

ON THE CHARACTERIZATION AND THE TAXONOMIC STATUS  
OF THE GROUP OF FISSIDENS SPECIES  
KNOWN AS PACHYFISSIDENS

BY

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ABSTRACT

It is demonstrated that the characters which so far have been considered to be typical for the subgenus *Pachyfiissidens* are also found in several species which on good grounds are included in the subgenus *Fissidens*. Therefore *Pachyfiissidens* can not be maintained as a subgenus; however, on account of a certain similarity in habit caused by the thickness of the leaves and on the ground of the fact that in all its species a central cylinder is normally lacking, *Pachyfiissidens* is retained as a section.

*F. rochensis* Broth., a species formerly placed in *Pachyfiissidens* is transferred to the section *Bryoidium*.

*Pachyfiissidens* was originally described as a section of the genus *Fissidens* (MÜLLER, 1849). Later KINDBERG (1897) gave it the rank of a subgenus. MÜLLER apparently did not agree with him, for in his "Genera Muscorum" of 1901 he maintained *Pachyfiissidens* as a section. BROTHERUS (1909) on the contrary followed KINDBERG and so did all subsequent authors.

According to BROTHERUS (1909; 1924) the subgenera *Pachyfiissidens* and *Fissidens* differ in three characters. Species of *Pachyfiissidens* have pluristratose leaves, a stem with a central cylinder and a capsule without stomata, whereas those of *Fissidens* have unistratose leaves, a stem with a central cylinder and a capsule with stomata.

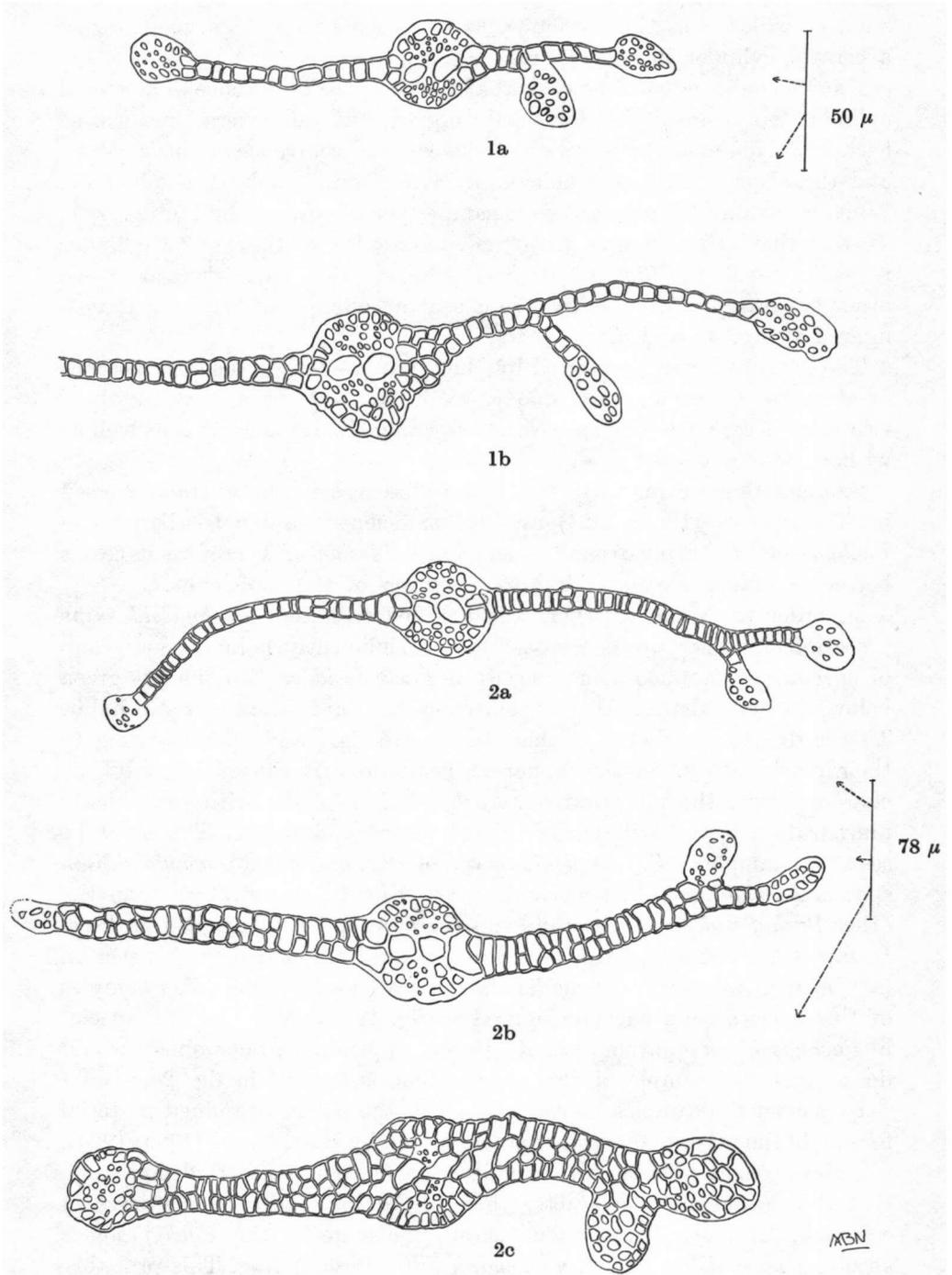
During my work on the section *Pachylomidium* of the subgenus *Fissidens* it appeared that several species of this subgenus too have or may have a partly or completely pluristratose lamina. Moreover, there are some parts in the lamina which in many species are liable to become pluristratose. Such parts are that at the base of the dorsal lamina, those alongside the nerve and border, the triangle at the base of the apical lamina in between the nerve and the sheathing lamina and, but less often, the apex. In some species, viz. in *F. rigidulus* Hook. f. et Wils., *F. steyermarkii* Bartr. and *F. ventricosus* Lesq., the dorsal lamina may even be pluristratose over its whole width. One therefore wonders whether these species should not be transferred to *Pachyfiissidens*, as indeed has been proposed for *F. ventricosus* by IRELAND and SCHOFIELD (1967).

In order to reach clarity in the discussion of the value of this character it is first of all necessary to obtain uniformity of opinion with regard to the question when a leaf should be called "pluristratose". Is it pluristratose only when the whole leaf except for the sheath is more than one cell layer thick? (The sheath should not be taken into consideration since even in typical *Pachyfissidens* species it often is unistratose). Or is it sufficient when the middle part of the dorsal lamina is over its whole width more than one cell layer thick? Or do we apply the term also to those leaves which have scattered bistratose parts in the middle of the dorsal lamina, or may be even to those which are only pluristratose in such parts as the base of the dorsal lamina, the parts alongside the nerve and the border or the basal triangle of the apical lamina?

Let us examine some examples. Fig. 1*a* and *b* show two sections through leaves of *F. rivularis* (Spruce) B.S.G. Both are taken from the middle of the leaf. One of them, fig. 1*a*, is completely unistratose. The other one has some pluristratose parts, viz. near the nerve and elsewhere in the dorsal lamina. Fig. 2*a-c* show comparable sections of *F. rigidulus*. All are more or less pluristratose. Figs. 1 and 2 together present a continuous series ranging from a leaf which is typical for the subgenus *Fissidens* (fig. 1*a*) to a typical *Pachyfissidens* leaf (fig. 2*c*).

From the above it is clear that, though it is possible to say that the leaves of some species are more conspicuously pluristratose than those of other ones, uni- and pluristratose merge into each other. Still one might use this character in combination with the other ones given by BROTHERUS. At least if distinctly pluristratose species never have a central cylinder or stomata on their capsules and if less conspicuously pluristratose and unistratose species always have a central cylinder and capsules with stomata.

Before we can talk about the presence of a central cylinder, there must be uniformity of opinion with regard to its definition. If well developed the central cylinder shows in a transverse section as a small round group of thin-walled cells in the centre of the stem (fig. 4*d*). If a central cylinder is clearly absent, all the inner cells are of about equal size and there are no differences with regard to the thickness of the cell walls (fig. 4*a*). However, should one speak of a central cylinder if there is but a slight decrease in size and/or in the thickness of the walls of the cells near the centre as is the case in fig. 4*b* and *c*? Or when a long thin central row of small compressed cells with thin walls is present as is the case in fig. 3? In my opinion fig. 4*a-d* present a gradual series ranging from stems clearly lacking a central cylinder to stems provided with a distinct one. All these figures are from the same species, viz. *F. rigidulus*. Moreover, not only between the stems of different specimens belonging to the same species, but also between different parts of the same stem there may be considerable differences. For instance fig. 4*a* and *b* show sections taken from the middle part of the same stem and the same applies to fig. 4*c* and *d*, while the



**Figs. 1 and 2.** Transverse sections of leaves. **Fig. 1.** *F. rivularis* (Spruce) B.S.G., *a* from Spruce (?) 47 and *b* from Marguand, Guernsey. **Fig. 2.** *F. rigidulus* Hook. f. et Wils., *a* from Sainsbury, Poverty Bay, *b* from Engel 3287 and *c* from Cook and Gilbert 670.

stem of which a section is shown in fig. 3 shows no signs whatever of a central cylinder in other parts.

From the above it will be clear that the presence or absence of a central cylinder too is unsuitable for separating the two subgenera. Besides, at least in *F. rigidulus*, the correlation between the occurrence of pluristratosity and the absence of a central cylinder is contradicted by the following. When we examine the stems of the samples which are pictured in fig. 2a-c, we find that in the sample with the thinnest leaves the central cylinder is badly developed (fig. 4b) or even wanting (fig. 4a); whereas in the other two samples the stems have a central cylinder of the kind that is figured in fig. 4c and d.

The last character mentioned by BROTHÉRUS—the presence or absence of stomata on the capsule—too can not be used for separating these two subgenera, for in one species, *F. steyermarkii*, capsules with as well as without stomata are found.

Summarizing we may say that the differences in the characters used by BROTHÉRUS (1909; 1924) are not sufficiently stable to distinguish *Pachyfissidens* sharply from the subgenus *Fissidens*. Therefore it seems better to reduce *Pachyfissidens* to a section of that subgenus.

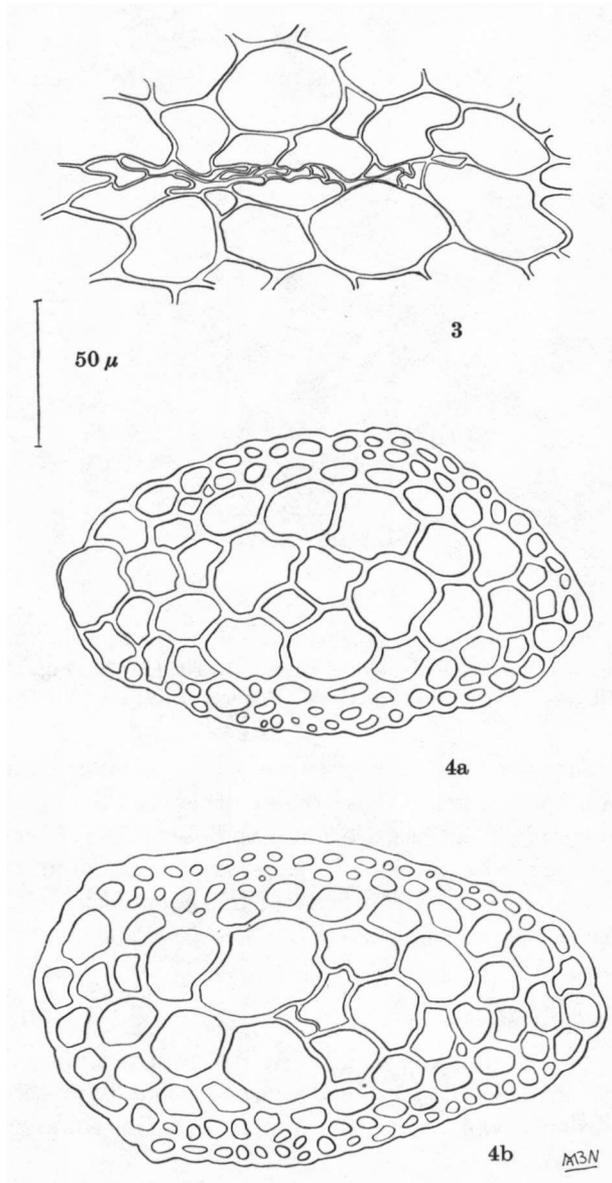
In order to decide whether it is justified to accept *Pachyfissidens* as a section, in other words whether it is a sufficiently homogenous group of species, I examined some species of *Pachyfissidens* (see the list given below) in more detail. All of them show the same characteristic habit. This is due to the fact that their leaves are rigid and opaque owing to their pluristratosity. So this apparent uniformity is caused by only one character, viz. the pluristratosity. *Pachyfissidens* plants with less thickly pluristratose leaves will probably look entirely different. This may be seen for example in *F. sedgwickii* Broth. et Dix. and in the *Pachylomidium* species *F. rigidulus*. *F. sedgwickii* is less thickly pluristratose than the other *Pachyfissidens* species and looks therefore quite different from these. In fact I am not even sure whether it should be included in this section (see below). As regards *F. rigidulus*, everyone not knowing other samples of this species than the one figured in fig. 2c would place this species in *Pachyfissidens* on account of its general appearance, but nobody would do so with the sample of this species that is figured in fig. 2a.

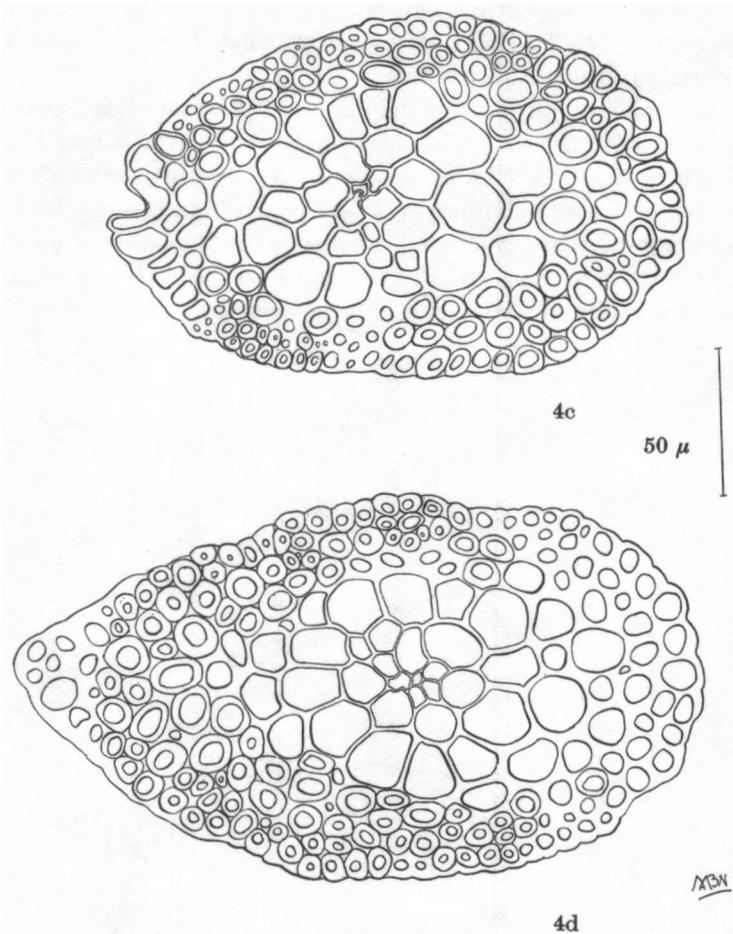
I checked the samples marked with ! in the list of examined material for one of the other diagnostic characters used by BROTHÉRUS (1909; 1924), viz. the absence of a central cylinder in the stem. I got the impression that this is one more character that all *Pachyfissidens* species have in common. (But see fig. 3 which shows the stem of the *Pachyfissidens* species *F. grandifrons* Brid. var. *planicaulis* (Besch.) Nog. This probably is an abnormality since other plants of this variety do not possess a central cylinder. Moreover, the stem of which the section shown in fig. 3 was made appeared to lack a central cylinder in other parts).

I did not have the opportunity to compare the sporophytes of all these

species. So I can not say much about possible similarities in these. However, from BROTHÉRUS (1909; 1924) we can learn that *Pachyfissidens* is not a very uniform group in this respect.

From the above we can conclude that the species included in *Pachyfissidens*, with the exception of *F. sedgwickii*, form a rather uniform group with a characteristic habit and generally without a central cylinder. However, none of these characters is—as we have seen—confined to this section. Moreover, many more specimens of *Pachyfissidens* species will have to be sectioned and examined before we can be sure that these characters are really invariable in *Pachyfissidens*.





Figs. 3 and 4. Transverse sections of stems. Fig. 3. *F. grandifrons* Brid. var. *planicaulis* (Besch.) Nog. from *Verdoorn*, *Musc. sel. crit.* II, 67. Fig. 4. *F. rigidulus* Hook. f. et Wils., *a* and *b* from *Sainsbury*, Poverty Bay, *c* and *d* from *Engel* 3287

If *Pachyfissidens* is to be accepted as a section, it should be possible to separate its species from those of all other sections. Since so far as I know *Pachyfissidens* species are not papillose, they are most likely to be confused either with species of *Serridium* (sensu NORRETT, 1969) or, as we have seen above, with those of *Pachylomidium*. The following table will enable us to separate *Pachyfissidens* species from those of *Pachylomidium*.

*Pachyfissidens*

No border of prosenchymatic cells, except in *F. sedgwickii*. In this species the border is confined to the sheathing part of the leaf.

*Pachylomidium*

Border of prosenchymatic cells in all species normally present in all three laminae; never completely wanting.

Central cylinder normally lacking. Central cylinder normally present.

Leaves pluristratose.

Leaves pluri- or unistratose; if pluristratose then as a rule less conspicuously so than those of the *Pachyfissidens* species.

*F. rochensis* Broth. is hereby transferred from the section *Pachyfissidens* to the section *Bryoidium*. This is done on account of its completely bordered leaves, the fact that this border is for the greater part unistratose and because of the presence of a central cylinder.

The other section with which *Pachyfissidens* might be confused, viz. *Serridium*, is less well known to me than *Pachylomidium* is. Therefore I won't venture to give indications about how to distinguish both sections. When one consults BROTHERUS (1909) with regard to this problem, the most obvious characters for separating them are again the pluristratosity of the leaves and the absence, respectively presence of a central cylinder in the stem. However, pluristratosity can not be used as at least two *Serridium* species, viz. *F. cristatus* Wils. ex Mitt. and *F. nobilis* Griff., are partly (completely?) pluristratose too. With regard to the presence or absence of a central cylinder it is quite possible that all *Serridium* species have one, but certainty on this point can not be reached before the stems of many more species have been sectioned. Another character by the aid of which it seems to be possible to separate at least part of the *Serridium* species from those of *Pachyfissidens* is the presence of a thickened zone of a different colour along the margin of the leaf. This character can not be used either since a zone which is indistinct but shows a similar structure is found in the *Pachyfissidens* species *F. geyskesii* Florsch.

From the above we can see that new characters will have to be found to separate the section *Pachyfissidens* with certainty from the section *Serridium*.

In the meantime it is uncertain whether *F. sedgwickii* should be inserted in *Pachyfissidens* or in *Serridium*. This species differs from *Pachyfissidens* species by its smaller and thinner leaves and by the presence of a prosenchymatic border on its sheathing lamina. A prosenchymatic border on the sheath is also found in the *Serridium* species *F. nitens* Rehm. ex Salm. and *F. nobilis* Griff. In the character of the thickness of the leaves *F. sedgwickii* seems to be somewhat intermediate between the two sections.

## EXAMINED MATERIAL

- F. fasciculatus* Hornsch.: *Persoon* (?) 498 ! (L), 120 (L); *Splügerber*, Cap. b. spei (L); *Rehman*, Musc. austro-afr. 281 (L) and 283 (L).
- F. geyskesii* Florsch.: *Geyskes*, Paloemeu (type) ! (U).
- F. grandifrons* Brid. (incl. var. *planicaulis* (Besch.) Nog.): *Bruggeman* 384 (BN), 1290 ! (BN); *Dismier*, Bryoth. Gall. 267 (YALE); *Inoue*, Bryoph. sel. exs. 34 ! (L); *Verdoorn*, Musc. sel. crit. II, 67 (YALE); *Noguchi*, Musc. Jap. 18, 869 (L).
- F. nobilis* Griff.: *Dozy & Molkenboer*, Japonica ! (U); *Van Zanten* 68191A (GR).
- F. perdecurrens* Besch.: *Noguchi & Hattori*, Musc. Jap. 3, 102 ! (L).
- F. rigidulus* Hook. f. et Wils.: *Sainsbury*, Poverty Bay ! (L); *Cook & Gilbert* 670 ! (NY); *Engel* 3287 ! (H).
- F. rivularis* (Spruce) B.S.G.: *Marguand*, Guernsey ! (BM); *Spruce* (?), Bagnères de Bigorre ! (BM).
- F. rochensis* Broth.: *Duss* 116 (type) ! (H); *Allard* 18339C ! (NY).
- F. sedgwickii* Broth. et Dix.: *Sedgwick*, W. Ghats ! (L); *Touw* 10788 ! (L).

! means that the stem has been checked for the presence of a central cylinder.

BN means present in my own collection.

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