Remarks on bryophyte collections from N-Spain including the first record of Dicranodontium didymodon in Europe

Jan-Peter Frahm

Abstract: Fontinalis antipyretica var. mollis is recorded for Spain, which differs by orbicular, not keeled leaves. The presence in the same tufts together with var. antiypretica reveals that it is a somatic mutant of the latter. A form of Pellia epiphylla was observed which has wide thallus margins of unistratose cells resembling those of Aneura maxima. A Campylopus was collected resembling C. flexuosus but with ventral stereids in transverse section of the costa. It is described as C. flexuosus var. anomalus. An (unsuccessful) attempt has been made to find the locality in which P. Allorge found Campylopus setifolius for the only time in the Iberian Peninsula. The bryophilous fungus Octosporella jungermanniarum is reported as new to Spain. Dicranodontium didymodon, known before from the Himalaya and western China, is reported as new to Europe.

From February 27 to March 7, 2013, I made a fieldtrip through northern Spain (Cantabria, Asturias, Galicia) in order to study the atlantic bryoflora. An enumeration of the collections is omitted here, since the distribution of most of the species seems to be well known, however, some otherwise remarkable collections as well as notes on previous records are compiled here.

A somatic mutant of Fontinalis antipyretica

Whilst collecting aquatic mosses (Cinclidotus fontinaloides, C. riparius, Fontinalis antipyretica) in the Rio Puron (near the village of Puron in the vicinity of Llanes, -4,700197, 43,385116, alt. 27 m), a strange Fontinalis was found with almost orbicular, very concave leaves and no indication of a keel. Such a Fontinalis was already reported from Germany, where it was collected in the river Sülz near Cologne (Frahm 2009). Except for Fontinalis cymbifolia Nichs., no other species of the genus from Europe matches this specimen, however, a F. antipyretica var. mollis (C. Müll.) Welch in Grout was described earlier from North America and therefore this name was tentatively applied. Interestingly var. mollis was described as a variety of F. antipyretica, although the round leaves without keel would suggest that the taxon would belong even to a different subgenus. In Germany, F. antipyretica var. mollis was associated in the river with normal expressions of F. antipyretica, which proved that var. mollis is genetically distinct and no modification when

growing together with the type variety. This seemed to be also the case in Spain until single stems of the var. mollis were found growing intermingled in tufts of var. antipyretica. This indicates that the mollis expression is a somatic mutant of var. antipyretica.
The shape of the leaves of var. mollis resembles that of the perichaetial leaves and it seems as if a genetical switch is thrown to produce perichaetial leaves along a normal stem.
Cases of somatic mutants are known and genetically proved from other mosses such as Hypnum cupressiforme and Platyhypnidium riparioides. The mutant of H. cupressiforme with julaceous foliation was described as H. heseleri and that of P. riparioides with multitratose lamina as P. mutatum. In the case of Hypnum, single branches of the heseleri expression were found (van Zanten & Hofman 1994) and in P. mutatum, single plants were found growing in tufts of P. riparioides (Frahm 2005), although both species grow usually in separate tufts. Thamnobryum fernandezii, again an aquatic moss with multitratose lamina, is growing intermingled with Th. alopecurum (pers. obs.)
In all these cases the mutant was described as separate species because of the morphological and anatomical differences, although isozyme analyses (H. heseleri) or DNA sequences (Platyhypnidium mutatum, Palustriella pluristratosa, Ochyrea tatrensis etc.) reveal no or no significant differences as compared with the original species. If this use is applied to the case of Fontinalis, the mutant has to be named F. mollis C. Müll. in Röll.

Fig. 1: Branches of Fontinalis antipyretica var. antipyretica (top) and var. mollis (bottom) in the same tuft.

Pellia epiphylla with wide unistratose thallus margin

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Searching for atlantic species such as Drepanolejeunea hamatifolia or Harpalejeunea molleri in a ravine near San Sebastian de Garabandal in the valley of Rio Vendula(Cantabria,4,426084°,43,205882, alt. 420m) a thallose liverwort was found which was

Fig. 2: Thallus of Pellia epiphylla with broad unistrtatose borsder.

Fig. 3: The same thallus in translucent light.

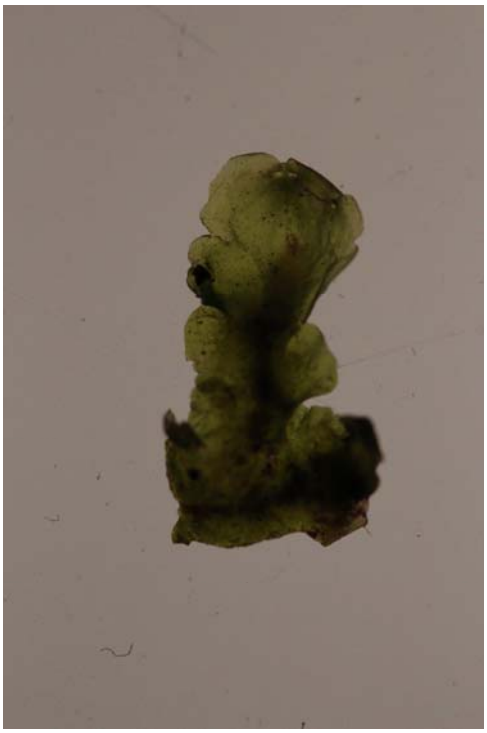

Fig. 4: For comparison thallus of “normal” Pellia epiphylla.

as Aneura maxima (interestingly a synonym of Aneura maxima in Japan is Aneura pellioides). Later sporophytes were found, which showed involucres proving that the plants belong to Pellia epiphylla.

Principally Pellia epiphylla has unistratose thallus margins, which are usually rather narrow (cf. fig. 4), but in this case the broad unicellulular wings of Pellia epiphylla (fig. 3) remind at Aneura maxima, for which the Pellia was taken at first in the field. It might be that there is a gene in the genome of both species, (or generally in the Aneuraceae and Pelliaceae), which is usually switched off in Pellia).

Campylopus flexuosus with ventral stereids

In April 2011, Felipe Gutiérez Pérez collected a species of Campylopus in NW-Spain, which had ventral stereids in transverse section of the costa. Since Campylopus brevipilus is the only species in Europe with ventral stereids, the specimen was tentatively attributed to this species, however, as he stated, the leaves had no hairpoints and were like in C. flexuosus in shape, but the basal cells near de costa porose.

Worldwide, there are several Campylopus species resembling C. flexuosus but with ventral stereids, Campylopus arctocarpus in the Neotropics, C. arctocarpus ssp. madegassus in tropical Africa, C. flagelliferus in SE-Asia, C. cubensis in the Carribbean and C. incacorralis in the tropical mountains. All species are presumably of common origin and geographical vicariants. For a final decision, the specimen was sequenced by Michael Stech, specialist for molecular systematics of Dicranaceae, (University of Leiden), however the marker studied placed the specimen to C. flexuosus.

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Ventral stereids in the costa of Campylopus flexuosus were already reported by Frahm (1977) with regard to the infrageneric classification of the genus by Limpricht (1890) based upon the transverse section of the costa. Limpricht grouped the species in those having ventral and dorsal stereids (Palinocraspis), dorsal stereids (Campylopus) and no stereids (Pseudocampylopus). The fact that Campylopus flexuosus, the type species of the genus and subgenus Campylopus can have ventral hyalocysts as well as stereids, corroborate this differentiation. Recent molecular systematic studies (Stech 1999) did not maintain this classification.
The reason for the fomation of ventral stereids in C. flexuosus is not clear. Frahm (1977) excluded different habitats or age of the three specimens mentioned from Germany.
During the author´s trip, a Campylopus cf. flexuosus with ventral stereids (fig. 5,6) was collected again in Asturias, in the valley of Rio de NuevaA new molecular study based on this material is in progress.
The problem involved is that the anatomical structure of the costa is distinctly different from C. flexuosus, although the sequence of the marker used is identical, and that plants with different anatomical structure deserve to be recognized as a different taxon. Therefore this aberrant expression is described here as a new variety:
Campylopus flexuosus (Hedw.) Brid. Mant. Musc. 4:71, 1819 var. anomalus J.-P. Frahm var. nov.
Differs from the typical variety by the presence of distinct ventral stereids in the transverse section of the costa instead of ventral hyalocysts.
Type: Spain, Asturias, Rio de Nueva S of Nueva, on a N-exposed slope (known for the occurrence of Woodwardia radicans), 4,949374° W, 43,430688°N, alt. 200m., ca. 2 km upstream of road AS 340, leg. Frahm 2.3.2013 no. SP-046 (hb. Frahm BONN).

Fig. 5,6: Transverse section of the costa of Campylopus cf. flexuosus with ventral stereids. (Frahm SP-046)

Campylopus setifolius in Spain

In 1933, Pierre Allorge collected Campylopus setifolius in northern Spain, new to the Iberian Peninsula (Allorge 1934) which is so far the only record. It is cited as follows:
Asturias: vallee du Rio Ore Carroyas, quartzites suintants, a 1 km environ de l'Ocean'
I have seen the specimen, which is deposited in the Natural History Museum in Paris. The specimen is labelled as follows:
rochers quartzites, valle du rio Ore, Carroyas, entre Luarca et Canero, leg. P. Allorge 12.9.33 teste Dixon.
In 2013, Gordon Rothero asked in the bryonet whether this is still the only record outside Britain and where this locality is situated, since Google failed to locate the place.
Except for some suggestions, the Spanish bryologist Montserrat Brugues gave the information:
Caroyas (47º32'44,23"N/6º28'40,72"W), río Orio (or Esba, name of this river when is near the ocean).
Allorge´s information seems to be quite distinct (about 1 km near the ocean). Caroyas is in fact spelled with one r, not two. It is situated 1 kilometre away from a river which is today called rio Esva.
The supplementary informationon the label (between Luarca and Canero) reveals that the valley of rio Ore must be the present rio Esva. A search for the locality in March 2013 revealed the following:
Inhabitants of the village of Caroyas do not know Rio Ore, however, in his publication, Allorge (1934) mentions more collections (such as Saccogyna viticulosa, Plagiochila spinulosa and Bartramia stricta) from Vallée du rio Ore with the addition “entre Castaneda et Ponteijon”. This is misleading, because the village of Castand**a** is south of Santander. However, there is a village of Castaned**o** upstream rio Esva. Downstream is a village called Pontigon, which is probably the

same as Allorge´s Ponteijon. Interestingly, a village called Ore is closeby, an indication that the name of the river was rio Ore in the past.
Therefore it can be concluded that Allorge´s rio Ore is the present rio Esva and the locality of Campylopus setifolius is 1 km south of the mouth of the river. There are, however, no natural rocks or cliffs (fig. 7). In a longer distance, an old railway bridge is crossing the valley. Here are rocks along the eastern side of the road, on which Bryum alpinum, Amphidium mougeotii on seeping rocks as well as Campylopus introflexus, Targionia hypophylla and Trichostomum brachydontium in drier situation are growing. Compared with the habitats in Scotland the situation here is fairly dry. It must be supposed, that the roadside rocks were cut when the road was expanded. As shown by cut offs of an old narrow road, the road was renewed, probably after Allorge´s visit. Under this praecondition, a suitable habitat has been destroyed, although is is almost two kilometres from the sea. Due to the lack of any other suitable habitats in the surroundings, C. setifolius is most probably no more present in the Iberian Peninsula.
The only record of an atlantic bryophyte species in Northern Spain is nothing exceptional. Even Lepidozia cupressina (one of the commonest representatives of this element) or Lejeunea mandonii have been found there only once. Other species, for example, Breutelia chrysocoma, and Isothecium holtii, which are frequent in areas where the species occurs, are surprisingly rare and scattered in northern Spain. This indicates that these records are probably no relics of former larger extensions but new colonizations.

Fig. 7. Google map of the mouth of Rio Esva, where Allorge found Campylopus setifolius in 1 km distance from the ocean (yellow line = 1 km).

Fig. 8: Octosporella jungermanniarum growing on Plagiochila punctata.

Octosporella jungermanniarum, a hepaticolous fungus new to Spain

Whilst searching for Tetralophozia filiformis at the place where E. Urmi found this species for the first time in Europe (Asturias, 2,5 km S of Sellano at Rio Ponga, -5,211722°W, 43,232059°N, about 340 m alt.), I collected Plagiochila punctata. Under the dissection microscope I observed fruit bodies of a jungus (fig. 8), which was identifies by Peter Döbbeler, specialist for bryophilous fungi, as Octosporella jungermanniarum (P. Crouan & H. Crouan) Döbbeler (Ascomycota, Pyronemataceae) According to Döbbeler, this species is new to Spain although it has been recorded about 50 times from Central Europe.

Dicranodontium didymodon (Griff.) Par new to Europe

When bryologizing in the valley of Rio de Nueva[1], I collected a dicranaceous moss which looked in the field like a Campylopus or, what I supposed, perhaps Dicranodontium uncinatum, however with less uncinate leaves. A microscopic examination revealed that it was in fact a Dicranodontium, because of the elongate upper laminal cells, the extremely long and fine subula and the ventral stereids in transverse section of the costa. It was, however, none of the known species from Europe. These can easily be divided in two groups: species with large, lax, hyaline inner basal laminal cells (like in Calymperes) including D. asperulum and D. uncinatum and a

[1] Asturias, Rio de Nueva S of Nueva, on a N-exposed slope, 4,949374° W, 43,430688°N, alt. 200m., ca. 2 km upstream of road AS 340, leg. Frahm 2.3.2013 no. SP-047 (hb. Frahm BONN).

species with “normal” inner basal laminal cells such as D. denudatum and D. subporodictyon. The present plants had “normal” inner basal laminal cells, but differed from D. denudatum by a only finely serrate to almost smooth subula and the costa well differentiated from the lamina at the base of the leaf. In contrast, D. denudatum has a sharply serrate subula (like a rats tail file) and the costa is not clearly separated from the lamina at the base of the leaf. In addition, the leaves of D. denudatum are easily falling off or are easily detached with a wet finger, leaving a stem with rests of leaf bases which look like an old defoliate branch of a spruce.

Years ago, I had monographed Dicranodontium (Frahm 1997) and using the key, I ended with D. didymodon (Griff.) Par. This species is known from the Himalaya region, from India (Darjeeling, Sikkim), Bhutan, Nepal, northern Thailand and Burma to China (Sichuan).

With regard to this range, the occurrence in northern Spain seems to be surprising, however, Dicranodontium asperulum, D. subporodictyon and D. uncinatum have the same disjunction as well as numerous species, which are found in the Himalaya, Japan, western North America, the atlantic coastal regions of Europe and the alpine mountains of Europe (or parts of it). Examples are except for the three species of Dicranodontium mentioned above Campylopus gracilis, Leptodontium recurvifolium and especially liverworts such as Herbertus sendtneri, Anastrophyllum assimile, A. donnianum, A. joergensenii, Pleurozia purpurea, Matsigophora woodsii, Bazzania perasonii. Douinia ovata, Anastrepta orcadensis, Plagiochila carringtonii, Scapania ornithopodioides and S. nimbosa. So this new record is just a new example.

Interestingly, the liverwort Tetralophozia filiformis was found as new to Europe in 1978 in Asturias in the valley of Rio Ponga (Urmi 1983). It has a similar somehow wider distribution and is known from Sikkim, Darjeeling, Yunnan, Sichuan, Japan, Taiwan, Borneo and British Columbia. Later search of several bryologists could not confirm the existence at this locality anymore, however, this species found later again at more localities (e.g. Fuertes Lasala 1987) at much higher altitudes. Therefore the first locality can be regarded as untypical for this montane species.

In the valley of Rio de Nueva, Dicranodontium grew in tufts of Leucobryum glaucum on humid silicous rocks on the base of a N-exposed slope (fig. 9), which is known for the occurrence of the fern Woodwardia radicans. The slope is mainly covered by Sphagnum capillifolium, S. denticulatum, S. palustre, Hylocomium splendens. Other associates were Fissidens polyphyllus, Plagiochila exigua, P. punctata, Kurzia sylvatica, Scapania nemorea, Plagiothecium undulatum and Calypogeia neesiana.

Dicranodontium didymodon may be overlooked in northern Spain because of its very inconspicuous appearance like a Dicranum scoparium or Campylopus (fig. 10). It is differentiated in the field with a handlens from the first by the wide costa and from the latter only under the microscope by the characters mentioned above (fig. 11). A characteristic of Dicranodontium seems to be that the ventral stereids in transverse section of the costa are confinded to the middle of the costa, whereas the extend over the whole costa in species of Campylopus with ventral stereids.

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Fig. 9: Habitat of Dicranodontium didymodon at the Woodwardia locality in the valley of Rio de Nueva.

Fig. 10: Dicranodontium didymodon

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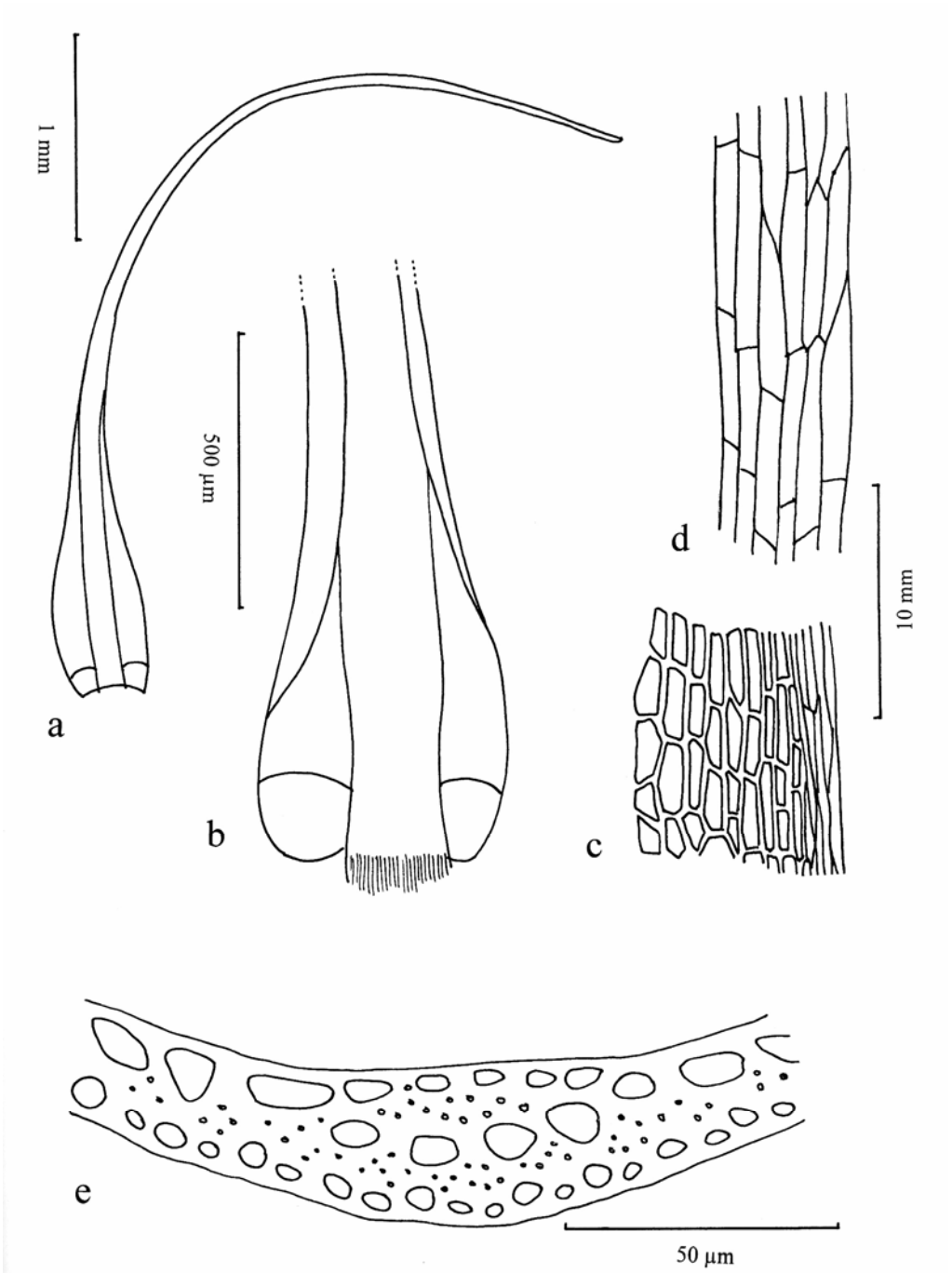

Fig. 4. *Dicranodontium didymodon* (Griff.) Par. (*Griffith 32*, H-BR). — a: leaf. — b: Leaf base. — c: Basal laminal cells. — d: Upper laminal cells. — e: Transverse section of costa.

Fig. 11: Illustration of Dicranodontium didymodon from Frahm (1997).

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