A taxonomic revision of *Dicranodontium* (Musci)

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The 39 species of *Dicranodontium* which are currently included in the genus are critically revised and reduced to 7. *Dicranodontium fleischerianum* Schultze-Motel could not be separated from *D. uncinatum* (Harv.) Jaeg. and is regarded as synonymous with the latter. *Dicranodontium dimorphum* Mitt. has proven to be synonymous with *D. didictyon* (Mitt.) Jaeg., *D. meridionale* Bartr. with *D. pulchroalare* Broth., *D. ceylonense* Fleisch., *D. subasperum* Williams and *D. perviride* Dix. & P. Varde are synonymous with *D. denudatum* (Brid.) Britt., *D. subintegri folium* Broth., *D. attenuatum* (Mitt.) Wils., *D. caespitosum* (Mitt.) Par. and *D. decipiens* (Mitt.) Mitt. ex Broth. are synonymous with *D. didymodon* (Griff.) Par., *D. blindioides* (Besch.) Broth., *D. sparsum* Dix. are synonymous with *D. uncinatum* (Harv.) Jaeg. *Dicranodontium sinense* (C. Müll.) Par. is identical with *Campylopus japonicus* Broth. and recognized as *Campylopus sinensis* (C. Müll.) J.-P. Frahm comb. nov. *Dicranodontium falcatum* Broth. (described as endemic from Hawaii) is synonymous with *D. porodictyon* Card. & Thér. from China, *D. tanganyikae* J. Tayl. & P. Varde is identical with *Campylopus flexuosus* (Hedw.) Brid. var. *incacorralis* (Herz.) J.-P. Frahm, *D. humilis* P. Varde is a species of *Blindia*, *D. interruptum* P. Varde is identical with *Bryohumbertia filifolia* (Hornsch.) J.-P. Frahm, *D. horricuspis* Card. and *D. capillifolium* (Dix.) Takaki are synonymous with *D. asperulum* (Mitt.) Broth. *Dicranodontium brasiliense* Herz. is placed as subspecies in *D. pulchroalare*. *Dicranodontium intermedium* Allen is placed into *Atractylocarpus* and recognized as *A. intermedius* (Allen) J.-P. Frahm comb. nov. *Dicranodontium insularum* Bartr. and *D. tristaniense* Dix. & Thér. belong to *Dicranoloma*. *Dicranodontium tenii* Broth. described from China is identical with *Dicranum hamulosum* Mitt. from Japan. *Dicranodontium tenuinerve* Dix. & Sak. described from Japan is identical with *Bryohumbertia subcomosa* (Dix.) J.-P. Frahm. *Dicranodontium filifolium* Broth. seems not to belong to this genus, but its systematic position is dubious. *Dicranodontium subporodictyon* Broth. is transferred to the genus *Dicranum* Hedw. and recognized as *D. subporodictyon* (Broth.) Gao. The types of *Dicranodontium tapes* (C. Müll.) Par. and *D. papillifolium* Gao were not available, but it is very unlikely that these species belong to this genus.

Key words: Dicranaceae, *Dicranodontium*, Musci, nomenclature, taxonomy
INTRODUCTION

Dicranodontium is a genus of the Dicranaceae subfam. Campylopondioideae. This subfamily comprises the genera Atractylocarpus, Bryohumbertia, Campylopus, Dicranodontium, Pilopogon and Sphaerothecium (Frahm 1991). All of these genera except Dicranodontium have been revised (Atractylocarpus: Padberg & Frahm 1986, Bryohumbertia: Frahm 1982, Pilopogon: Frahm 1983, Sphaerothecium: Frahm 1986; Campylopus was revised in numerous single publications). The present publication will complete the treatments of genera of Campylopondioideae.

Seventy-four species of Dicranodontium and 32 infraspecific taxa are listed in Index Muscorum (Van der Wijk et al. 1959), and 35 of them were accepted. Two species were added in the additions to the Index Muscorum 1963–89 (Crosby et al. 1992), one species was later described by Allen (1994) and another species was transferred to Dicranodontium from Campylopus by Frahm (1994). Two species were excluded from the genus by Frahm (1991), resulting in a total of 39 species. For comparison: Brotherus (1901) recognized 18 species within the genus in the first edition of the “Natürlichen Pflanzenfamilien” and 21 species in the second edition (Brotherus 1924). Except for the species occurring in Canada (Ireland 1987), this genus has so far not been revised.

The purpose of this paper is to give a world-wide overview of the genus and a critical revision of the taxa. Therefore the majority of infraspecific taxa are not treated, of which 32 were described. Furthermore, a revision of all taxa which were previously placed by other authors into different genera has been omitted.

Dicranodontium species are difficult to separate from those of Campylopus, Dicranum, Atractylocarpus or Bryohumbertia. This is shown by the fact that 12 species of Dicranodontium were originally described as species of Campylopus or Dicranum or more rarely Paraleucobryum and Dicranella and 17 species described as Dicranodontium were later transferred to Campylopus, Atractylocarpus, Campylopondium, Paraleucobryum, Dicranella or Dicranoloma. Some species of Dicranodontium (those without enlarged or incrassate and pitted juxtacostal cells) resemble Atractylocarpus in the gametophyte (Padberg & Frahm 1986) and can hardly be distinguished without sporophytes. Only the sporophytes differ. In Atractylocarpus, the setae are long, 15–25 mm, erect when dry and flexuous when wet, in Dicranodontium the setae are shorter, 6–15 mm long, flexuous when dry but cygneous when wet and or in the young state. This difference is certainly not satisfying, especially when specimens are sterile. Therefore Atractylocarpus and Dicranodontium were synonymized by Williams (1913). This view was followed by Allen (1994) in his treatment of the Central American Dicranaceae, and it was used to support a new species, Dicranodontium intermedium, which is autoicous like Atractylocarpus but has cygneous setae like Dicranodontium. However, if this view is accepted, Dicranodontium has also consequently to be synonymized with Campylopus because it differs from certain species of Campylopus only by its longer upper laminal cells; Pilopogon must be synonymized with Campylopus because it differs from Campylopus only by its straight setae and long sheathing perichaetal leaves; Bryohumbertia must be united with Campylopus because it does not differ gametophytically from the latter but only in some capsule characters; and Sphaerothecium must be included in Campylopus because it differs only in the larger spores. This would create a large and unwieldy genus comprising all genera so far included in the subfamily with several hundred species, for pragmatic reasons alone this does not seem to be an advantage.

In spite of their anatomical similarities, Dicranodontium and Atractylocarpus differ in their ranges in that Dicranodontium is holarctic in distribution, reaching the tropics only in SE-Asia and in the Andes but Atractylocarpus occurs worldwide in the high montane or alpine belt.

TAXONOMIC TREATMENT

Dicranodontium B.S.G.

Type: Dicranodontium longirostre (Web. & Mohr) B.S.G. (= D. denudatum).

Plants erect, in dense cushions. Leaves erect, sinuose to falcato-secund or hamate, from a sheathing concave base narrowed into a long often tubulose setaceous tip. Lamina short, reaching only 1/4 of leaf length. Costa filling (1/4—)1/3

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of the leaf width, in transverse section with a ventral layer of epidermal cells, a ventral stereid band, a median row of large deuter cells, a dorsal stereid band and a dorsal layer of epidermal cells, excurrent, serrate to serrulate all around in the upper part or rarely (in *D. didymodon*) almost smooth. Alar cells differentiated, thin-walled, hyaline or reddish, inflated or not, sometimes auriculate. Inner basal laminal (juxtacostal) cells inflated, hyaline, sharply delimited from the outer cells or not. Outer laminal cells smaller and narrower, forming a distinct limbidium or not. Upper laminal cells rectangular to elongate rectangular.

Dioicous. Seta flexuous when dry, cygneous when moist or young, 0.6–1.5 cm long. Capsule short cylindrical, erect, smooth, weakly furrowed when empty. Operculum longly rostrate, as long or almost as long as the capsule. Annulus absent. Peristome teeth 16, typically dicranoid, divided or almost as long as the capsule. Calyptra cucullate, usually smooth or rarely ciliate.

Vegetative propagation by means of deciduous leaves or leaf tips. Deciduous leaves are very typical for most species of the genus and are expressed in the epithet "denudatum". The leaves can be deciduous in such a number that large parts of the stem are defoliate. The stem looks then like a *Picea*-branch without needles.

As in many other dioicous genera, sporophytes are produced infrequently, perhaps due to the lack of male plants, which are smaller. Sterile populations usually consist entirely of female plants.

All species treated here in *Dicranodontium* are very similar in appearance; they have a very short lamina, long subula, a similar transverse section of the costa and also similar sporophytic characters (length of seta and shape of capsule). Therefore there are only a few differentiating characters, e.g. the shape of the inner basal laminal cells or the denticulation of the subula. Because of the small number of differentiating characters, there are fewer combinations of characters possible than species described and thus a reduction of the species number could be expected.

The leaves can be circinate, falcate or almost straight and flexuose in the same species; there are always falcate forms known in species which usually have straight and flexuose leaves and “subfalcaturn” forms in species with usually circinate leaves. Therefore no illustrations of the habit of the species are provided here.

The presence/absence, size or form of the alar cells, which is often used in the literature to differentiate species, is not used here since this character proved to be too variable.

A main source of confusion in the genus has been the description of the inner basal laminal cells. They are described as distinctly or indistinctly differentiated from the outer ones. In *Dicranodontium asperulum*, *D. didictyon*, *D. meridionale*, *D. porodictyon* and *D. uncinatum* they are as conspicuous as in the leaf base of Calypneaceae. They are usually thin-walled, hyaline, translucent, much enlarged and distinctly and very abruptly differentiated from the narrow elongate cells at the margins. In contrast, the inner basal laminal cells of *D. denudatum* and *D. didymodon* are larger than the outer ones, but not differentiated in color from the outer ones. The transition to the outer basal laminal cells is more gradual. The inner ones are usually thick-walled but not pitted. The shape of the inner basal laminal cells is the only character which seems to group the genus into natural units and can therefore be used for an infrageneric classification.

The upper laminal cells are usually described as elongate in this genus, a character, which differentiates it from related genera such as *Campylopus*. However, if this character is studied carefully, it turns out that the upper laminal cells of *Dicranodontium denudatum* are sometimes only about 5 times longer than broad, those of *D. didictyon* are only 5–7 times longer as broad, and some species such as *D. uncinatum* have almost no upper laminal cells. In this case the subula is excurrent above the leaf shoulders. Really long upper laminal cells (12:1) are only found in *D. pulchroalare*.

The costa has principally the same structure in all species with a median row of guide cells, ventral and dorsal layers of stereids and ventral and dorsal rows of epidermal cells. The latter will distinguish *Dicranodontium* from species of *Campylopus* with two stereid bands or also most species of *Dicranum*. The ventral layer of stereids can be almost as broad as the costa (e.g. in *Dicranodontium asperulum*, *D. pulchroalare*, *D. porodictyon* and *D. uncinatum*) or shorter (e.g. in *D. denudatum*, *D. didymodon*, *D. didictyon*). In the latter case, the stereid band is visible in the
costa as a dark band and the costa seems to be ill defined. A broad ventral stereid band is found in species with hyaline inner basal laminal cells and a narrow ventral stereid band is found in species without hyaline inner laminal cells. The single exception to this is *D. didymodon*, which has a narrow stereid band but large hyaline inner basal laminal cells.

The subula is 4–5 times longer than the lamina, which is also a character that helps to distinguish *Dicranodontium* from related genera. It is almost smooth in *D. didymodon*, but serrate in all other species. The subula of *D. asperulum* is said to be serrate all around, but this is principally also the case in all other species, at least in the uppermost part of the subula. The subula of *D. asperulum* is, however, serrate all the way down. The intensity of serration can vary greatly even in leaves from the same plant.

*Dicranodontium* is vegetatively very similar to certain species of *Campylopus* and those species of *Dicranum* with a broad costa. It can be distinguished from these genera by its elongate upper laminal cells and its leaf shape which has a distinguished from these genera by its elongate to certain species of *Campylopus*.

Sporophytically, *Dicranodontium* resembles *Bryohumbertia* in a smooth calyptra, an operculum, which is as long as the capsule, and a relatively long seta (as compared with *Campylopus*) which is sinuose in the upper part. The capsules of species of *Dicranodontium* are, however, cylindrical and the seta is not twisted.

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**Key to the species of *Dicranodontium***

1. Inner basal laminal cells large, hyaline, thin-walled, strongly contrasting with the smaller, chlorophyllose outer cells ....................................................... 2

1. Inner basal laminal cells not strongly contrasting with the outer ones ................................................................. 6

2. Leaf margin toothed almost to the leaf base. Subula serrate all around .......................... 1. *D. asperulum*

2. Leaf toothed only in the upper third of the subula ......................................................................................... 3

3. Robust plants, 4–10 cm high. Ventral stereid bands in transverse section of the costa as broad as the costa .. 4

3. Slender plants, up to 5 cm high, in appearance much like *D. denudatum* but with enlarged hyaline juxtacostal cells. Ventral stereid band in transverse section of the costa only in the middle of the costa .. 3. *D. didymodon*

4. Lamina extending almost to the apex in a very narrow band 1–4 cells wide, denticulate at margins ................................................................. 7. *D. uncinatum*

4. Lamina not extending to the apex in a narrow band at margins ................................................................. 5

5. Upper laminal cells pitted ...... 6. *D. pulcro-alare*

5. Upper laminal cells not pitted ...... 5. *D. porodictyon*

6. Upper third of subula denticulate all around ........... ......................................................................................... 2. *D. denudatum*

6. Upper third of subula almost smooth to finely serrate ................................................................. 4. *D. didymodon*

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**Dicranodontium asperulum** (Mitt.) Broth. (Fig. 1)


India. Assam, Aka Hills, 1933, Bor & Piri s. n. (holotype BM).

Plants usually very tall, to 10 cm high, yellowish green, in dense tufts, slender with small leaves, densely foliate, erect, more or less appressed (as plants grown on sandstone such as the type of *D. aristatum*) or robust, distantly foliate with sinuose or homomallous leaves. Leaves 5–6 mm. Margin finely toothed almost to the leaf base. Lamina reaching only 1/4 of the leaf length. Alar cells fugacious, hyaline. Inner basal laminal cells enlarged, hyaline, well separated from the narrow, longer, chlorophyllose outer ones. Middle laminal cells rectangular, incrassate, not pitted.

Sporophyte rarely found. Seta 1.5–2 cm long, sinuous when moist. Capsule oblong, 1.5–2 mm long. Operculum longly rostrate, almost the length of the urn. Spores 13 mm.


This species usually is easily recognized by its long arista, which is serrate all around (as a rat’s tail file, as expressed in the species names *asperulum* and *aristatum*), therefore the leaf apex is not canaliculate as in most other species of the genus, and the leaf margin is denticulate to the base. There are rarely forms with almost smooth or only finely denticate leaves, which can be identified, however, by the large hyaline inner basal laminal cells in combination with very slender, almost erect leaves. Furthermore, the leaves are usually (and very unusual for the genus) upright and erect patent to appressed. There are also forms with curved leaves ("*Dicranodontium aristatum var. falcatum*"). But these, however, are sometimes found in the same collection sites and seem to represent only modifications. The character strongly serrate vs. almost smooth leaf apex is not correlated with these forms.

The arista is sometimes extremely fine and long, in which case it is often curled.

The protologue of *Dicranodontium asperulum* includes two syntypes, Hooker 18 and 29. The herbarium of Mitten, however, includes only no. 29, which is therefore chosen as lectotype.

As pointed out by Frahm (1994), *Dicranodontium capillifolium* was described from Assam as species of *Brothera*. Takaki (1968) in a study of the genus *Brothera* transferred it to *Dicranodontium*. The species was only known from the type locality in Assam, but recently it has been reported from several localities in Sichuan and Yunnan, China (Frahm 1994). These records belong, however, to forms of *Dicranodontium denudatum*, in which the leaf apex ends in a very long and fine subula which partially consists of a single row of cells. This feature, however, is found only in the uppermost leaves of a plant. The other leaves are less long and resemble those of “*typical*” *Dicranodontium denudatum*. Furthermore, the leaf anatomy of the long-pointed leaves is not different from those from *D. denudatum*.

The range of *Dicranodontium asperulum* is mainly holarctic. It is, however, found in SE-Asia in Nepal, Sikkim, Yunnan, Taiwan and in Sulawesi (type of *D. horricuspis*). Although only known from this single record in Sulawesi, its identity is unquestionable.

Habitat: on siliceous rocks (sandstone, gneiss, granite) in cool, humid montane areas, based on the size and quantity of herbarium specimens, often in large masses.

Distribution: North America, Appalachian Mtns. (Georgia, North Carolina, Tennessee, Virginia, Pennsylvania), Canada (British Columbia), Alaska. Europe (Scotland, Norway, Germany, Czech Republic, Poland, Slowakia, Austria, Switzerland, Italy). Himalayan region (India, Nepal, Sikkim), China (Sichuan, Yunnan), Sulawesi, Taiwan, Japan.

Specimens examined. — Norway. Söndhordaland, Støle, Wulfsberg 22 (H-SOL); Hordaland, Tyeskaret, Kotiline s. n. (H); Aalesund, Berggren s. n. 1868 (H, H-SOL); Ryfylke, Trafjord, Bryn s. n. 1889 (H); Bergen, Wulfsberg 12 (H, H-SOL); Rogerland, Dirdal, Persson s. n. (H). Scotland. Glasgow, Linnox Castle, McKinley s. n., Bryotheca europ. 940 (H-SOL); Ben Vorloich, Schimper s. n., Hunt s. n. (H, H-SOL); Perthshire, Stuearchroin, Meldrum s. n. (H). Highland Region, Seven Sisters National Park near Shiel Bridge, Frahm s. n. (hb. Frahm). Germany. Franken, Nußhard, Molendo s. n. (H-SOL). Sachsen, Zittauer Gebirge, am Töpfer bei Oybin, Kopsch 316 (hb. Frahm). Elbsandsteinengebirge, Teufelsgrund, Siegel s. n. (hb. Frahm). Czechia. Adersbach, Milde s. n. (H-BR); auf Glimmerschiefer der Hohen Seewand bei Eisenstein im Böhmerwald, Bryotheca Bohemia 110 (H); “Enge Stiege” in der böhm. Schweiz, auf Sandstein, Schiffner s. n. (H); auf Sandstein im Khaatoble bei Schönlinde, Bryotheca Bohemica 16 (H); Böhmerwald, Płockenstein, Kujala s. n. 1926 (H). Adrspacheské skaly, in saxis arenaceis prope pag. Janovice, Musci cechosl. exsicc.
Dicranodontium denudatum (Br.) Britt. (Fig. 2)


Dicranum pachyneuron Mol. in Williams, N. Am. Fl. 15: 151. 1913. — Type not seen.


Plants in silky dark green tufts, to 8 cm tall (usually 2–4 cm), tomentose below. Stems distantly foliate, often partially or totally denudated of leaves. Comal leaves sometimes caducous and covering the tufts with loose leaves, with a much longer subula and a different structure of the costa as described for D. fleischerianum by Tan (1983). Leaves 5–7 mm long, short and slightly curved or flexuose and with relatively short subula, which is only 1.5 times longer than the lamina, or longer and falcate-secund with longer subula, often deciduous, from sheathing, concave base narrowed into a long channelled subula. Costa covering 1/4–1/3 of leaf base, indistinctly limited from the lamina, often with a dark stripe in the middle caused by the ventral stereid band and a gradual transition to the lamina, excurrent in a more or less denticate apex. Alar cells thin-walled, inflated, reddish or hyaline. Basal laminal cells rectangular, thick-walled, 3–5 times longer as wide, rarely pitted, narrower and thinner at margins, the inner and outer ones not strongly differentiated. Upper laminal cells firm walled, ca. 5–10 times longer than broad.

Seta 6–10 mm long, erect, twisted and flexuose, curved when wet in young sporophytes. Capsule oblong, ovoid, elliptic to short cylindric, 1.5–2 mm long, smooth. Operculum as long as the capsule. Calyptra smooth at base. Spores 10–15 mm.

Illustrations: Grout (1937): pl. 43; Crum & Anderson (1981): fig. 103; Bartram (1939): fig. 49 as D. subasperum; Frahm (1991): fig. 142. The illustration in Gangulee (1971: fig. 150), drawn from a Japanese specimen, shows a leaf with a relatively narrow costa, a lamina reaching far up the leaf with almost quadrate upper laminal cells and the leaves crisped when dry. It does not fit this species but was probably drawn from a species of Dicranum.

There are no specimens of Dicranodontium denudatum in the Bridel-Herbarium in B, however, one of the syntypes cited in the protologue is in G, and this specimen is proposed as lectotype.

Dicranodontium denudatum is very variable in appearance. The variation ranges from small plants with almost erect and relatively short pointed leaves to robust plants with distinctly falcate leaves. Dicranodontium didymodon seems only to differ by its smooth leaf tips.

Campylopus alpinus (D. denudatum var. alpinum) consists of plants in dense tufts with almost erect, shorter pointed leaves, which are only slightly curved at the stem tips. The plants give the impression of a species of Campylopus and can only be distinguished when sterile by its longer upper laminal cells, which are about ten times longer as wide. These plants also much resemble Dicranodontium submorodictyon in appearance. The latter has, however, strongly porose laminal cells. This type of variation is often seen in alpine expressions of many other species, and so this taxon is not given taxonomic rank.

According to Eddy (1988), Dicranodontium subasperum cannot be distinguished from stressed or juvenile forms of D. uncinatum. The inner basal cells of D. subasperum are, however, “merging rather gradually into the narrow marginal cells” (Eddy 1988), but are distinct in D. uncinatum. D. subasperum is not treated here as a form of D. uncinatum, since this character seems to be a fundamentally different character state within the genus.

The authors of Dicranodontium perviride compare the species with D. sparsum, from which it differs by a less broad limbidium at the leaf margins, and D. ceylonense, from which it differs by a scabrous subula. Both D. sparsum and D. ceylonense are synonymous of D. denudatum. These characters are regarded as relatively unimportant for delimiting a species and therefore also D. perviride is provisionally placed here into the synonymy of D. denudatum.

Habitat: on siliceous rocks and boulders (sandstone, granite), on rotten wood and tree stumps in humid habitats from the submontane to the alpine belt.
Distribution: Holarctic; Eurasia (Europe, Caucasus, Himalaya, Siberia, China, Japan), south to India, Sri Lanka and the Philippines, North America, Newfoundland, Ontario, British Colombia, from there through the Rocky Mountains south to Central and South America (Mexico, Guatemala, Honduras, Nicaragua, Costa Rica, Venezuela, Bolivia, here newly recorded for Peru).

confused with the latter, especially because both species occur together in parts of the Himalaya and can hardly be distinguished macroscopically. It differs, however, microscopically by the enlarged hyaline and well differentiated inner basal laminal cells.

The enlarged hyaline inner basal laminal cells are shared with *Dicranodontium uncinatum*. This seems to be the reason that *D. didictyon* (or its synonym *D. dimorphum*) has been reported from within the range of *D. uncinatum* in tropical SE-Asia. *Dicranodontium uncinatum* is, however, more robust and has a different transverse section of the costa. The transverse section of *D. didictyon* resembles that of *D. denudatum* with a small group of ventral stereids in the middle of the costa, whereas the ventral stereids of *D. uncinatum* cover the whole costa.

The authors of *Dicranodontium dimorphum* compare this species with *D. didicyton* (“*D. dictyoni* (sic) valde affinis”), from which *D. dimorphum* is distinguished by a couple of quantitative characters such as smaller size, narrower and longer, less dentate leaves, narrower laminal cells, shorter seta and smaller capsule. Gangulee (1971) differentiates *D. dimorphum* from *D. dictydon* in his key by weakly delimited lower pale cells and a smooth leaf tip. These characters are not sufficient to separate the two species. Therefore *D. dimorphum* is regarded as a synonym of *D. dictydon*.

**Habitat:** on rotten wood and ground.

**Distribution:** N India, China (Chiuhan, first record from Yunnan).

*Specimens examined.* — **India.** Sikkim, Tonglou, Kurz 2107 as *D. attenuatum* (H-BR); Rhambhi 1 829 m, Long 7887 as *D. dimorphum* (H-BR); Senchal Range, *Hartless 2206 as D. dimorphum* (H-BR); prope Kurseong, *Decoly & Schaull 2548 bis as D. dimorphum* (H-BR). Darjeeling, *Stevens 4–6 (H-BR); Thareg 3 353 m, Long 7552 (H-BR); Ghoom Ridge, *Hartless 2205 (H-BR).** China.** Sichuan. Setschwan, in montium Daliang-schan, *Handel-Mazzetti 1531 (H-BR); inter Yenyuen et Yungning, *Handel-Mazzetti 2946 (H-BR).* Yunnan. prope fines Tibeto-Birmanicas inter fluvis Lu-djiang et Djiou-djiang, *Handel-Mazzetti 9247, 9491, 9350, (H) as D. armatum.*

*Dicranodontium didymodon* (Griff.) Par. (Fig. 4)


Plants 0.5–2(–)3 cm high. Leaves up to 6 mm long, falcate secund especially at stem tips, from an ovate, concave base quickly contracted into a long, tubulose subula. Costa filling 1/3–1/2 of the leaf base or more, often with a dark line in the middle, excurrent into a subula, which is very minutely serratulate in the upper part or almost smooth. Alar cells inflated, lax, sometimes auriculate, hyaline and thin-walled. Inner laminar cells incrassate, short rectangular (1:2–5), hardly pitted, much larger than the outer basal laminal cells but not very sharply separated from them. Upper laminar cells elongate rectangular, 10–12:1.

Seta 8–10 mm long. Capsule 1.5 mm long, oblong or short cylindrical. Calyptra smooth at base.

Illustrations: Gangulee (1971): fig. 148 as *D. decipiens*, fig. 147 as *D. attenuatum*, fig. 154 (see note below), fig. 156 as *D. caespitosum*.

This species is conspicuously small and slender, distinctly more slender than *Dicranodontium denudatum*. Microscopically it is easily recog-
Fig. 4. *Dicranodontium didymodon* (Griff.) Par. (*Griffith 32, H-BR*). — a: leaf. — b: Leaf base. — c: Basal laminal cells. — d: Upper laminal cells. — e: Transverse section of costa.
nized by the almost smooth subula, a character found within the genus only in this species. It has, however, a much more slender habit (and has therefore been described as *Dicranella attenuata*). Even the tallest plants seen (material named *Dicranodontium birmense* by Brotherus) look therefore different from *D. denudatum*.

The species has been described under several names, but all from the same range. Gangulee (1971) separated *Dicranodontium decipiens* and *D. attenuatum* from *D. didymodon* by "comparatively slender or low plants" and the couplet, which should have differentiated *D. decipiens* and *D. attenuatum* contains no alternative to distinguish both species.

*Dicranodontium longigemmatum* was described as species of *Campylopus* and was transferred to *Dicranodontium* by Frahm (1985) based on an isotype kept in the herbarium of Beijing (PE), since the type was not available. The isotype on an isotype kept in the herbarium of Beijing (PE), since the type was not available. The isotype contains no alternative to distinguish both species. *D. longigemmatum* from PE cited by Frahm (1994) as well as the isotype belong to *Dicranodontium didymodon*.

Gangulee (1971) describes and illustrates *Griffith 32*, which differs from the type and the specimen *Griffith 32* in H-SOL by a narrow costa, filling only 1/6 of the leaf base, a long cylindric capsule and erect-patent leaves.

Habitat: on ground, rotten wood, and bark of trees between 200 and 3,900 m altitude.

Distribution: Himalaya (Darjeeling, Sikkim, Bhutan, here newly recorded to Nepal), where it seems to be quite frequent, China (Yunnan), Thailand, Burma.


*Dicranodontium porodictyon* Card. & Thér. (Fig. 5)


Plants to 8 cm high, erect, in tufts, reddish tomentose below. Leaves up to 9 mm long, flexuose (type of *D. hawaiicum*) or falcate (type of *D. falcatum*), concave at base, quickly narrowed into a long, setaceous apex. Costa filling one third of leaf base, excurrent, finely denticulate in the upper part. Lamina reaching 1/4 of leaf length. Alar cells large, hyaline or reddish. Inner basal laminar cells enlarged in a short group, shortly rectangular (1:2–5), hyaline and thin-walled and also incrassate and pitted. Outer basal and middle laminar cells elongate, incrassate and pitted. Upper laminar cells linear, incrassate.

Sporophyte not known.
A species which is easily recognized by its strongly porose basal laminal cells. The species was known only from the Chinese type specimen until it was discovered that specimens collected in the Himalaya as *Dicranodontium macroalare* and the species described from Hawaii as *D. falcatum* or *D. hawaiicum* are conspecific. The records from Hawaii are much more numerous than those from Asia.

**Habitat:** on trees and wet peaty banks.

**Distribution:** India (Sikkim), China, Hawaii.

**Specimens examined.** — **USA.** Hawaii, swamps of Kohala, *Rack* s. n. as *D. falcatum* (H-BR), Kohala Mtns., Alakai trail, Bishop & Herbst s. n. (U). Maui, Baldwin 247, 1138, 1141 as *D. falcatum* (H-BR), Haleakala, Skottsberg 1177, 1178 as *D. falcatum* (H-BR), Puu Kukui, Skottsberg 1630 as *D. falcatum* (H-BR), Oahu, Baldwin 1696 as *D. falcatum* (H-BR). Kohalu, Upper Kamakua ditch, Selling 4664 as *D. falcatum* (H); Oahu, N Waianae Mtns., Bryoph. Hawaiica Exsicc. 53 as *D. falcatum* (H, MICH, U); Puu Kaala, Hoe 483 (MICH). Maui, Kula Pipe Line Trail, Bartram 570 as *D. falcatum* (H), ibidem Hoe 373 (MICH); Puu Kukui, Cranwell 4058 as *D. falcatum* (H); Alakai swamp, Selling 4288 as *D. falcatum* (H); Oahu, Kipapa Gulch, Hosaka s. n. as *D. falcatum* (H). Maui, Haleakala Nat. Park, Vitt 14860 (ALTA, hb. Frahm). **India.** Sikkim, Shikar Jum 3 505 m, Long 7886 as *D. macroalare* (H-BR). Sencal Range 8 000 ft., Hartless 2209 (H-BR). **China.** See type cited above.

**Dicranodontium pulchroalare** Broth. (Fig. 6)


Plants to 10 cm long, distantly foliate, in loose tufts. Stems tomentose below. Leaves erect spreading or curved, 8–10(–12) mm long, longly setaceous, canaliculate at base. Costa excurrent in a long awn which is densely spinulose all around in the upper third. Lamina reaching only 1/4 of leaf length. Alar cells reddish or hyaline, large, thin-walled, inner basal laminal cells enlarged, shortly rectangular (1:2–5), thin-walled and hyaline, in older leaves also incrassate and pitted, but always distinct from the outer laminal cells, which are narrow elongate, firm-walled and pitted. Middle laminal cells as outer basal laminal cells. Upper laminal cells elongate, 7–12: 1, firm-walled, slightly pitted.

Seta 9 mm long. Capsule oval. Spores 13–15 µm.

Illustrations: Frahm (1991): fig. 143 as *D. meridionale*, fig. 144.

*Dicranodontium meridionale* and *D. pulchroalare* were accepted as separate species in the treatment of the Campylopodioideae in the Flora Neotropica series (Frahm 1991). The latter species was only known from the type locality and recorded from an additional collection in Costa Rica. However, *D. pulchroalare* differs only by its larger size and pitted inner basal laminal cells. The first character is merely a quantitative character and cannot be used to differentiate at the species level. The second character is also found in large forms of *D. uncinatum* and seems to be an effect of the larger size.

Often it is difficult to distinguish this species from *Dicranodontium uncinatum* because the leaf anatomy of both species is very similar. *Dicranodontium pulchroalare* has erect-spreading, patent or appressed and slightly curved leaves, *D. uncinatum* has usually circinate leaves, but the *D. fleischarianum* expression in the tropics also ap-pressed and slightly curved leaves. A character differentiating both species is a small band of 1–4 laminal cells extending up the leaf in *D. uncinatum*, which is denticulate at margins.

Brotherus was not sure where to place this species when he described it. The specimens in his herbarium are labelled as “*Campylopus perauriculatus*”, “*Atractylocarpus perauriculatus*” and “*Dicranodontium pulchro-alare*”. The enlarged inner basal laminal cells in combination with the elongate laminal cells and the long serratulate leaf apex make it, however, most probable that this species belongs to *Dicranodontium*.

*Dicranodontium denudatum* and *D. pulchroalare* have several times been collected at the same localities.

*Dicranodontium pulchroalare* was found only a few times with sporophytes and is usually sterile, which is surprising considering its relatively large range.
Habitat: on soil, rocks and rotten wood at elevations from 1 100–2 600 m.

Distribution: Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Venezuela, Colombia, Peru, Bolivia, here newly recorded for Ecuador and Mexico.


**Type:** Brazil. Serra dos Orgaos, Type: Brazil. Serra dos Orgaos, v. Lützelburg 6519 (holotype H-BR).

**Dicranodontium** pulchroalare ssp. brasiliense (Herz.) Frahm, comb. et stat. nov.


Illustrations: Frahm (1991) fig. 140.

**Dicranodontium** brasiliense differs from *D. pulchroalare* only in the falcate leaves and the less serrate leaf tip, as already mentioned by Frahm (1991). Therefore it is regarded as a vicariant sub-species of the latter in SE-Brazil.

Distribution: Known only from the type locality.

**Dicranodontium** uncinatum (Harv.) Jaeg. (Fig. 7)


Fig. 7. Dicranodontium uncinatum (Harv.) Jaeg. (Durel 26, H-BR). — a: Leaf. — b: Basal laminal cells. — c: Leaf apex. — d: Margin of upper part of the leaf. — e: Transverse section of costa.
Dicranodontium fleischerianum Schultze-Motel var. longisetum (Broth.) Touw, J. Hattori Bot. Lab. 44: 152. 1978.
— Type: Malaysia. Borneo, Mt. Kinabalu, Clemens 10741 (holotype H-BR).

Plants 6–10(–20) cm long, in golden green, glossy tufts, tomentose below, larger plants prostrate, ascending with stem tips. Leaves up to 12 mm long, with broad sheathing base of 1/4–1/5 leaf length, circinate, setaceous, curved and homomallous or slightly curved and stronger curved at stem tips or almost erect and only slightly sinuose. Costa filling 1/3 of the leaf base, excurrent in a fine subula which is serrulate down to the middle. Alar cells hyaline and thin-walled, inflated, often remaining at the stem. Inner basal laminal cells conspicuous, forming a large group of hyaline, rectangular (1:3–5) cells which are sharply delimited from the outer and upper laminal cells. Outer laminal cells in 10–12 rows very narrow and linear. Upper laminal cells two-layered, merging with the costa which is indistinctly delimited (as in Chorisodontium), thick-walled and pitted. Seta 10–15 mm long, erect, sinuose. Capsule 2 mm long, ovoid to short cylindrical, smooth or slightly ribbed. Operculum nearly as long as the capsule, obliquely rostrate. Calyptra ciliate at base, slightly ribbed. Operculum nearly as long as the capsule, obliquely rostrate. Calyptra ciliate at base, slightly ribbed. Operculum nearly as long as the capsule, obliquely rostrate. Calyptra ciliate at base, slightly ribbed.

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Illustrations: Nyholm (1954): fig. 33A; Gangulee (1971): fig. 155 (does not seem to fit the species), fig. 153 as D. fleischerianum; Fleischer (1900–1902): fig. 9 as D. nitidum; Tan (1983): figs. 1–5.

This species is very easily recognized by its robust size (it is apparently the largest species within the genus), in its typical expression with circinate leaves. The plants named Dicranodontium fleischerianum have falcate but not circinate, weakly falcate or almost straight leaves. Some specimens from Europe grow in dense tufts and have less strongly curved leaves (var. subfalcatum Limpr.). Such less falcate forms seem to occur at higher elevations and can be compared with alpine forms of D. denudatum.

I was not able to sufficiently separate Dicranodontium uncinatum and D. fleischerianum. Both species have been reported from SE-Asia. Tan (1983) states that “the two species can be difficult to separate in some collections.” In keys (Fleischer 1901–1902, Gangulee 1971), “D. fleischerianum is generally distinguished from D. un-
and is better accepted as Atractylcarpus novoguineensis (Broth. & Geh.) Norris & T. Kop.

Dicranodontium sparsum consists of very “sparse” plants which are a few millimeters high. The leaves show distinct hyaline enlarged cells at base. Since the leaf apices are serrate, it is supposed that the species was described from young plants of Dicranodontium uncinatum. Dicranodontium didictyon resembles it better in size but has almost smooth leaf apices.

Dicranodontium uncinatum was originally described as species of Thysanotomitron because of the ciliate base of its calyptra. It is apparently the only species of Dicranodontium with a ciliate calyptra.

Dicranodontium uncinatum was erroneously cited as an illegitimate homonym by the authors of Index of Mosses (Crosby et al. 1992).

Habitat: on damp, shaded silicic rocks and cliffs in cool montane regions, in the southern Himalaya (Sikkim) also on trees, in tropical regions on rocks, rotten wood and soil in montane rainforests. In Scotland often together with species of similar distribution such as Pleurozia purpurea, Breutelia chrysocoma, Campylopus schwarzii and also Dicranodontium asperulum. According to the quantities collected in some places apparently growing in large masses.

Distribution: Atlantic parts of Europe (Scotland, Norway), Suedes, Alps (Austria, Switzerland); West Coast of North America (British Columbia); Japan, Taiwan, Himalaya (Nepal, Sikkim, Bhutan, N-Burma). Sri Lanka, Java, Sulawesi, Burma, Borneo, Philippines, tropical to subtropical China (Hainan, Yunnan).

Specimens examined. — **Scotland.** Hunt s. n. (H); Ben More, Meldram s. n. (H); Loch Assynt, Sutherland, Duncan s. n. (H); Ben Lawers, Hunt s. n. (H); Argyllshire, Ballachulish, Binstead s. n. (H); Ben Vuirloch, Hunt s. n. (H), Greville s. n. (H-SOL). **Norway.** Rogaland, Otlen, Dirdal, Persson s. n. (H); Bergen, Isdalen, Jürgensen s. n. (H); Hordaland, Fitjar, Levar, Störmer s. n. (H); Rugsund, Wulfberg s. n. (H-SOL); Stavanger, Kaalau s. n. (H-SOL); Hordaland, Os, nar Mösnecken, Persson s. n. (H); Stavanger, Nyman s. n. (H); Suedal, Brynh s. n. (H); Nordfjord, Rugsund, Wulfberg s. n. (H). **Poland.** Karkonosze, Bryotheca Polonica 309 (H). **Austria.** Salzburg, Krimmler Falle, Handel-Mazzetti s. n. (H), Breidler s. n. (H-SOL); Tirol, St. Anton am Arlberg, Musci europ. exsicc. 729 (H); Styria, Saetertal, Dürmerssteig, Breidler s. n. (H); St. Nikolai, Breidler s. n. (H, H-SOL), Flora Exsiccata Austro-Hungarica 1126 (H); Kaltenbachl bei Sölk, Breidler s. n. (H-SOL); Steiermark, Hexstein bei Irdning, Breidler s. n. as D. denudatum (H-SOL); Preneggthal bei Schladming, Breidler s. n. (H-SOL). **Canada.** British Columbia, Queen Charlotte Isl., Schofield 45087 (H); Graham Isl., Dawson Inlet, Persson s. n. as D. denuatum (H). Moresby Isl., Takakia Lake 10 miles S of Moresby Logging Camp, Schofield 25076 (NY). Peel Inlet, Schofield 30477 (NY, U), 30761 (NY). **Japan.** Yakushima Isl., Bryophyta selecta exsiccata 433 (H); Saitama Pref., Chichibu Mtns., near Jumonji Pass, Bryoph. Sel. Exsicc. 185 (H); Kyushu, Kumamoto Pref., Mt. Ichiusaya, Mayebara 22912 (H); Tokushima Pref., Mt. Tsurugi, Koponen 36550 (H, hb. Frahm). **Bhutan.** Inter Maria Basti et Labar, Durel 26 as D. didictyon (H-BR). **Nepal.** Between Ghopote and Gosa, Iwatsuki 993 (H). **India.** Darjeeling, Phalut, Hara et al. 200936 (H). Siri 7 000 ft., Gambler 10070 as D. didictyon (H-BR); Beang, on trees 600 ft., Long 7543 (H-BR); Thallur 11 880 ft., Long 7551 as D. didictyon (H-BR); prope Kurseong 1 900 m, Breutaeau 1706 as D. didictyon (H-BR); ibid., Mahaldaram 6 800 ft., Decoly & Schau 2558 as D. didictyon (H-BR); ibid. Decoly 270 (H-BR). Tiger Hill, Fleischer B 3240 (H). **China.** Yunnan, “prope fines Tibeto-Birmanicas in convalle fluvii Djou-djang … supra vicum Schutsche”, Handel-Mazzetti 9451 (H-BR) as D. blindioides. Hainan, on trees alt. 1 500 m, McClure 8696 as D. forbesii rev. Tan (H-BR). Sichuan, Omei Shan, along trail to Golden Summit, Redfearn 34688 (SMS, hb. Frahm). **Sri Lanka.** Horton Plains, Cryptogamae Exs. 1690 (H); Central Province, without collector (H-BR); an Felsen der Name-Bya Schlucht bei Nuwara Eliya, Herzog 161 (H-BR). Nuwara Eliya, v. HübSchmann s. n. (hb. Frahm); ibidem Eggers SL 5,6, SL9,1 (hb. Frahm). **Indonesia.** Java. Prov. Preanger, Tjibodas, Cryptog. Exsicc. 3876 (H); Tjibodas, Nyman s. n. 1898 (H-BR); Tjiburrum 1 700 m, Musci Arch. Indici 119 (H-BR); ibid. Nyman 110 (H-BR); ibid. Schiffner s. n. (S, hb. Frahm). Pangeraongo, Kurz 875, 658, Wichura 2508, 2509, Didrichsen s. n., Möller 342, 343, Nyman 38, 40, Fleischer s. n., Musci Arch. Indici 120 (H-BR); Salak, Möller 353 (H-BR) as D. forbesii. Sulawesi, Pik von Bonthain, Warburg s. n. (H-BR). **Burma.** Nattorang 7 000 ft., Kurz 2877 as D. didictyon (H-BR). Saw Chau, Chin Hills, Dickason 8556 (H). Siam, Hosseus s. n. as D. dimorphum (H-BR). **Malaysia.** Borneo. Mt. Kinabaluu Park, Bryoph. Selecta exsiccatia 831, 983 (H); Clemens 10741, 10742 (H-BR), Meijer s. n. (S, hb. Frahm). **Philippines.** Luzon, Mt. Tabayoc, Jacobs B 566 (H, L); Mindanao, Mt. Lipa, Ramos 37165 (H-BR); Luzon, Benguet, Pauai, Clemens 9313, McGregor 8699 as D. didictyon rev. Tan (H-BR). Prov. of Laguna, Mt. Banajao, Robinson 6593 as D. didictyon (H-BR). Mt. Polia, Ifugao Prov., Panceo 4802 (FLAS). **Taiwan.** Prov. Taityn, Mt. Nobo, Suzuki 2668 as D. subunicatum (H-BR); Mt. Tai-ping-shan, Ilan Co., Chuang 2060 (H). Prov. Takao, Mt. Daibu, Simada 3809 (H).

**GEOGRAPHIC DISTRIBUTION**

The genus Dicranodontium is mainly holarctic in distribution. There are two species in North
America (D. denudatum and D. asperulum), three in Europe (the latter two plus D. uncinatum), however, twenty-three were described from the Himalayas and adjacent China, which raised much confusion and much more than half of the specimens from this area needed to be revised. Even after the revision, there are 5 species (D. asperulum, D. denudatum, D. didictyon, D. didymodon and D. uncinatum) occurring together in the small region of Sikkim. Gangulee (1971) has pointed out that the species within the genus Dicranodontium are heavily concentrated in Asia.

It is conspicuous that the three species occurring in the temperate latitudes of the northern hemisphere belong to two different sections of the genus. These species are also those with the largest ranges, covering the entire holarctic, although the ranges are fragmentary, probably as a result of the Quaternary climate changes. It can be supposed that these species were the ancestors, from which the other species derived, e.g. Dicranodontium didictyon from D. uncinatum and D. didymodon from D. denudatum in the region from Sikkim to Yunnan.

Dicranodontium denudatum is the most frequent and most widespread species of the three species occurring in the temperate region of the holarctic. It is not only very frequent in western Europe but is also found in Russia (Moscow, Altai Mtns.).

Dicranodontium asperulum and D. uncinatum have a very similar distribution in the northern hemisphere and are occasionally even found together. The highly disjunct range comprises British Columbia, Scotland and Norway as well as in Japan, which could be interpreted as a relictical range from the Tertiary in an area, which was not ice covered during glaciation, similar to the range of Campylopus atroviresens. However, both species of Dicranodontium are also found in Central Europe (Alps, Tatra), which corroborates this hypothesis.

All species of Dicranodontium described from the southern hemisphere and tropical Africa were misplaced in this genus.

EXCLUDED SPECIES

Dicranodontium asperifolium (Mitt.) Broth.


Dicranodontium australé Dix.


Dicranodontium brachydictyon Broth.


Dicranodontium costaricense (C. Müll.) Williams


Dicranodontium filifolium Broth.


Although the leaves of the type specimen have a rather broad costa (1/4 of the leaf width at leaf base), the upper laminal cells are short rectangular (1:2) to almost quadrate and extend nearly to the leaf tip, and the basal laminal cells are short rectangular and very strongly incrassate. The most conspicuous character of this species is that the comal leaves end in a very long subula which is 5–7 times longer than the lamina. The type material is sterile and therefore the systematic position of this species remains unclear.

Dicranodontium humile P. Varde


This species, which is known only sterile and only from the type specimen, is certainly no Dicranodontium. Its costa fills only 1/10 of the leaf width, the subula is short, smooth (denticulate only in the extreme apex), the basal laminal cells are homogenous thick walled and incrassate and not
differentiated in inner and outer ones. The large inflated alar cells indicate that it is probably a species of *Blindia*, perhaps *B. acuta* (Hedw.) B.S.G., which is known from higher elevations in Central Africa.

Dicranodontium insularum  Bartr.


Dicranodontium intermedium  Allen


The epithet refers to the intermediate position between *Atractylocarpus* and *Dicranodontium*. The species is autoicous like *Atractylocarpus* but has cygneous setae like *Dicranodontium*. Compared with all other species included here in *Dicranodontium*, the species lacks however, ventral and dorsal epidermal cells in transverse section of the costa as in *Atractylocarpus*. It has furthermore thick-walled, pitted inner basal laminal cells, a character, which is not present in *Dicranodontium* but which is found in *Atractylocarpus neocaldonicus* Broth. For these reasons, I place *Dicranodontium intermedium* in *Atractylocarpus*, although the cygneous setae clearly shows that the systematic placement of this species is still problematical.

Atractylocarpus intermedii (Allen) J.-P. Frahm *comb. nov.*

*(Dicranodontium intermedium* Allen, Novon 2:1. 1991.)

Allen (1994) includes *Atractylocarpus* in *Dicranodontium* as Williams (1913) did. This eliminates the problem with the generic position.

Dicranodontium interruptum  P. Varde


It could be concluded from its epithet that this species is not a *Dicranodontium* but belongs to *Bryohumbertia*, because the interrupted foliate stems are highly characteristic for the latter genus. The exact identity of *D. interruptum* is not known since the genus *Bryohumbertia* lacks a worldwide revision and the situation in Africa is very puzzling. There are three species recognized worldwide: *B. filifolia* (Hornsch.) J.-P. Frahm in the Neotropics, *B. flavicoma* (C. Müll.) J.-P. Frahm in tropical Africa and *B. subcomosa* (Dix.) J.-P. Frahm in SE and E-Asia. *Bryohumbertia filifolia* usually consists of large plants with several tufts of verticillate leaves. In contrast, *Bryohumbertia flavicoma* consists of small plants which have only a basal rosette of leaves or one comal tuft in addition. *Bryohumbertia subcomosa* resembles *B. flavicoma*. In the neotropics there exists, however, a small form within the range of *B. filifolia*, which resembles *B. flavicoma* or *B. subcomosa*. This is presently regarded as *B. filifolia* var. *humilis* (Mont.) J.-P. Frahm. At present it is not known whether *B. filifolia* var. *humilis* is a separate species or not and whether *B. flavicoma* and *B. subcomosa* are identical with the latter. Most confusing is the very rare presence of *B. filifolia*-like plants in Africa. It is not known whether these belong to *B. filifolia* from the neotropics or whether these are larger forms of *B. flavicoma*. The type of *Dicranodontium interruptum* consists of such large *B. filifolia*-like plants which are 7 times interrupted foliate.

Dicranodontium novo-guineense  Broth. & Geh.


Dicranodontium papillifolium  Gao Chien

Type material was not available on request. This species is described as having papillose leaves, a character which would be unique in this genus and which makes it very unlikely that this species belongs to *Dicranodontium*. Specimens named *D. papillifolium* in PE, of which the labels written in Chinese could not be transcribed, belong to *D. asperulum*.

*Dicranodontium schwabei* Herz. & Thér.


*Dicranodontium setosum* Williams


*Dicranodontium sinense* (C. Müll.) Par.


This species should be referred to *Campylopus japonicus* Broth. because of its quadrate upper laminal cells and the almost smooth long leaf tip. For the distribution of *C. japonicus* in China, see Frahm (1992). Since the epithet “sinense” has the priority, a new combination must be introduced:

*Campylopus sinensis* (C. Müll.) J.-P. Frahm, *comb. nov.*


*Dicranodontium sordidum* (Mitt.) Gangulee


According to the authors of the Index Muscorum (Van der Wijk *et al.* 1959), this species is *Blindia sordida*. However, Bartlett and Vitt (1986) state in their monograph of *Blindia* that the type (not seen) is dicranoid and not seligeroid. So this problem needs further study.

*Dicranodontium subporodictyon* Broth.


*Dicranum subporodictyon* (Broth.) Gao


This species differs from all other species of *Dicranodontium* by (1) a lamina which reaches 2/5 of the leaf length and therefore the leaves lack a long subula, (2) reddish, inflated, not fugacious alar cells, (3) not deciduous leaves, (4) a relatively narrow costa, which fills only 1/4 of the leaf base, and which is indistinctly confined and widened in the part of the leaf where it fills the subula (as in the genus *Chorisodontium*), (5) strongly incrassate and pitted basal laminal cells, (6) gradually tapering leaves as already noticed by Corley and Wallace (1974), and (6) relatively short incrassate and pitted upper laminal cells. The sporophyte is not known.


Gao placed this species in *Dicranum*. *Dicranodontium subporodictyon* differs in fact from other species of the genus by so many characters, that it cannot be kept in the genus. Its generic placement is, however, dubious due to the lack of sporophytes.

There are several species of *Dicranum* (*Orthodricranum* viz. *Crassidicranum*) in E-Asia such as *D. leiodontium* Card. and *D. hamulosum* Mitt. in Japan, to which *Dicranum subporodictyon* seems to be related, however, this complex is in urgent need of a revision. Brotherus (1924) established a subgenus *Pseudochorisodontium* within *Dicranum*, which reminds one of the *Chorisodontium*-like costa of *D. subporodictyon*, but the four species put by Brotherus in this subgenus (two of them from E-Asia) have a very narrow costa.
This species was described and previously known only from Yunnan. In 1971, E. C. Wallace collected a specimen in Scotland, which he suspected to be a *Campylopus*, but could not name. He sent a sample to the author as well as other bryologists, who regarded it as a *Dicranodontium*, perhaps a form of *D. denudatum*. Later M. F. V. Corley compared it with specimens of *Dicranodontium* kept in the British Museum and found that the Scottish specimen was identical with *D. subporodictyon* from Yunnan. The description of the Scottish specimen given by Corley and Wallace (1974) differs from the type by scantyomentum and the indication of 1–2 rows of upper laminar cells in the upper half of the leaf. They mention, however, a conspicuous character of *D. subporodictyon*, a dark stripe in the middle of the costa. According to herbarium specimens, W. B. Schofield had collected this species in British Columbia in 1962 and then later in 1964 and 1968. As shown from his labels, he had also named it first as *Campylopus* sp. Furthermore, an unnamed specimen collected by W. C. Steere in 1949 could be identified as *Dicranodontium subporodictyon*. It is recorded here for the first time for Alaska viz. the United States.

Although all specimens named *Dicranodontium denudatum var. alpinum* from Scotland and several from other regions (e.g. Norway) were examined, no additional record of *Dicranodontium subporodictyon* from Europe could be found.

The disjunction between Scotland and the Himalayas viz. Yunnan is also met in the hepatics *Mastigophora woodsii*, *Bazzania pearsonii*, *Anastrophyllum donianum*, *A. joergensenii*, *Plagiochila carringtonii*, *Scapania ornithopodioides*, *S. nimbosa*, *Pleurozia purpurea*, and in the mosses *Campylopus schwarzii* and *Leptodontium recurvifolium* (Corley & Wallace 1974).

Habitat: on wet siliceous rocks.


Specimens examined. — Scotland. Above Kniloch Hourn, West Inverness, Wallace s.n. (hb. Frahm), Canada, Brit. Columbia, Queen Charlotte Islands., Graham Isl., Goose Cove, Schofield 37198 (H, U, hb. Frahm); S. E. Moresby Isl., Bigsby Inlet, Schofield 24064; Chaat Isl., Schofield 18666 (H); Moresby Isl., mouth of Tasu Sound, Schofield 84011 (H), 73669 (U), USA, Alaska, mouth of Kings River at junction with Matanuska River, Glenn Highway mi 67, Steere 12549 det. Frahm (NY).

**Dicranodontium tanganyikae** J. Tayl. & P. Varde

Kew Bull. 1954: 506, 1954. — Tanzania. Type: Tangan-
yika, Lupanga Peak 4 000 ft., Burtt 4713 (holotype PC).

The sterile type specimen of this species, which is known only from the type, does not be-
long to *Dicranodontium* because of its short (1:1.5–2) upper laminar cells. But it is identical with *Campylopus flexuosus* (Hedw.) Brid. var. *incacorralis* (Herz.) J.-P. Frahm, an alpine variety known from the Andes and the afro-alpine regions.

**Dicranodontium tapes** (C. Müll.) Par.

Ind. Bryol. 120. 1900. — *Dicranum tapes* C. Müll., Hed-
wigia 36: 348. 1897. — Type: Australia. Tasmania, Deal Island, Dobson s. n. (not available).

**Dicranodontium tenii** Broth. & Herz.

Hedwigia 65: 150. 1925. — Type: China. Yunnan, “Umge-
gend von Pe yen tsin auf faulem Holz ca. 3 000 m, Ten 36 (holotype H-BR).

This species seems to be identical with *Dic-
ranum hamulosum* Mitt. (*Orthodicranum hamulo-
sum* (Mitt.) Broth.) described from Japan and so far recorded as endemic from Japan. However, the systematic position of this species as well as other E-Asian species of *Dicranum* such as *D. leiodontium* Card. is dubious. Noguchi (1987) notes for instance that “*D. leiodontium* is very similar to *Dicranodontium.*” The plants have leaves with broad costae and short upper laminar cells and thus resemble certain species of *Cam-
pylopus* but have setae 10–15 mm long which are flexuose when moist, capsules with long opercu-
ulum and thus resemble *Dicranodontium*.

**Dicranodontium tenuinerve** Dix. & Sak.


Although described from Japan, this species was not treated by Noguchi (1987). Surprisingly, the type specimen turned out to be *Bryohumbertia subcomosa* (Dix.) J.-P. Frahm (= *B. walkeri* (Mitt.) J.-P. Frahm), a SE-Asian species, which was re-
corded first for Japan by Frahm and Deguchi.
(1987). The leaves can be superficially compared with those of *Dicranodontium*. They end in a long dentate arista and have large inflated alar cells, however, the upper laminal cells are not longly rectangular or linear but only shortly rectangular.

*Dicranodontium tristaniense* Dix. & Thér.


As mentioned by Dixon in the protologue (or by Bartram, who edited the publication after the death of Dixon?), this species differs from all other species of *Dicranodontium* by an erect seta, "which shows no sign of curving when moistened", and the peristome teeth are not divided to the base. It is furthermore evident from the description, that this species has an annulus. Therefore it is probably not a species of *Dicranodontium* but more likely a *Dicranoloma* or *Chorisodontium*.

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