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# Grimmia dissimulata E. Maier sp. nova, and the taxonomic position of *Grimmia trichophylla* var. *meridionalis* Müll. Hal. (Musci, Grimmiaceae)

EVA MAIER

## ABSTRACT

MAIER, E. (2002). *Grimmia dissimulata* E. Maier sp. nova, and the taxonomic position of *Grimmia trichophylla* var. *meridionalis* Müll. Hal. (Musci, Grimmiaceae). *Candollea* 56: 281-300. In English, English, German and French abstracts.

A neglected widespread European *Grimmia* species is described and a name coined: *Grimmia dissimulata* E. Maier. *Grimmia trichophylla* var. *meridionalis* Müll. Hal. is elevated to the specific rank as *Grimmia meridionalis* (Müll. Hal.) E. Maier. Descriptions of these two species, as well as of *Grimmia lisae* De Not. and *Grimmia trichophylla* Grev. are given, the taxonomic position of the new species is commented, and a key provided.

## ZUSAMMENFASSUNG

MAIER, E. (2002). *Grimmia dissimulata* E. Maier sp. nova, und die taxonomische Stellung von *Grimmia trichophylla* var. *meridionalis* Müll. Hal. (Musci, Grimmiaceae). *Candollea* 56: 281-300. Englisch, englische, deutsche und französische Zusammenfassungen.

Eine verkannte, weitverbreitete europäische *Grimmia*-Art wird beschrieben und ein Name geprägt: *Grimmia dissimulata* E. Maier. *Grimmia trichophylla* var. *meridionalis* Müll. Hal. wird in den Artrang erhoben als *Grimmia meridionalis* (Müll. Hal.) E. Maier. Neben diesen Arten werden *Grimmia lisae* De Not. und *Grimmia trichophylla* Grev. beschrieben, die taxonomische Stellung der neuen Art besprochen und ein Schlüssel unterbreitet.

## RÉSUMÉ

MAIER, E. (2002). *Grimmia dissimulata* E. Maier sp. nova, et position taxonomique de *Grimmia trichophylla* var. *meridionalis* Müll. Hal. (Musci, Grimmiaceae). *Candollea* 56: 281-300. En anglais, résumés anglais, allemand et français.

Une espèce commune mais mal connue d'Europe du genre *Grimmia* est décrite comme nouvelle sous le nom *Grimmia dissimulata* E. Maier. *Grimmia trichophylla* var. *meridionalis* Müll. Hal. est élevé au rang spécifique comme *Grimmia meridionalis* (Müll. Hal.) E. Maier. Ces deux espèces, ainsi que *Grimmia lisae* De Not. et *Grimmia trichophylla* Grev. sont décrites, la position taxonomique de la nouvelle espèce est commentée et une clé est fournie.

**KEY-WORDS:** *Grimmia* – Bryophytes – Europe.

## Introduction

In recent years European *Grimmia* species have been collected intensively. Especially German bryologists gathered material in Turkey, Cyprus, Greece, Italy, Spain, Portugal, and particularly in Western Germany (Saarland).

The identification of most of the specimens succeeded well although one taxon turned out to be unnamed. This widespread species shows a superficial resemblance to *G. lisae* De Not. as well as to *G. trichophylla* Grev. The present study has been undertaken with the aim of finding a name for the new taxon and commenting its taxonomic position. Descriptions of the species under review in this study are given, allowing the comparison of their diagnostic characters.

### Material

The treatise is based on collections made by F. Koppe, R. Düll, and M. Nebel (STU), E. Sauer (SAAR), and T. A. J. Hedderson (BOL). Of great value proved to be the abundance of material recently gathered by private collectors such as J. Bertram, S. Caspari, R. Lübenau, M. Lüth, H. v. Melick, A. Schäfer-Verwimp, F. Schumm and U. Schwarz as well as by other collectors. Their specimens are housed in private herbaria. Four hundred and eighty-three specimens have been examined, among these 103 specimens of the species so far unnamed.

### Description of the new species

***Grimmia dissimulata*** E. Maier, **spec. nova** (Fig. 1.1-23, 5.1-3).

*Species dioica subgeneris Rhabdogrimmia Limpr. pars; caespitosa, condensata; caulis erectus vix mm 30 altus, comosus; folia caulina sicca erecta, adpressa, humida erecto-patentia vel patula, e basi ovata lanceolata-acuminata, carenata, pilo plus minus longo, margine recurvata; cellulis basilaribus rectangulis sat laxis, plus minus nodulosis; costa dorso prominens, in basi duca 4, hydroidea, strati stereoides composita, cellulae dorsales incrassatae; seta curvata, ca. 5 mm alta; theca ellipsoidea, sicca leviter vel parce 8-costata; operculum rectirostrum; calyptra mitriformis, anulus latus, fragmentarie dehiscens; peristomii dentes e basi late lanceolati, bifidi, inferne rugosi, superne robuste rugosi; trabeculae inferiores latissimae, undulatae.*

**Typus:** "Flora von Zypern. *Grimmia trichophylla* Grev. v. *meridionalis* Schpr. f. *racomitrioides*. Bez. Kyrenia, Kalkfelsen am Pass über Lapithos, an der Strasse bei 400 m", 10.V.1972, F. Koppe 10.5.1972(1) (Holo-: STU; iso-: G, STU).

The name chosen is a reminiscence of the long unrecognized existence of this taxon.

Bryologists have used different names for *G. dissimulata*. All the names used are of the *Grimmia lisae-trichophylla*-complex. These are:

"*Grimmia britannica* A. J. E. Smith" (GREVEN, 1995: 50, Fig. 8b);

"*Grimmia decipiens* (Schultz) Lindb.", see GEISSLER & MAIER (1995: 499);

"*Grimmia lisae* De Not.";

"*Grimmia trichophylla* var. *lisae* (De Not.) Bott.";

"*Grimmia sardoa* Müll. Hal.";

"*Grimmia trichophylla* Grev.";

"*Grimmia trichophylla* var. *brachycarpa* De Not.";

"*Grimmia trichophylla* var. *meridionalis* Müll. Hal.";

"*Grimmia trichophylla* var. *meridionalis* Schpr. f. *racomitrioides*" [nom. inval.].

However, none of them is relevant to the new taxon. Their characters and their types will be compared with *G. dissimulata* farther on.

### On some other name and specimens

SCHIMPER (1876: 257) described *G. trichophylla* var. *lusitanica* Schimp. from "in rup. graniticis m. Foya ad Monchique Algarviae [Portugal] (C. H. Solms)." Especially the description

of the cells in the leaf base as being rectangular, quite large, slightly sinuose (“*cellulis basilari-bus rectangulis sat laxis leviter sinuosis*”) tends to suggest the cell pattern in the leaf base of *G. dissimulata*. According to STAFLEU & COWAN (1985), Schimper’s original moss herbarium and the Portuguese mosses of Solms-Laubach are housed at BM. However, no potential type material of *G. trichophylla* var. *lusitanica* could be found there. An unidentified specimen from the type locality, with the label Solms has been seen among other material of BM. It turned out to be *G. lisae*. Relevant material housed in GOET has been examined: *G. trichophylla* var. *lusitanica* is not present. Careful search in HAL where material of Solms-Laubach should be present failed (the curator in litt.). Van der WIJK & al. (1962) refer this name to *G. trichophylla* var. *meridionalis*, following JONES (1933). Furthermore, MUÑOZ & PANDO (2000) cite *G. trichophylla* var. *lusitanica* in the list of names with type material not seen.

In W is housed a specimen examined by V. Schiffner. It is labelled: “Grimmia spec. Mesopotamia: in tergo medii montis, Dschebel Abd-el-Asis supra vici ruinam Gharra, ad rupes marginis septentrionalis, calcareo, ≈ 900 m, 22.6.1910, leg. Handel-Mazzetti, Tagebuch-No. 1807 (362), det. Schiffner”. Besides some *Bryum* species, this is the only *Grimmia* species, a sterile plant, SCHIFFNER (1913) was unable to identify, as he writes in the introduction to his treatise of the mosses from Mesopotamia and Kurdistan. It turned out to be *G. dissimulata*.

In G a specimen identified by J. Baumgartner as *G. lisae* is labelled: “Grimmia Lisae de Not., jugoslawisches Adriagebiet (Primorje): Halbinsel Peljesak (Sabioncello), Gegend von Ston (Stagno), auf Kalkgestein im lichten, immergrünen Buschwalde, c. 300 m.s.m. 3.VI.1931. legit Julius Baumgartner”. A note attached to the sheet indicates that the plants grow abundantly in large cushions. They turned out to be *G. dissimulata*.

A non identified specimen in Z+ZT, collected by J. Albrecht (Zugerberg, Canton of Zug, Switzerland), is labelled “Grimmia spec. CH, VD (Switzerland, Canton of Vaud), Rivaz [Lake of Geneva], Felsen Kalkgestein, 29.3.1959. leg. J. Albrecht, Zugerberg”. This specimen again is *G. dissimulata*.

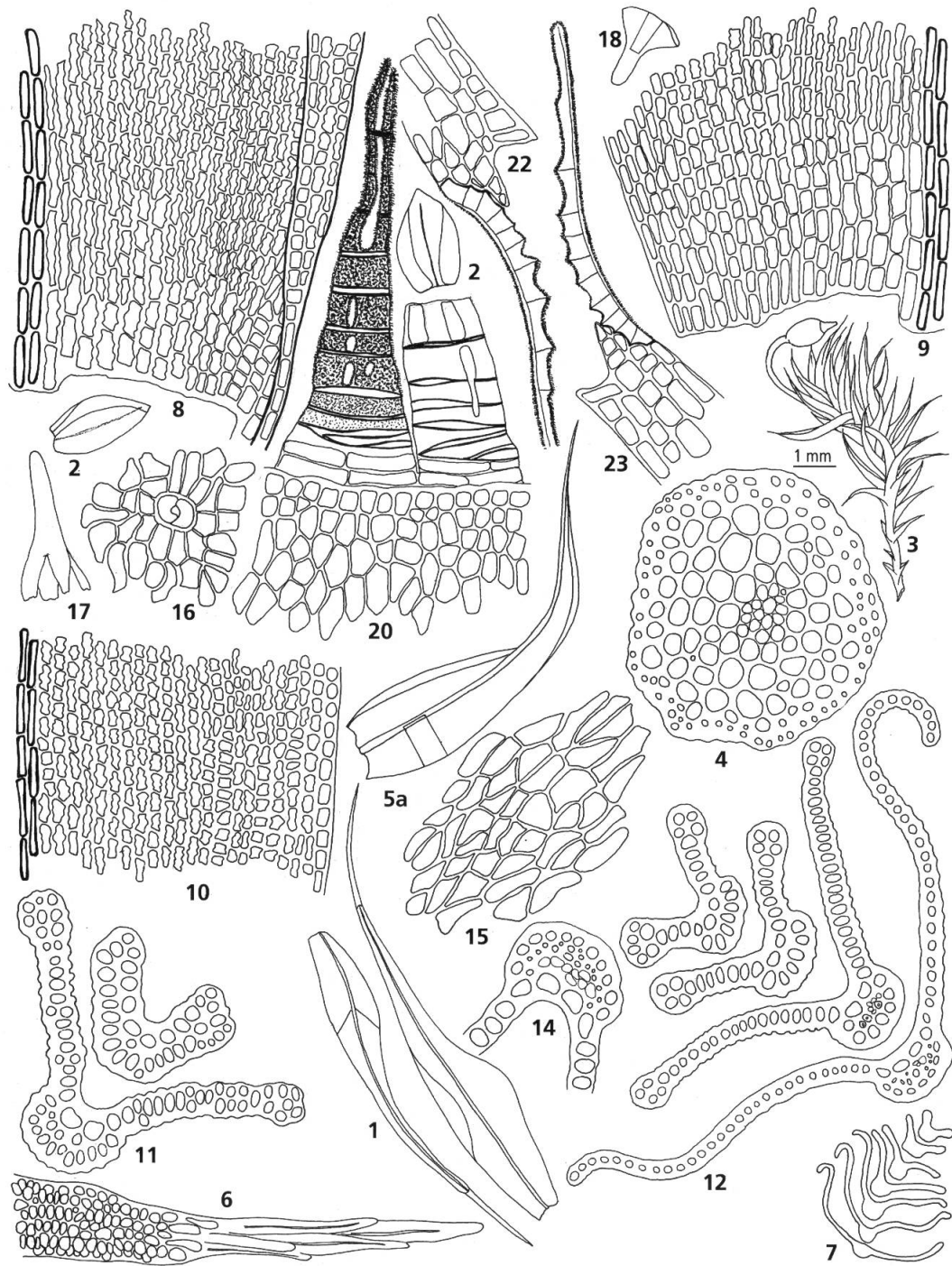
In 1996, the author found the species at the place indicated by J. Albrecht, on pudding-stone, and later on in the Rhone valley in the Canton of Valais, Switzerland. The plants show the same aspect with comal tufts developed on young shoots with leaves appressed to the stem as found by J. Albrecht and as they can be collected on limestone, rich in dolomite, in Rheinland-Pfalz (Western Germany). The northernmost occurrence is recorded for Westfalen (North-Western Germany), on limestone rocks, collected by F. Koppe as *G. trichophylla*.

DIXON (1912) found “*G. trichophylla* var. *lusitanica* Schp. in numerous localities about Caldas and Monchique... Solms-Laubach referred the Algarvian moss to *G. ancistrodes* Mont., which is Schimper’s *G. trichophylla* var. *meridionalis* [*G. ancistrodes* Durieu & Mont (Fig. 7.4-6) is a synonym of *G. lisae* (MUÑOZ & PANDO, 2000)], but Schimper considered it different and gave it the name *lusitanica*. The distinctive characters did not seem to us very obvious.” This text illustrates the uncertainty concerning the use of these names. It is just one typical example of many other comments on such collections and brings to light the somewhat controversial opinions of bryologists, in the past century, concerning the *G. lisae-trichophylla*-complex.

In addition the type specimens of *G. trichophylla* var. *teneriffae* Renaud & Cardot (PC), *G. azorica* Renaud & Cardot (PC, MO), *G. trichophylla* var. *subincurva* Winter, *G. pulvinata* var. *sardoa* Herzog (both JE), as well as type material of *G. subsquarrosa* Wilson (BM) were studied. All belong to taxa clearly distinct from *G. dissimulata*.

### Comparaison of the characters of the species under review

The descriptions of the vegetative part refer to sterile plants in humid condition, those of the growth form to dry specimens. Leaves are measured without hair-point, the seta from the rim of the vaginula (regardless of ochrea). The description of perichaetial and perigonal leaves refers to the innermost ones. The calyptra is included in the sporophyte description. Exothecium cells are drawn from the middle of the capsule. The descriptions conform to the following scheme:



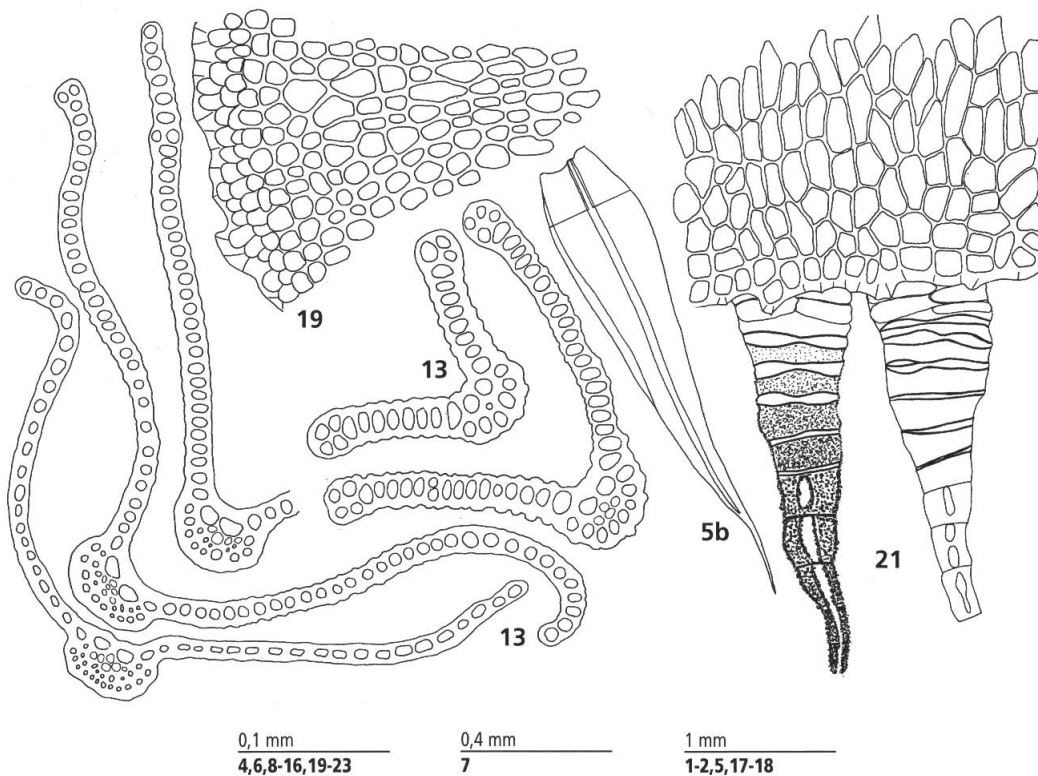


Fig. 1. – *Grimmia dissimulata* E. Maier: **1**, perichaetial leaves; **2**, perigonal leaves; **3**, plant with sporophyte; **4**, transverse section of stem; **5a**, leaf (the rectangle marks the area of Fig. 1.10), **5b**, leaf (the rectangle marks the area of Fig. 1.8-9); **6**, hair-point and leaf cells at apex; **7**, outlines of transverse sections of leaf; **8-9**, cells in leaf base; **10**, cells in transitional zone; **11-13**, transverse sections of leaf; **14**, transverse section of costa; **15**, exothecial cells; **16**, stoma; **17**, calyptra; **18**, operculum (the rectangle marks the area of Fig. 1.19); **19**, cells at margin of operculum; **20-21**, peristomes, outer side; **22-23**, longitudinal sections of peristome teeth.

[**1, 3, 20, 23**, Lübenau GR-RH 44; **2**, Bertram s.n.; **4-5, 10, 15-16**, Lübenau GR-K 35; **6**, Sauer A24; **7-8, 13**, Sauer A18; **9**, Hedderson 9585; **11, 17-19**, Hedderson 9746; **12**, Caspari 1458; **14**, Lübenau s.n.; **21-22**, Caspari s.n.]

**Gametophyte: sexual condition. Female:** perichaetial leaf, length, shape; male: perigonia, perigonal leaf, length, shape, paraphyses. **Growth form:** plant, stem. **Leaf:** length, disposition on stem in dry and wet state, shape; *leaf form in situ*; cell pattern in leaf base, in transitional zone, in laminal part; stratosity of leaf base and lamina. **Costa:** dorsal view, shape and architecture seen in transverse section.

**Sporophyte: seta:** form, length. **Capsule:** shape, exothecium cells, stomata. Calyptra. **Operculum:** shape, marginal cells. **Peristome:** annulus; insertion of peristome teeth, dorsal view, and longitudinal section of peristome tooth.

#### Spores.

*Diagnostic characters.*

*Comments.*

*Arguments.*

*Distribution:* the details given are based on the labels of the specimens examined.

*Habitat and substratum.*

*Ecology in SW Germany.*

*Specimens examined.*

For the descriptions, commonly used terms are taken from MAGILL (1990) and SMITH (1978). Some specified terms are defined as follows:

**Costa channelled:** shape on ventral side, described as “hollowed out like a gutter and semi-circular in transverse section” (MAGILL, 1990), specified here as widely channelled (Fig. 2.11a) or narrowly channelled (Fig. 2.11b).

**Costa rounded:** shape on dorsal side, specified here as widely rounded (Fig. 3.11a) or rounded (Fig. 3.11b).

**Hydroids** (“Begleiterzellen”, LORENTZ, 1868): thin-walled cells arranged between guide cells and stereids or substereids (observed in transverse section of leaves) (Fig. 1.14).

**Joint thickenings** (DEGUCHI, 1978): thickenings (observed in transverse section of leaves) at the leaf surface on both ends of longitudinal walls of lamina cells (Fig. 1.11).

**Lamina:** the upper part of a leaf as contrasted to the base (see there).

**Leaf base:** lowest part of a leaf as contrasted to the lamina. Base and lamina are not sharply delimited. Usually there is a transitional zone. This transition is generally the broadest part of the leaf. In this zone elongated cells of the leaf base with smooth or nodulose walls change to shorter cells of the lamina with mostly sinuose walls. In the same zone the elongated costa cells change to short cells.

**Leaf channelled:** with a groove formed by upturned margins (like a gutter), best observed in transverse section (Fig. 1.7).

**Leaf keeled:** disposition of the lamina halves relative to the leaf axis, the opening of angles expressed in degree of a circle, determined as widely keeled ( $>45^\circ$ ), keeled ( $\approx 45^\circ$ ), narrowly keeled ( $<45^\circ$ ), spreading ( $\approx 90^\circ$ ).

**Paracostal cells:** the innermost cells of leaf base along costa, differ in shape from neighbouring cells (Fig. 3.8).

**Trabeculae:** cross-bars formed from residual horizontal cell walls on the dorsal side of peristome teeth, specified here as wavy, broad (Fig. 1.20), small, thin (Fig. 4.16).

NOTE: attention should be paid to the differences in cell pattern of the leaf base according to the developmental stage of the plants. In general, strongly elongated basal paracostal cells may occur rather far below developing perigonia or perichaetia. The species under review in this study, may show at leaf insertion an enlarged costa resulting from the addition of a bistratose subcostal cell row, either at both sides or at one side only.

### 1. *Grimmia dissimulata* E. Maier (Fig. 1.1-23, 5.1-3).

**Gametophyte. Dioicous. Female:** Innermost perichaetial leaf (Fig. 1.1) 1.8-2.5 mm, scarcely or slightly sheathing up to broadest part at mid-leaf, this part being hyaline, costa weak in sheathing part, broad in chlorophyllous part, filling apical part, excurrent to a long, weakly and bluntly denticulate or nearly smooth hair-point; **male:** perigonia in multifoliate buds on stem tip or on short stalk, on branches or in leaf axils, occasionally several on a stem, innermost perigonial leaf (Fig. 1.2) 0.7 mm, sheathing, concave, broad, apex obtuse, hyaline in lower part, costa ending far below apex, paraphyses few. **Growth form:** cushion compact, adherent to substratum by rhizoids, young shoots originating from older stem parts, with appressed leaflets; plants erect (Fig. 1.3), up to 30 mm, branched; stem with thick-walled cells, central strand (Fig. 1.4) well developed and clearly defined. **Leaves** (Fig. 1.5) 1.9-2.5 mm, short at base of stem, well developed in comal tuft, loosely arranged around stem, erect or somewhat contorted when dry, older leaves quickly spreading when moistened, younger ones slowly so, erectopatent to patulous when wet; from ovate base lanceolate, tapering to acuminate apex, muticous or with weakly denticulate hair-point (Fig. 1.6) of variable length; propagule development occasionally on dorsal side of lower part of lamina, destroying the tissue but preserving costa; *leaf form in situ:*

(Fig. 1.7) channelled near insertion, keeled ( $\approx 45^\circ$ ) throughout, margin recurved at one side from insertion or lower part of leaf base up to upper part of lamina, if recurved on other side, then only weakly so; in leaf base few rows of rectangular paracostal cells (Fig. 1.8), other basal cells broad, short-rectangular of nearly the same length, walls thickened, more or less nodulose, occasionally smooth (Fig. 1.9), at margin some rows of nearly isodiametric cells with smooth walls, in transitional zone (Fig. 1.10) cells short-rectangular, walls sinuose, in lower part of lamina cells isodiametric, walls slightly sinuose, in upper part of lamina lumina rounded, rarely without joint thickenings; lamina unistratose, upper part of lamina occasionally in places bistratose (Fig. 1.11), margin of lamina in 1 or 2 rows of cells bistratose. **Costa**, seen on dorsal side, of nearly uniform width, scarcely weaker at insertion, percurring to hair-point; seen in transverse section (Fig. 1.12-13), costa on dorsal side at insertion and leaf base somewhat angulate or flat, in lamina prominent, rounded, on ventral side at leaf base widely channelled, in lamina channelled; at insertion, in leaf base and lower part of lamina 4 guide cells, in upper part of lamina 2 of them markedly enlarged, more rounded or elliptic, in apical part 2 guide cells, at leaf base a group of large hydroids, from transitional zone up to apical part enlarged to a band of hydroids (Fig. 1.14), between hydroids and dorsal cells a band of substereids, exterior cell walls of dorsal cells markedly thickened.

**Sporophyte.** *Seta* arcuate (Fig. 1.3), up to 5 mm, vaginula 1-1.2 mm, with ochrea. **Capsule** exerted, pendulous, ellipsoid, with short neck, after dehiscence scarcely constricted at orifice, with 8 not always clearly visible ribs, exothecial cells (Fig. 1.15) irregularly shaped, cell walls curved, stomata (Fig. 1.16) in neck, few or numerous. **Calyptra** (Fig. 1.17) mitrate, lobed, covering one fifth of capsule. **Operculum** (Fig. 1.18) conical, beak straight, long, margin hyaline (Fig. 1.19) of 2 or 3 rows of rounded cells, walls very thin, in conical part cells of various size, lumina mostly rounded, walls thick. Annulus of 3-4 rows of cells, revoluble, falling off as ring-like fragments. **Peristome** (Fig. 1.20-21) inserted at orifice level, teeth straight when dry, broad at base, lanceolate, in upper part split into 2 branches, in lower part longitudinally perforate, trabeculae in lower part very broad, wavy, in upper part small; seen in longitudinal section (Fig. 1.22-23) between exothecium and teeth 3 layers of cells; outer plates of tooth markedly thicker than inner ones, inner side covered with coarse papillae, lowest outer plates smooth, the 2 or 3 following covered with fine papillae, upper ones densely so with papillae becoming gradually stronger and sharper; trabeculae protruding.

**Spores** 10-15  $\mu\text{m}$ , rarely 18  $\mu\text{m}$ , smooth or finely granulose.

*Diagnostic characters.* – **Gametophyte:** in leaf base a few rows of rectangular paracostal cells, other basal cells broad, short-rectangular of nearly the same length, walls thickened, more or less nodulose, occasionally smooth. Costa in the basal part of leaf with 4 guide cells, hydroids, and a band of substereids, in upper part 2 guide cells markedly enlarged, exterior walls of dorsal cells strongly thickened. **Sporophyte:** trabeculae in lower part of peristome teeth very broad, wavy, papillae from above base up to tip becoming gradually stronger and sharper.

*Distribution.* – Cyprus; France; Germany; Great Britain; continental Greece and islands: Corfu, Crete, Naxos, Rhodos, Samos, Thasos; continental Italy and islands: Elba, Sicily; continental Spain and Mallorca; Morocco; Switzerland; Syria; Turkey; Yugoslavia.

*Habitat and substratum.* – Margin of small stream, riverbed dry or damp, near waterfall, garrigue, sunny rocks, rock crevices, boulders in arid grassland, limestone, dolomite, andesit, volcanic rocks in pine forest, shady areas. Nearly 70% of the specimens examined were collected on limestone or dolomite. At altitudes between 50 and 1300 m, in Cyprus, generally between 300 and 900 m.

*Ecology in SW Germany.* – On plane to concave surfaces of rocks and large boulders of dolomitic limestone and conglomerate rich in base or volcanic rock, frequently subject to occasional seepage, in open to slightly shaded situations, notably indifferent to aspect.

*Specimens examined.* – **One hundred and three**, the ones selected for the description are: **CYPRUS.** **Kyrenia:** “Kalkfelsen am Pass über Lapithos an der Strasse bei 400 m”, 10.V.1972, *Koppe 10.5.1972(1)* (G, STU); **Paphos:** “Road along Ezoussas below Ayia. Bed of the Ezoussas river and inflowing, steep walled stream; volcanic complex. Alt. 400 m”,



23.IV.1991, *Hedderson 9585* (BOL, G); “Kidhasi, Dhiazos river bed. Riverbed and adjacent meadows. Alt. 400 m”, 27.IV.1991, *Hedderson 9746* (BOL, G). **FRANCE. Charentes-Maritimes:** “Château d’Oléron, remparts”, 24.IV.1991, *Pierrot 91007* (G, Pierrot). **GERMANY. Rheinland-Pfalz:** “Trier-Saarburg. Dolomitreiche Kalkfelsen, Weinberge, 260 m”, IV.1993, *Caspari 1458* (Caspari, G); **Westfalen:** “Kreis Arnsberg, Hönnetal, trockene Massenkalkfelsen über Volkeringhausen”, 25.VII.1934, *F. Koppe & K. Koppe s.n.* (STU). **GREECE. Crete:** “Lassithi, Lassithi-Ebene bei Zeushöhle, 1010 m”, 12.IV.1995, *Lübenau GR-K 35* (G, Lübenau); **Rhodos:** “Profitis Ilias, bei ehemaligem Hotel Elafo. An Stein, 750 m”, 1.IV.1997, *Lübenau GR-RH 44* (G). **SPAIN. Malaga:** “Antiquera”, *Bertram s.n.* (Bertram, G). **SYRIA. Aleppo:** “Westliches Kalkgebirge, Karstlandschaft, alte Römerstrasse, auf überhöht verlegten Kalksteinquadern”, 5.VI.1998, *Lübenau s.n.* (G, Lübenau). **TURKEY. SW-Anatolia:** “Antalya, bei Kemer. An Steinen, ca. 500 m”, 21.III.1982, *Sauer A18* (G, SAAR); “Antalya, 15 km SE Kumluca. Pinus brutia-Wald, (Kalk?)felsen ca. 430 m”, 15.III.1982, *Sauer A24* (G, SAAR); **Prov. Mugla:** “Strasse Turuná-Bozburum. Kalkfelsen, ca. 500 m”, 22.IV.1995, *Caspari s.n.* (Caspari, G).

2. *Grimmia lisae* De Not., Muscol. Ital. Spic.: 15. 1837 (Fig. 2.1-20, 5.4-6).

**Typus:** “In collibus taurinensibus. leg. Lisa 1836”, *Lisa s.n.* (Lecto-: RO, lectotypified by MUÑOZ, 1999).

- = *Grimmia trichophylla* var. *brachycarpa* De Not., Syllab. Musc.: 250. 1838. **Typus:** “*Grimmia trichophylla brachycarpa* St. Barbara pr Cagliari 3/3 835”, *De Notaris s.n.* (Lecto-: RO, lectotypified by MUÑOZ & PANDO, 2000) (synonymised by MUÑOZ & PANDO, 2000) (Fig. 7.1-3).
- = *Grimmia sardoa* Müll. Hal., Syn. Musc. Frond. 1: 786. 1849. **Typus:** “Ad rupes in montanis Sardinia australis. a D. De Notaris”, *De Notaris s.n.* (Lecto-: RO, lectotypified by MUÑOZ, 1999) (synonymised by MUÑOZ, 1999) (Fig. 7.7-8).
- = *Grimmia ancistrodes* Durieu & Mont. in Ann. Sci. Nat. Bot. ser. 3, 12: 318. 1849. **Typus:** “*Grimmia ancistrodes* DR & Mgn. Algerie [sic!] Durieu”, *Durieu s.n.* (Lecto-: PC, lectotypified by MUÑOZ & PANDO, 2000) (synonymised by MUÑOZ & PANDO, 2000) (Fig. 7.4-6).

**Gametophyte. Dioicous. Female:** Innermost perichaetial leaf (Fig. 2.1) 1.9-3.2 mm, sheathing up to lower third of leaf or to mid-leaf, from ovate base lanceolate, upper part linear, subulate, lower third of leaf hyaline, costa in lower part weak, broad in upper part, excurving to bluntly denticulate hair-point; **male:** perigonia on stem tip in axils of branches as multifoliate buds on short stalk, innermost perigonal leaf (Fig. 2.2) 0.8-0.9 mm, sheathing up to above broadest part, ovate, tapering to acute apex, hyaline in lower part, costa ending below apex, paraphyses few. **Growth form:** cushion mostly disintegrating, adhering to substratum by rhizoids, young shoots originating from rotten plants; plants erect (Fig. 2.3), up to 35 mm, strongly branched; stem with central strand (Fig. 2.4) well defined, small, thin-walled. **Leaves** (Fig. 2.5-6) 1.8-2.7 mm, loosely arranged on stem, straight, apices of comal leaves slightly curved when dry, older leaves quickly bending backwards when moistened, younger ones slowly so, erectopatent to spreading or squarrose when wet; from ovate base lanceolate or broad-lanceolate, tapering to acute apex, mucicous or with bluntly denticulate hair-point (Fig. 2.7) of variable length; propagule development on dorsal side of leaf base; *leaf form in situ:* (Fig. 2.8) at insertion one side with weak plica, above leaf base widely keeled (>45°), in upper part of lamina keeled (≈45°), margin at one side recurved from insertion up to mid-leaf, occasionally slightly so at other side from transitional zone up to mid-leaf, in upper part of lamina both sides plane; basal cells (Fig. 2.9), besides some marginal cell rows, rectangular to elongate-rectangular, walls smooth or slightly nodulose, cells near margin isodiametric or rectangular, walls smooth, in transitional zone (Fig. 2.10) cells isodiametric, walls sinuose, in upper part of lamina lumina rounded, exterior cell walls smooth or with joint thickenings; leaf base unistratose, lamina unistratose, in upper part occasionally with bistratose cell rows or apical part partly bistratose, lamina margin with some bi- or tristratose cell rows. **Costa,** seen on dorsal side, of similar width, diminishing in apical part, percurving to hair-point; seen in transverse section (Fig. 2.11), costa on dorsal side at insertion and leaf base widely rounded, in lamina rounded; at insertion and leaf base on ventral side widely channelled, from upper part of lamina up to apex narrowly channelled, at insertion and leaf base 6 guide cells, occasionally 7 or 8, reduced in upper part of lamina to 4, in apical

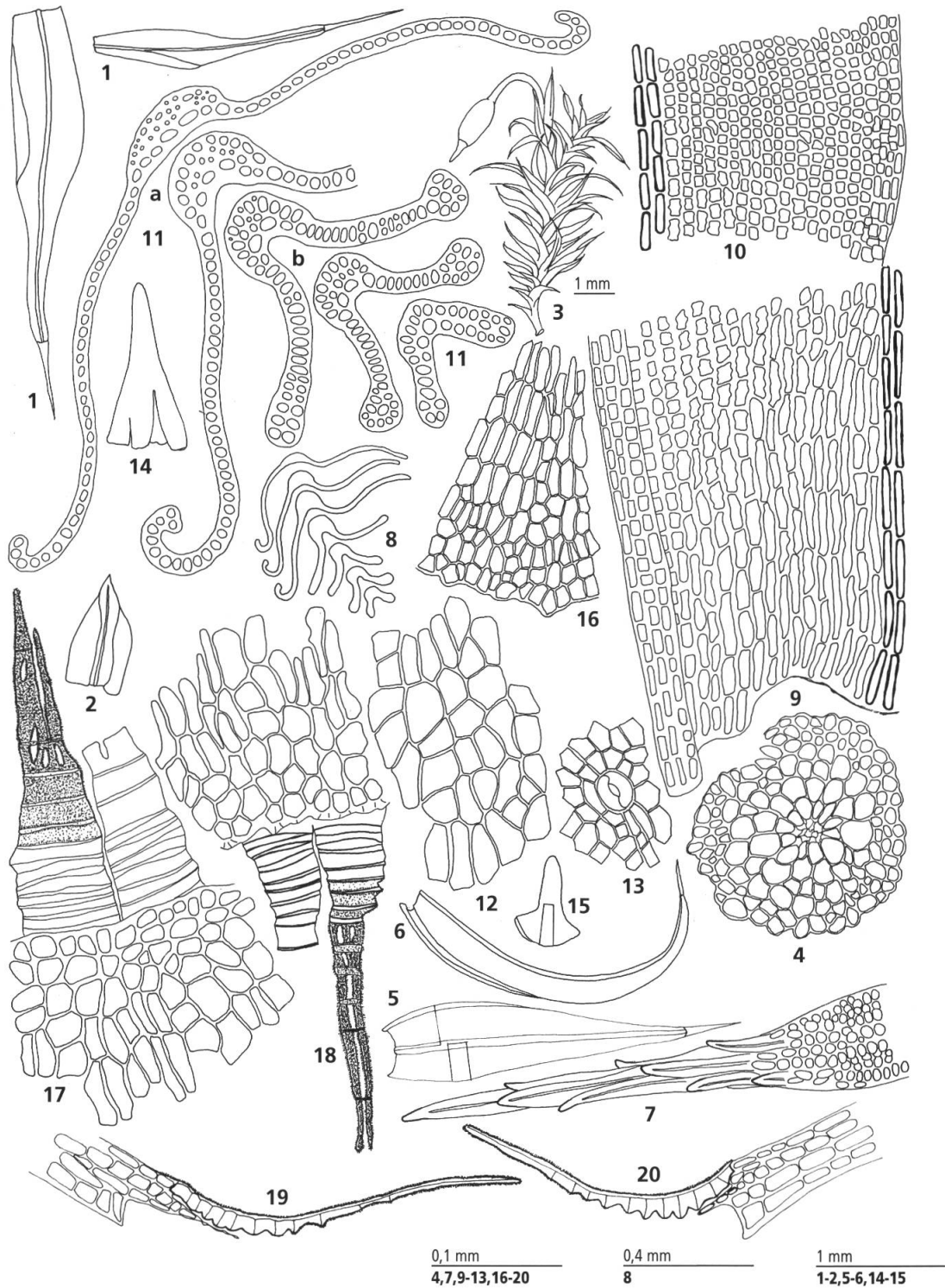


Fig. 2. – *Grimmia lisaе* De Not.: 1, perichaetial leaves; 2, perigonial leaf; 3, plant with sporophyte; 4, transverse section of stem; 5-6, leaves (the rectangles mark the area of Fig. 2.9-10); 7, hair-point and leaf cells at apex; 8, outlines of transverse sections of leaf; 9, cells in leaf base; 10, cells in transitional zone; 11, transverse sections of leaf, 11a, costa widely channelled, 11b, costa narrowly channelled; 12, exothecial cells; 13, stoma; 14, calyptra; 15, operculum (the rectangle marks the area of Fig. 2.16); 16, cells at margin of operculum; 17-18, peristomes, outer side; 19-20, longitudinal sections of peristome teeth.

[1, 5, 13, 15-16, Lübenau s.n.; 2, Sauer A68; 3, Geissler 138; 4, Caspari 5941; 6-7, Nebel 169; 8, 11, Caspari 4359; 9, Sauer B23; 10, Sauer A77; 12, 17, Hedderston 9551; 14, 18-20, Lüth 1811]

part to 2 guide cells, a median band of substereids throughout, no hydroids besides a small median group at insertion and in leaf base in rare cases.

**Sporophyte.** *Seta* (Fig. 2.3) arcuate, when dry nearly straight, up to 4.8 mm, vaginula 1.2 mm. *Capsule* exerted, pendent, ellipsoid, with short neck, after dehiscence constricted at orifice, shrivelled, weakly ribbed, exothecial cells (Fig. 2.12) variable in shape, nearly isodiametric cells mixed with rectangular ones, stomata (Fig. 2.13) numerous at neck. *Calyptra* (Fig. 2.14) mitrate, covering upper one fourth of capsule. *Operculum* (Fig. 2.15) conical, beak up to 0.6 mm, straight, margin (Fig. 2.16) uneven, 2 marginal rows of angulate cells, in conical part elongate-hexagonal, thin-walled. Annulus of 3-4 rows of cells, revoluble, falling off as ring-like fragments. *Peristome* (Fig. 2.17-18) inserted at or slightly below orifice, teeth straight when dry, lanceolate, broad at base, upper half split into 2 branches, somewhat perforated, trabeculae broad, in uppermost part small; seen in longitudinal section (Fig. 2.19-20) between exothecium and teeth 2 layers of cells and a paradental uniseriate prolongation of 2 cells; outer plates of teeth thicker than inner ones, inner side densely covered with papillae, lower third of outer side smooth, followed by three plates covered with fine papillae, upper third densely covered with prickly papillae; trabeculae strongly protruding, neared, in upper third weakly expressed.

**Spores** 14-17  $\mu\text{m}$ , granulose.

*Diagnostic characters.* – **Gametophyte:** leaves loosely arranged on stem, not contorted; cells in leaf base short, rectangular; costa broad, at insertion 6 guide cells. **Sporophyte:** operculum with long, straight beak. Characteristic papillosity of peristome teeth.

*Comments.* – Comparison of the specimens examined with the type specimen of *G. lisae* shows correspondence of leaf shape (Fig. 5.4), cell pattern in leaf base (Fig. 5.5), and costa architecture (Fig. 5.6).

*Arguments for synonymies.* – The type specimen of *G. trichophylla* var. *brachycarpa* shows correspondence of leaf shape (Fig. 7.1), cell pattern in leaf base (Fig. 7.2), and costa architecture (Fig. 7.3) with the type specimen of *G. lisae*.

The type specimen of *G. sardoa* shows correspondence of costa architecture (Fig. 7.7) with the type specimen of *G. lisae*.

The type specimen of *G. ancistrodes* shows correspondence of leaf shape (Fig. 7.4), cell pattern in leaf base (Fig. 7.5), and costa architecture (Fig. 7.6) with the type specimen of *G. lisae*.

*Distribution.* – Cyprus; France; Germany; Great Britain; continental Greece and islands: Crete, Ikaria, Lesbos, Naxos, Patmos, Rhodos, Thasos; continental Italy and islands: Ischia, Lipari, Sardinia; Portugal and Madeira; continental Spain and islands: Gran Canaria, Gomera, Tenerife; Switzerland; Turkey.

*Habitat and substratum.* – Pinus forest, gorges, dry grassland, near river, macchia, vineyards, exposed, shaded or humid rocks, rock crevices, volcanic rocks, basalt, andesite, granite. Rarely on limestone. At altitudes between 100 and 800 m, at high altitudes in Madeira and Tenerife.

*Ecology in SW Germany.* – On plane to concave rock walls and large boulders of neutral to slightly acidic conglomerate, volcanic rock and schist, occasionally in the inundation zone of creeks and rivers or otherwise subject to irrigation, in open to deeply shaded situations with a W, S or E aspect.

*Specimens examined.* – **One hundred and ninety-six**, the ones selected for the description are: **CYPRUS.** Paphos: "Road along Ezoussas below Ayia. Volcanic complex. Alt. 400 m", 23.IV.1991, *Hedderston 9551* (BOL, G). **FRANCE.** Provence: "Banyuls. Macchia, 180 m", 11.III.1970, *Geissler 138* (G); **Var:** "Montagne de Roquebrune bei le Muy. Silikatfelsen", 8.IX.1975, *Sauer B23* (G, SAAR). **GERMANY.** Rheinland-Pfalz: "Kreis Bad Kreuznach. Andesit-Felskuppe im Nahetal E Norheim, S-exp., 130 m", 30.XII.1998, *Caspari 5941* (Caspari, G); "Kreis Birkenfeld. Andesitfelsen am Heinzberg E Idar-Oberstein, W-exp., 340 m", 26.XI.1996, *Caspari 4359* (Caspari, G). **GREECE:** Crete: "Chania, NW Epanochori. Nasse, schattige Felswand in Bachseitental, Silikatgestein, 950 m", 5.IV.1997, *Lüth 1811* (G, Lüth); **Naxos:** "Kronos-Massif, Berg Mavrovouni, Nord exponierter Hang, geschützte Felsnische nahe dem Gipfel, auf Feinerde, basenreiches Silikatgestein, 890 m", 15.V.1996, *Nebel 169* (G, STU). **ITALY.** Ischia: "Mt. Trippodes, ca. 500 m", 30.IV.1973, *Lübenau s.n.* (G, Lübenau). **TURKEY.** Aydin: "Zwischen Çine und dem Göbkel-Pass. Feuchte Felsen an Bachrand,

Granit, ca. 450 m”, 9.III.1989, *Sauer A68* (G, SAAR); **Izmir**: “Karaburun. Küstenfelsen, Silikat, ca. 10 m”, 12.IV.1992, *Sauer A77* (G, SAAR).

3. *Grimmia meridionalis* (Müll. Hal.) E. Maier, **stat. nov.** (Fig. 3.1-19).

≡ *Grimmia trichophylla* var. *meridionalis* Müll. Hal., Syn. Musc. Frond. 1: 785. 1849.  
 ≡ *Grimmia trichophylla* subsp. *meridionalis* (Müll. Hal.) Loeske in Biblioth. Bot. 101: 171. 1930. **Typus**: “In coll. siccis prope Granatam. Schpr. lgt.”, *Schimper s.n.* (Lecto-: H-SOL, lectotypified by MUÑOZ, 1999) (Fig. 6.1-3).

= *Grimmia sardoa* var. *gracilis* Warnst. & M. Fleisch. in Bot. Centralbl. 65: 299. 1896.  
**Typus**: “*Grimmia sardoa* De Not var. *gracilis* Warnst. et Flschr. [Italy] Romano: Monti Albani, Mt. Cavo an Lavafelsen. 900 m. 7.6.1895 leg. M. Fleischer”, *Fleischer s.n.* (Lecto-: FH, lectotypified by MUÑOZ, 1999; isolecto-: GOET, PC, Z + ZT) (Fig. 6.4-6) (**syn. nov.**).

**Gametophyte. Dioicous. Female**: Innermost perichaetial leaf (Fig. 3.1) 1.5-2 mm, sheathing up to two third of leaf length, from broad ovate leaf base restricted to short, linear apical part, hyaline up to mid-leaf, costa weak in hyaline part, stronger in apical part, excurrent to elongated, bluntly denticulate, slightly decurrent hair-point; **male**: perigonia in separate cushions or mixed to fruiting plants, as small buds at tip of stem on short stalks in leaf axils, innermost perigonal leaf (Fig. 3.2) 0.9 mm, slightly sheathing, concave, broadly ovate, tapering to acute apex, hyaline up to broadest part of leaf, costa stout, ending below apex, paraphyses few. **Growth form**: cushion dense, adhering to substratum by rhizoids, interwoven with young shoots, leaflets loosely arranged on stem; plants erect (Fig. 3.3), up to 30 mm, slightly branched, leaves markedly arranged in tiers; stem with central strand (Fig. 3.4) in thick-walled tissue, well defined, small. **Leaves** (Fig. 3.5) up to 2 mm, at base of tier short, becoming longer up to base of following tier, crowded, loosely arranged on stem when dry, slowly bending backwards when moistened, patent to erectopatent when wet, apices of comal leaves curved backwards; from ovate, slightly narrowed leaf base lanceolate, tapering to acute apex, hair-point (Fig. 3.6) of different length, bluntly denticulate; propagule development very rare on dorsal side of leaf base; **leaf form in situ**: (Fig. 3.7) channelled at insertion and leaf base, widely keeled (>45°) in lower part of lamina, keeled (≈45°) in upper part, margin at one side recurved from insertion up to upper part of lamina, at other side from mid-leaf up to upper part of lamina, in apical part both sides plane; basal cells (Fig. 3.8), besides some rows near margin, elongate-rectangular, thick-walled, nodulose, near margin 3-4 rows of rectangular smooth-walled hyaline cells, gradually vanishing above broadest part of leaf, in transitional zone (Fig. 3.8) cells rectangular, walls strongly sinuose, some rows at margin isodiametric, lumen of lamina cells rounded, with joint thickenings; leaf base and lamina unistratose, incomplete bistratose (Fig. 3.9) occasionally appear in apical part, in lamina 1 or 2 marginal cell rows bistratose. **Costa**, seen on dorsal side, of uniform width, percurrent to hair-point; seen in transverse section (Fig. 3.10-11), costa on dorsal side at insertion widely rounded, flattened, rounded up to apex, from insertion up to lower part of lamina widely channelled on ventral side, in upper part of lamina narrowly channelled; at insertion and leaf base 4 guide cells, from transitional zone up to apex 2 small elliptic guide cells of which the longer axes form an angle (Fig. 3.11c, 6.3, 6.6), a central group of small hydroids, vanishing in apical part, between dorsal cells and hydroids a band of substereids with very narrow lumen.

**Sporophyte. Seta** (Fig. 3.3) arcuate, straight after dehiscence, up to 5 mm, vaginula 0.7-1 mm. **Capsule** before maturity hidden in cushion, subglobose to ellipsoid, pendent, with short, marked neck, smooth, after dehiscence shrivelled, ribbed, somewhat narrowed at orifice, exothecial cells (Fig. 3.12) elongated, mostly pentagonal, stomata (Fig. 3.13) numerous in neck. **Calyptra** mitrate (Fig. 3.14), lobed, covering one fourth of capsule, fugaceous. **Operculum** (Fig. 3.15) conical, rostrate, beak straight, margin (Fig. 3.16) smooth, a marginal row of oval cells, in conical part cells of various shape, mostly angulate, thick-walled. Annulus of 3-4 rows of cells, revoluble, falling off as ring-like fragments. **Peristome** (Fig. 3.17-18) inserted at orifice or just below, teeth slightly spreading when dry, lanceolate, entire or in upper half split into 2 branches,

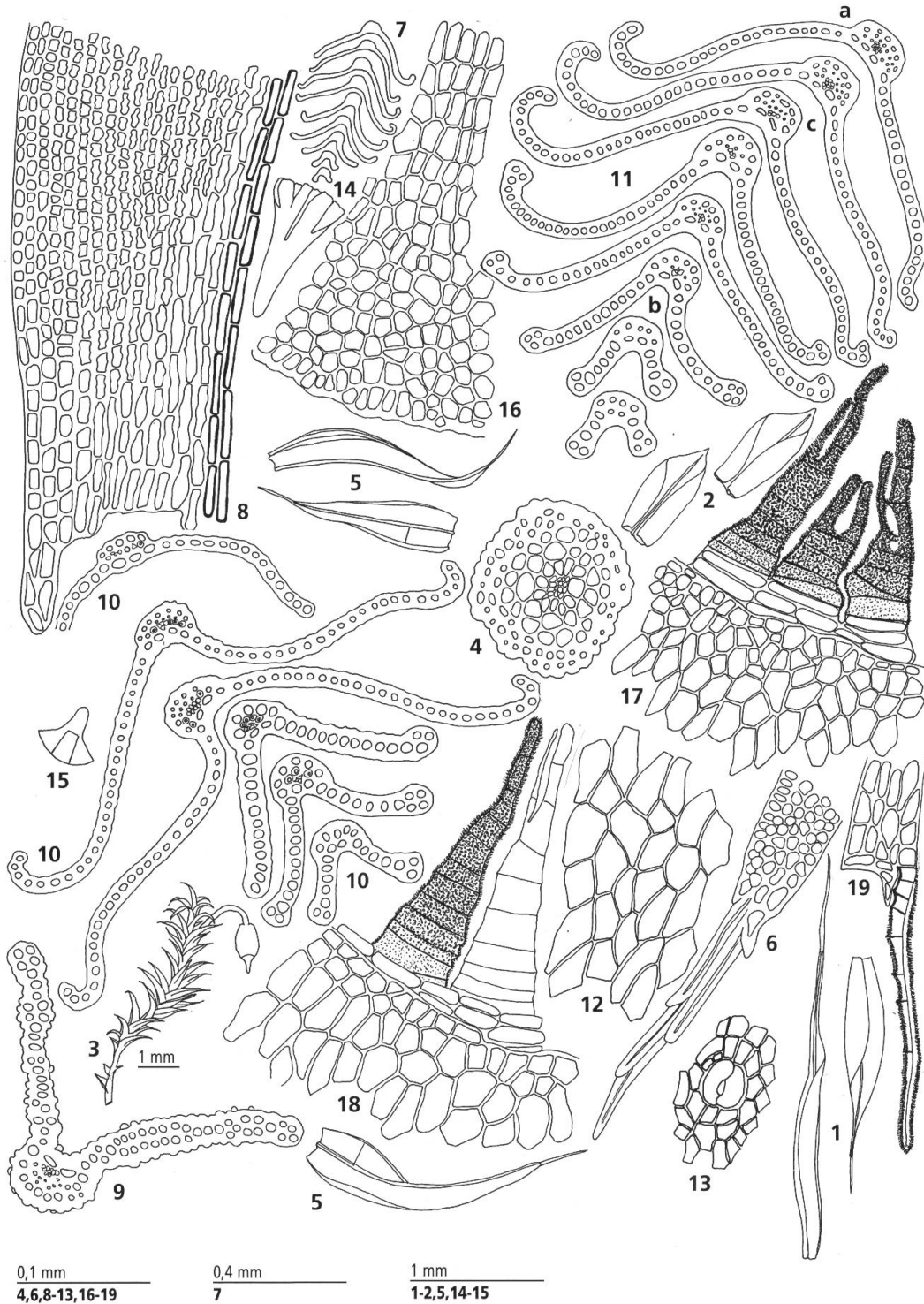


Fig. 3. – *Grimmia meridionalis* (Müll. Hal.) E. Maier: 1, perichaetial leaves; 2, perigonal leaves; 3, plant with sporophyte; 4, transverse section of stem; 5, leaves (the rectangle marks the area of Fig. 3.8); 6, hair-point and leaf cells at apex; 7, outlines of transverse sections of leaf; 8, leaf base with transitional zone; 9, transverse sections of leaf, bistratose; 10–11, transverse sections of leaf, 11a, costa widely rounded, 11b, costa rounded, 11c, distinctly elliptic guide cells; 12, exothecial cells; 13, stoma; 14, calyptra; 15, operculum (the rectangle marks the area of Fig. 3.16); 16, cells at margin of operculum; 17–18, peristomes, outer side; 19, longitudinal section of peristome tooth.

[1, 3, 15–17, 19, Lübenau 2; 2, Maier 10754; 4–5, 7, 11–13, Lübenau 9; 6, 8, 10, Maier 10299; 9, Koppe 1; 14, Culmann s.n.; 18, Hedderson 9625]

trabeculae thin throughout; seen in longitudinal section (Fig. 3.19) between exothecium and teeth 2-3 layers of cells; outer plates of teeth thicker than inner ones, inner side densely covered with coarse papillae, outer side of teeth smooth at base, the following 2 or 3 plates papillose, all others densely covered with coarse prickles; trabeculae at base neared, protruding, above distant, weakly expressed.

**Spores** 14-18  $\mu\text{m}$ , granulose.

**Diagnostic characters.** – **Gametophyte:** besides some rows of hyaline cells near margin, basal cells elongate-rectangular, walls thick, nodulose; in transitional zone cells rectangular, walls strongly sinuose. Costa from transitional zone up to apex with 2 small elliptic guide cells of which the longer axes form an angle (Fig. 3.11c, 6.3, 6.6). **Sporophyte:** coarse papillae of outer cell plates.

**Comments.** – Comparison of the specimens examined with the type specimen of *G. trichophylla* var. *meridionalis* shows correspondence of leaf shape (Fig. 6.1), cell pattern in leaf base (Fig. 6.2), and costa architecture (Fig. 6.3).

**Arguments in favor of the elevation of *G. trichophylla* var. *meridionalis* Müll. Hal. to the specific rank.** – Neither the specific characters of the gametophyte nor of the sporophyte show any correspondence with those of *G. trichophylla*. The strongly nodulose cell walls in the leaf base (Fig. 6.2) and the rectangular cells with the markedly sinuose walls in the transitional zone (Fig. 6.2) are different from the elongated smooth-walled cells in the leaf base (Fig. 5.8) and the short-rectangular cells in the transitional zone (Fig. 4.9) of the leaf of *G. trichophylla*. Transverse section (Fig. 6.3) of the costa show a small group of hydroids nearly throughout, whilst the costa of *G. trichophylla* (Fig. 5.9) is composed of nearly homogeneous cells. The coarse prickles covering nearly completely the outer side of the peristome teeth (Fig. 3.17-19) are in sharp contrast to the papillosity of the teeth of *G. trichophylla* (Fig. 4.16-19) which are smooth in the lower part and covered with fine papillae in upper part. *Grimmia trichophylla* var. *meridionalis* is definitely an autonomous taxon. It is at least as different from *G. trichophylla* as some other closely related and generally accepted species of *Grimmia* are from each other (e.g. *G. elongata* and *G. incurva*). Consequently it deserves specific rank as *G. meridionalis* rather than being a mere synonym of *G. trichophylla* as proposed by MUÑOZ (1999).

**Arguments for synonymy.** – The type specimen of *G. sardoa* var. *gracilis* shows correspondence in leaf shape (Fig. 6.4), cell pattern at lower part of leaf (Fig. 6.5), and costa architecture (Fig. 6.6) with the type specimen of *G. trichophylla* var. *meridionalis* (Fig. 6.1-3). Consequently it is justified to see *G. sardoa* var. *gracilis* as being synonymous to *G. meridionalis* and not to *G. trichophylla* as proposed by MUÑOZ (1999).

**Distribution.** – Cyprus; France: Corsica; Germany; continental Greece and islands: Crete, Ikaria, Lesbos, Naxos, Patmos, Rhodos, Samos, Santorini; continental Italy and islands: Lipari, Sicily; Morocco; Portugal and Madeira; continental Spain and islands: Gran Canaria, Tenerife; Turkey.

**Habitat and substratum.** – Temporary streambed, gorges, near sources and streams, arid grassland, pinus forest, rock crevices, rocks, sand, sunny and shady places, on granit, volcanic rocks, weathered gabbro, andesite, rarely on limestone. At altitudes between sea level and 1700 m in Madeira, in general between 300 and 900 m.

**Ecology in SW Germany.** – On convex surfaces of neutral to slightly acidic volcanic rocks in warm and open situations with a SW to SE aspect, always well far from even occasional seepage.

**Specimens examined.** – **One hundred and thirteen**, the ones selected for the description are: **CYPRUS. Limasol:** “Troodos-Gebirge, Schlucht 0,5 km südl. Prodromos, Gestein, 1500 m”, 3.V.1972, *Koppe 1* (G, STU); **Nicosia:** “Ayia Irini. Weathered gabbro and diorite; Pinus brutia and Cistus creticus on margin of fields. Alt. 550 m”, 26.IV.1991, *Hedderston 9625* (BOL, G). **GERMANY. Rheinland-Pfalz:** “Idar-Oberstein, Naheschleife, Steine in besonntem Trockenrasen, Gestein: Basen ausgelaut”, 13.IV.1996, *Maier 10754* (G); “Niederalfen, NSG Mittagfels; Felsen in Trockenrasen, Andesit, 220 m”, 18.III.1996, *Maier 10299* (G). **ITALY:** “Pozzi di S. Romolo bei Lastra di Signe bei Florenz 270 m”, 2.IV.14., *Culmann s.n.* (Z+ZT); **Lipari:** “Anstieg zum Obsidianstrom d. Rocce Rossi”, 8.IV.1968, *Lübenau 17* (G, Lübenau);

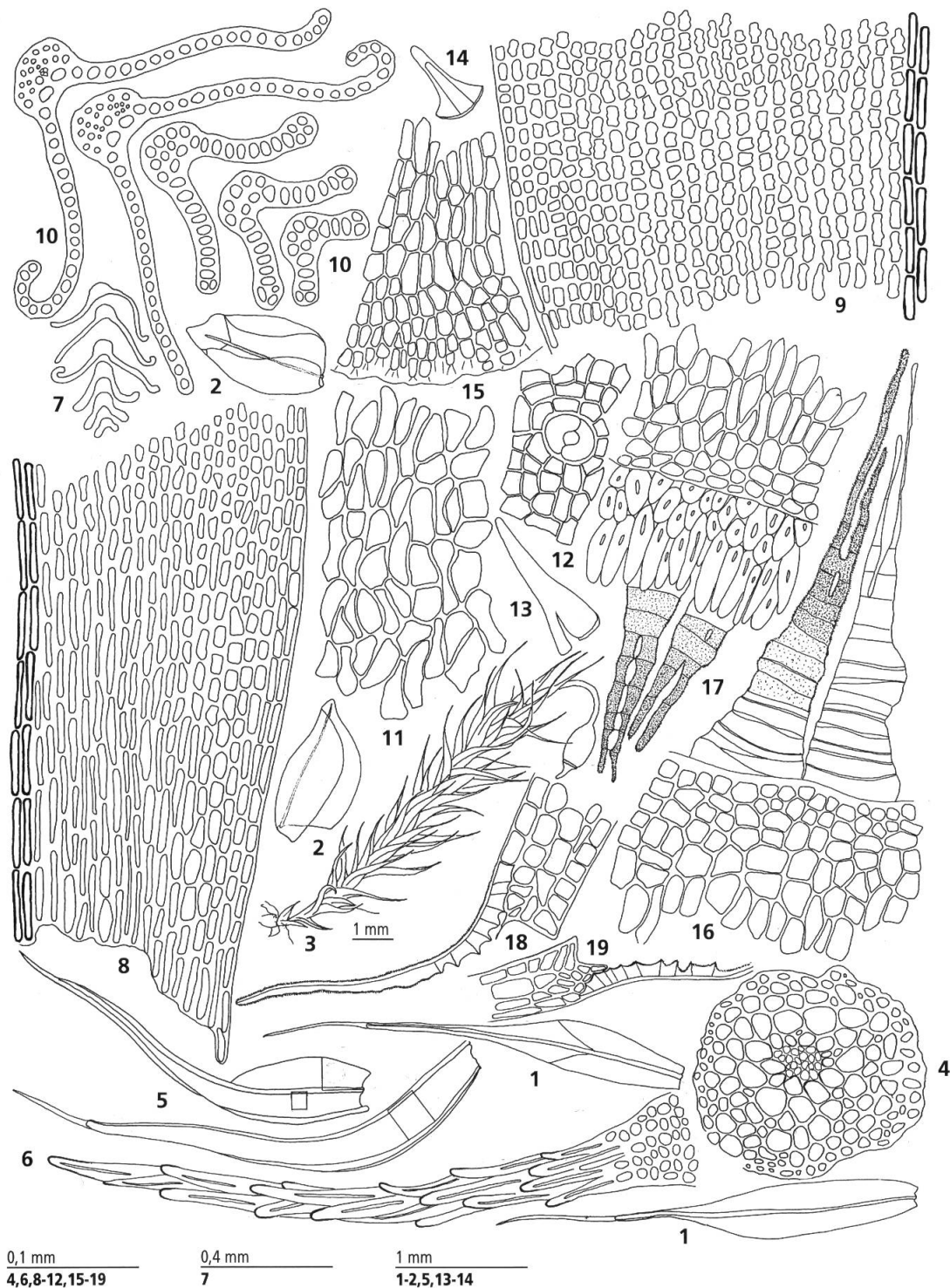


Fig. 4. – *Grimmia trichophylla* Grev.: 1, perichaetial leaves; 2, perigonal leaves; 3, plant with sporophyte; 4, transverse section of stem; 5, leaves (the rectangles mark the area of Fig. 4.8-9); 6, hair-point and leaf cells at apex; 7, outlines of transverse sections of leaf; 8, cells in leaf base; 9, cells in transitional zone; 10, transverse sections of leaf; 11, exothecial cells; 12, stoma; 13, calyptra; 14, operculum (the rectangle marks the area of Fig. 4.15); 15, cells at margin of operculum; 16-17, peristomes, outer side; 18-19, longitudinal sections of peristome teeth.

[1, 9, 11-12, 14-15, 17, 19, Lauer P11794; 2, Meinunger 22556; 3, Maier 7828; 4, 7, 10, Caspari s.n.; 5-6, 8, 18, s.coll. s.n.; 13, 16, herb. Hooker.]

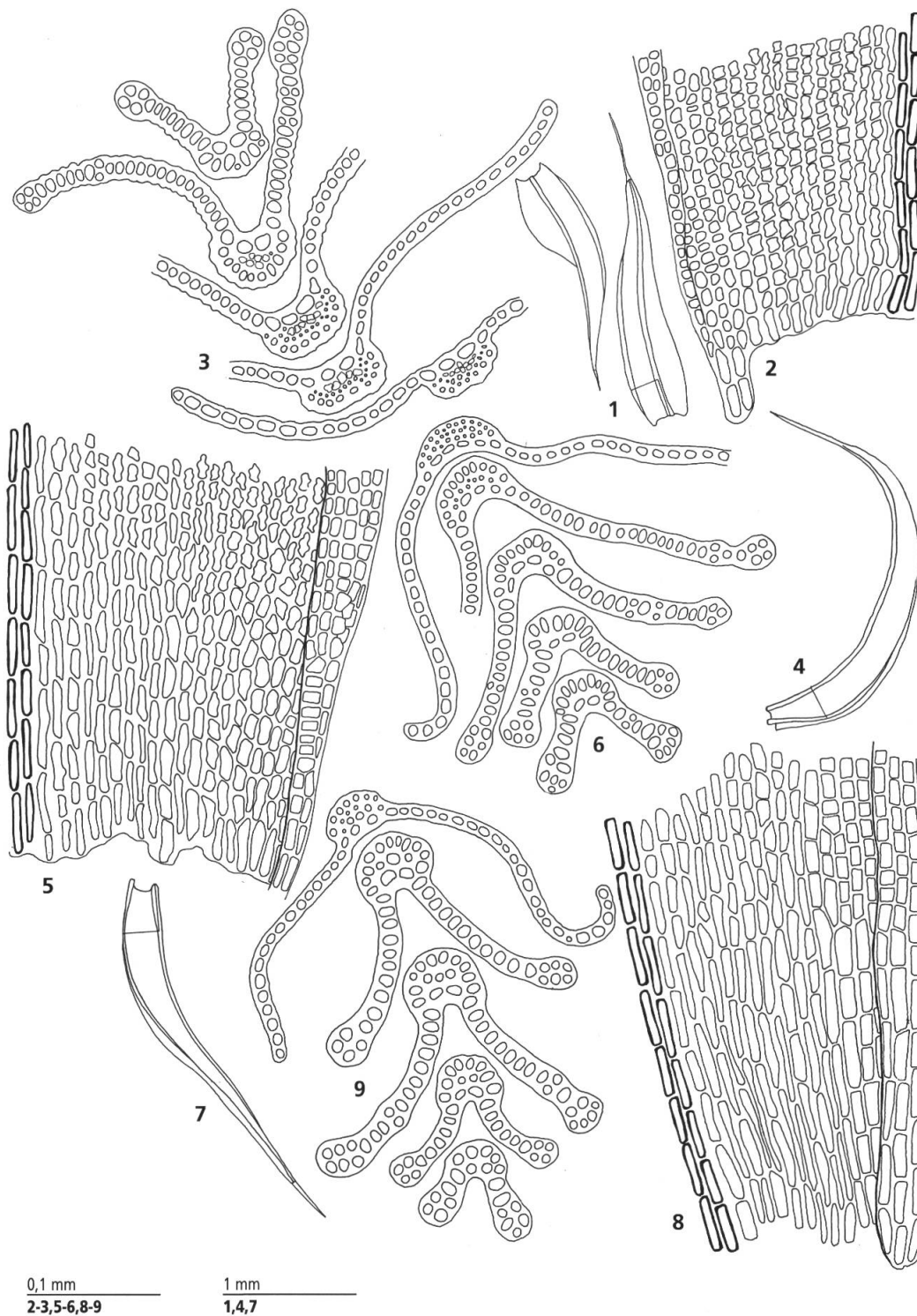


Fig. 5. – Analysis of the type specimens. *Grimmia dissimulata* E. Maier: **1**, leaves (the rectangle marks the area of Fig. 5.2); **2**, cells in leaf base; **3**, transverse sections of leaf. *Grimmia lisae* De Not.: **4**, leaf (the rectangle marks the area of Fig. 5.5); **5**, cells in leaf base; **6**, transverse sections of leaf. *Grimmia trichophylla* Grev.: **7**, leaf (the rectangle marks the area of Fig. 5.8); **8**, cells in leaf base; **9**, transverse sections of leaf.

[**1-3**, *F. Koppe* 10.5.1972(1); **4-6**, *Lisa s.n.*; **7-9**, *Greville s.n.*]



“Monte Ospedale; Lava. ca. 380 m”, 11.IV.1968, *Lübenau 9* (G, Lübenau); “Fossa del Valle, zw. S. Margerita u. Lipari; Schlucht”, 12.IV.1968, *Lübenau 2* (G, Lübenau).

4. *Grimmia trichophylla* Grev., Fl. Edin.: 235. 1824 (Fig. 4.1-19, 5.7-9).

**Typus:** “*Grimmia trichophylla* Grev. fl. Scot. de Greville 1822”, *Greville s.n.* (Lecto-: E, lectotypified by GEISSLER & MAIER, 1995).

**Gametophyte. Dioicous. Female:** Perichaetial leaves (Fig. 4.1) 2-2.5 mm, sheathing up to mid-leaf, suddenly narrowed to linear upper part, subulate, lower half of leaf hyaline, costa in hyaline part weak, in upper part strong, excurring to weakly denticulate hair-point; **male** plants in separate cushions, perigonia numerous at stem in leaf axils, in multifoliate buds on short stalks, innermost perigonial leaf (Fig. 4.2) sheathing, very large, concave, tubulose, apex obtuse, hyaline up to apical part, costa weak, ending far below apex, paraphyses few. **Growth form:** cushion lax, disintegrating easily, plants erect (Fig. 4.3), up to 30 mm, branched, rhizoids at base of stem; stem with central strand (Fig. 4.4) well developed, clearly defined. **Leaves** (Fig. 4.5) up to 2.7 mm, imbricate, loosely and spirally arranged on stem when dry, bending quickly backwards when moistened, erectopatent when wet; from narrow leaf base elongate-lanceolate, tapering to acute apex, hair-point (Fig. 4.6) of variable length, faintly denticulate; propagule development on dorsal side of leaf base; **leaf form in situ:** (Fig. 4.7) at insertion and leaf base one side slightly plicate, in lower part of lamina keeled ( $\approx 45^\circ$ ), in upper part of lamina narrowly keeled ( $< 45^\circ$ ), margin recurved at one side from insertion up to below mid-leaf; basal paracostal cells (Fig. 4.8) elongate-rectangular, walls straight, smooth or, rarely, faintly nodulose, towards margin shorter, at margin 2 rows of rectangular, hyaline cells, ending at broadest part of leaf, in transitional zone (Fig. 4.9) cells short-rectangular, walls more or less sinuose, in upper part of lamina cells (Fig. 4.6) isodiametric, lumina rounded; leaf base unistratose, lamina unistratose, rarely some cell rows bistratose, in apical part some cell rows bistratose, some marginal cell rows bi-rarely tristratose. **Costa**, seen on dorsal side, of almost uniform width, slightly weaker at insertion; seen in transverse section (Fig. 4.10), costa on dorsal side rounded, on ventral side in leaf base widely channelled, in lamina narrowly channelled; from insertion up to upper part of lamina 4 guide cells, at insertion and leaf base are added dorsally and arranged in a second layer 1, 2, or occasionally 3 slightly smaller cells than guide cells (Fig. 4.10, 5.9), from upper part of leaf up to apex 2 guide cells, besides a median group of smaller cells vanishing in apical part costa cells are nearly homogeneous, at mid-leaf some hydroids, stereids or substereids, often asymmetrically arranged, may be observed occasionally.

**Sporophyte. Seta** arcuate (Fig. 4.3), up to 5 mm, vaginula 0.8-1 mm. **Capsule** exerted, pendent, ellipsoid, when mature with 8 ribs, exothecial cells (Fig. 4.11) elongated, penta- or hexagonal or of various shape, walls curved, thin, 2 rows of stomata (Fig. 4.12) in short neck. **Calyptra** conico-mitrate (Fig. 4.13), lobed at base, covering operculum and annulus. **Operculum** (Fig. 4.14) rostrate, beak oblique, rarely straight, margin (Fig. 4.15) uneven, a marginal row of rounded cells, in conical part elongated cells, lumen rounded, walls thickened. Annulus of 3-4 rows of cells, persistent or detaching in small fragments. **Peristome** (Fig. 4.16-17) inserted below orifice, teeth straight when dry, lanceolate, in upper half split into 2 or 3 fine branches, trabeculae small in lower half, thin in upper half; seen in longitudinal section (Fig. 4.18-19) between exothecium and teeth 2-3 layers of cells; outer plates of teeth thicker than inner ones, inner side densely covered with fine papillae, outer side smooth in lower third, the following plates sparingly covered with fine papillae, upper half of teeth densely covered with lesser fine papillae; trabeculae protruding in lower half, in upper half weakly expressed, distant.

**Spores** 10-14  $\mu\text{m}$ , very finely granulose.

**Diagnostic characters.** – **Gametophyte:** basal paracostal cells elongate-rectangular, at margin of leaf base a row of elongate-rectangular, hyaline cells. At insertion and leaf base costa dorsally with a second layer of 1, 2 or 3 slightly smaller cells than guide cells (Fig. 4.10, 5.9), costa cells in lamina nearly homogeneous. **Sporophyte:** papillosity of peristome teeth.

*Comments.* – Comparison of the specimens examined with the type specimen of *G. trichophylla* shows correspondence of leaf shape (Fig. 5.7), cell pattern in leaf base (Fig. 5.8), and costa architecture (Fig. 5.9).

NOTE: In MAIER & GEISSLER (1995) the Fig. 18.b, d-f belong to *G. lisae* (MUÑOZ, 1999).

*Distribution.* – France; Germany; Great Britain; continental Greece and Naxos; continental Italy and Sardinia; Portugal.

*Habitat and substratum.* – Forest in gorges, erratic boulders, blocks in dry grassland, in shady places, exclusively on siliceous substratum. At altitudes between 200 and 700 m.

*Ecology in SW Germany.* – On slightly to strongly acidic stones, boulders and various rock surfaces of sandstone, conglomerate, schist, quartzite and volcanic rock, mostly in, but not confined to shaded situations, indifferent to aspect but rarely at open sunny slopes, usually not subject to seepage.

*Specimens examined.* – **Seventy-one**, the ones selected for the description are: **FRANCE. Vosges:** in rupib. arenac. Vogesi. Vere”, *Herb. Hooker.* (BM, G). **GERMANY. Baden:** 17.V.1889, *s.coll. s.n.* (G); **Bayern:** “Oberfranken, Messnerskreith; Granitfelsen, 24.III.1995, *Meinunger 22556* (G, Meinunger); **Rheinland-Pfalz:** “Pirmasens; Buntsandstein-Quader. 280 m”, 3.V.1992, *Lauer 11794* (G, Lauer); **Saarland:** “St. Wendel, Friedhofsmauer; Sandsteinplatten”, 2.IV.1995, *Caspari s.n.* (Caspari, G); “Zweibrücken; Silikatgestein”, *Mougeot, Nestler, Schimper* (G).

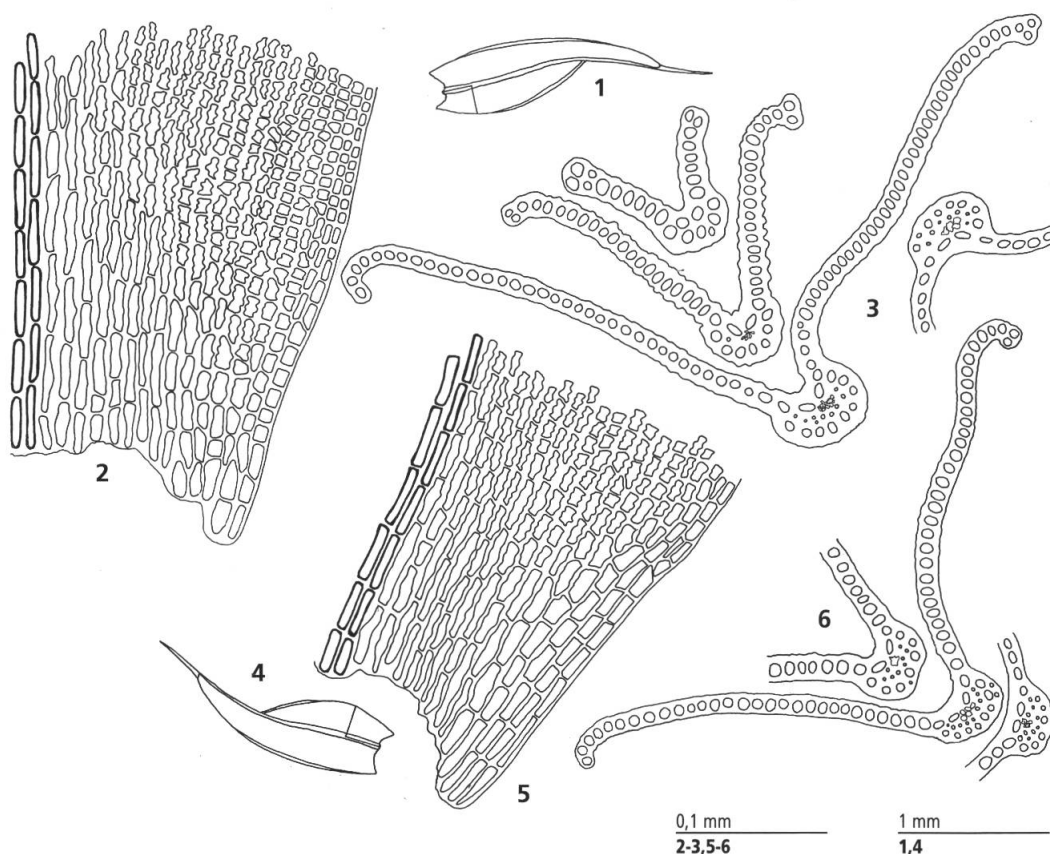


Fig. 6. – Analysis of the type specimens. *Grimmia meridionalis* (Müll. Hal.) E. Maier: **1**, leaf (the rectangle marks the area of Fig. 6.2); **2**, cells in leaf base; **3**, transverse sections of leaf. *Grimmia sardoa* var. *gracilis* Warnst. & M. Fleisch.: **4**, leaf (the rectangle marks the area of Fig. 6.5); **5**, cells in leaf base; **6**, transverse sections of leaf.

[1-3, *Schimper s.n.*; 4-6, *Fleischer s.n.*]

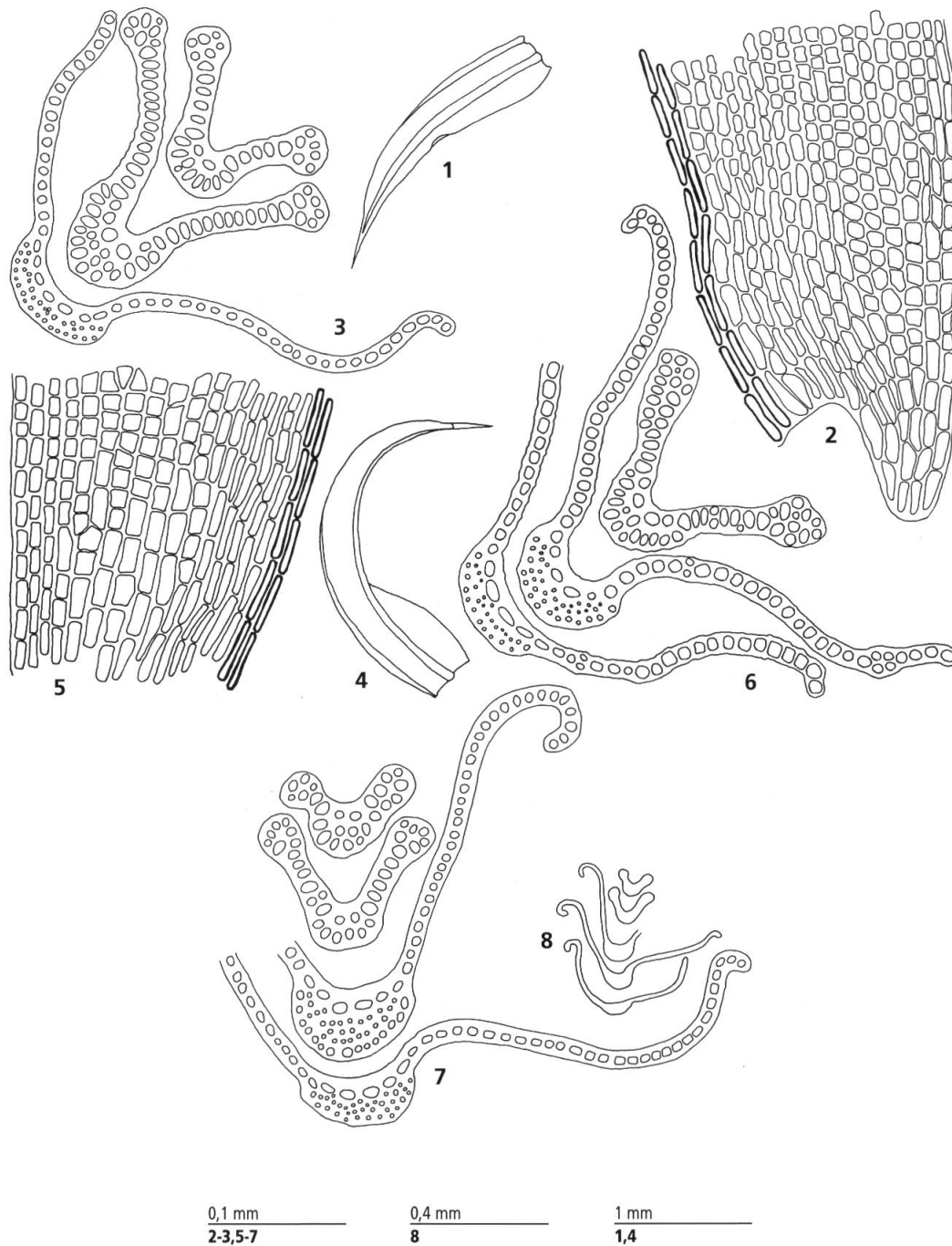


Fig. 7. – Analysis of the type specimens. *Grimmia trichophylla* var. *brachycarpa* De Not.: **1**, leaf; **2**, cells in leaf base; **3**, transverse sections of leaf. *Grimmia ancistrodes* Durieu & Mont.: **4**, leaf; **5**, cells in leaf base; **6**, transverse sections of leaf. *Grimmia sardo* Müll. Hal.: **7**, transverse sections of leaf; **8**, outlines of transverse sections of leaf.

[**1-3**, De Notaris s.n.; **4-6**, Durieu s.n.; **7-8**, De Notaris s.n.]

### Final comments and key of the species treated

The species treated in this study belong to the subgenus *Rhabdogrimmia* Limpr. (Van der WIJK & al., 1962). Following LIMPRICHT (1889), a symmetric, ribbed capsule, with mitrate calyptra, on curved seta are the defining characters. The costa architecture divides the 4 species into 2 groups. *Grimmia lisae* (Fig. 5.6) presents 6 guide cells at the insertion. *Grimmia dissimulata* (Fig. 5.3), *G. meridionalis* (Fig. 6.3), and *G. trichophylla* (Fig. 5.9) show 4 guide cells at the insertion. The differences of these species are expressed by the costa architecture and the cell pattern in the leaf base. The short cells in the leaf base of *G. dissimulata* (Fig. 5.2) are comparable to the cell pattern in the leaf base of *G. lisae* (Fig. 5.5), and, in spite of the lower number of guide cells, would suggest a place closer to *G. lisae* than to *G. trichophylla* (Fig. 5.8) or *G. meridionalis* (Fig. 6.2) with their elongate-rectangular leaf base cells. The disregard of the costa architecture and the superficial similarity of the cell pattern in the leaf base of *G. dissimulata* and *G. lisae* could be an explanation for the preponderant use of the names of *G. lisae* and its subspecies. Comparing the peristome characters of the 4 taxa to defend their taxonomic position is not helpful. Each species presents a particular, specific architecture.

A concise key for plants in the vegetative state may summarize these statements:

1. Costa at insertion and in leaf base with 6 guide cells . . . . . **Grimmia lisae**
- 1a. Costa at insertion and in leaf base with 4 guide cells . . . . . 2
2. Guide cells at insertion and in leaf base arranged in 2 layers, the inner one consists of 1 or 2, rarely 3 cells larger than the rest of the costa cells . . . . . **Grimmia trichophylla**
- 2a. Guide cells at insertion and in leaf base arranged in 1 layer . . . . . 3
3. Guide cells in transverse section of broadest part of leaf distinctly elliptic, their longer axes forming an angle (Fig. 3.11c, 6.3) . . . . . **Grimmia meridionalis**
- 3a. Guide cells in transverse section more or less rounded . . . . . **Grimmia dissimulata**

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