

The first record of a *Sphagnum* from the Tertiary in Baltic amber and other new records of mosses from Baltic and Dominican amber

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Abstract – The genus *Sphagnum* is reported for the first time from the Tertiary in Baltic amber (45 ma). Additionally *Campylopodiella himalayana* and *Symphyodon* sp. are reported from Baltic as well as specimens of *Trichosteleum* sp. and *Mniomalina* sp. from Dominican amber.

Baltic amber / Dominican amber / *Sphagnum* / Tertiary

INTRODUCTION

The known moss flora of the Baltic amber forest (Eocene) includes 63 taxa (Frahm, 2008). Ten belong to extant species, 18 can be attributed to extant genera, nine are extinct species of extant genera, the rest is dubious or cannot safely be identified and is placed in form genera. These mosses as well as the hepatics studied and published by the late Riclef Grolle (Grolle & Meister, 2004) give a vivid impression of the bryophyte vegetation in the former pine oak forest about 45 million years b.p. The trunks were covered by small epiphytes, the most common *Hypodontopsis mexicana*, accompanied by species of *Lejeunea*, *Mastigolejeunea*, *Nipponolejeunea*, *Frullania*, *Radula* and *Porella*. The bases of trees and rotten wood were overgrown by *Campylopodiella himalayana*, several species of *Trachycystis*, *Rhizogonium*, *Calomnion*, *Haplocladium angustifolium*, species of *Bazzania*, *Scapania* and *Lophozia*. The forest floor was covered by several species of *Atrichum*, *Campylopus*, polytrichaceous species, species of *Brotherella*, *Calypogeia* and *Notoscyphus*.

The forest probably consisted of drier parts (perhaps on hills) indicated by smaller epiphytes such as *Fabronia* spp., *Frullania* and others and more humid parts (perhaps in valleys) with more hygrophilous taxa such as *Barbella*, *Echinodium* and hypnaceous mosses. The amber forest might also have undergone climatic changes during the millions of years. The fossils include distinctly subtropical elements such as species of *Merrillibryum*, *Symphyodon*, *Bescherellea*, *Boulaya*, *Mastopoma*, *Aptychella* amongst the mosses and Lejeuneaceae

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amongst the liverworts, as well as temperate species of *Hypnum*, *Ctenidium*, *Brachythecium*, *Atrichum*, *Trachycystis* and *Ptilidium pulcherrimum*.

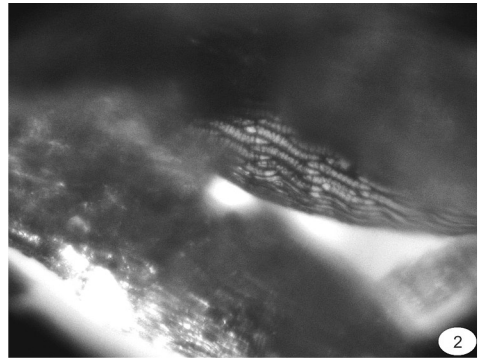
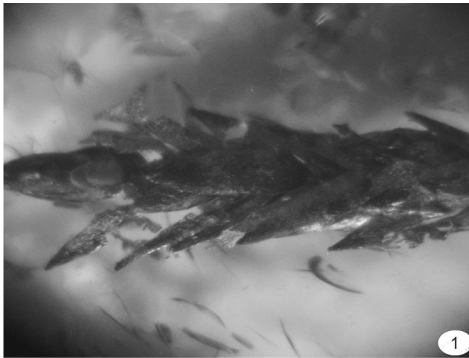
By the courtesy of Mr. Jürgen Velten (Idstein, Germany), who has already provided numerous inclusions of mosses for study, I received several new specimens of Baltic (Ba) and Dominican (DR) amber with embedded mosses. Interestingly, one included two branches of *Sphagnum* in Baltic amber, which seems to be the first record of a peat moss from the Tertiary.

BALTIC AMBER

Sphagnum sp. (Sect. *Acutifolia*) Velten Ba III

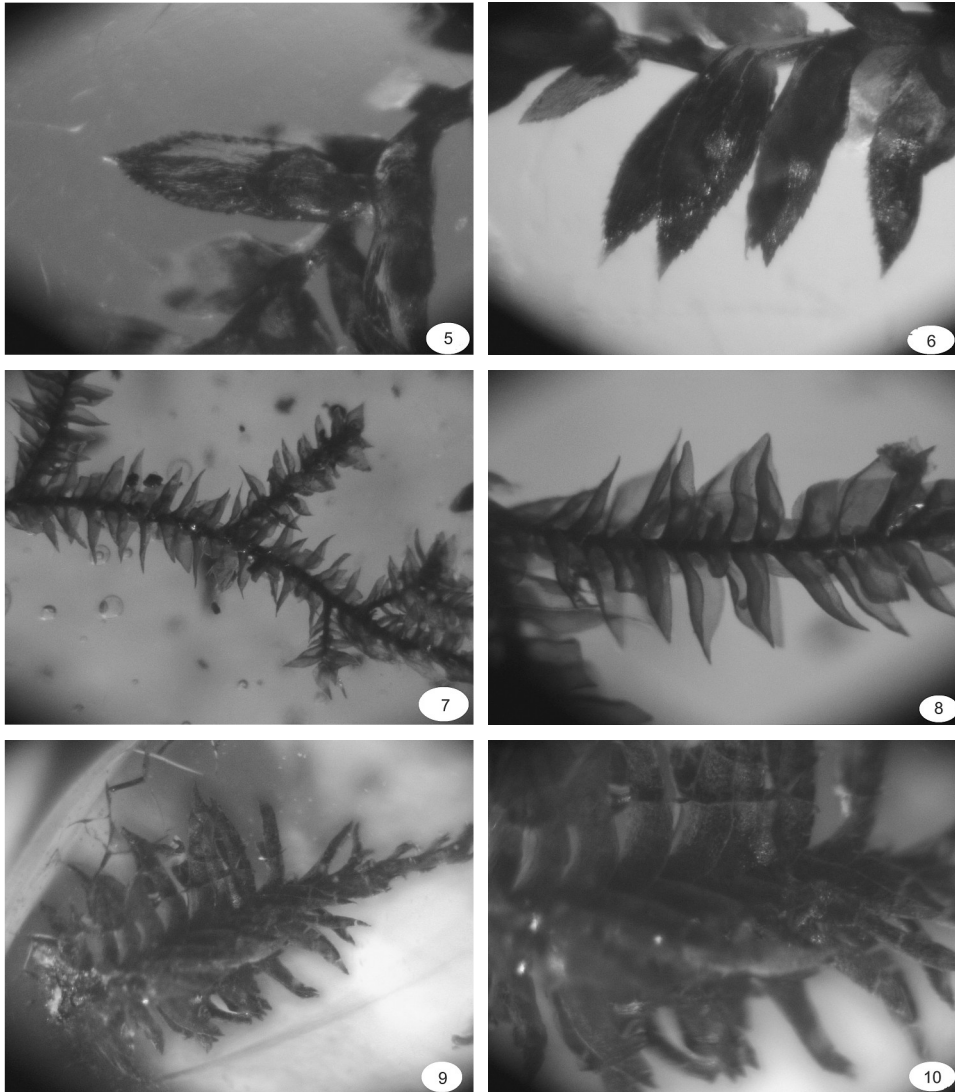
Figs 1-2

The amber includes one branch of 7 mm length with appressed lanceolate leaves. The second branch is 5 mm long but badly conserved. An illumination from above shows elongate, thick walled cells, however translucent light through the leaves which are not covered by others reveals the typical structure of sphagnoid laminal cells with chlorocysts, hyalocysts and fibrils. The hyalocysts have single large commissural pores and in the cell angles. A more detailed identification is not possible but the leaf shape suggests a member of sect. *Acutifolia*. The chlorocysts seem to be exposed to the abaxial side of the leaf, which supports this conclusion. There are several extant species of *Sphagnum* with such pores (*S. subnitens*, *fuscum*, *capillifolium* etc.).



This discovery indicates that also peat mosses grew at the bottom of the forest, in a depression or a small swamp in the forest and that detached branches were blown by wind into the resin.

So far, there were no remnants of *Sphagnum* in amber from the Tertiary. The earliest fossil record of a *Sphagnum* dates from the Jurassic (Reissinger, 1950). Another fossil record of sphagnoid leaves, *Sphagnophyllites triassicus*, is less distinct and may not belong to *Sphagnum* but to another sphagnalean taxon (Oostendorp, 1987). The relation to *Protosphagnum* from the Permian, which has



Figs 1-10. **1-2.** *Sphagnum* sp. in Baltic amber (Velten Ba III). **3.** Single leaves of *Campylopodiella himalayana* (Velten Ba I). **4-6.** *Symphyodon* sp. (Velten Ba II). **7-8.** *Trichosteleum* sp. (Velten DRI). **9-10.** *Mniomalia* sp. (Velten DR II).

also sphagnoid laminal cells but large, 6 cm long leaves with a costa, is controversially discussed. Krassilov & Schuster (1984) regard it as “presumably ancestral to the Sphagnales”. Schofield (1985) comments “it is hazardous to speculate, since only gametophytic material is available”.

Campylopodiella himalayana (Velten Ba I)

Fig. 3

Velten Ba I shows – beside of one small apical part of a plant - dozens of single leaves, which serve for vegetative propagation. This species has been recorded many times from Baltic and Saxon amber (Frahm 1996, 1999, 2004, 2005, 2006), even with sporophytes, and must have been one of the commonest mosses in the amber forest. It is found today in the Eastern Himalaya and Yunnan.

Symphiodon sp. (Velten Ba II)

Figs 4-6

Preserved is the branch of a pleurocarpous moss of 4 mm length with distinctly complanate foliation. The leaves are elongate oval and are sheathing the stem at base. The margins are roughly serrate from the apex half way down. A costa is not visible. The laminal cells are elongate oval and incrassate. The specimen also includes a sterile plant of *Hypnodontopsis* sp.

Similar plants were found earlier in Baltic and Saxon amber (Frahm, 1999, 2004, 2005). *Symphiodon* is the only genus of the Symphyodontaceae with 15 species, of which one is neotropical and all others are found in SE-Asia.

DOMINICAN AMBER

Trichosteleum sp. (Velten DR I)

Figs 7-8

A 6.5 mm long part of a pleurocarpous moss with several branches. The leaves are lanceolate-oval, somewhat concave, arranged in four rows and sheathing the stem at base. The laminal cells are rhombic and strongly papillose with single large papillae, making the back of the leaves scabrous. The costa is short and double.

Although alar cells are not visible, the specimen resembles much species of *Trichosteleum* (Sematophyllaceae) with the short and double costa and the unipapillose laminal cells. The leaf shape resembles *T. subdemissum* (Besch.) A. Jaeger (Buck, 1998), however, the laminal cells of the fossil specimen give the impression that they are rhombic throughout the leaf, whereas *T. subdemissum* has rhombic cells only in the leaf apex. Other mosses with unipapillose laminal cells such as Thuidiaceae, Leskeaceae or Meteoriaceae have no short and double costa.

Mniomalia sp. (Velten DR II)

Figs 9-10

The imbedded plant is 7.5 mm long. The lower third is foliate with normal leaves, the upper part consists of a flagella with reduced leaves. The leaves are complanate, secund and distant from the stem, asymmetric and sheathing the stem. The costa reaches into the leaf apex, the laminal cells are roundish and slightly mamilllose. The leaf margins are bordered by elongate cells.

The plant resembles a species of *Fissidens* but has a flagellate shoot and no vaginate lamina. The only neotropical species, *M. viridis* (Mitt.) Müll. Hal. has

been reported from Dominican amber (Frahm & Newton, 2005). It has, however, shorter, more oval leaves, whereas the present specimen has more elongate, not “mniaceous” leaves. It can therefore not be identical with the latter but may represent an extinct species. The preservation of the specimen is, however, not as good that it can be described here as a new species.

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