

Grimmia trichophylla Greville - Fl. Edinensis: 235. 1824.

Type: U.K., Scotland, near Edinburgh, leg. R.K. Greville, lectotype, designated by Geissler & Maier (1995), E!; isolectotypes, FH!, H-SOL.

Synonyms: *Grimmia brownii* Par., *G. cockaynei* R. Brown ter, *G. consobrina* C. Müll., *G. crispatula* C. Müll. & Hampe, *G. dicksonii* (Dus.) Dus., *G. finitima* R. Brown ter, *G. flexicaulis* var *dicksonii* Dus., *G. fuliginea* Stirt., *G. imberbis* C. Müll., *G. inaequalis* Stirt., *G. kaikouraensis* R. Brown ter, *G. macropulvinata* Dus., *G. meridionalis* (C. Müll.) E. Maier, *G. microphylla* Fleisch., *G. petriei* R. Brown ter, *G. polita* Stirt., *G. rubescens* Stirt., *G. stevensii* R. Brown ter, *G. stirtonii* Schimp., *G. versabilis* R. Brown ter, *G. watsonii* Lesq. & Jam.

Distribution: Afr. Am.1,2,4,6. As. 1,5. Austr. Eur. Oc.

Description

Grimmia trichophylla grows in dense to loose, yellowish-green to dark green patches, the leaves are loosely appressed, slightly twisted when dry, erecto-patent when moist, lanceolate to oblong-lanceolate, tapering to acute apex, usually sharply carinate, clusters of gemmae occasionally present in upper leaf axils, the costa is firm, projecting on dorsal side, hair-points are variable, short to long, smooth to denticulate, not conspicuously flattened at base, the margins are recurved on one or both sides, plane to erect above. The distal areolation is unistratose, occasionally with bistratose ridges, the mid-leaf cells are short-rectangular with slightly sinuose and incrassate walls, the basal marginal cells are rectangular with thickened transverse walls, the basal juxtacostal cells are elongate to linear with incrassate, ± nodulose walls. The sexuality is dioicous, and capsules on arcuate setae are occasionally present, they are exserted, oblong-ovoid, striate when dry, with a rostrate operculum.

Discussion:

In the northern hemisphere, *G. trichophylla* is principally a lowland species, occurring in the mountains up to about 1000 m. In the southern hemisphere, it may be found up to 4000 m. In New Zealand, *G. trichophylla* is a common species that, in contrast to Europe, frequently bears capsules. The New Zealand plants are usually smaller than the European specimens and the leaves are frequently contorted. Extreme variability seduced the New Zealand bryologist Robert Brown into describing the species with seven different names. The nearly cosmopolitan *G. trichophylla* has many phenotypes and numerous subspecies and varieties have

been described. In damp and shaded habitats, the hair-points may be short, just as in dry unfavourable habitats at high altitudes, where stunted specimens may occur with small short leaves and reduced hair-points, or even with muticous leaves. Smith (1978) recognized five varieties for Britain and Ireland: *tenuis*, *stirtonii*, *robusta*, *subsquarrosa* and *trichophylla*. *G. trichophylla* has frequently been confused with related species such as *G. muehlenbeckii*, *G. lisae* and *G. austrofunalis*. The sharply keeled, lanceolate leaves with recurved margins and merely unistratose lamina will usually distinguish *G. trichophylla*.

Discussion of the *Grimmia trichophylla* group (Greven 1995)

Grimmia trichophylla is an extremely variable *Grimmia* species.

In the Index Muscorum (Wijk et al. 1962), it is represented with 8 subspecies:

G. azorica (Ren. et Card.) Luis,

G. eutrichophylla Loeske, (*Grimmia trichophylla* var. *trichophylla*)

G. lisae (De Not.) Boul.

G. meridionalis (C.Muell.) Loeske,

G. muehlenbeckii (Schimp.) Boul.,

G. sardoa (C.Muell.) Bott.,

G. stirtonii (Schimp.) Dix. and

G. subsquarrosa (Wils.) Dix.

The number of varieties amounts to 21, and because also from the above mentioned subspecies many varieties were described, the total number of described taxa within this group amounts to nearly 40. Loeske did not really know how to handle the problems, and the majority of his text deals with formerly published conceptions of other bryologists.

Finally he recognized in *G. trichophylla* s.l. five subspecies:

- *G. eutrichophylla* Loeske

- *G. muehlenbeckii* (Schimp.) Dixon

- *G. meridionalis* Schimp.

- *G. subsquarrosa* (Wils.) Dixon

- *G. stirtonii* (Schimp.) Dixon

However, probably because he doubted the subspecies *G. subsquarrosa* and *G. stirtonii*, he included in his key only *G. eutrichophylla*, *G. muehlenbeckii* and *G. meridionalis*.

I started my investigation of the *Grimmia trichophylla* group with study of the holotype of *Grimmia trichophylla*, loaned to me by The Royal Botanic Garden in Edinburgh. The taxon was published in 1824 by Robert Kay Greville from plants collected in the vicinity of Edinburgh. I was happy to discover that the holotype was exactly what I, so far, had understood by this taxon. Of importance is that the holotype bears unicellular, yellowish gemmae in the upper leaf axils, and that it is provided with dull, oblong, yellowish, striate capsules.

Differences between *Grimmia trichophylla* and *Grimmia muehlenbeckii*

Loeske (1930) reduced to synonymy with *Grimmia trichophylla* ssp. *muehlenbeckii* (Schimp.) Dixon: *G. muehlenbeckii* Schimp., *G. trichophylla* var. *septentrionalis* Schimp. and *G. incurva* (Schwaegr.) Bruch et Schimp. The question is now, has *muehlenbeckii* to be considered as a good taxon, or occur transitions to *eutrichophylla*? Loeske describes *muehlenbeckii* as small, dark-green to blackish tufts with short, when dry, appressed leaves with angular to lowly winged costas, denticulate hair-points, dark-yellowish to brown basal cells with thickened transverse walls, bistratose upper lamina, brown, multicellular gemmae on short stalks in the upper leaf axils, ovoid dark-brown capsules with undivided dark-red peristome teeth, and a boreal to montane/alpine distribution. I have studied numerous specimens of *G. muehlenbeckii* from the Swedish Museum of Natural History in Stockholm, and in my opinion it is a good taxon worthy to be treated at specific level. However, this opinion is principally based on the characters of the sporophyte, because the gametophytes of *G. muehlenbeckii* are very similar to some forms of the extremely variable *G. trichophylla*. As contrasted with Smith (1992), I noticed that the costa in *G. muehlenbeckii* is only rarely winged, and I have seen frequently specimens of this taxon in which the majority of the leaves had round-angled costas, while in those tufts only a few plants had more sharp-angled or low-winged costas. In all studied exsiccata the costas were dorsally shiny and very prominent, and when capsules were present, the determination was without problems. However, it is rather problematic to distinguish gametophytes of *G. muehlenbeckii* from *G. trichophylla*, because the multicellular gemmae on short stalks are only occasionally present and short basal cells, denticulate hair-points and a bistratose upper lamina can also be found in some forms of *G. trichophylla*. When only gametophytes are present, the combination of characters has to turn the scale, the low green-blackish tufts with short-lanceolate, when dry

± appressed leaves with greatly protruding, shiny costas, the short rectangular, yellowish basal cells with smooth walls and the conspicuous bistratose lamina in the apex. Smith (1992) describes and draws leaf transverse sections of several *Grimmia trichophylla* s.l. specimens, and the typical angular or even winged costa, that he noticed in *muehlenbeckii*, was not present in *eutrichophylla*. However, he remarks that although the winged costa is only a qualitative character to separate the gametophytes of *G. muehlenbeckii* from *G. trichophylla*, this character is not easy to use, and I agree with him for I have found in The Netherlands, on granitic boulders of so-called hunebeds, graves from 5.000 years ago, frequently *Grimmia trichophylla* plants coming very close to *G. muehlenbeckii*, but as no capsules were found, I did, so far, not name them *G. muehlenbeckii*. The Belgian bryologist Sotiaux has sent me very characteristic, richly fruiting *G. muehlenbeckii* from the Pyrenees (Andorra, alt. ± 2000 m). However, in this for *G. muehlenbeckii* very luxurious 2 cm high tufts, with winged costas and characteristic sporophytes, the lower parts of the gametophytes were not blackish but brown.

The differences between *Grimmia trichophylla* and *Grimmia meridionalis*

Loeske (1930) reduced to synonymy with *G. trichophylla* ssp. *meridionalis* (Schimp.): *G. trichophylla* var. *meridionalis* Schimp., *G. trichophylla* var. *lusitanica* Schimp., *G. lisae* De Not. and *G. sardoa* De Not. He spented four pages to discuss the problems however, he did not express his own vision, but he merely interprets the visions of Fleischer, Schimper, Hagen, Bottini, De Notaris, Limpricht and Luisier. He reported his study of a considerable quantity of specimens of the ssp. *meridionalis*, and admitted that he could not distinguish *G. sardoa* from *G. lisae* and *G. trichophylla* var. *lusitanica*. In all specimens he noticed a robust habit and conspicuously squarrose leaves. It is peculiar that he did not include in his discussion *G. subsquarrosa* Wils. and *G. retracta* Stirton, at that time only known from Britain and Ireland, for his description of *G. lisae* fits precisely with those species. In the past years I have studied over 500 specimens named: *G. trichophylla*, *G. lisae*, *G. sardoa*, *G. ancistrodes*, *G. retracta* and *G. subsquarrosa*, with many subspecies and varieties, from a large number of western, southern and eastern European countries, including Cyprus, Mallorca, Sardinia, Crete, Corsica, Sicily, Madeira, Azores and the Canary Islands, and I can understand why bryologists have described so many taxa within this group for the variability is enormous. The British Museum of Natural History loaned me specimens from the herbarium of H.N. Dixon, and it is very teachable to read how this great bryologist also struggled with this complex. E.g. he wrote with pencil under a sheet with specimens of *G.*

lisae: "I cannot separate this from our *G. subsquarrosa*, which seems practically the same thing as *G. lisae*". I agree with Dixon that *G. subsquarrosa* and *G. lisae* are synonymous. I have studied the type of *G. lisae* De Not. from RO, collected by Domenica Lisa "Ad rupes et saxa in collibus Taurinensibus". There is a second sample, collected by Giuseppe de Notaris in 1837 on the island of Capraria, and mentioned in Briologia Italiana (G. de Notaris, 1869). I have also studied from RO the type of *G. sardoa* De Not., collected by G. de Notaris in 1835 in Sardinia: "media montibus, ad rupes". The poor sample consists of some loose plants with sporophytes, and because, just like Loeske, I could not find significant differences with *G. lisae*, I consider *G. sardoa* conspecific with *G. lisae*. The characteristic features of the three above mentioned samples from RO are: broadly lanceolate leaves in comal tufts, conspicuously recurved to squarrose when moist, costa with a median layer of stereid cells, basal paracostal cells short-rectangular, pellucid to hyaline with thin smooth walls; cells above base short-rectangular, sinuately incrassate; cells in mid-leaf and apex very small, rounded, not sinuose, slightly incrassate. Hair-points stout, short to long, denticulate. Sporophytes on a strongly arcuate seta, ovate, slightly sulcata. The investigations of the *meridionalis* group lead to the following conclusions. There are two groups to distinguish:

A. A group with oblong capsules, leaves not in comal tufts, when wetted not squarrose, with thin, smooth to slightly denticulate hair-points, costa without median layer of stereid cells, gemmae at the base of the upper leaves frequently present, basal paracostal cells with sinuose walls: *G. trichophylla* s.s., occurring in nearly all parts of the world and very variable with respect to leaf form, areolation and length of the hair-point. Characteristic for this taxon are lanceolate leaves, usually tapering to a long acute apex, mostly sharply keeled above, a yellow green areolation with sinuose cells, unistratose to (in the upper part) bistratose with in the upper part quadrate sinuose cells, and long, sinuately-incrassate basal paracostal cells. At high elevations and in other unfavourable habitats, depauperate plants occur frequently. These plants may have very short leaves, deviating greatly from the normal type. In BM there are samples of *G. sardoa* var. *gracilis* Fl. et Warnst., spread by Fleischer & Warnstorff in their Bryotheca Europ. meridionalis. I conceive these samples forms of *G. trichophylla*.

B. A group with ovate capsules, leaves in comal tufts, when wetted spreading to squarrose, costa with a median layer of stereid cells, hair-point short to long, stout, denticulate, gemmae absent, basal paracostal cells with smooth walls: *G. lisae*, occurring in southern and eastern European countries principally and extremely

variable with respect to leaf form, areolation, colour, and length of hair-point. Characteristic for this taxon are squarrose leaves, gradually tapering to a more broad apex, with in the upper part of the leaf very small, dark-green, isodiametric, incrassate but not sinuose, rounded cells, mucous or short denticulate hair-pointed leaf tips and translucent, short-rectangular, usually thin-walled basal paracostal cells. The sporophyte differs from *G. trichophylla* by its shiny, brownish colour, oval form and arcuate stout seta, hiding the capsules in the vegetation. In south European countries sporophytes are not rare, and I have found them at Sardinia, Cyprus, Madeira and Tenerife. In BM there is a sample of *G. sardoa* var. *robusta* Fl. et Warnst., spread by Fleischer and Warnstorf in their *Bryotheca Europaea Meridionalis*, this sample belongs to *G. lisae*. In *G. lisae*, I include the from Britain described *G. subsquarrosa* Wils. and *G. retracta* Stirt. About *G. retracta* Dixon (1924) wrote: "This plant is intermediate in habit and other characters between *G. hartmanii* and *G. subsquarrosa*" and about *G. subsquarrosa* he noticed: "By the basal areolation (basal cells short, wide, rectangular, somewhat hyaline, rather thin-walled, with the walls smooth, not sinuose) and by the decidedly squarrose-recurved comal leaves, it may without difficulty be recognized". Because *G. lisae* is the oldest correctly published name, this name should be used. With respect to the ecology of *G. lisae*, can be noticed that it prefers habitats with a high air-humidity, thus having a narrower ecological amplitude than *G. trichophylla*. This was shown by a revision of *G. trichophylla* s.l. from the Canary islands, collected by the Dutch bryologist G. Dirkse (Tenerife, Gran Canaria, La Palma) and by myself (Tenerife).

Distribution of *Grimmia trichophylla* and *Grimmia lisae* (N=164) on the Canary Islands

Altitudes:	Species:	Samples:	Species:	Samples:
0 - 250 m	<i>G. trichophylla</i>	1	<i>G. lisae</i>	0
250 - 500 m	<i>G. trichophylla</i>	18	<i>G. lisae</i>	0
500 - 1000 m	<i>G. trichophylla</i>	28	<i>G. lisae</i>	22
1000 - 1500 m	<i>G. trichophylla</i>	26	<i>G. lisae</i>	25
1500 - 2000 m	<i>G. trichophylla</i>	19	<i>G. lisae</i>	3
2000 - 2300 m	<i>G. trichophylla</i>	28	<i>G. lisae</i>	0

The revision showed that *G. trichophylla* occurs at random at altitudes from 250 to 2300 m, while *G. lisae* has a significant preference for altitudes between 500

and 1500 m. This is the area of the *Laurus* forest, characterized by a high air-humidity and cloudy moss vegetation. However, with respect to the substrate *G. lisae* has a wider ecological range than *G. trichophylla*, because this species may be found on slightly acid substrates, like basalt but also on obvious basic substrates, like limestone, while *G. trichophylla* occurs predominantly on acidic rock and only rarely on weathered, acidified limestone. Recently *G. lisae* was also found in Belgium and Luxemburg (Greven et al., 1994).

Specimens examined

Austria. Carinthia, Hermagor, Guggenberg, alt. 1090 m, leg. H.C. Greven, nr. 3061, 3062; **Azores.** Pico, Magdalena, leg. H.C. Greven, nr. 2572, 2599; Fayal, Pedro Miguel, leg. H.C. Greven, nr. 2600; **Belgium.** Prov. Luxemburg, Ancien Moulin de Rèn 'siwé, leg. H.C. Greven, nr. 2576; Angre, Caillou qui Bique, leg. H.C. Greven, nr. 2598; **Canary Islands.** Tenerife: Bosque de la Esperanza, alt. 1300 m, leg. H.C. Greven, nr. 2603, Valle de la Orotava, Barranco del Agua, alt. 1400 m, leg. H.C. Greven, nr. 2561, Valle de la Orotava, alt. 800 m, leg. H.C. Greven, nr. 2578, 2587, Las Canadas, alt. 1600 m, leg. H.C. Greven, nr. 2577, La Esperanza, alt. 1400 m, nr. 1400 m, leg. H.C. Greven, nr. 2579; La Palma: Caldeira, alt. 2300 m, leg. H. Lauer, nr. Ka. 105; Piedra Llana, alt. 2300 m, leg. G.M. Dirkse, nr. 7389, Monte Lunal, alt. 750 m, leg. G.M. Dirkse, nr. 7438. **Corsica.** Col de Verde, alt. 1420 m, leg. H.C. Greven, nr. 2982; Stue Menhir, alt. 300 m, leg. H.C. Greven, nr. 2983; Vivario, alt. 807 m, leg. H.C. Greven, nr. 2984; **Crete.** Lagos, leg. H.C. Greven, nr. 2563, 2676; **Cyprus.** Troodos, Prodhromos, alt. 1700 m, leg. H.C. Greven, nr. 2618; Troodos, Pano Platres, alt. 1100 m, leg. H.C. Greven, nr. 2619, 2620; Troodos, Kalokhorio, alt. 700 m, leg. H.C. Greven, nr. 2621; Troodos, Mt. Kionia, alt. 110 m, leg. H.C. Greven, nr. 2622; **France.** Pyrenees, Bigorra, Ste. Engrace, alt. 900 m, leg. H.C. Greven, nr. 2571; The Vosges, Magelsberg, alt. 762 m, leg. H.C. Greven, nr. 2784; The Vosges, Plombières les Bains, Valle de la Semouse, alt. 410 m, leg. H.C. Greven, nr. 2573; Limoges, leg. H.C. Greven, nr. 2597; **Germany.** Pfaltz, Donnersberg, alt. 685 m, leg. Hooock, herb. H. Lauer, nr. P 3658; **Luxemburg.** Vianden, leg. H.C. Greven, nr. 2559; **Madeira.** Corticeiras, leg. H.C. Greven, nr. 2569; Pico do Areiro, alt. 1800 m, leg. J. Nieuwkoop; **Mallorca.** Coll de Soller, alt. 900 m, leg. H.C. Greven, nr. 2829; Puig de Massanella, alt. 850 m, leg. H.C. Greven, nr. 2832; Puig Major, alt. 1000 m, leg. H.C. Greven, nr. 2833; **Portugal.** Serra da Estrela, Penhas Douradas, alt. 1450 m, leg. H.C. Greven, nr. 2560, 2596; Serra da Estrela, Manteigas, alt. 900 m, leg. H.C. Greven, nr. 2553, 2555; Serra da Estrela, Covao do Boe, alt. 1900 m, leg. H.C. Greven, nr. 2554;

Serra da Estrela, Lagoa Comprida, alt. 1600 m, leg. H.C. Greven, nr. 2594; Serra da Estrela, Cavao da Ametade, alt. 1500 m, leg. H.C. Greven, nr. 2595; **Sardinia**. Monti del Gennargentu, Seulo, alt. 819 m, leg. H.C. Greven, nr. 2604; Monte Arbu, alt. 1290 m, leg. H.C. Greven, nr. 2592, 2605; Ste. di Villanovatula, alt. 348 m, leg. H.C. Greven, nr. 2606; Fluminimaggiore, alt. 105 m, leg. H.C. Greven, nr. 2607; Seui, Genna é Medau, alt. 990 m, leg. H.C. Greven, nr. 2574; Villanova Monteleone, Tomba dei Giganti, alt. 400 m, leg. H.C. Greven, nr. 2608; Seui, Mnt. Arcueri, alt. 900 m, leg. H.C. Greven, nr. 2575, 2580; Lago Alto Flumendosa, alt. 1000 m, leg. H.C. Greven, nr. 2591; Teulada, alt. 300 m, leg. H.C. Greven, nr. 2590; Arbus, alt. 490 m, leg. H.C. Greven, nr. 2581; Punta la Marmora, alt. 1200 m, leg. H.C. Greven, nr. 2593; Urzulei, alt. 700 m, leg. H.C. Greven, nr. 2585, 2586; **Scotland**, Edinburgh, leg. R.K. Greville; Perth, Hillem Stii, leg. W. Evans; Kinghorn, leg. J. Mc. Andrew; **Slovakia**. Ziar valley, Jastraba, leg. H.C. Greven, nr. 2583; Banska Stiavnica, Vyhne, Kamenne More, leg. H.C. Greven, nr. 2567; Stiavnické Vrchy, Krivin, leg. H.C. Greven, nr. 2568; **Spain**. Zaragossa, Caspe, leg. H.C. Greven, nr. 2547; Morella, Santuario de Vallivana, leg. H.C. Greven, nr. 2564; **Sweden**. Skane, Degeberga, leg. H.C. Greven, nr. 2584; **The Netherlands**. Drente: Drouwen, leg. H.C. Greven, nr. 2614, Loon, leg. H.C. Greven, nr. 2556, Valthe, leg. H.C. Greven, nr. 2557, Midlaren, leg. H.C. Greven, nr. 2615, Ballo, leg. H.C. Greven, nr. 2616, Eext, leg. H.C. Greven, nr. 2617; Spakenburg, Wielse sluis, leg. H.C. Greven, nr. 2582, 2613; Oenkerk, Stania state, leg. H.C. Greven, nr. 2558; Dwingelo, Jewish cemetery, leg. W.D. Margadant, nr. 771, Drente, Loon, leg. W.D. Margadant, nr. 59-3-27-1; **Wales**. Mwaddach estuary, Bontddu, leg. H.C. Greven, nr. 2549; Dogellau, Cader road, leg. H.C. Greven, nr. 2548, 2612; Dolgellau, Croeslwyd, leg. H.C. Greven, nr. 2609; Dolgellau, Gwernan, leg. H.C. Greven, nr. 2610; Dolgellau, Llanfachreth, leg. H.C. Greven, nr. 2611; Snowdonia, Waunfawr, Betws Garmon, leg. H.C. Greven, nr. 2551, 2589; Snowdonia, Llyn y Dwarchen, leg. H.C. Greven, nr. 2588; Snowdonia, Llyn y Dwarchen, leg. H.C. Greven, nr. 2550; Snowdonia, Rhyd Ddu, leg. H.C. Greven, nr. 2552; **Bolivia**: La Paz, road nr. 3, just south of La Cumbre, damp slope, alt. 4000 m, leg. H.C. Greven nr. Bolivia, road Cochabamba–Oruro, boulder along road, alt. 4100 m, leg. H.C. Greven nr. Bol. 54, 55, 60, 15-05-2005; Road Potosi–Uyuni, near Visicia, leg. H.C. Greven Bol. nr. 56, 59, 14-05-2005; **Canada**: British Columbia, Fraser River Canyon, Hell’s Gate Bridge, leg. H.C. Greven nr. 3048, 09-07-1998; British Columbia, Fraser River Canyon, 4 km south of Boston Bar, near Hell’s Gate Canyon, leg. H.C. Greven nr. 3049, 09-07-1998;

