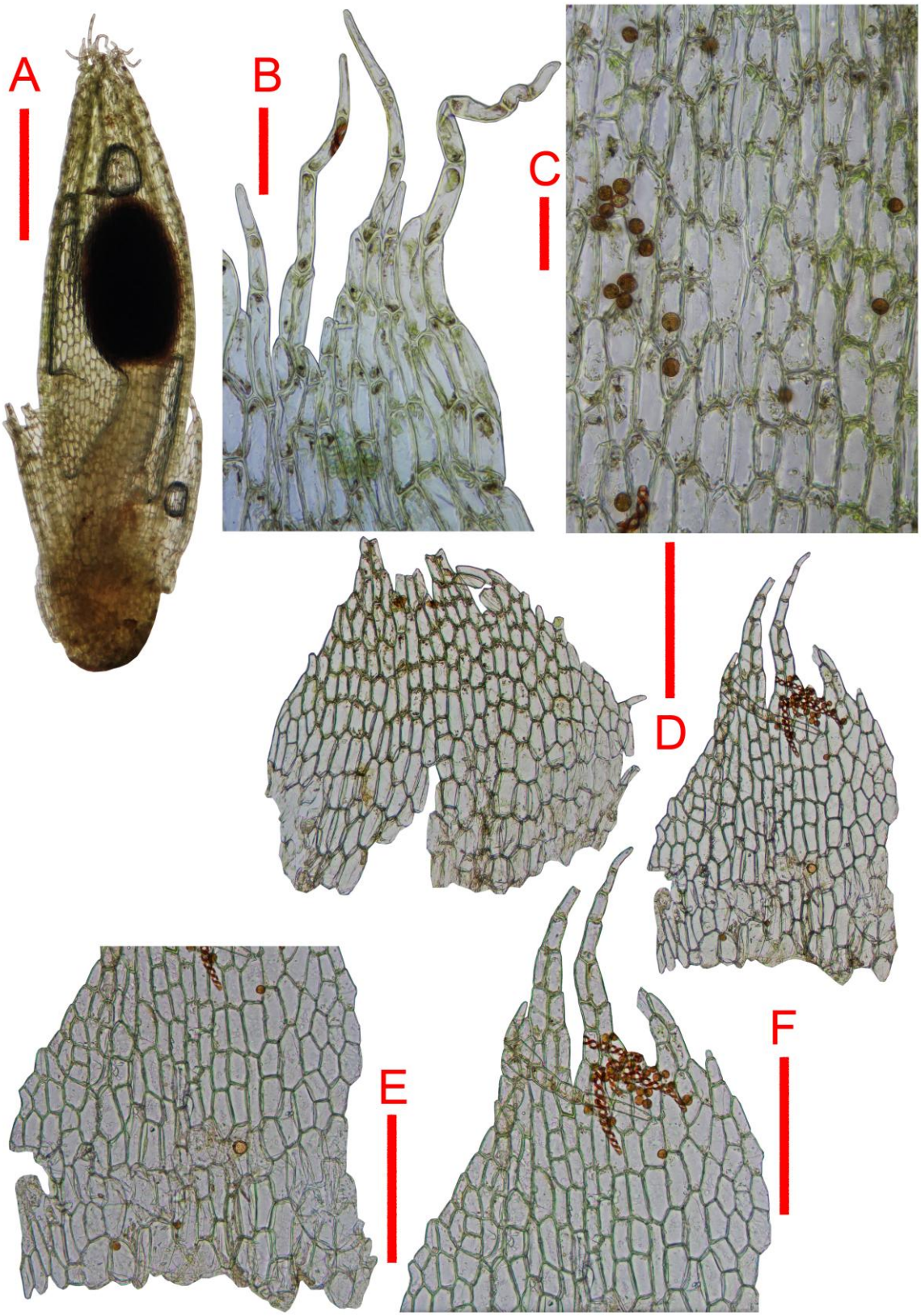

Plate 213: *Neolepidozia papulosa* var. *kalatunganensis*: A – Perianth, B – Perianth mouth, C – Perianth middle, D – Female bract, E – Female bract apex, F – Female bract base; Scales: A – 0.5 mm; D – 0.3 mm; E, F – 0.2 mm; B, C – 50 µm (from SHEVOCK 61990 – holotype)

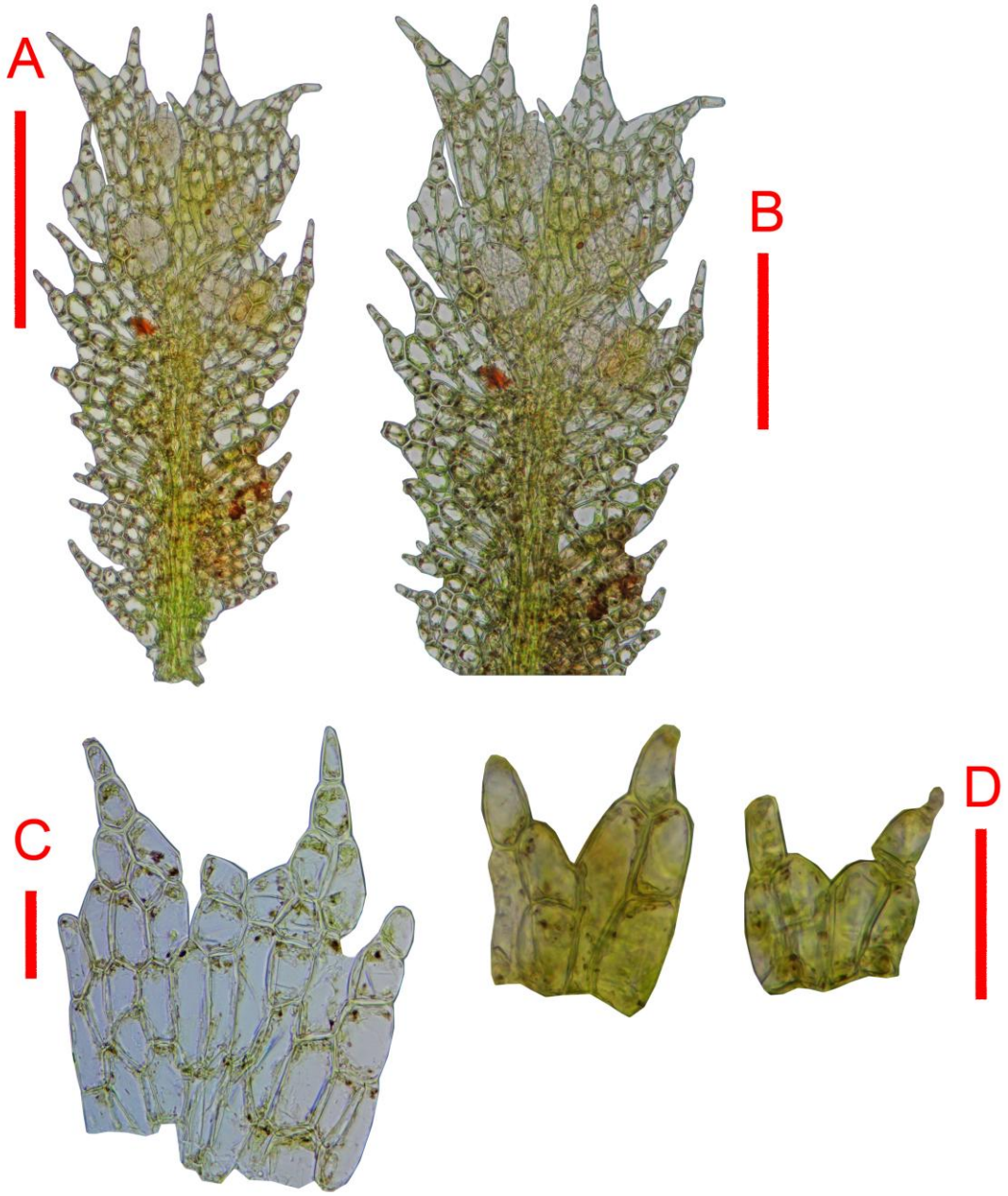

Plate 214: *Neolepidozia papulosa* var. *kalatunganensis*: A, B – Male branch, C – Male bract, D – Male branch underelaves; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SHEVOCK 61990 – holotype)

Neolepidozia papulosa var. *plumula* (HERZOG) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

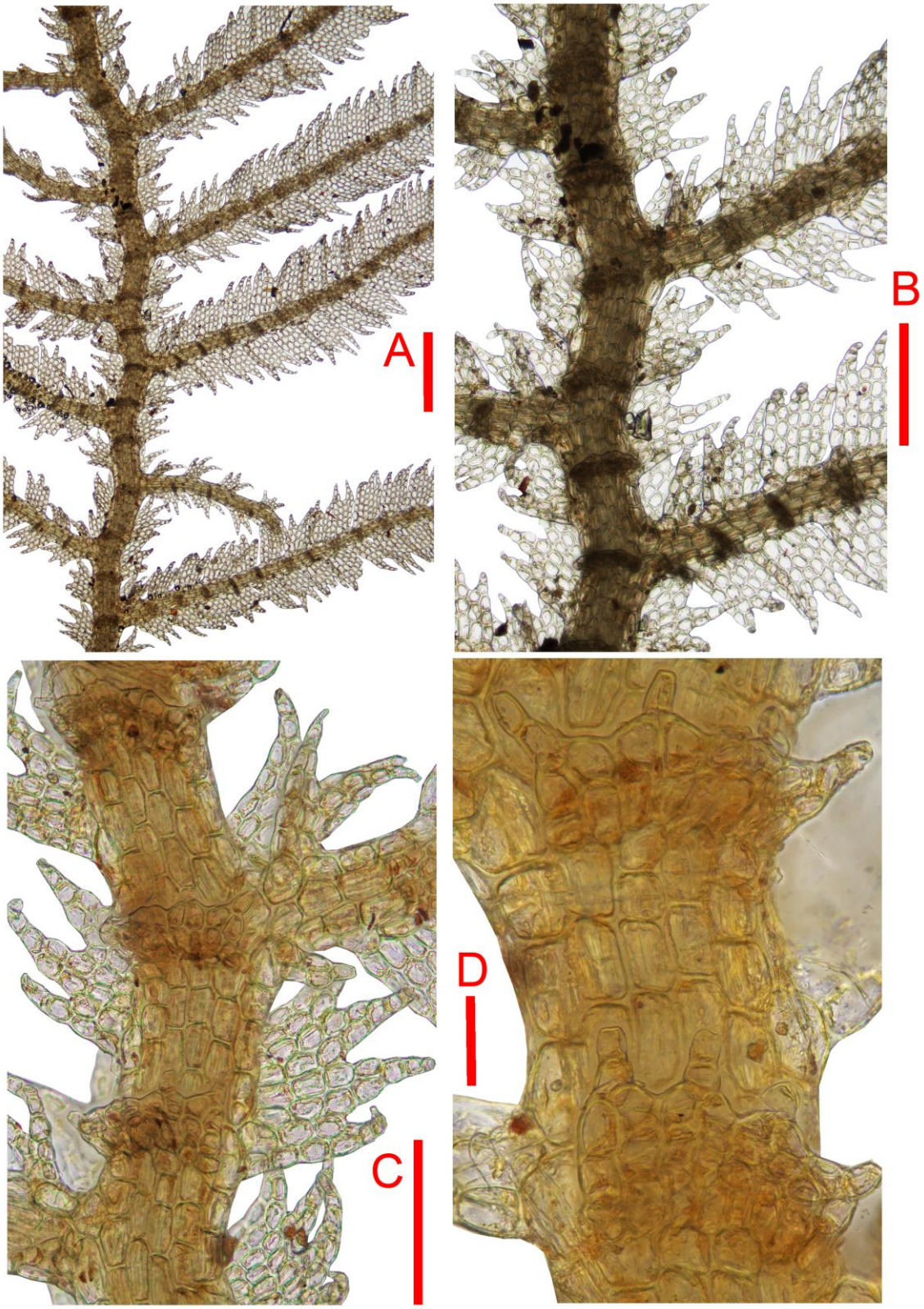

Plate 215: *Neolepidozia papulosa* var. *plumula*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from HERZOG – holotype *Lepidozia plumula*)

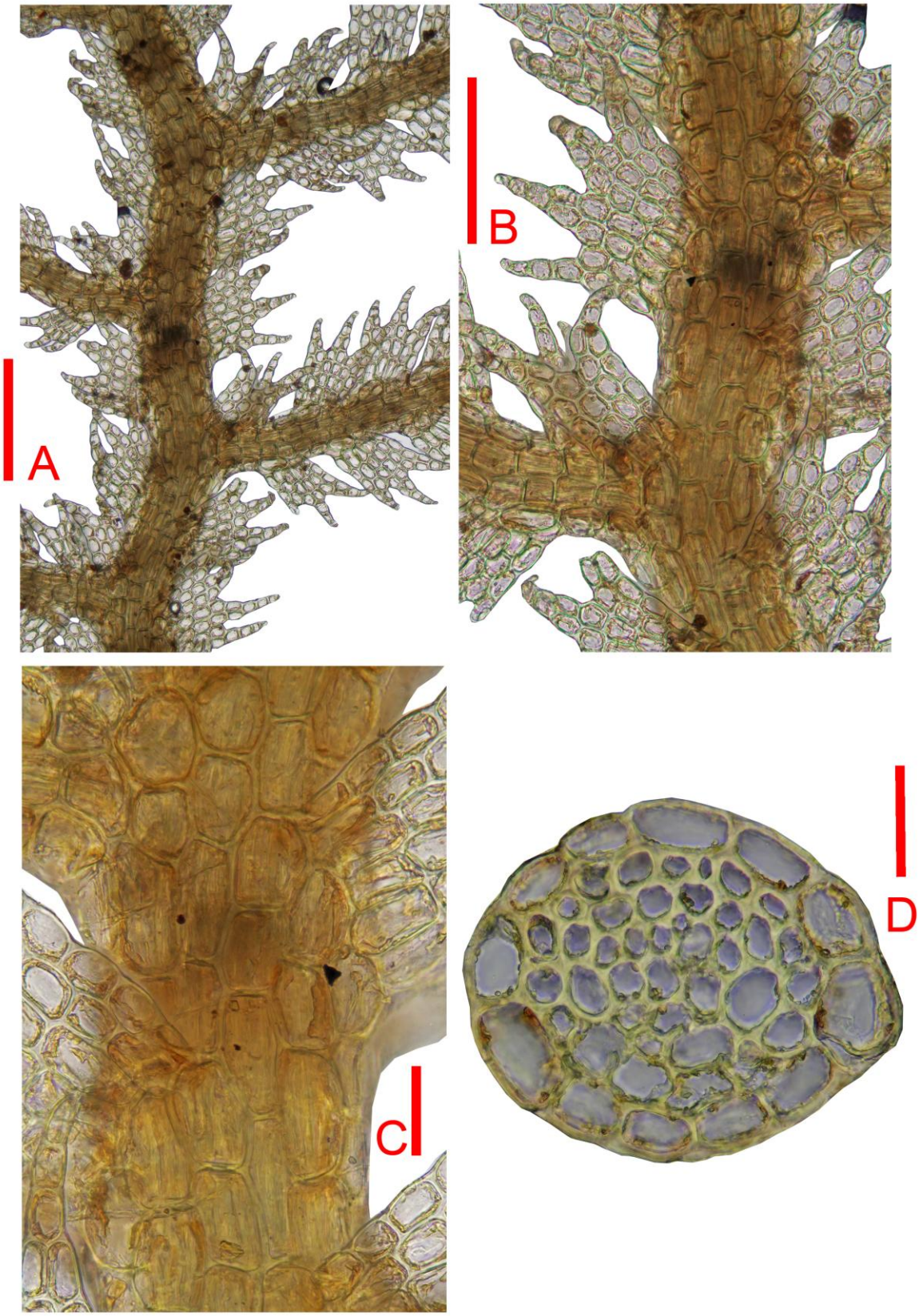

Plate 216: *Neolepidozia papulosa* var. *plumula*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from HERZOG – holotype *Lepidozia plumula*)

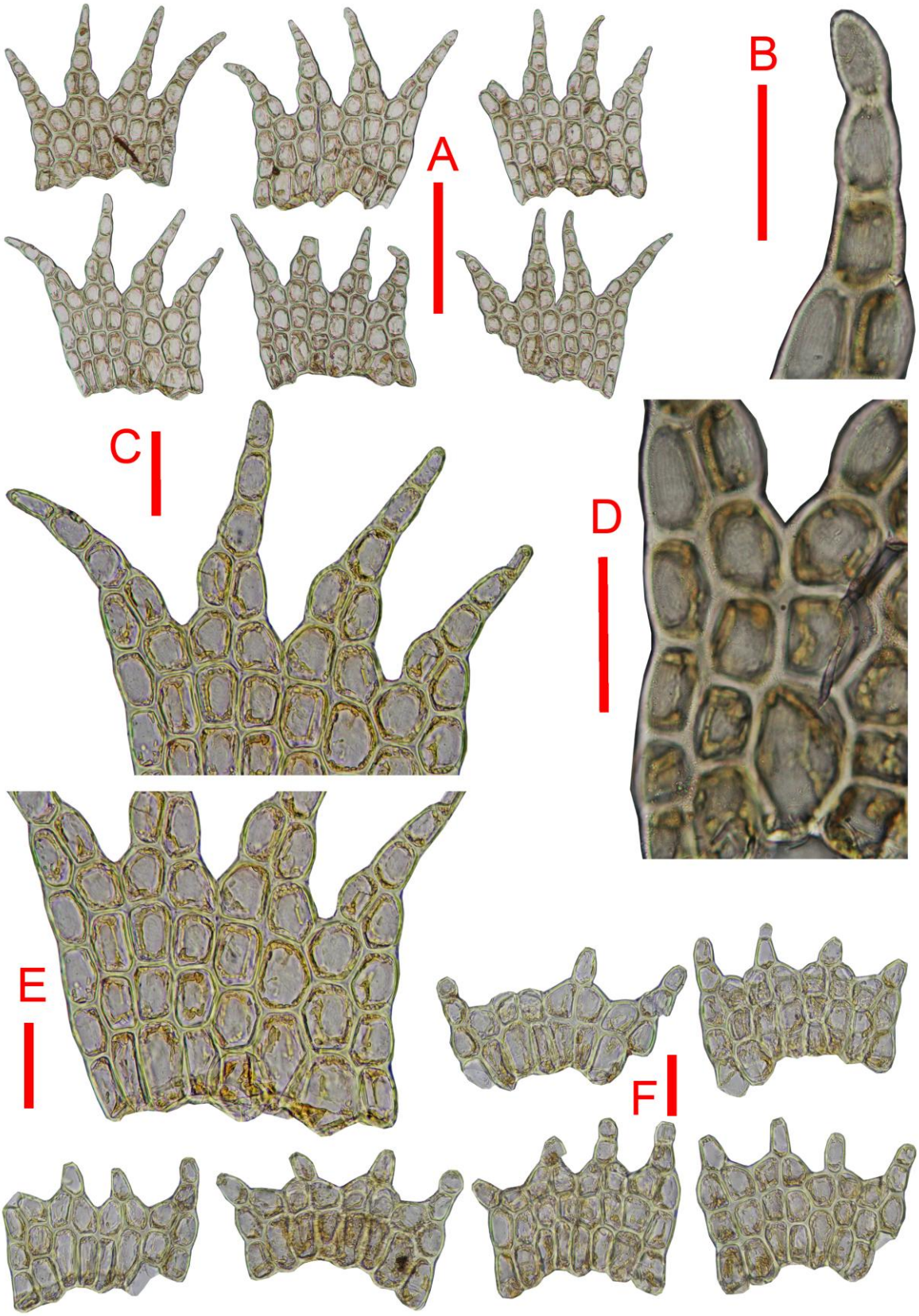

Plate 217: *Neolepidozia papulosa* var. *plumula*: A – Stem leaves, B, C – Stem leaf lobes, D, E – Stem leaf disc, F – Stem underleaves; Scales: A – 0.2 mm; B, C, D, E, F – 50 µm (from HERZOG – holotype *Lepidozia plumula*)

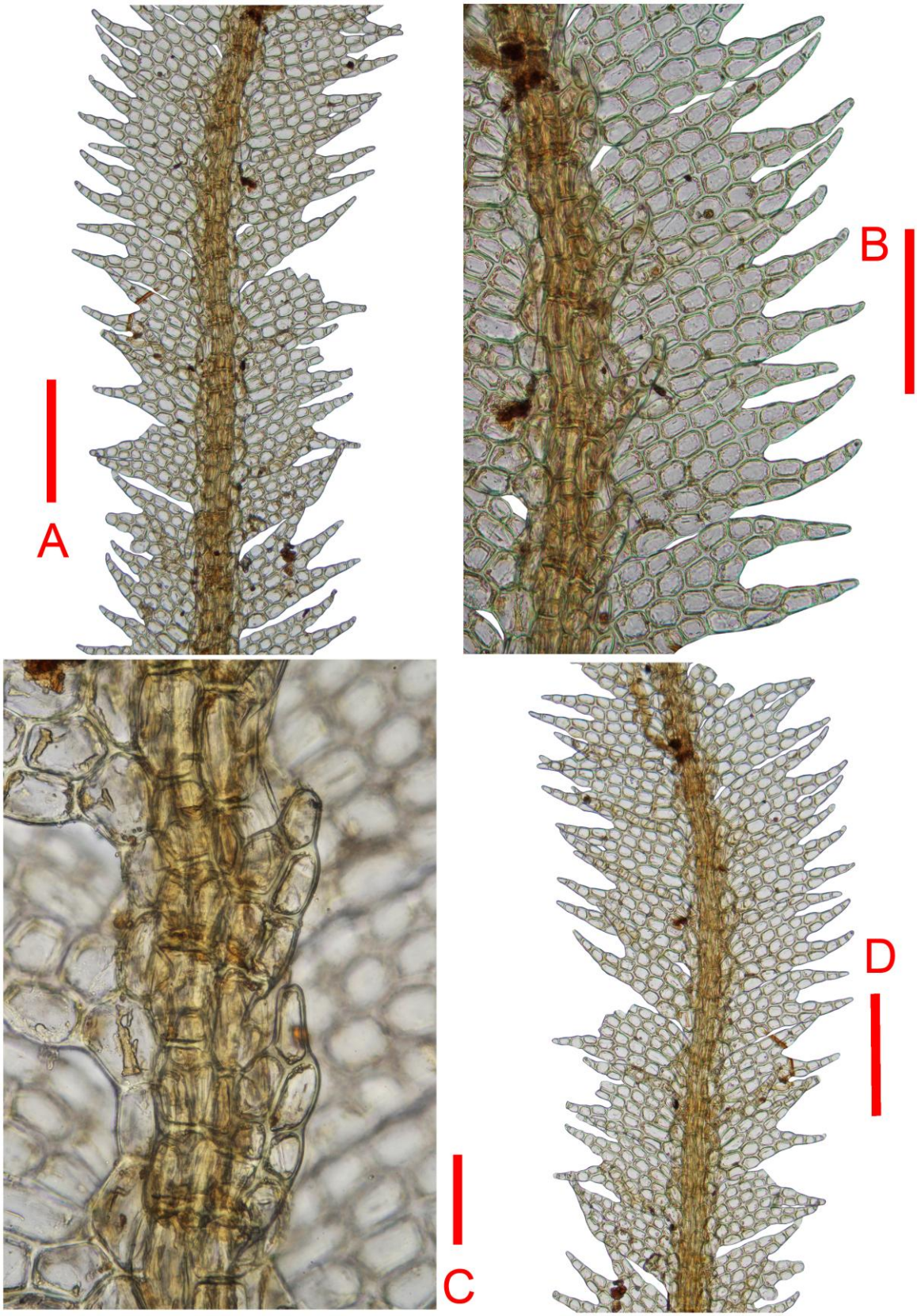

Plate 218: *Neolepidozia papulosa* var. *plumula*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm, B – 0.2 mm; C – 50 µm (from HERZOG – holotype *Lepidozia plumula*)

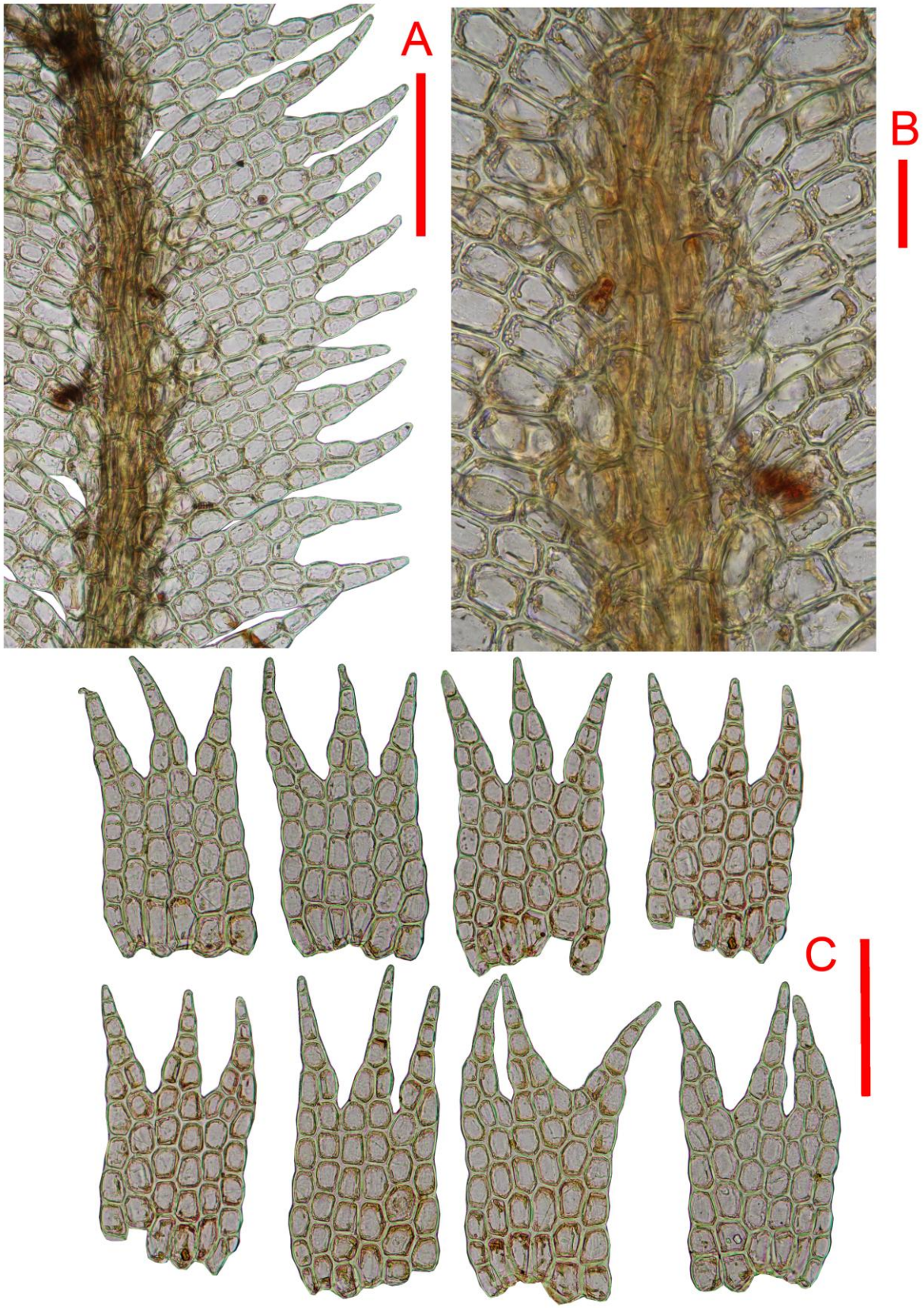

Plate 219: *Neolepidozia papulosa* var. *plumula*: A, B – Branch dorsal, C – Branch leaves; Scales: A, C – 0.2 mm, B – 50 µm (from HERZOG – holotype *Lepidozia plumula*)

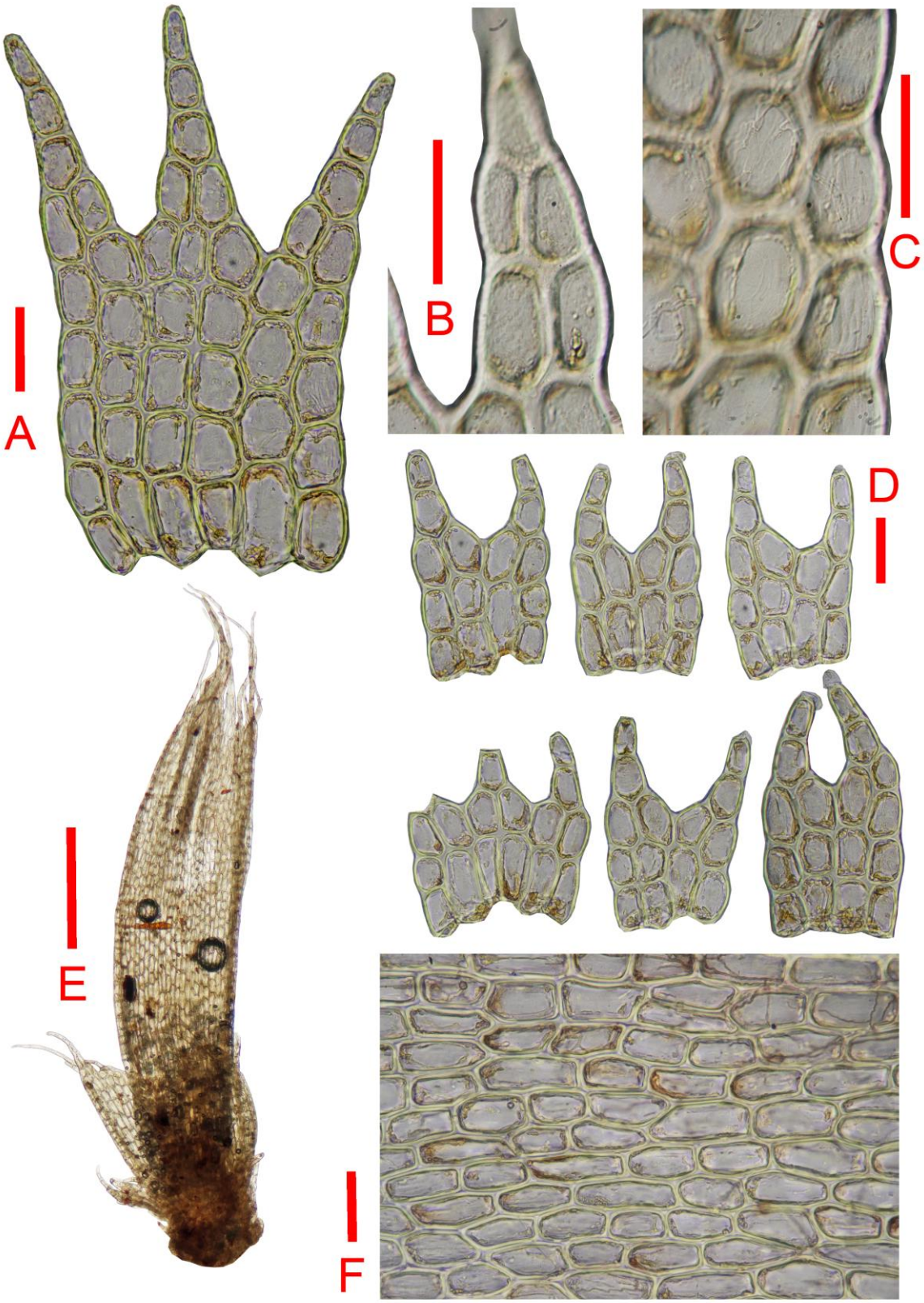

Plate 220: *Neolepidozia papulosa* var. *plumula*: A – Branch leaf, B – Branch leaf lobe, C – Branch leaf disc, D – Branch underleaves, E – Perianth, F – Perianth middle; Scales: E – 0.5 mm, A, B, C, D, F – 50 µm (from HERZOG – holotype *Lepidozia plumula*)

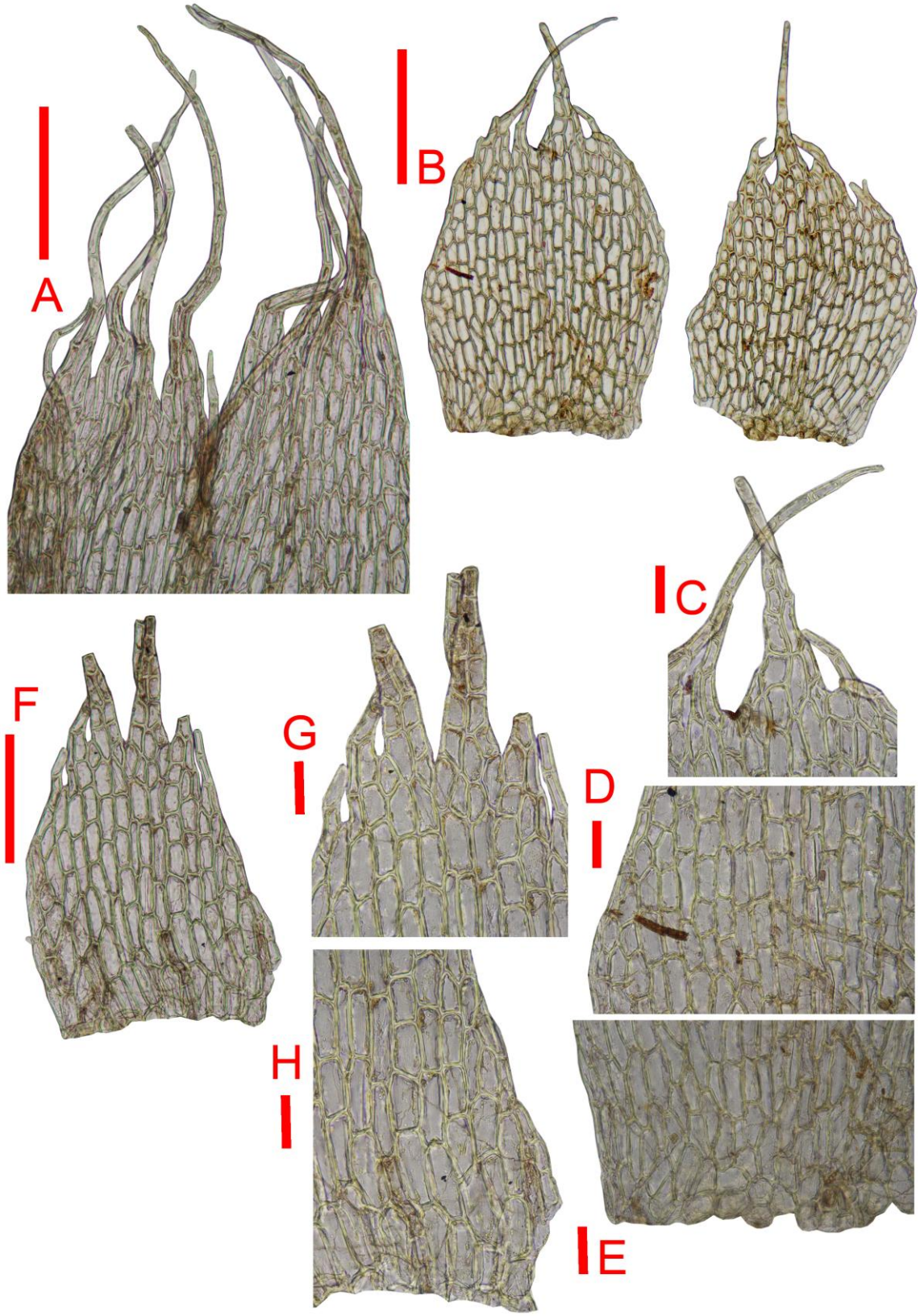

Plate 221: *Neolepidozia papulosa* var. *plumula*: A – Perianth mouth, B – Female bract, C – Female bract apex, D – Female bract middle, E – Female bract base, F – Female bracteole, G – Female bracteole apex, H – Female bracteole base; Scales: B – 0.3 mm, A, F – 0.2 mm, C, D, E, G, H – 50 µm (from HERZOG – holotype *Lepidozia plumula*)

Neolepidozia papulosa var. sakuraii **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

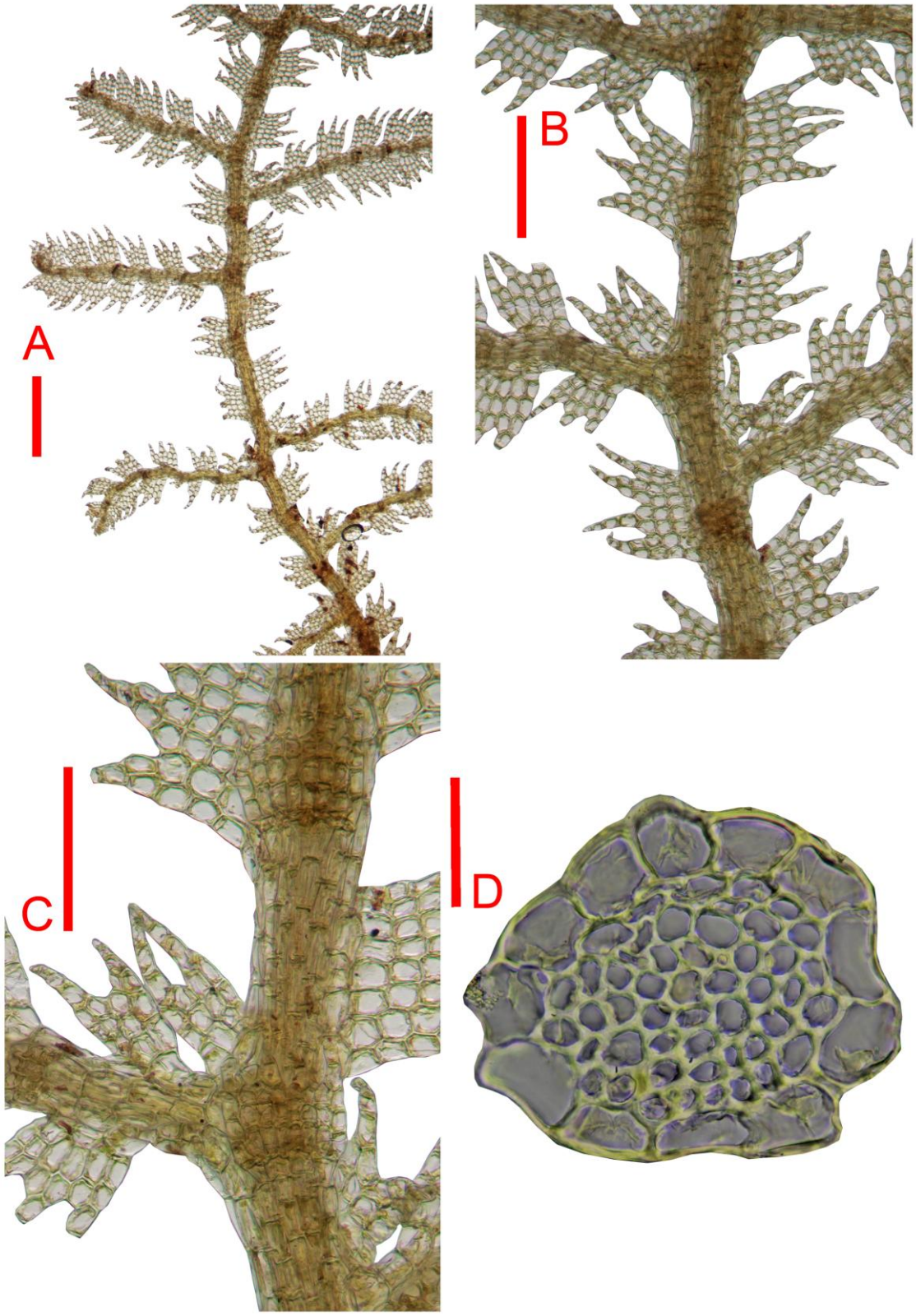

Plate 222: *Neolepidozia papulosa* var. *sakuraii*: A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SAKURAI 11694)

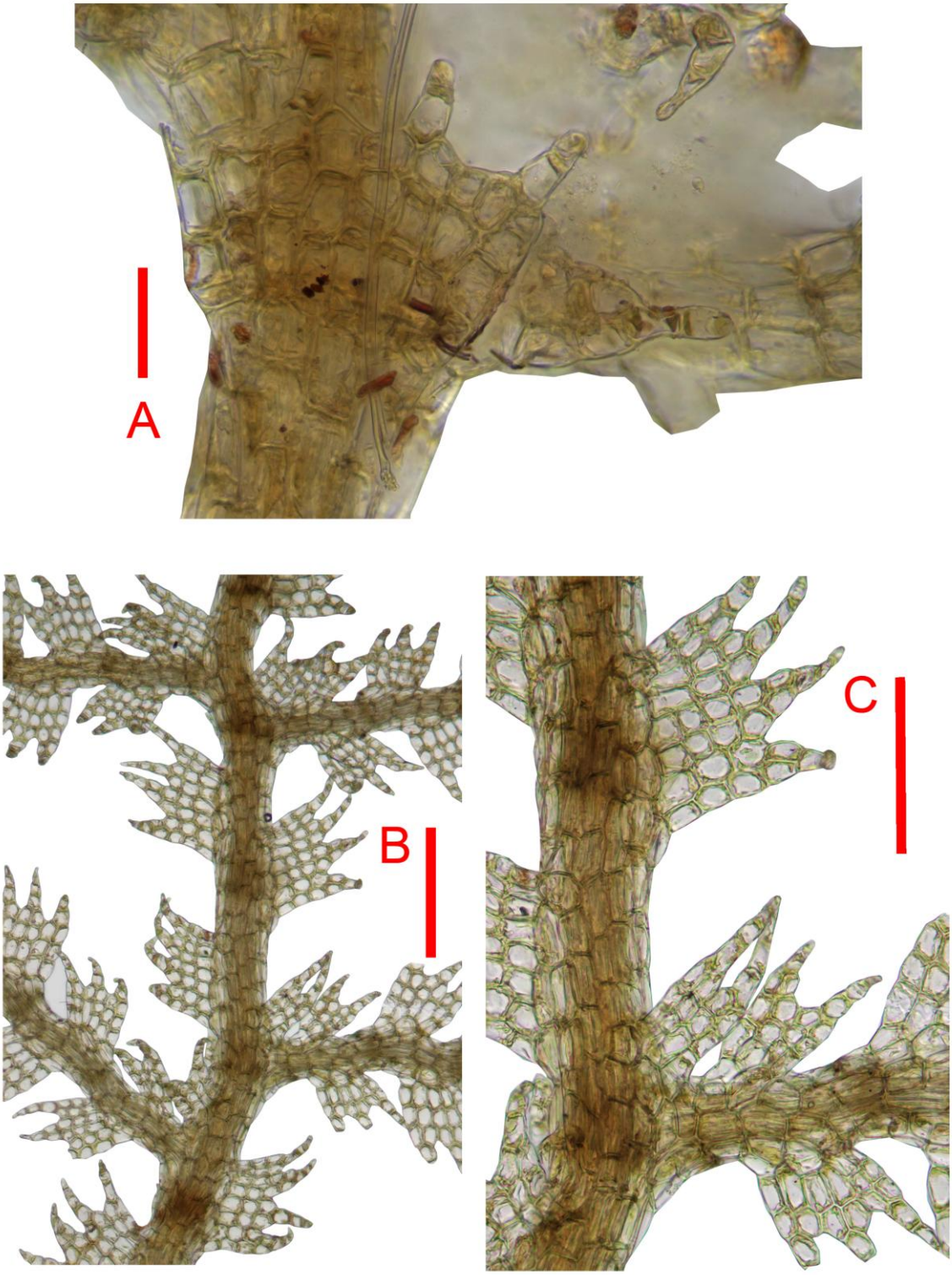

Plate 223: *Neolepidozia papulosa* var. *sakuraii*: A – Plant ventral, B, C – Plant dorsal; Scales: A – 50 µm; B – 0.3 mm; C – 0.2 mm (from SAKURAI 11694)

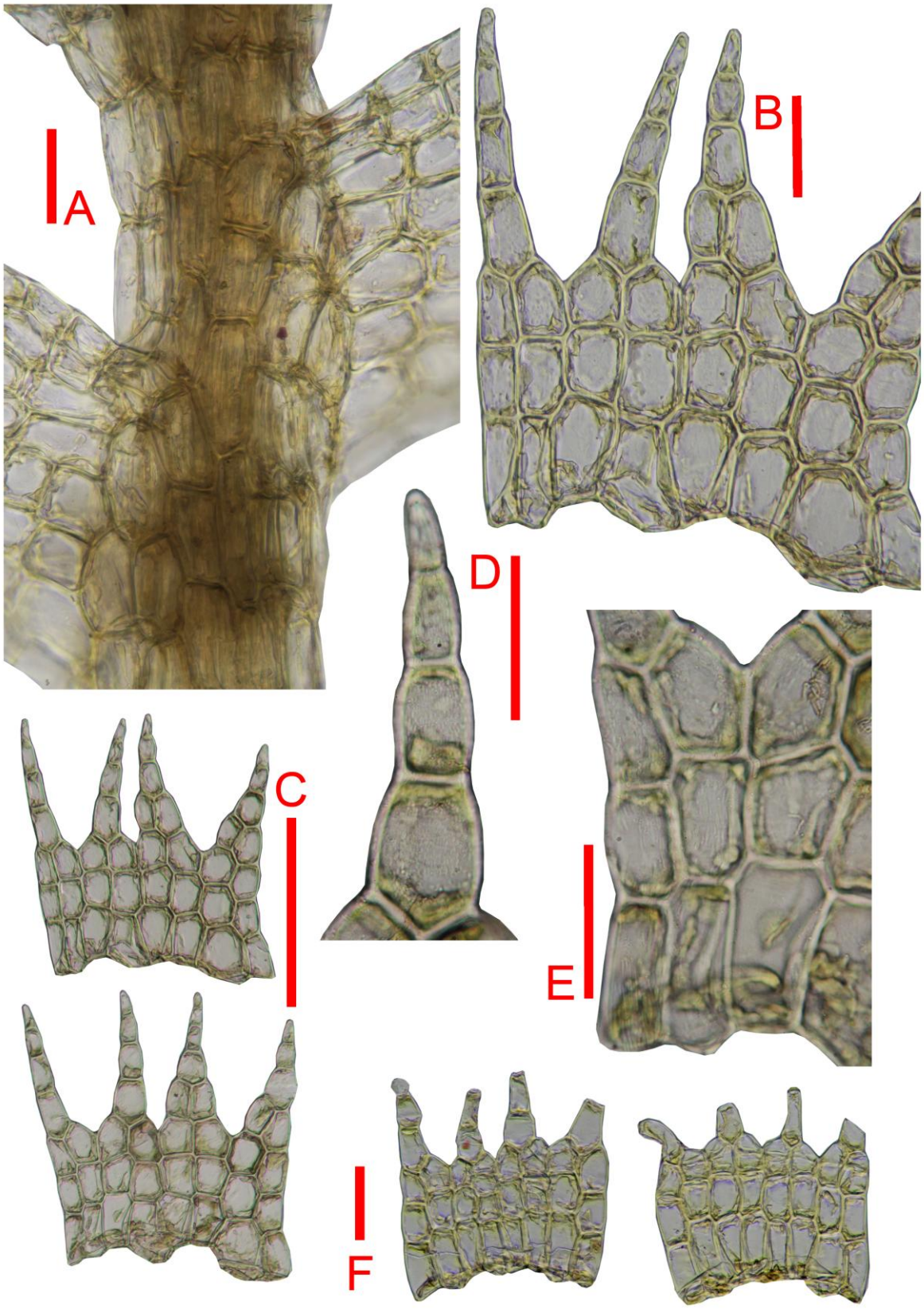

Plate 224: *Neolepidozia papulosa* var. *sakuraii*: A – Plant dorsal, B, C – Stem leaves, D – Stem leaf lobe, E – Stem leaf disc, F – Stem underleaves; Scales: A, B, D, E, F – 50 µm; C – 0.2 mm (from SAKURAI 11694)

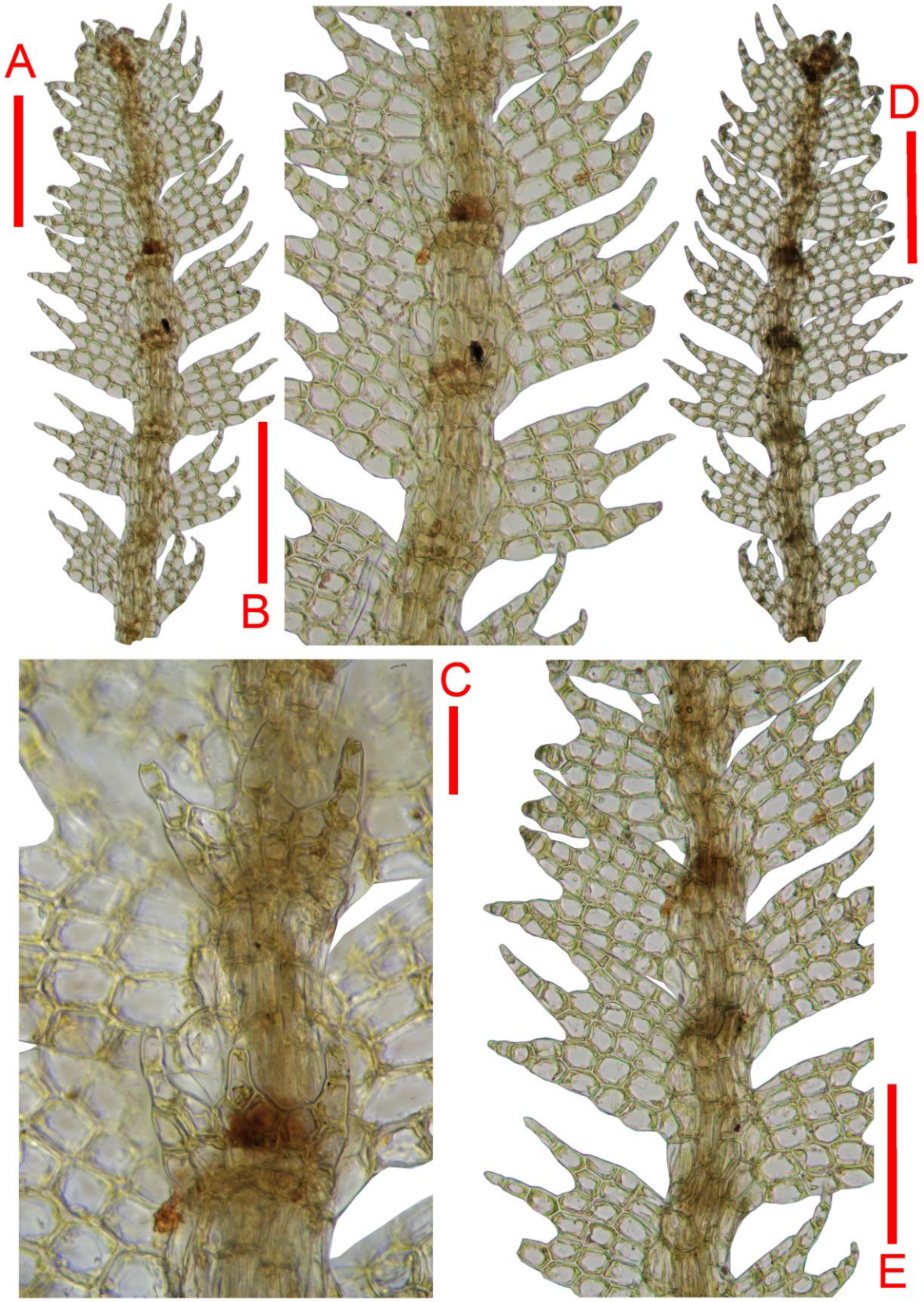

Plate 225: *Neolepidozia papulosa* var. *sakuraii*: A, B, C – Branch ventral, D, E – Branch dorsal; Scales: A, D – 0.3 mm; B, E – 0.2 mm; D – 50 µm (from SAKURAI 11694)

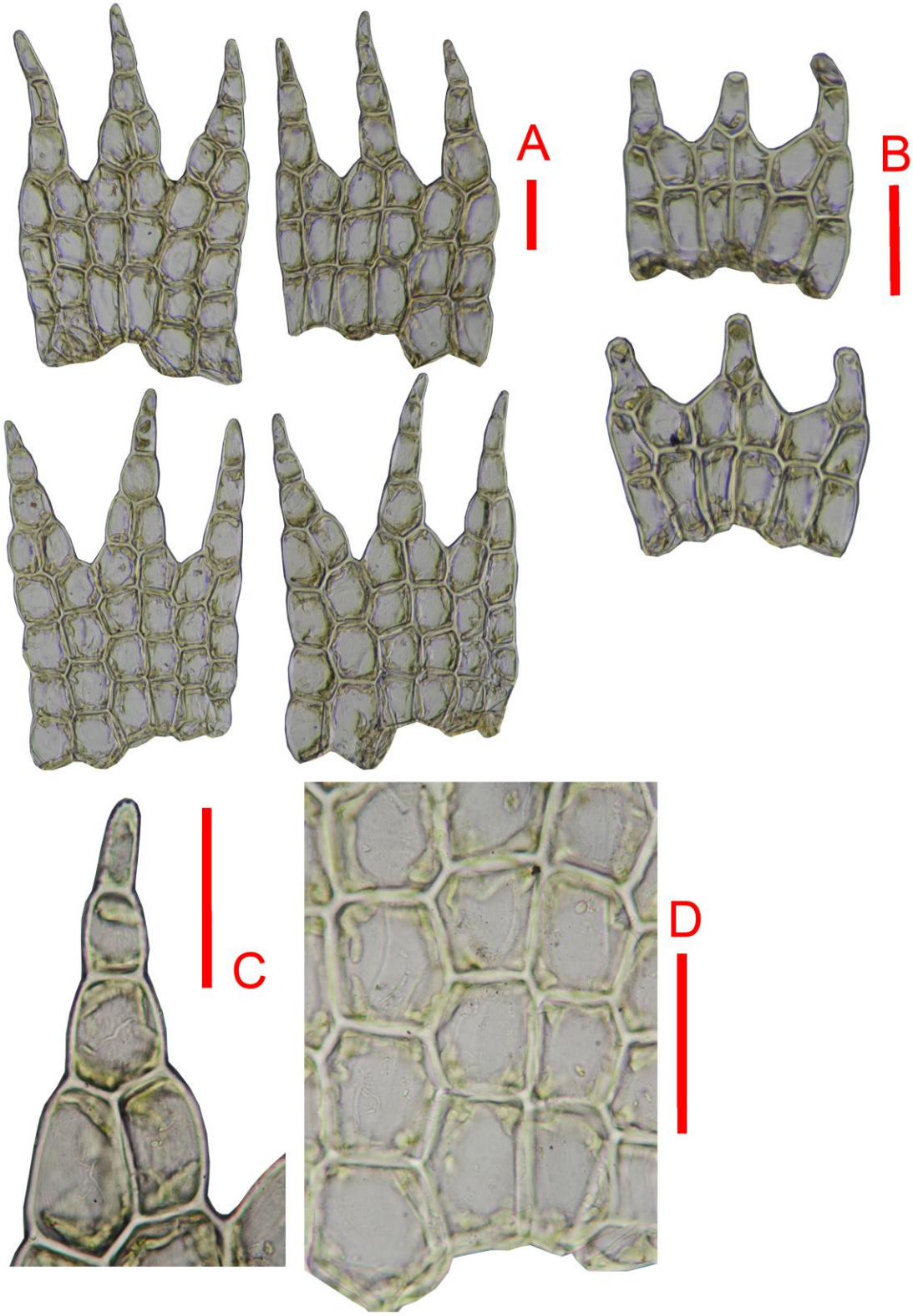

Plate 226: *Neolepidozia papulosa* var. *sakuraii*: A – Branch leaves, B – Branch underleaves, C – Branch leaf lobe, D – Branch leaf disc; Scales: A, B, C, D – 50 µm (from SAKURAI 11694)

***Neolepidozia papulosa* var. *uniseriata* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

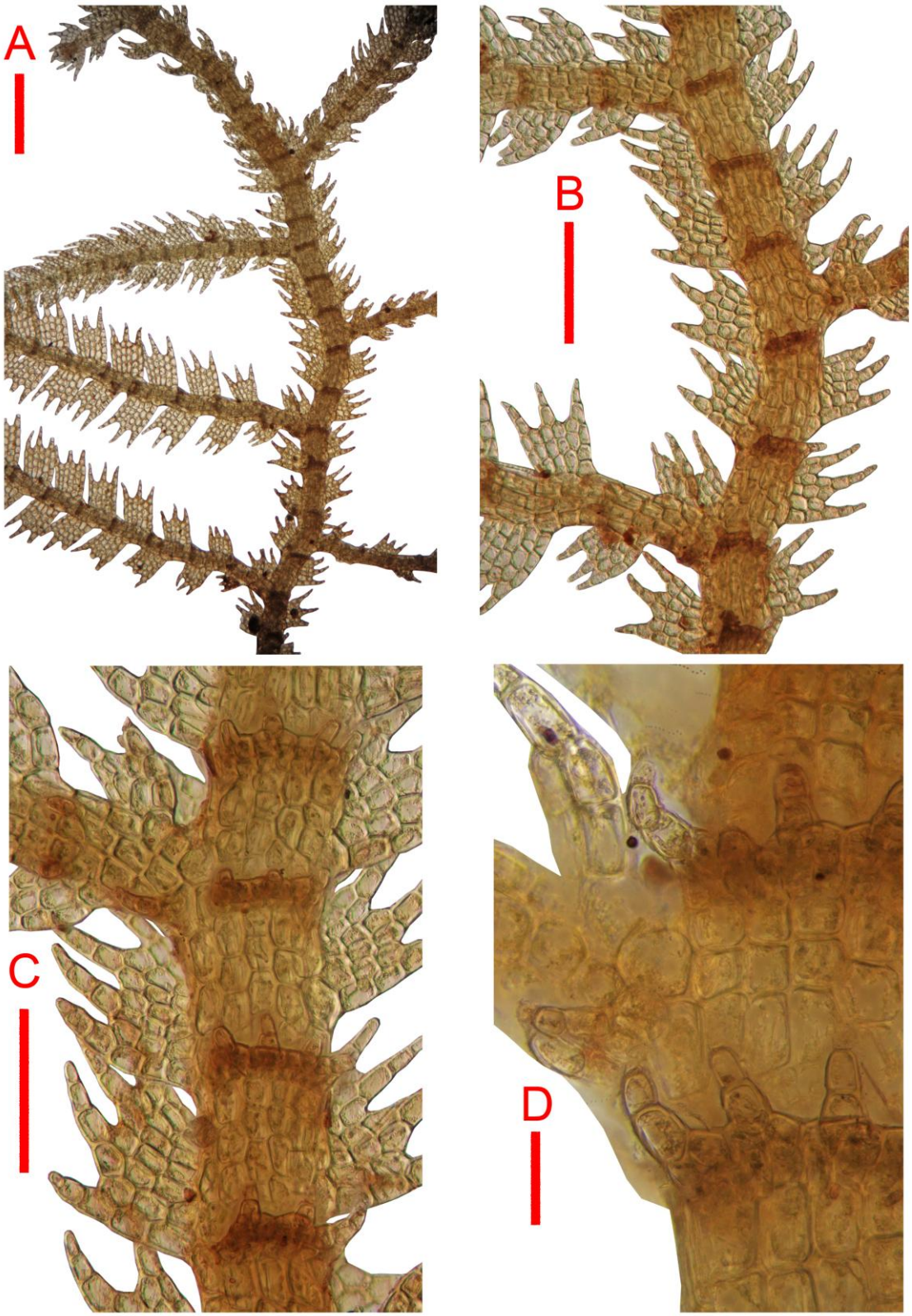

Plate 227: *Neolepidozia papulosa* var. *uniseriata*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SHEVOCK 62130 – holotype)

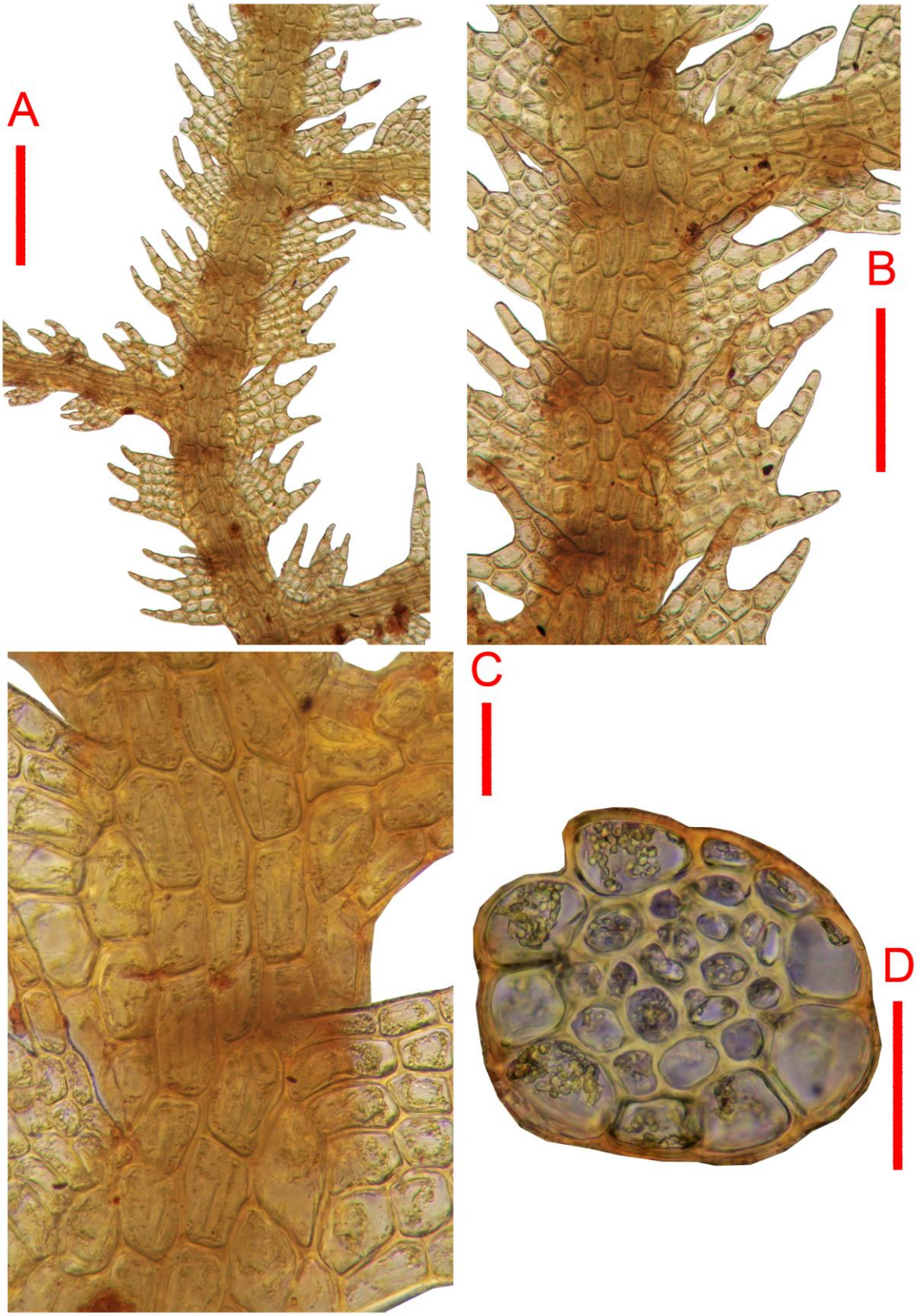

Plate 228: *Neolepidozia papulosa* var. *uniseriata*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SHEVOCK 62130 – holotype)

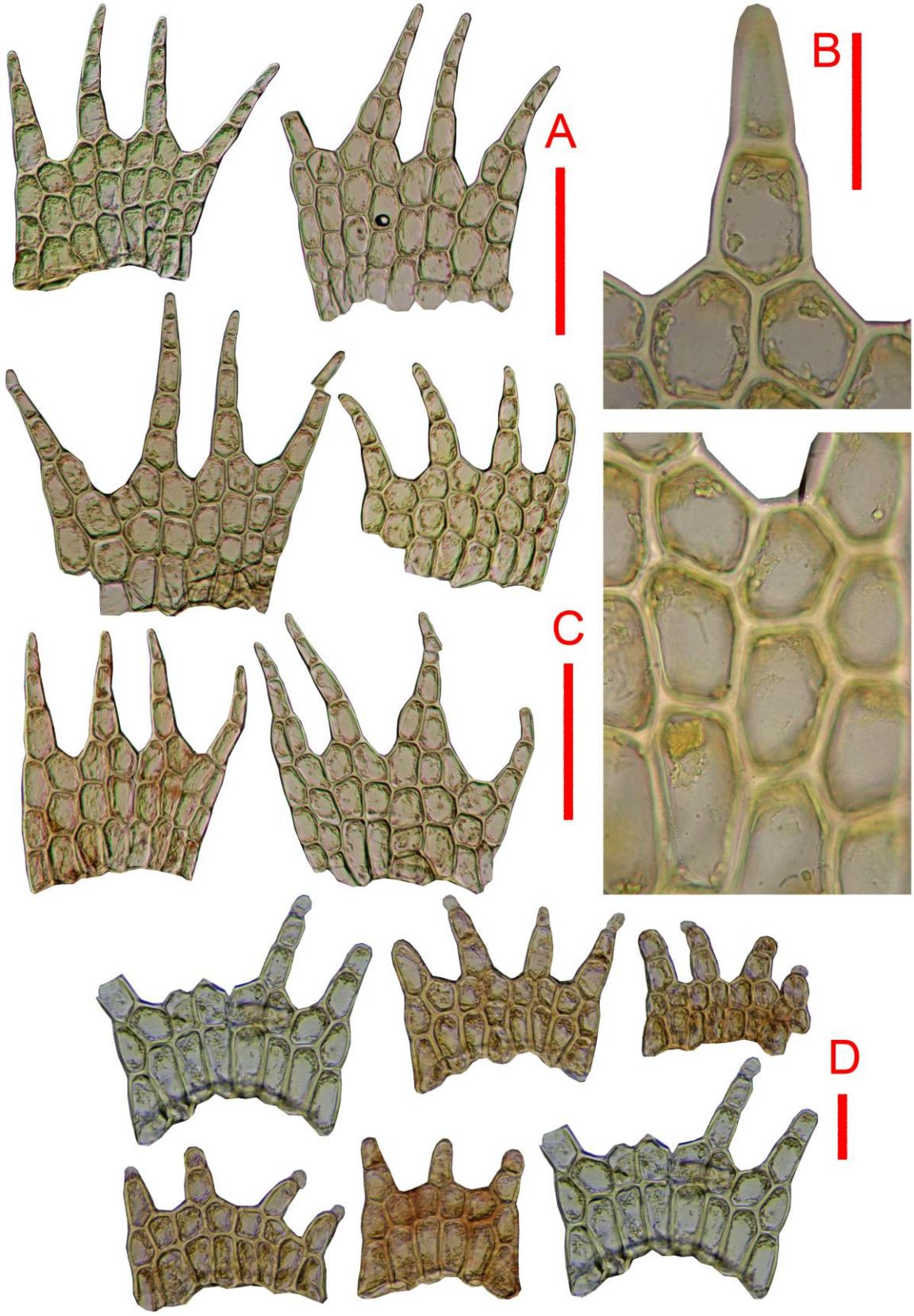

Plate 229: *Neolepidozia papulosa* var. *uniseriata*: A – Stem leaves, B – Stem leaf lobe, C – Stem leaf disc, D – Stem underleaves; Scales: A – 0.2 mm; B, C, D – 50 µm (from SHEVOCK 62130 – holotype)

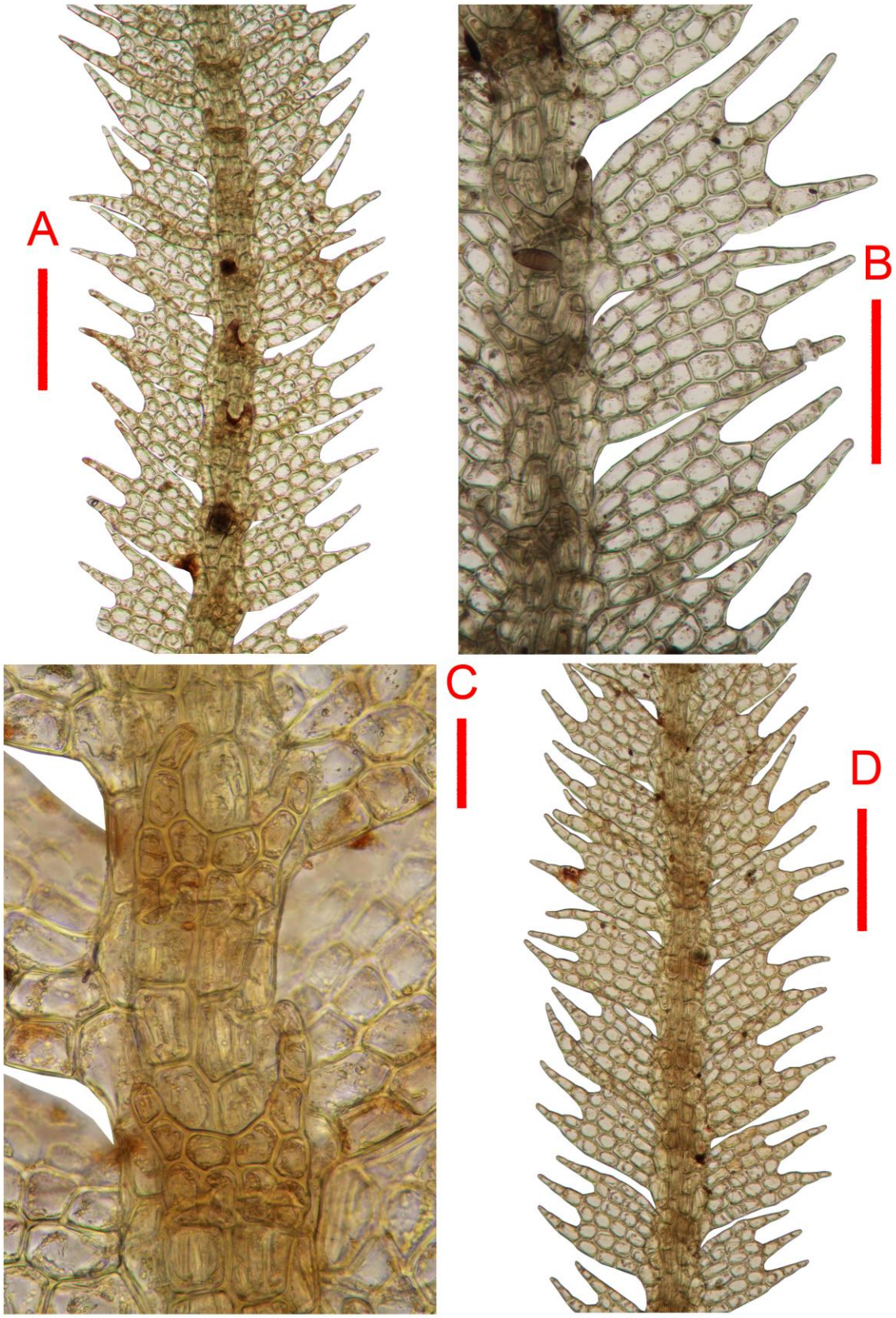

Plate 230: *Neolepidozia papulosa* var. *uniseriata*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm; B – 0.2 mm; C – 50 µm (from SHEVOCK 62130 – holotype)

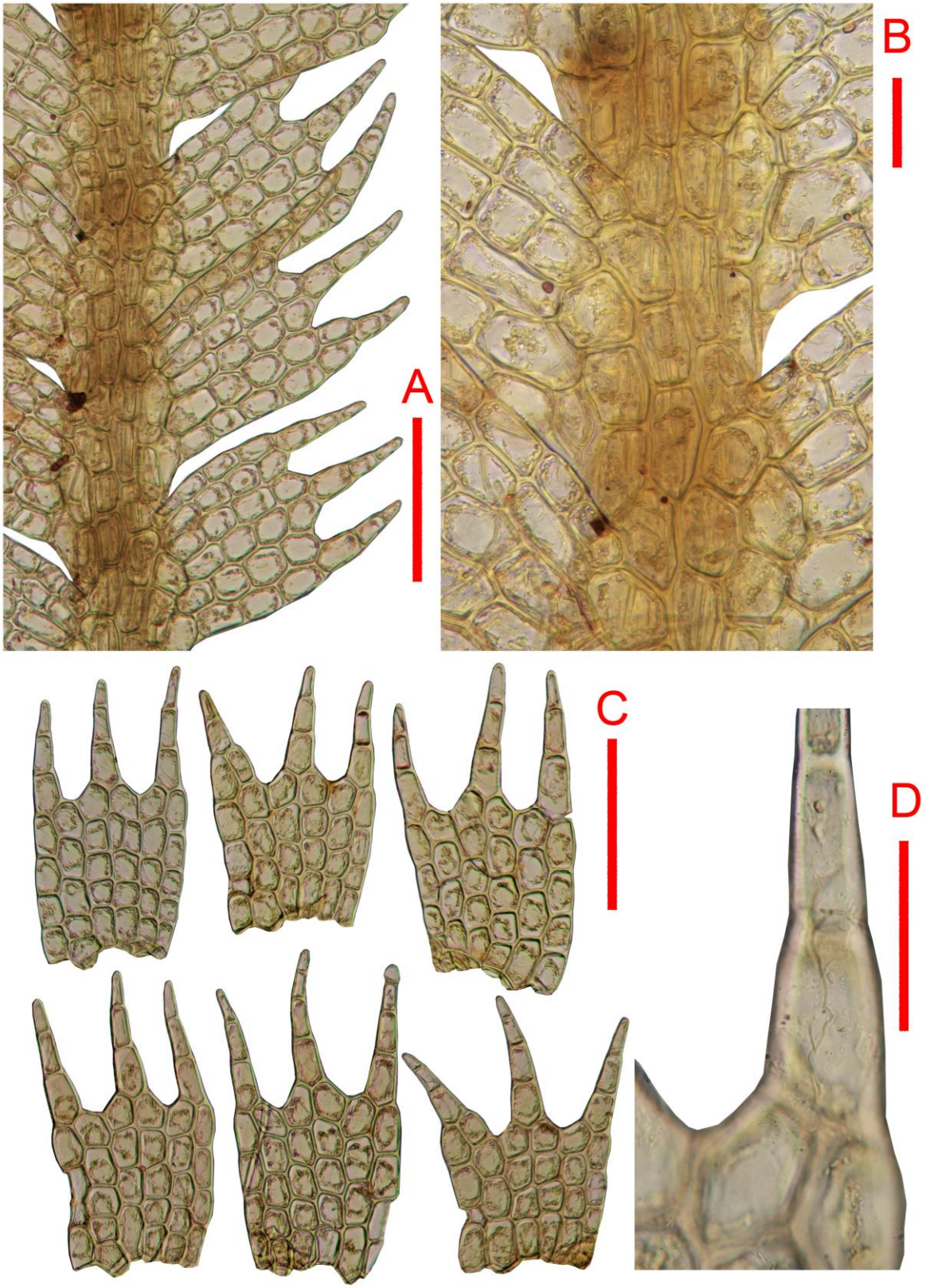

Plate 231: *Neolepidozia papulosa* var. *uniseriata*: A, B – Branch dorsal, C – Branch leaves, D – Branch leaf lobe; Scales: A, C – 0.2 mm; B, D – 50 µm (from SHEVOCK 62130 – holotype)

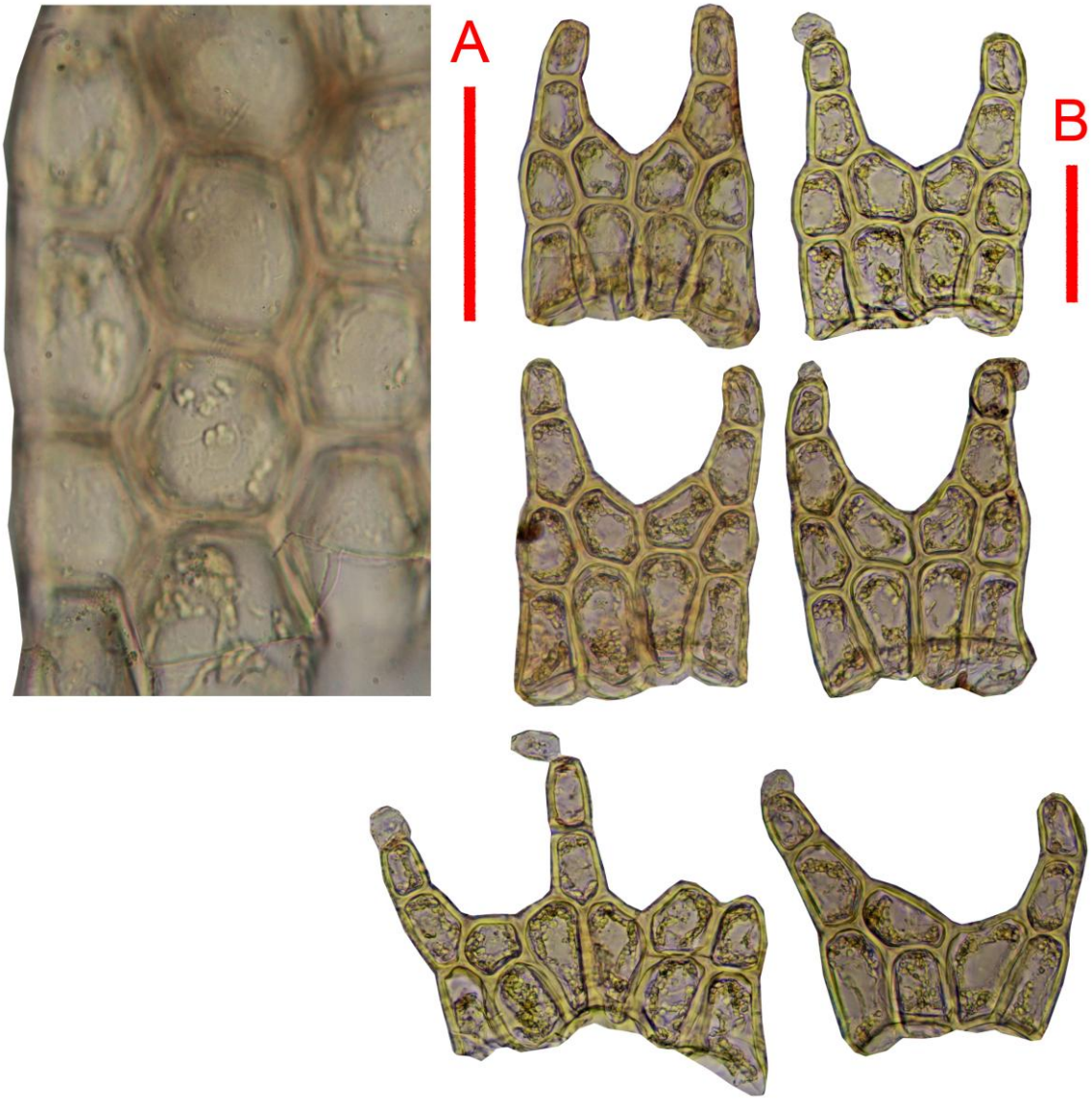

Plate 232: *Neolepidozia papulosa* var. *uniseriata*: A – Branch leaf disc, B – Branch underleaves; Scales: A, B – 50 µm (from SHEVOCK 62130 – holotype)

Neolepidozia parvula **(N. KITAG.) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

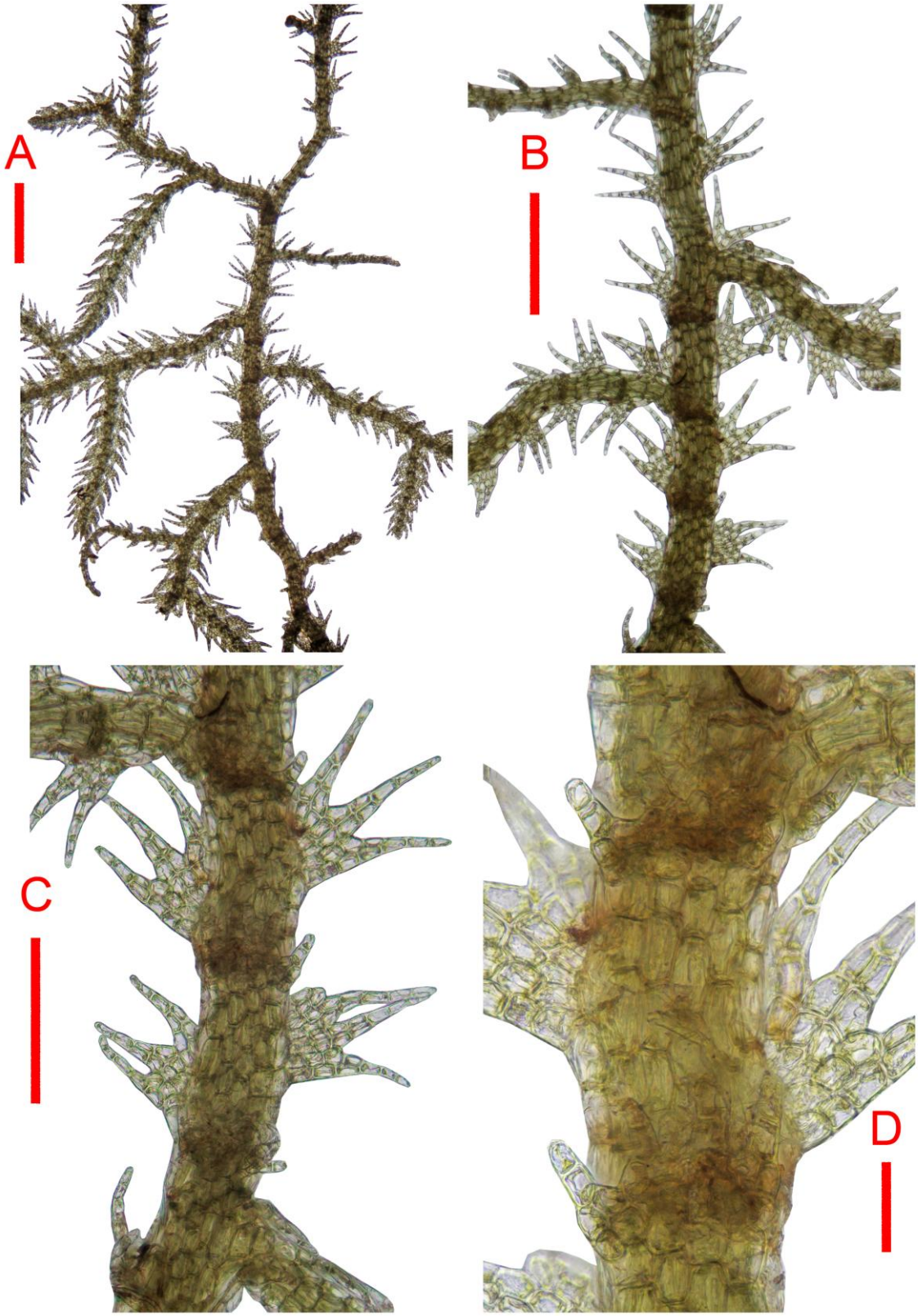

Plate 233: *Neolepidozia parvula*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from TOUW 11808 A)

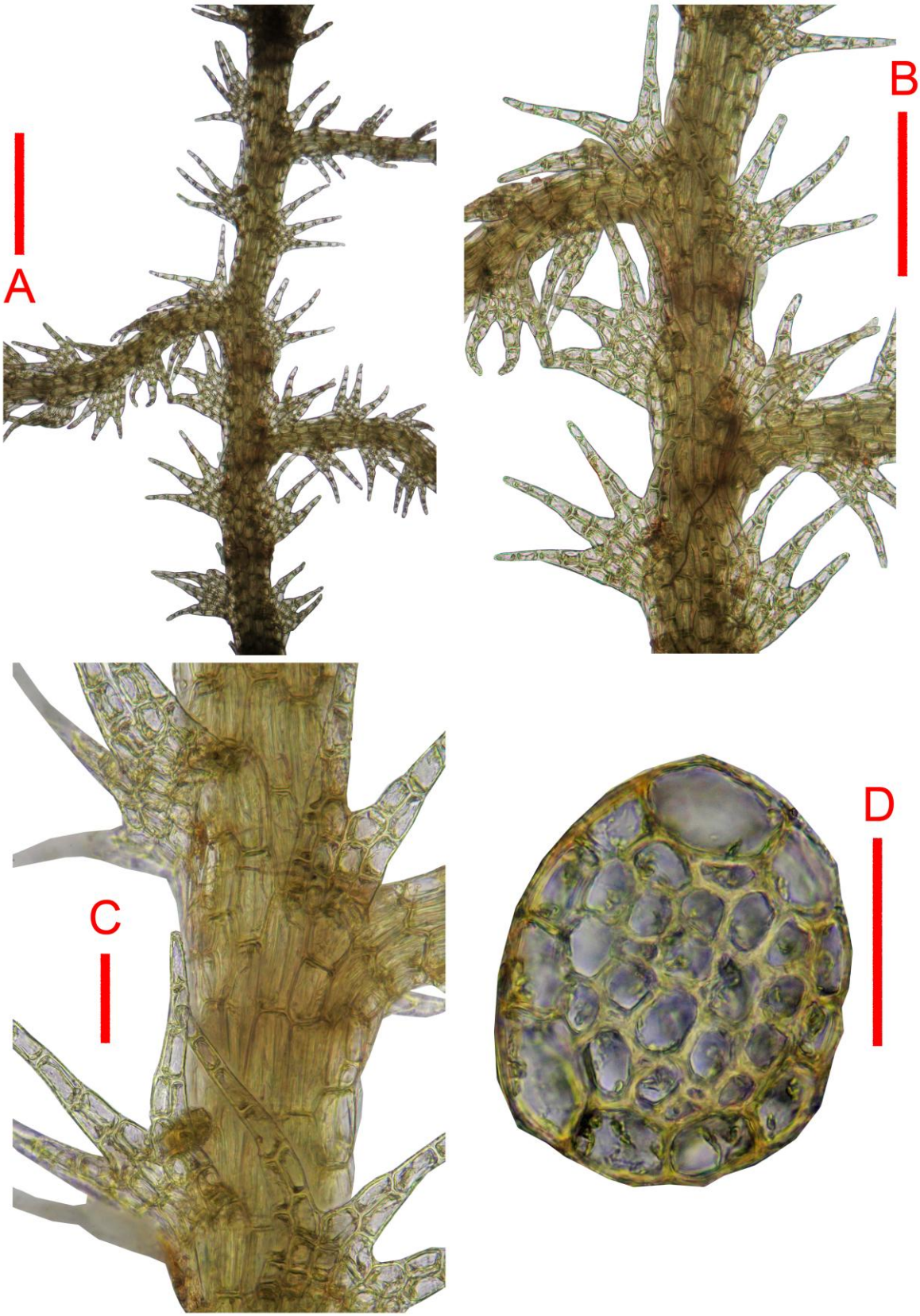

Plate 234: *Neolepidozia parvula*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from TOUW 11808 A)

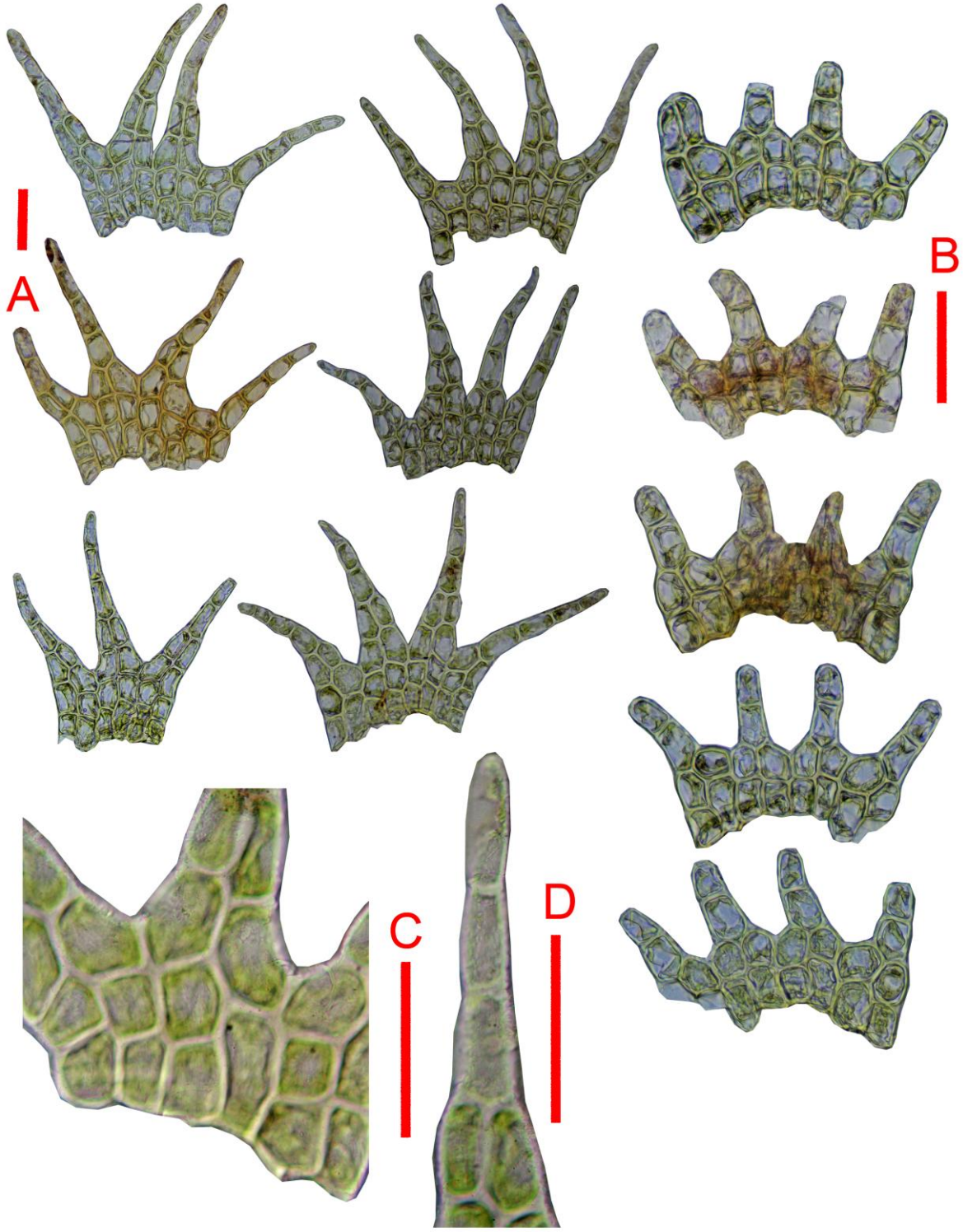

Plate 235: *Neolepidozia parvula*: A – Stem leaves, B – Stem underleaves, C – Stem leaf disc, D – Stem leaf lobe; Scales: A, B, C, D – 50 µm (from TOUW 11808 A)

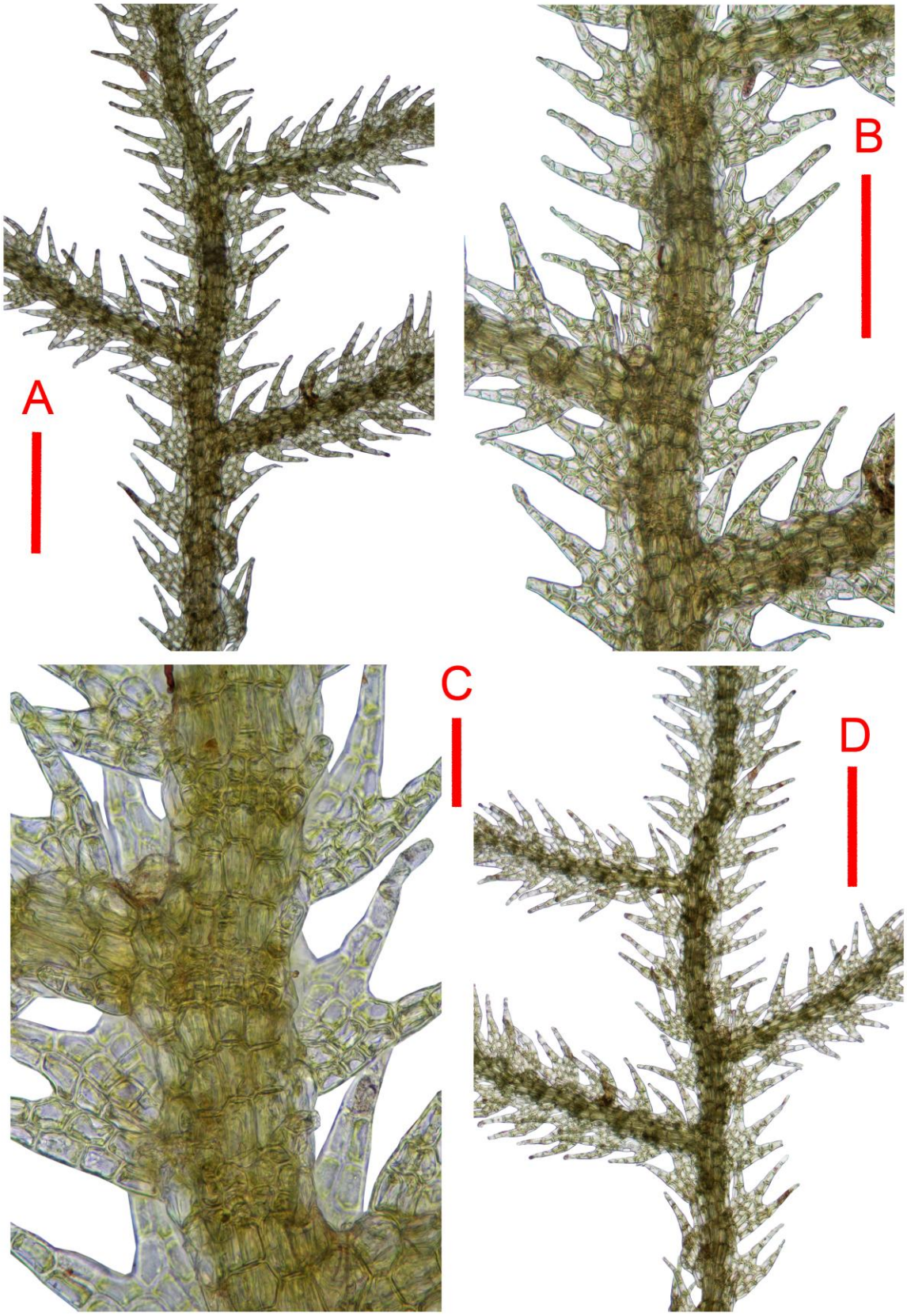

Plate 236: *Neolepidozia parvula*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm; B – 0.2 mm; D – 50 µm (from TOUW 11808 A)

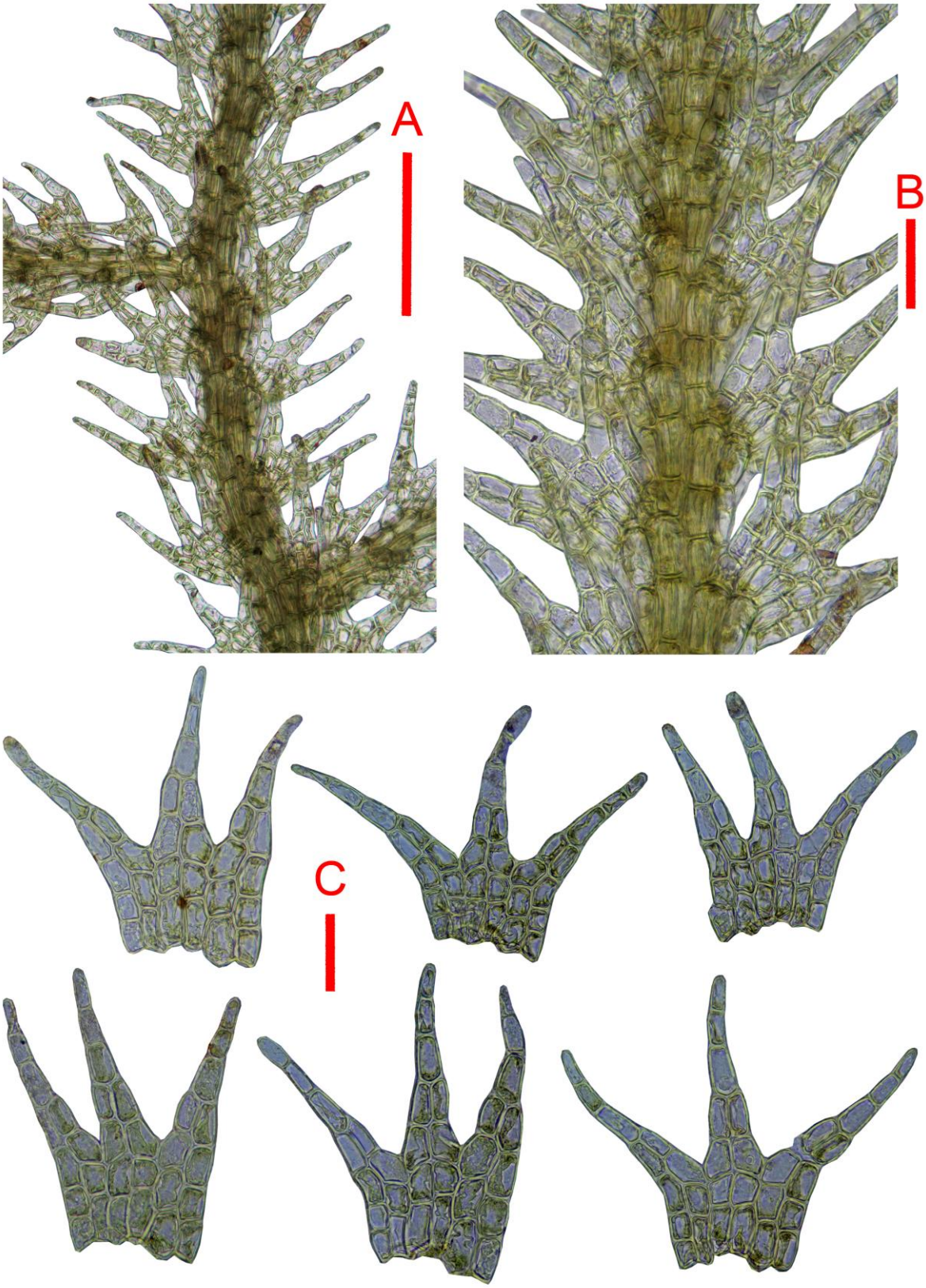

Plate 237: *Neolepidozia parvula*: A, B – Branch dorsal, C – Branch leaves; Scales: A – 0.2 mm; B, C – 50 µm (from TOUW 11808 A)

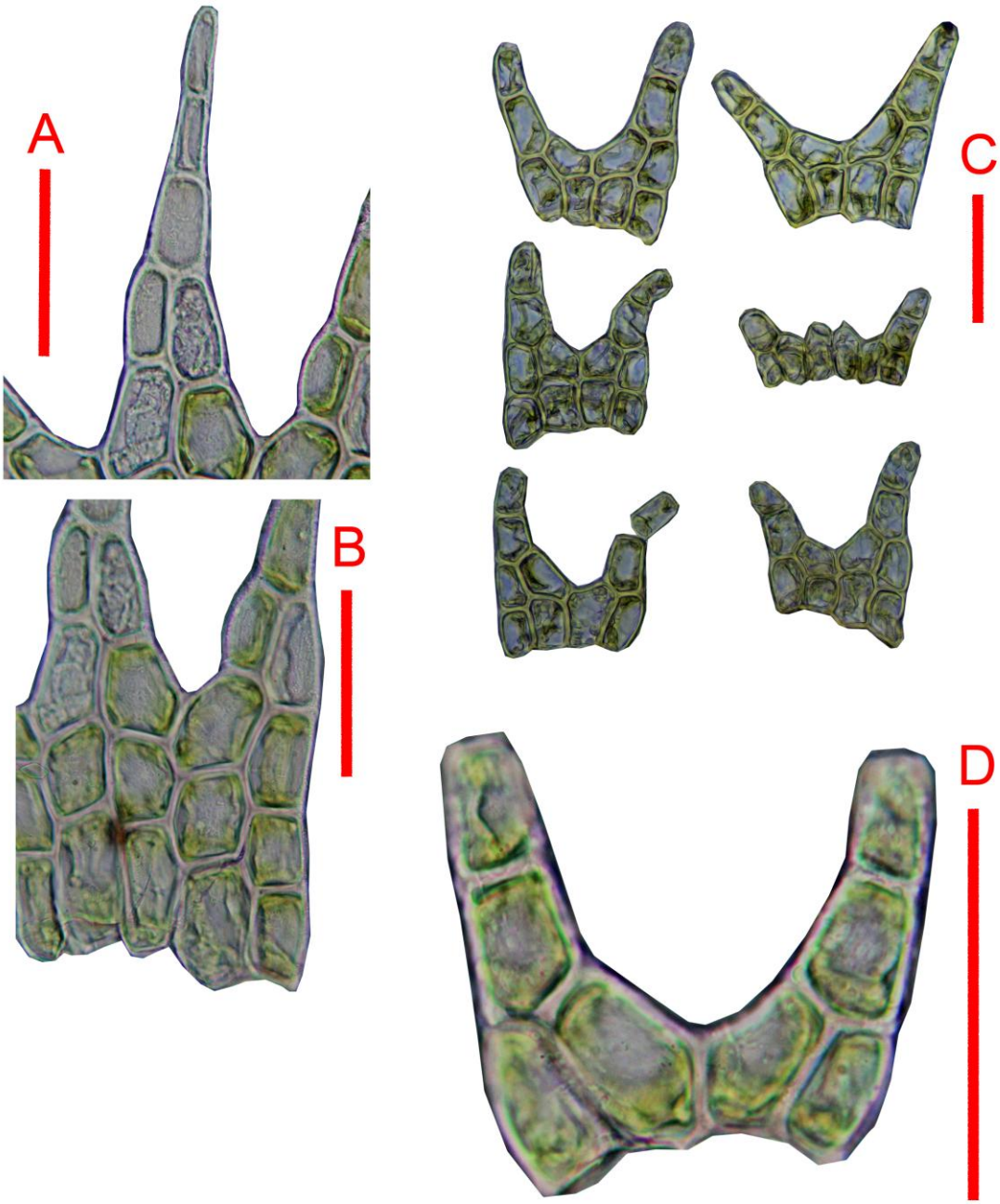

Plate 238: *Neolepidozia parvula*: A – Branch leaf disc, B – Branch leaf lobe, C, D – Branch underleaves; Scales: A, B, C, D – 50 µm (from TOUW 11808 A)

Neolepidozia philippinensis **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

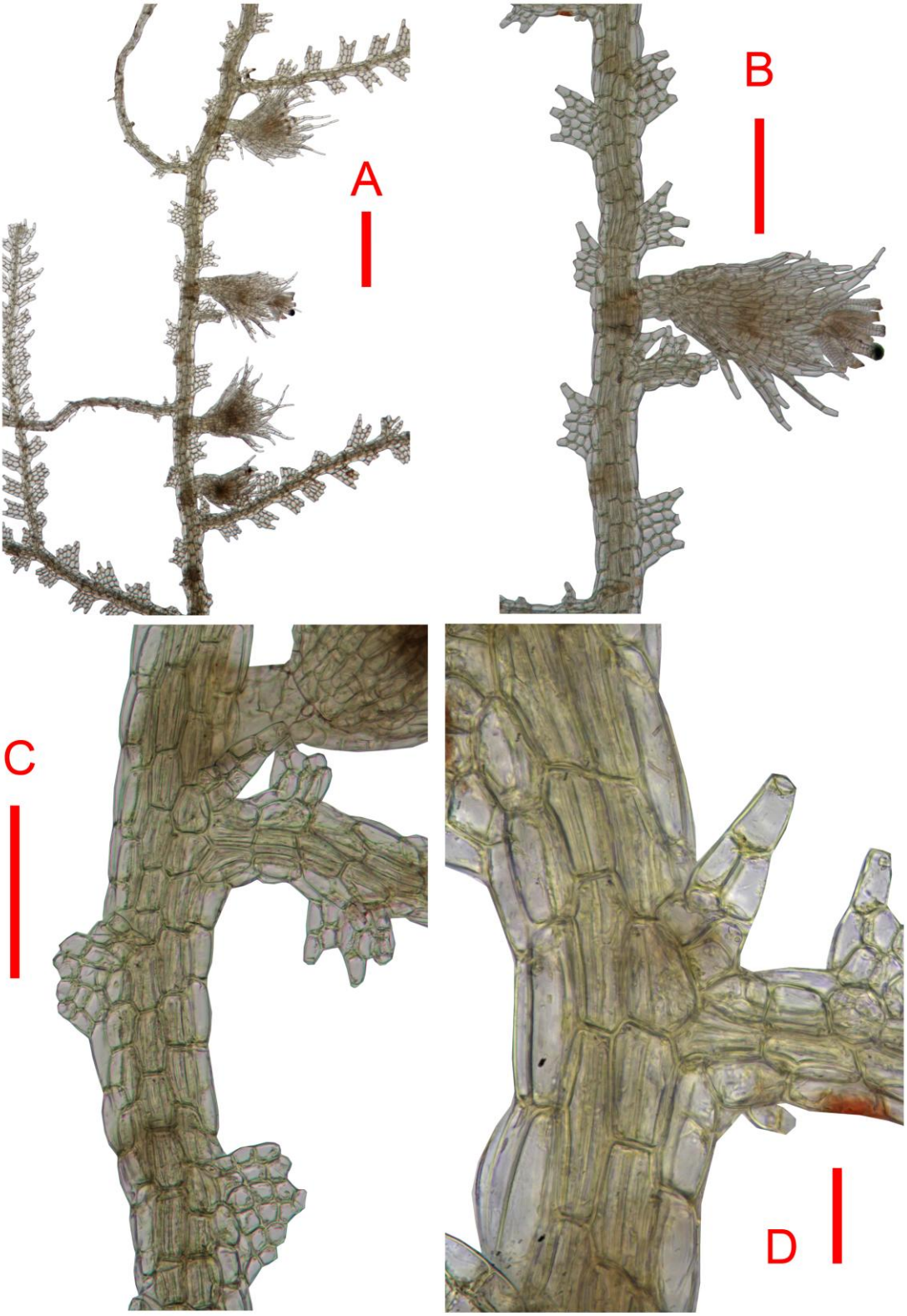

Plate 239: *Neolepidozia philippinensis*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from YORONG 931b – holotype)

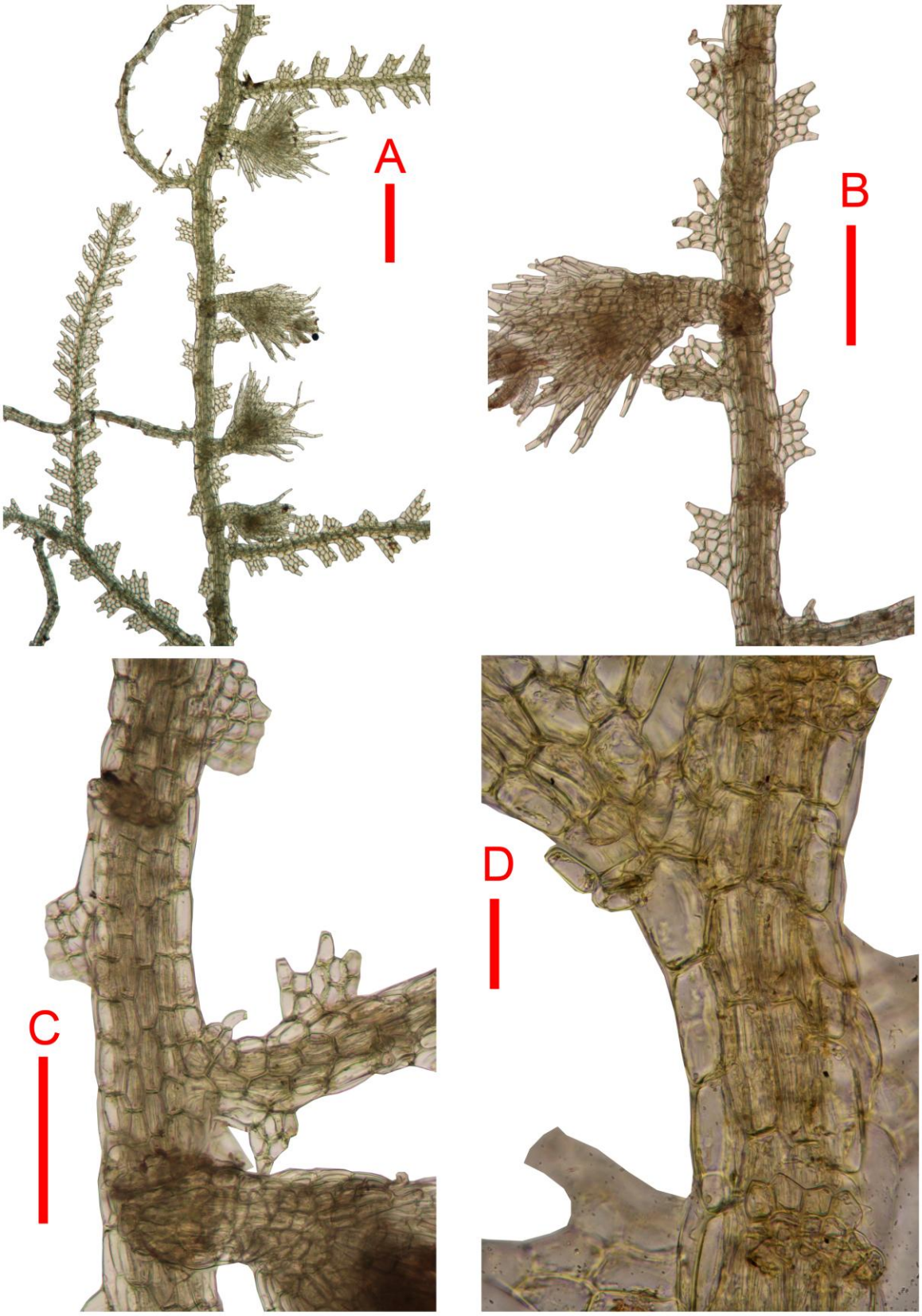

Plate 240: *Neolepidozia philippinensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from YORONG 931b – holotype)

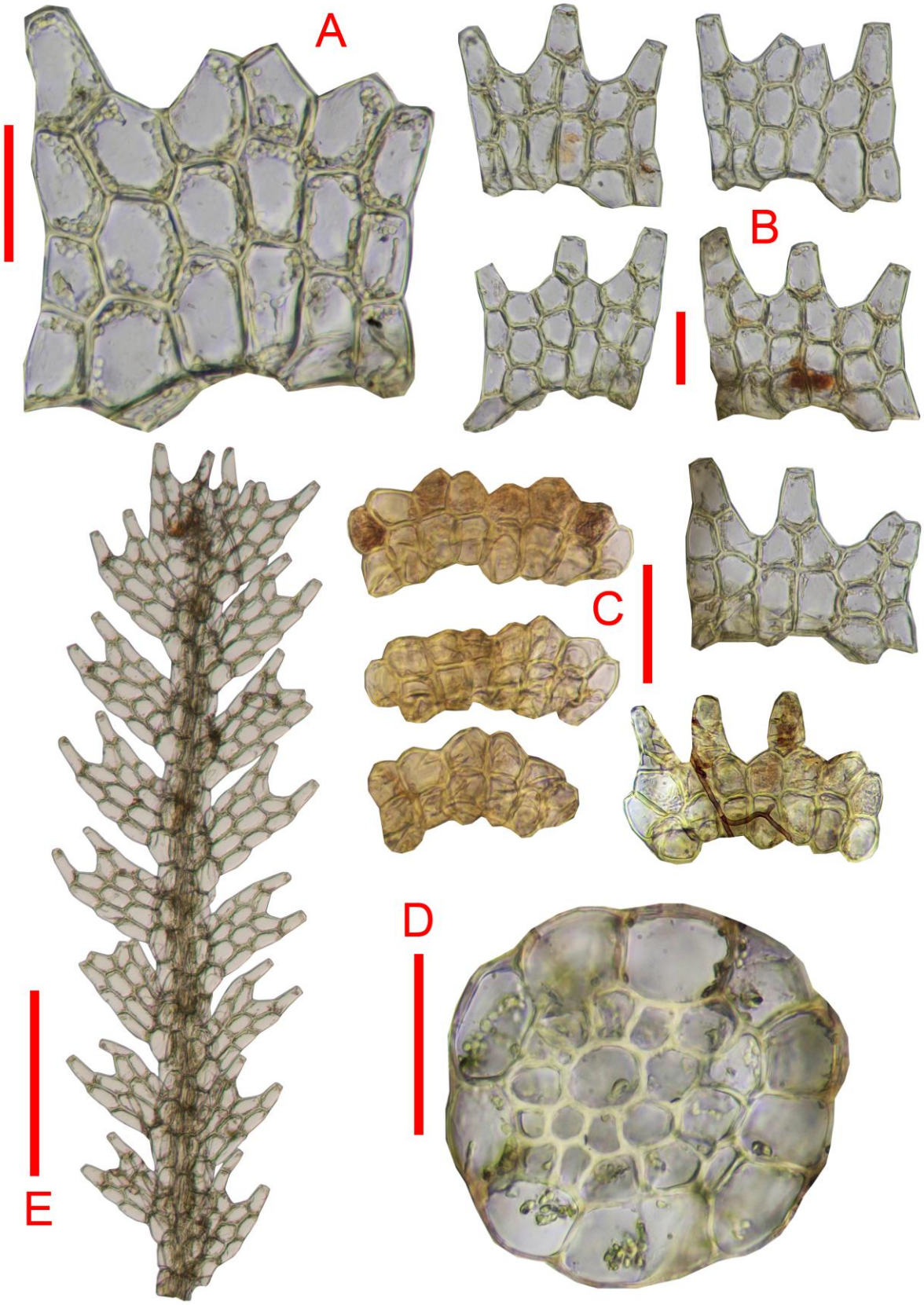

Plate 241: *Neolepidozia philippinensis*: A, B – Stem leaves; C – Underleaves; D – Stem cross section; E – Branch dorsal; Scales: A, B, C, D – 50 µm; E – 0.3 mm (from YORONG 931b – holotype)

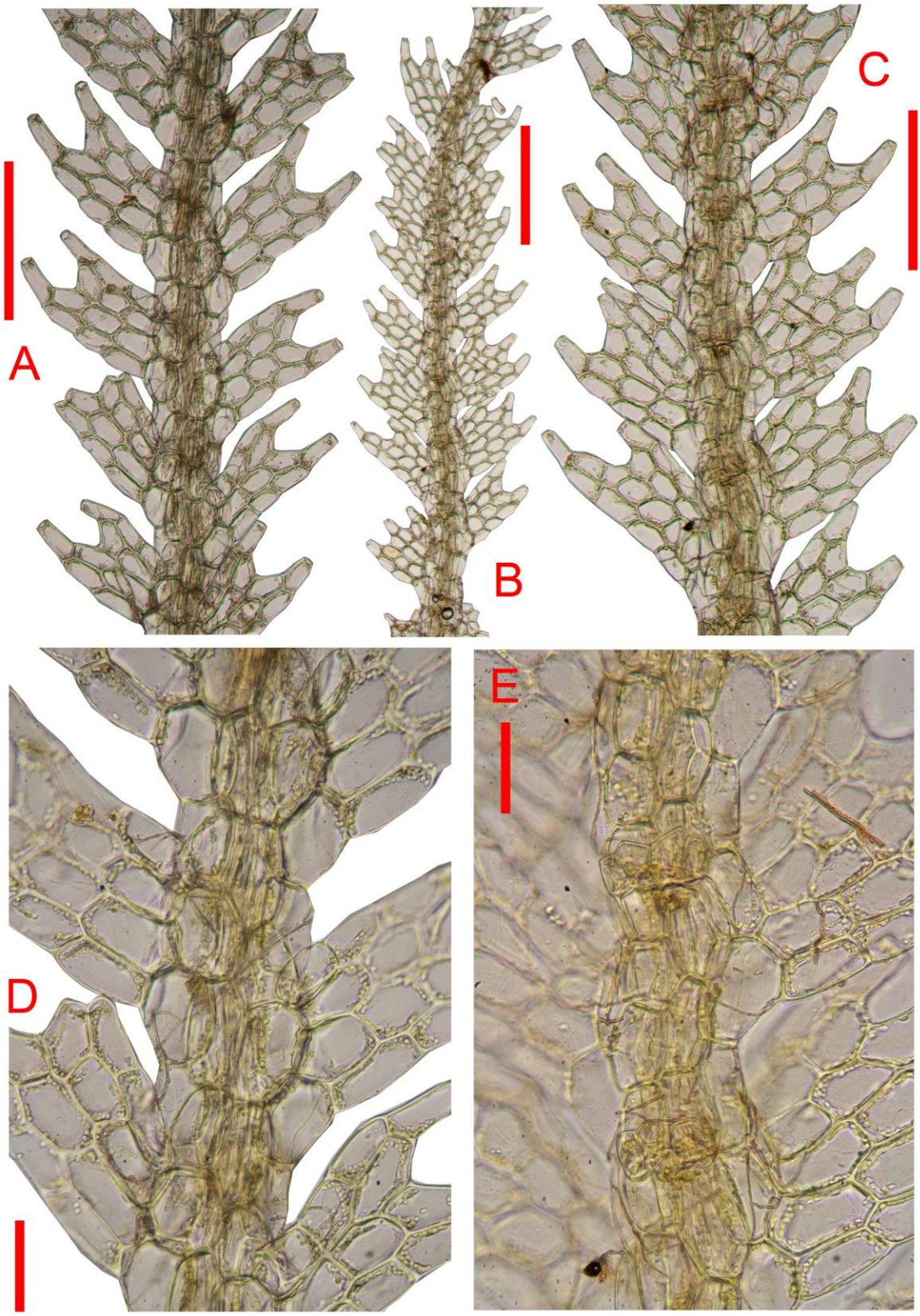

Plate 242: *Neolepidozia philippinensis*: A, D – Branch dorsal; B, C, E – Branch ventral; Scales: A, C – 0.2 mm; B – 0.3 mm; D, E – 50 µm (from YORONG 931b – holotype)

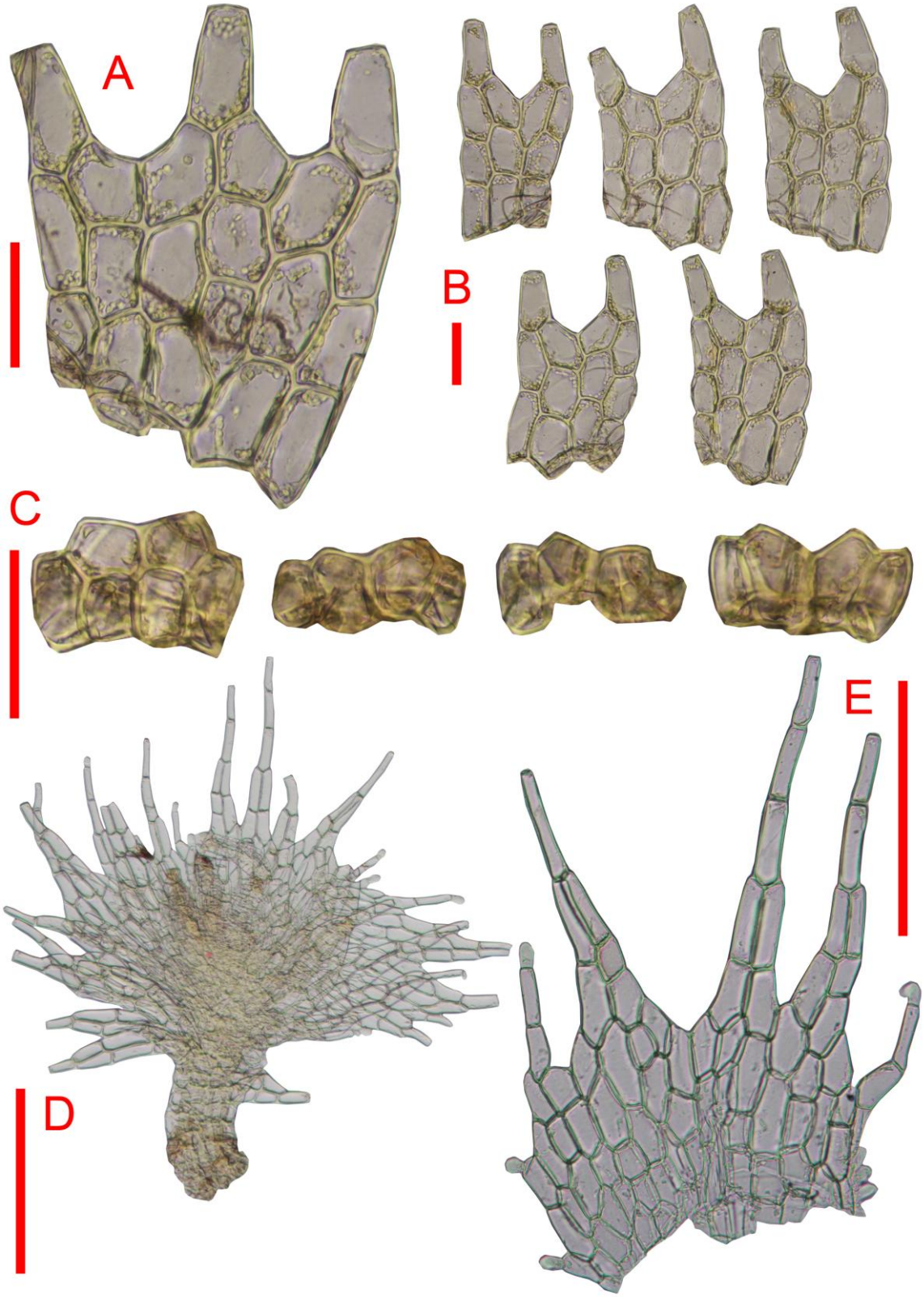

Plate 243: *Neolepidozia philippinensis*: A, B – Branch leaves; C – Branch underleaves; D – Female inflorescence; E – Female bract; Scales: A, B, C – 50 µm; D – 0.3 mm; E – 0.2 mm (from YORONG 931b – holotype)

Neolepidozia richardsii (HERZOG) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

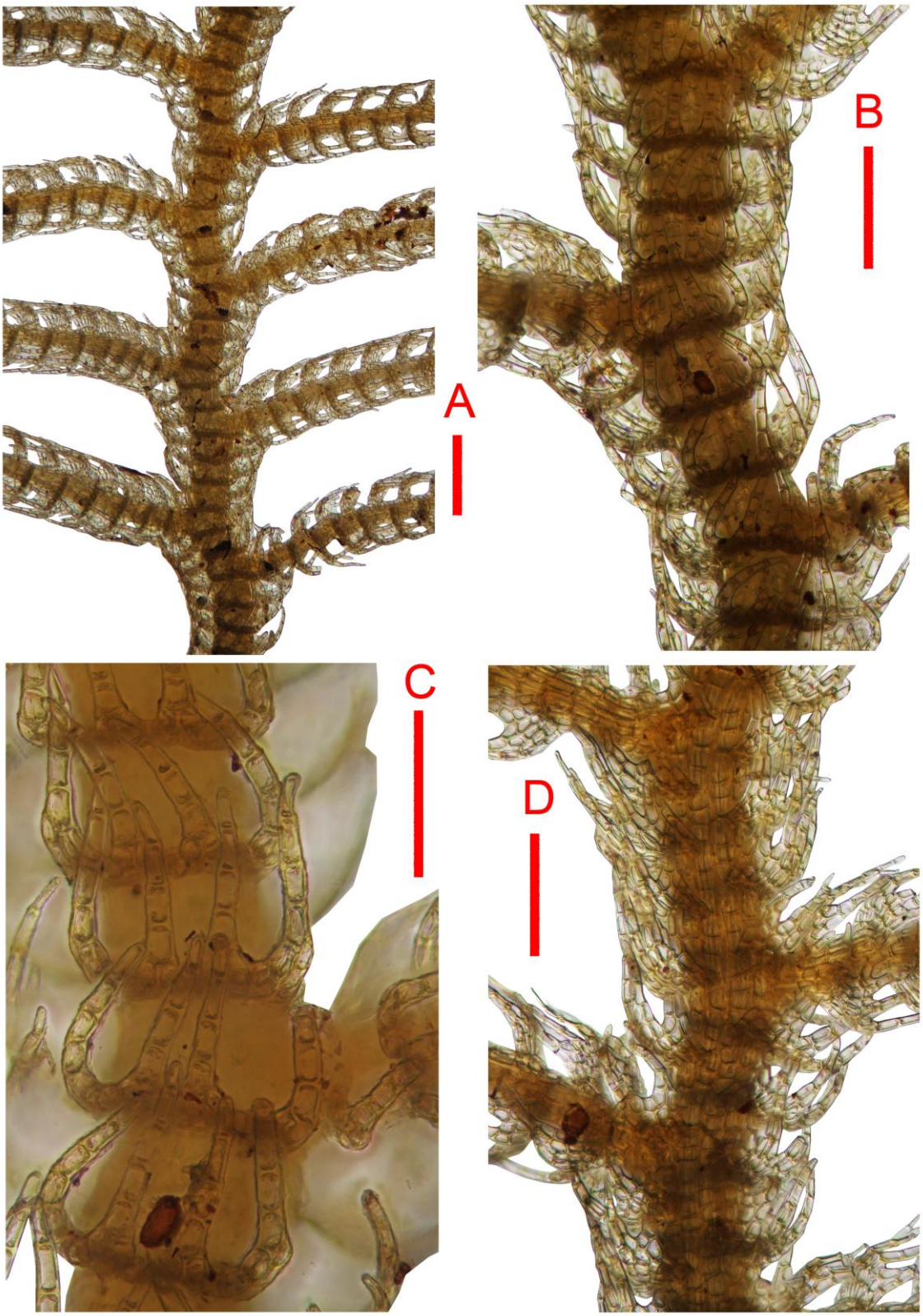

Plate 244: *Neolepidozia richardsii*: A, B, C – Plant ventral, D – Plant dorsal; Scales: A – 0.5 mm; B, D – 0.3 mm; C – 0.2 mm (from RICHARDS 1068 – lectotype).

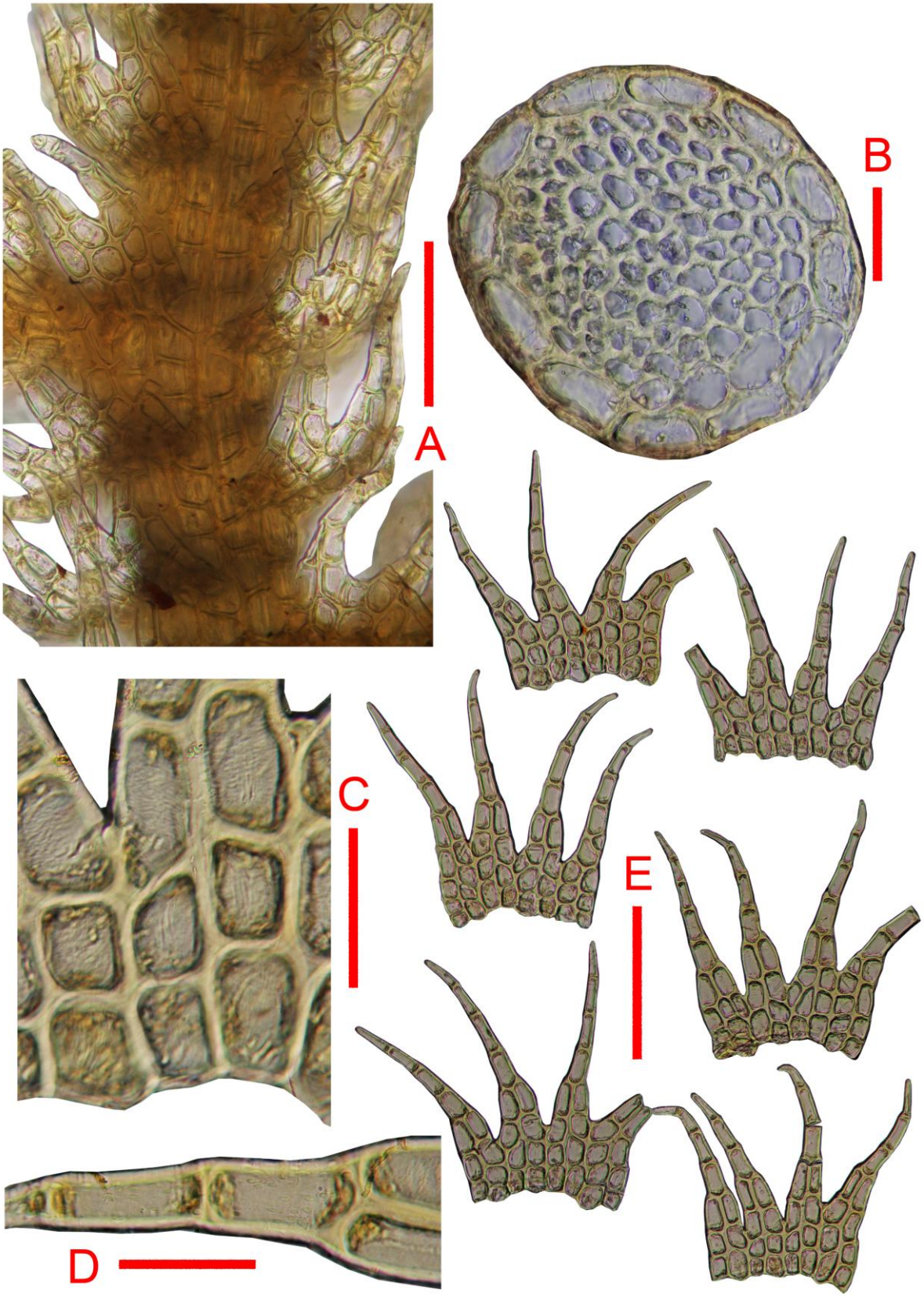

Plate 245: *Neolepidozia richardsii*: A – Plant dorsal, B – Stem cross section, C – Stem leaf disc, D – Stem leaf lobe, E – Stem leaves; Scales: A, E – 0.2 mm; B, C, D – 50 µm (from RICHARDS 1068 – lectotype).

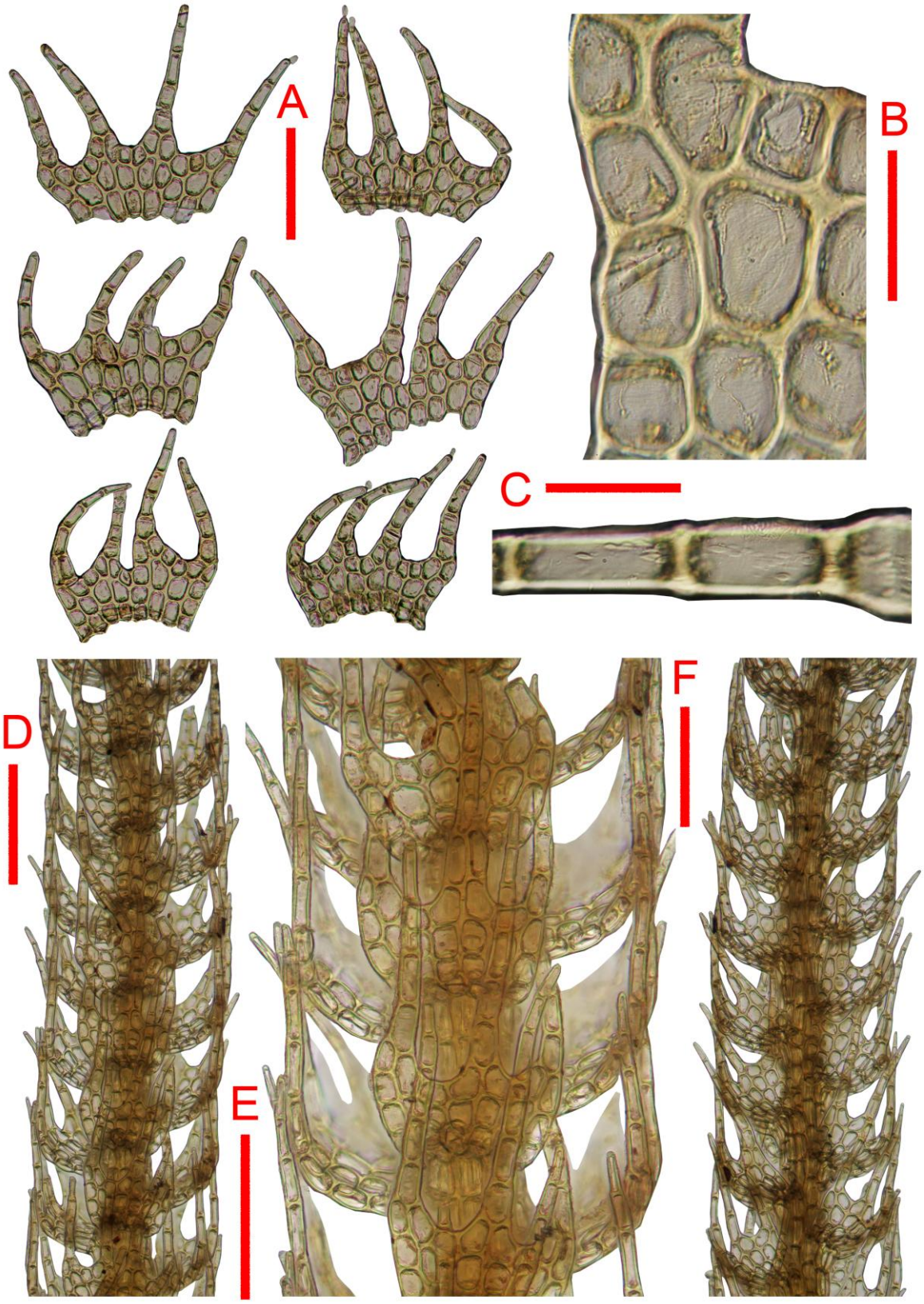

Plate 246: *Neolepidozia richardsii*: A – Stem underleaves, B – Stem underleaf disc, C – Stem underleaf lobe, D, E – Branch ventral, F – Branch dorsal; Scales: D, F – 0.3 mm, A, E – 0.2 mm; B, C – 50 µm (from RICHARDS 1068 – lectotype).

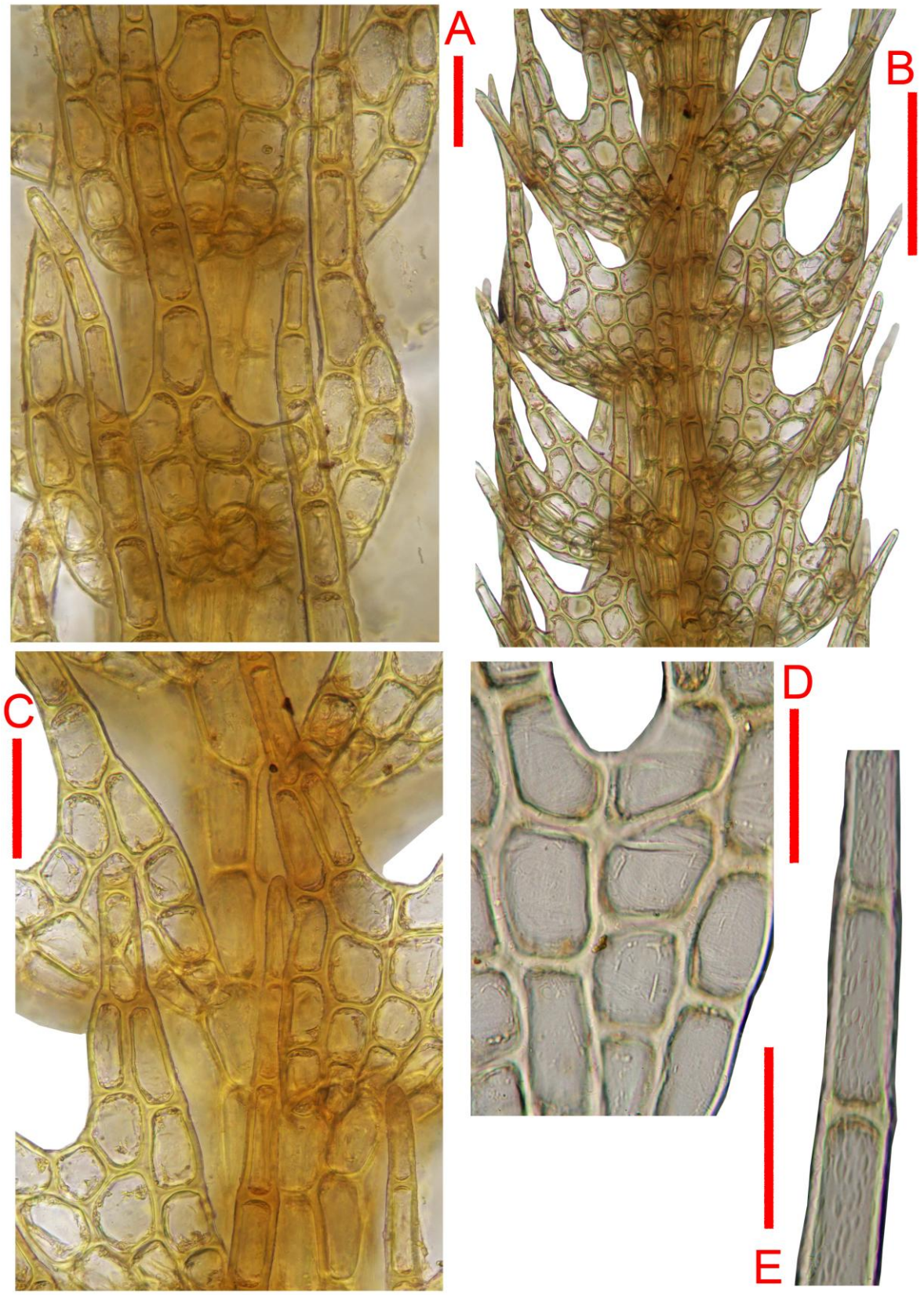

Plate 247: *Neolepidozia richardsii*: A – Branch ventral, B, C - Branch dorsal, D – Branch leaf disc, E – Branch leaf lobe; Scales: B – 0.2 mm; A, C, D, E – 50 µm (from RICHARDS 1068 – lectotype).

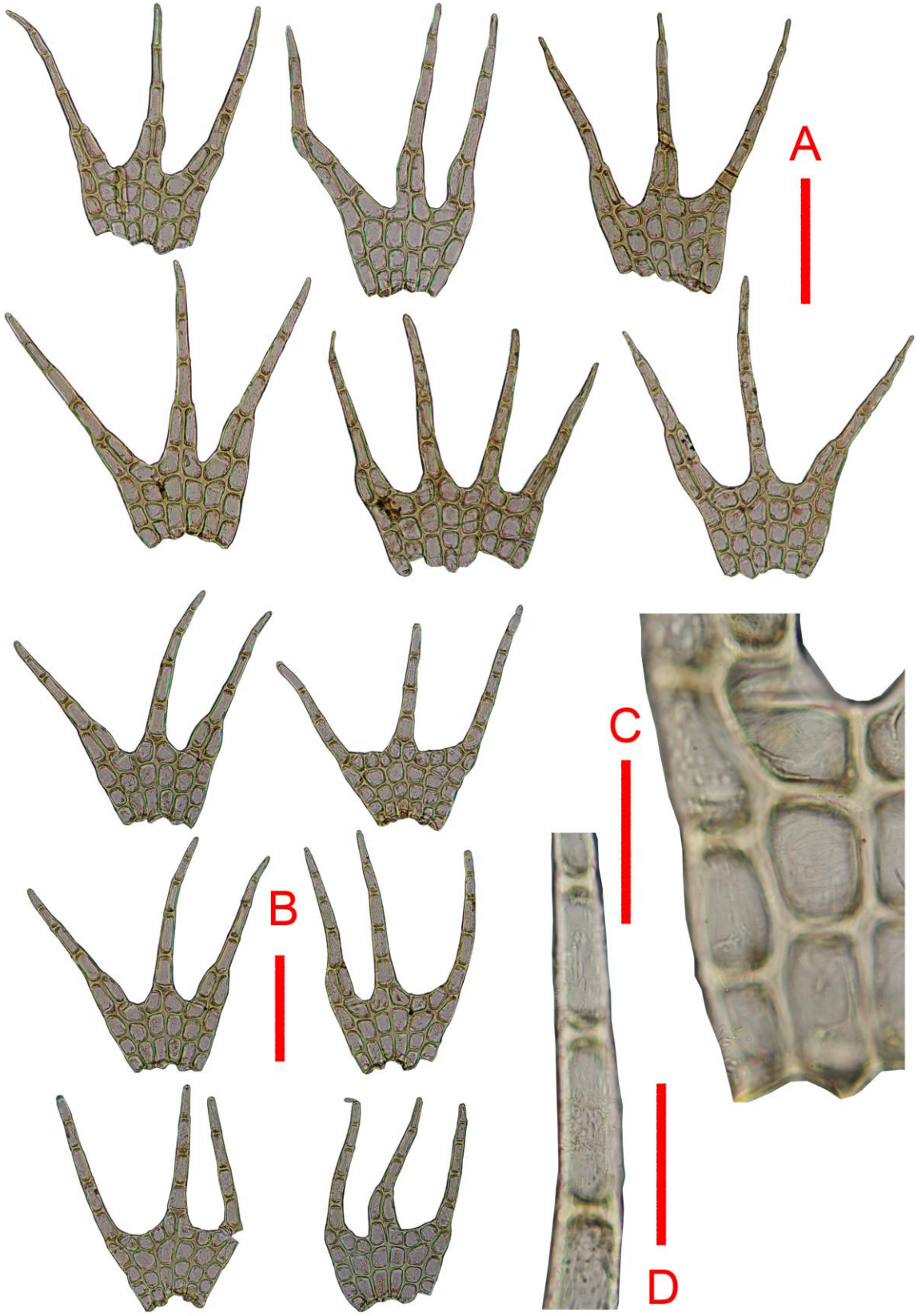

Plate 248: *Neolepidozia richardsii*: A – Branch leaves, B – Branch underleaves, C – Branch underleaf disc, D – Branch underleaf lobe; Scales: A, B – 0.2 mm; C, D – 50 µm (from RICHARDS 1068 – lectotype).

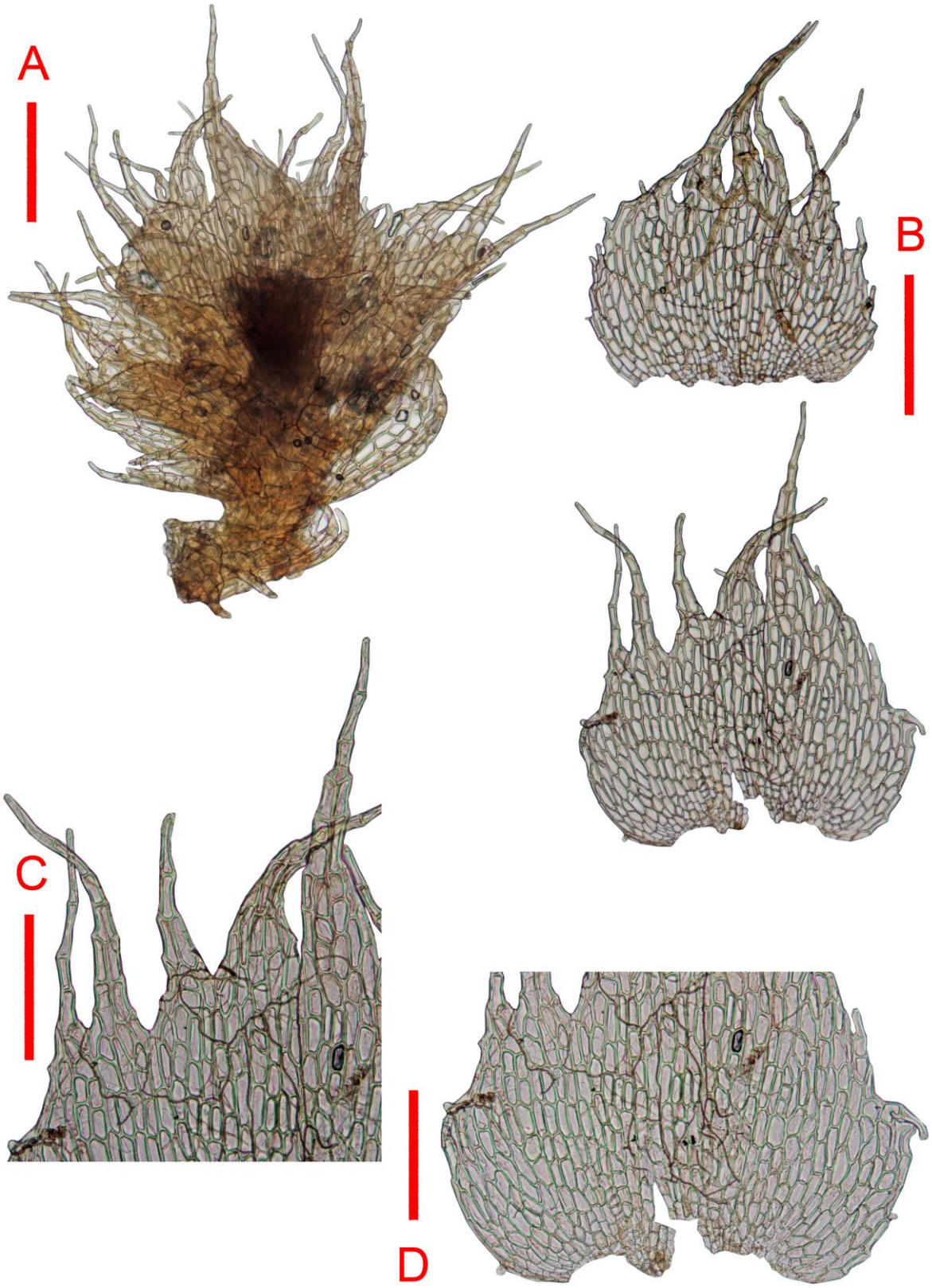

Plate 249: *Neolepidozia richardsii*: A – Female inflorescense, B – Female bract, C – Female bract apex, D – Female bract base; Scales: A, B – 0.3 mm; C, D – 0.2 mm (from RICHARDS 1068 – lectotype).

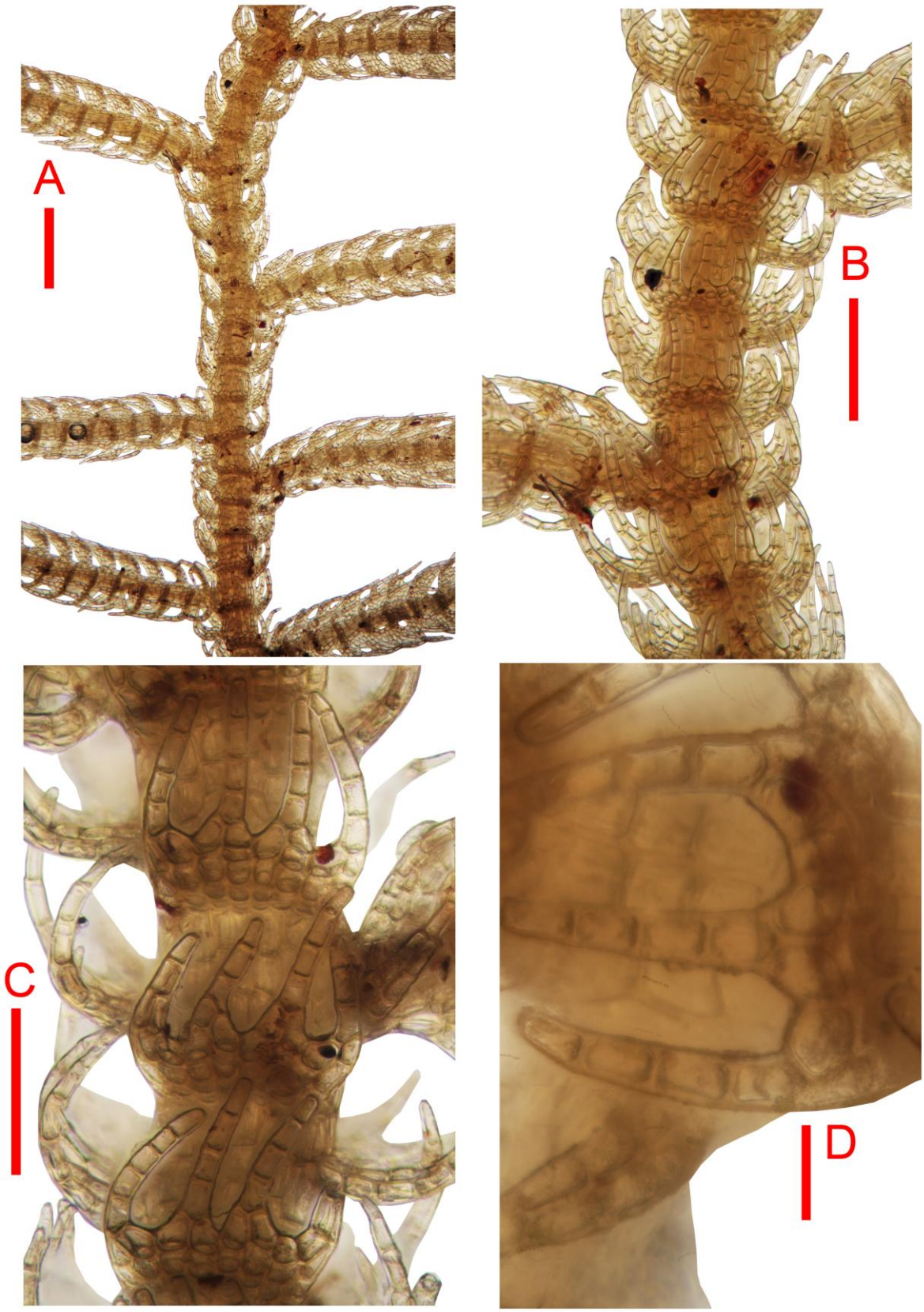

Plate 250: *Neolepidozia richardsii*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SHEVOCK 54810).

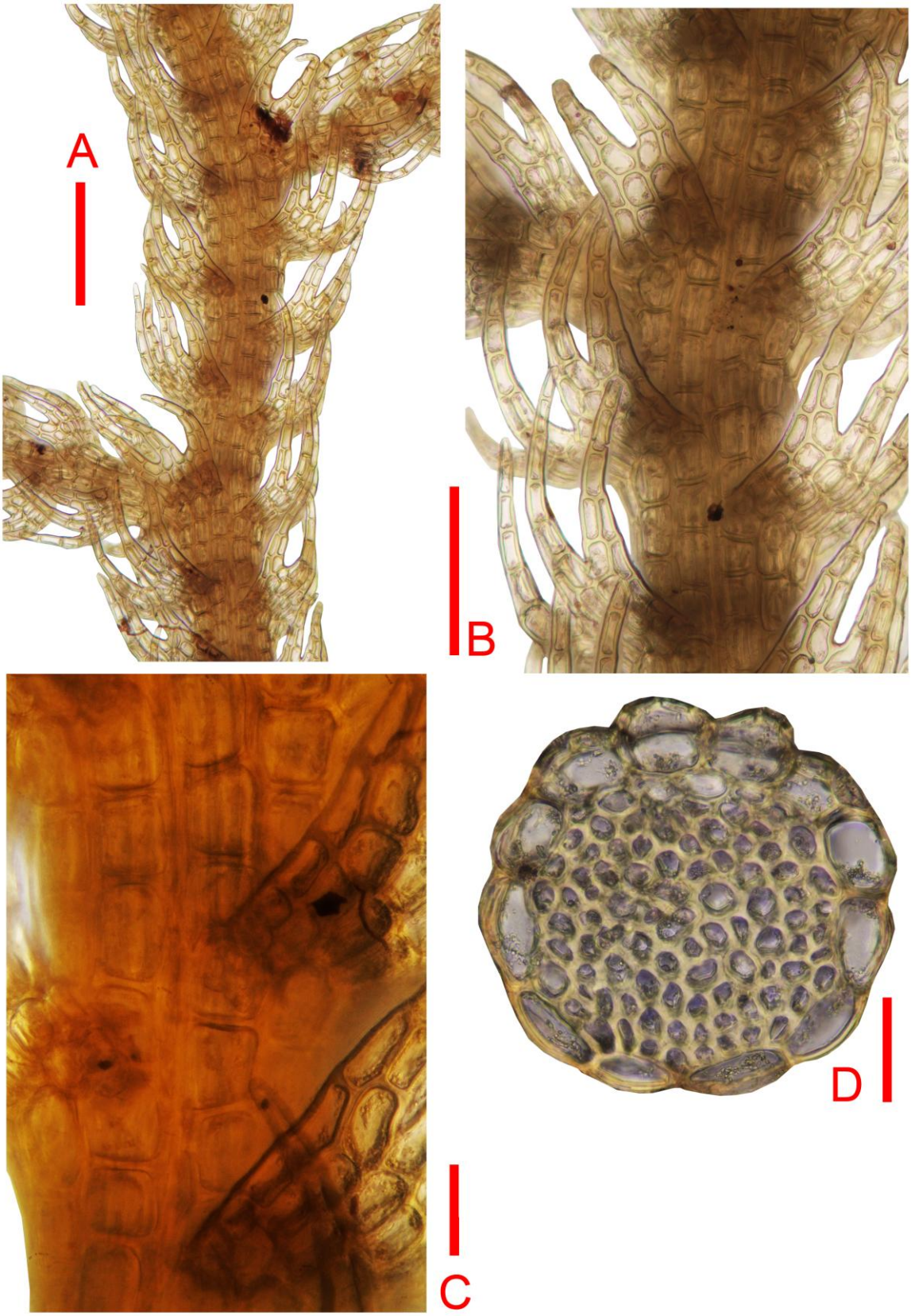

Plate 251: *Neolepidozia richardsii*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D 50 – µm (from SHEVOCK 54810).

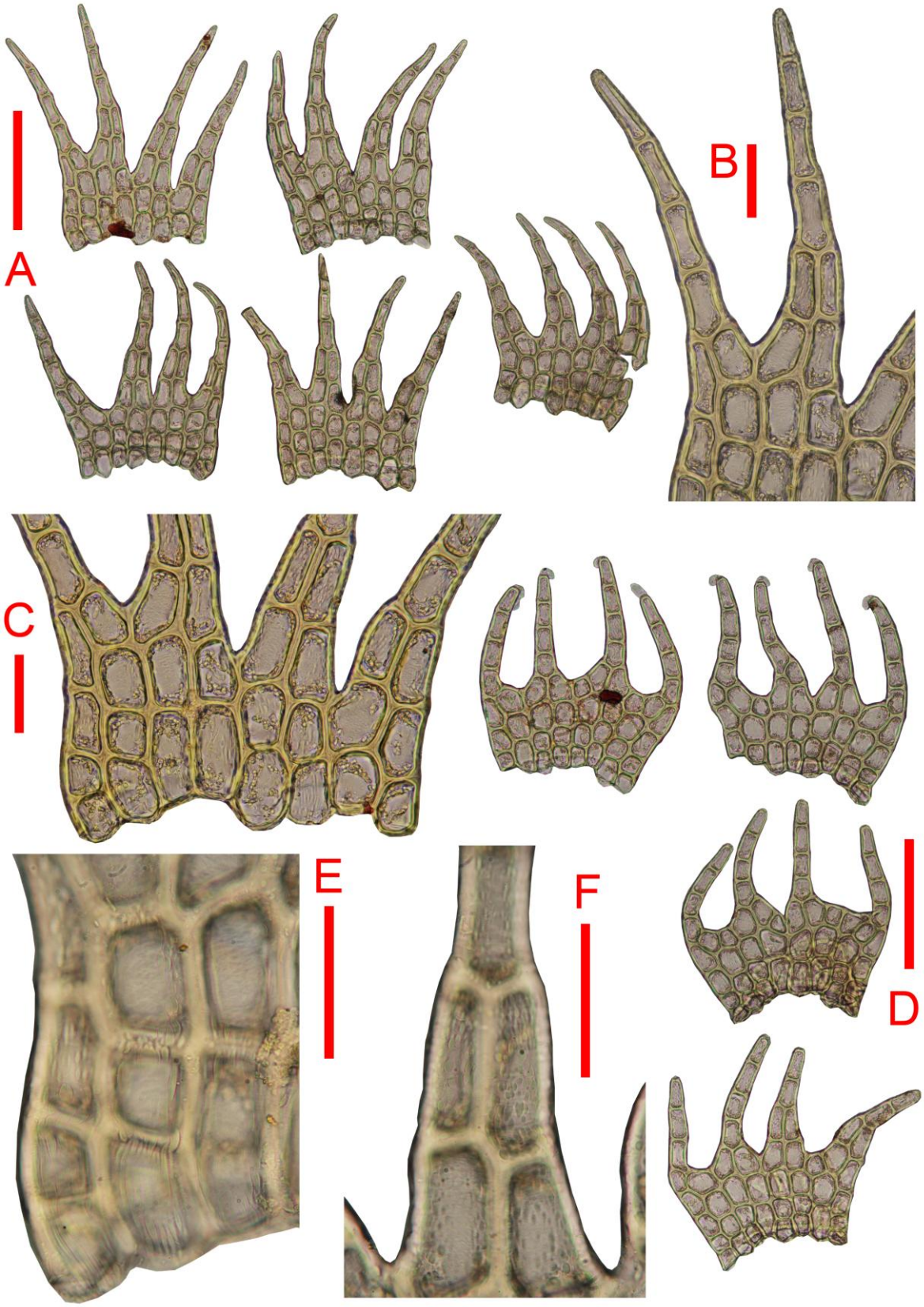

Plate 252: *Neolepidozia richardsii*: A – Stem leaves, B, F – Stem leaf lobes, C, E – Stem leaf disc, D – Stem underleaves; Scales: A, D – 0.2 mm; B, C, E, F – 50 µm (from SHEVOCK 54810).

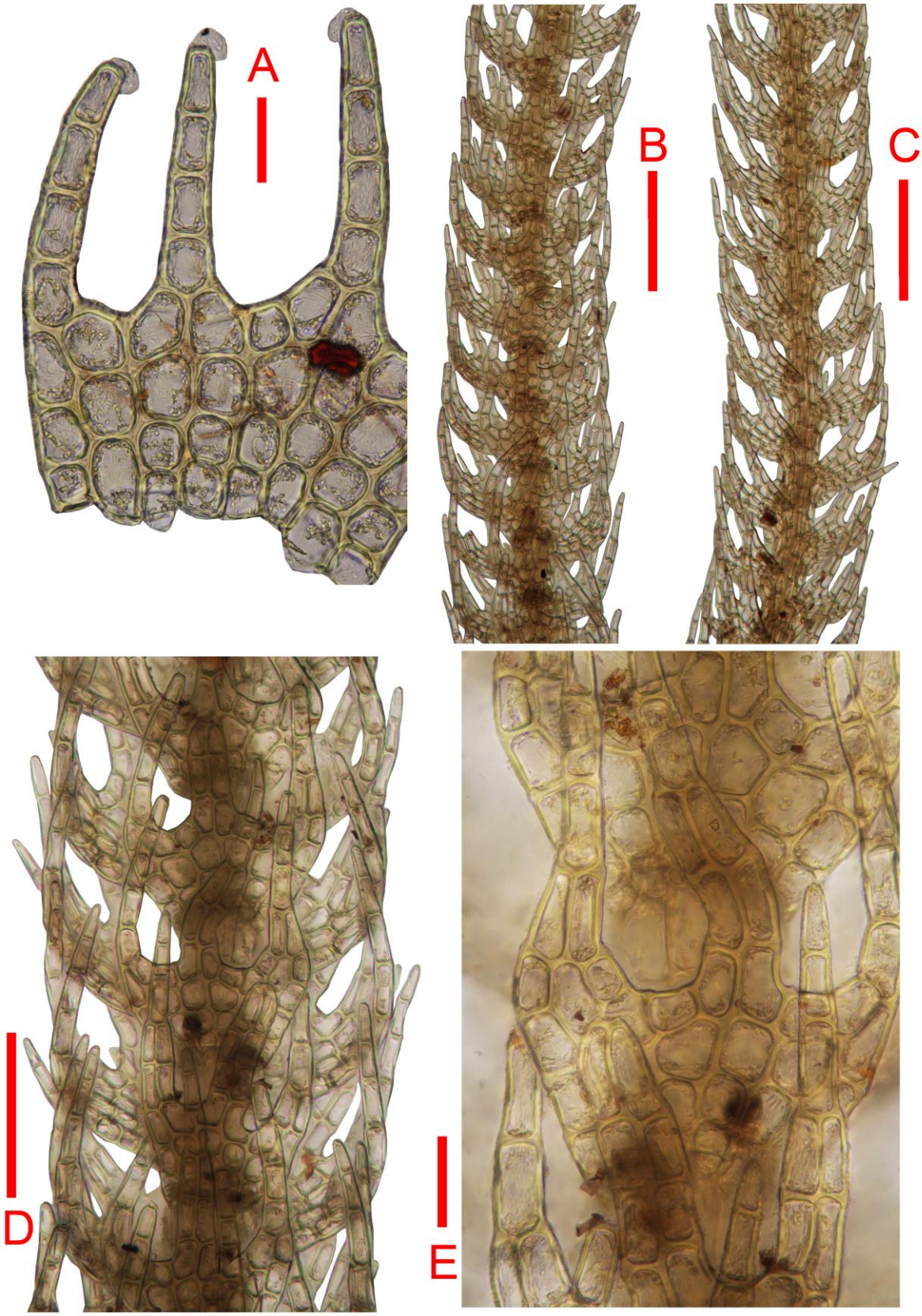

Plate 253: *Neolepidozia richardsii*: A – Stem underleaf, B, D, E – Branch ventral, C – Branch dorsal; Scales: B, C – 0.3 mm; D – 0.2 mm, A, E – 50 µm (from SHEVOCK 54810).

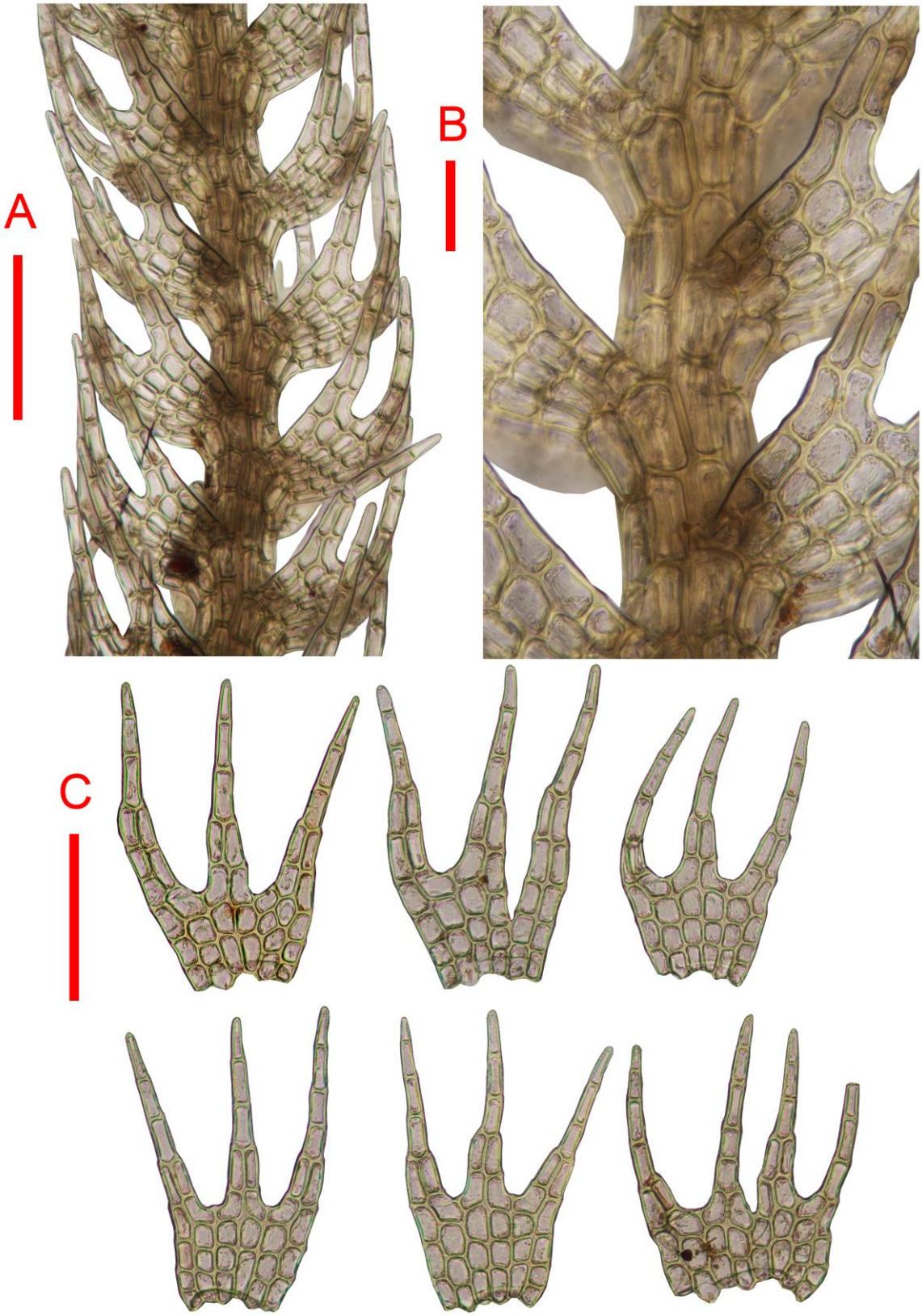

Plate 254: *Neolepidozia richardsii*: A, B – Branch dorsal, C – Branch leaves; Scales: A, C – 0.2 mm; B – 50 µm (from SHEVOCK 54810).

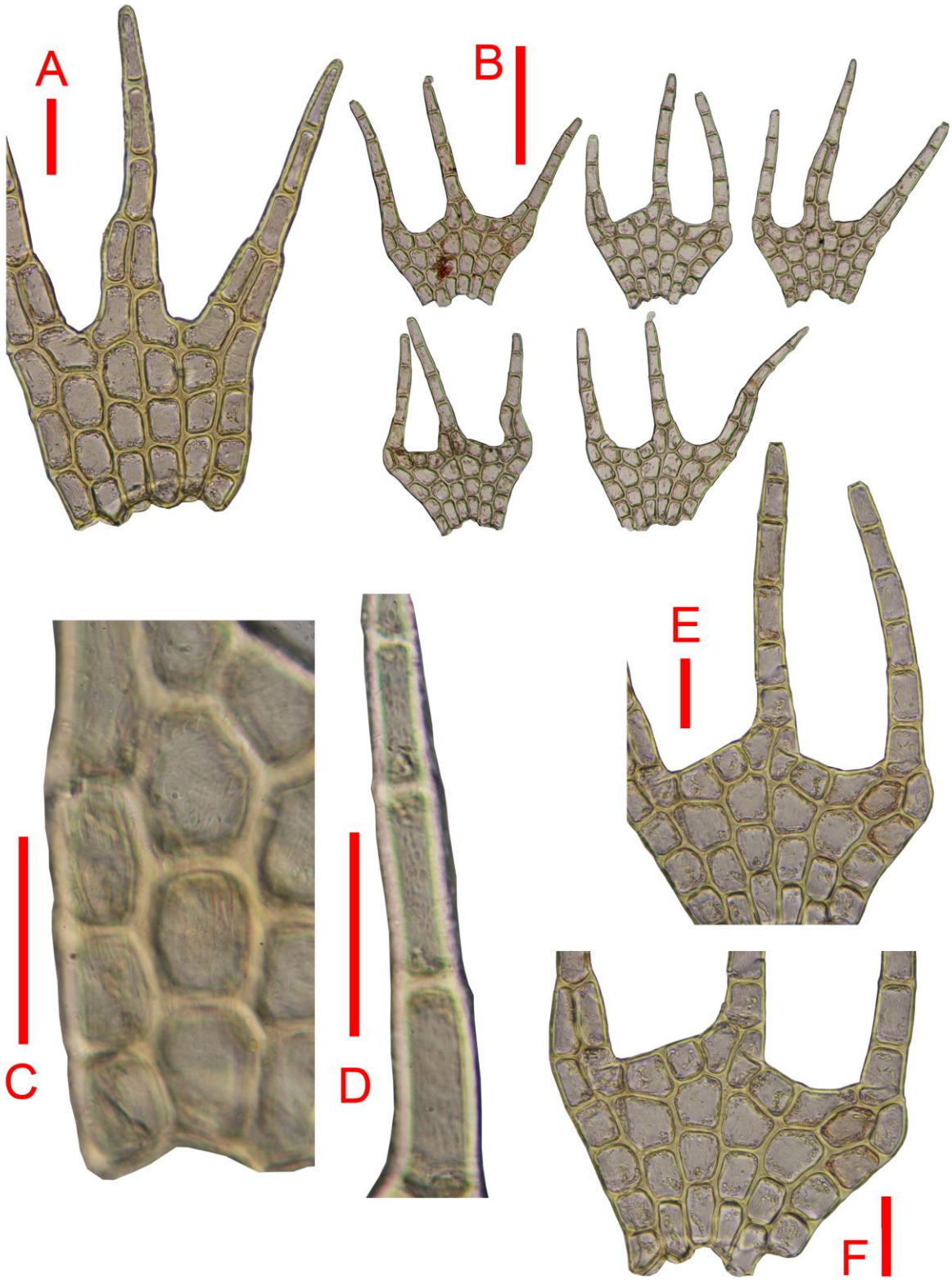

Plate 255: *Neolepidozia richardsii*: A – Stem leaf, B – Branch underleaves, C – Stem leaf disc, D – Stem leaf lobe, E – Branch underleaf lobes, F – Branch underleaf disc; Scales: B – 0.2 mm; A, C, D, E, F – 50 µm (from SHEVOCK 54810).

Neolepidozia salasii **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

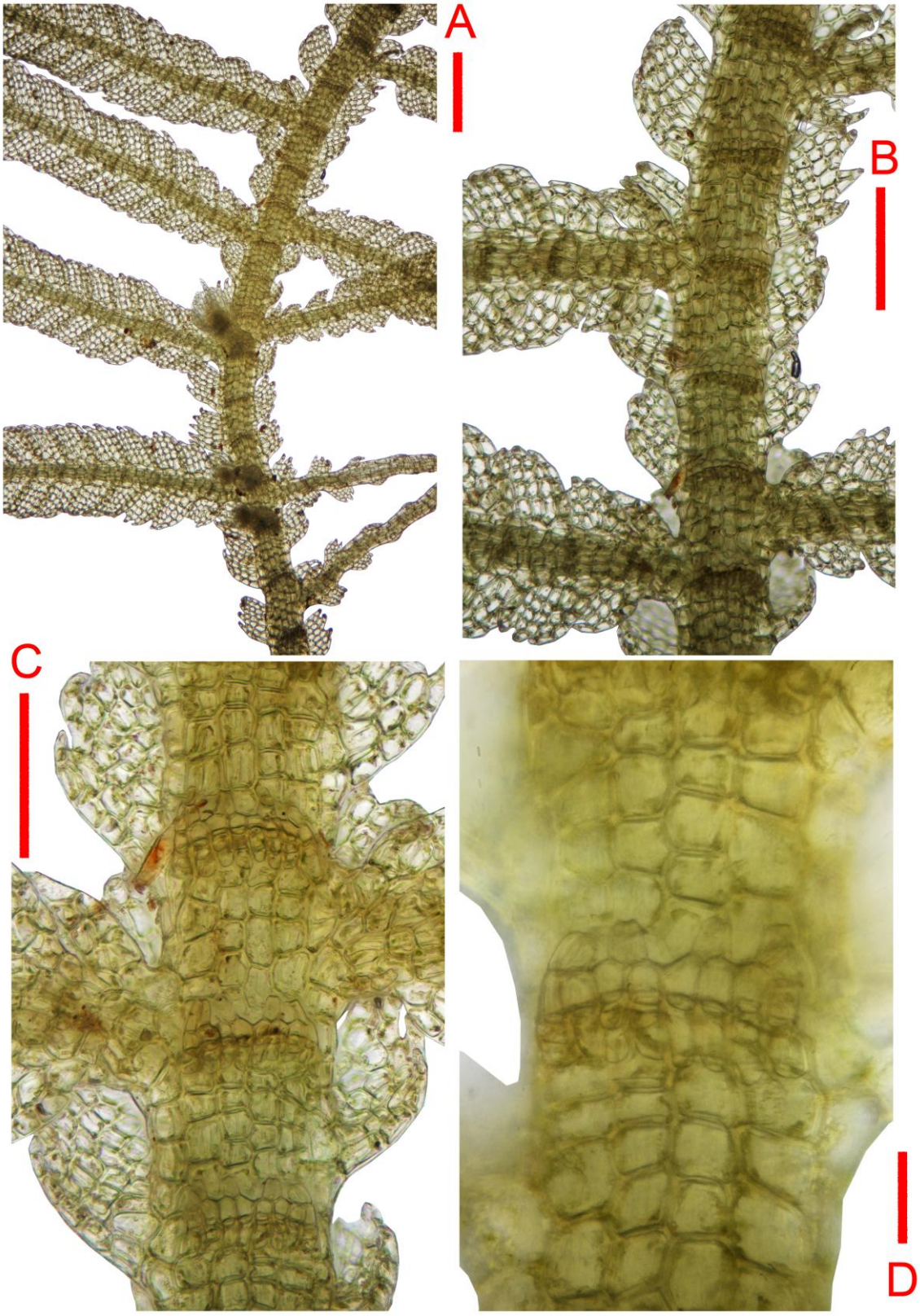

Plate 256: *Neolepidozia salasii*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SHEVOCK 56230 – holotype)

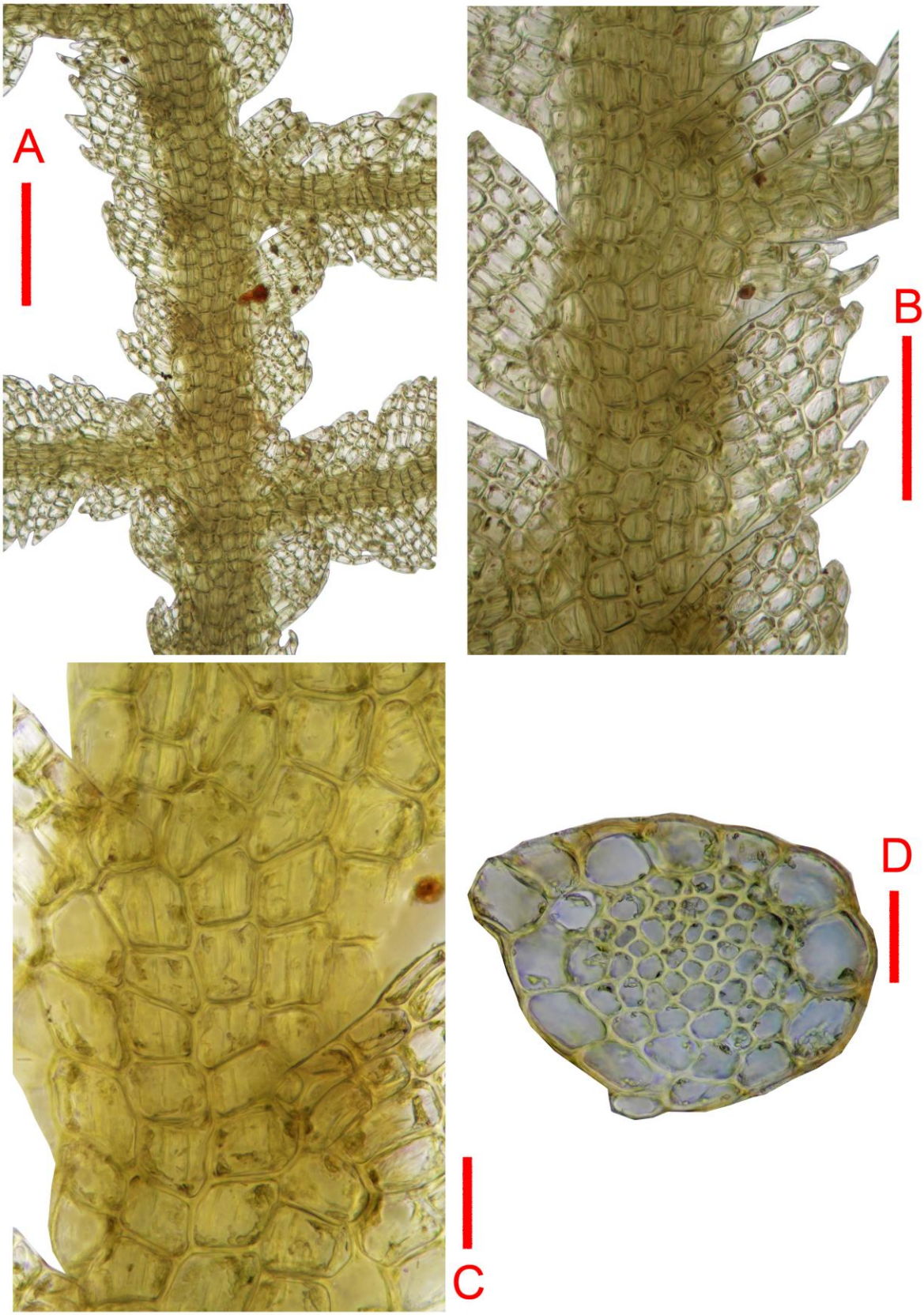

Plate 257: *Neolepidozia salasii*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SHEVOCK 56230 – holotype)

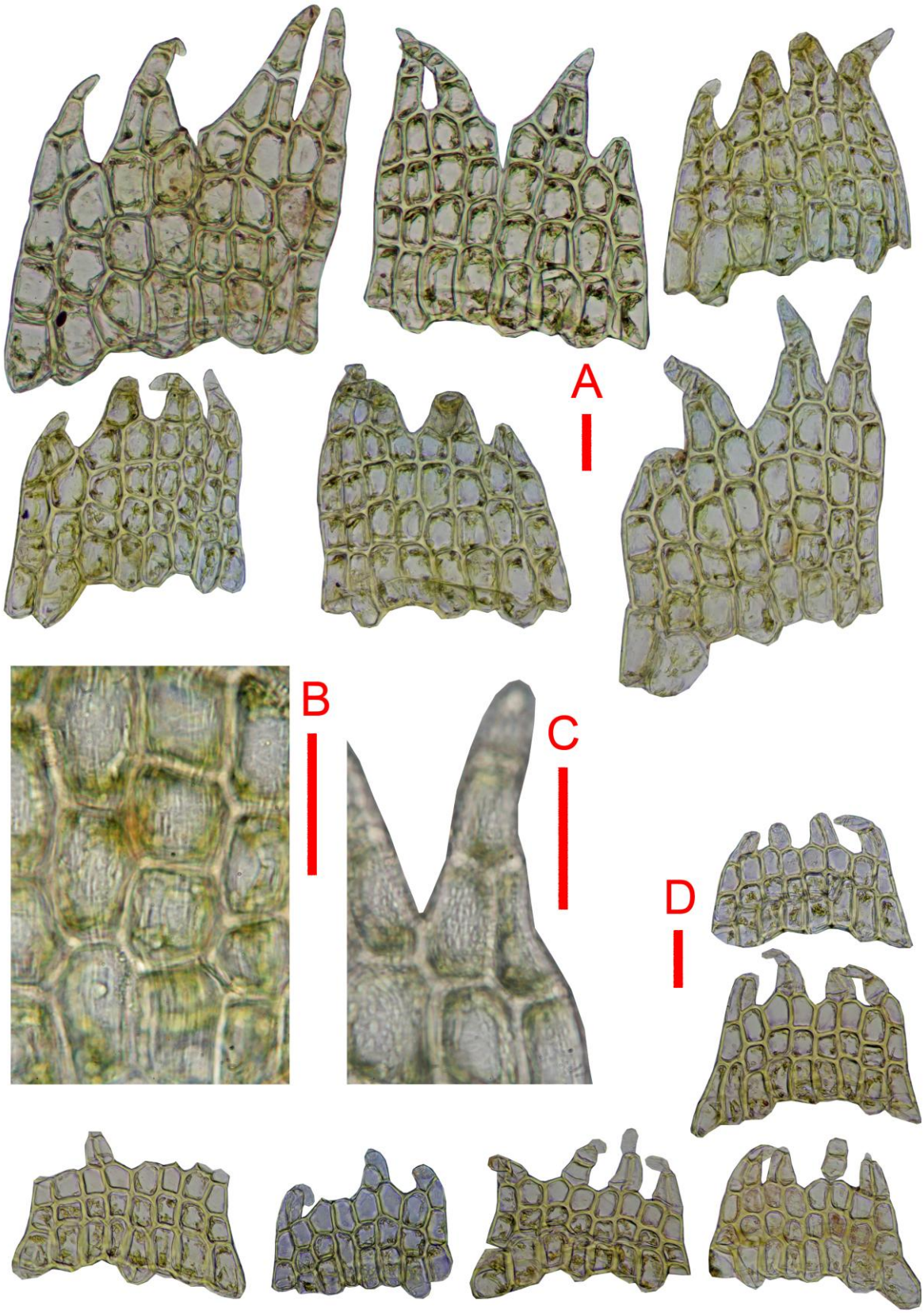

Plate 258: *Neolepidozia salasii*: A – Stem leaves, B – Stem leaf disc, C – Stem leaf lobe, D – Stem underleaves; Scales: A, B, C, D – 50 µm (from SHEVOCK 56230 – holotype)

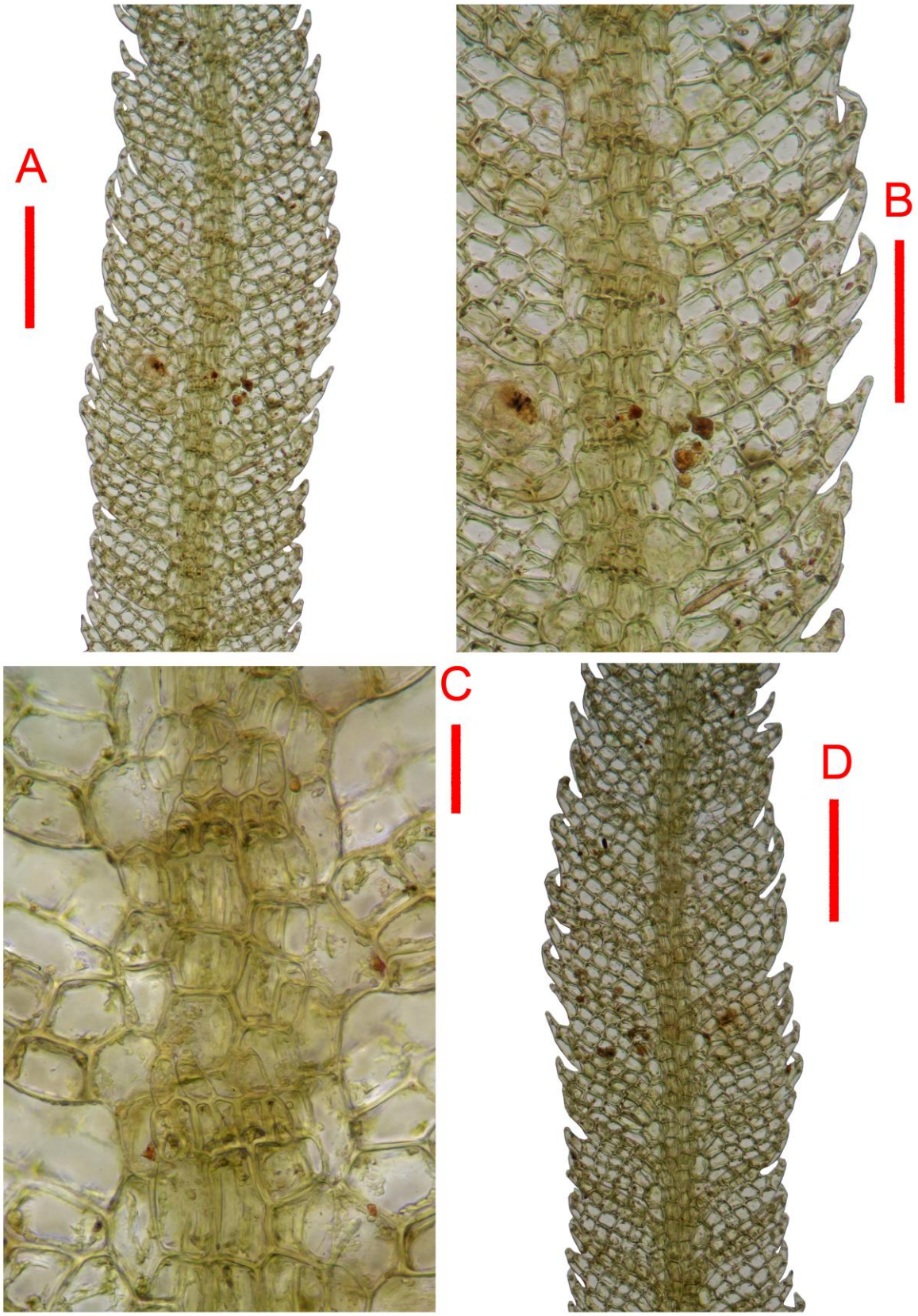

Plate 259: *Neolepidozia salasii*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm, B – 0.2 mm, C – 50 µm (from SHEVOCK 56230 – holotype)

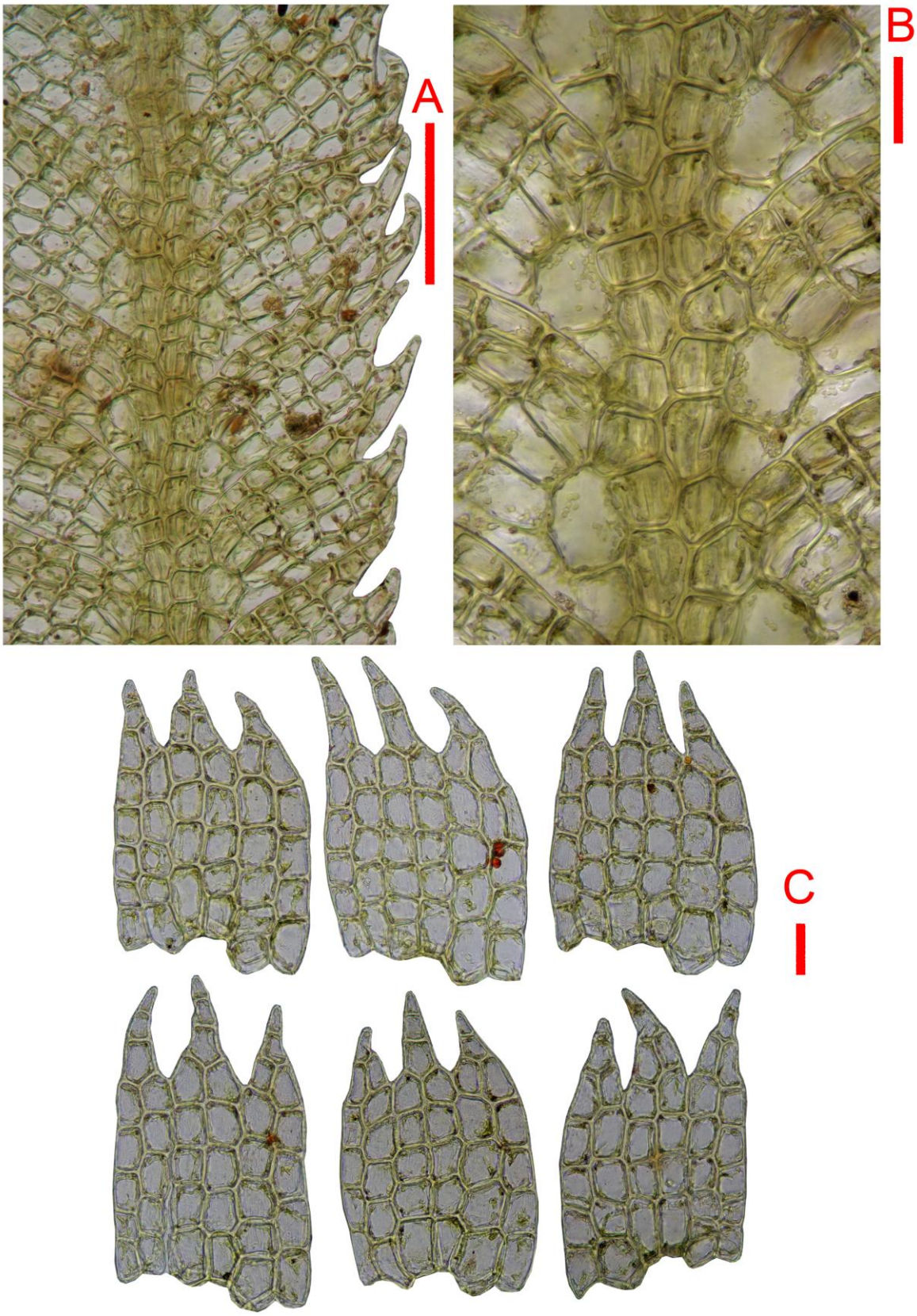

Plate 260: *Neolepidozia salasii*: A, B – Branch dorsal, C – Branch leaves; Scales: A – 0.2 mm; B, C – 50 µm (from SHEVOCK 56230 – holotype)

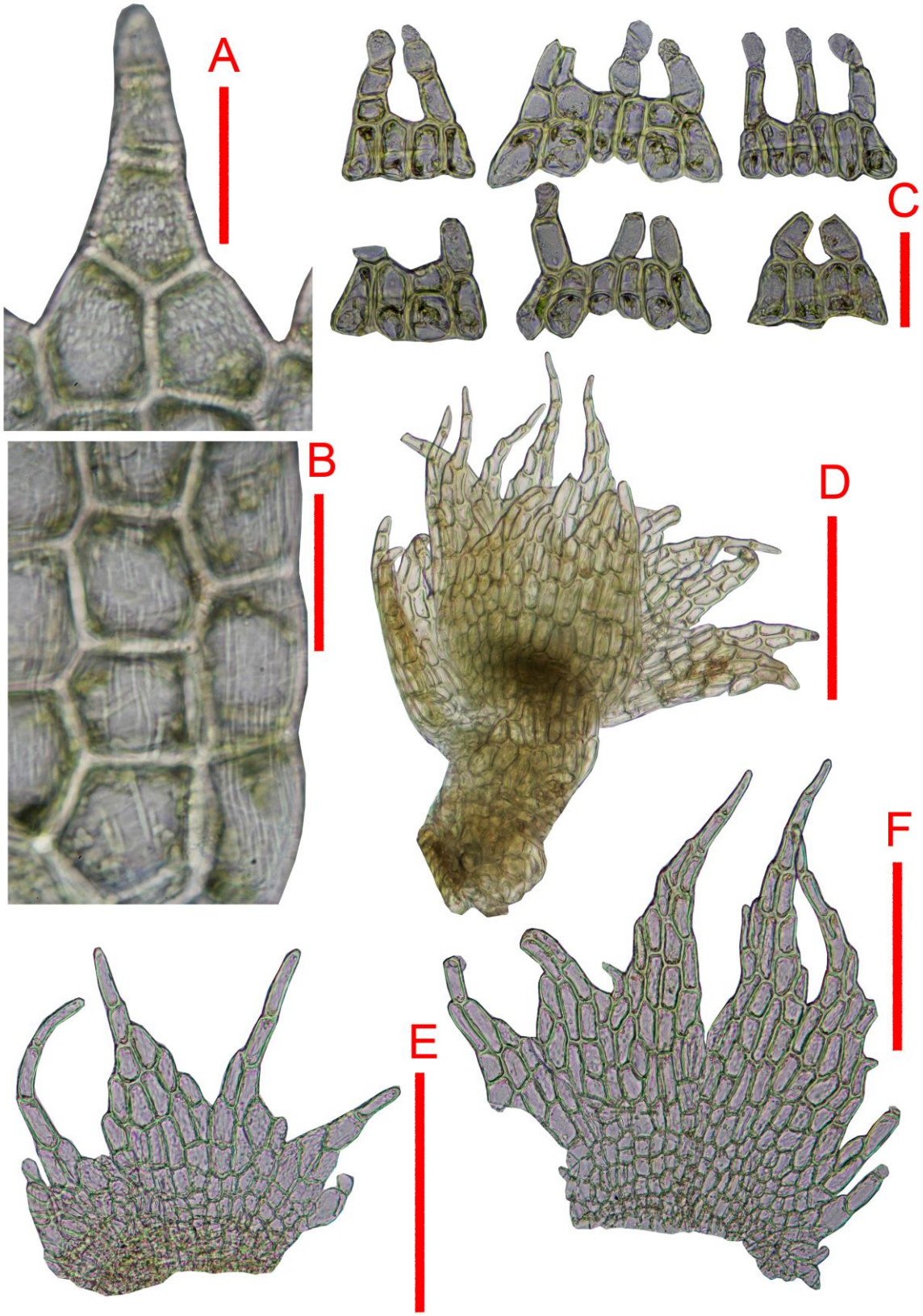

Plate 261: *Neolepidozia salasii*: A – Branch leaf lobe, B – Branch leaf disc, C – Branch underleaves, D – Female inflorescense, E – Female bracteole, F – Female bract; Scales: D – 0.3 mm; E, F – 0.2 mm; A, B, C – 50 µm (from SHEVOCK 56230 – holotype)

Neolepidozia sarawakensis **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

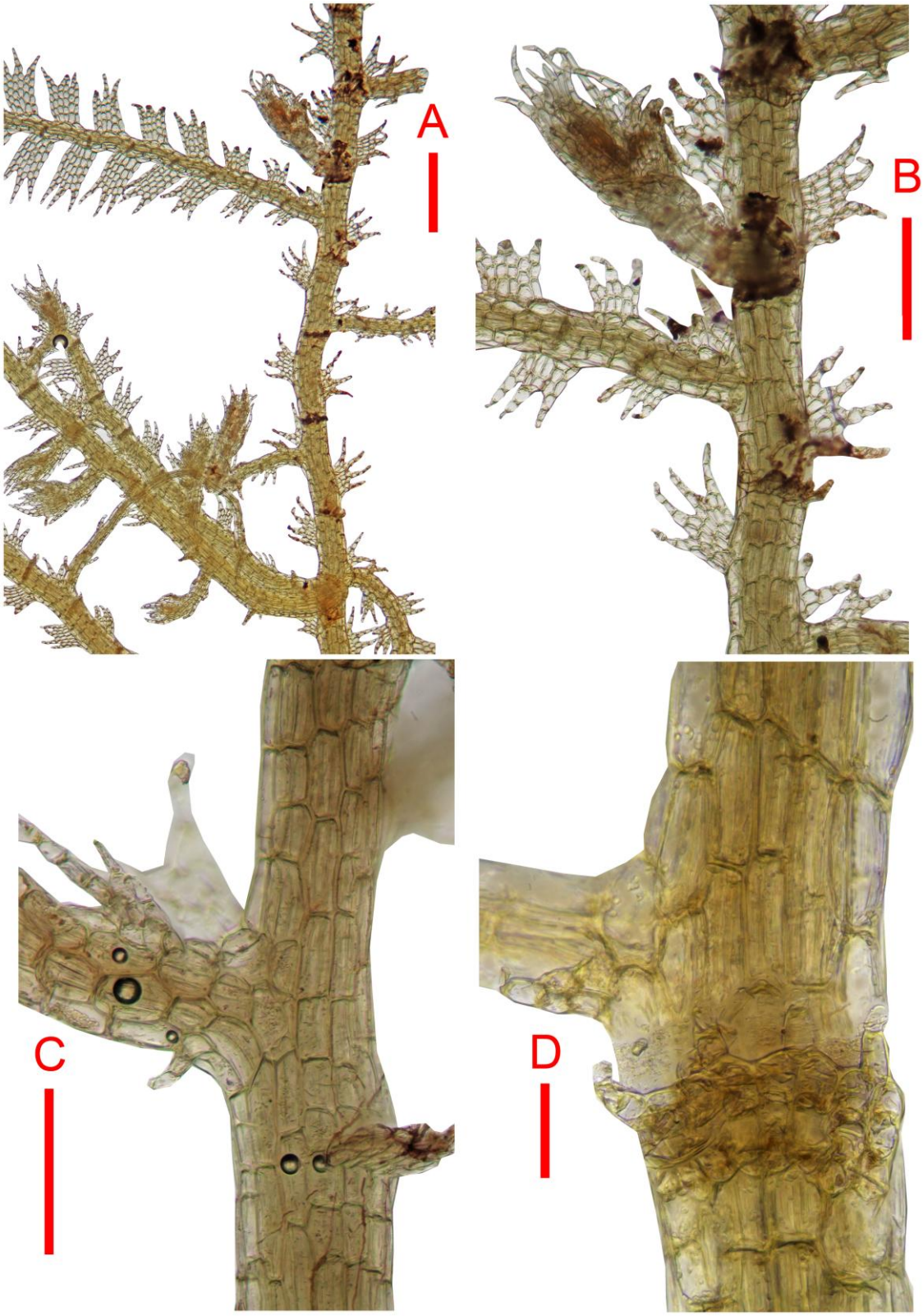

Plate 262: *Neolepidozia sarawakensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from RICHARDS 2153, JE04010703 – holotype)

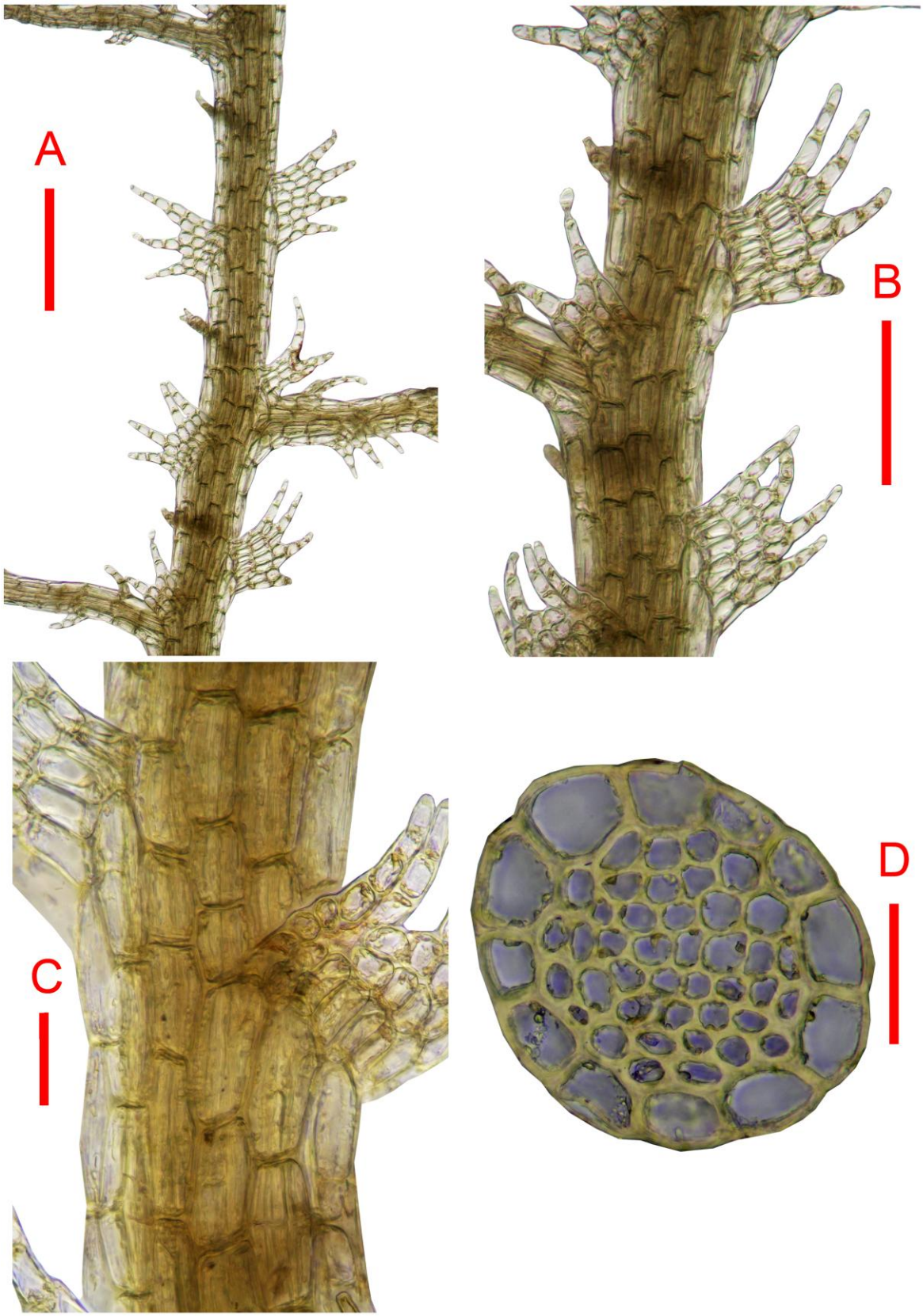

Plate 263: *Neolepidozia sarawakensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from RICHARDS 2153, JE04010703 – holotype)

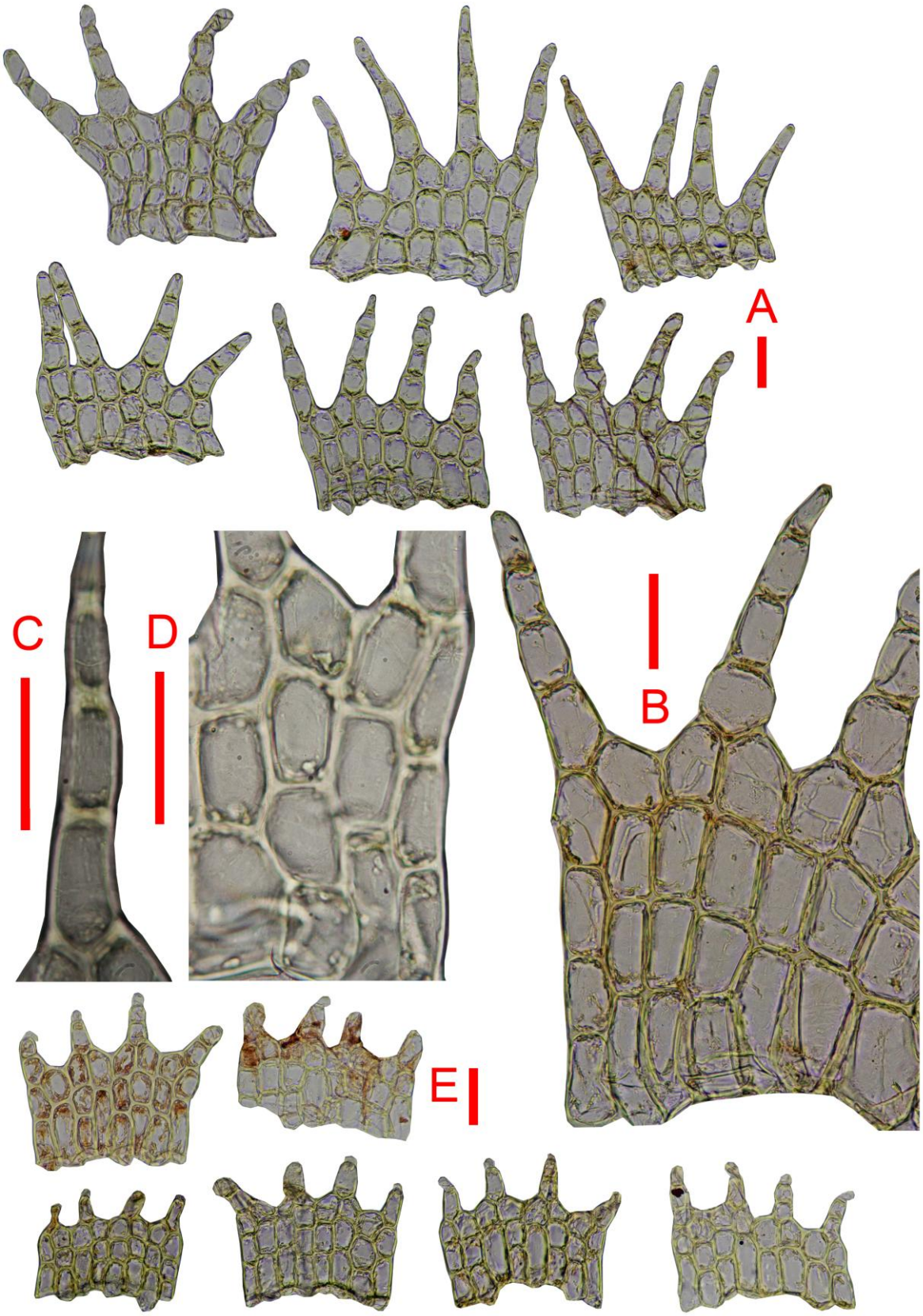

Plate 264: *Neolepidozia sarawakensis*: A, B – Stem leaves, C – Stem leaf lobe, D – Stem leaf disc, E – Stem underleaves; Scales: A, B, C, D, E – 50 µm (from RICHARDS 2153, JE04010703 – holotype)

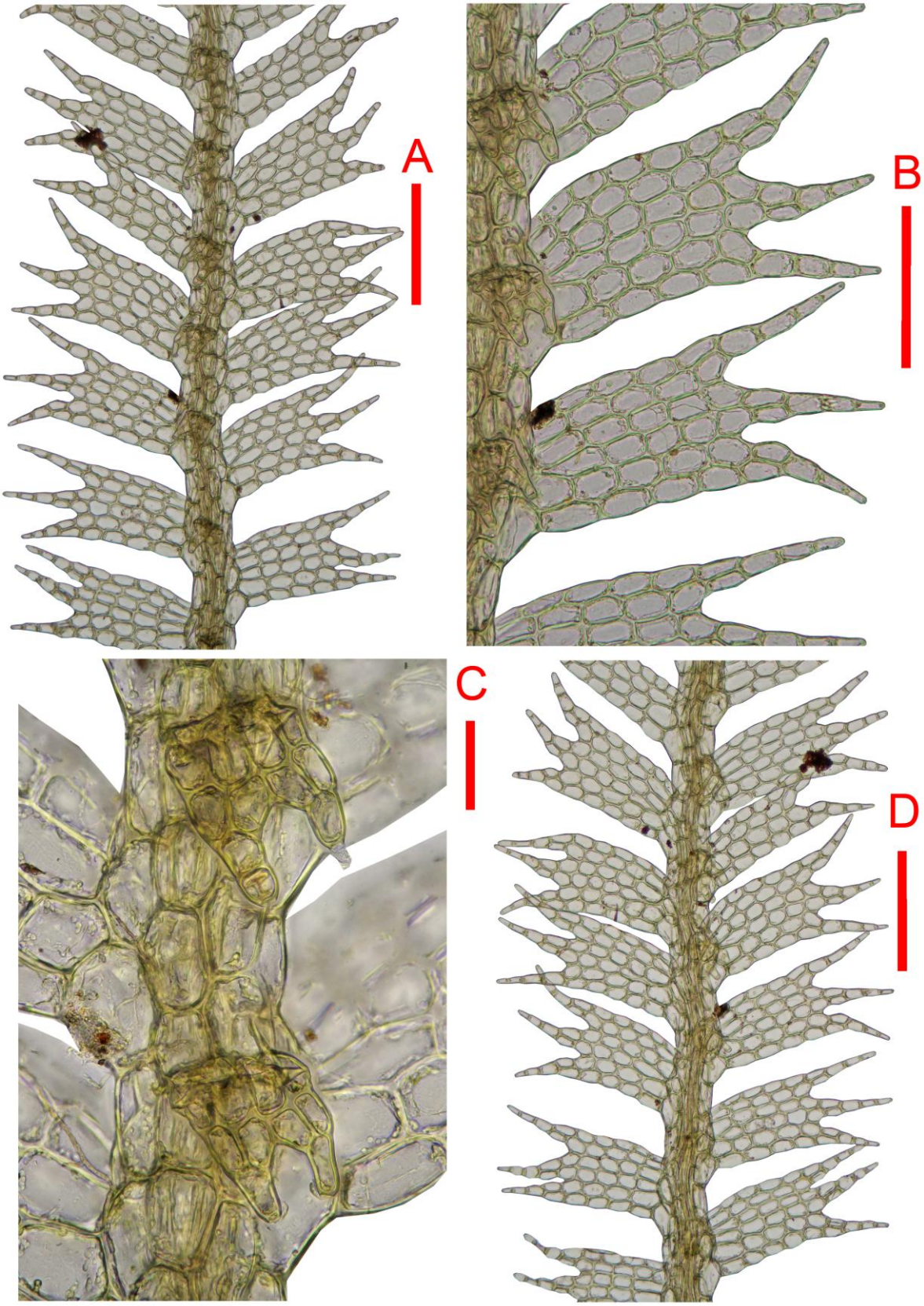

Plate 265: *Neolepidozia sarawakensis*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm; B – 0.2 mm; C – 50 µm (from RICHARDS 2153, JE04010703 – holotype)

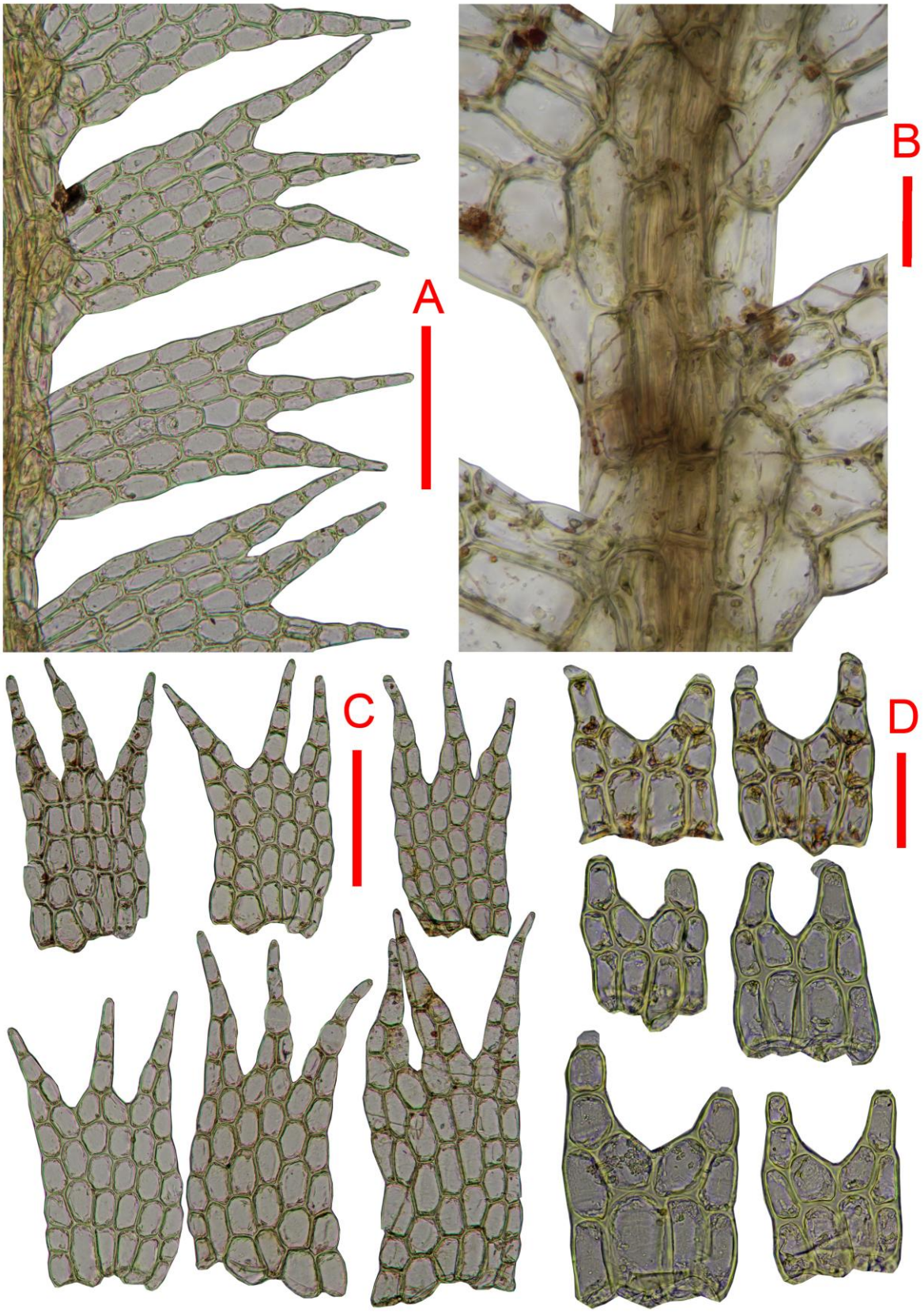

Plate 266: *Neolepidozia sarawakensis*: A, B – Branch dorsal, C – Branch leaves, D – Branch underleaves; Scales: A, C – 0.2 mm; B, D – 50 µm (from RICHARDS 2153, JE04010703 – holotype)

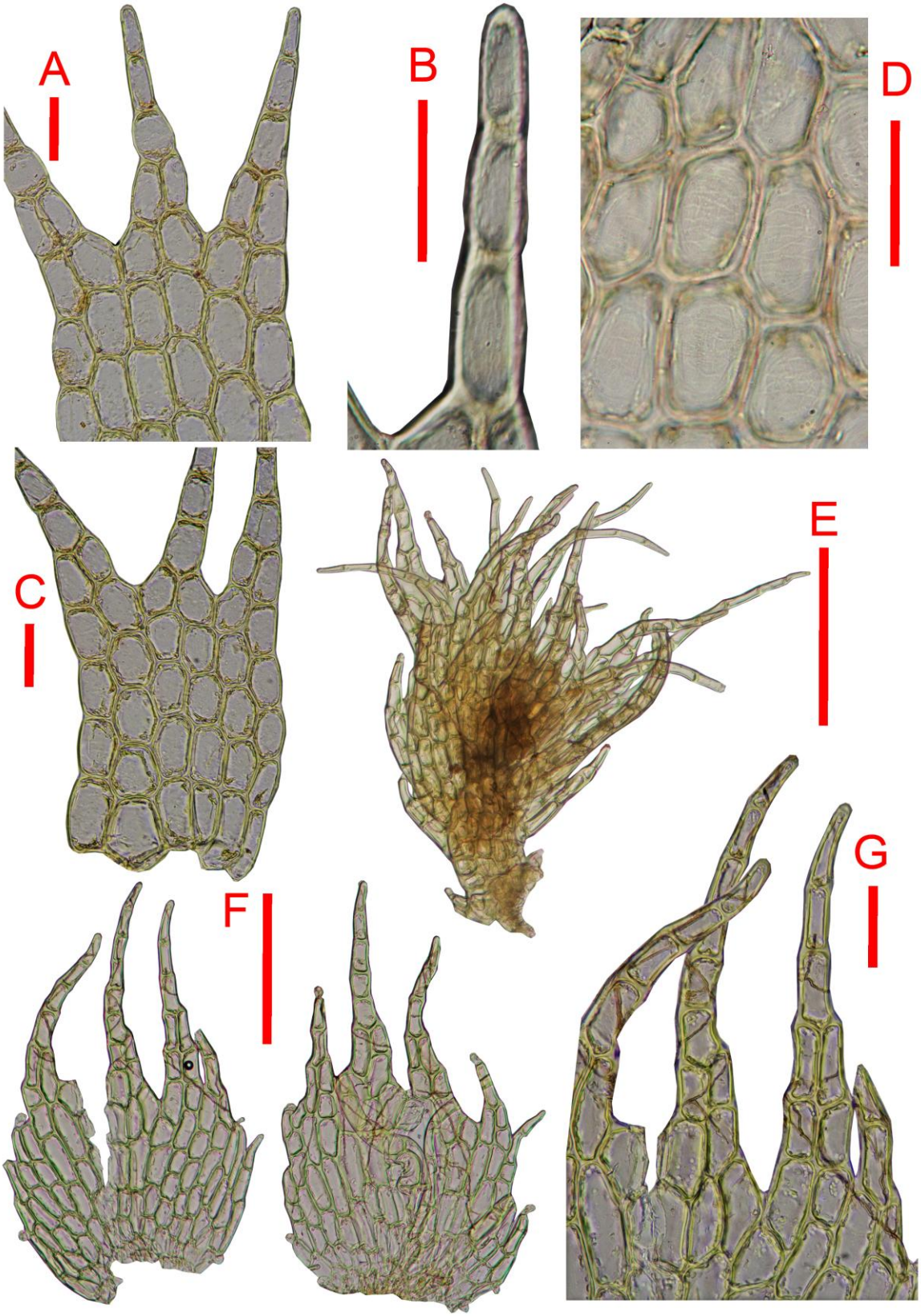

Plate 267: *Neolepidozia sarawakensis*: A, B – Branch leaf lobes, C, D – Branch leaf disc, E – Female inflorescense, F – Female bract, G – Female bract apex ; Scales: E – 0.3 mm; F – 0.2 mm; A, B, C, D, G – 50 µm (from RICHARDS 2153, JE04010703 – holotype)

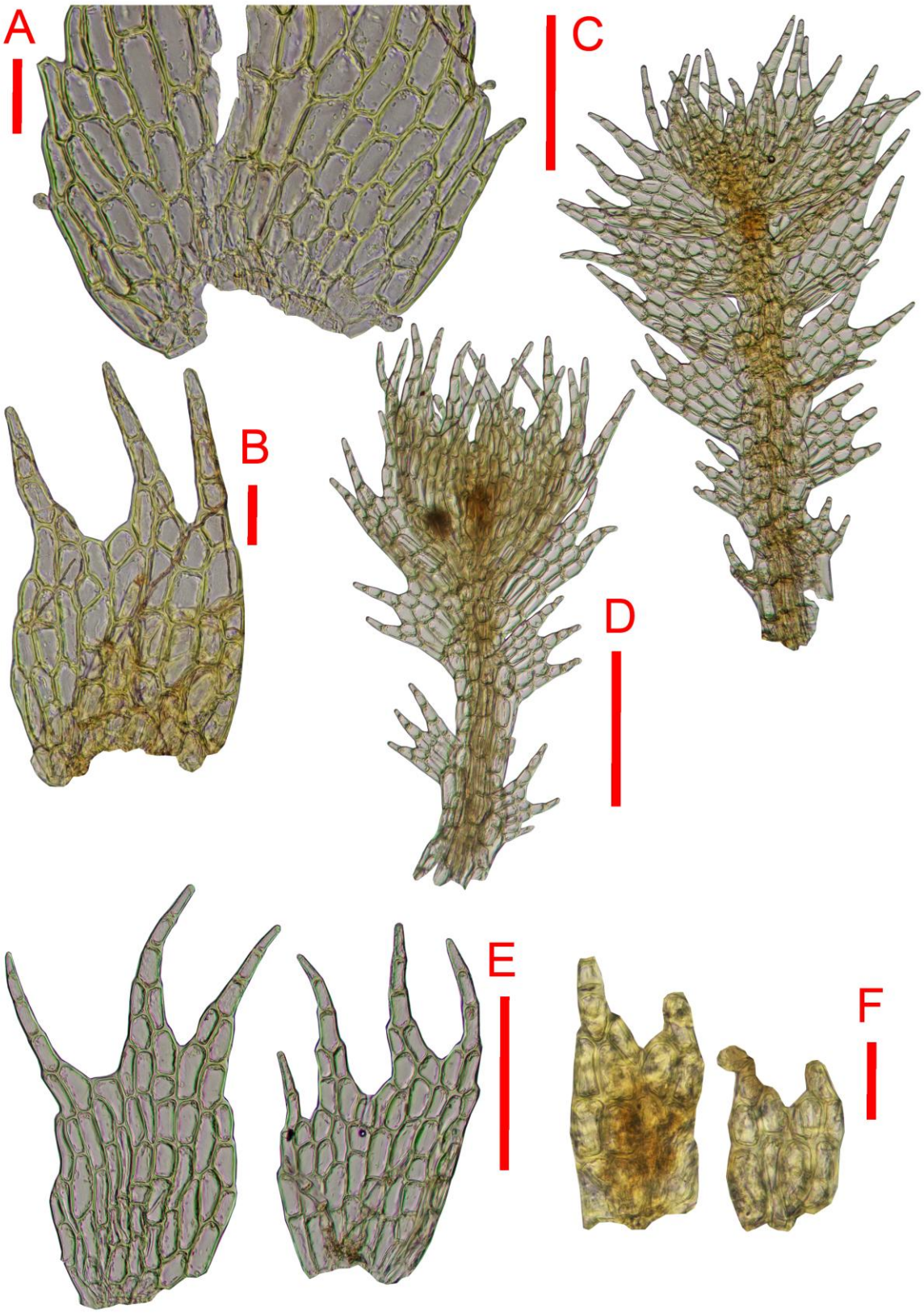

Plate 268: *Neolepidozia sarawakensis*: A – Female bract base, B – Female bracteole, C – Male branch dorsal, D – Male branch ventral, E – Male bracts, F – Male branch underleaves; Scales: C, D – 0.3 mm; E – 0.2 mm; A, A, B, F – 50 µm (from RICHARDS 2153, JE04010703 – holotype)

***Neolepidozia sarawakensis* var. *grandistipula* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

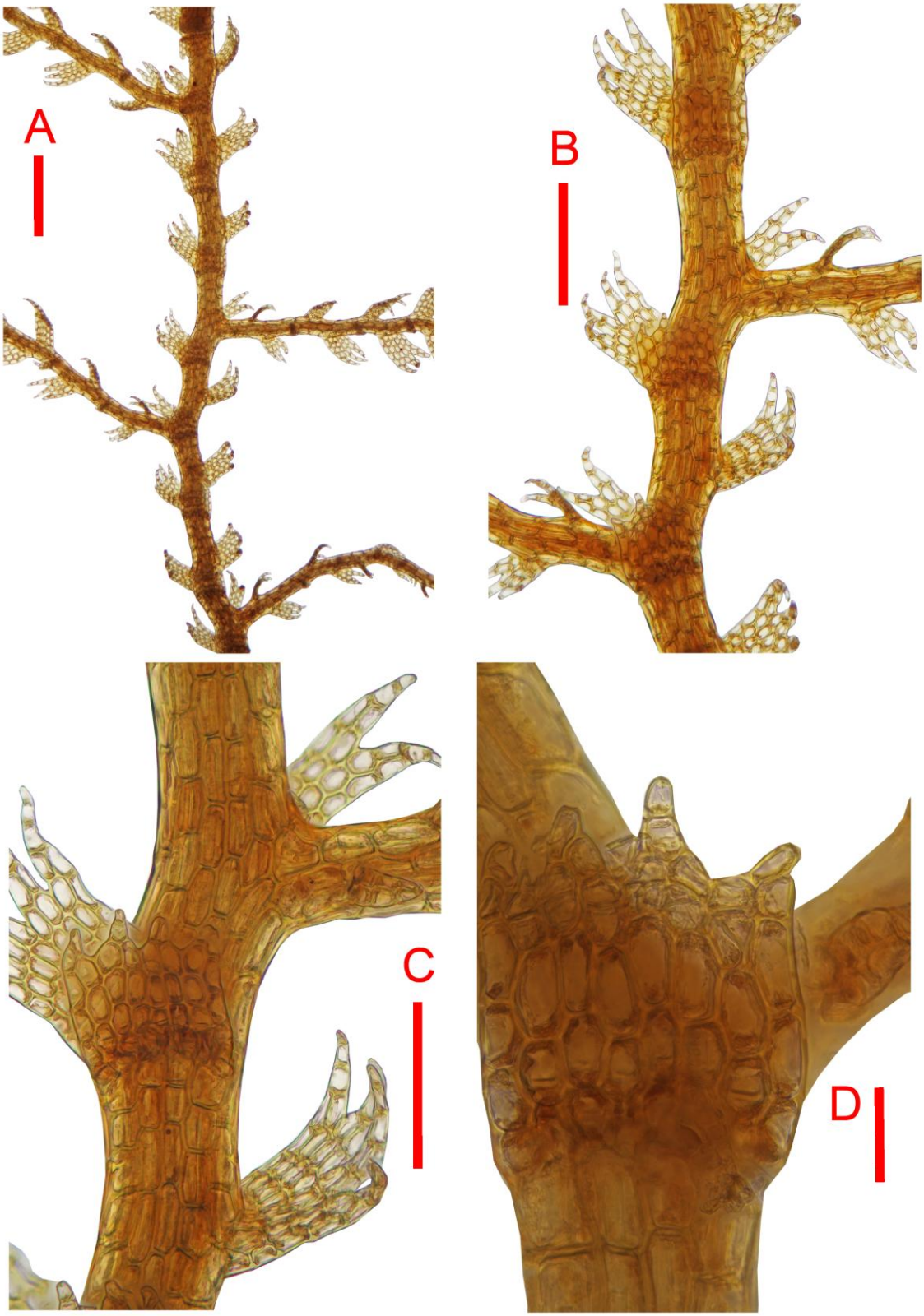

Plate 269: *Neolepidozia sarawakensis* var. *grandistipula*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from RICHARDS 1974b– holotype).

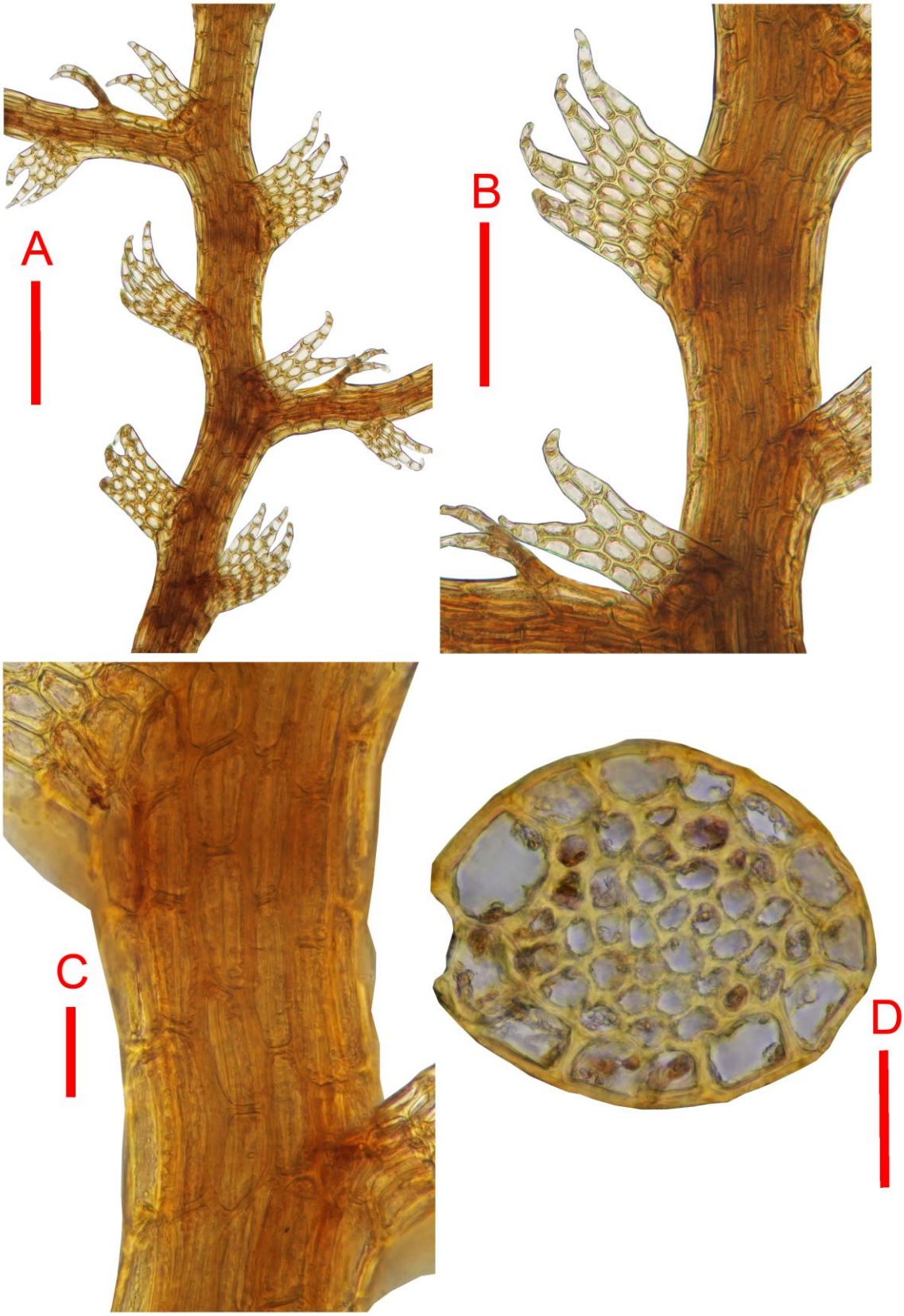

Plate 270: *Neolepidozia sarawakensis* var. *grandistipula*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from RICHARDS 1974b– holotype).

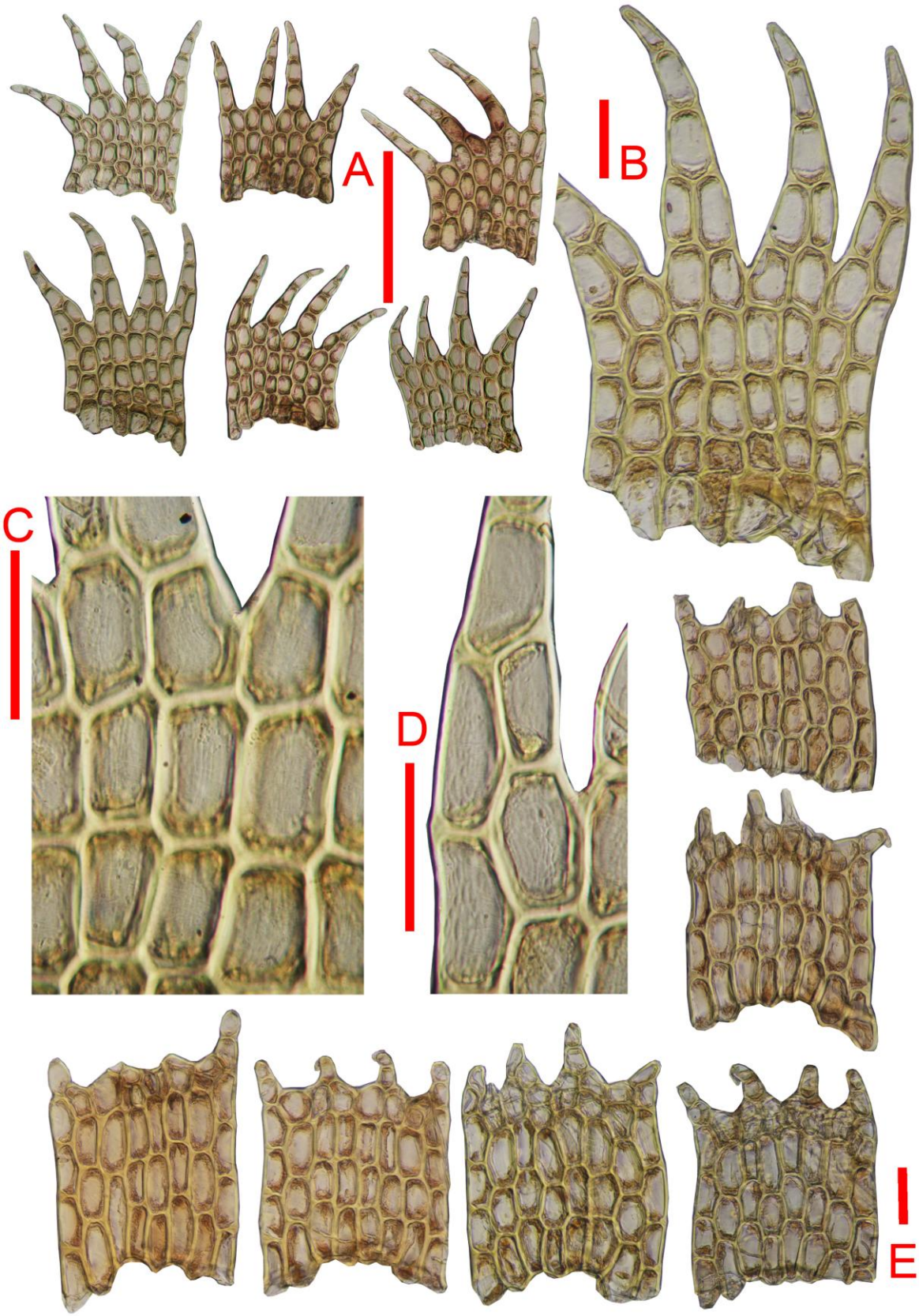

Plate 271: *Neolepidozia sarawakensis* var. *grandistipula*: A, B – Stem leaf, C – Stem leaf disc, D – Stem leaf lobe, E – Stem underleaves; Scales: A – 0.2 mm; B, C, D, E – 50 µm (from RICHARDS 1974b– holotype).

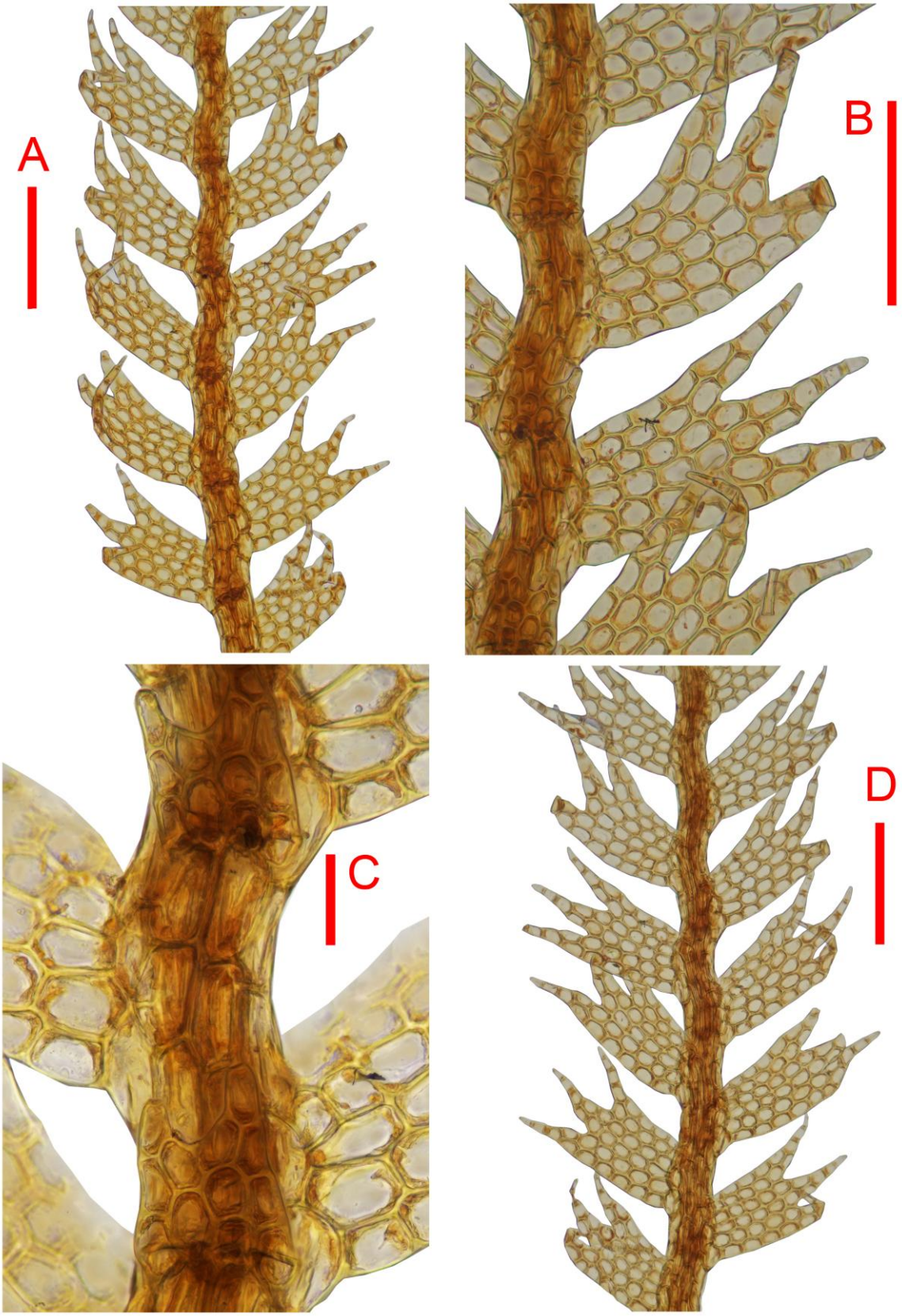

Plate 272: *Neolepidozia sarawakensis* var. *grandistipula*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.2 mm; B – 0.3 mm, C – 50 µm (from RICHARDS 1974b– holotype).

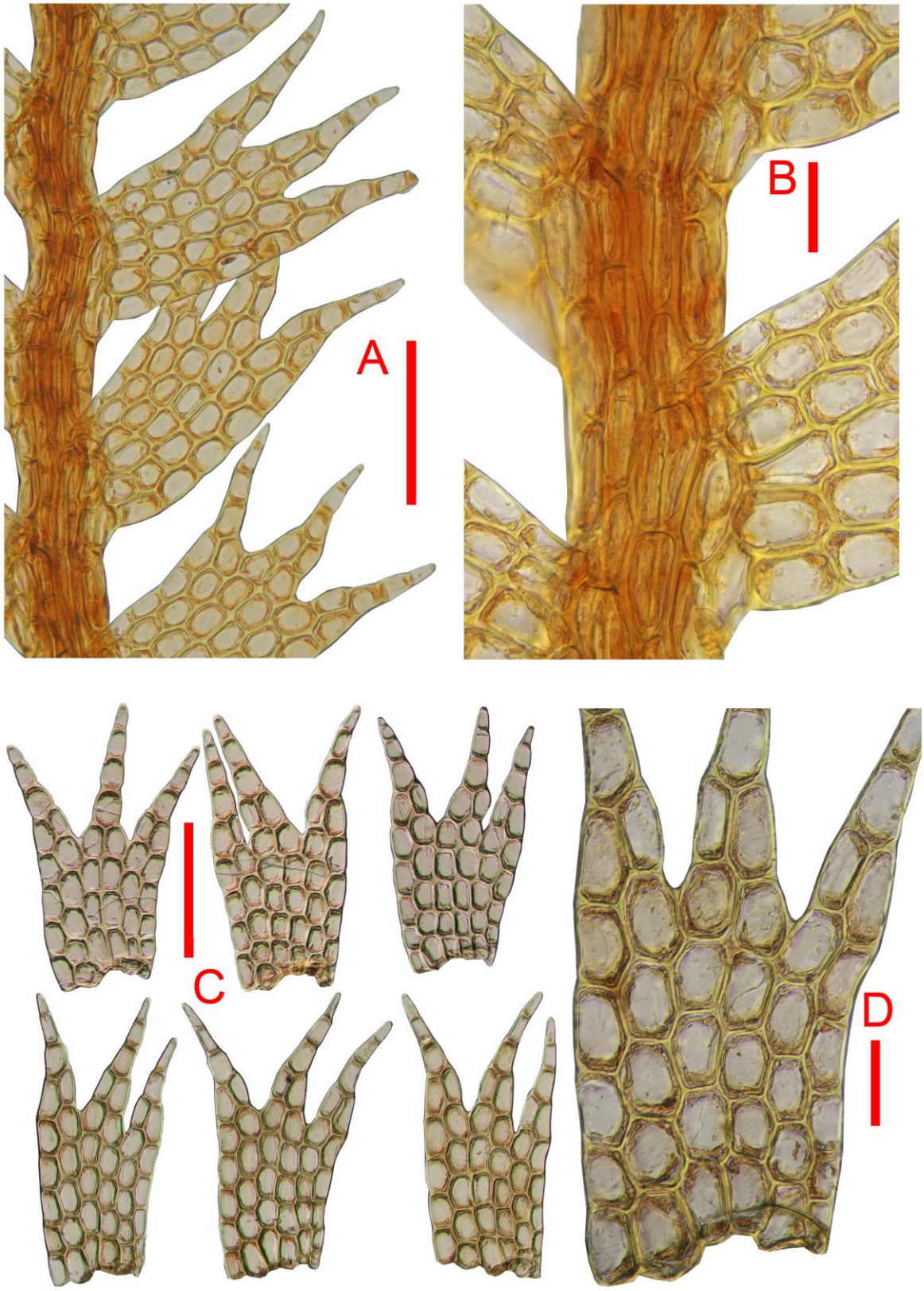

Plate 273: *Neolepidozia sarawakensis* var. *grandistipula*: A, B – Branch dorsal, C – Branch leaves, D – Branch leaf disc; Scales: A, C – 0.2 mm; B, D – 50 µm (from RICHARDS 1974b– holotype).

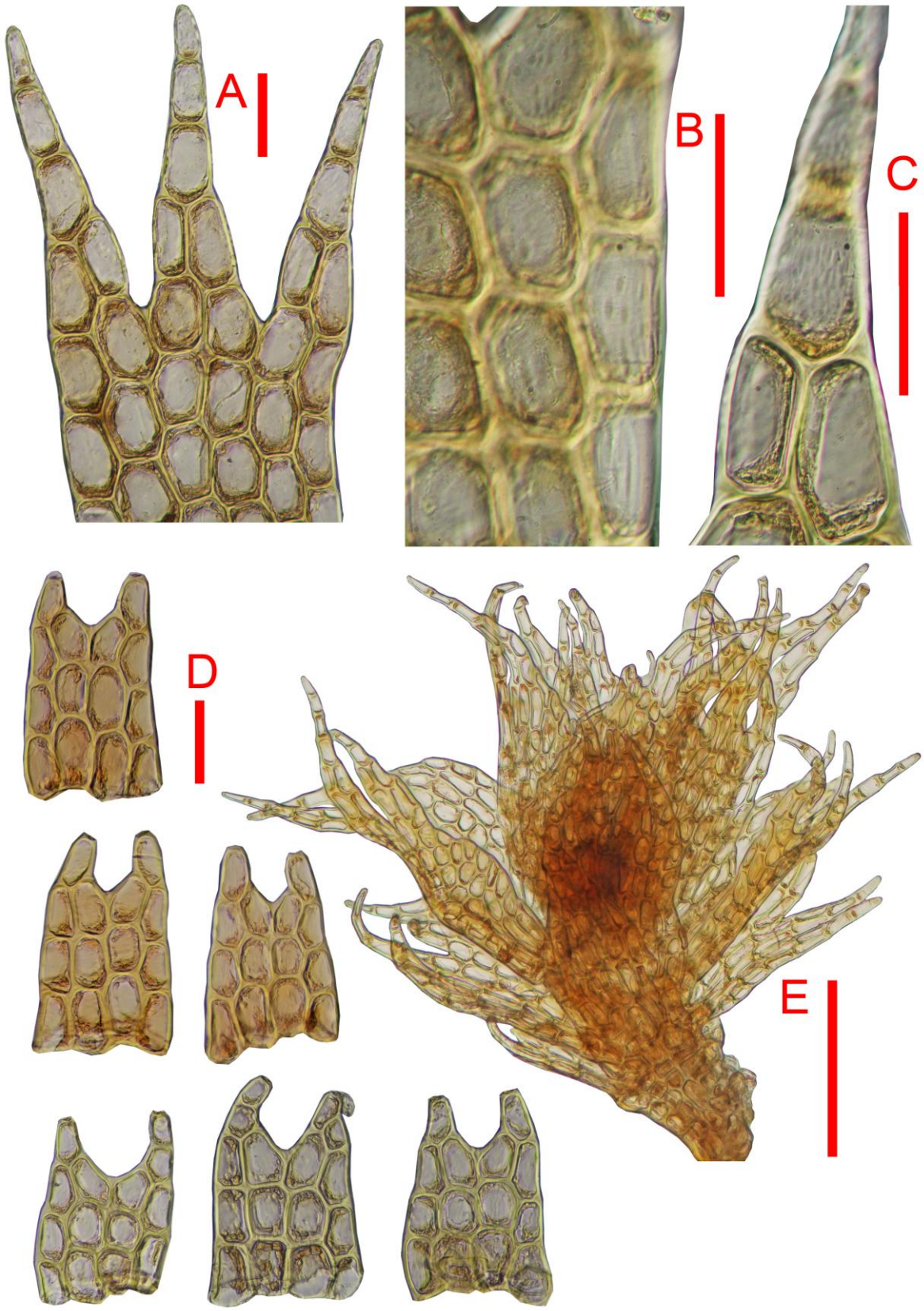

Plate 274: *Neolepidozia sarawakensis* var. *grandistipula*: A, C – Branch leaf lobes, B – Branch leaf disc, D – Branch underleaves, E – Female inflorescense; Scales: E – 0.3 mm; A, B, C, D – 50 µm (from RICHARDS 1974b– holotype).

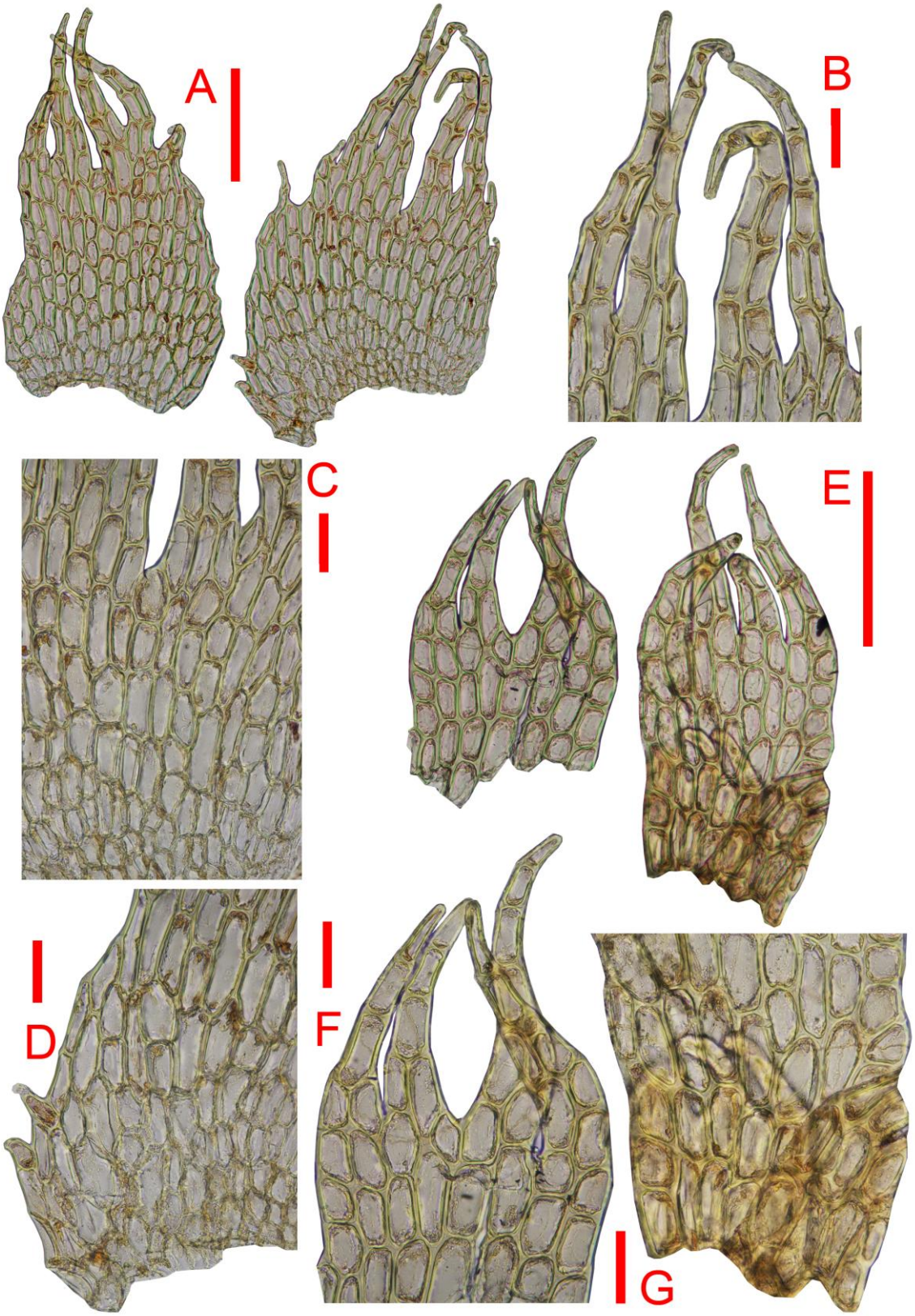

Plate 275: *Neolepidozia sarawakensis* var. *grandistipula*: A – Female bracts, B – Female bract apex, C – Female bract middle, D – Female bract base, E – Female bracteoles, F – Female bracteole apex, G – Female bracteole base; Scales: A, E – 0.2 mm; B, C, D, F, G – 50 µm (from RICHARDS 1974b– holotype).

***Neolepidozia sarawakensis* var. *rajaensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

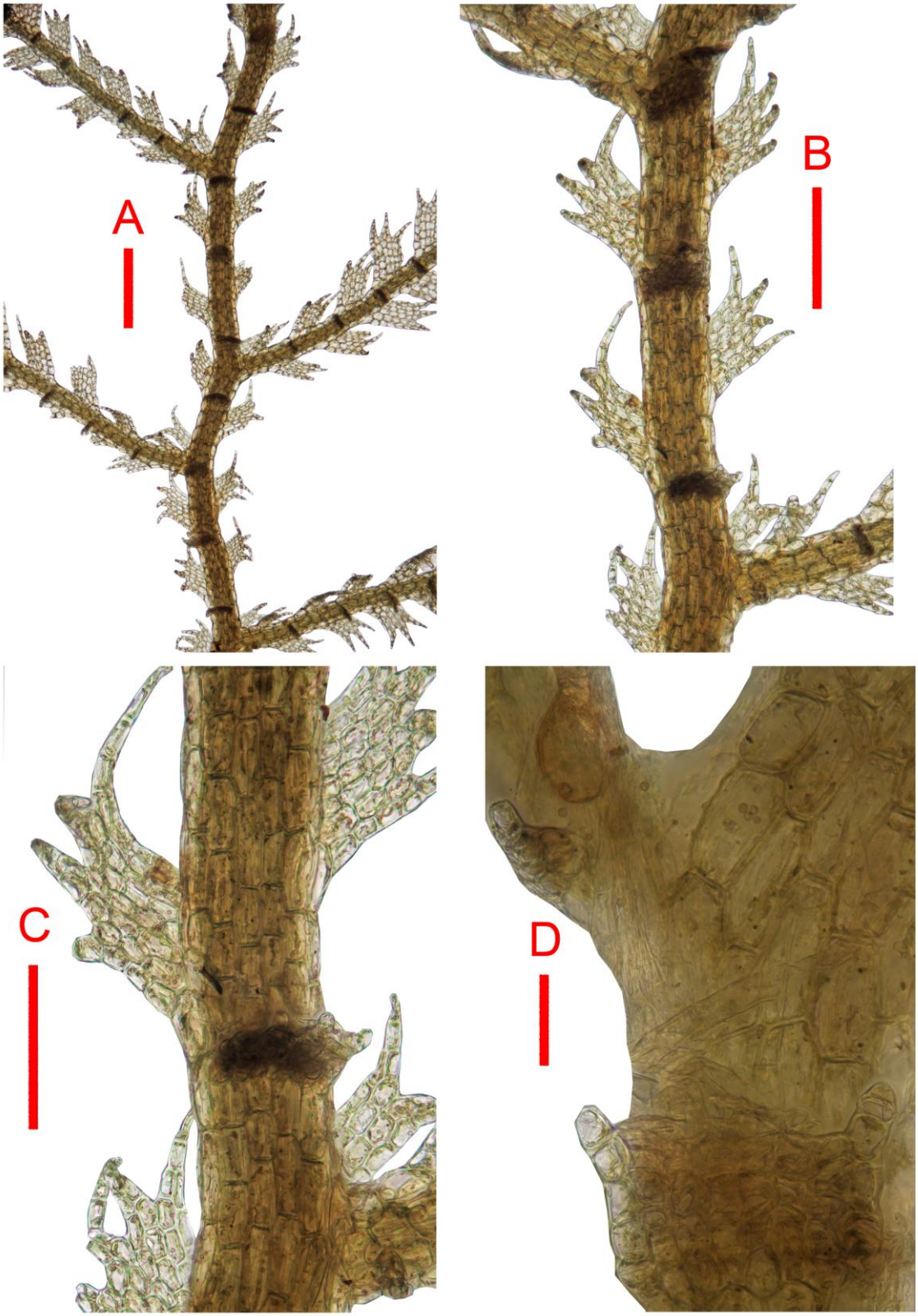

Plate 276: *Neolepidozia sarawakensis* var. *rajaensis*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from WINKLER 3165 – holotype)

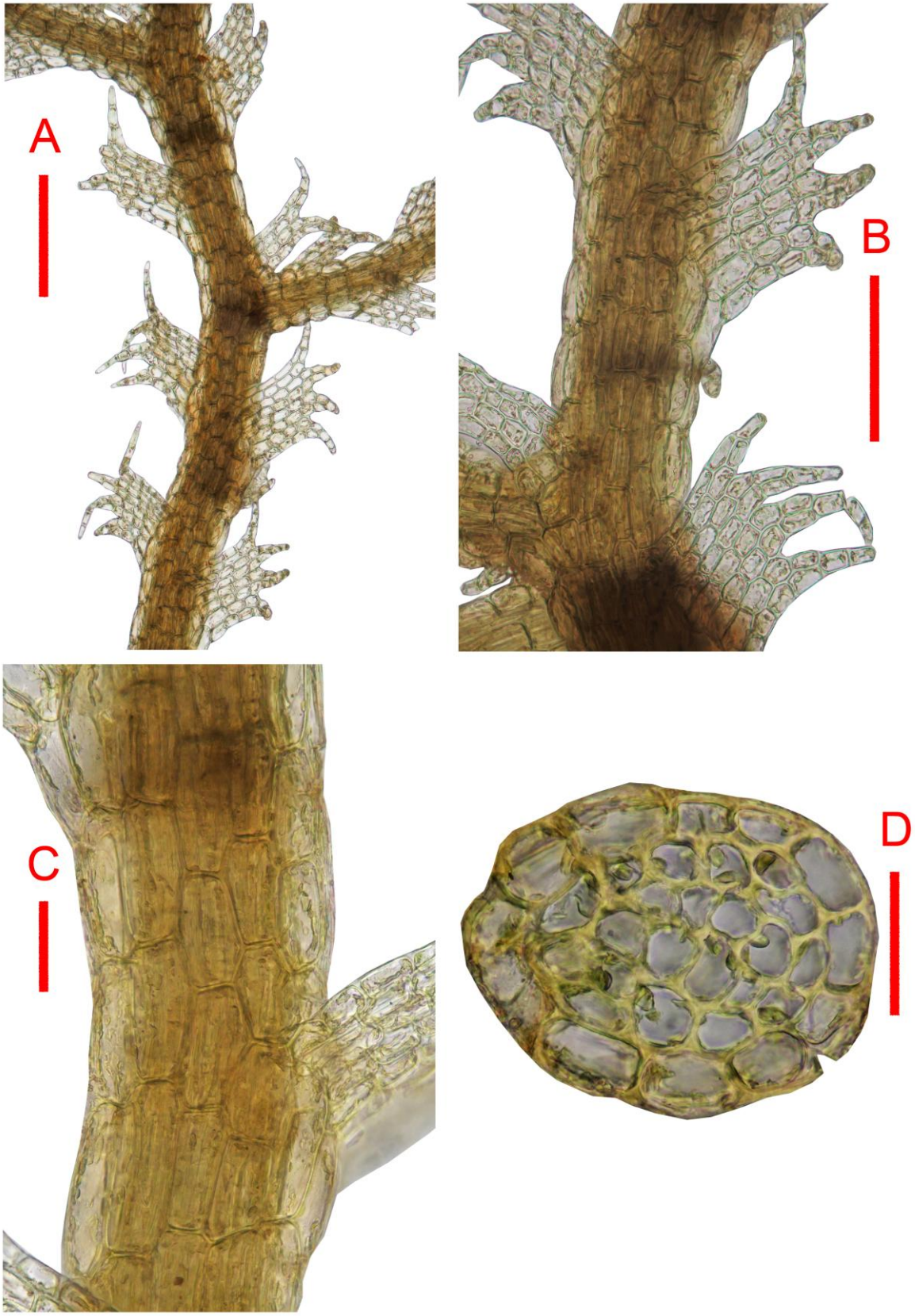

Plate 277: *Neolepidozia sarawakensis* var. *rajaensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from WINKLER 3165 – holotype)

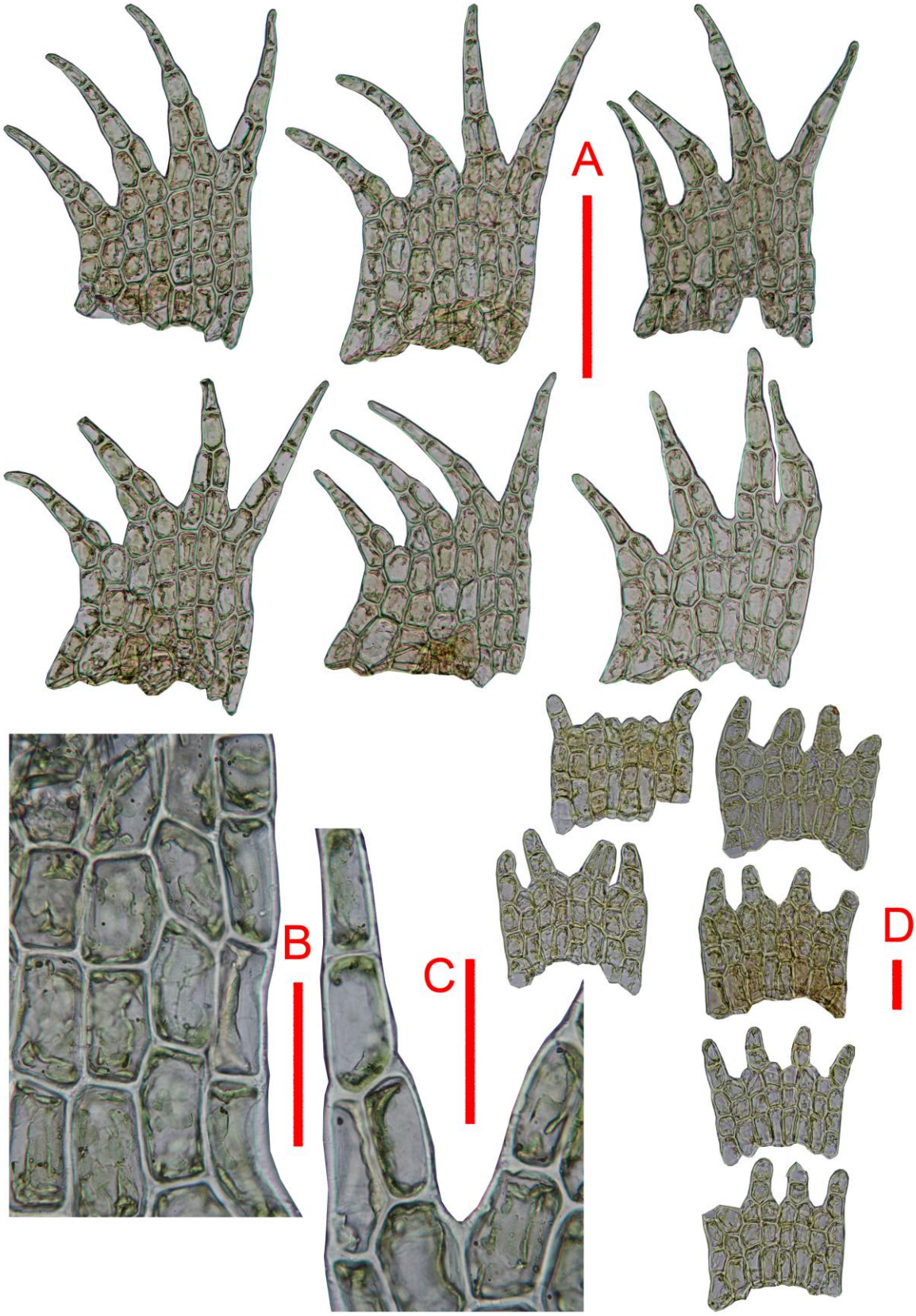

Plate 278: *Neolepidozia sarawakensis* var. *rajaensis*: A – Stem leaves, B – Stem leaf disc, C – Stem leaf lobe, D – Stem underleaves; Scales: A – 0.2 mm; B, C, D – 50 µm (from WINKLER 3165 – holotype)

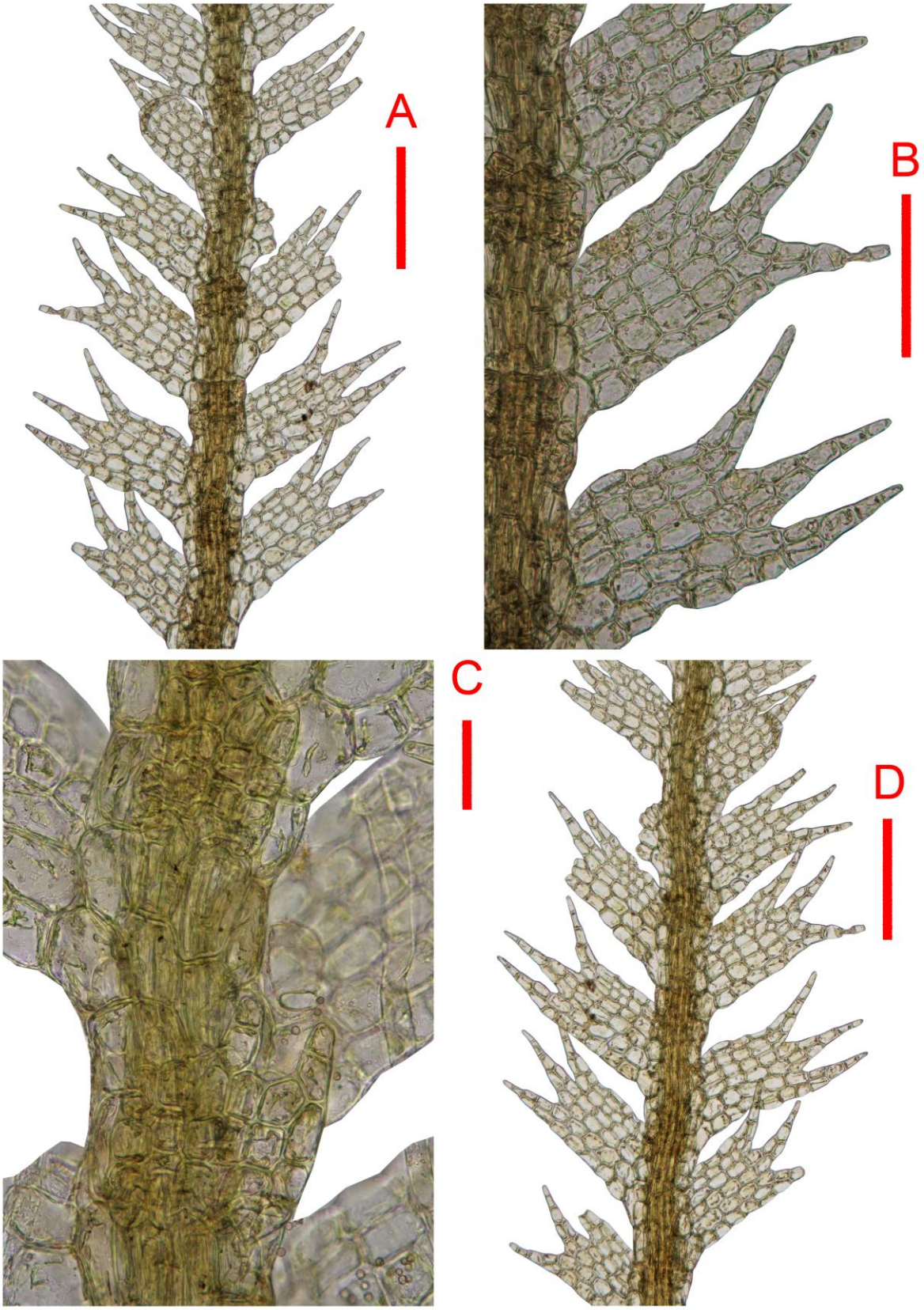

Plate 279: *Neolepidozia sarawakensis* var. *rajaensis*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm; B – 0.2 mm; D – 50 µm (from WINKLER 3165 – holotype)

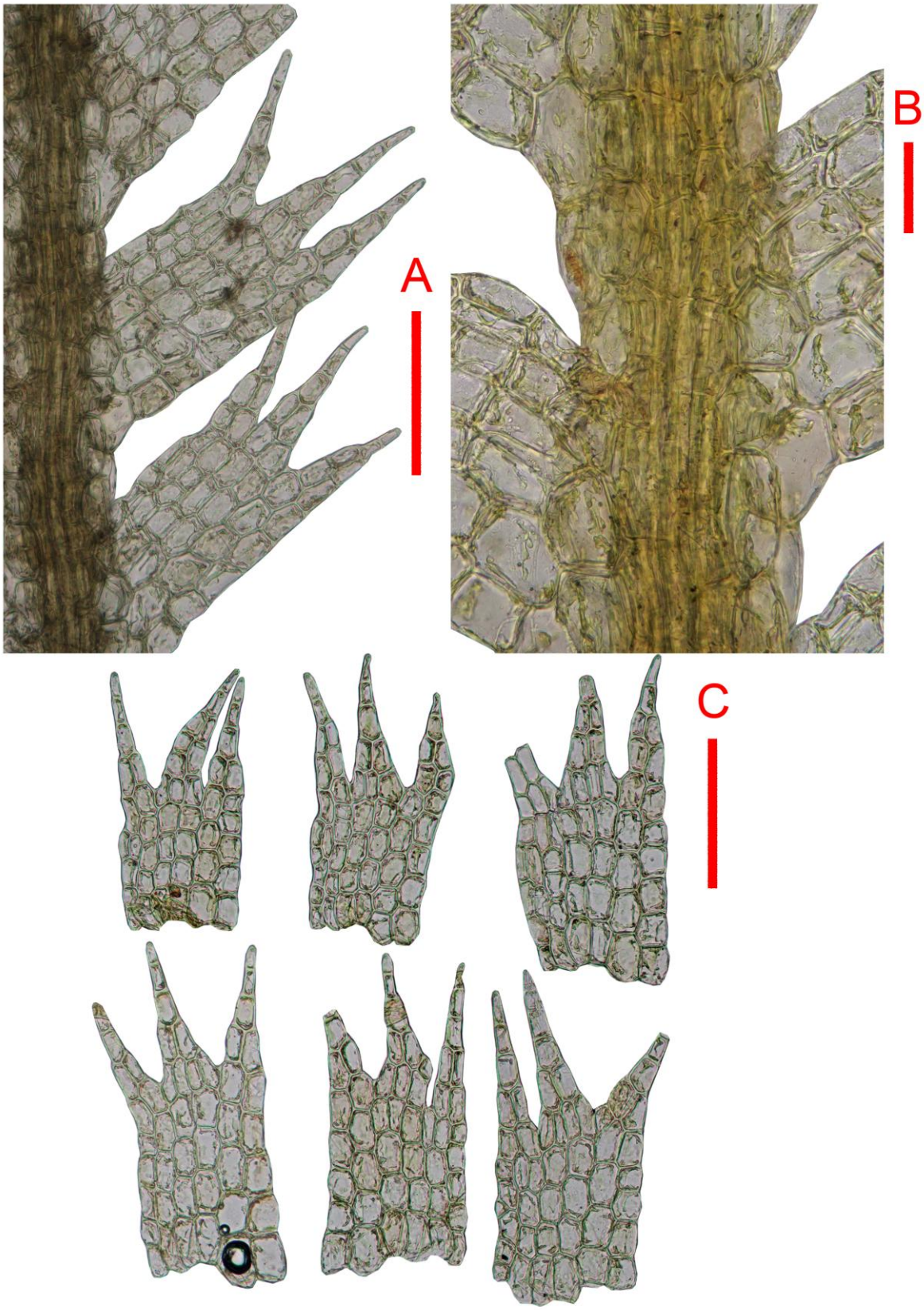

Plate 280: *Neolepidozia sarawakensis* var. *rajaensis*: A, B – Branch dorsal, C – Branch leaves; Scales: A, C – 0.2 mm; B – 50 µm (from WINKLER 3165 – holotype)

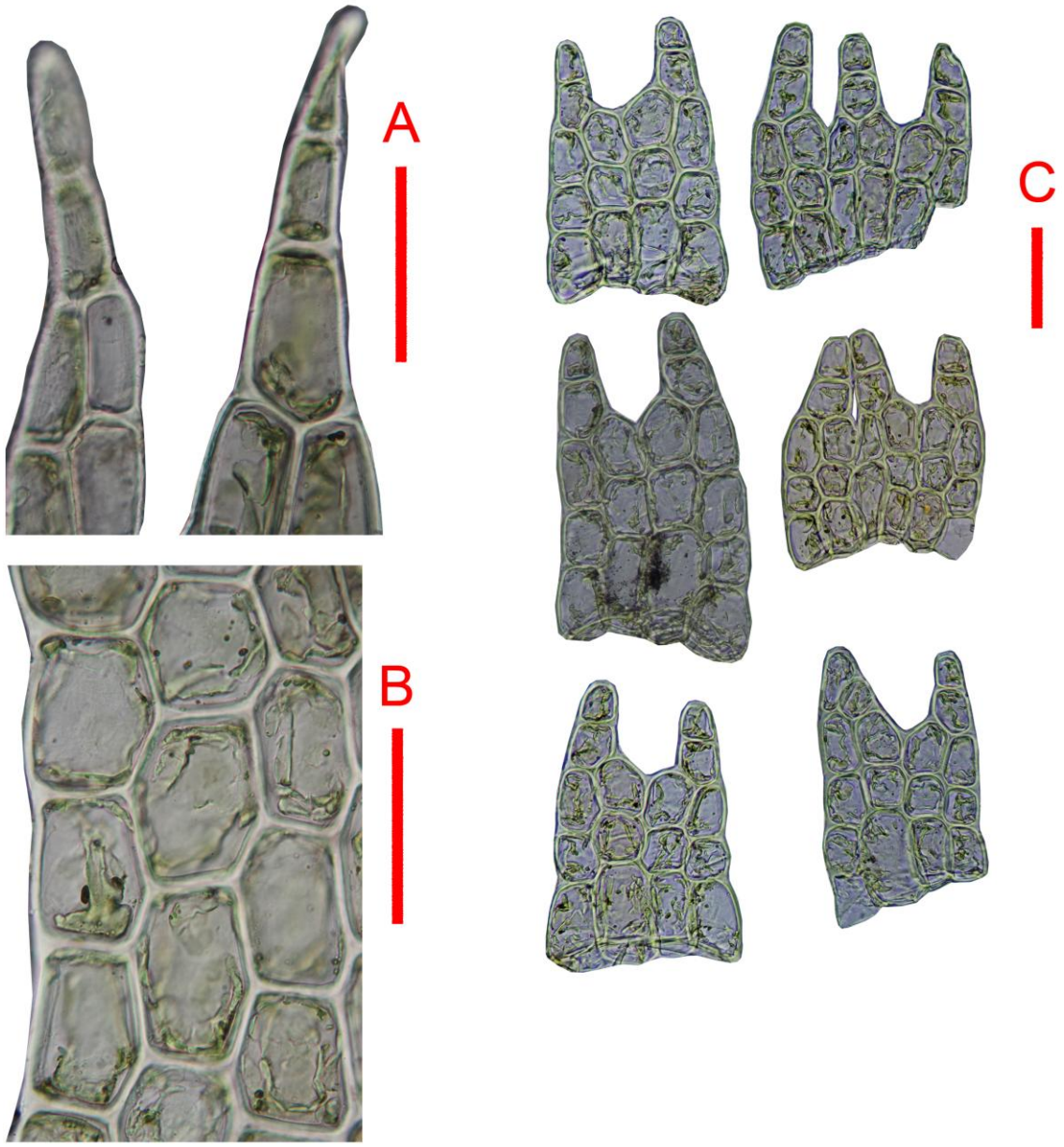

Plate 281: *Neolepidozia sarawakensis* var. *rajaensis*: A – Branch leaf lobe, B – Branch leaf disc, C – Branch unerleaves; Scales: A, B, C – 50 µm (from WINKLER 3165 – holotype)

Neolepidozia schaefer-verwimpii **U. SCHWARZ & SHEVOCK**

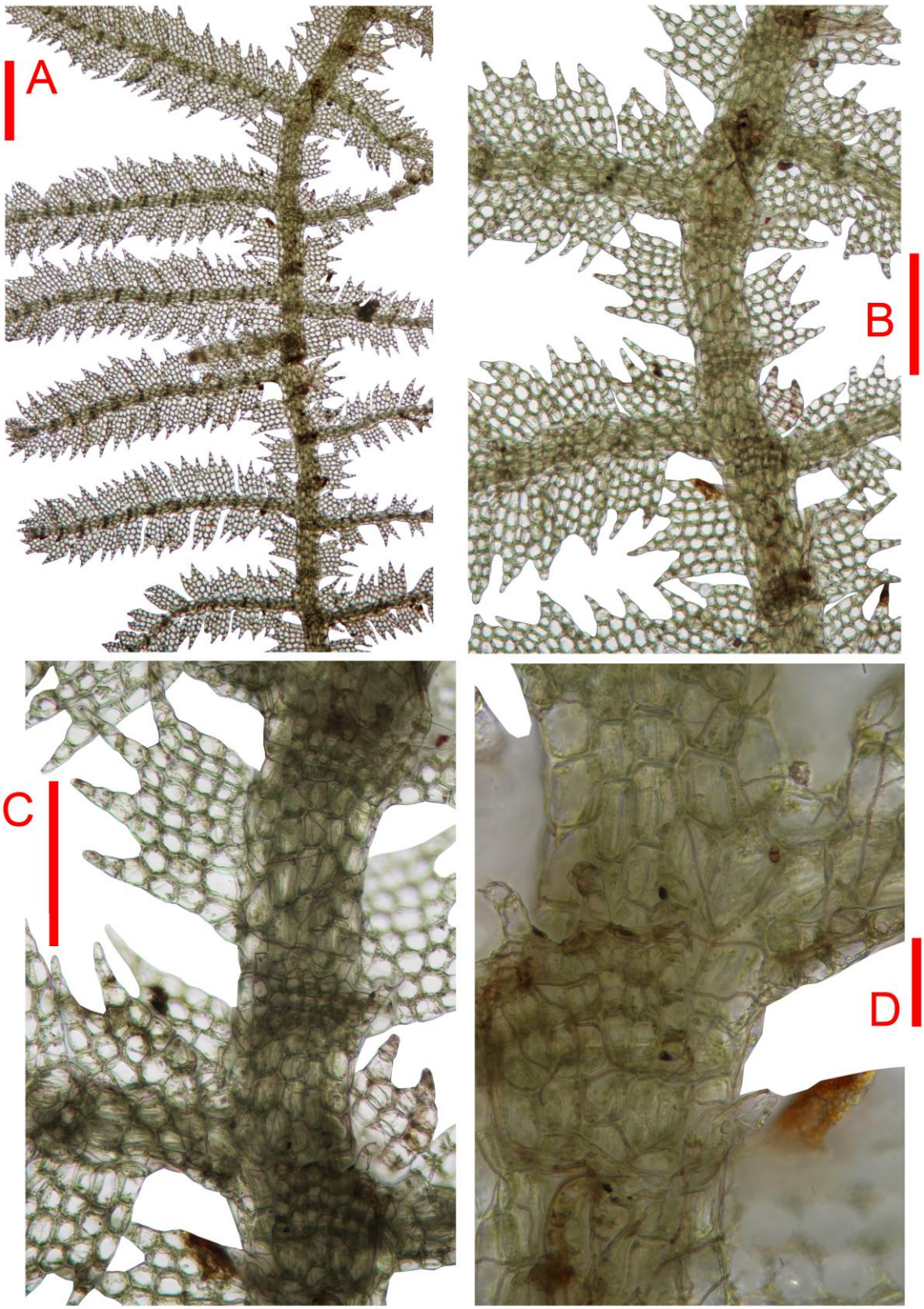

Plate 282: *Neolepidozia schaefer-verwimpii*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHÄFER-VERWIMP 37449 – holotype)

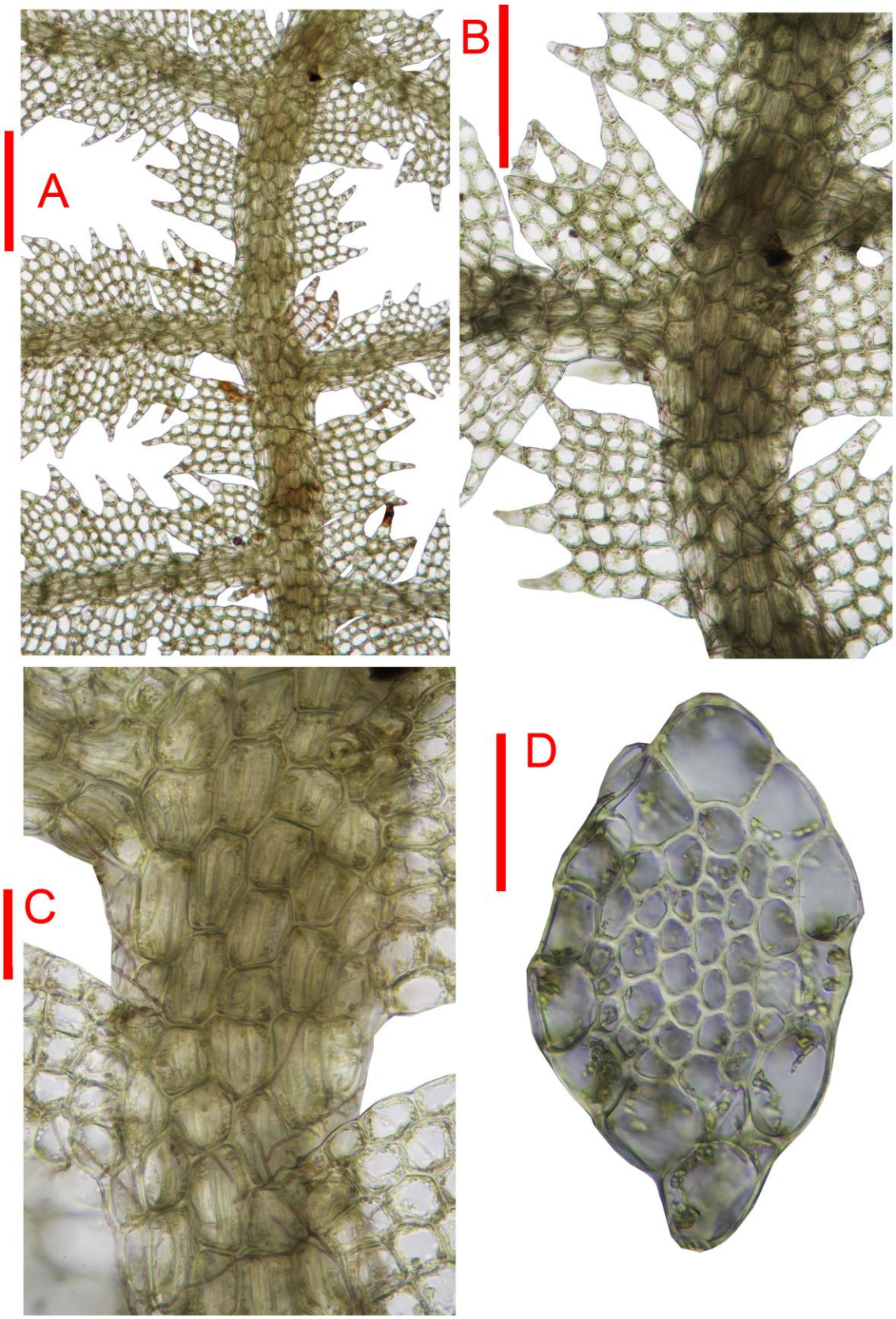

Plate 283: *Neolepidozia schaefer-verwimpii*: A, B, C – Stem dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from SCHÄFER-VERWIMP 37449 – holotype)

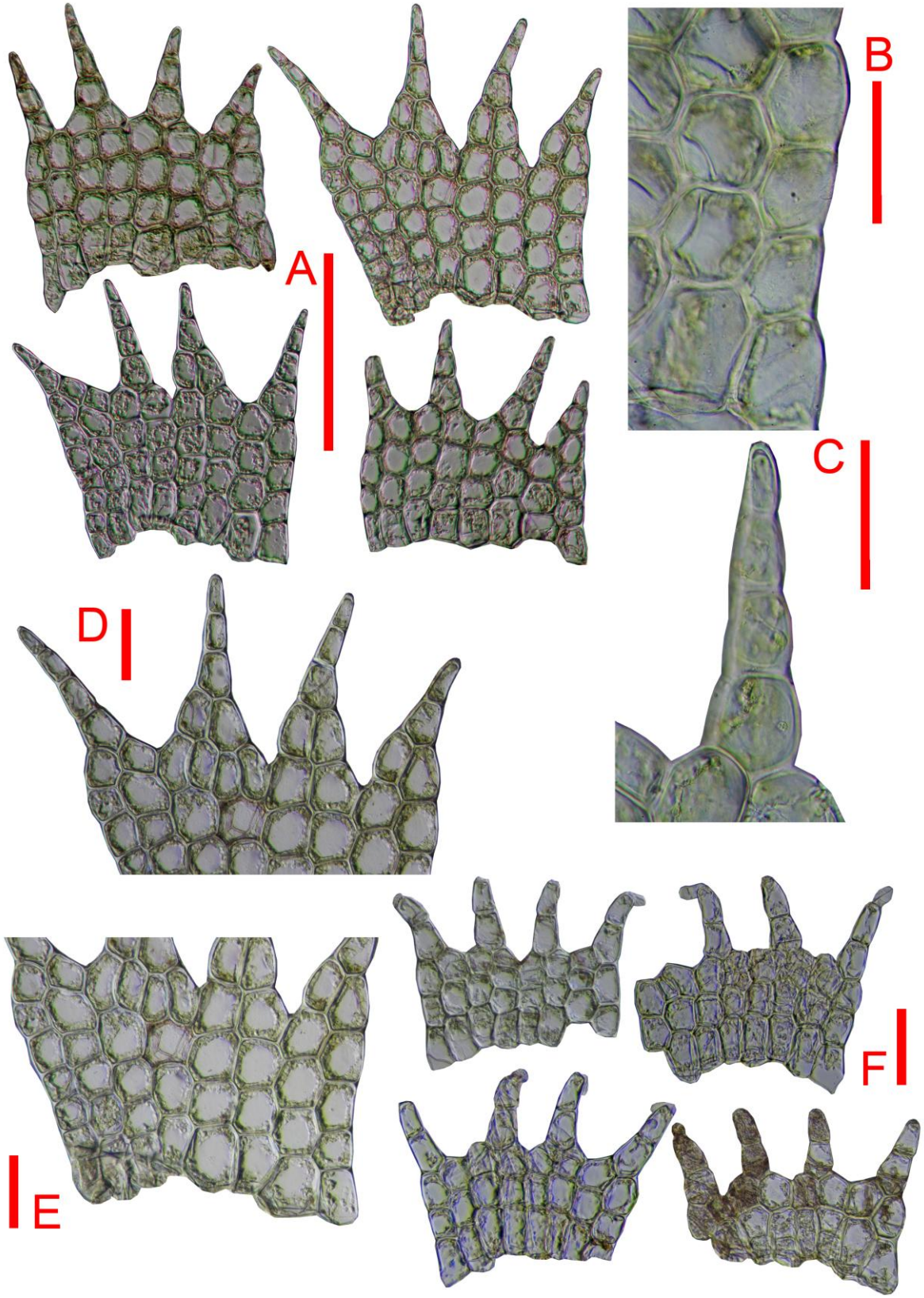

Plate 284: *Neolepidozia schaefer-verwimpii*: A – Stem leaves, B, E – Stem leaf disc, C, D – Stem leaf lobes, F – Stem underleaves; Scales: A – 0.2 mm; B, C, D, E, F – 50 µm (from SCHÄFER-VERWIMP 37449 – holotype)

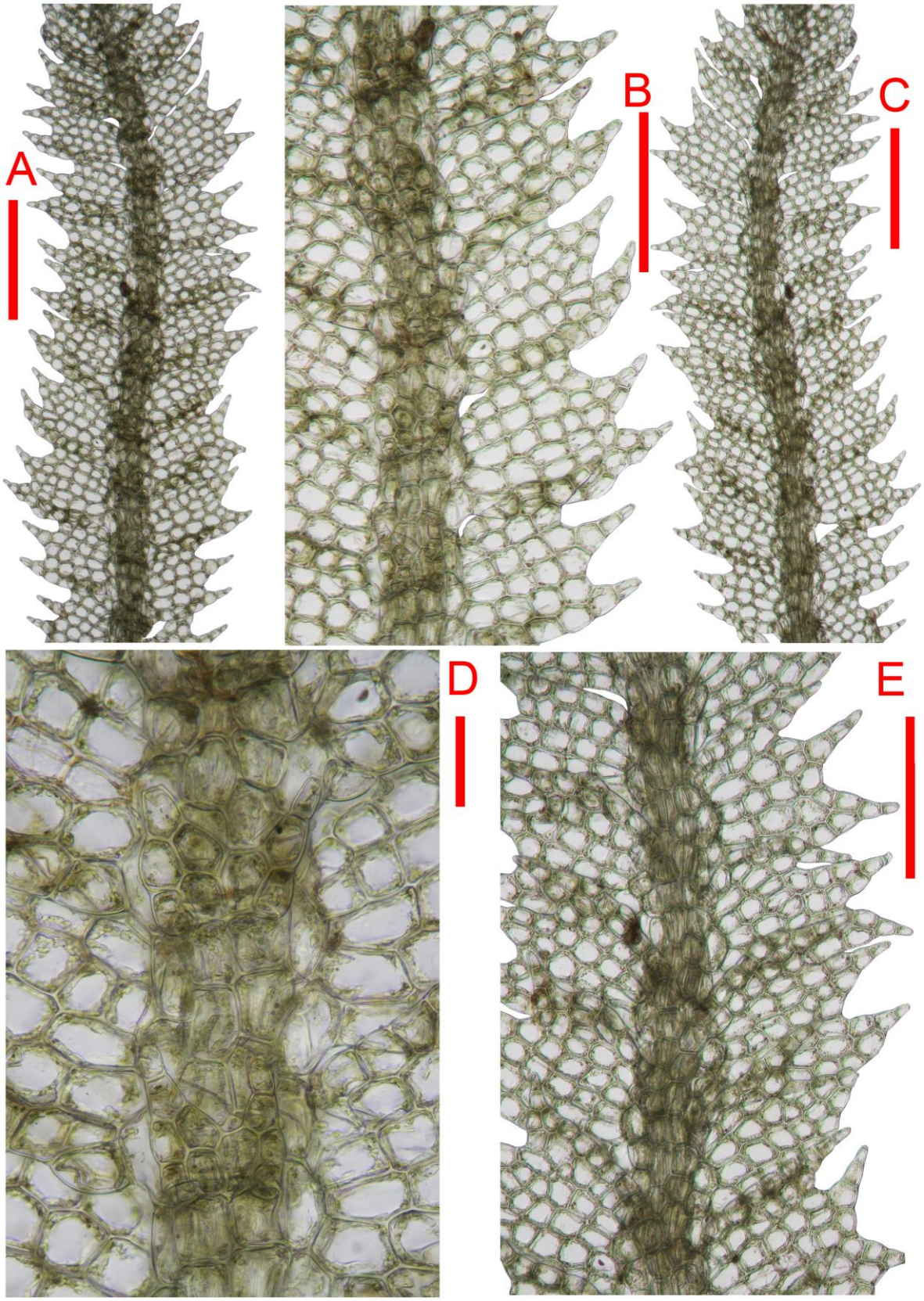

Plate 285: *Neolepidozia schaefer-verwimpii*: A, B, D – Branch ventral, C, E – Branch dorsal; Scales: A, C – 0.3 mm; B, E – 0.2 mm, E – 50 µm (from SCHÄFER-VERWIMP 37449 – holotype)

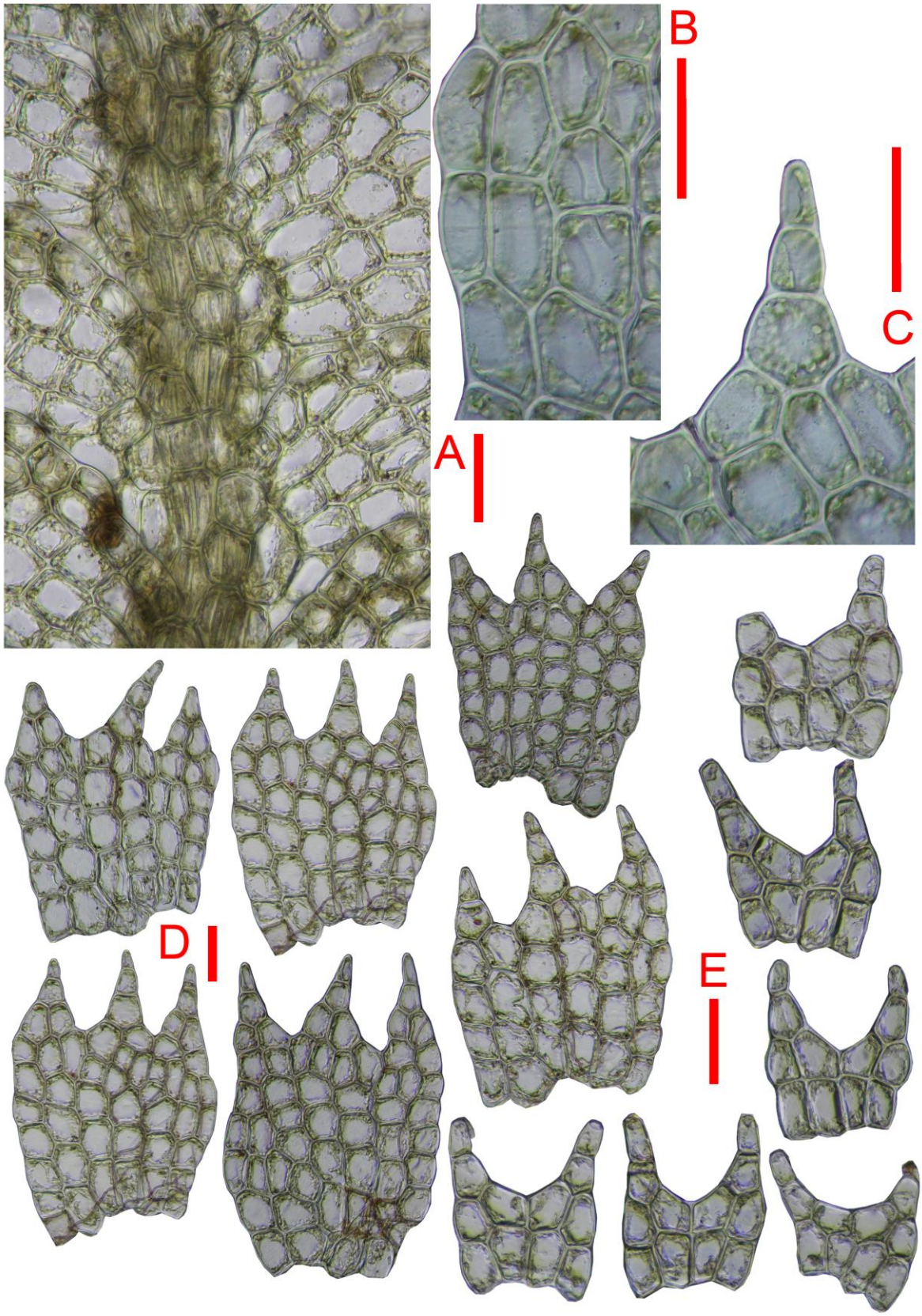

Plate 286: *Neolepidozia schaefer-verwimpii*: A – Branch dorsal, B – Branch leaf disc, C – Branch leaf lobe, D – Branch leaves, E – Branch underleaves; Scales: A, B, C, D, E – 50 µm (from SCHÄFER-VERWIMP 37449 – holotype)

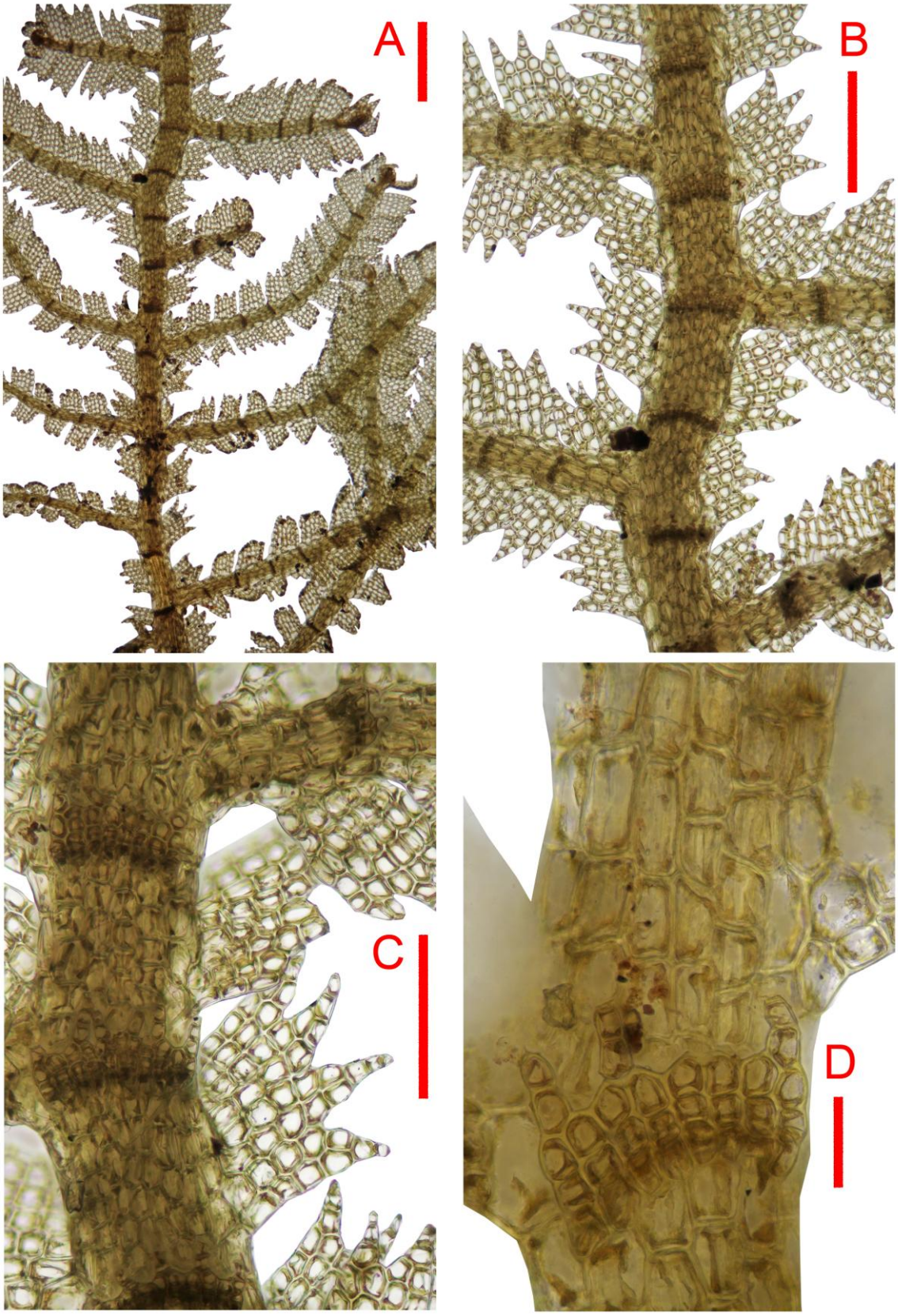

Plate 287: *Neolepidozia schaefer-verwimpii*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from TOUW 10868)

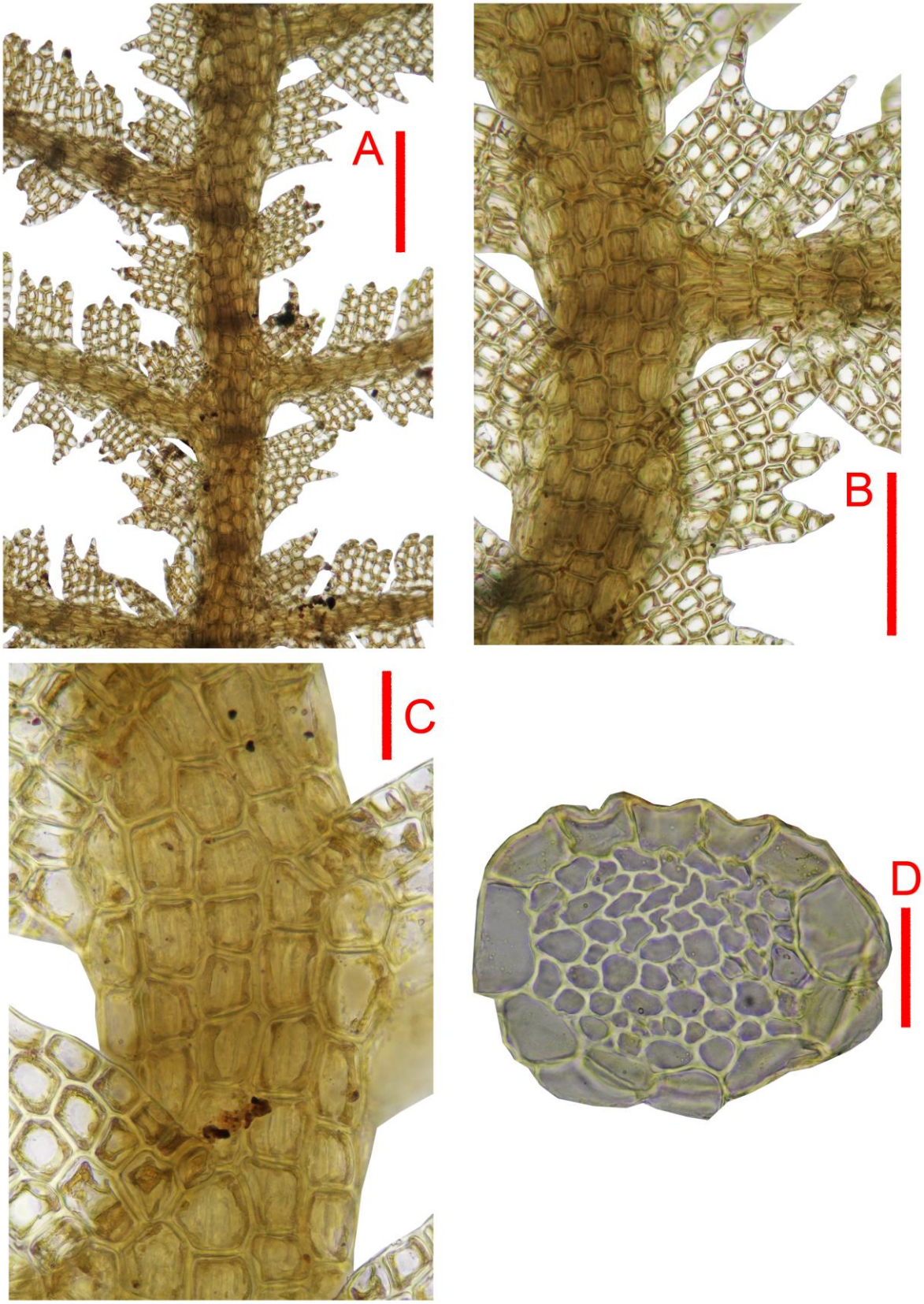

Plate 288: *Neolepidozia schaefer-verwimpii*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from TOUW 10868)

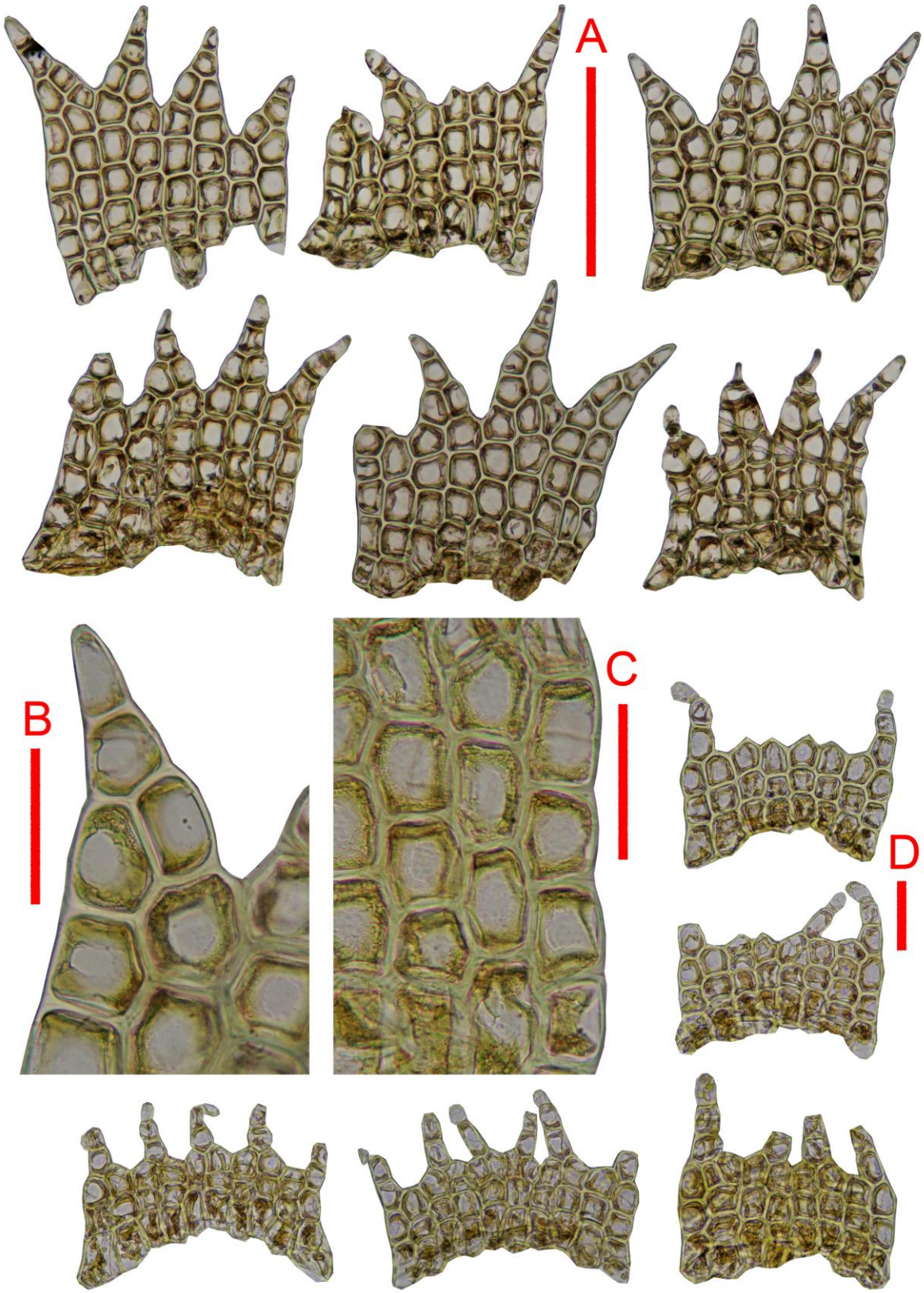

Plate 289: *Neolepidozia schaefer-verwimpii*: A – Stem leaves, B – Stem leaf disc, C – Stem leaf lobe, D – Stem underleaves; Scales: A – 0.2 mm; B, C, D – 50 µm (from TOUW 10868)

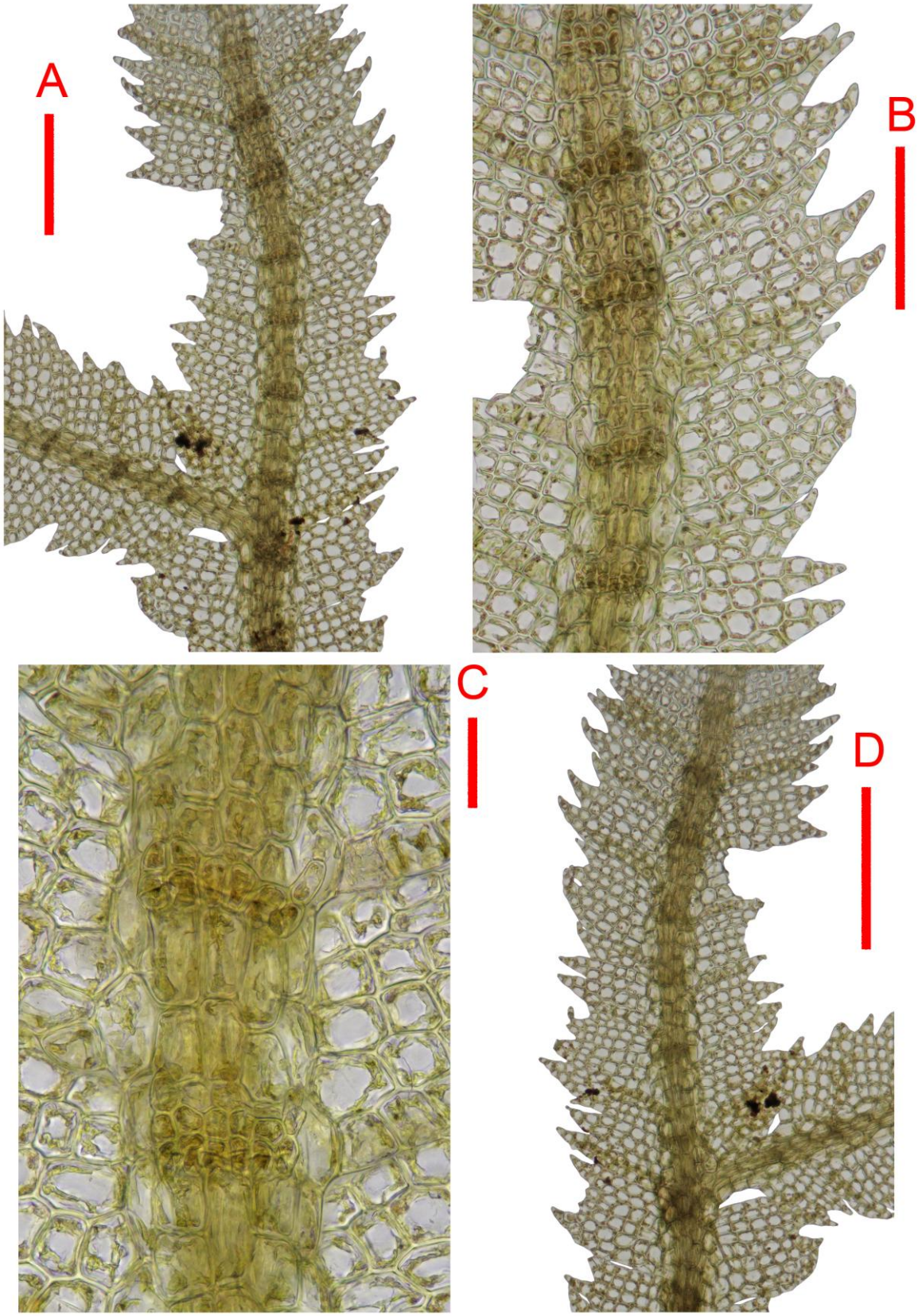

Plate 290: *Neolepidozia schaefer-verwimpii*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm; B – 0.2 mm; C – 50 µm (from TOUW 10868)

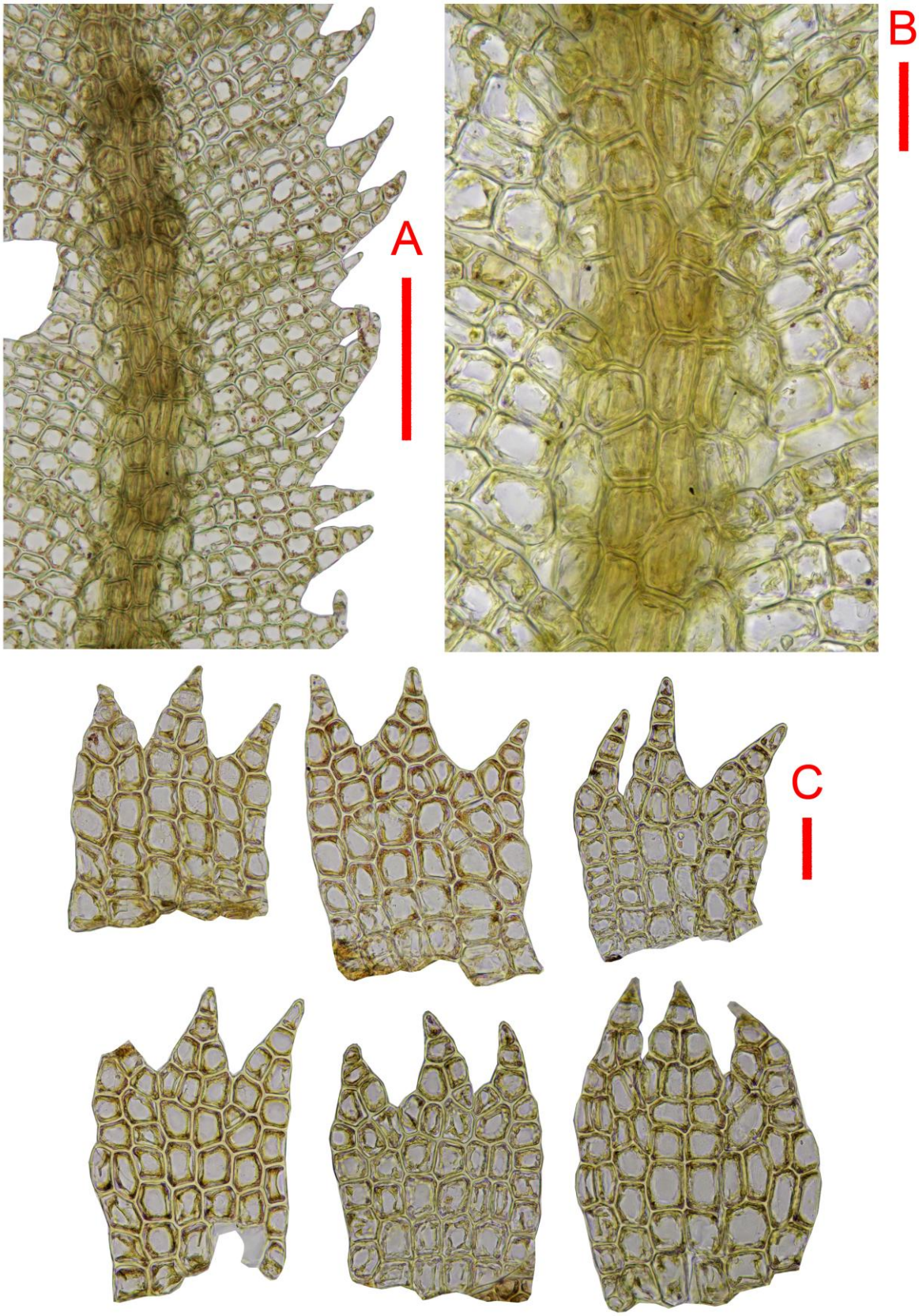

Plate 291: *Neolepidozia schaefer-verwimpii*: A, B – Branch dorsal, C – Branch leaves; Scales: A – 0.2 mm; B, C – 50 µm (from TOUW 10868)

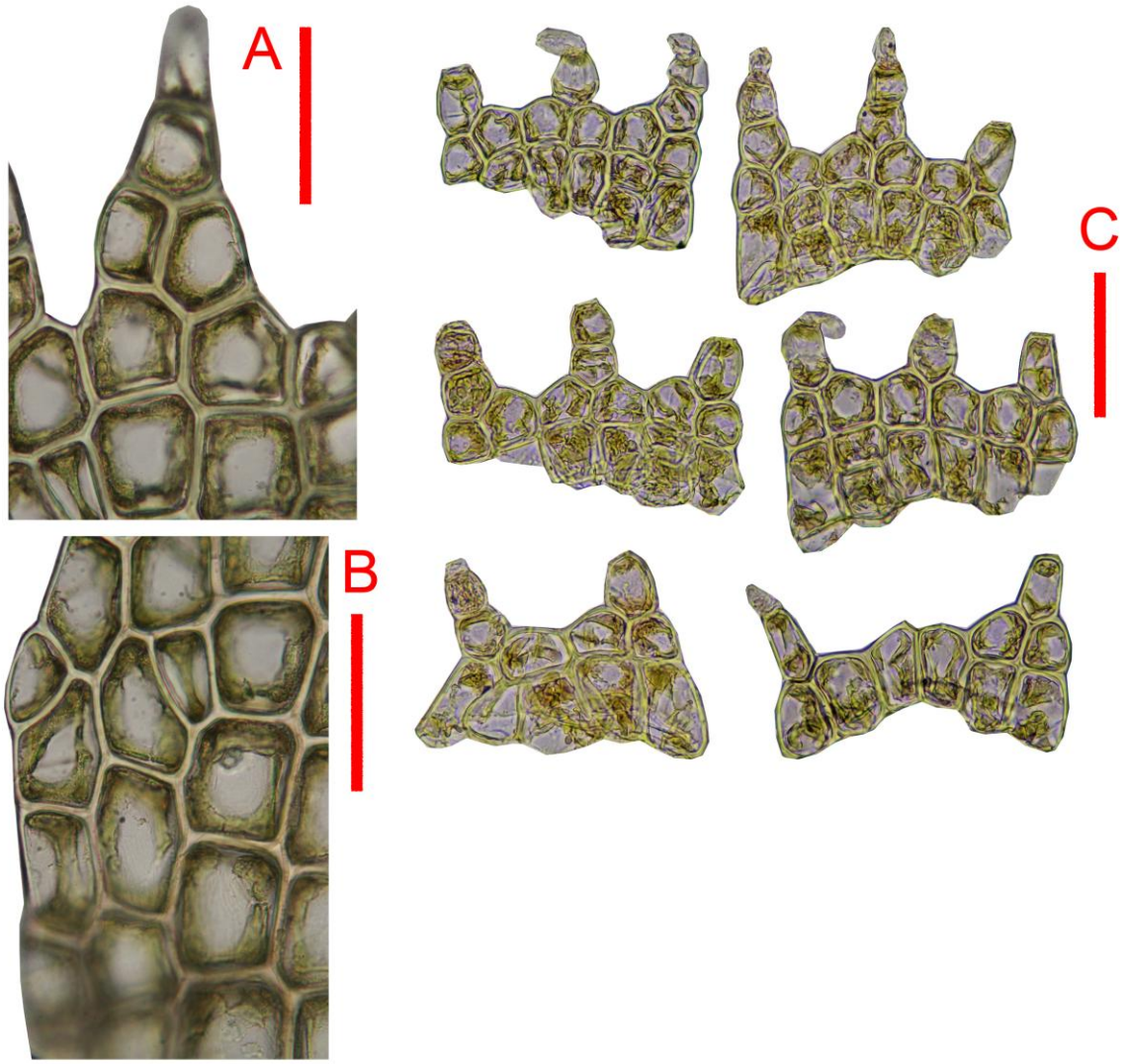

Plate 292: *Neolepidozia schaefer-verwimpii*: A – Branch leaf disc, B – Branch leaf lobe, C – Branch underleaves; Scales: A, B, C – 50 µm (from TOUW 10868)

Neolepidozia schusteri **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

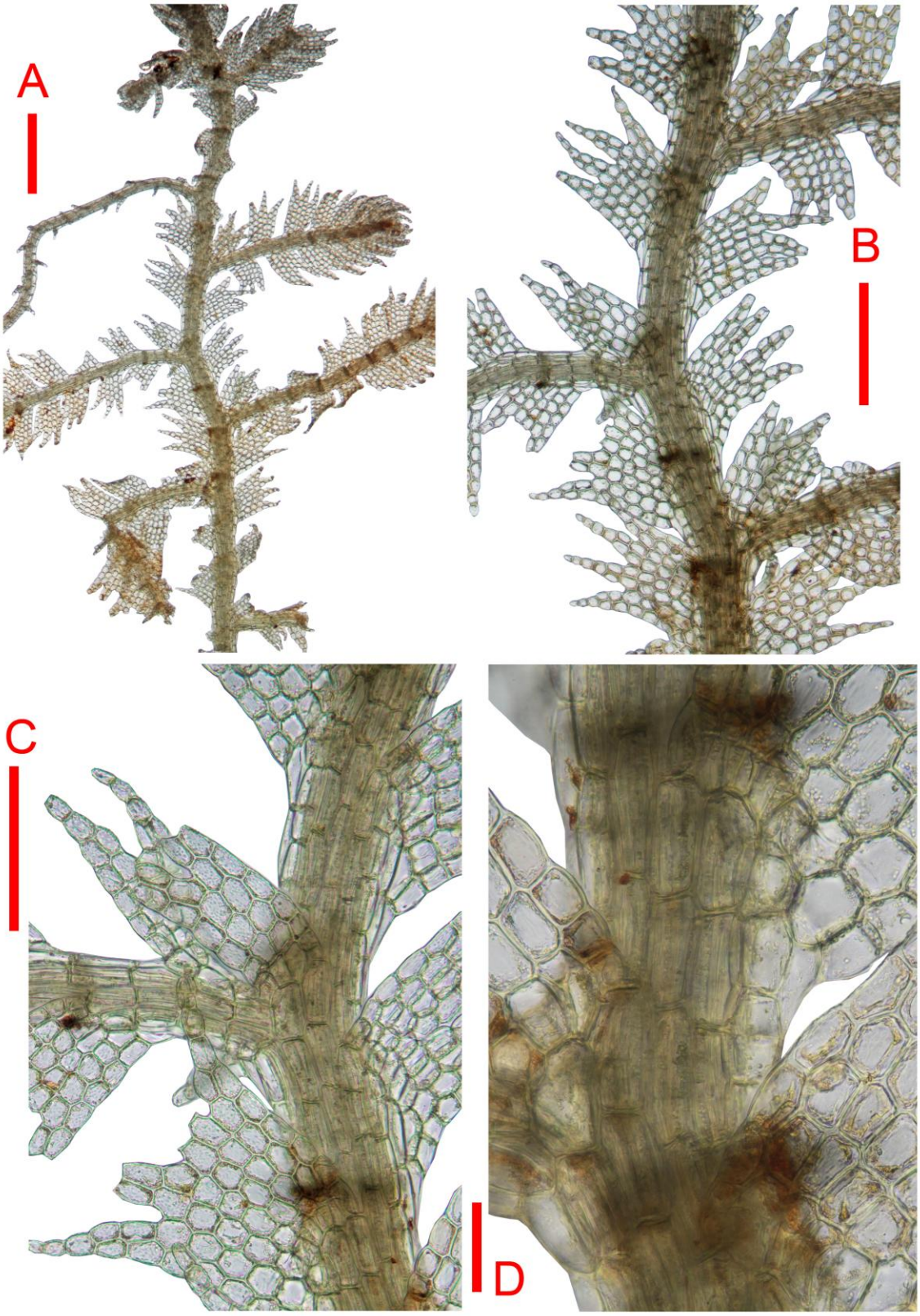

Plate 293: *Neolepidozia schusteri*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SCHUSTER 67-6268, JE – holotype)

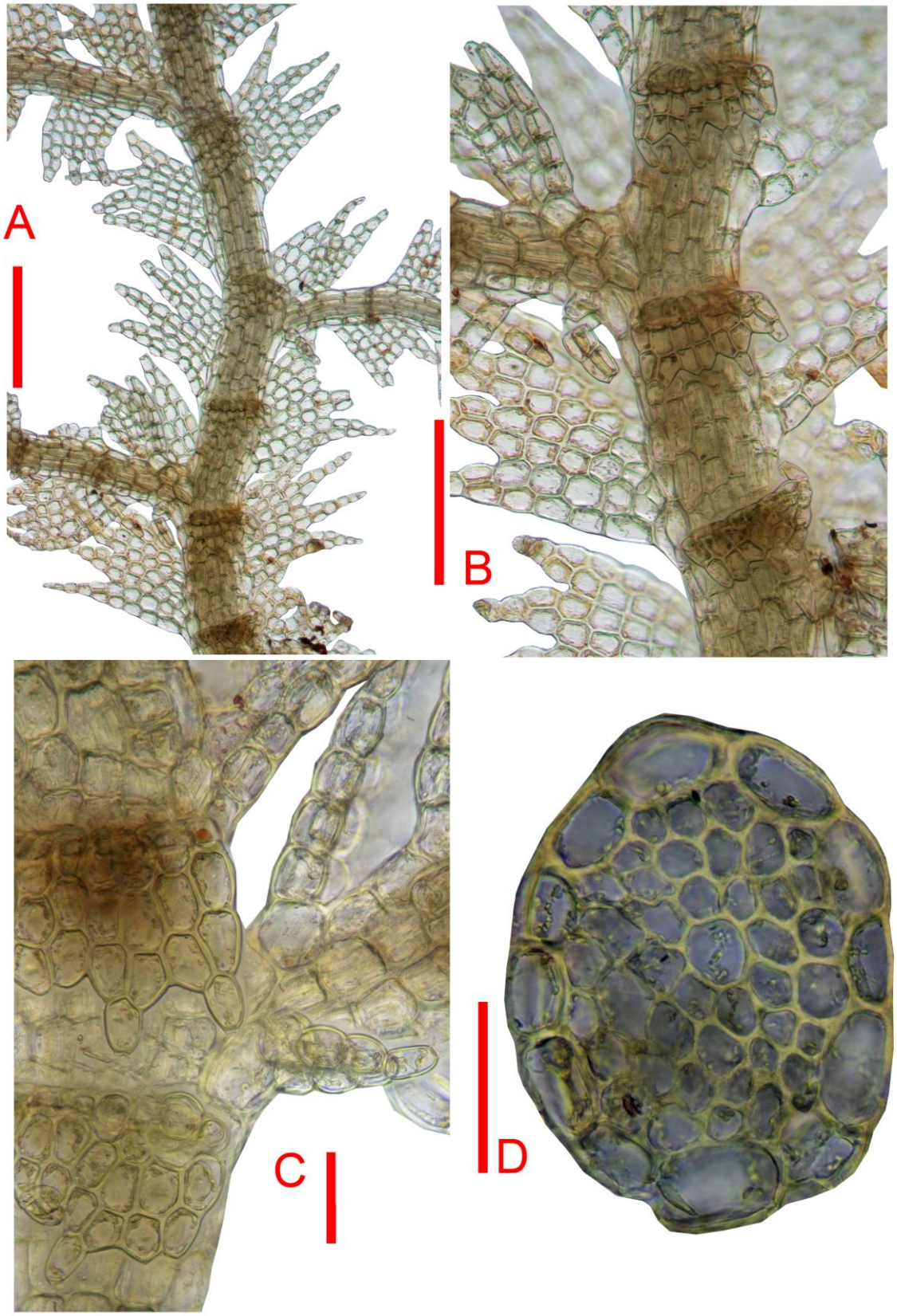

Plate 294: *Neolepidozia schusteri*: A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C,D – 50 µm (from SCHUSTER 67-6268, JE – holotype)

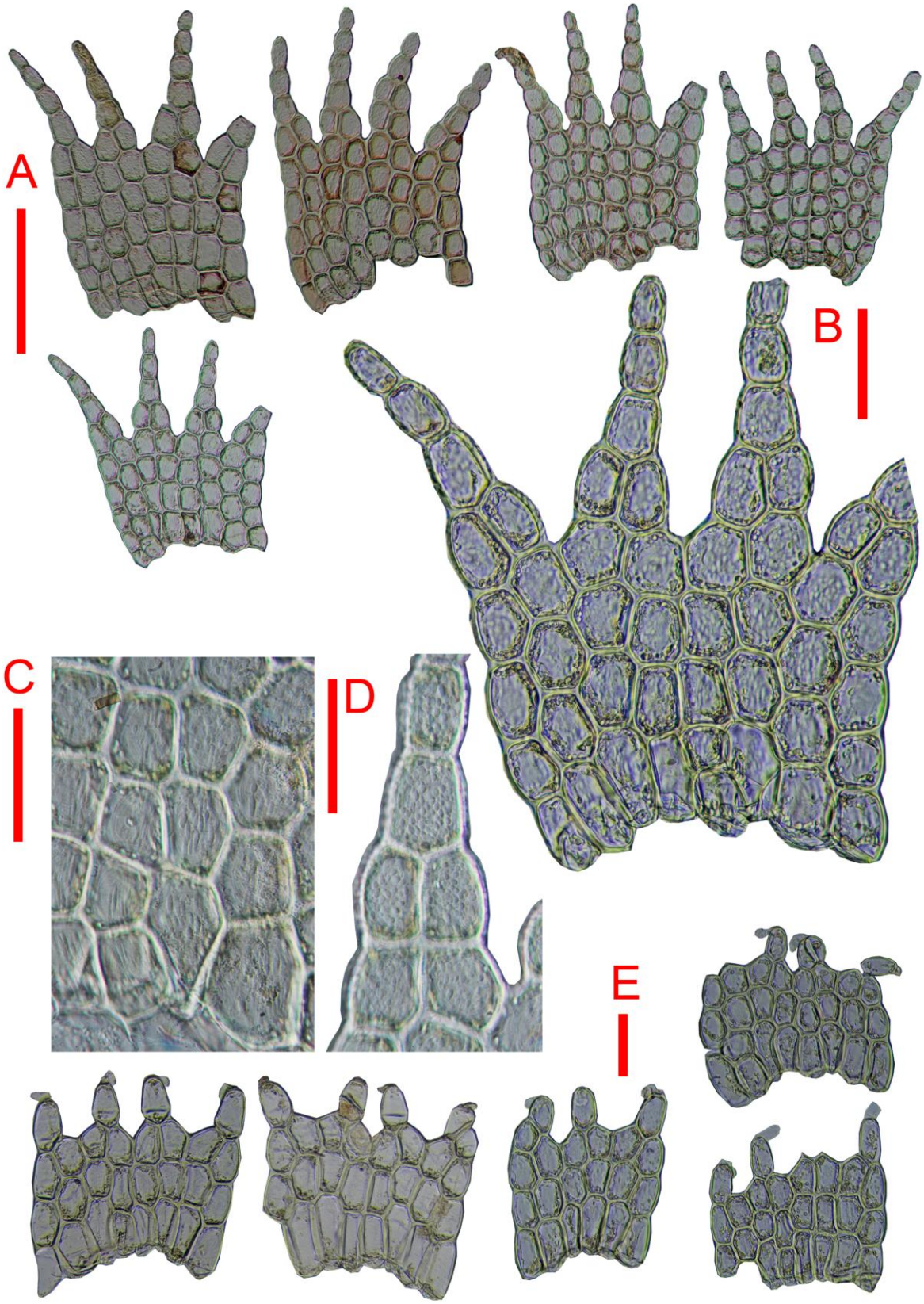

Plate 295: *Neolepidozia schusteri*: A, B – Stem leaves, C – Stem leaf disc, D – Stem leaf lobe, E – Stem underleaves; Scales: A – 0.2 mm; B, C, D, E – 50 µm (from SCHUSTER 67-6268, JE – holotype)

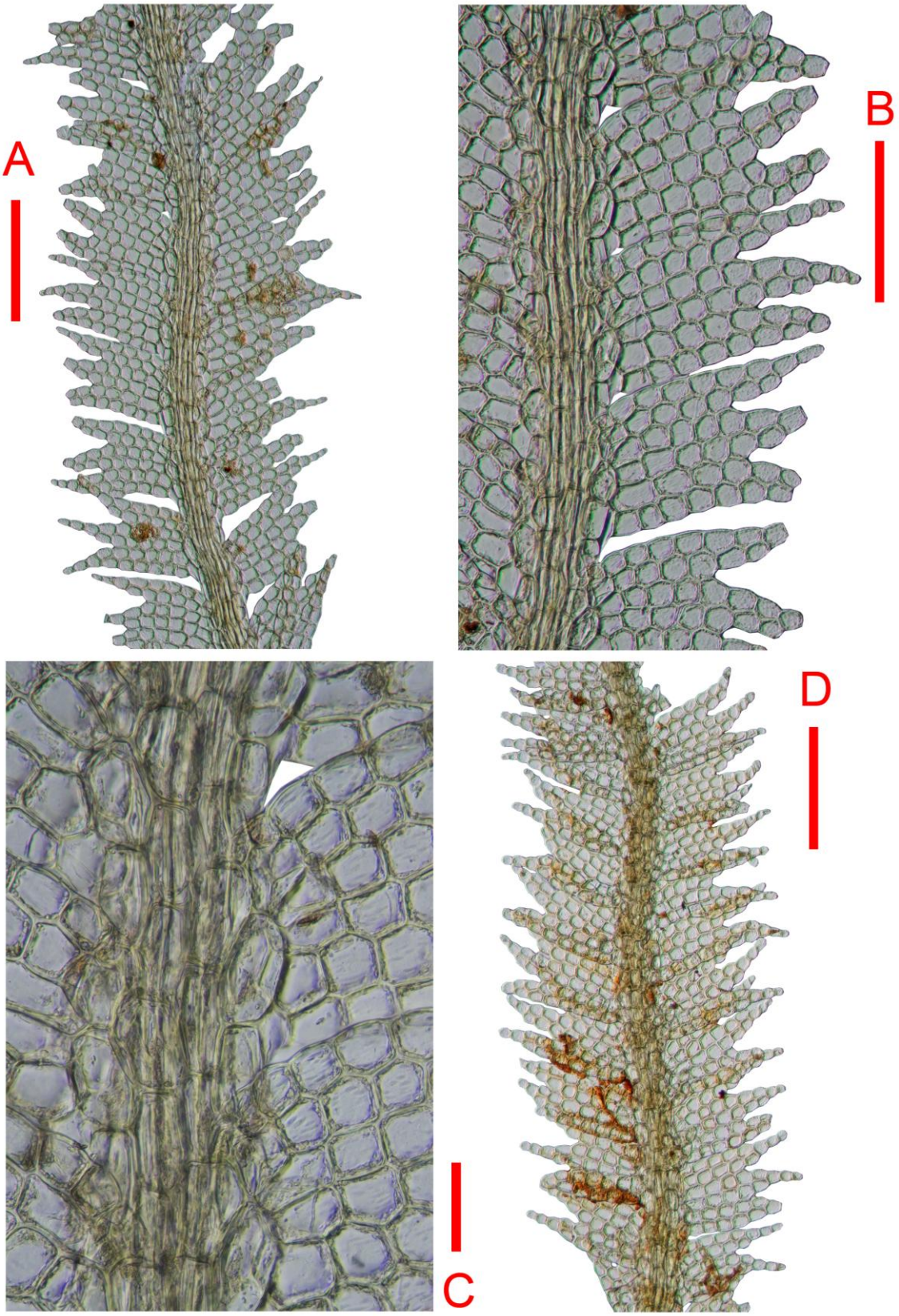

Plate 296: *Neolepidozia schusteri*: A, B, C – Branch dorsal, D – Branch ventral; Scales: A, D – 0.3 mm; B – 0.2 mm; C – 50 µm (from SCHUSTER 67-6268, JE – holotype)

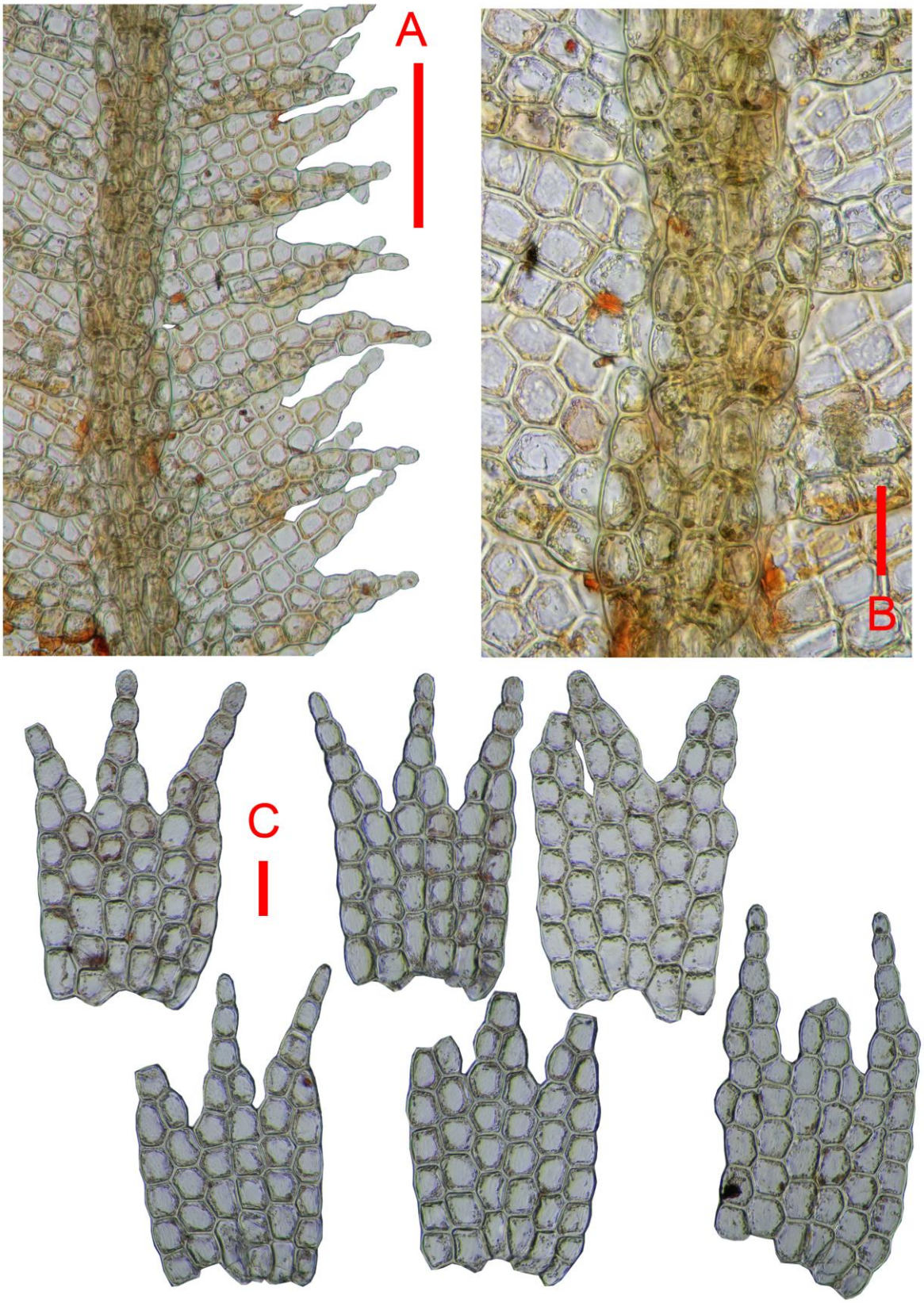

Plate 297: *Neolepidozia schusteri*: A, B – Branch ventral, C – Branch leaves; Scales: A – 0.2 mm; B, C – 50 µm (from SCHUSTER 67-6268, JE – holotype)

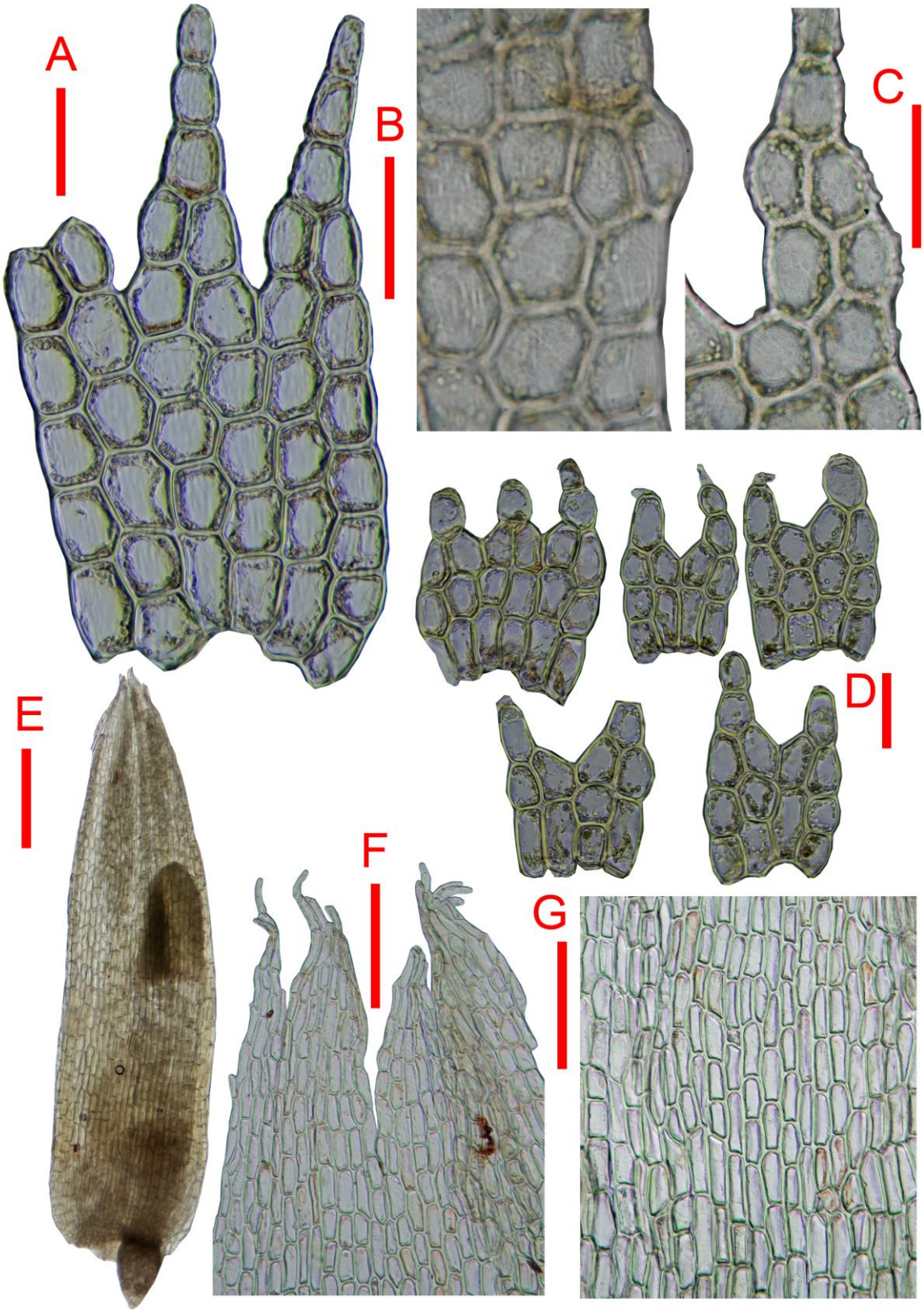

Plate 298: *Neolepidozia schusteri*: A – Branch leaf, B – Branch leaf disc, C – Branch leaf lobe, D – Branch underleaves, E – Perianth, F – Perianth mouth, G – Median perianth cells; Scales: A, B, C, D – 50 µm; E – 0.5 mm, F, G – 0.2 mm (from SCHUSTER 67-6268, JE – holotype)

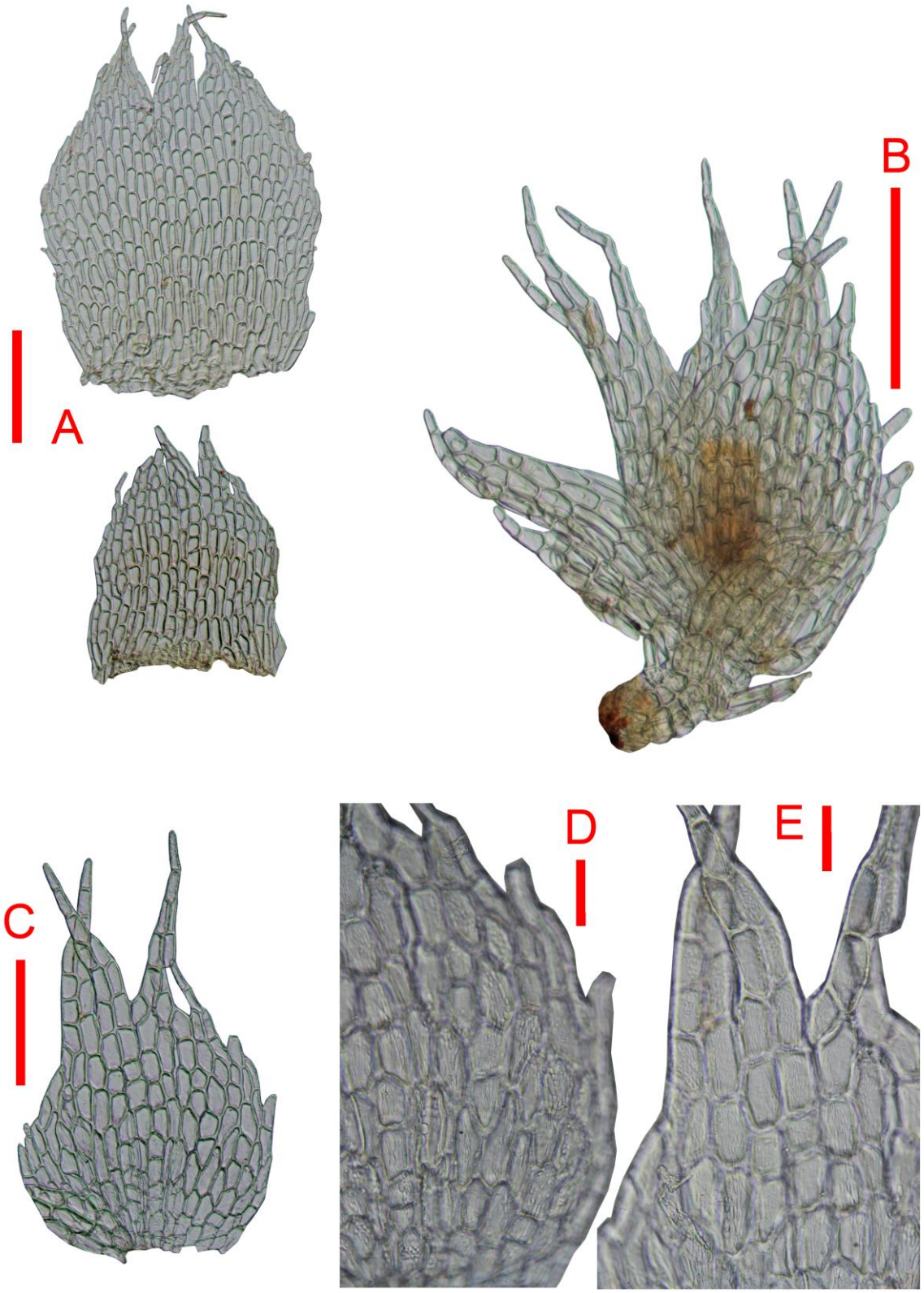

Plate 299: *Neolepidozia schusteri*: A – Female bracts, B – Female inflorescense, C – Young female bract, D – Young female bract base, E – Young female bract apex; Scales: A, B – 0.3 mm; C – 0.2 mm; D, E – 50 µm (from SCHUSTER 67-6268, JE – holotype)

***Neolepidozia shevockii* U. SCHWARZ; SCHÄF.-VERW.**

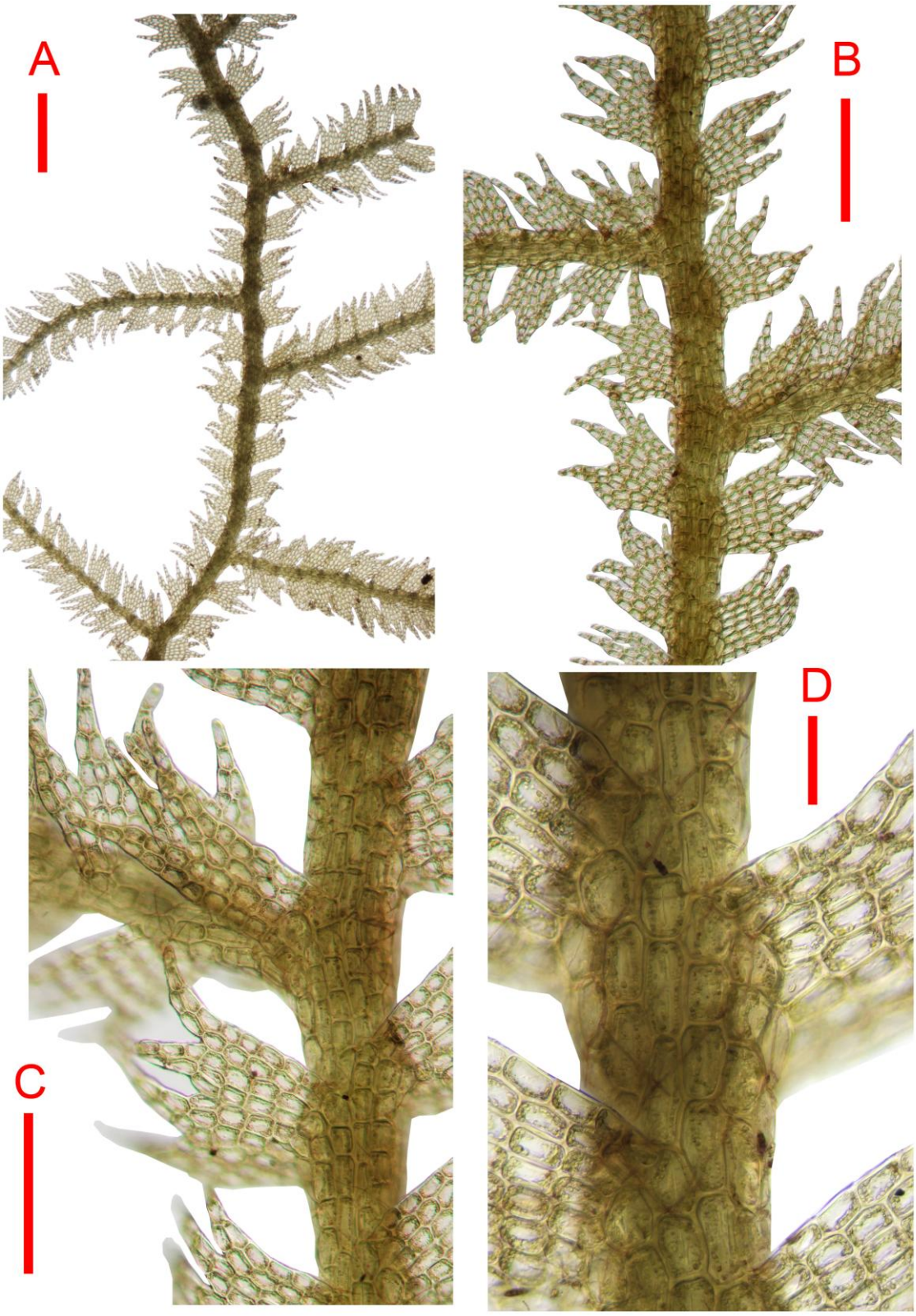

Plate 300: *Neolepidozia shevockii*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SHEVOCK 60200 – holotype)

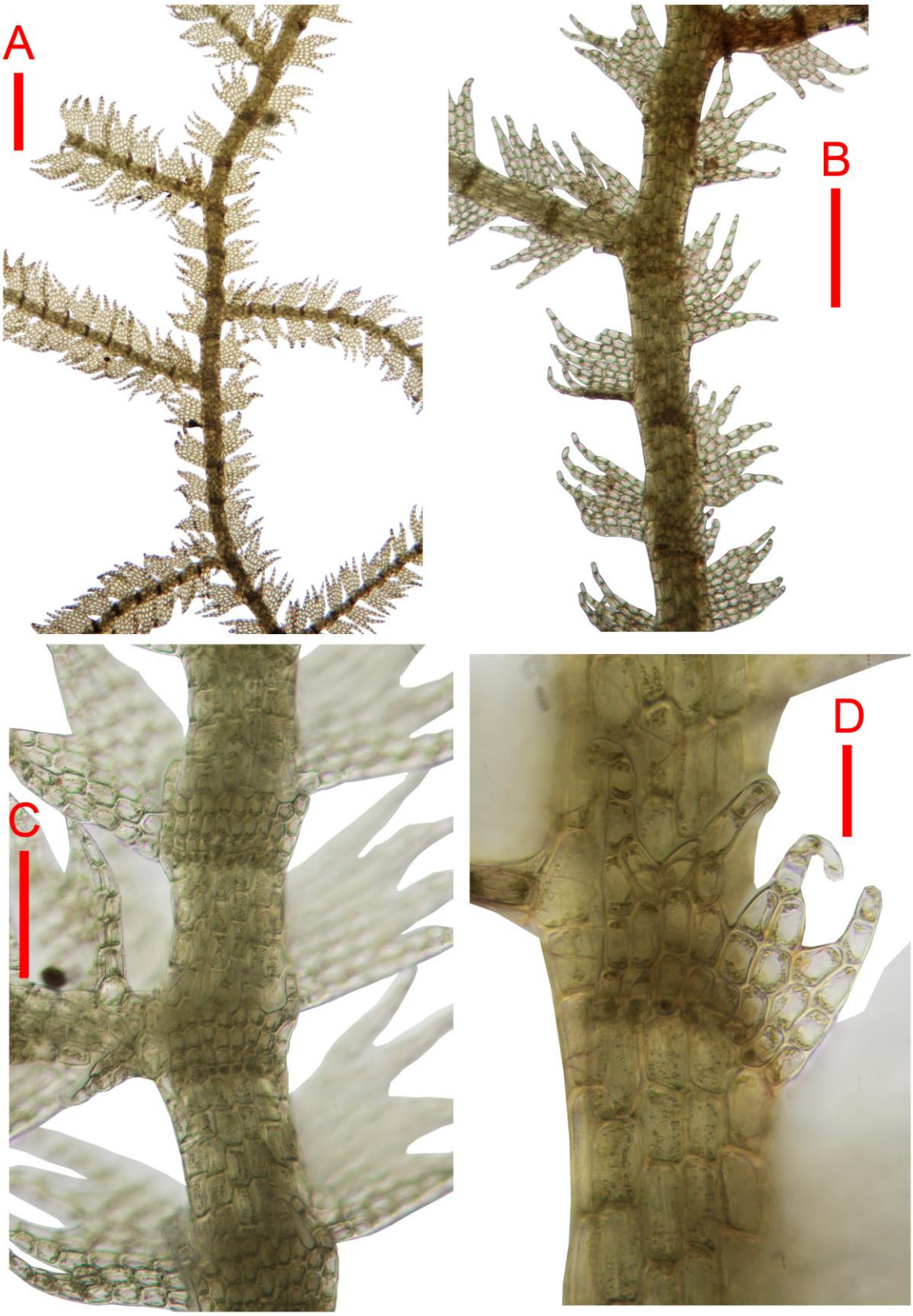

Plate 301: *Neolepidozia shevockii*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from SHEVOCK 60200 – holotype)

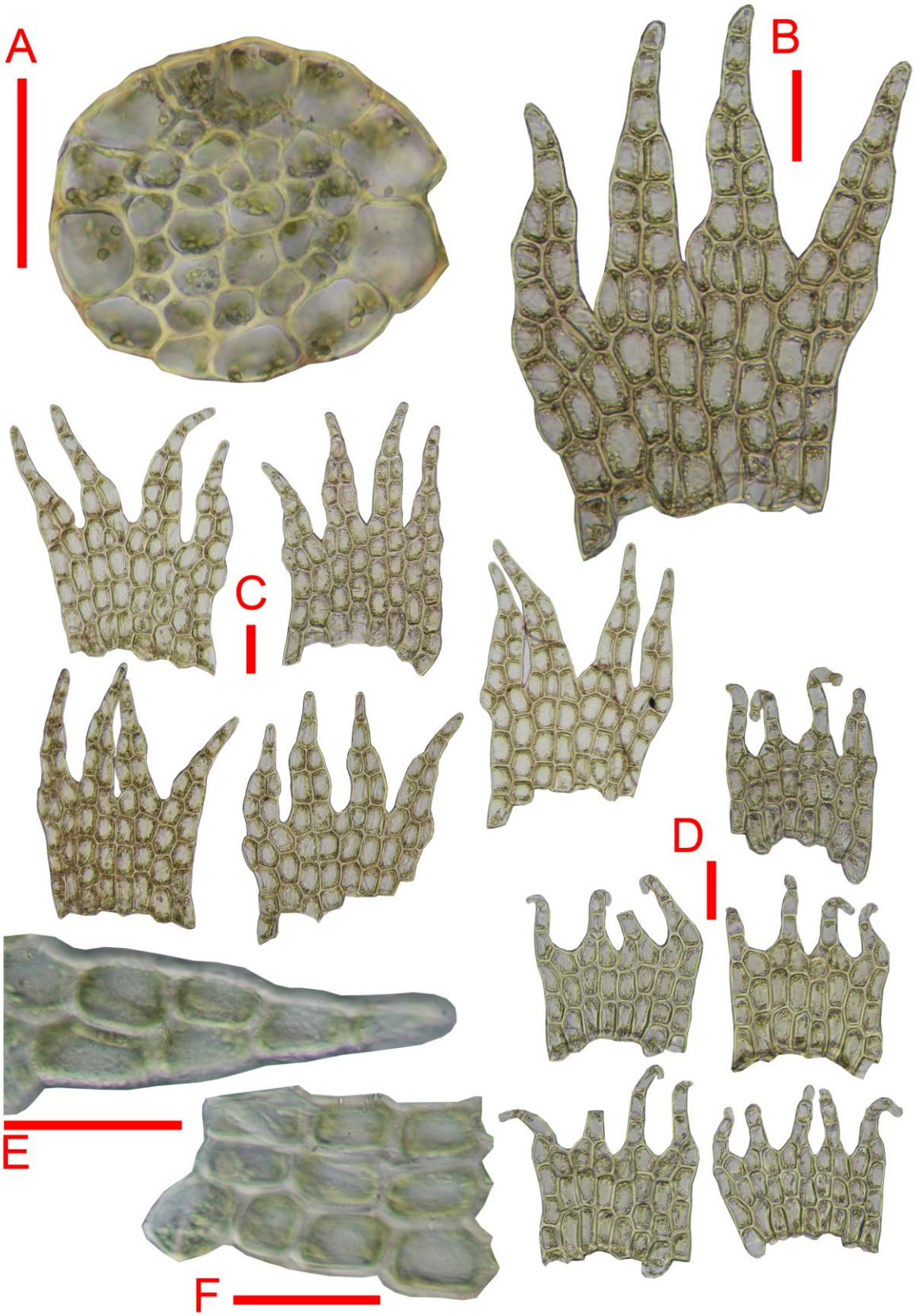

Plate 302: *Neolepidozia shevockii*: A – Stem cross section, B, C – Stem leaves, D – Stem underleaves, E – Stem leaf lobe, F – Stem leaf disc; Scales: A, B, C, D, E, F – 50 µm (from SHEVOCK 60200 – holotype)

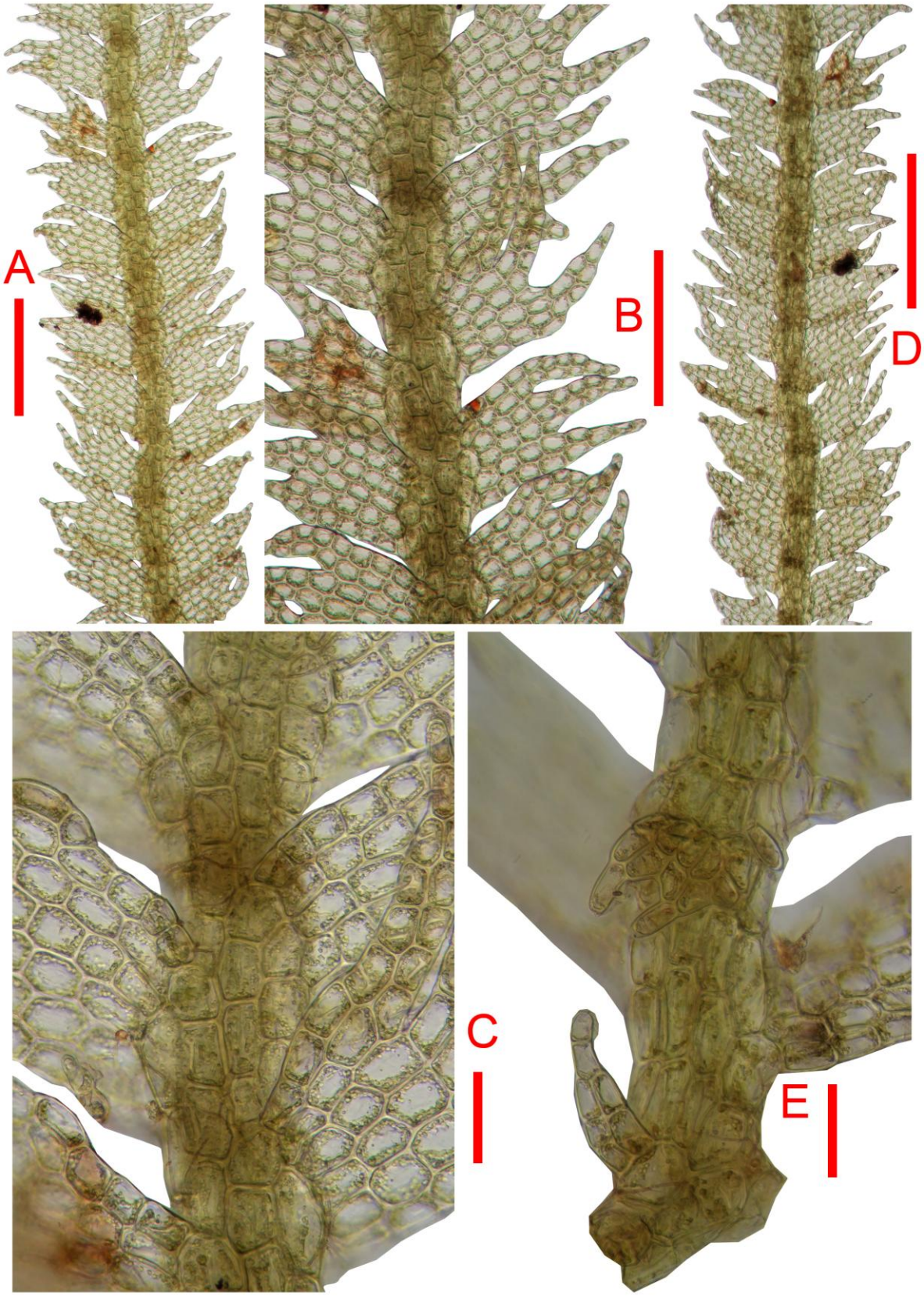

Plate 303: *Neolepidozia shevockii*: A, B, C – Branch dorsal, D – Branch ventral, E – Branch ventral with first amphigastrium; Scales: A, D – 0.3 mm, B – 0.2 mm, C, E – 50 µm (from SHEVOCK 60200 – holotype)

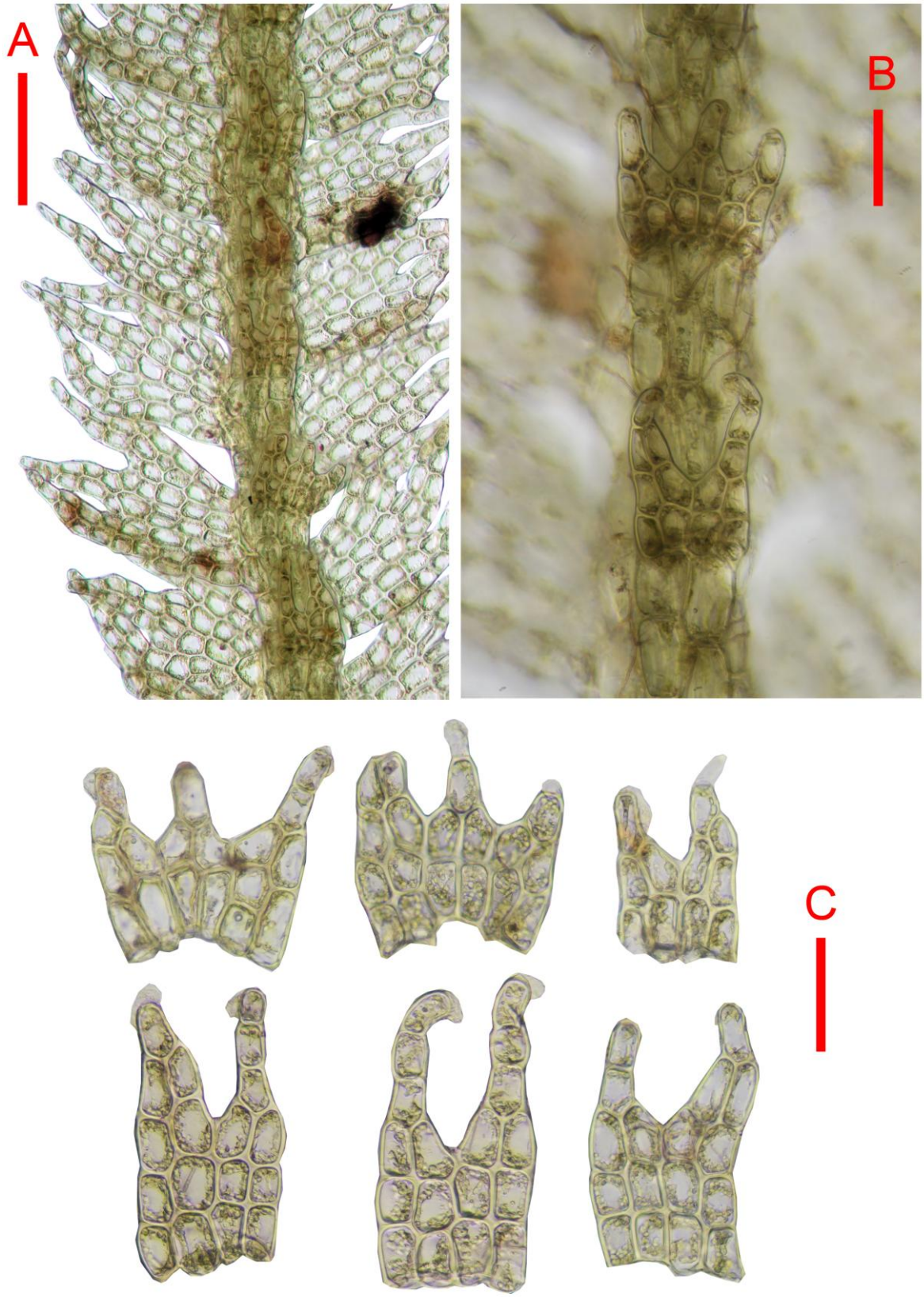

Plate 304: *Neolepidozia shevockii*: A, B – Branch ventral, C – Branch underleaves; Scales: A – 0.2 mm, B, C – 50 µm (from SHEVOCK 60200 – holotype)

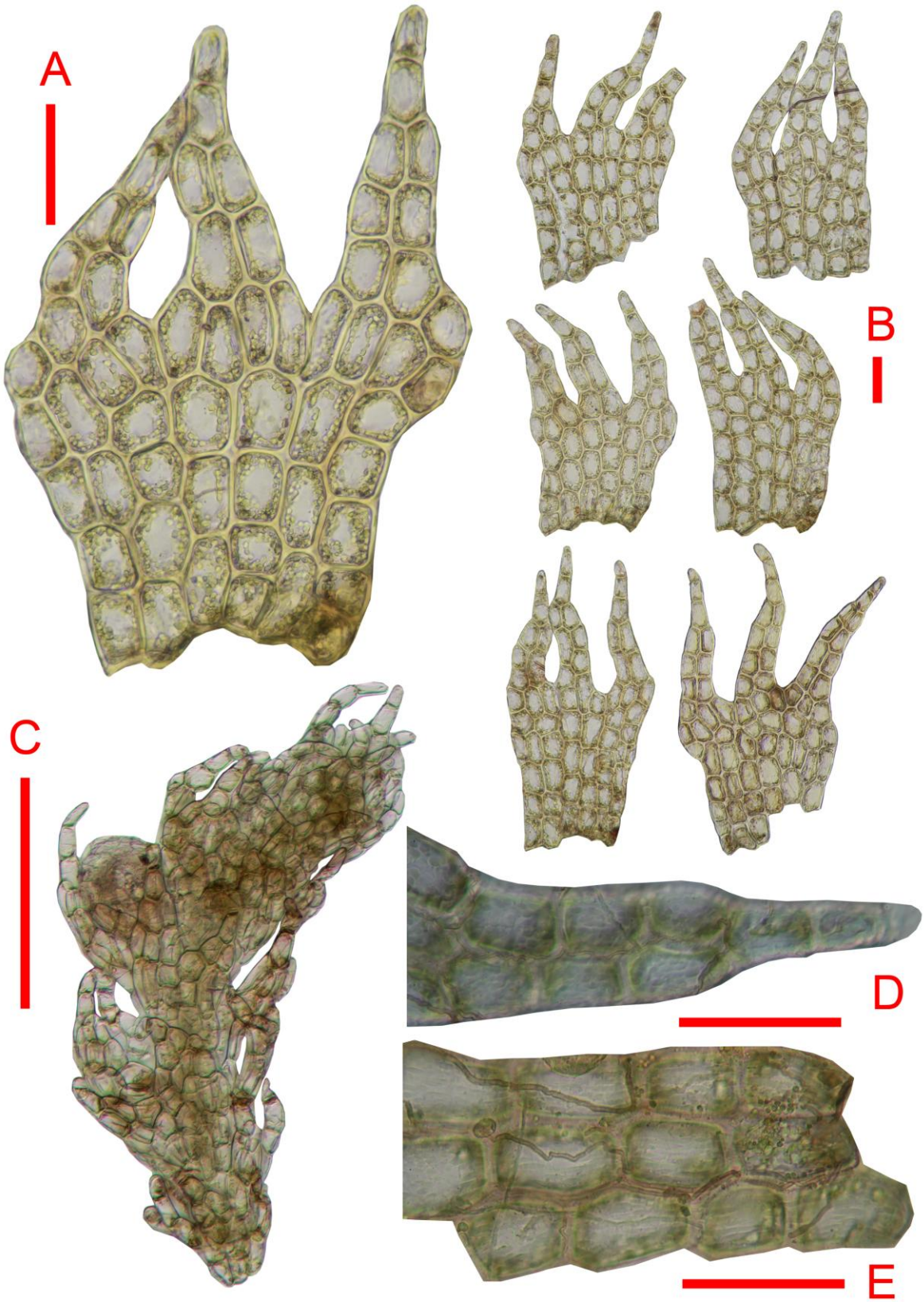

Plate 305: *Neolepidozia shevockii*: A, B – Branch leaves, C – Male branch, D – Branch leaf lobe, E – Branch leaf disc; Scales: C – 0.2 mm, A, B, D, E – 50 µm (from SHEVOCK 60200 – holotype)

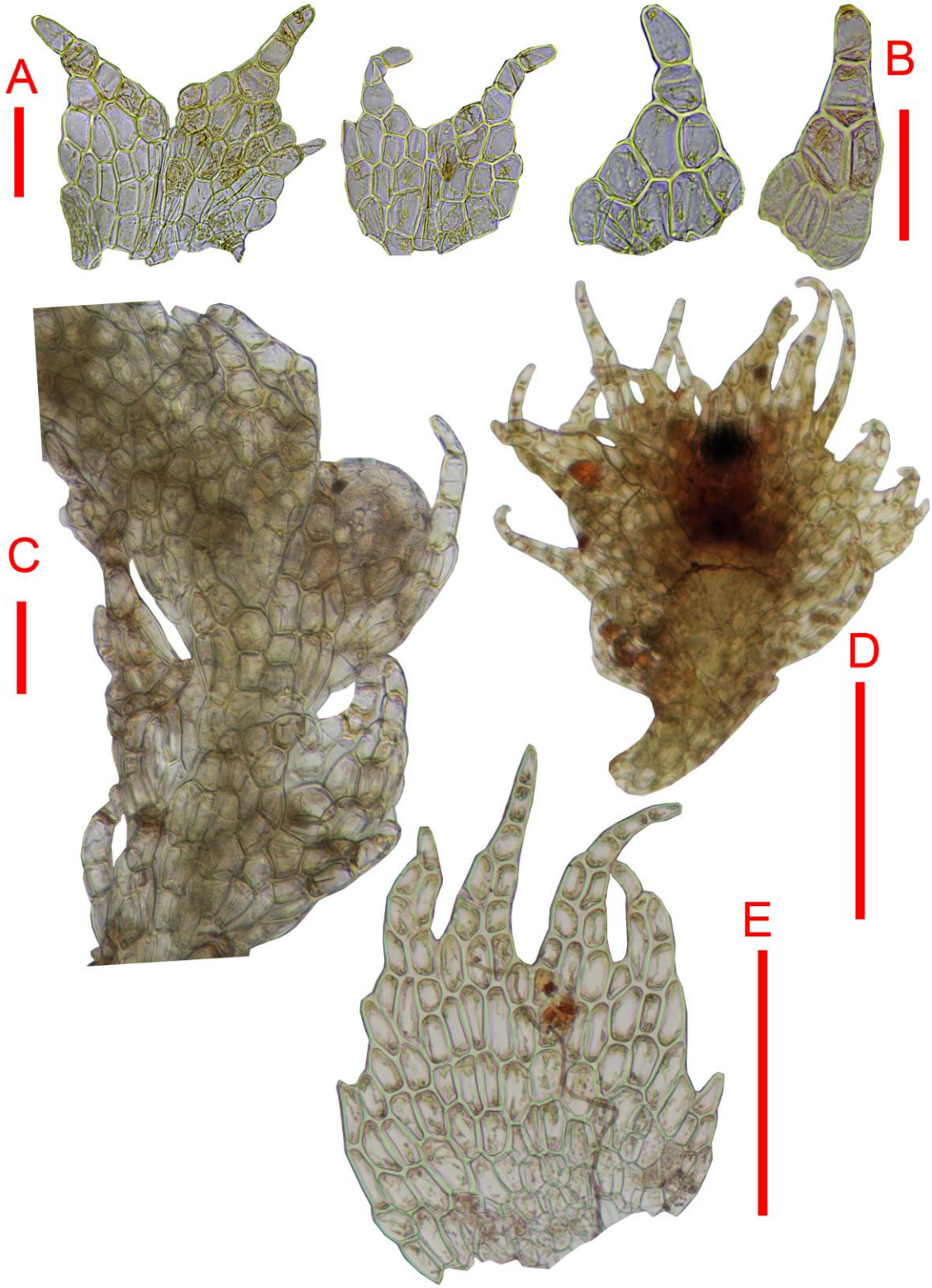

Plate 306: *Neolepidozia shevockii*: A – Male bracts, B – Underleaves of male branch, C – Male branch, D – Female inflorescense, E – Female bract; Scales: A, B, C – 50 µm, D – 0.3 mm, E – 0.2 mm (from SHEVOCK 60200 – holotype)

Neolepidozia solomonensis U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

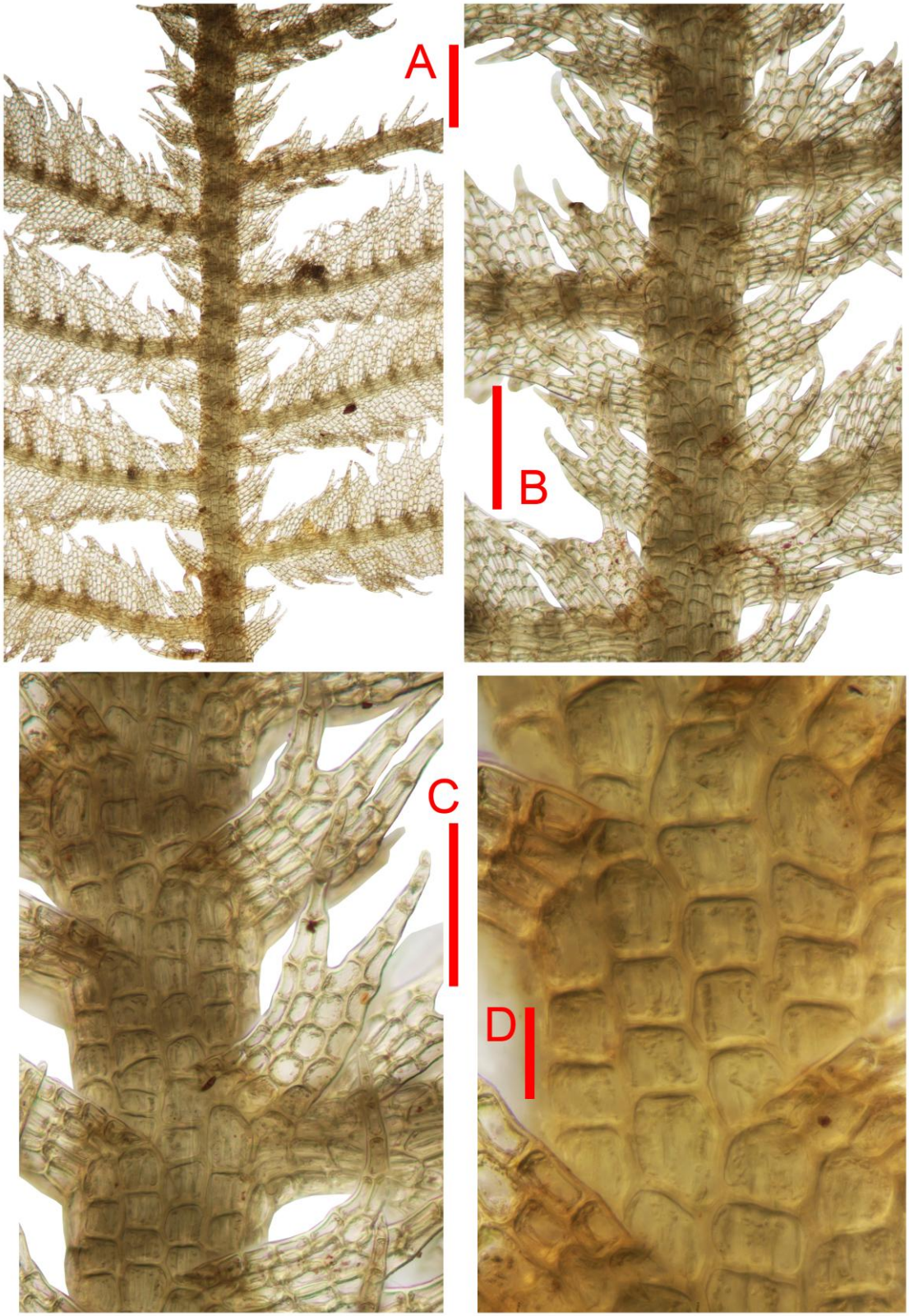

Plate 307: *Neolepidozia solomonensis*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from BRAITHWAITE 4567, JE)

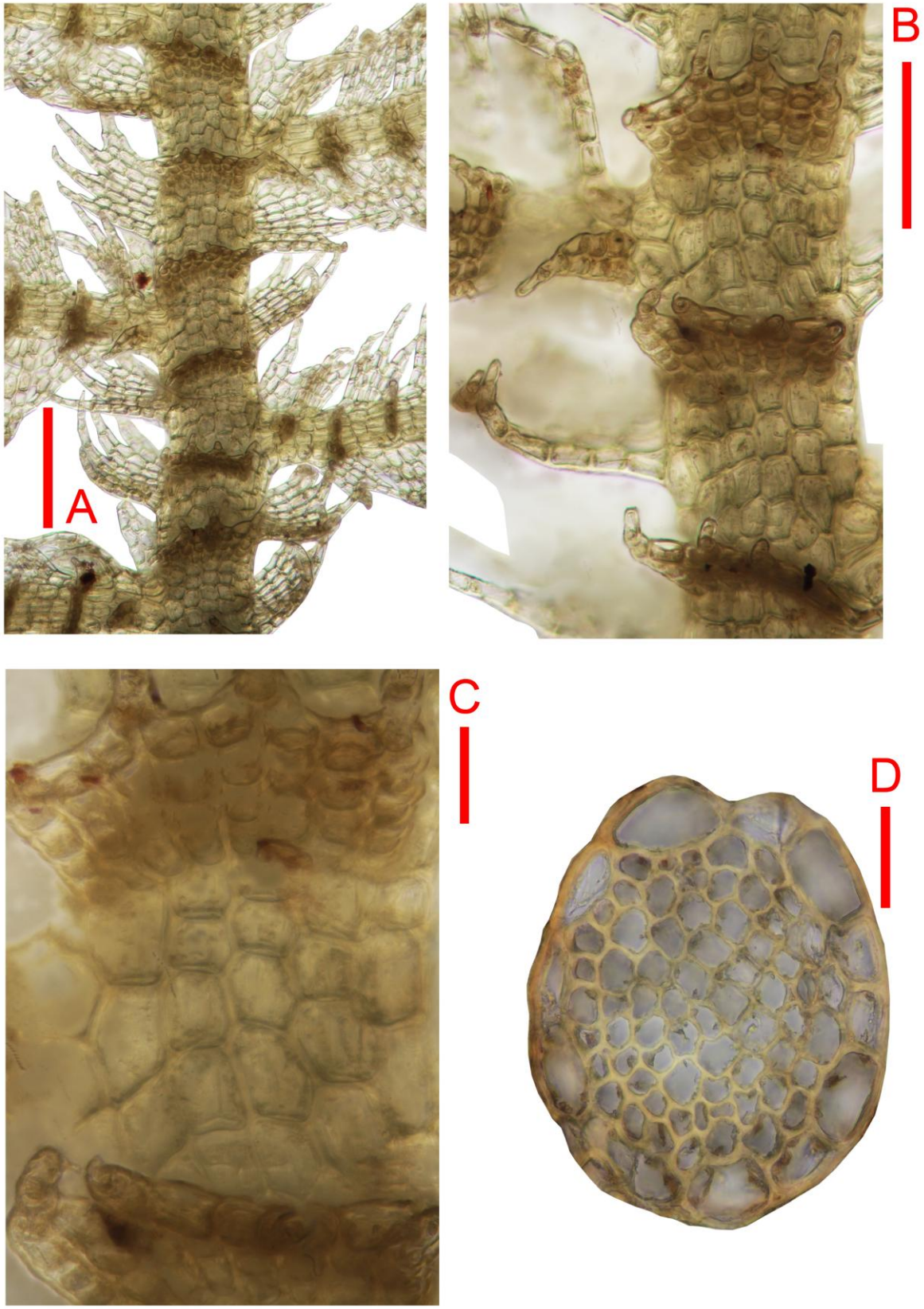

Plate 308: *Neolepidozia solomonensis*: A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from BRAITHWAITE 4567, JE)

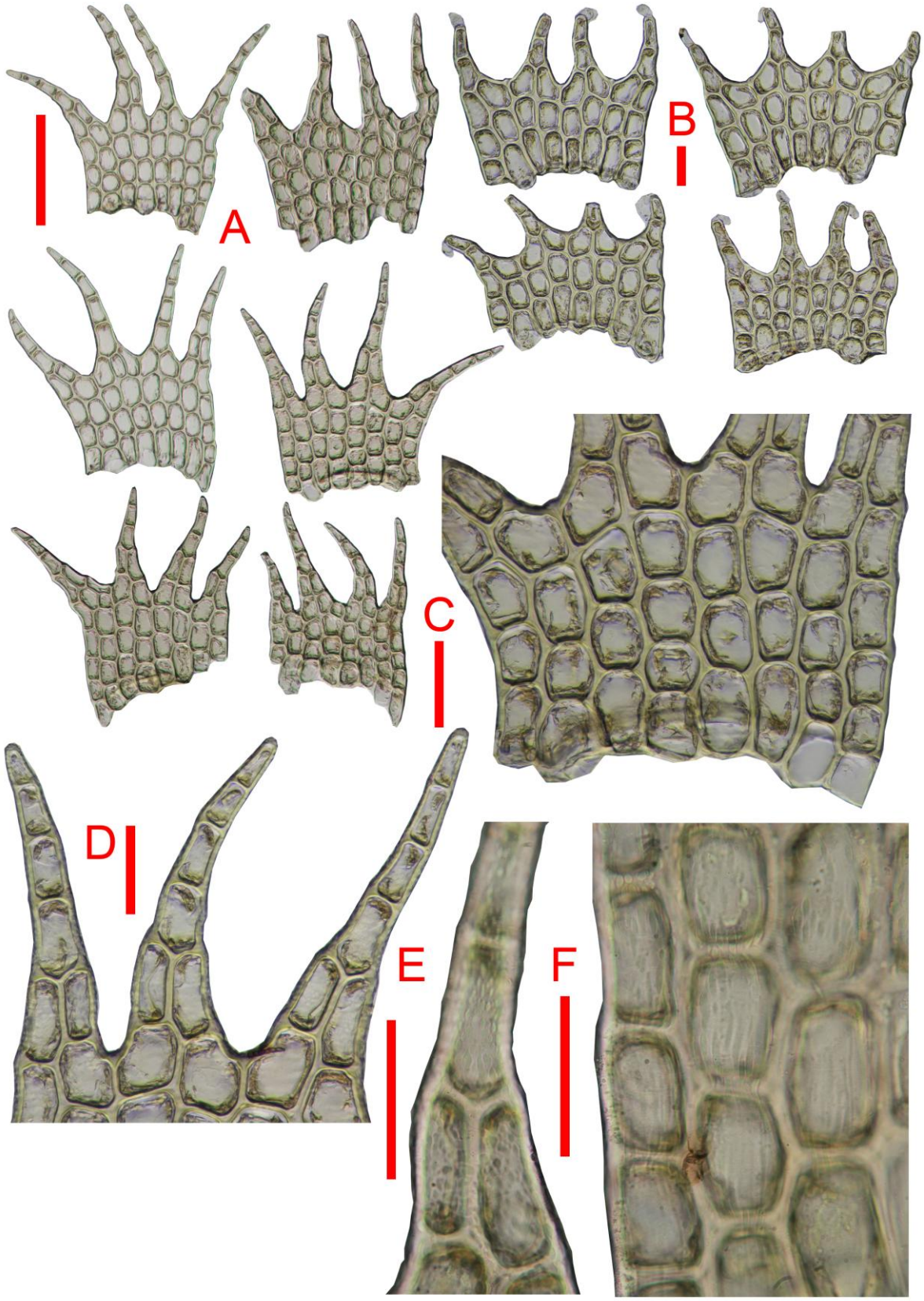

Plate 309: *Neolepidozia solomonensis*: A – Stem leaves, B – Stem underleaves, C, F – Stem leaf disc, D,E – Stem leaf lobe; Scales: A – 0.2 mm; B, C, D, E, F — 50 µm (from BRAITHWAITE 4567, JE)

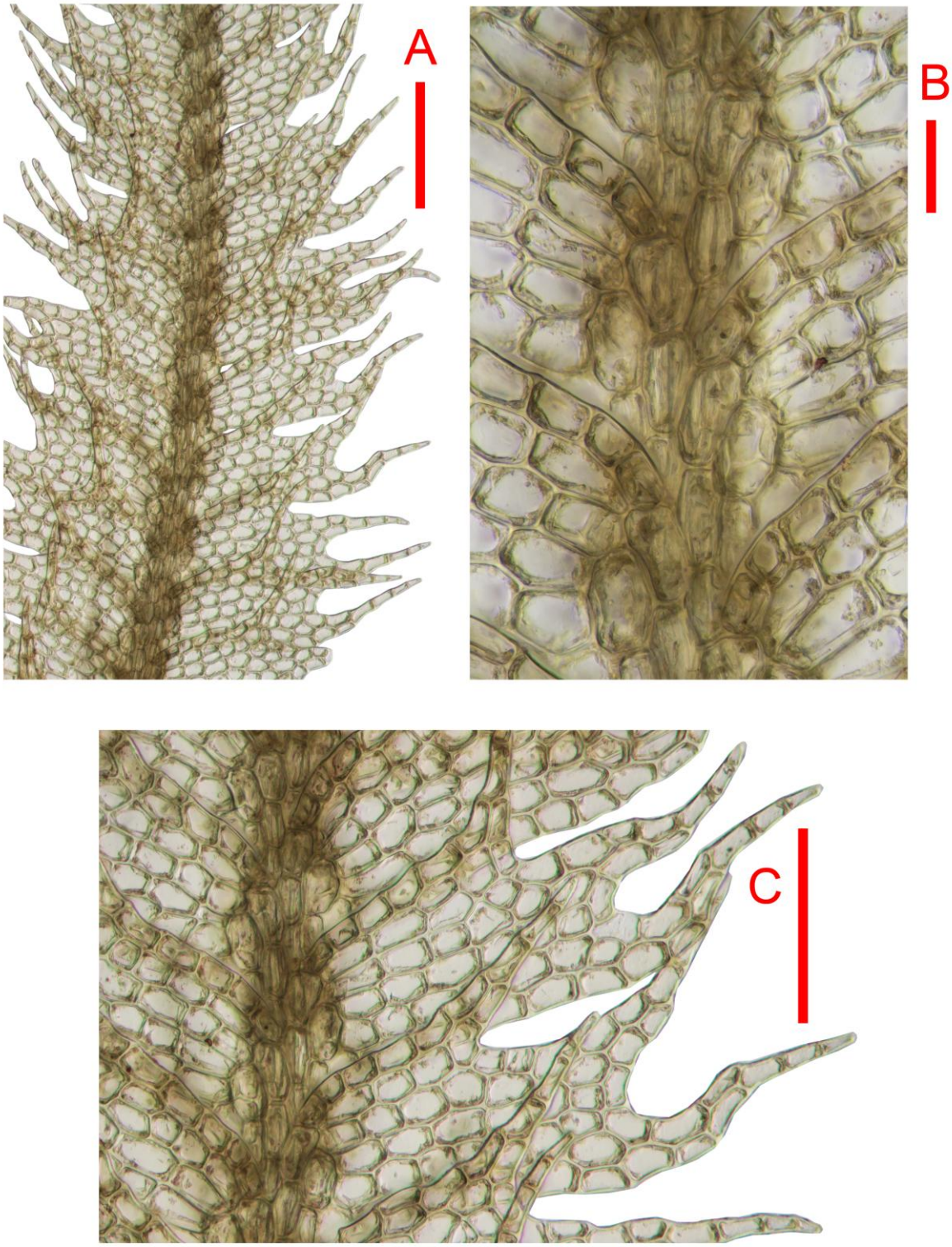

Plate 310: *Neolepidozia solomonensis*: A, B, C – Branch dorsal; Scales: A – 0.3 mm; B – 50 µm, C – 0.2 mm (from BRAITHWAITE 4567, JE)

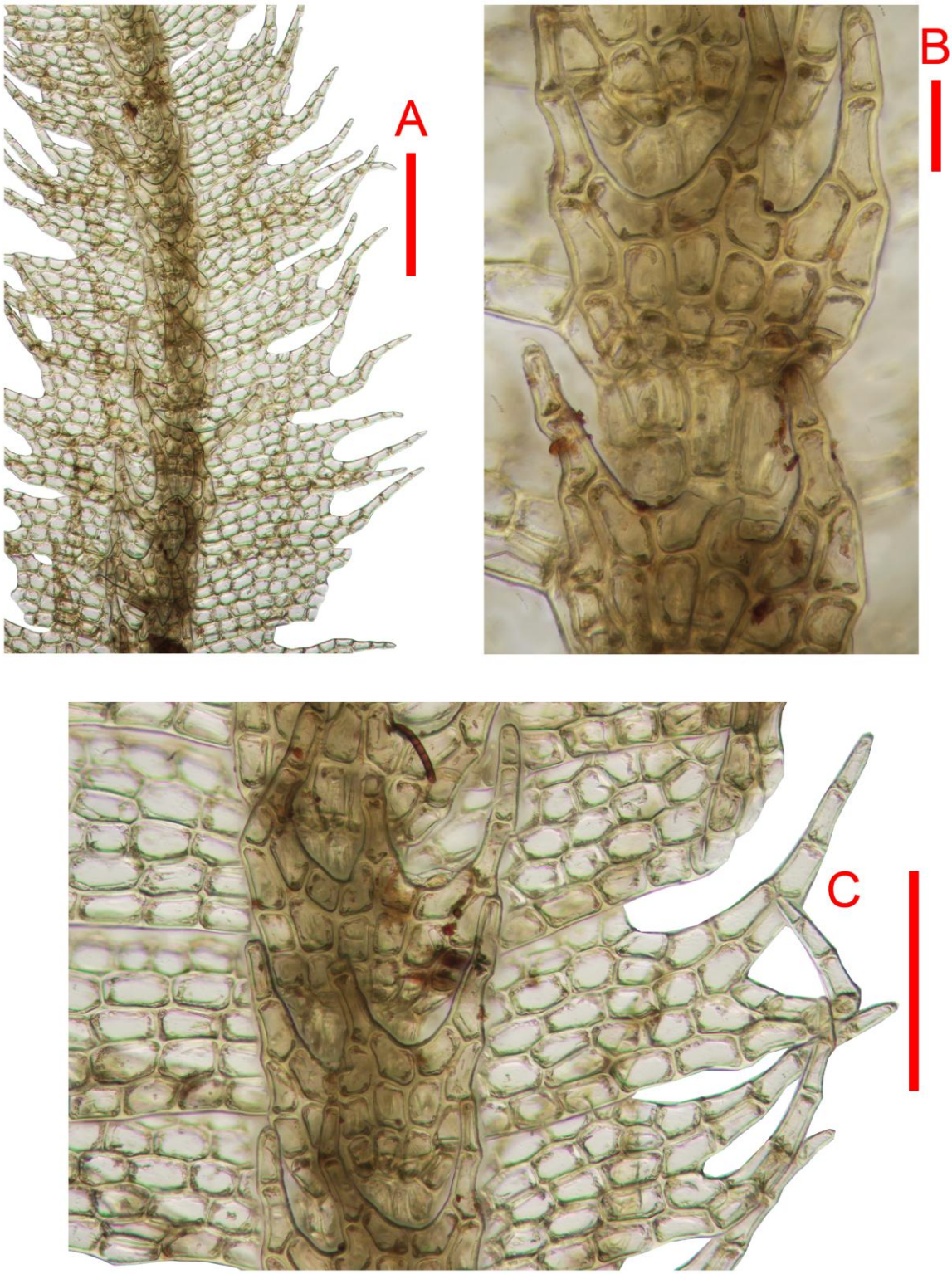

Plate 311: *Neolepidozia solomonensis*: A, B, C – Branch ventral; Scales: A – 0.3 mm; B – 50 µm, C – 0.2 mm (from BRAITHWAITE 4567, JE)

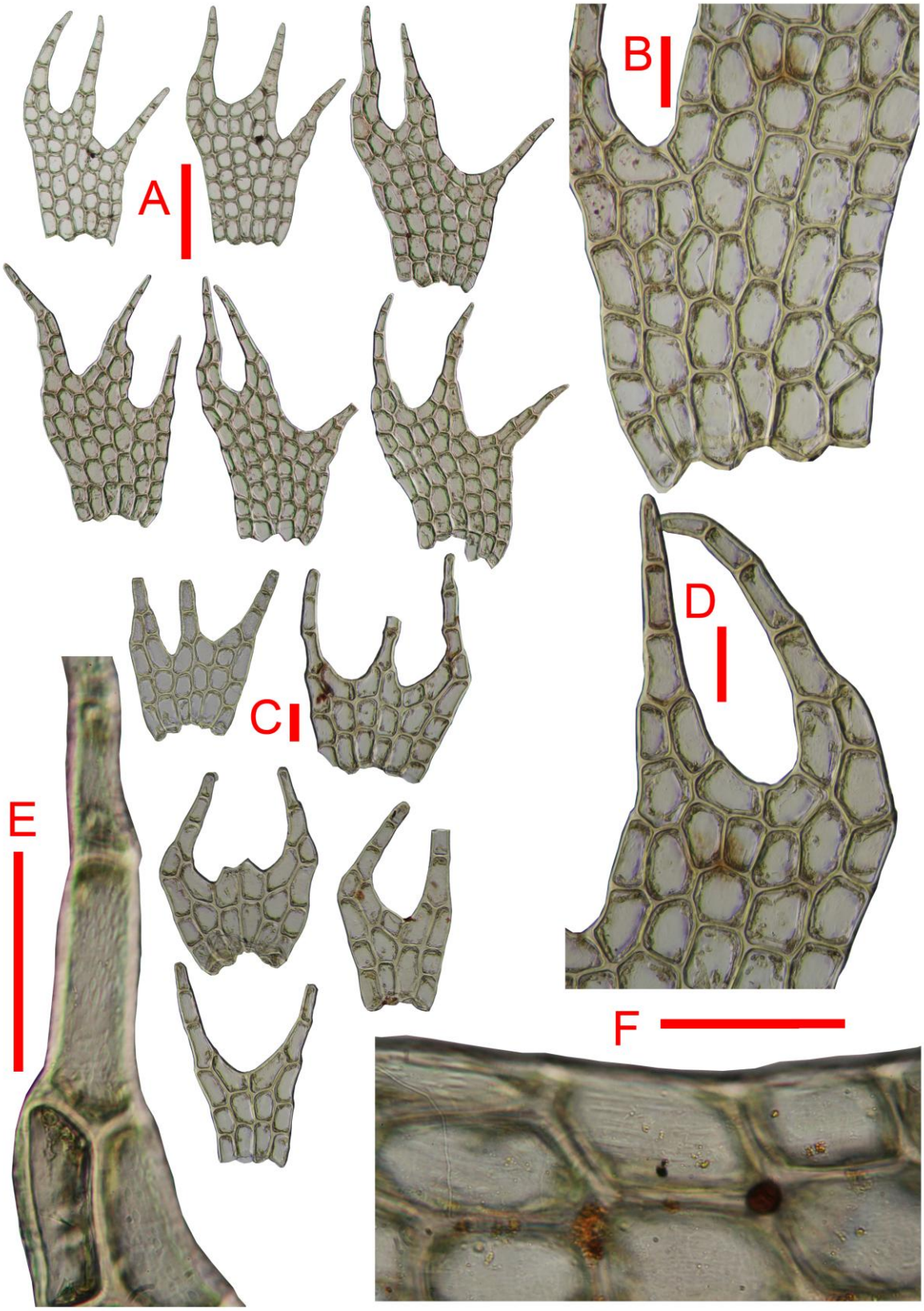

Plate 312: *Neolepidozia solomonensis*: A – Branch leaves, B, F – Branch leaf disc, C – Branch underleaves, D, E – Branch leaf lobes; Scales: A – 0.2 mm; B, C, D, E, F — 50 µm (from BRAITHWAITE 4567, JE)

Neolepidozia streimannii **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

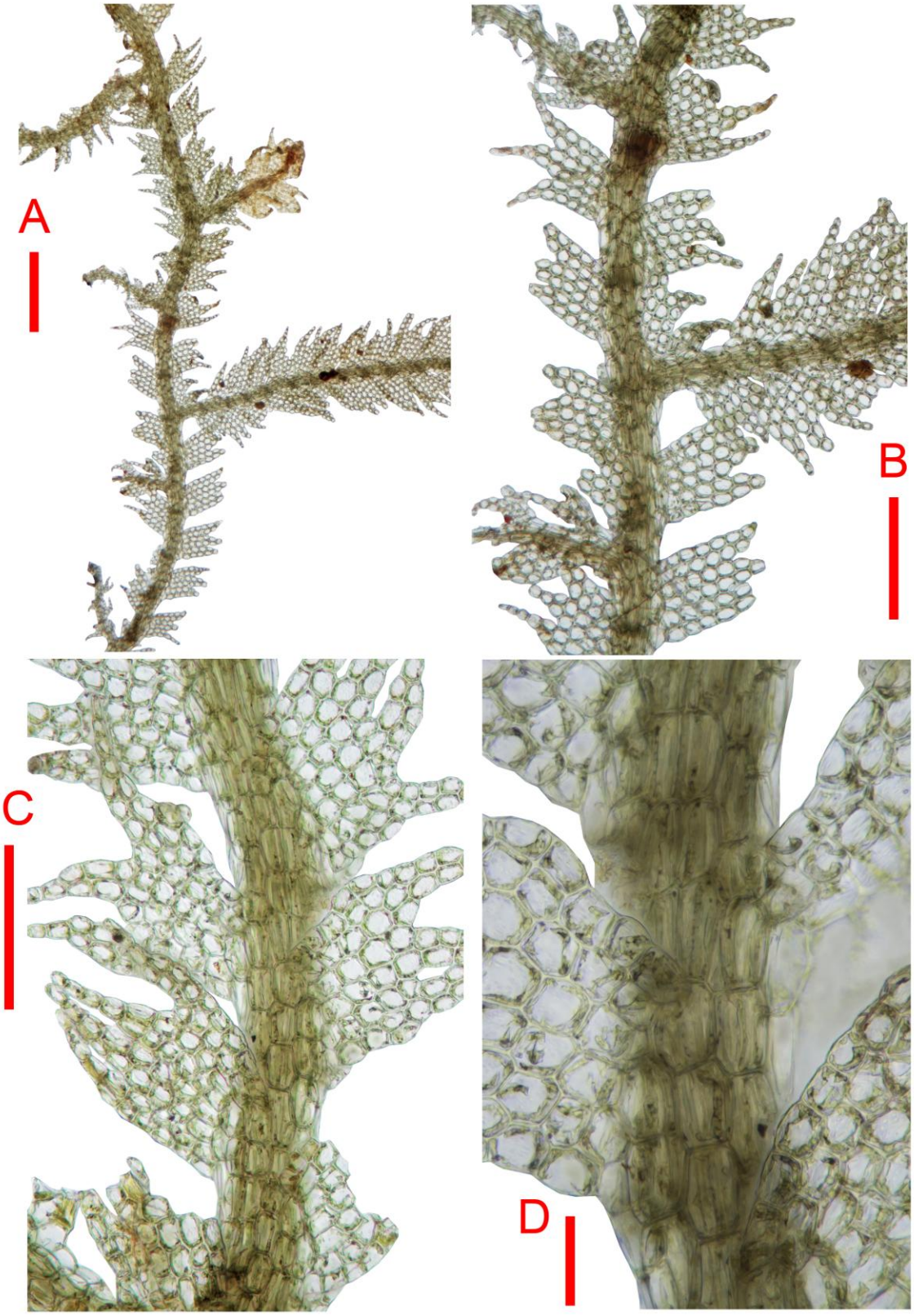

Plate 313: *Neolepidozia streimannii* : A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from STREIMANN 13547, JE – holotype)

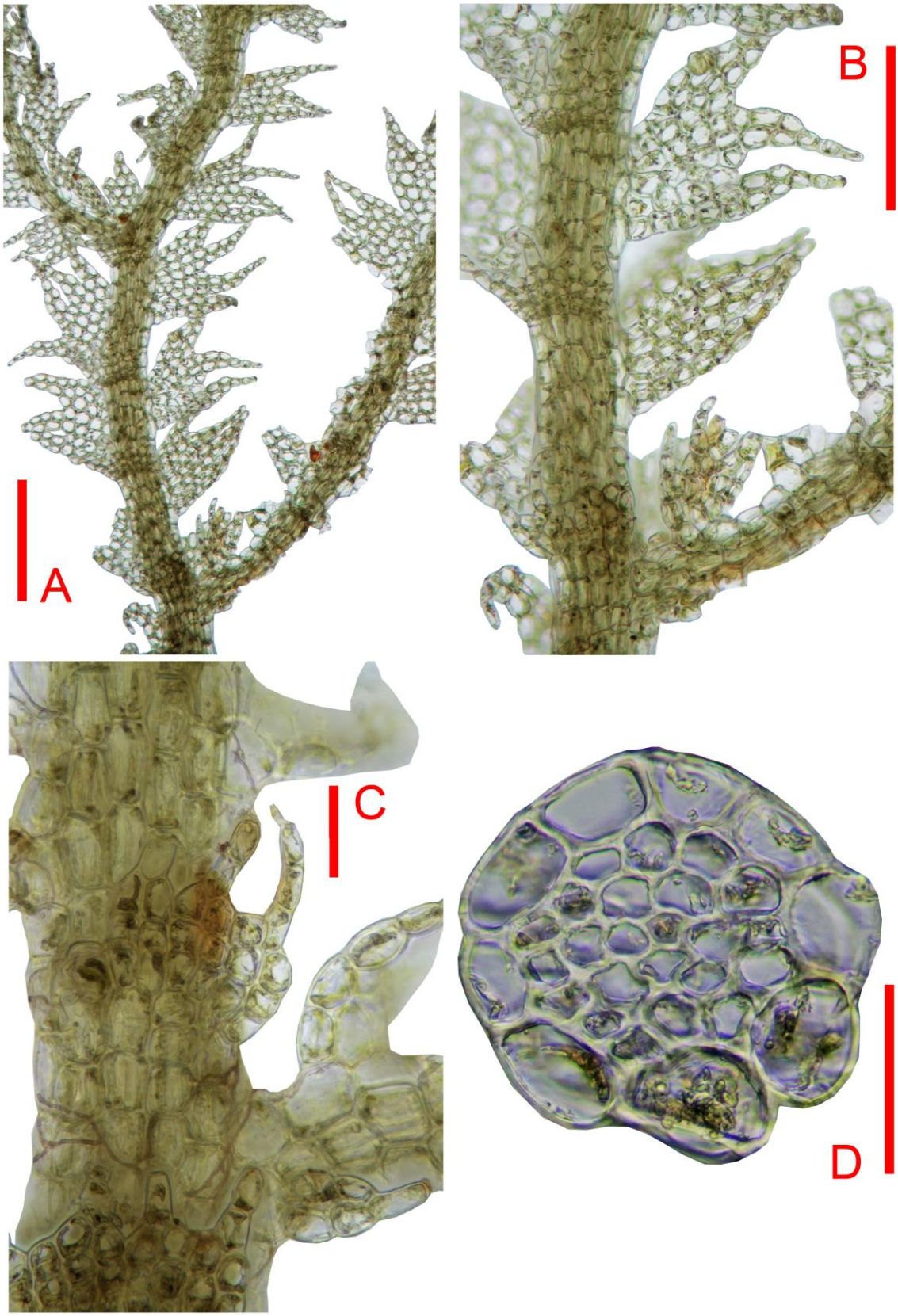

Plate 314: *Neolepidozia streimannii* : A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from STREIMANN 13547, JE – holotype)

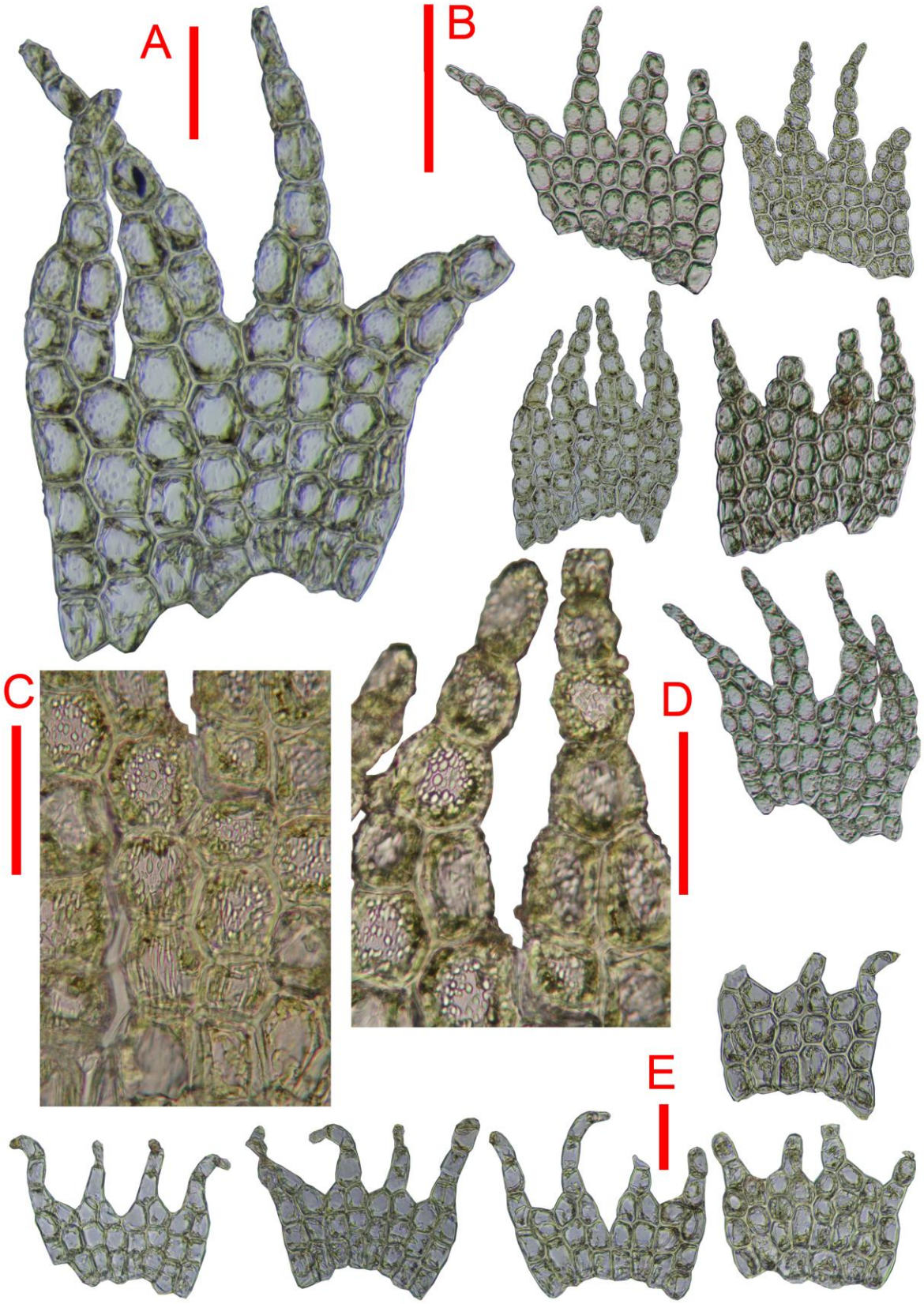

Plate 315: *Neolepidozia streimannii* : A, B – Stem leaves, C – Stem leaf disc, D – Stem leaf lobes, E – Stem underleaves; Scales: B – 0.2 mm; A, C, D, E – 50 µm (from STREIMANN 13547, JE – holotype)

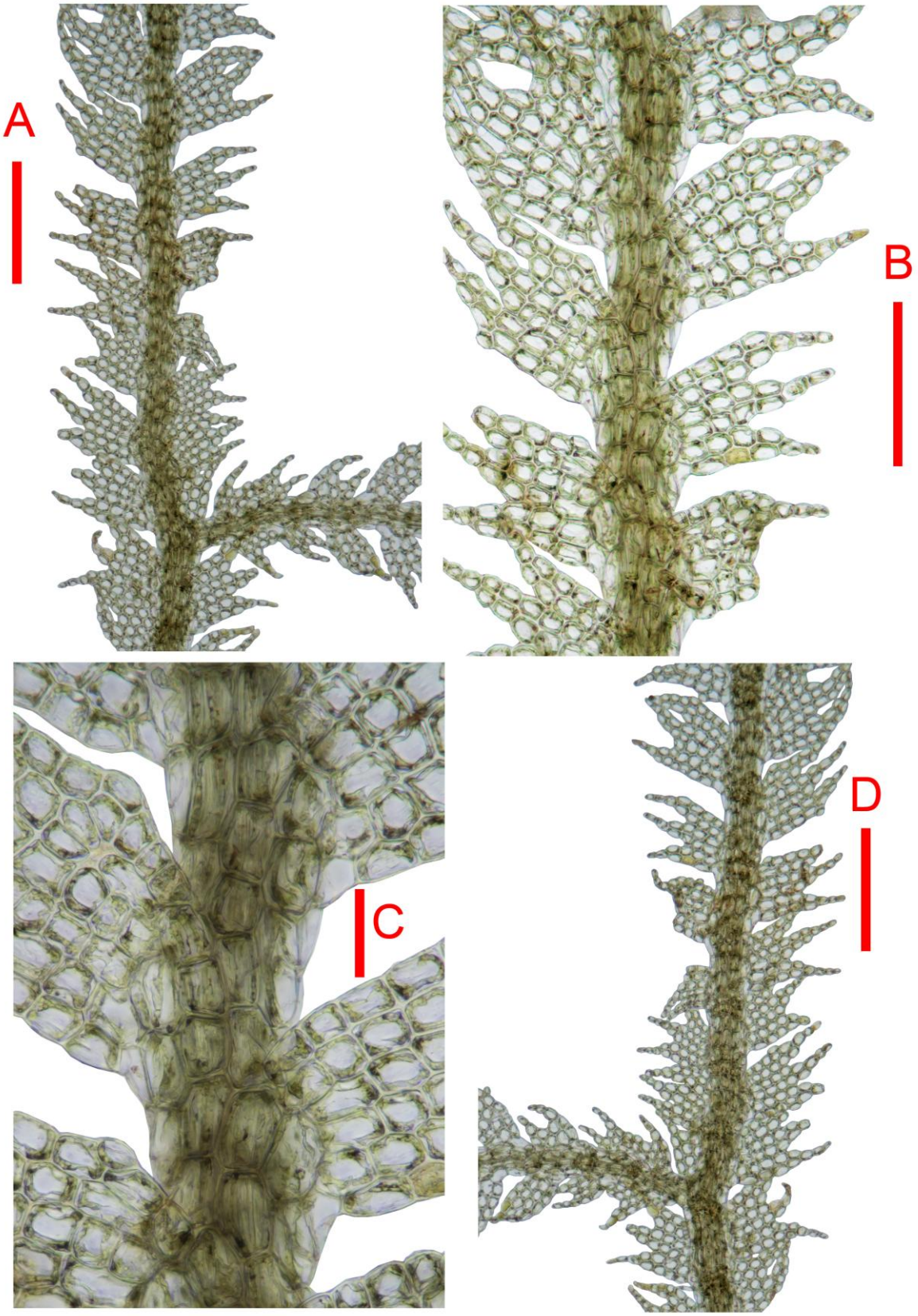

Plate 316: *Neolepidozia streimannii* : A, B, C – Branch dorsal, D – Branch ventral; Scales: A, D – 0.3 mm; B – 0.2 mm; C – 50 µm (from STREIMANN 13547, JE – holotype)

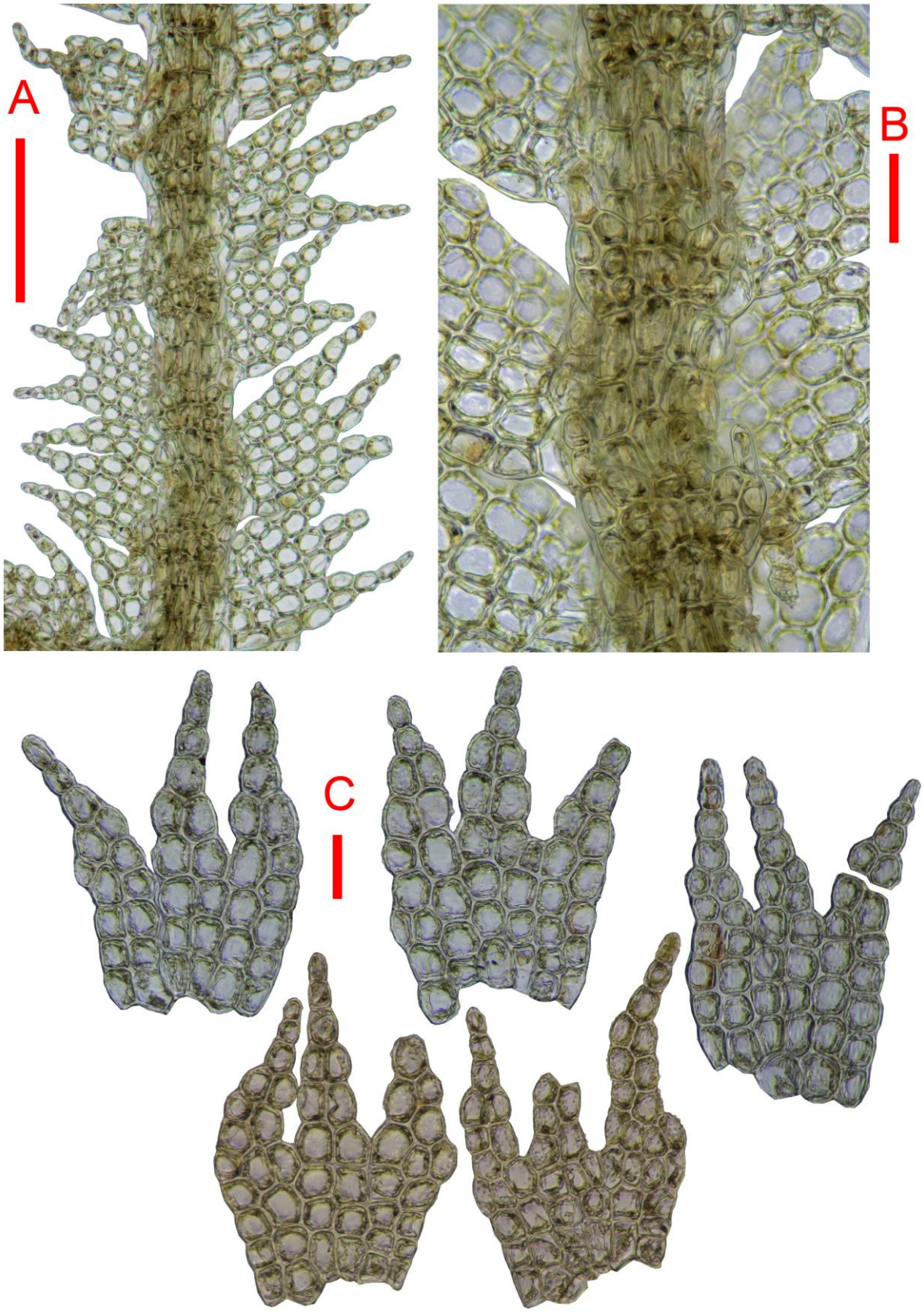

Plate 317: *Neolepidozia streimannii* : A, B – Branch ventral, C – Branch leaves; Scales: A – 0.2 mm; B, C – 50 µm (from STREIMANN 13547, JE – holotype)

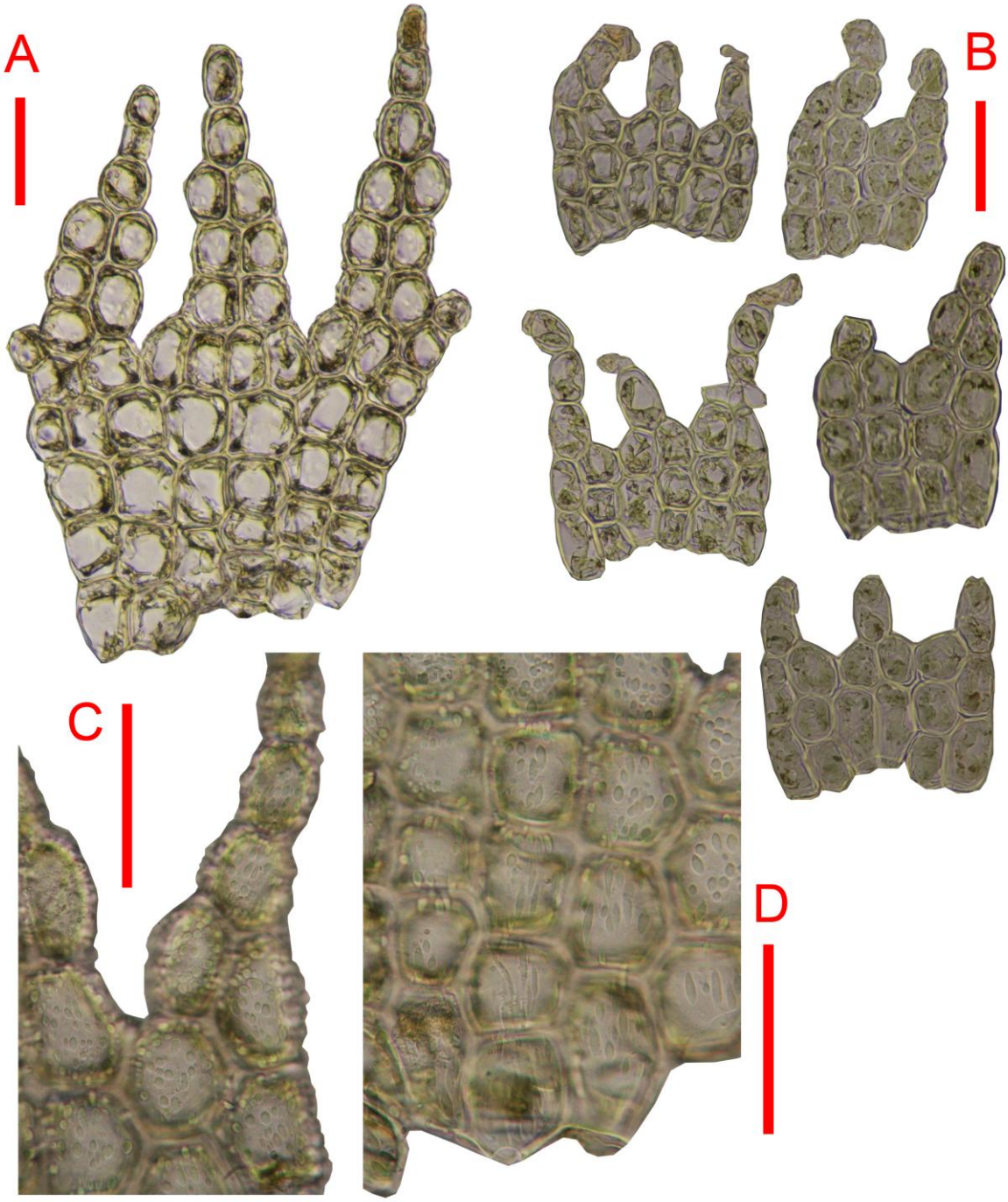

Plate 318: *Neolepidozia streimannii* : A – Branch leaf, B – Branch underleaves, C – Branch leaf lobe, D – Branch leaf disc; Scales: A, B, C, D – 50 µm (from STREIMANN 13547, JE – holotype)

Neolepidozia tangkulanensis **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

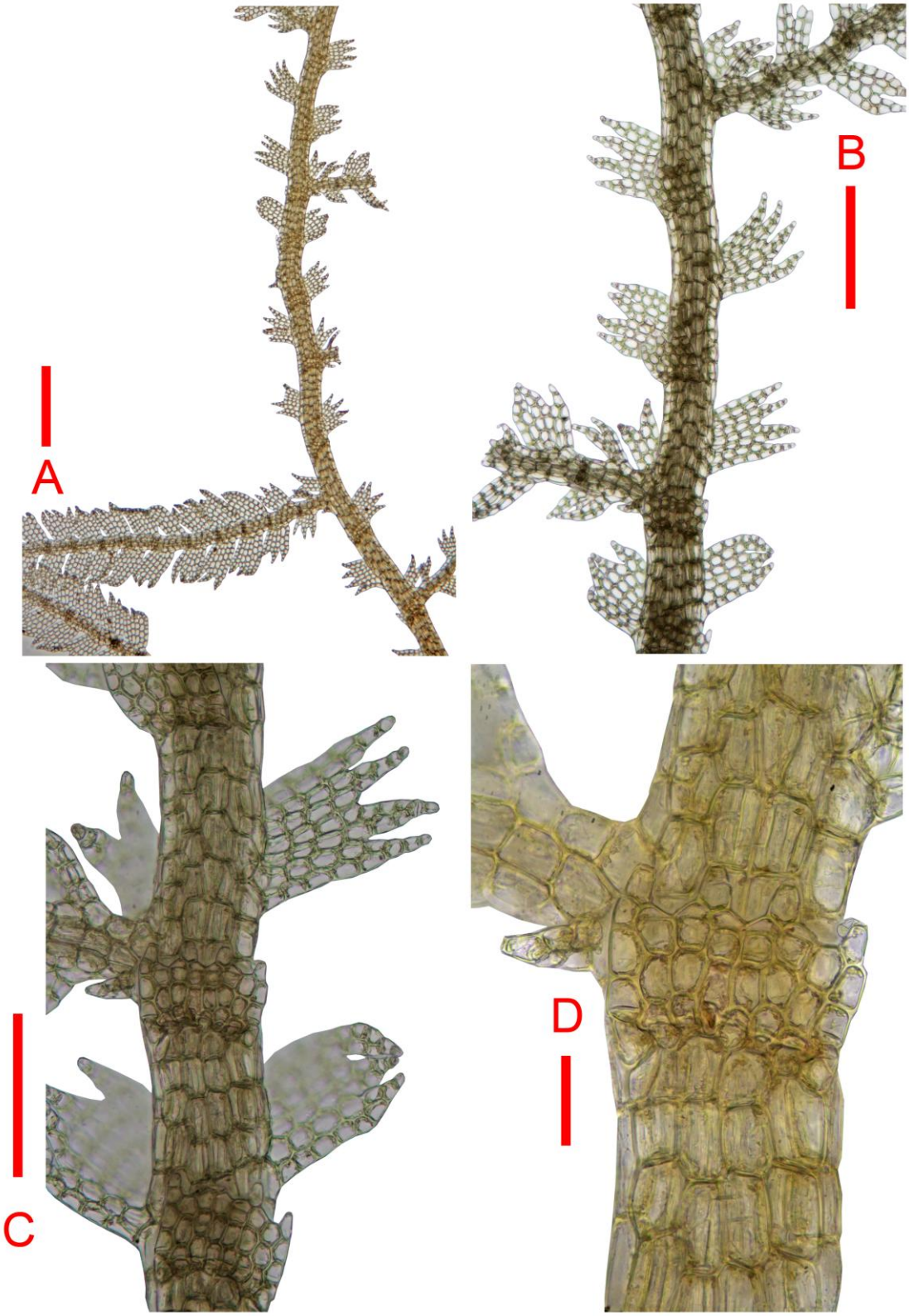

Plate 319: *Neolepidozia tangkulanensis*: A, B, C, D – Plant ventral; Scales: A – 1 mm; B – 0.5 mm; C – 0.2 mm; D – 50 µm (from YORONG 931c – holotype)

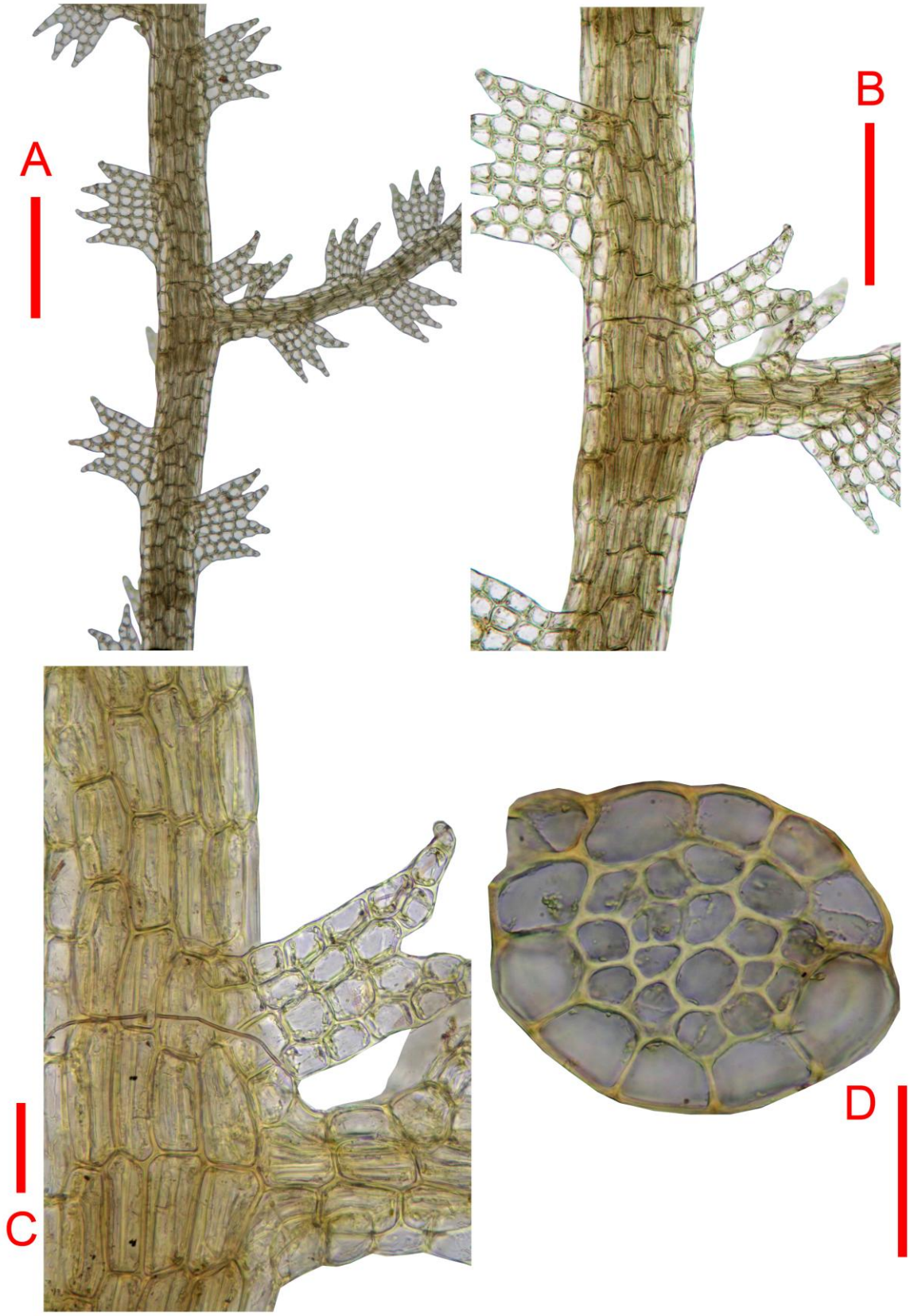

Plate 320: *Neolepidozia tangkulanensis*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm, B – 0.2 mm, C, D – 50 µm (from YORONG 931c – holotype)

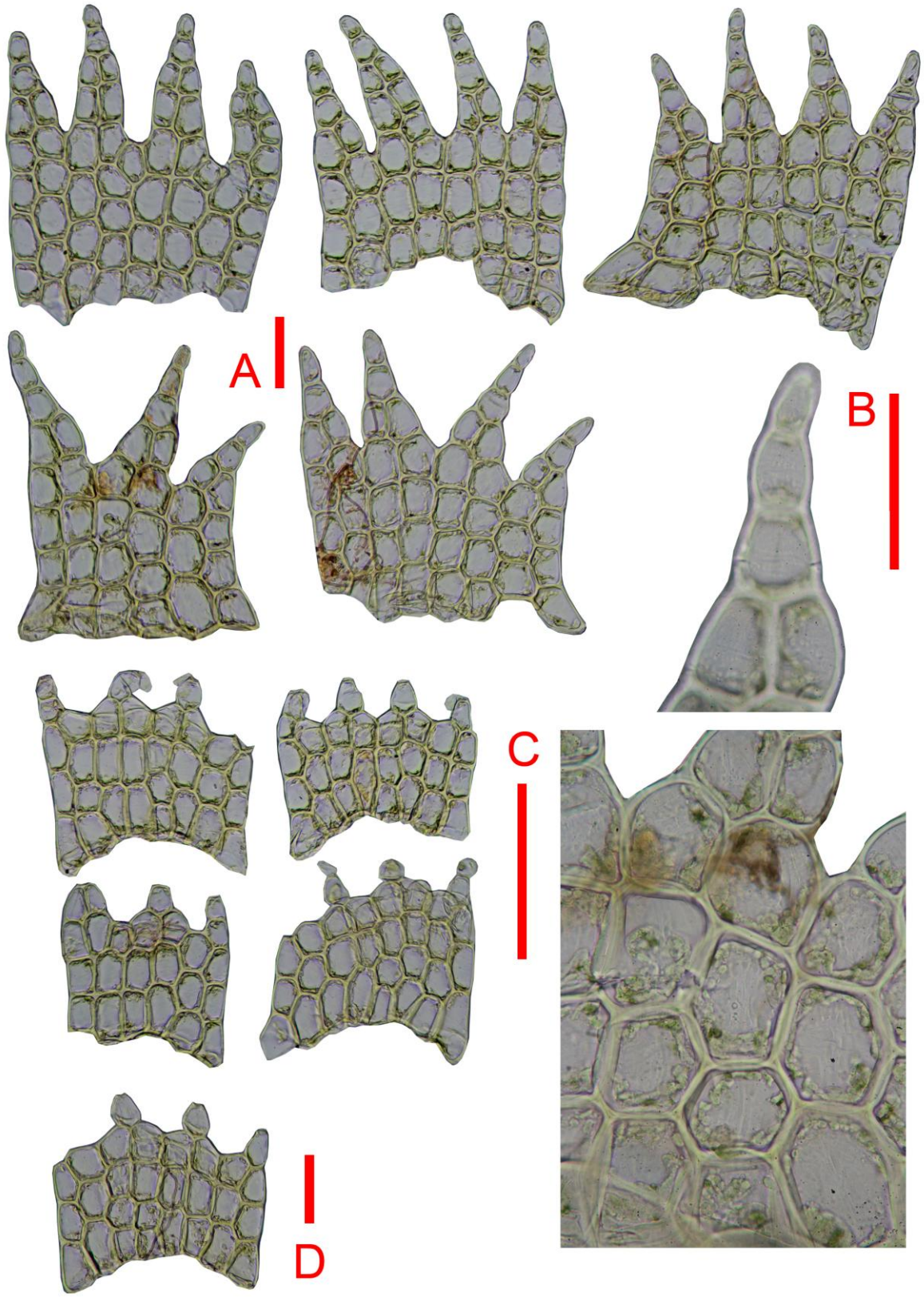

Plate 321: *Neolepidozia tangkulanensis*: A – Stem leaves, B – Stem leaf lobe, C – Stem leaf disc, D – Stem underleaves; Scales: A, B, C, D – 50 µm (from YORONG 931c – holotype)

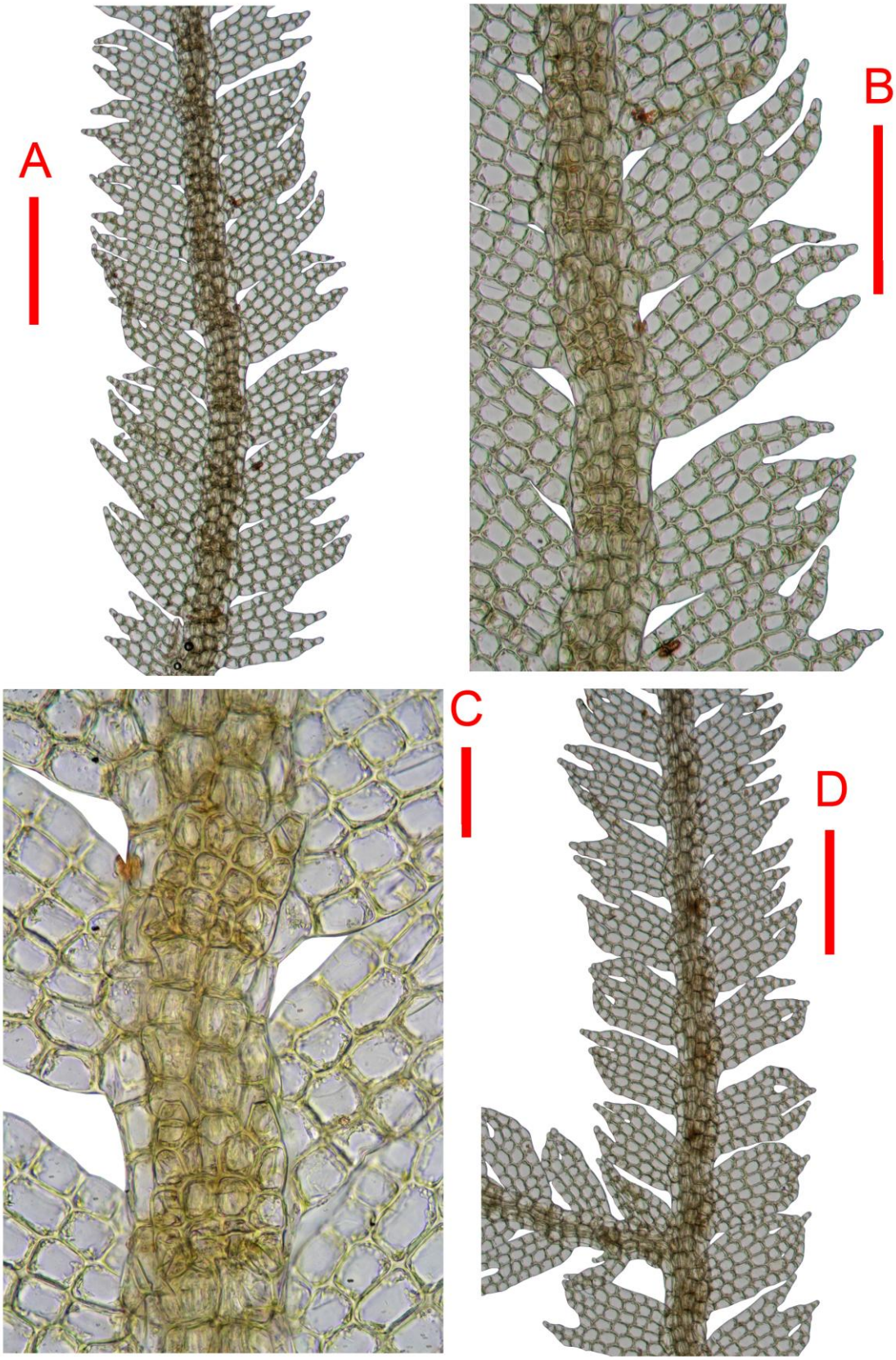

Plate 322: *Neolepidozia tangkulanensis*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm, B – 0.2 mm, C – 50 µm (from YORONG 931c – holotype)

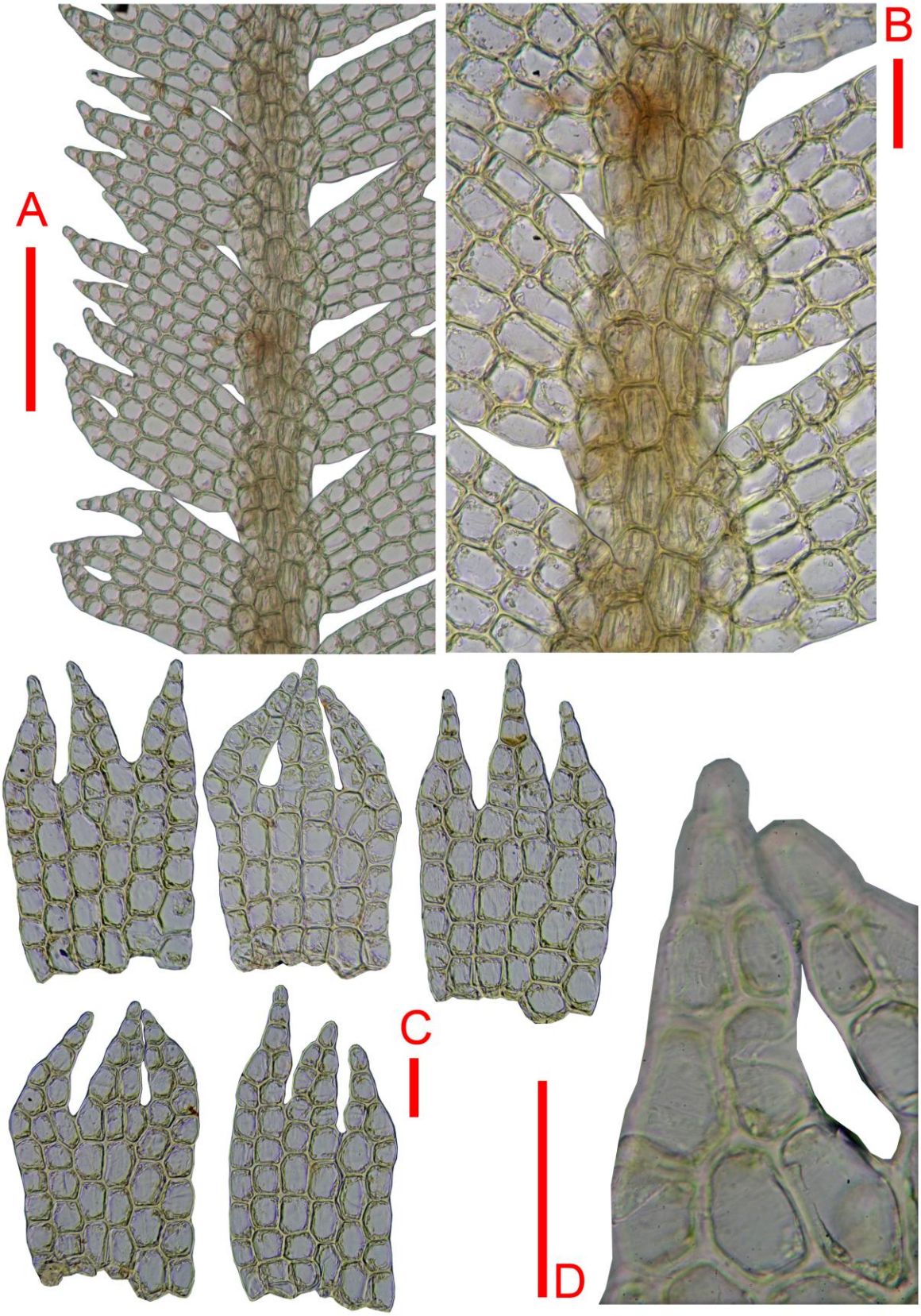

Plate 323: *Neolepidozia tangkulanensis*: A, B – Branch dorsal, C – Branch leaves, D – Branch leaf lobes; Scales: A – 0.2 mm, B, C, D – 50 µm (from YORONG 931c – holotype)

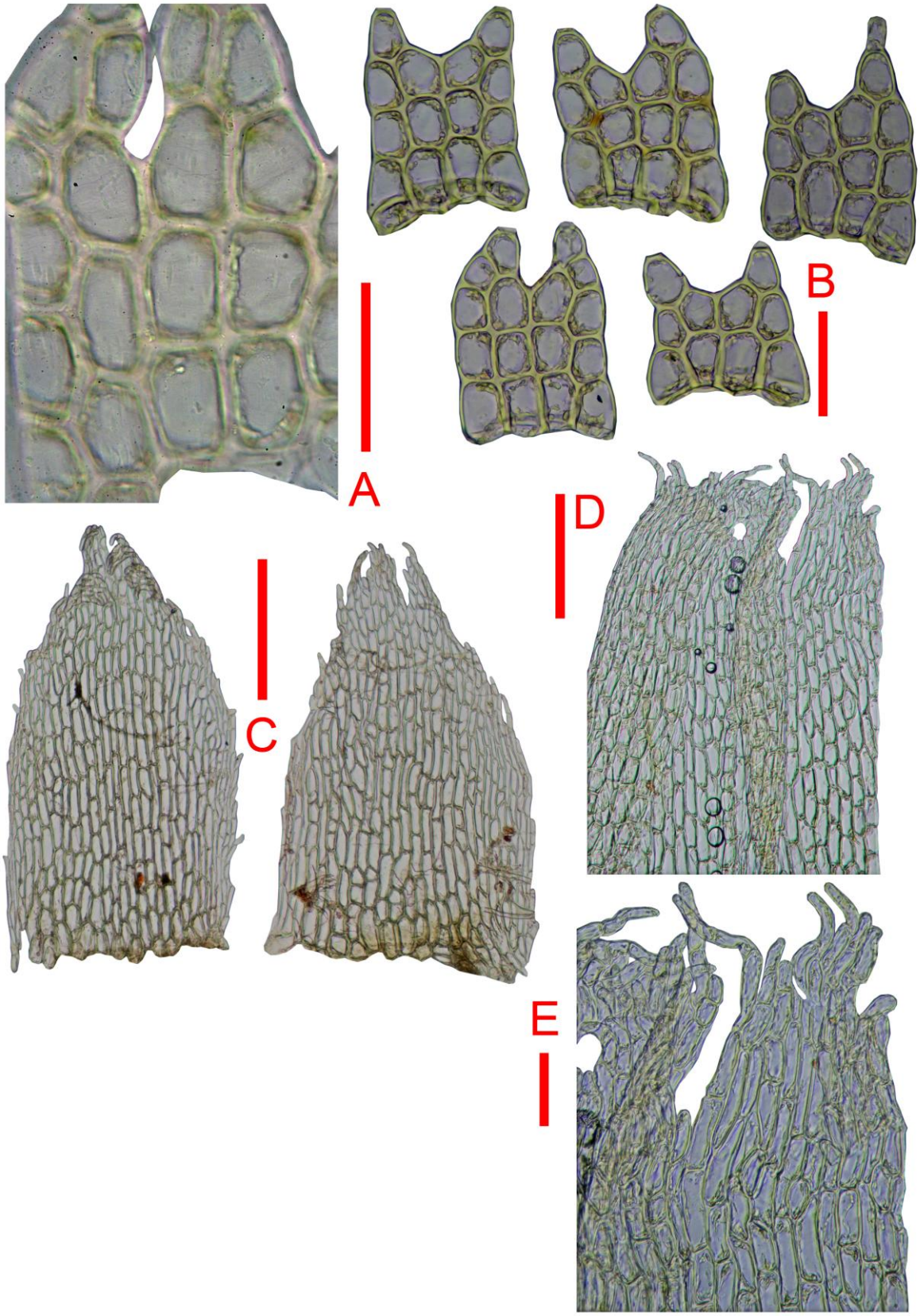

Plate 324: *Neolepidozia tangkulanensis*: A – Branch leaf disc, B – Branch underleaves, C – Female bracts, D, E – Perianth mouth; Scales: C – 0.3 mm, D – 0.2 mm, A, B, E – 50 µm (from YORONG 931c – holotype)

Neolepidozia tenera (STEPH.) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

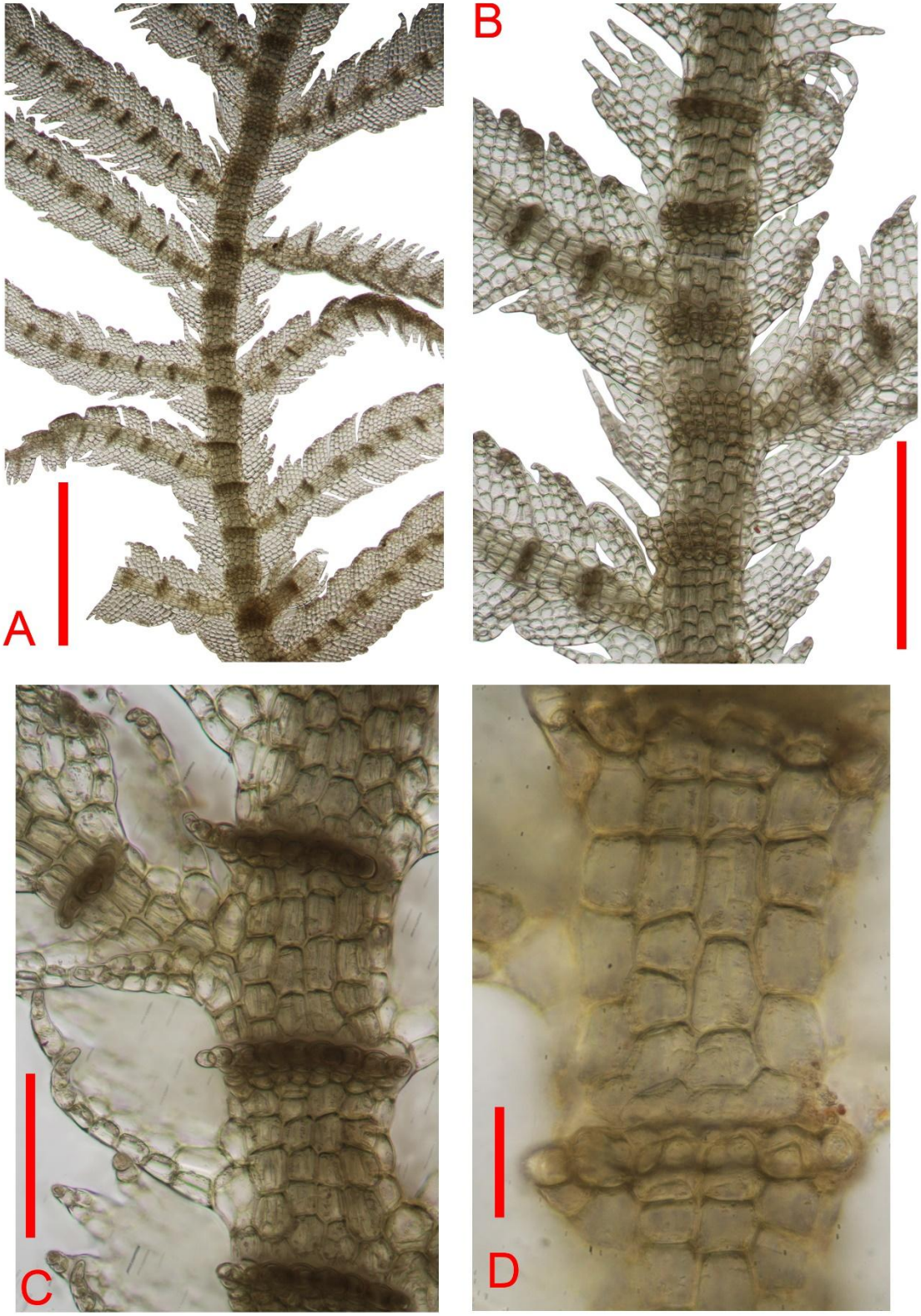

Plate 325: *Neolepidozia tenera*: A, B, C, D – Plant ventral; Scales: A – 1 mm; B – 0.5 mm; C – 0.2 mm; D – 50 µm (from SCHWARZ 4735)

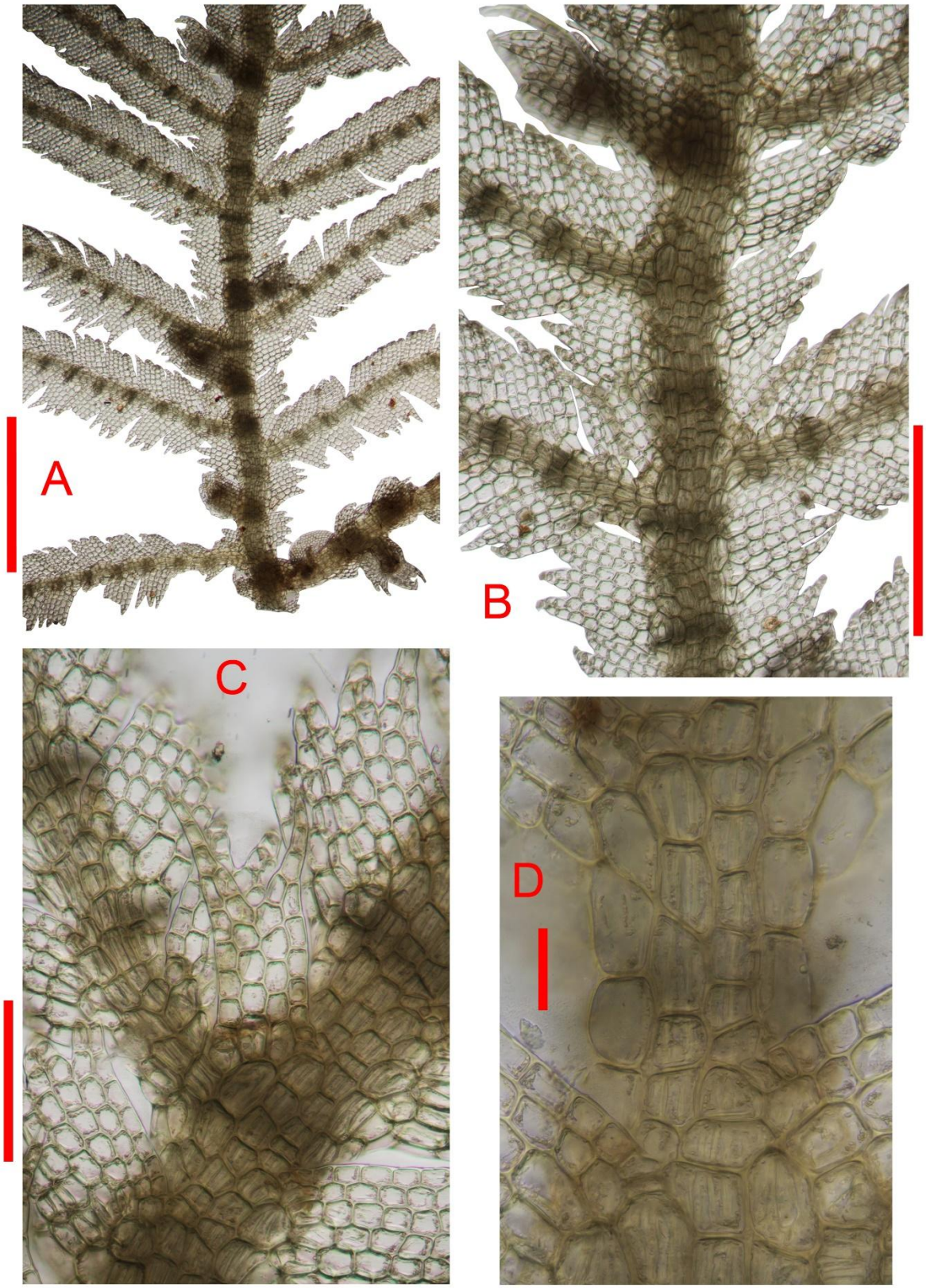

Plate 326: *Neolepidozia tenera*: A, B, C, D – Plant dorsal; Scales: A – 1 mm; B – 0.5 mm; C – 0.2 mm; D – 50 µm (from SCHWARZ 4735)

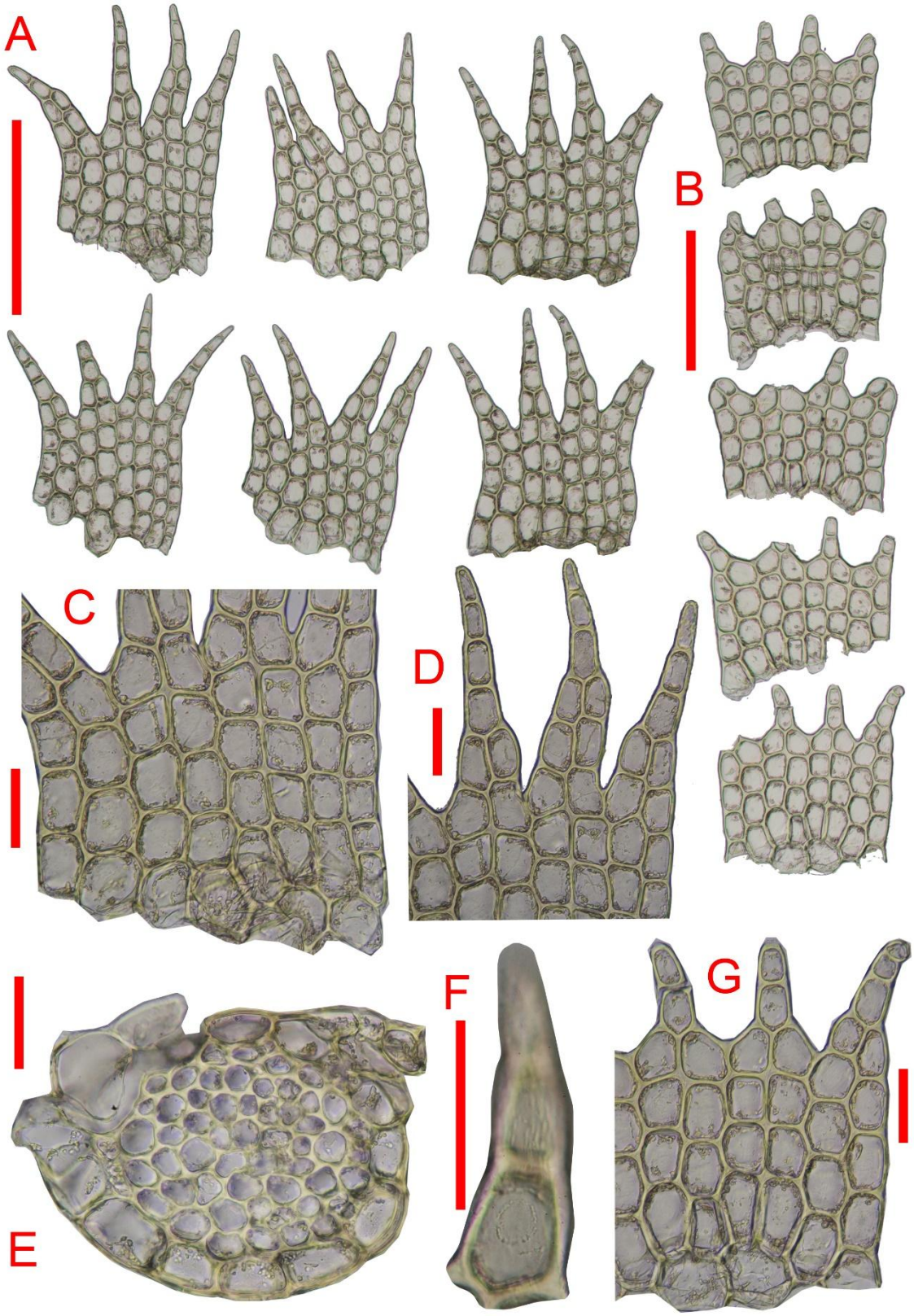

Plate 327: *Neolepidozia tenera*: A – Stem Leaves, B, G – Stem ampghigastria, C – Stem leaf disc; D, F – Stem leaf lobes; E – Stem cross section; Scales: A – 0,3 mm; B – 0.2 mm; C, D, E, F, G – 50 µm (from SCHWARZ 4735)

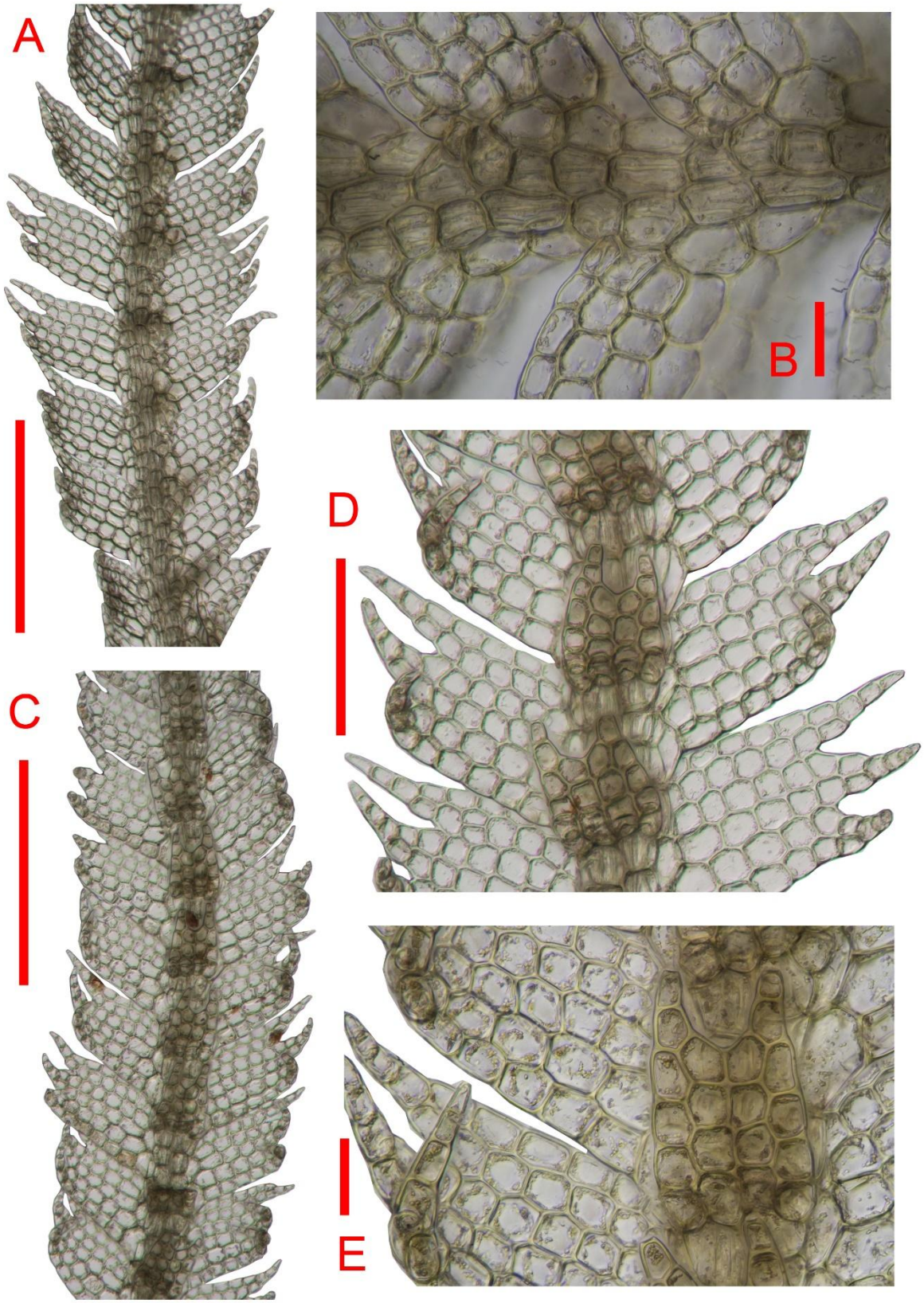

Plate 328: *Neolepidozia tenera*: A, B – Branch dorsal, C, D, E – Branch ventral; Scales: A, C – 0,5 mm; D – 0.2 mm; B, E – 50 µm (from SCHWARZ 4735)

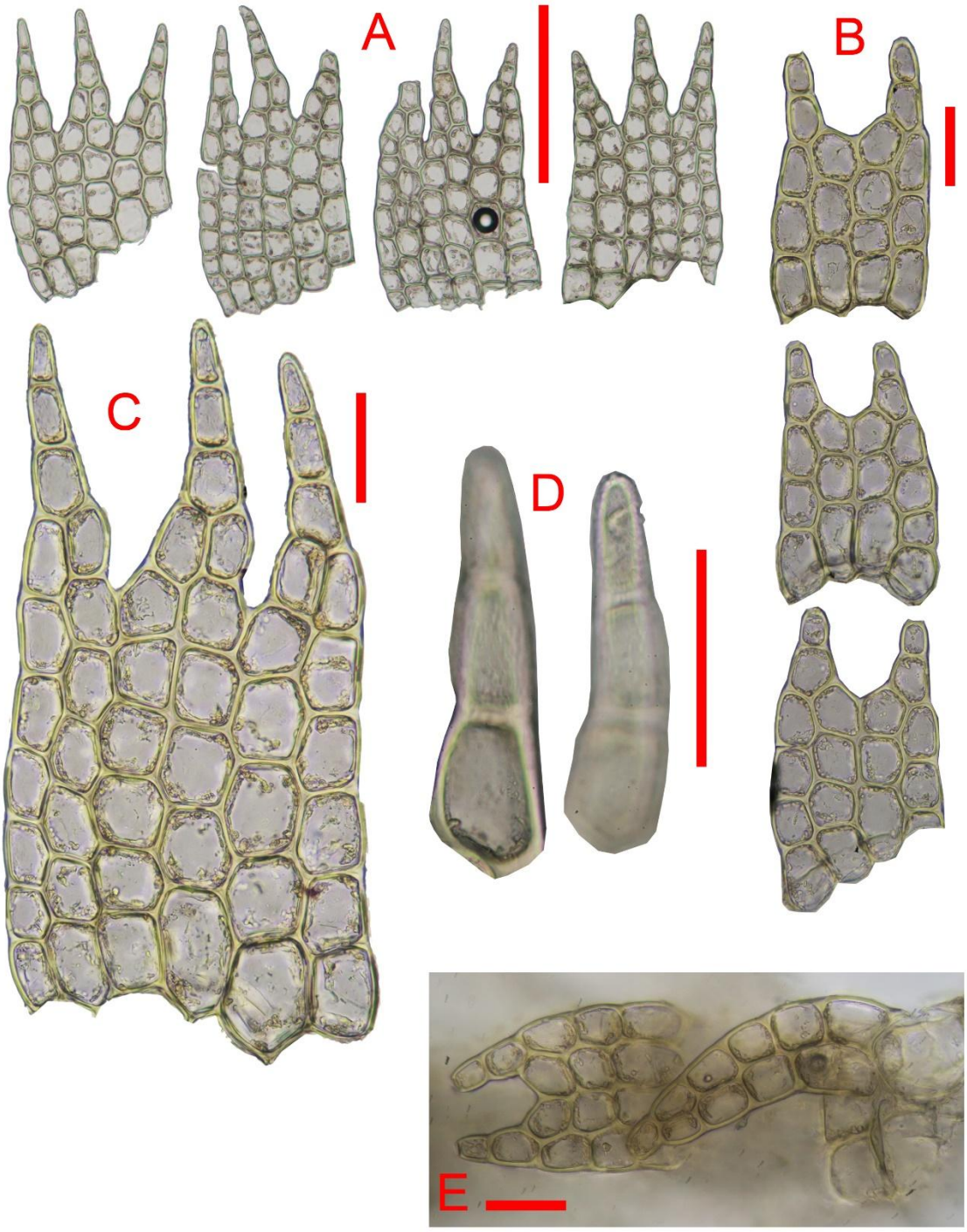

Plate 329: *Neolepidozia tenera*: A, C – Branch leaves, B – Branch underleaves, D – Branch leaf lobes, E – Branch with first amphigastrium; Scales: A – 0,2 mm; B, C, D, E –50 µm (from SCHWARZ 4735)

Neolepidozia variifolia (STEPH. IN GEHEEB) U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

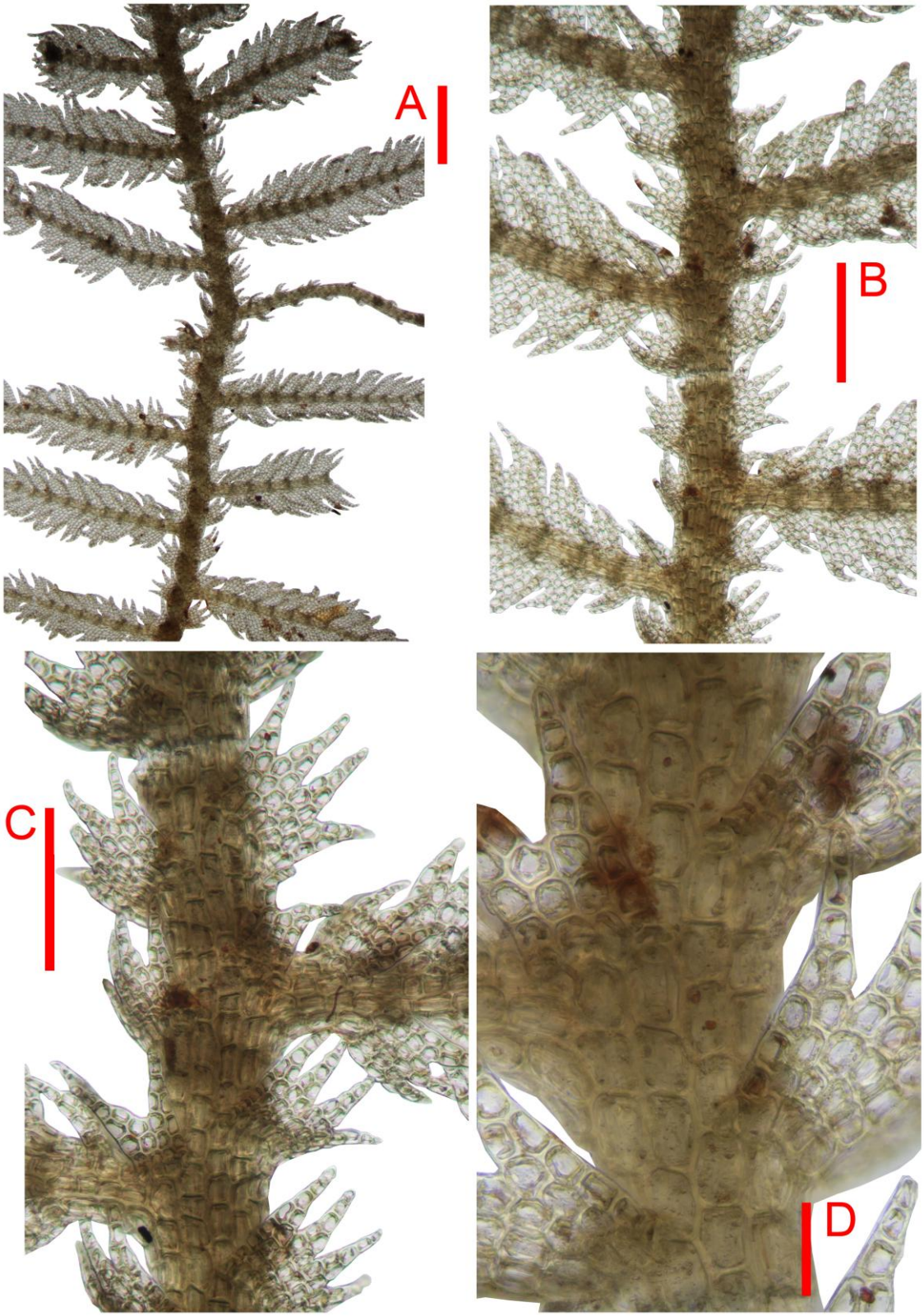

Plate 330: *Neolepidozia variifolia*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from TEYSMAN 11137, G00128053 – holotype)

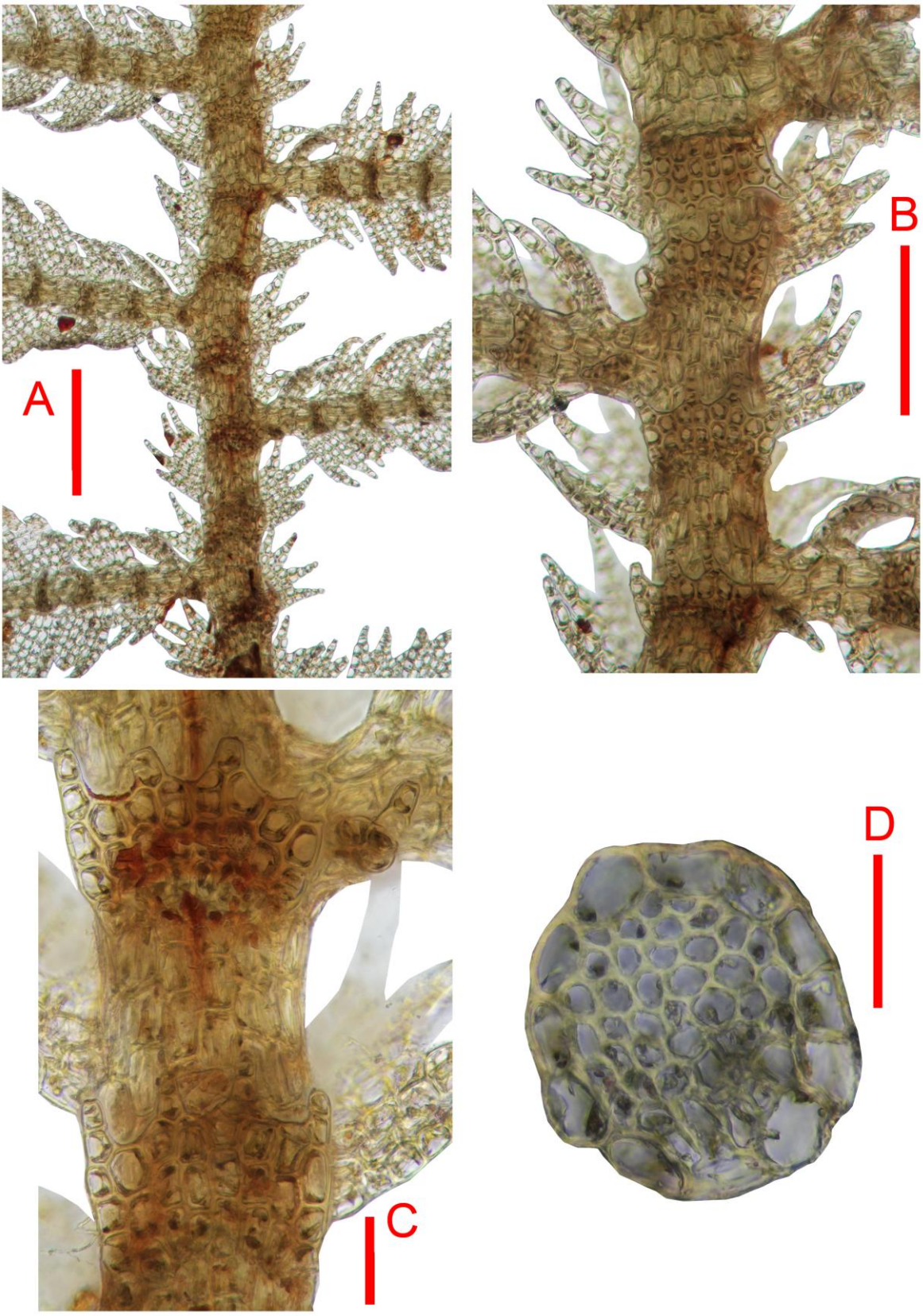

Plate 331: *Neolepidozia variifolia*: A, B, C – Plant ventral, D – Stem cross section; Scales: A – 0.3 mm; B – 0.3 mm; C, D – 50 µm (from TEYSMAN 11137, G00128053 – holotype)

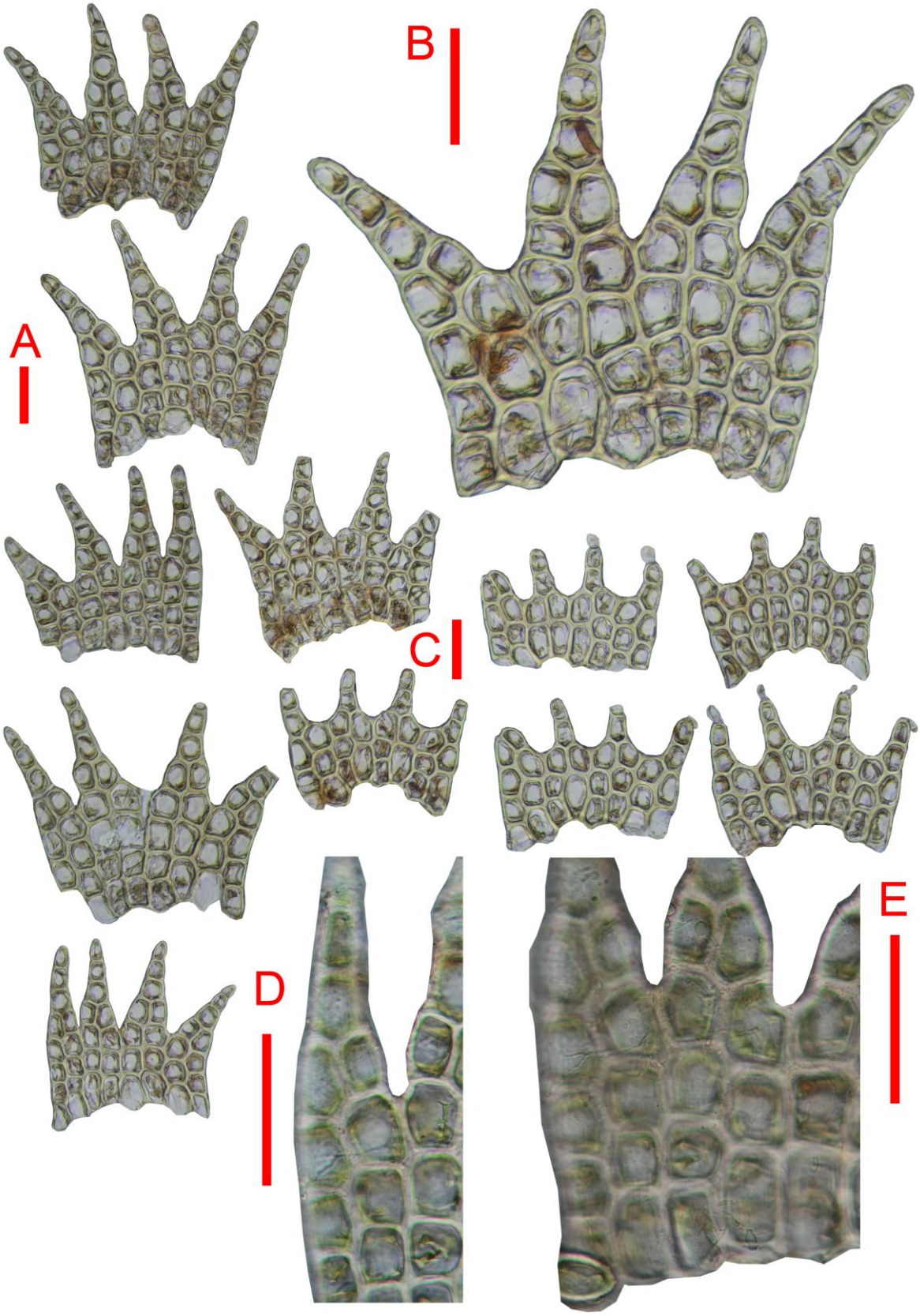

Plate 332: *Neolepidozia variifolia*: A, B – Stem leaves, C – Stem underleaves, D – Stem leaf lobe, E – Stem leaf disc; Scales: A, B, C, D, E – 50 µm (from TEYSMAN 11137, G00128053 – holotype)

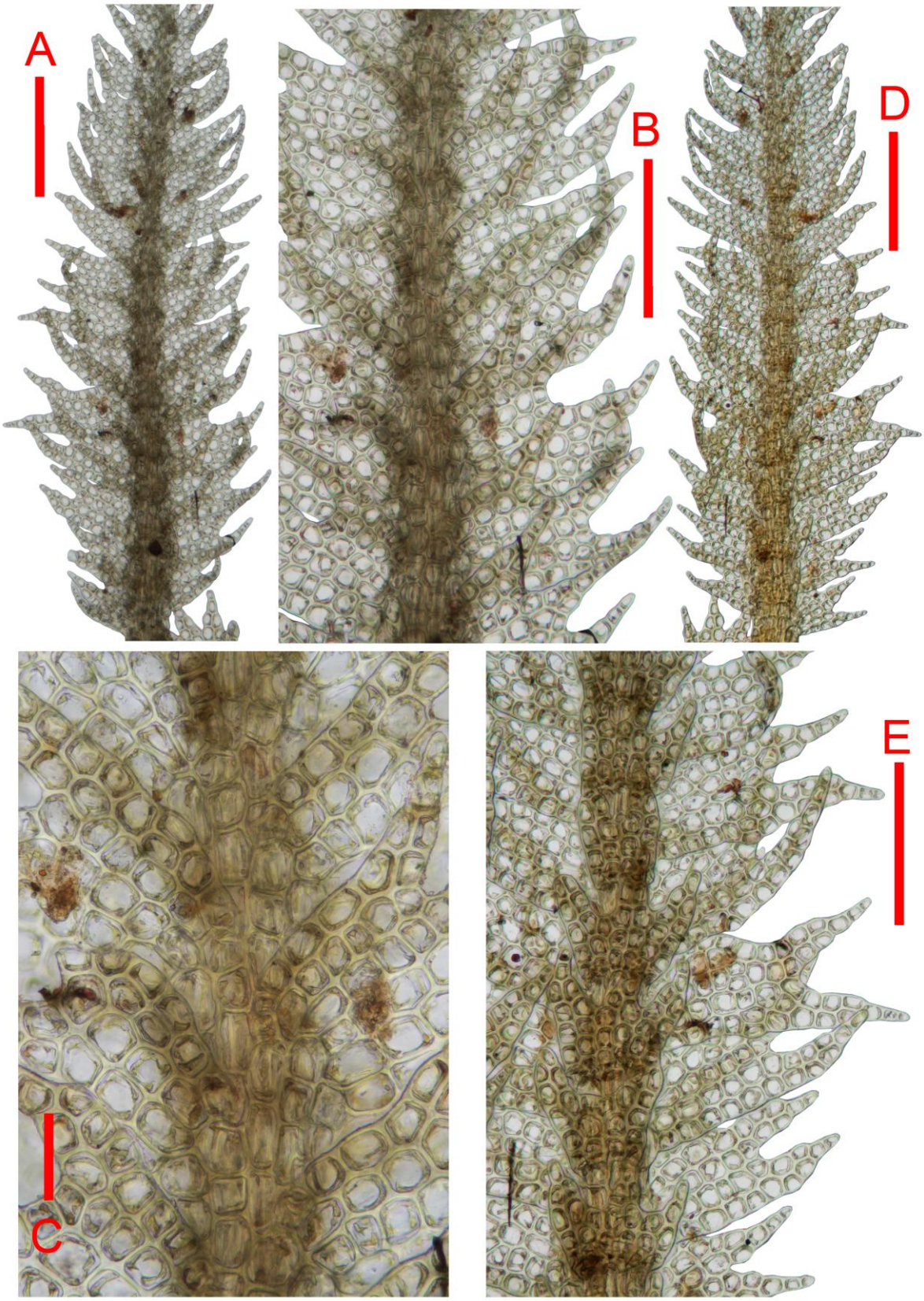

Plate 333: *Neolepidozia variifolia*: A, B, C – Branch dorsal, D, E – Branch ventral; Scales: A, D – 0.3 mm; B, E – 0.2 mm; C – 50 µm (from TEYSMAN 11137, G00128053 – holotype)

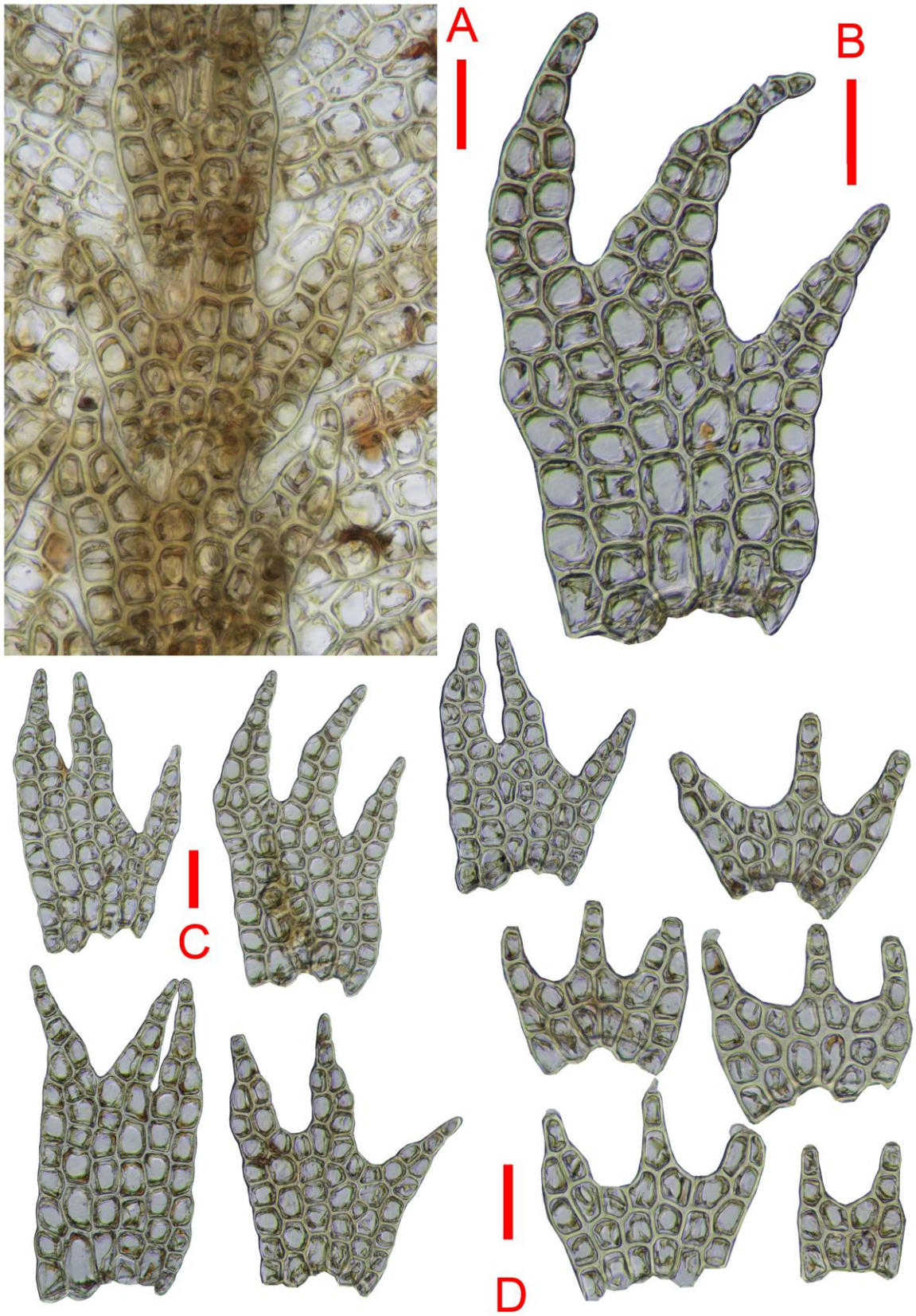

Plate 334: *Neolepidozia variifolia*: A, B, C – Branch dorsal, D, E – Branch ventral; Scales: A, D – 0.3 mm; B, E – 0.2 mm; C – 50 µm (from TEYSMAN 11137, G00128053 – holotype)

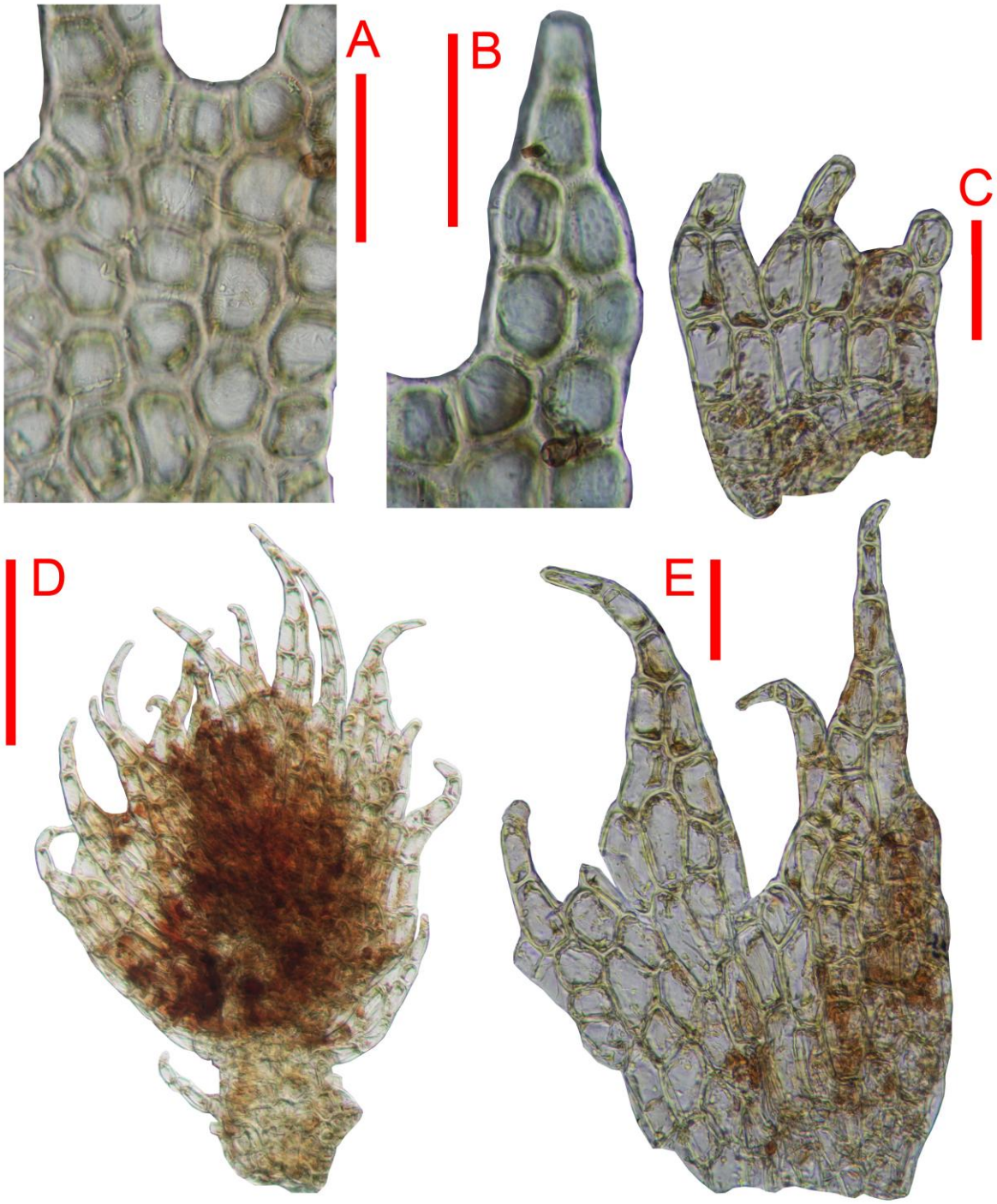

Plate 335: *Neolepidozia variifolia*: A – Branch leaf disc, B – Branch leaf lobe, C – Male branch underleaf, D – Male branch, E – Male bract; Scales: D – 0.2 mm; A, B, E, C – 50 µm (from TEYSMAN 11137, G00128053 – holotype)

***Neolepidozia variifolia* var. *kairuruensis* U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

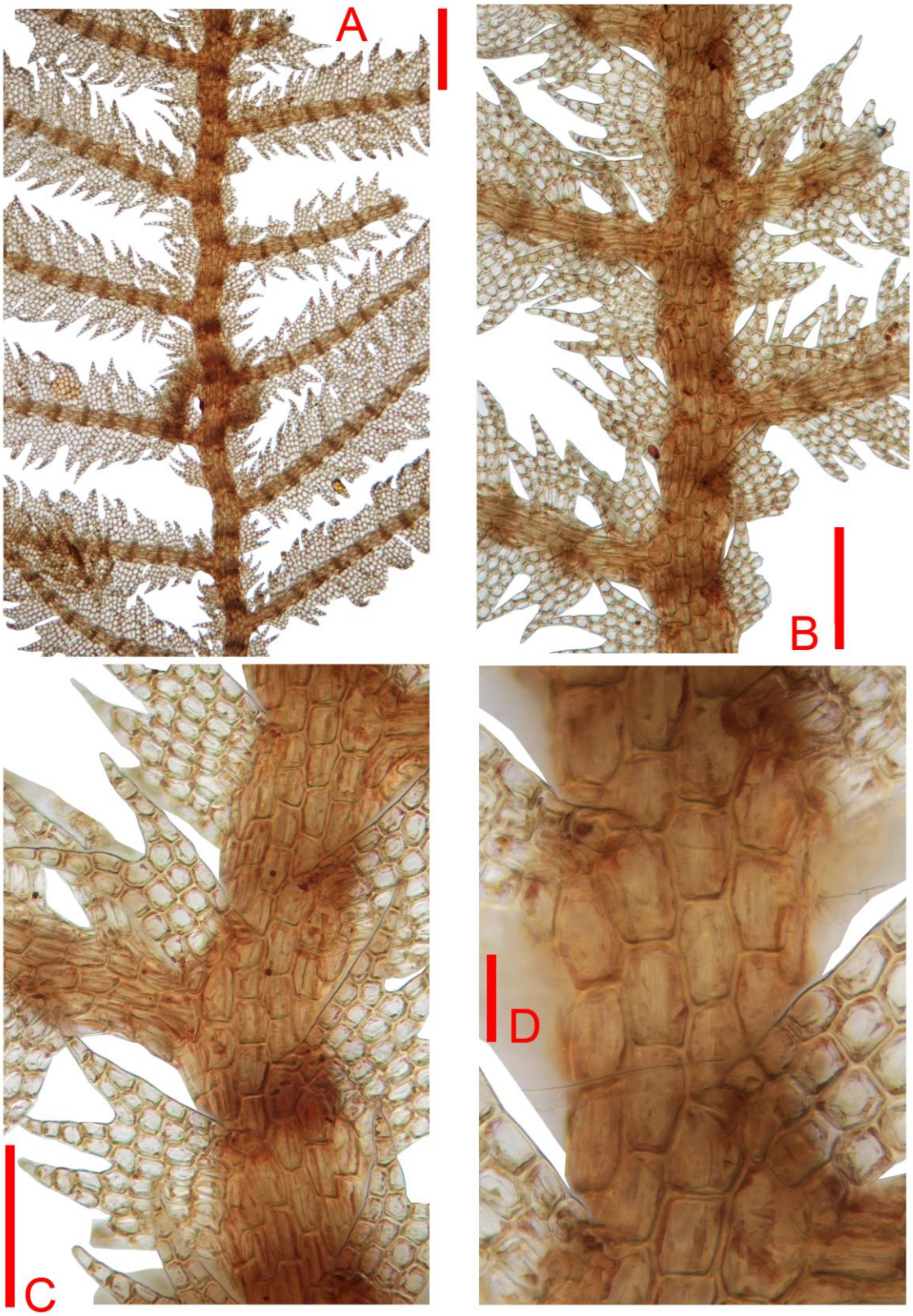

Plate 336: *Neolepidozia variifolia* var. *kairuruensis*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from BORRELL 30, JE – holotype)

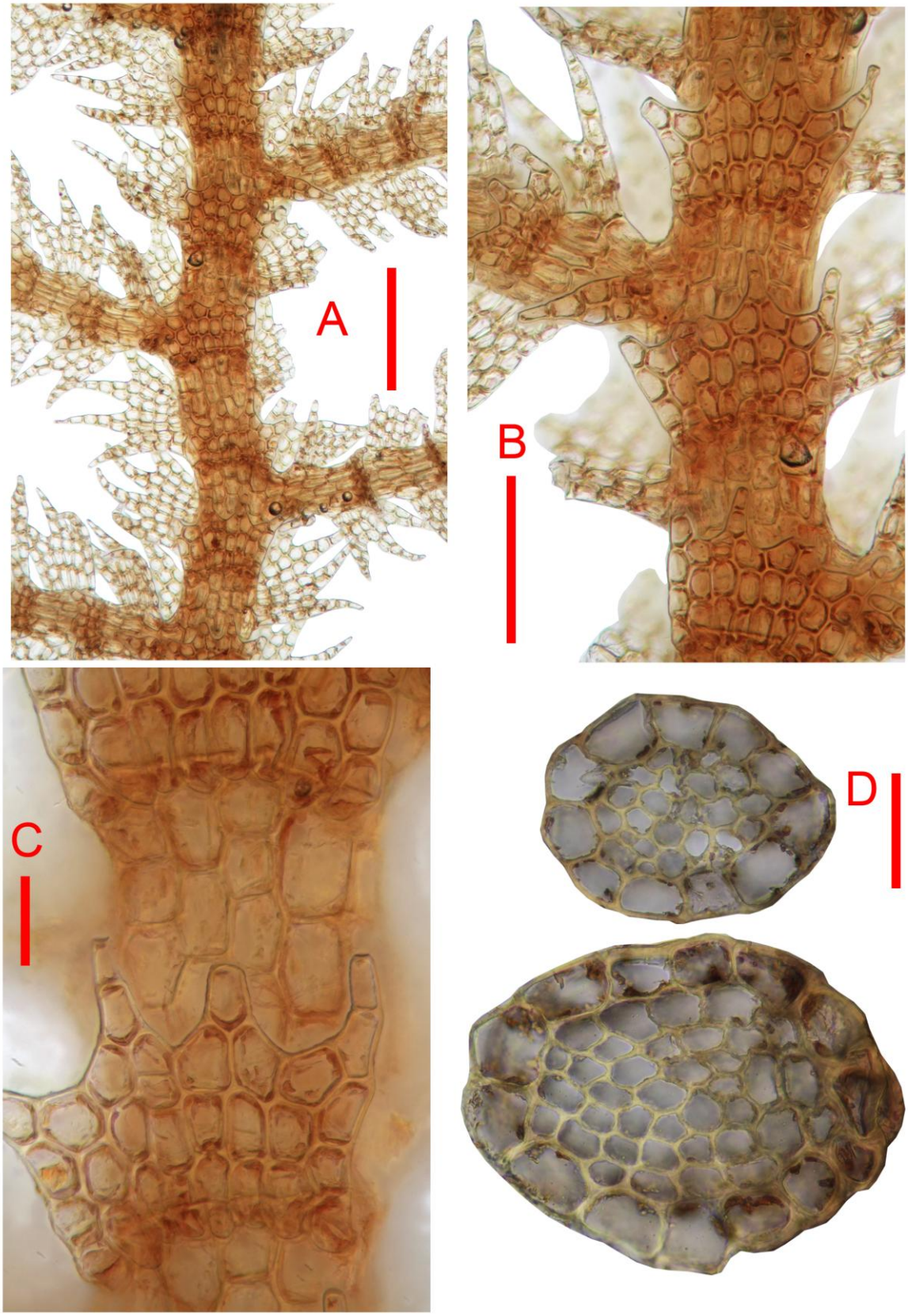

Plate 337: *Neolepidozia variifolia* var. *kairuruensis*: A, B, C – Plant ventral, D – Stem cross sections; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from BORRELL 30, JE – holotype)

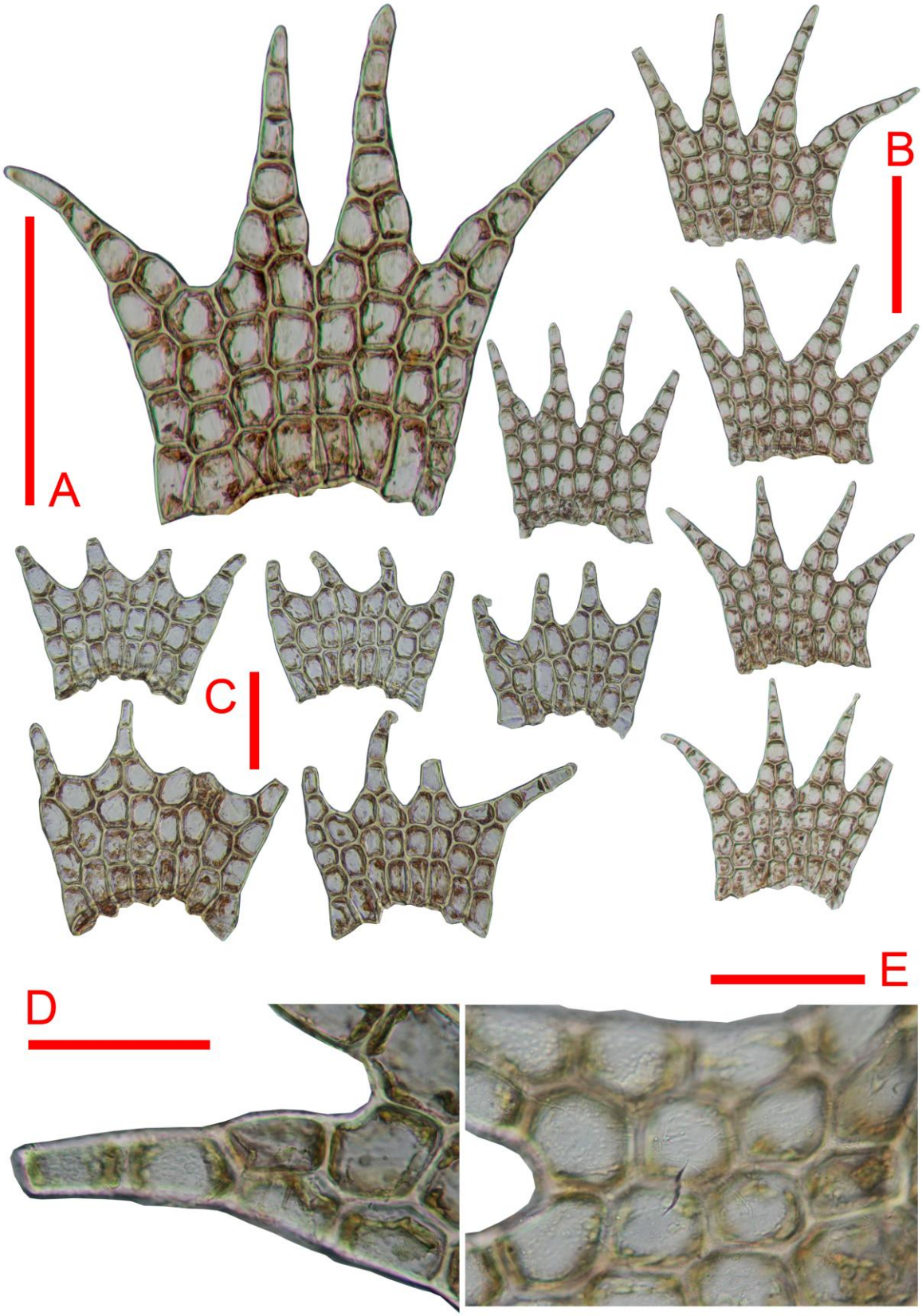

Plate 338: *Neolepidozia variifolia* var. *kairuruensis*: A, B – Stem leaves, C – Stem underleaves, D – Stem leaf lobe, E – Stem leaf disc; Scales: A, B – 0.2 mm; C – 0.1 mm; D, E – 50 µm (from BORRELL 30, JE – holotype)

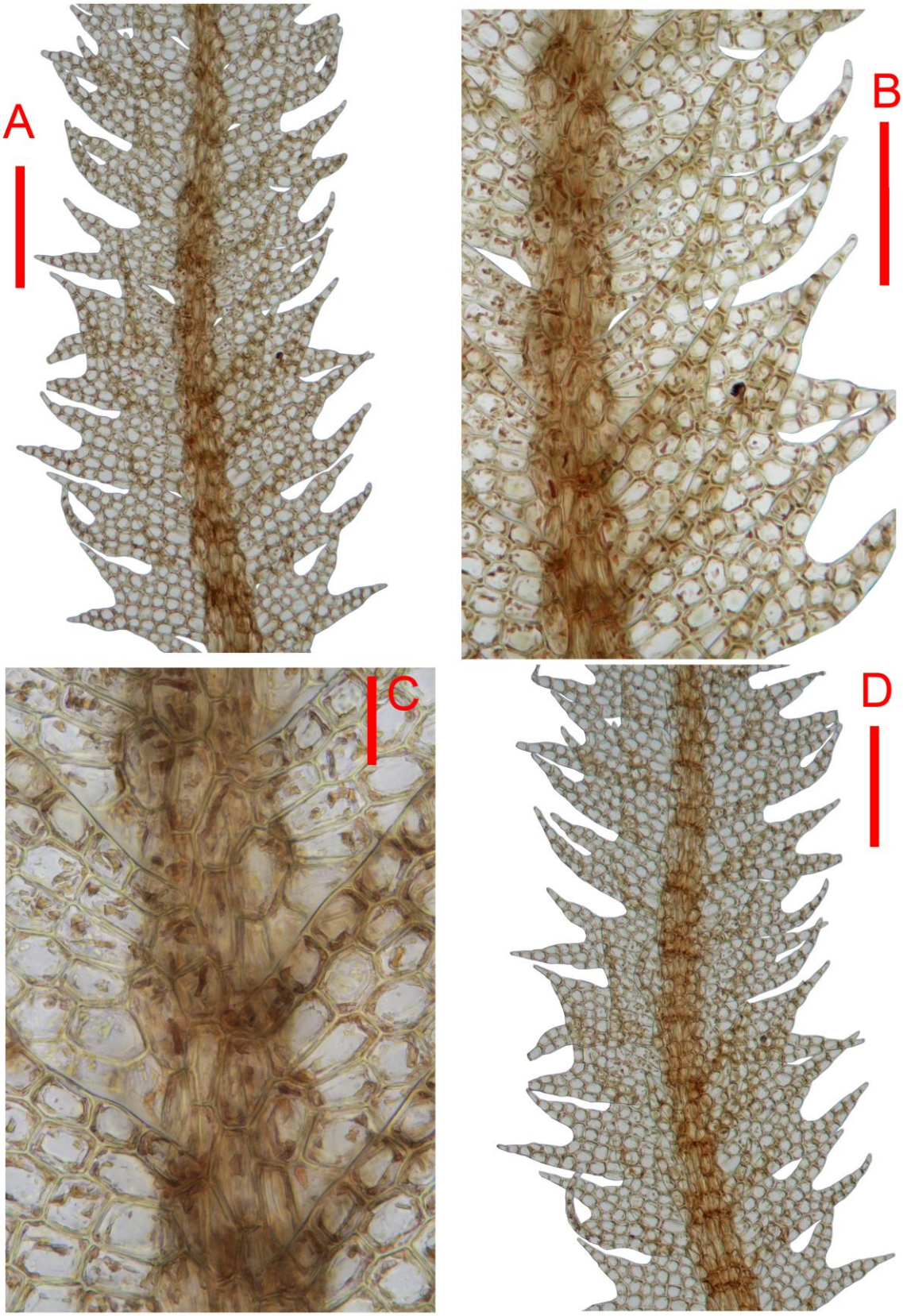

Plate 339: *Neolepidozia variifolia* var. *kairuruensis*: A, B, C – Branch dorsal, D – Branch ventral; Scales: A, D – 0.3 mm; C – 0.2 mm; D – 50 µm (from BORRELL 30, JE – holotype)

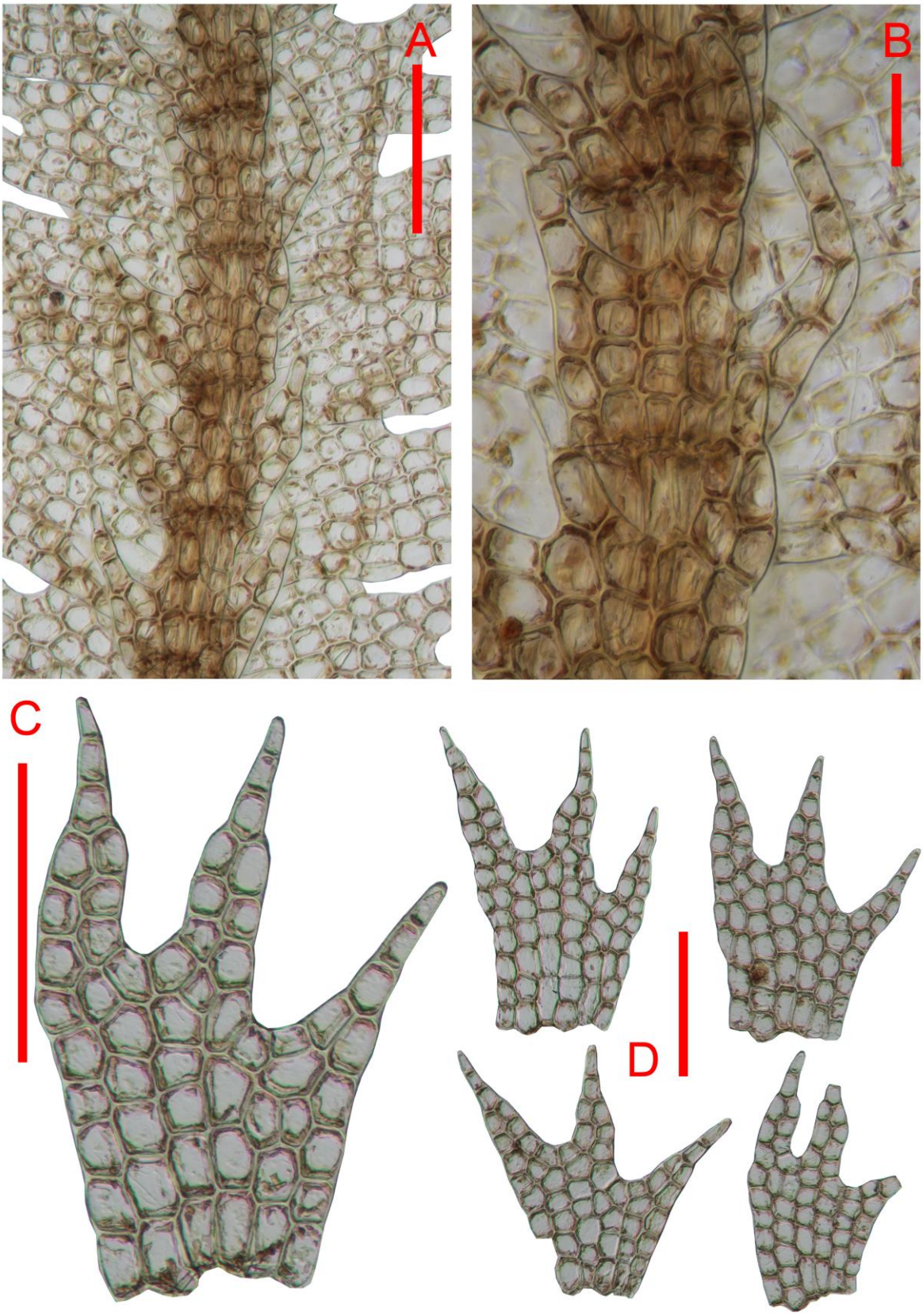

Plate 340: *Neolepidozia variifolia* var. *kairuruensis*: A, B – Branch ventral, C, D – Branch leaves; Scales: A, C, D – 0.2 mm; B – 50 µm (from BORRELL 30, JE – holotype)

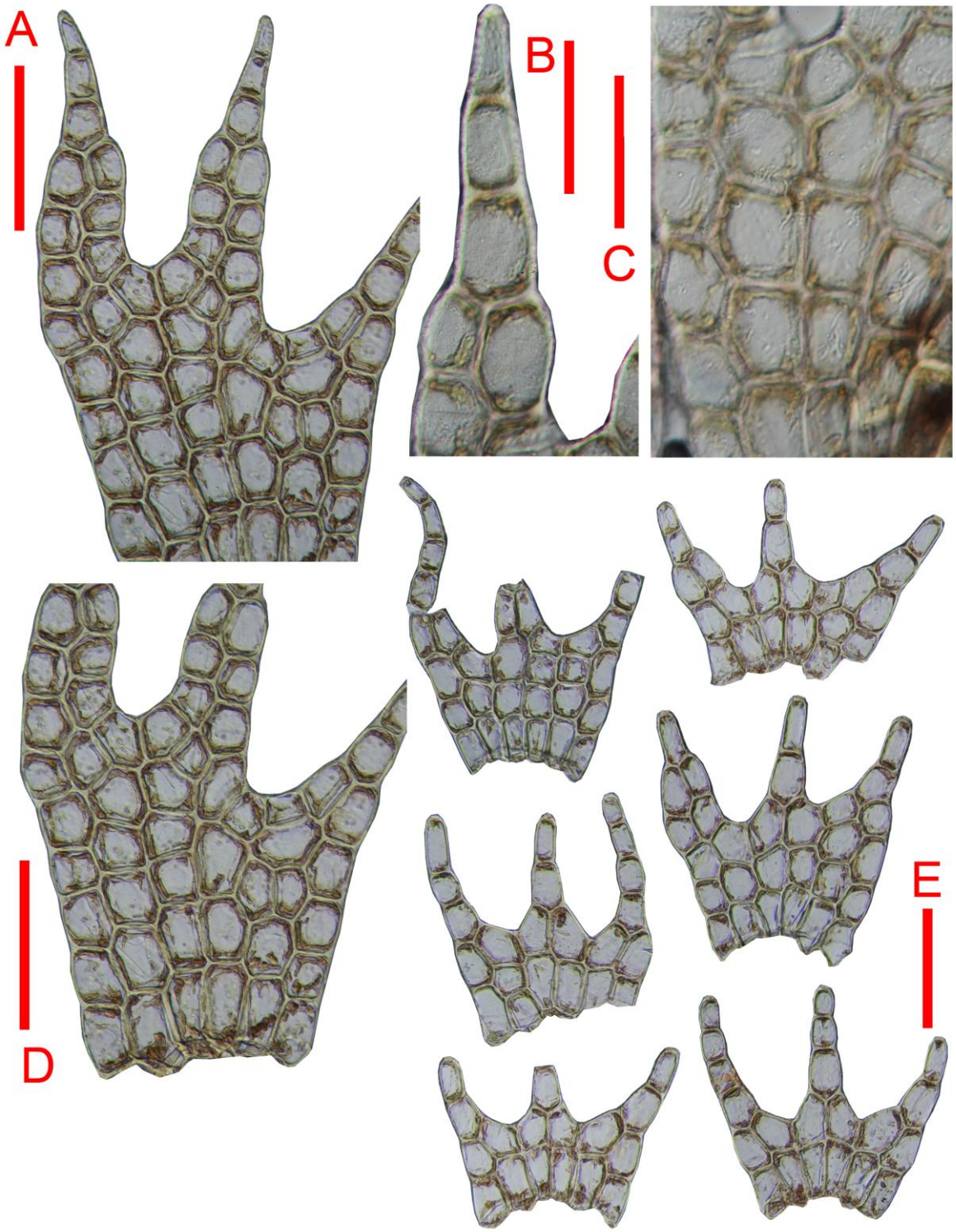

Plate 341: *Neolepidozia variifolia* var. *kairuruensis*: A, B – Branch leaf lobe, C, D – Branch leaf disc, E – Branch underleaves; Scales: A, D, E – 0.1 mm; B, C – 50 µm (from BORRELL 30, JE – holotype)

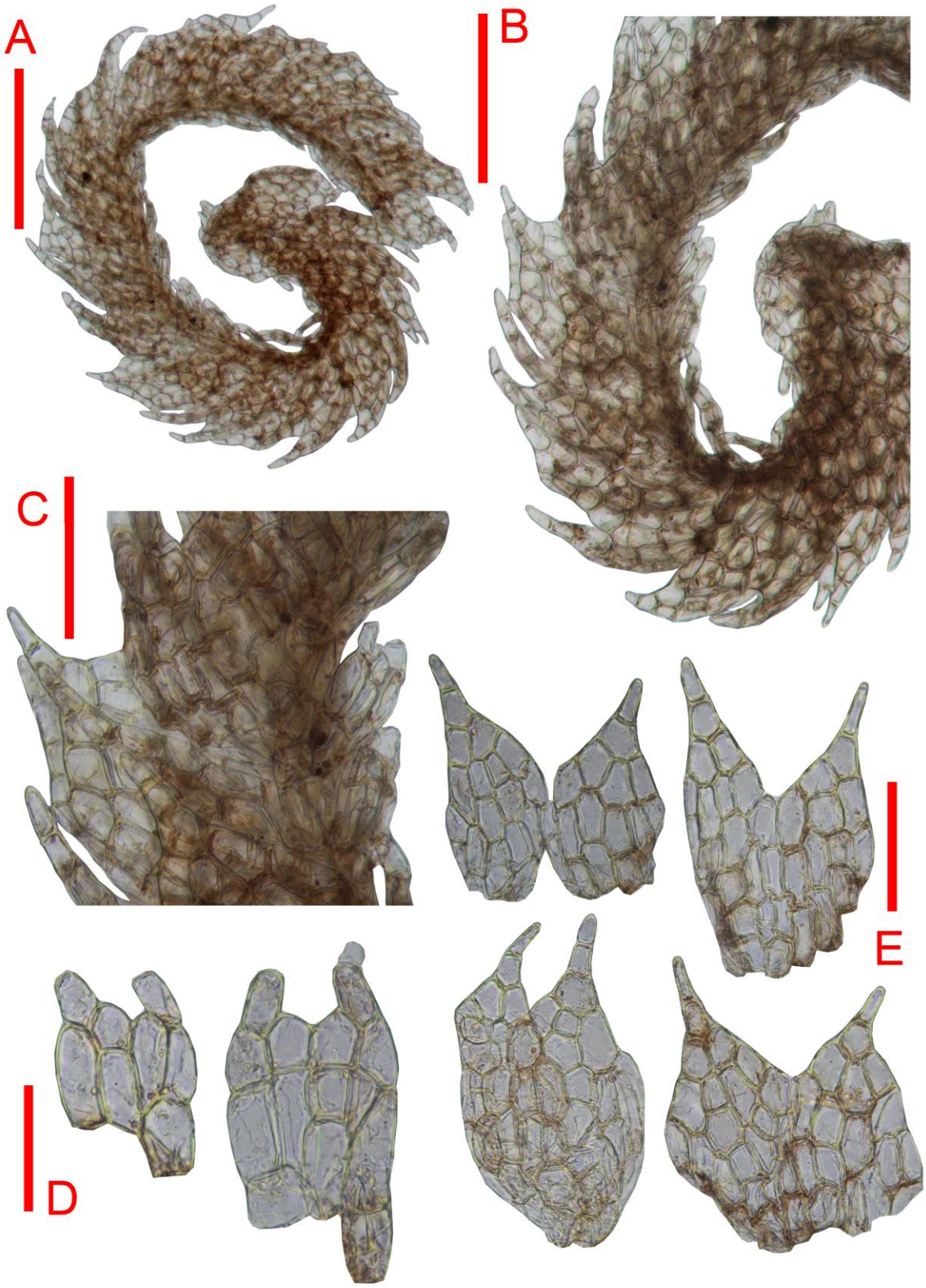

Plate 342: *Neolepidozia variifolia* var. *kairuruensis*: A, B, C – Male branch, D – Male branch underleaves, E – Male bracts; Scales: A – 0.3 mm, B – 0.2 mm, C, E – 0.1 mm, D – 50 µm (from BORRELL 30, JE – holotype)

Neolepidozia wallichiana **(GOTTSCHE, LINDENB. & NEES) FULFORD ET J. TAYLOR**

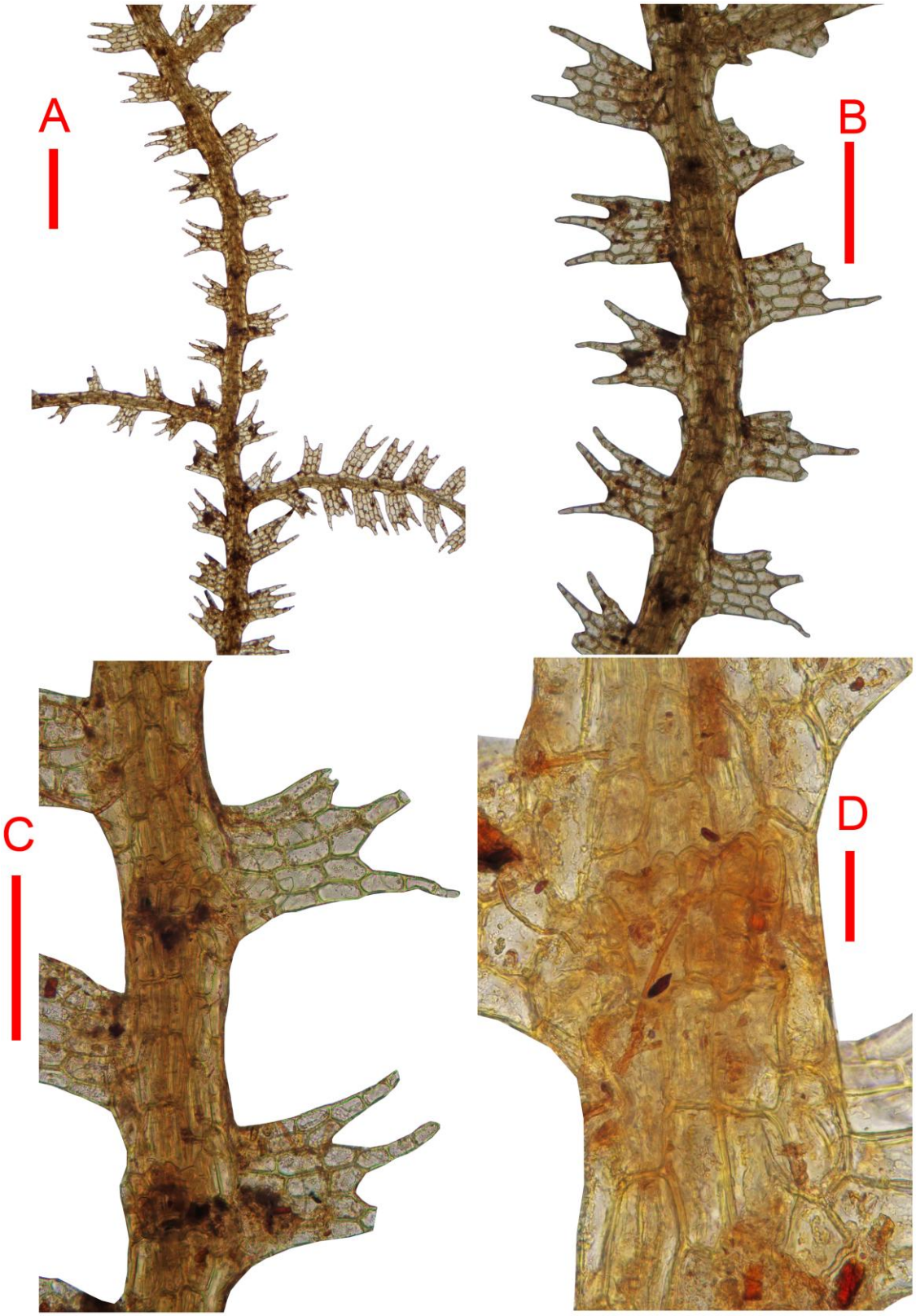

Plate 343: *Neolepidozia wallichiana*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from GLM-B-0006484 – isotype)

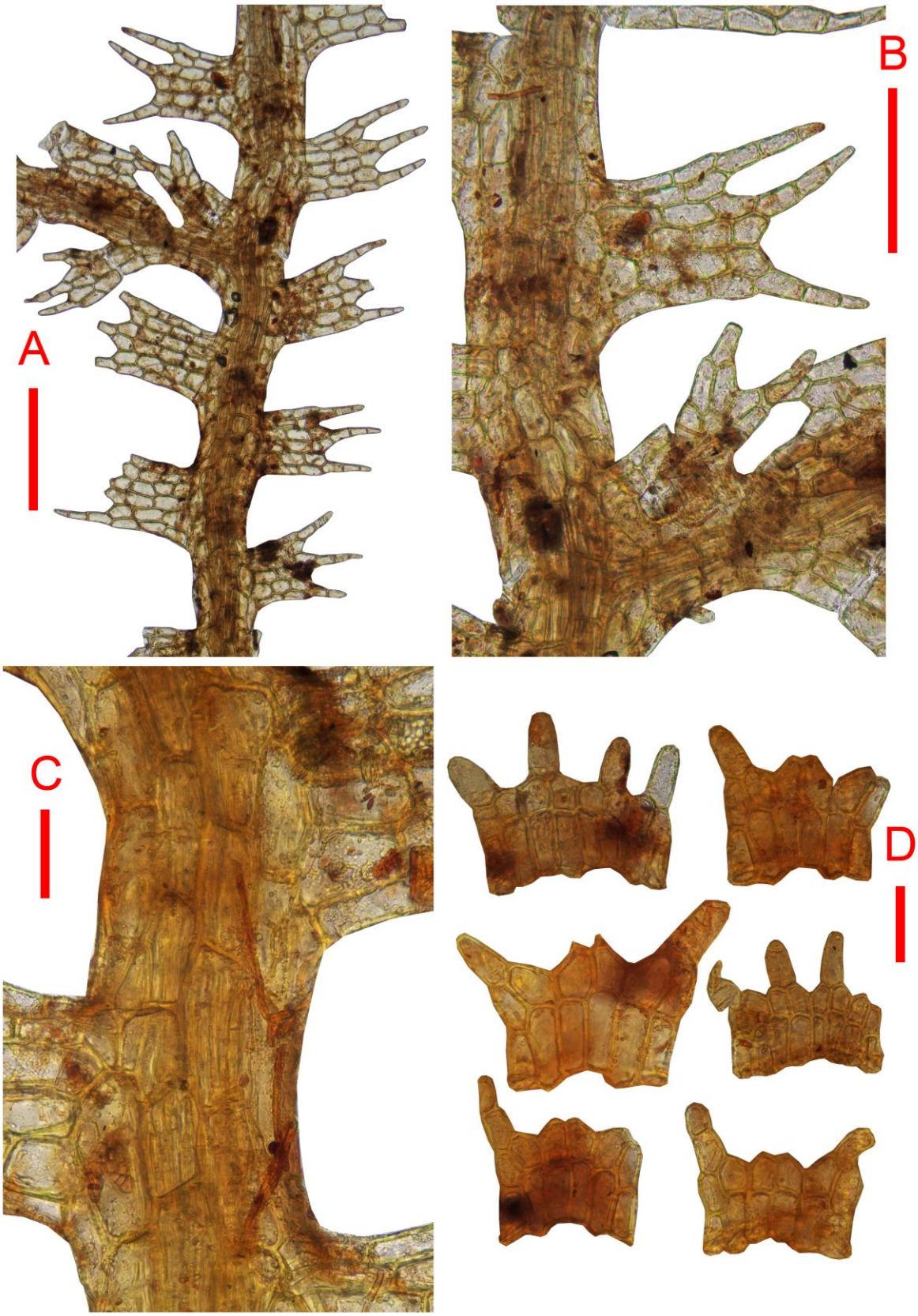

Plate 344: *Neolepidozia wallichiana*: A, B, C – Plant dorsal, D – Stem underleaves; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from GLM-B-0006484 – isotype)

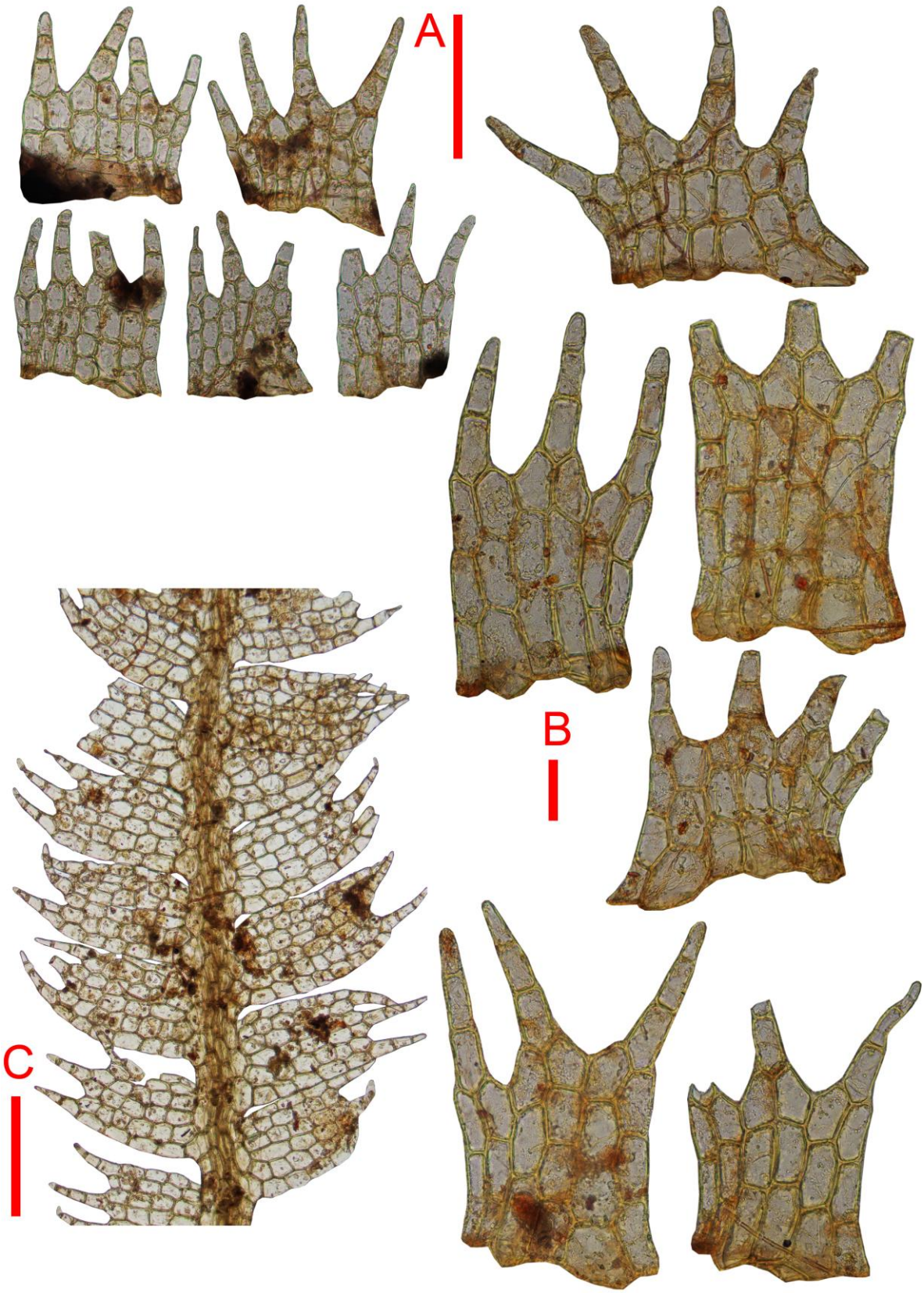

Plate 345: *Neolepidozia wallichiana*: A, B Stem leaves, C – Branch ventral; Scales: A – 0.2 mm; B – 50 µm; C – 0.3 mm (from GLM-B-0006484 – isotype)

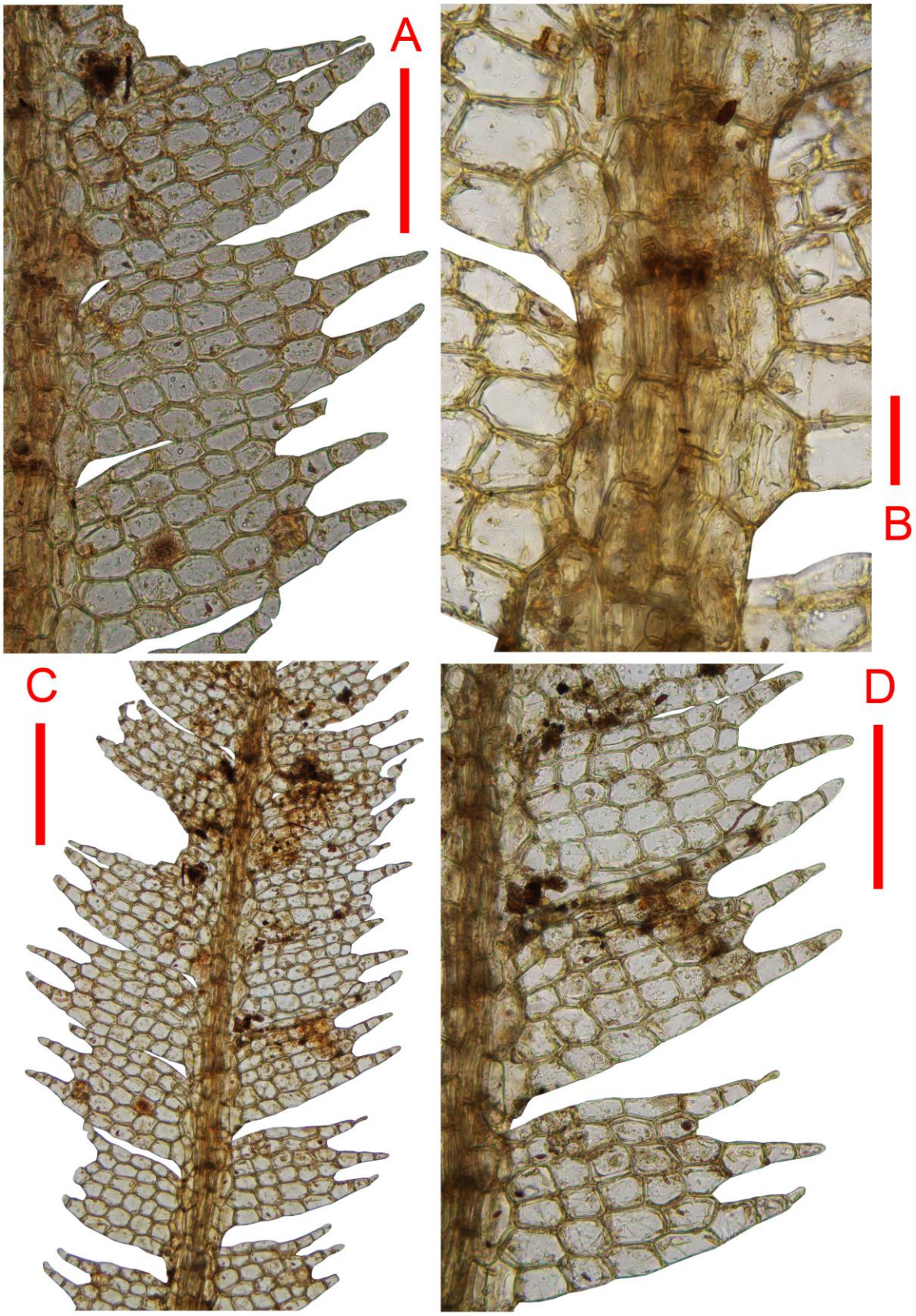

Plate 346: *Neolepidozia wallichiana*: A, B – Branch ventral, C, D – Branch dorsal; Scales: C – 0.3 mm; A, D – 0.2 mm; B – 50µm (from GLM-B-0006484 – isotype)

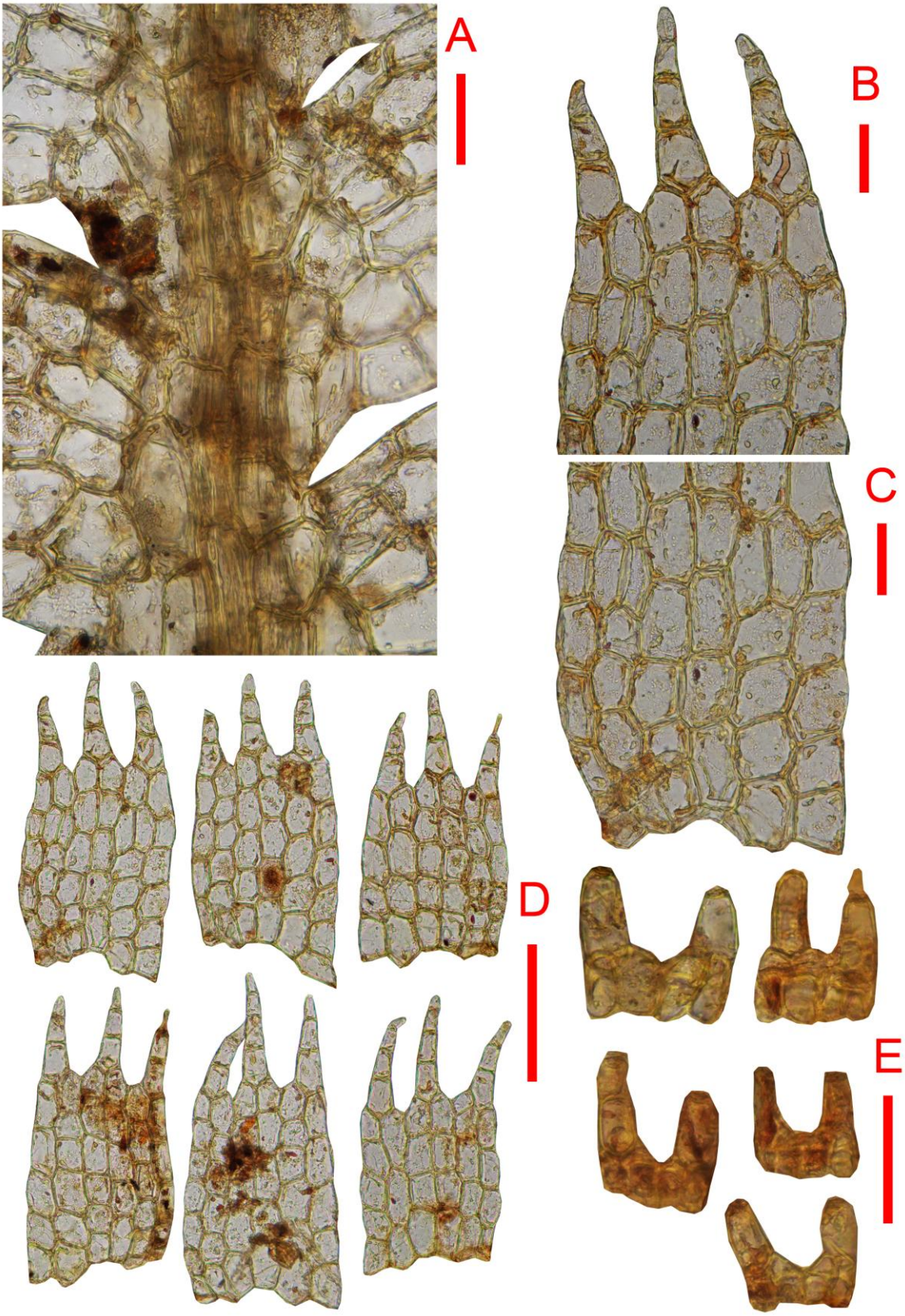

Plate 347: *Neolepidozia wallichiana*: A – Branch dorsal, B – Branch leaf lobe, C – Branch leaf disc, D – Branch leaves, E – Branch underleaves; Scales: D – 0.2 mm; A, B, C, E – 50µm (from GLM-B-0006484 – isotype)

Neolepidozia winteri U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

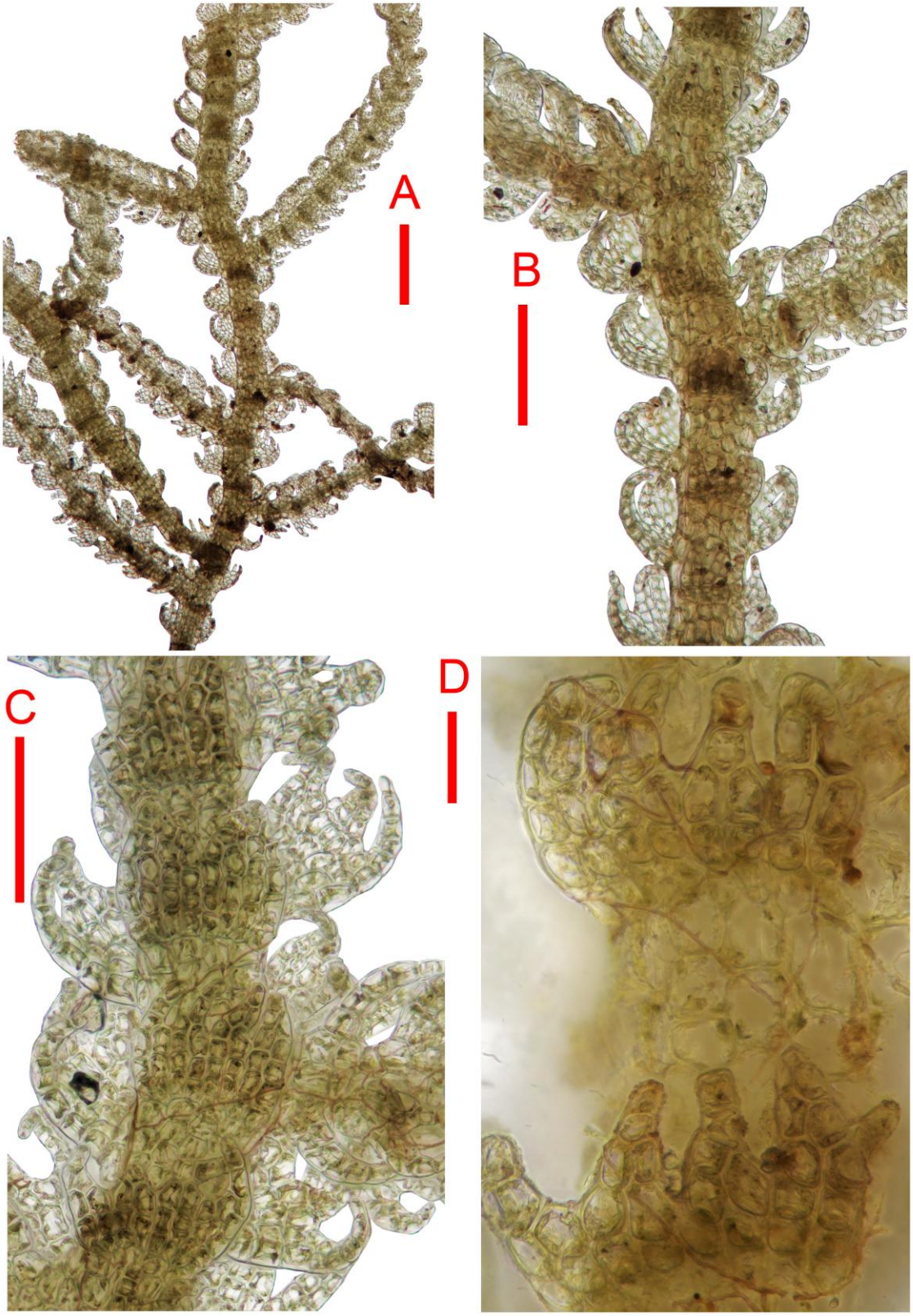

Plate 348: *Neolepidozia winteri*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from WINTER 671 – holotype)

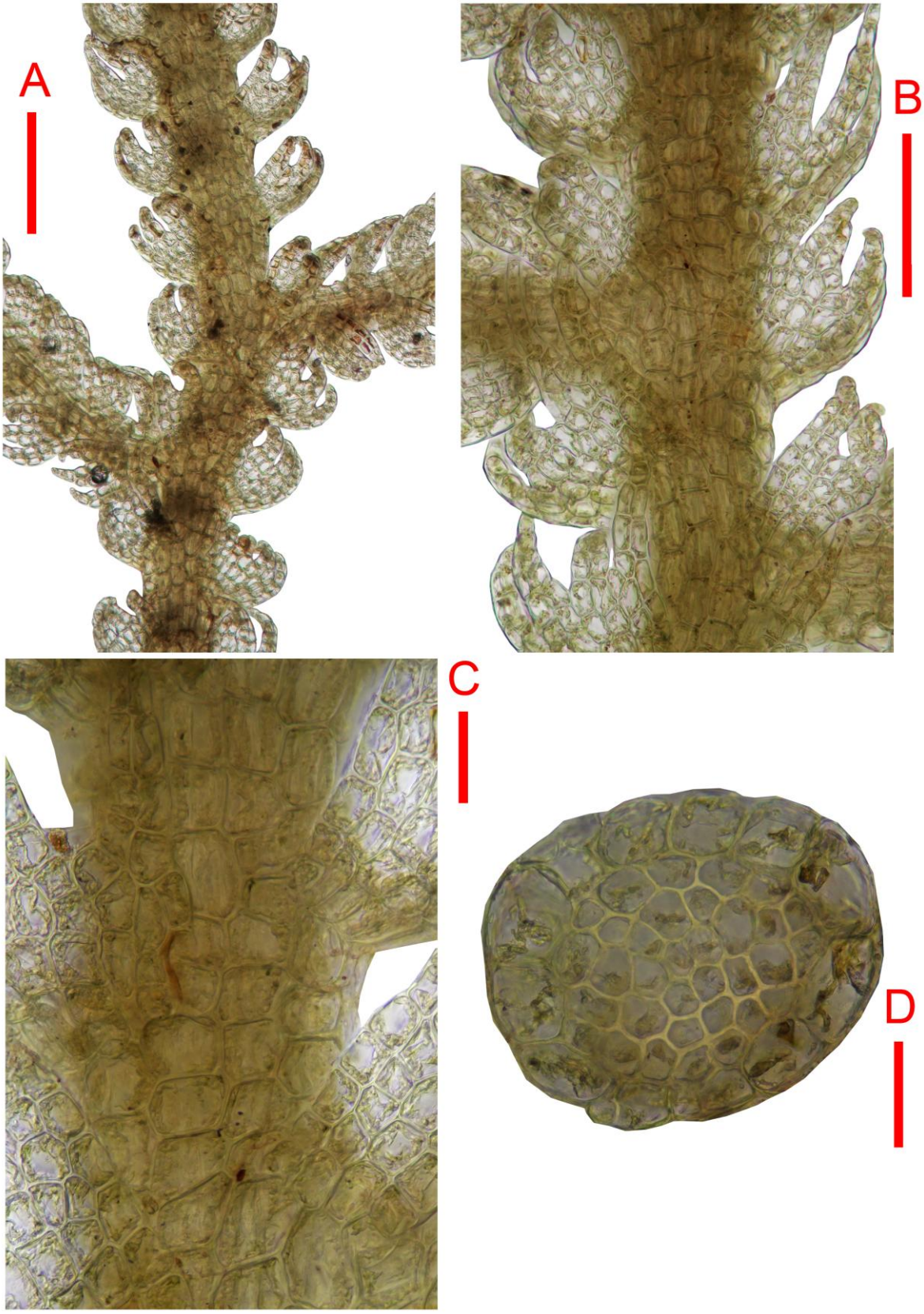

Plate 349: *Neolepidozia winteri*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from WINTER 671 – holotype)

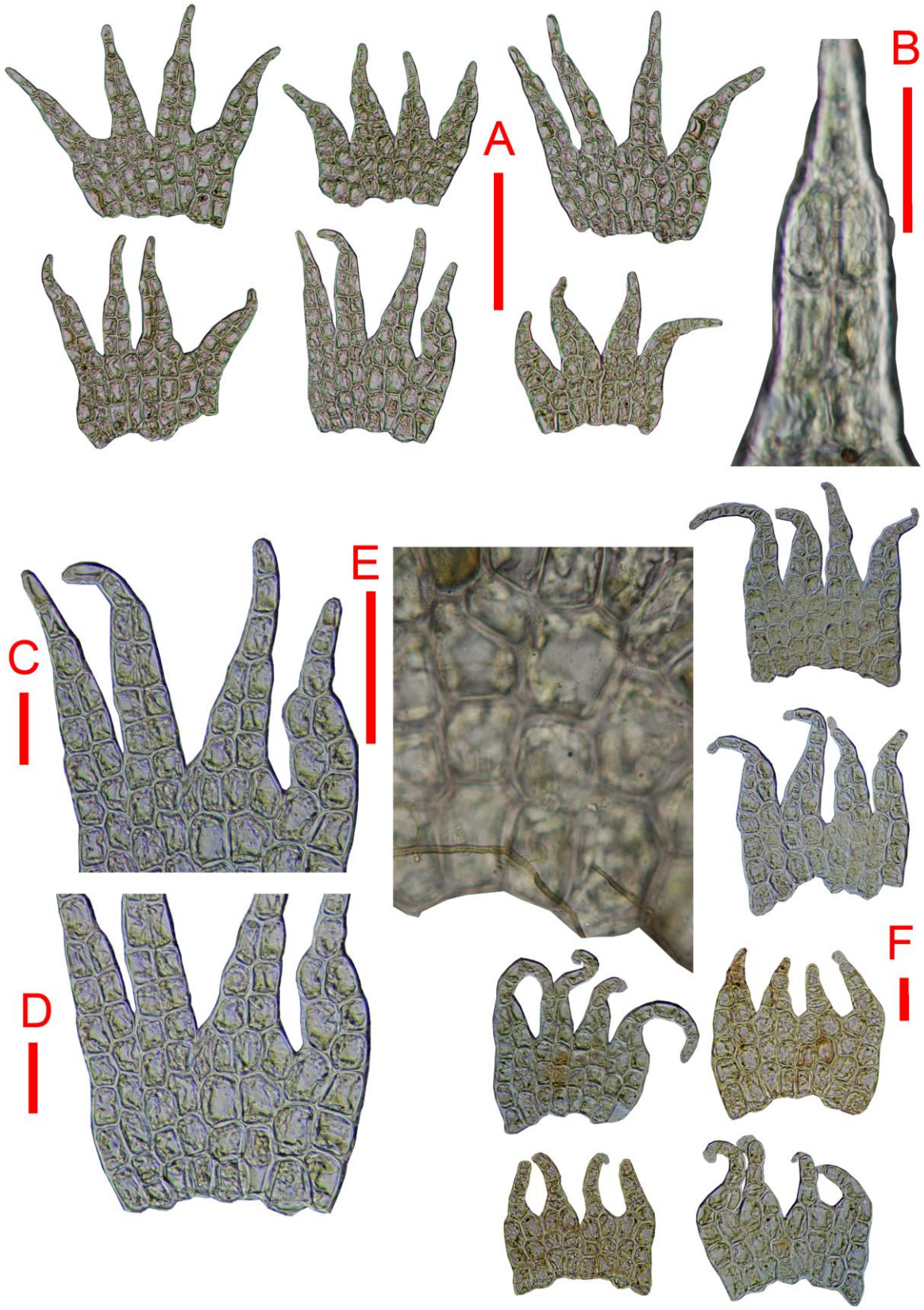

Plate 350: *Neolepidozia winteri*: A – Stem leaves, B, C – Stem leaf lobes, D, E – Stem leaf disc, F – Stem underleaves; Scales: A – 0.2 mm; B, C, D, E, F – 50 µm (from WINTER 671 – holotype)

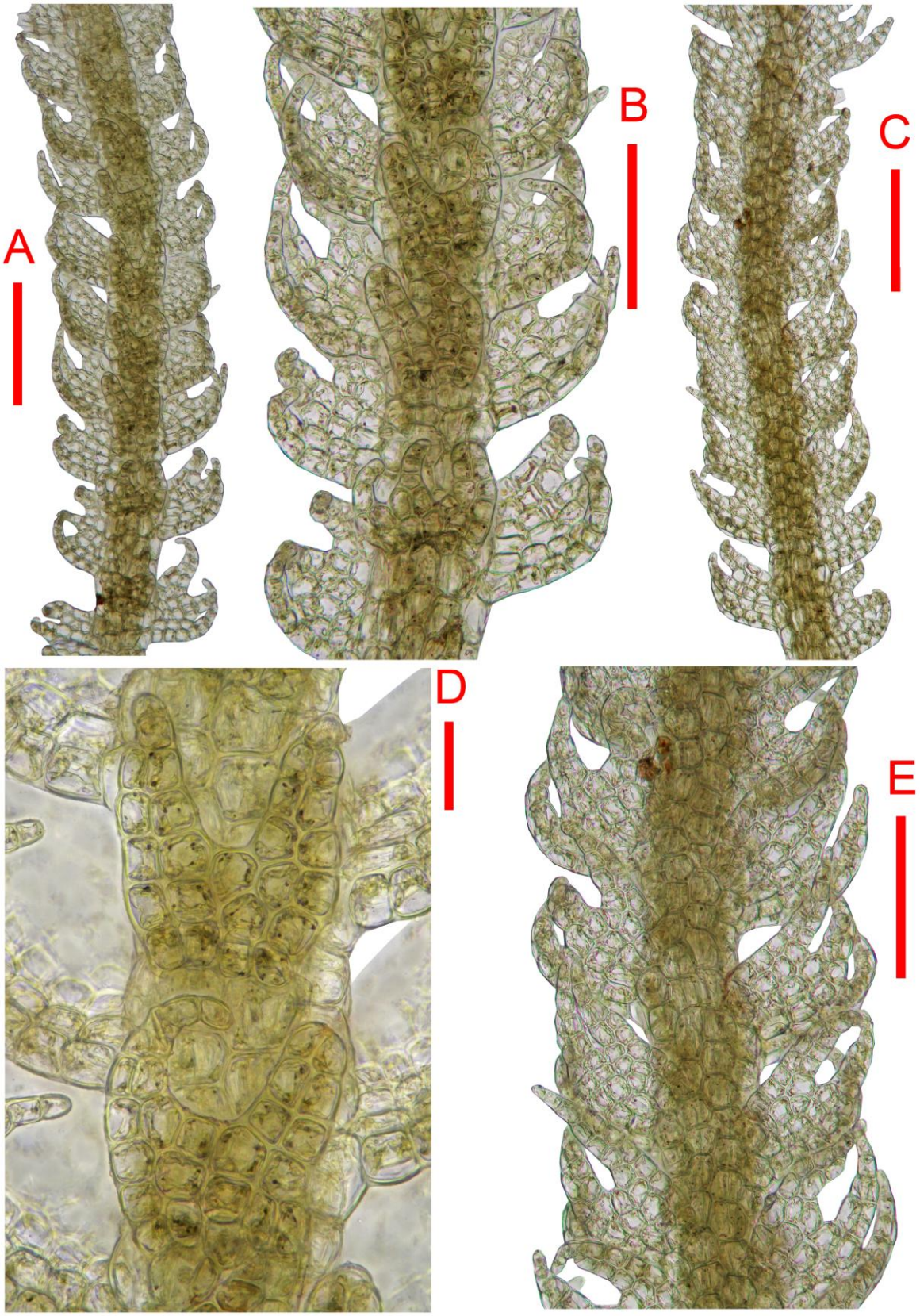

Plate 351: *Neolepidozia winteri*: A, B, D – Branch ventral, C, E – Branch dorsal; Scales: A, C – 0.3 mm; B, E – 0.2 mm, D – 50 µm (from WINTER 671 – holotype)

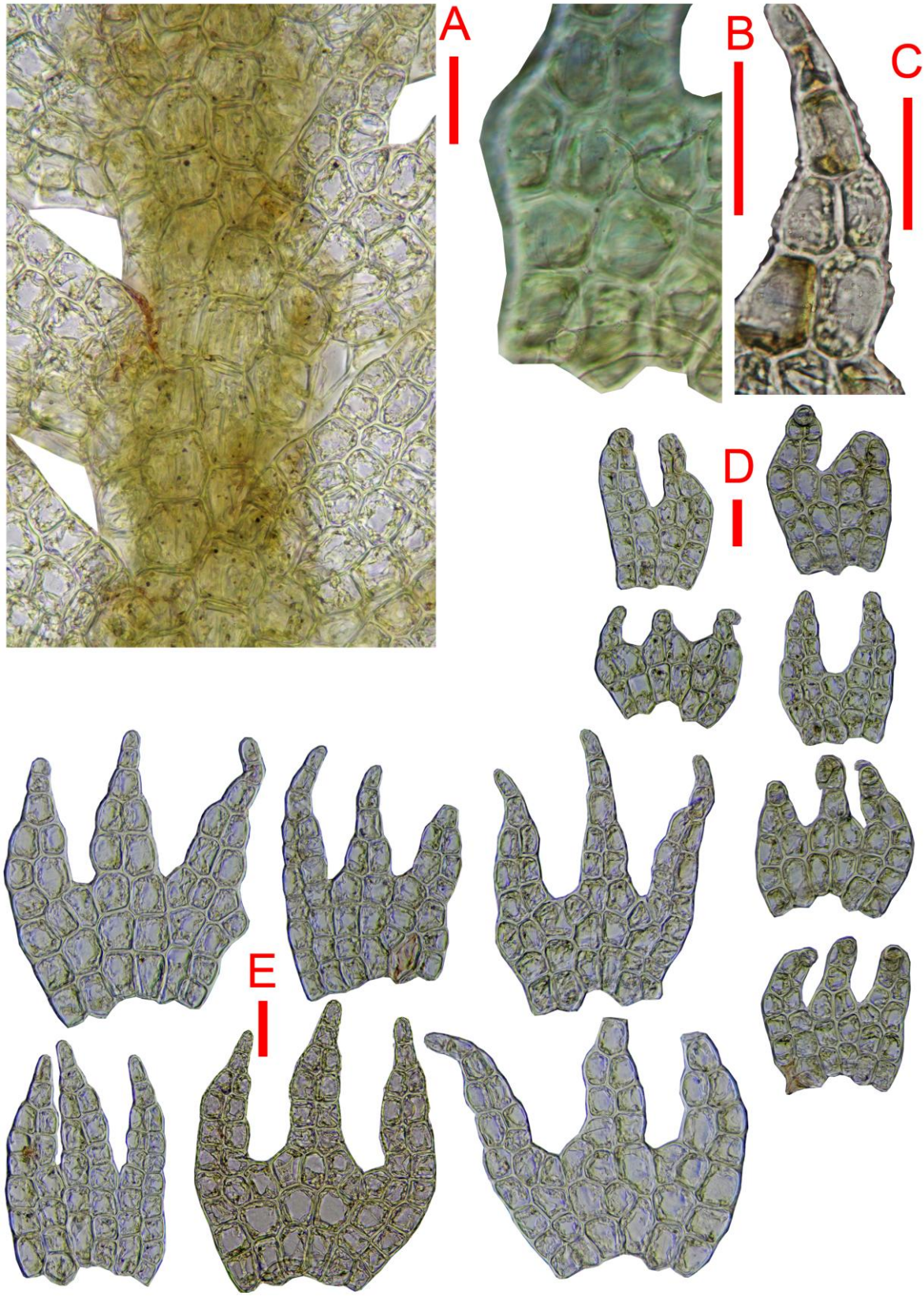

Plate 352: *Neolepidozia winteri*: A – Branch dorsal, B – Branch leaf disc, C – Branch leaf lobe, D – Branch underleaves, E – Branch leaves; Scales: A, B, C, D, E – 50 µm (from WINTER 671 – holotype)

Neolepidozia yorongii **U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK**

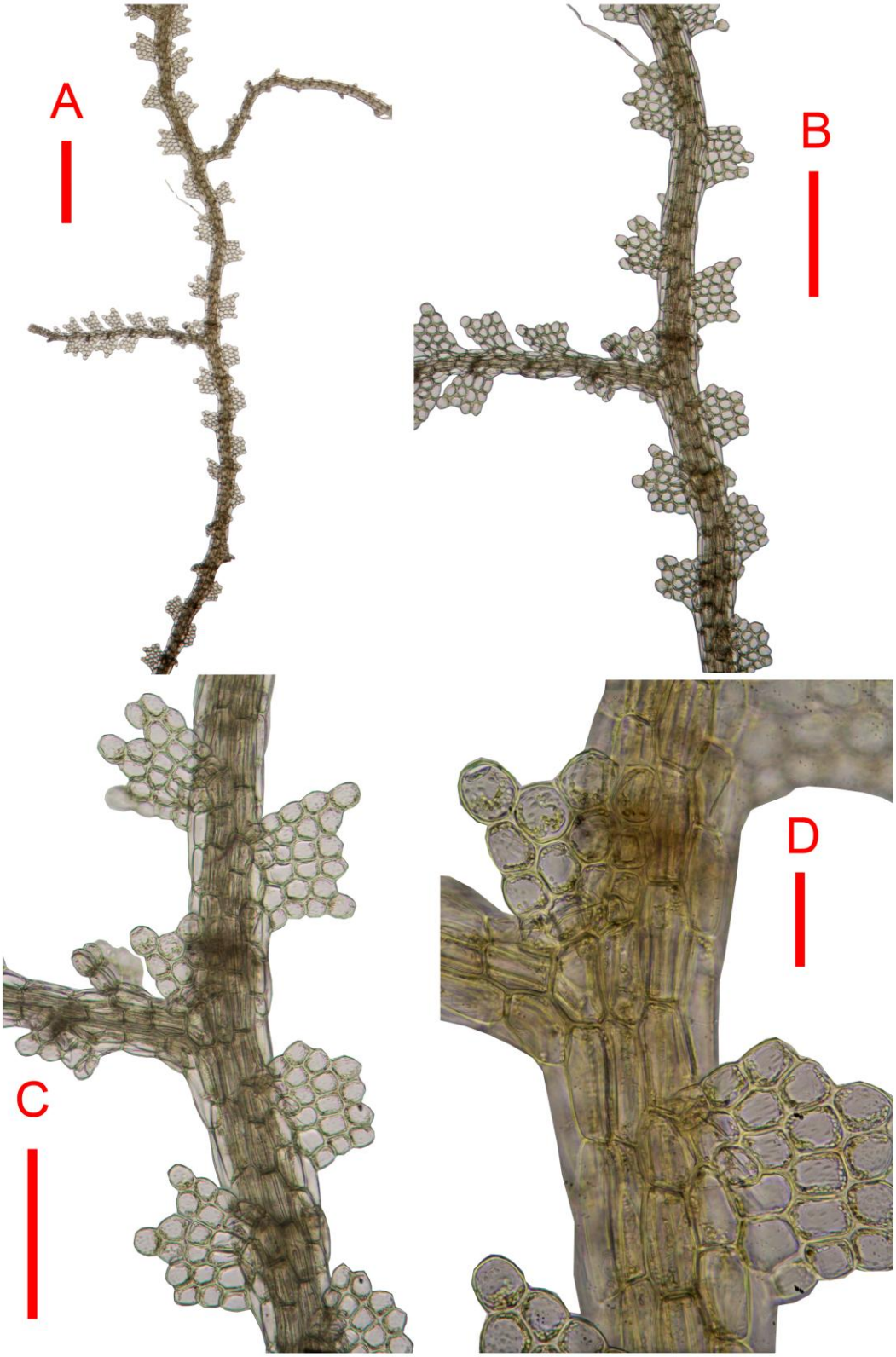

Plate 353: *Neolepidozia yorongii*: A, B, C, D – Plant dorsal; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from YORONG 931a – holotype)

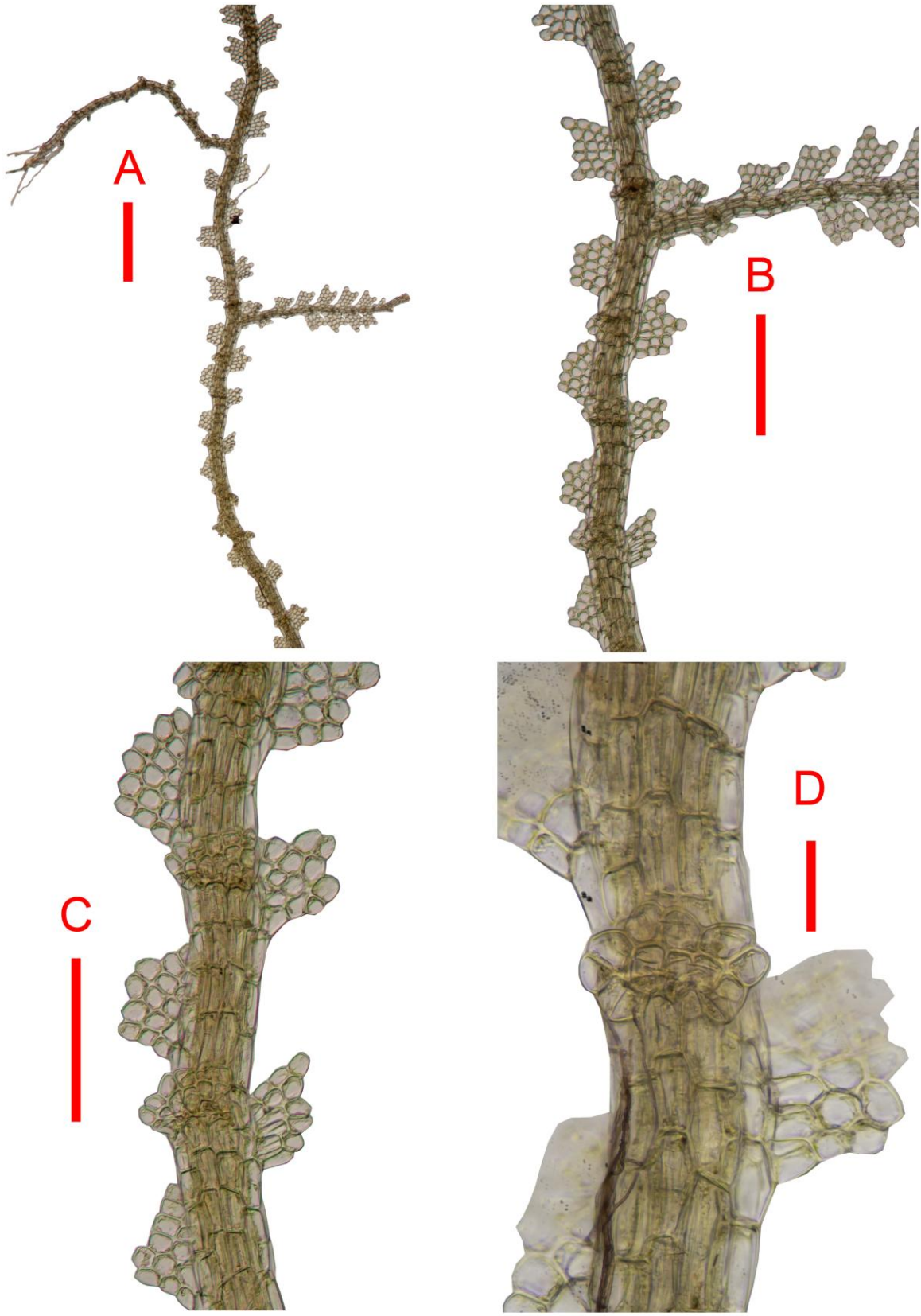

Plate 354: *Neolepidozia yorongii*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from YORONG 931a – holotype)

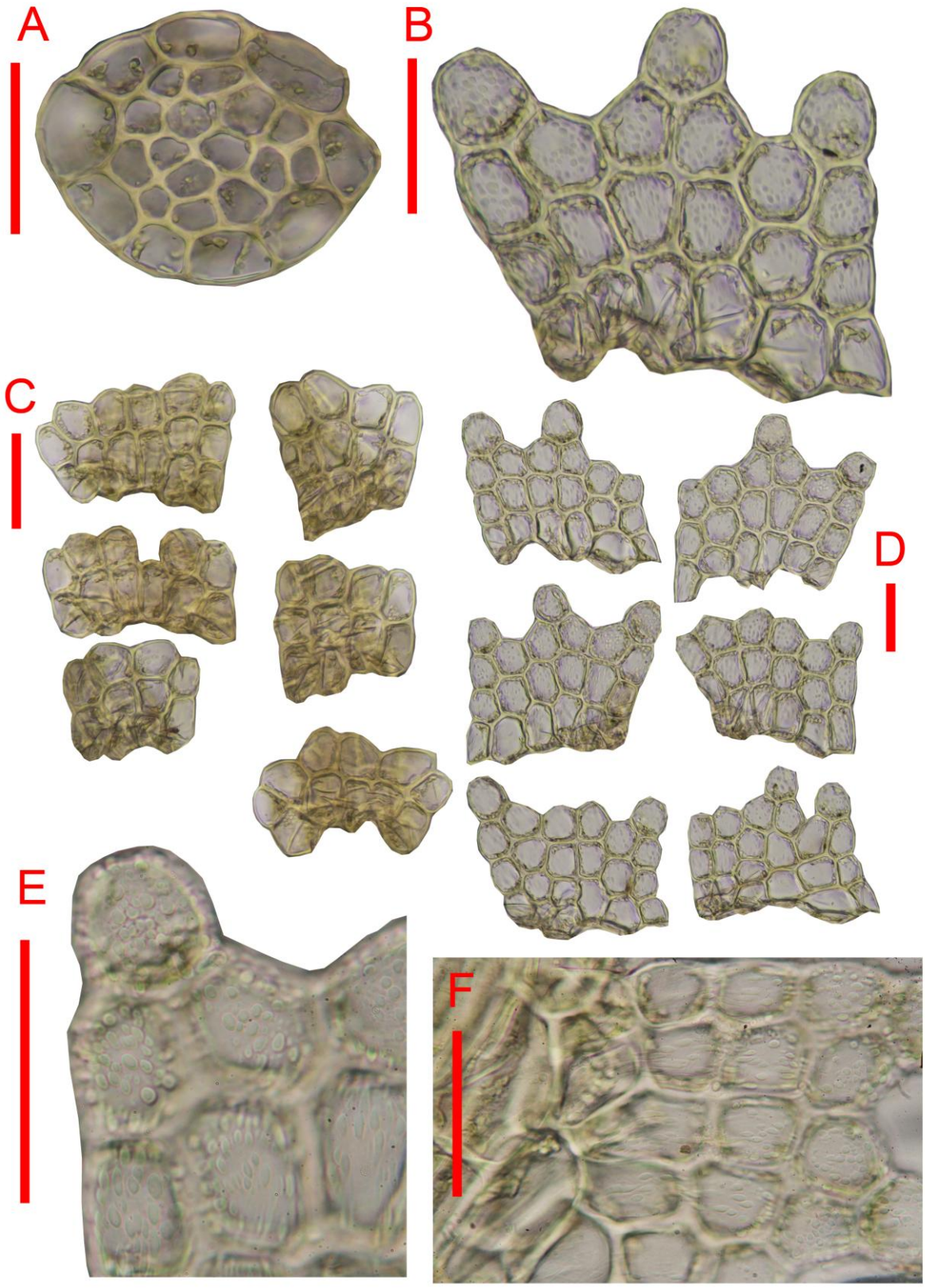

Plate 355: *Neolepidozia yorongii*: A – Stem cross section, B, D – Stem leaves, C – Stem underleaves, E – Stem leaf lobe, F – Stem leaf disc; Scales: A, B, C, D, E, F – 50 µm (from YORONG 931a – holotype)

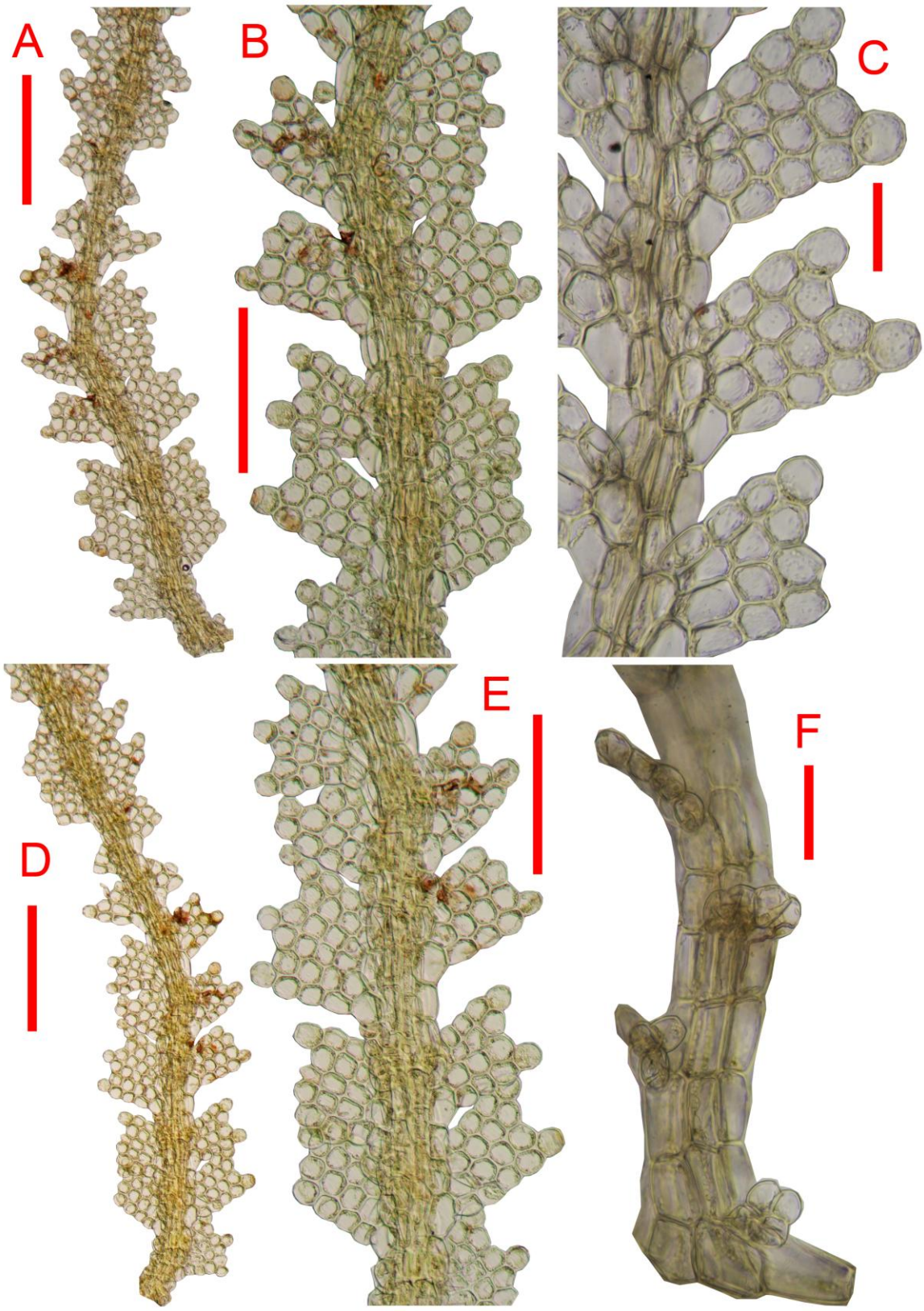

Plate 356: *Neolepidozia yorongii*: A, B, C – Branch dorsal, D, E – Branch ventral, F – Branch base with first amphigastrium; Scales: A, D – 0.3 mm, B, E – 0.2 mm, C, F – 50 µm (from YORONG 931a – holotype)

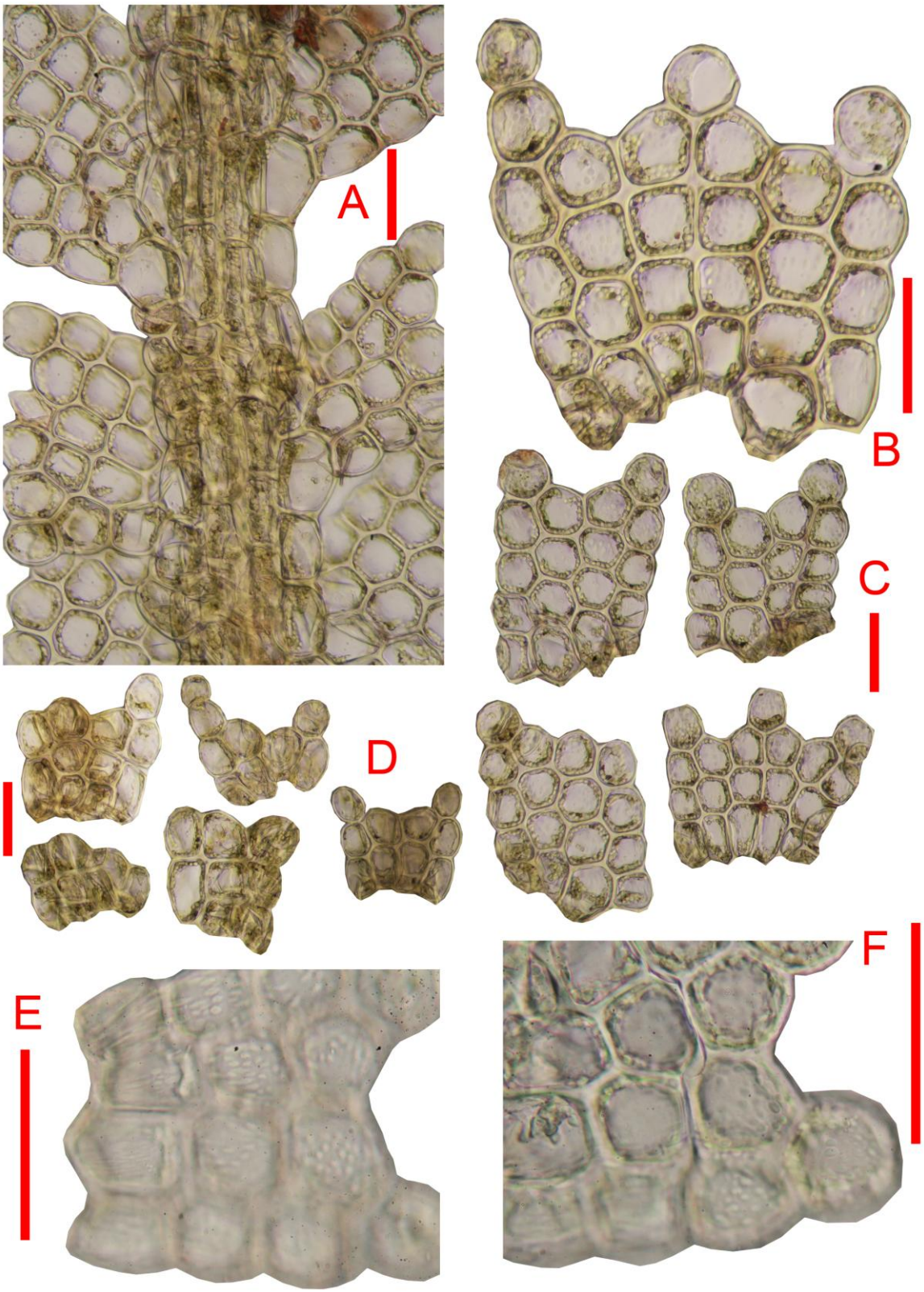

Plate 357: *Neolepidozia yorongii*: A – Branch ventral; B, C – Branch leaves; D – Branch underleaves; E – Branch leaf disc; F – Branch leaf apex; Scales: A, B, C, D, E, F – 50 µm (from YORONG 931a – holotype)

Neolepidozia zantenii U. SCHWARZ, SCHÄF.-VERW. & SHEVOCK

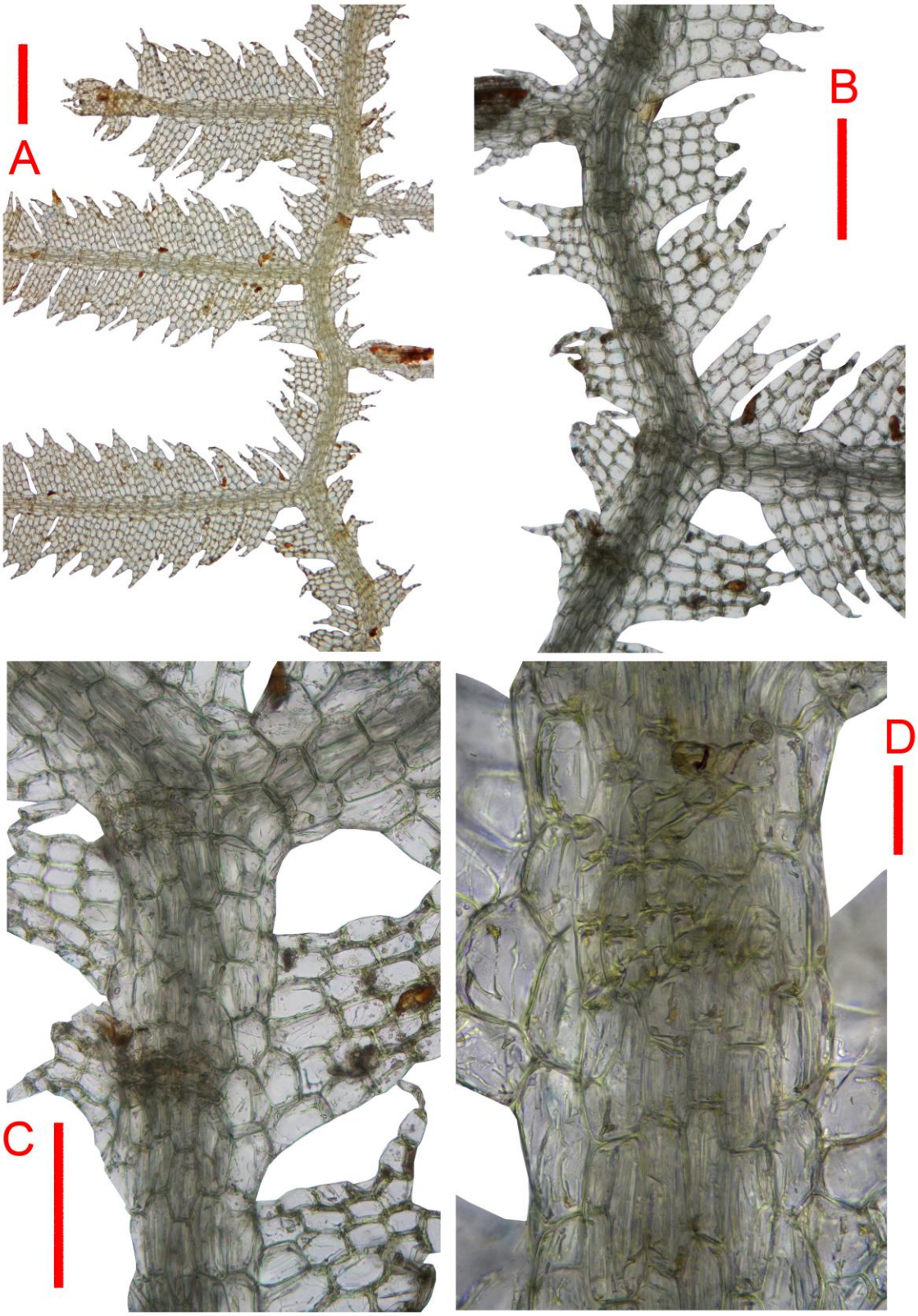

Plate 358: *Neolepidozia zantenii*: A, B, C, D – Plant ventral; Scales: A – 0.5 mm; B – 0.3 mm; C – 0.2 mm; D – 50 µm (from VAN ZANTEN 105 – holotype)

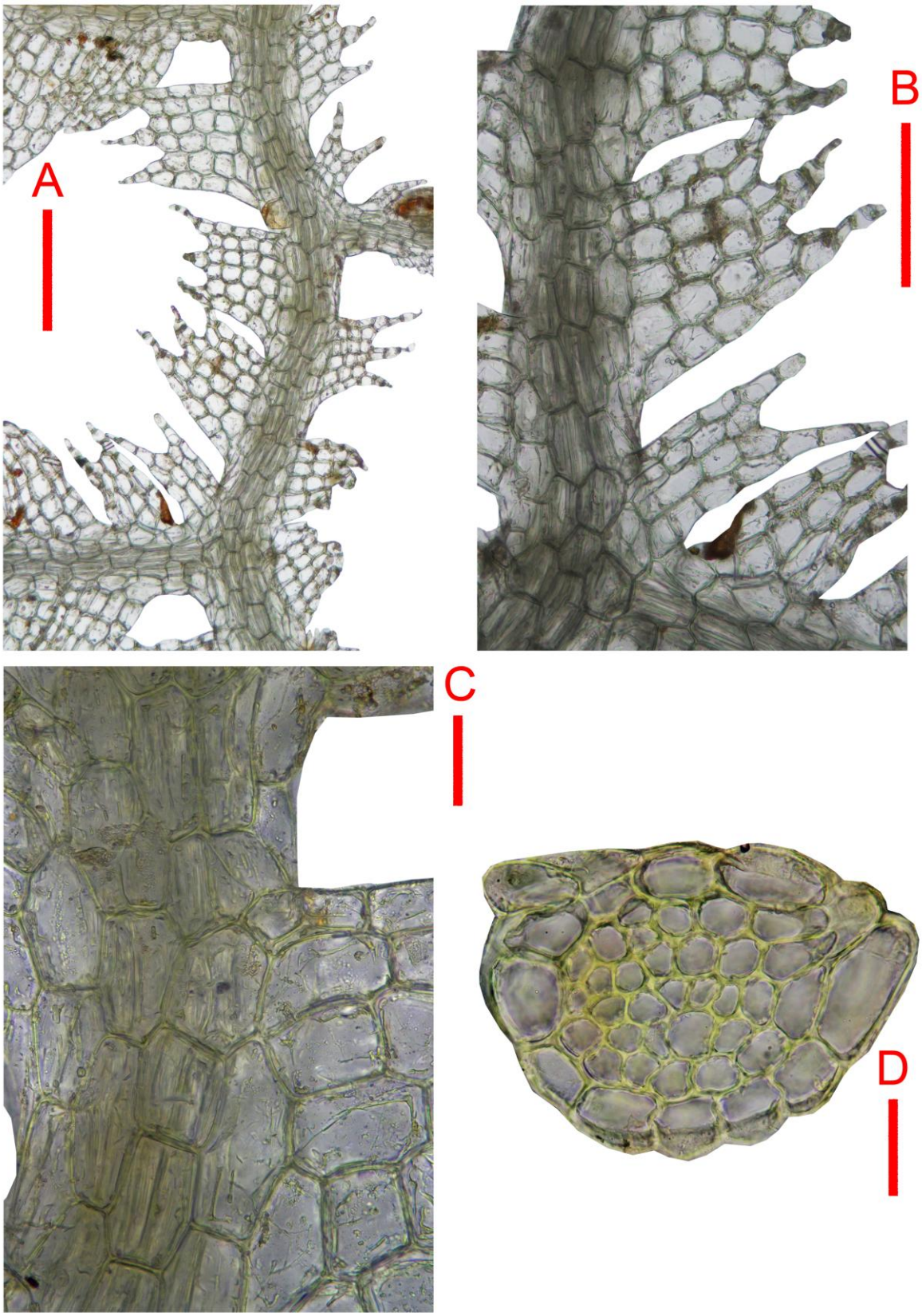

Plate 359: *Neolepidozia zantenii*: A, B, C – Plant dorsal, D – Stem cross section; Scales: A – 0.3 mm; B – 0.2 mm; C, D – 50 µm (from VAN ZANTEN 105 – holotype)

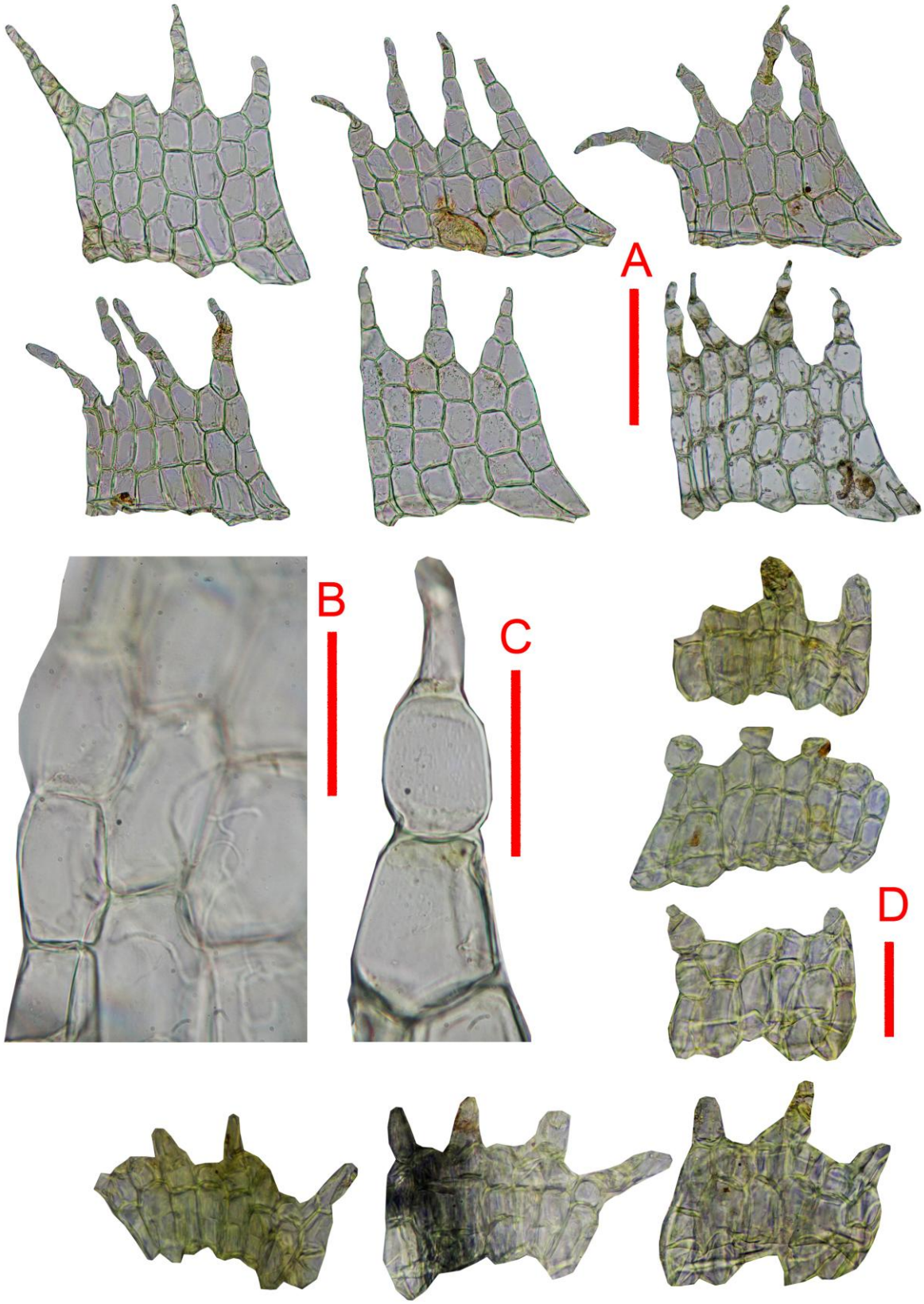

Plate 360: *Neolepidozia zantenii*: A – Stem leaves, B – Stem leaf disc, C – Stem leaf lobe, D – Stem underleaves; Scales: A – 0.2 mm; B, C, D – 50 µm (from VAN ZANTEN 105 – holotype)

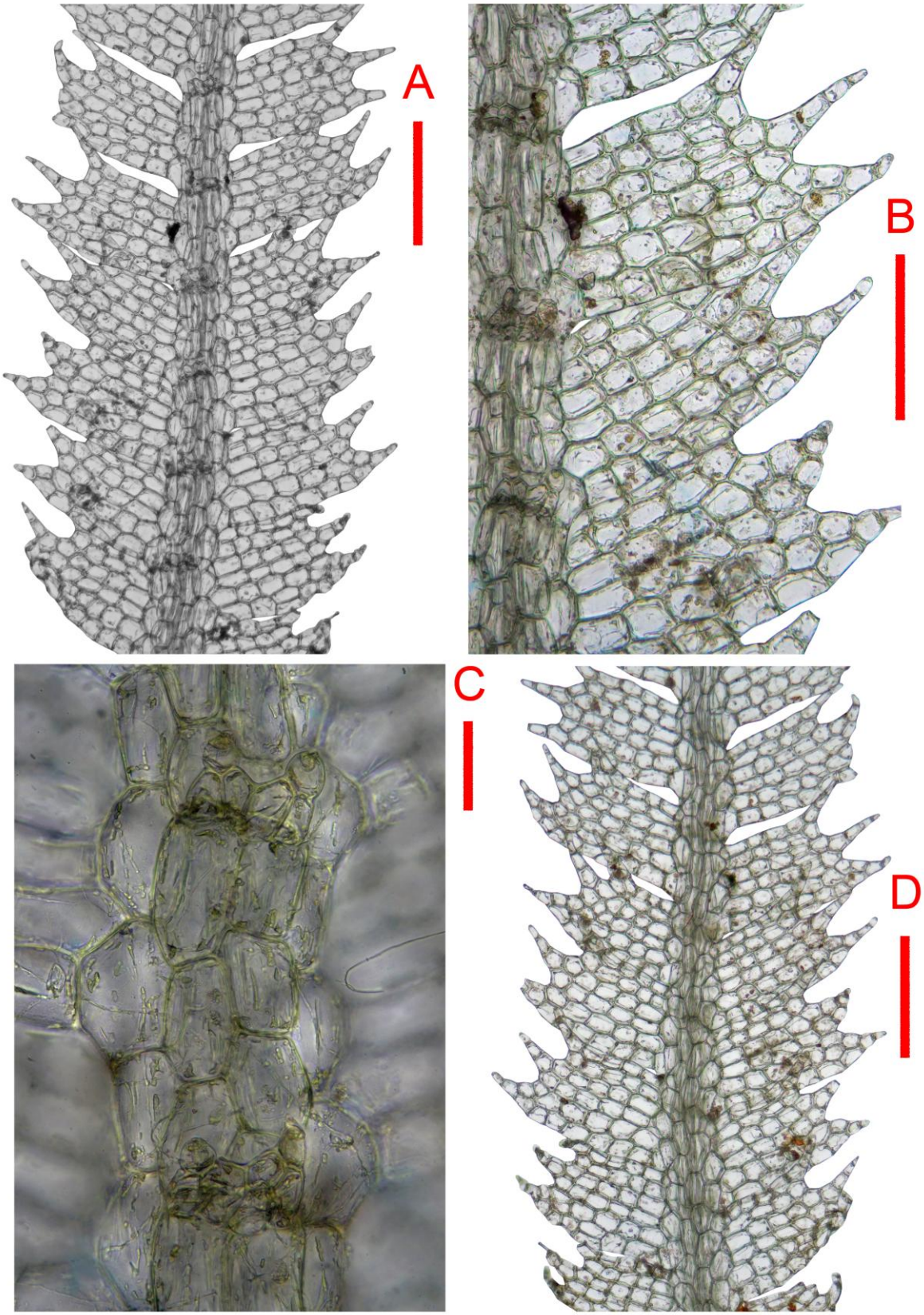

Plate 361: *Neolepidozia zantenii*: A, B, C – Branch ventral, D – Branch dorsal; Scales: A, D – 0.3 mm; B – 0.2 mm; C – 50 µm (from VAN ZANTEN 105 – holotype)

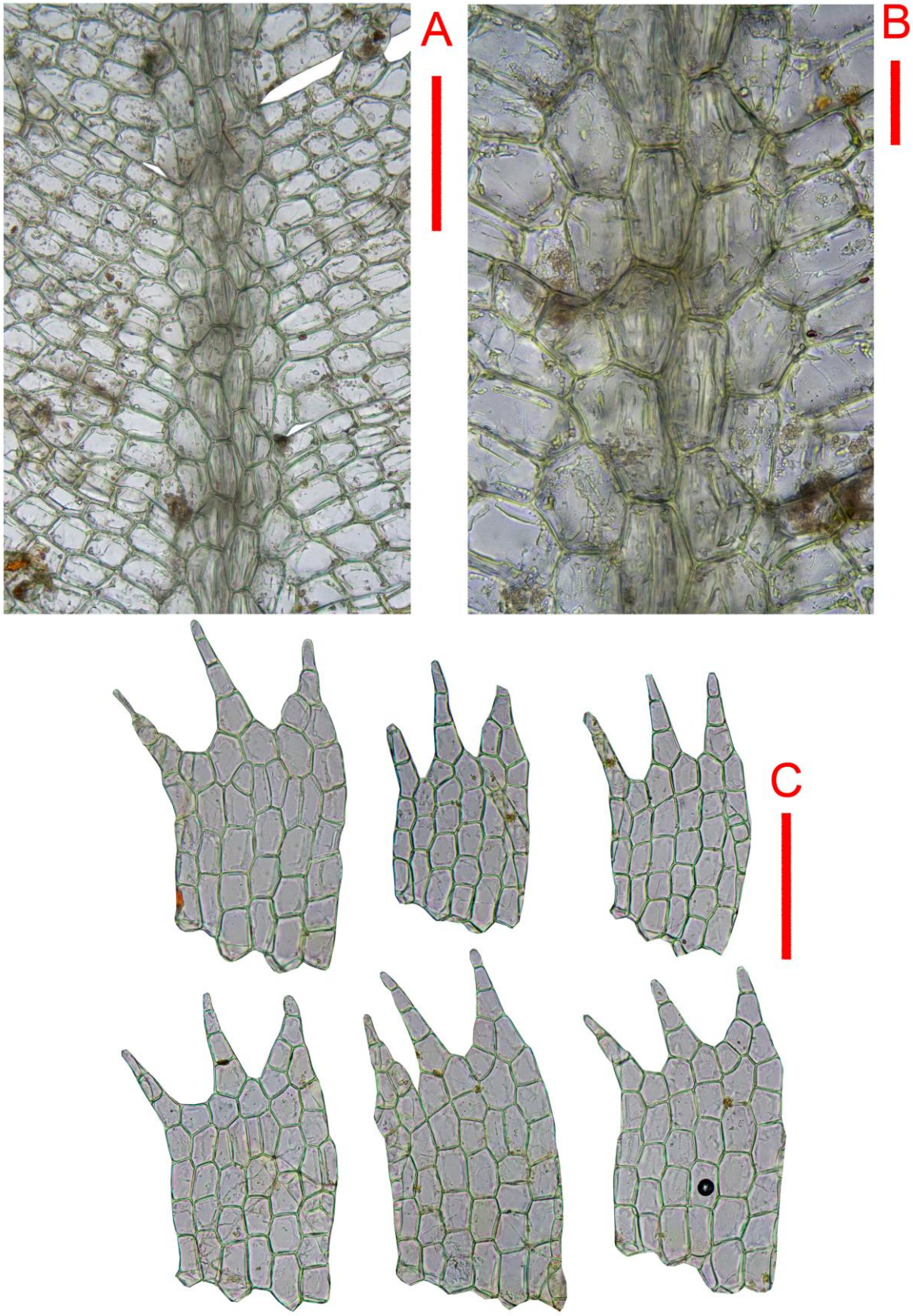

Plate 362: *Neolepidozia zantenii*: A, B – Branch dorsal, C – Branch leaves; Scales: A, C – 0.2 mm; B – 50 µm (from VAN ZANTEN 105 – holotype)

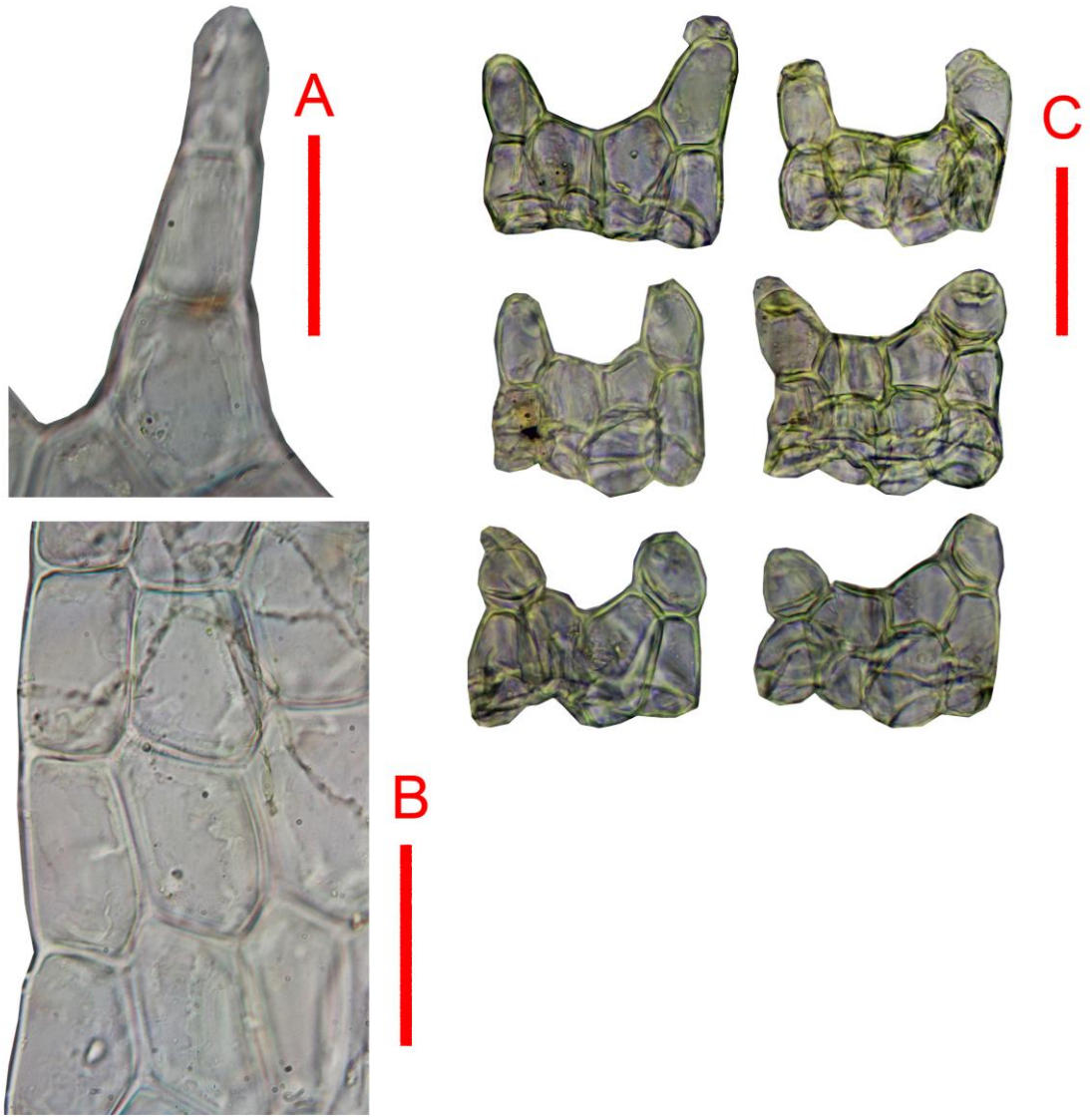

Plate 363: *Neolepidozia zantenii*: A – Branch leaf lobe, B – Branch leaf disc, C – Branch underleaves; Scales: A, B, C – 50 µm (from VAN ZANTEN 105 – holotype)

Lepidozia spec.

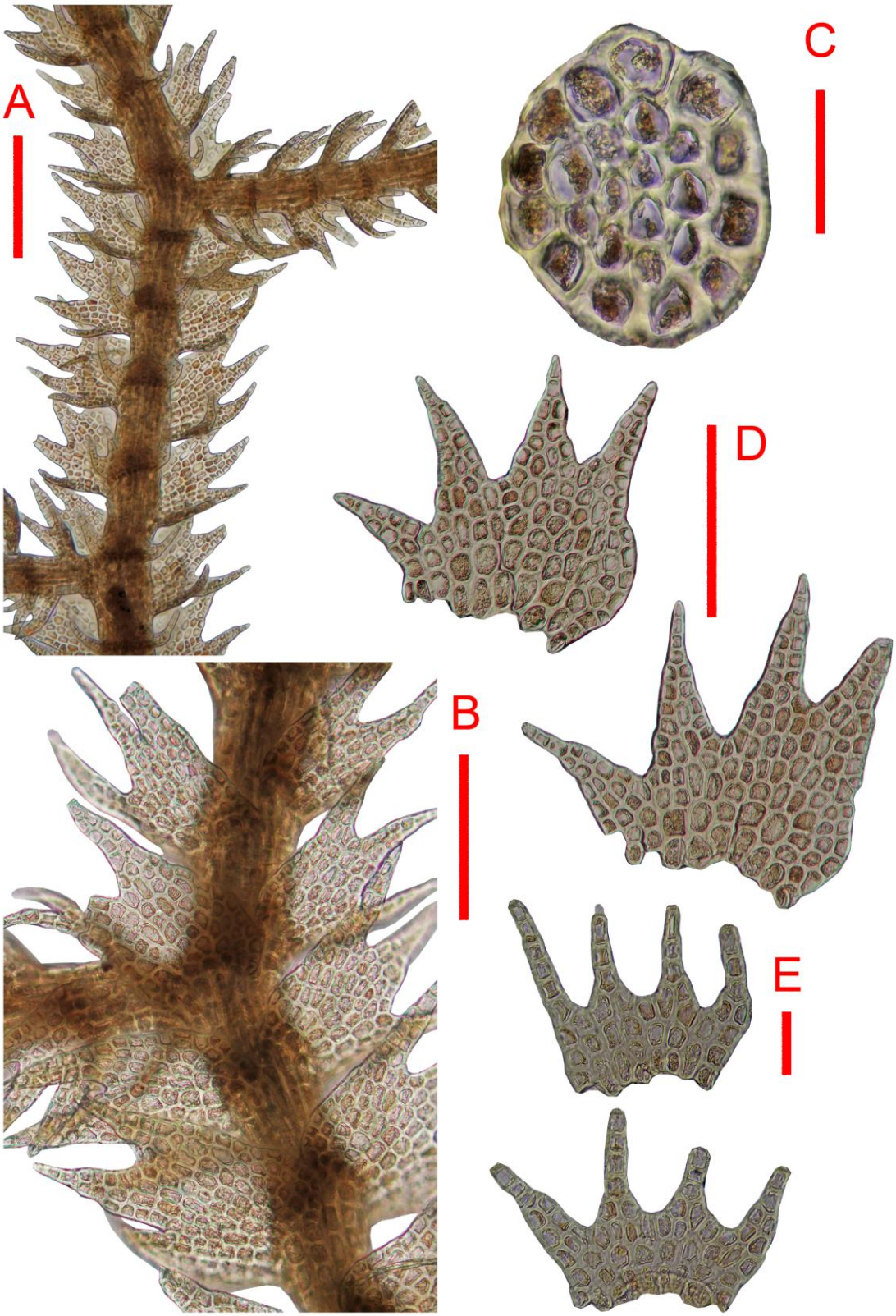

Plate 364: *Lepidozia spec.*: A – Stem ventral, B – Stem dorsal, C – Stem cross section, D – Stem leaves, E – stem underleaves; Scales: A – 0.3 mm; B, D – 0.2 mm; C, E – 50 µm (from VAN ZANTEN 68-3116/a)

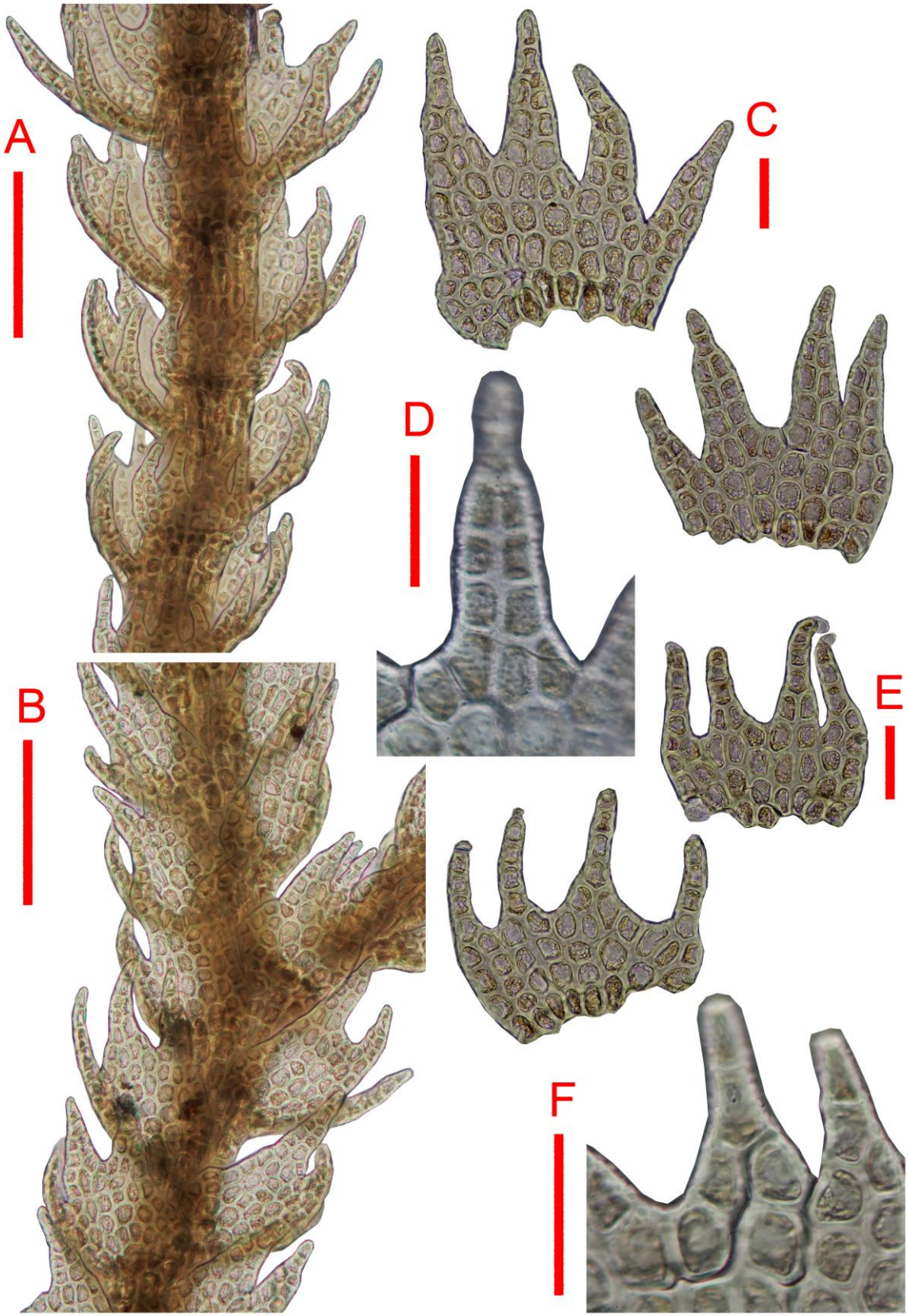

Plate 365: *Lepidozia spec.*: A – Branch ventral, B – Branch dorsal, C – Branch leaves, D – Branch leaf lobe, E – Branch underleaves, F – Branch underleaf lobes; Scales: A, B – 0.2 mm; C, D, E, F – 50 µm (from VAN ZANTEN 68-3116/a)

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