

## **Discovery of a natural hybrid between *Bruchia vogesiaca* Schwägr. and *Trematodon ambiguus* (Hedw.) Hornsch. (Musci, Bruchiaceae)**

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**Abstract** — A newly discovered natural hybrid ♀ *Bruchia vogesiaca* × ♂ *Trematodon ambiguus* is reported here. The sporophytic hybrid plants were recently found from a locality in the Vosges Mountains, France, growing together in a mixed stand with both sporophytic parent species. This hybrid represents the second known report of a hybrid within the Bruchiaceae.

**Bruchiaceae / *Bruchia* / *Trematodon* / hybrid / Vosges Mountains**

### **INTRODUCTION**

*Trematodon ambiguus* (Hedw.) Hornsch. and *Bruchia vogesiaca* Schwägr. are among the rarest mosses of the Vosges Mountains, eastern France. Although a rather widely distributed Northern temperate moss, in the Vosges *T. ambiguus* was found only three times by the ancient bryologists Blind, Boulay and Mougeot in the 19<sup>th</sup> century and twice by Renauld at the begin of the 20<sup>th</sup> century (Frahm, 2002). It was then rediscovered in one locality in the vicinity where Renauld found it a hundred years earlier (Frahm, 2003b, 2005a). *Bruchia vogesiaca* was described from a collection made by Mougeot in 1822 in the Vosges and therefore named “*vogesiaca*”, although the species later turned out to occur mostly in SW-Europe as well as two localities in North America (New Hampshire and New York) and one in China (Fujian). The species was observed to occur at the type locality (Ammeltalquelle S of the Hohneck summit) until 1964 (Frahm, 2002). In 1983, it was discovered at a new locality in the Vosges Mountains by Lecoite and Pierrot (Rastetter, 1985) and observed at this place until 1992 (Frahm, 2002, 2005b). During the next years, *B. vogesiaca* was found in several other sites in the surrounding of the latter locality by Frahm and Vadam (Frahm, 2005b) as well as in one location at La Montagne north of the previous records (Frahm, 2003a, 2005b) at the edge of a fish pond. Since *B. vogesiaca* is a species of the Bern Convention, the latter locality was announced to the authorities with the result that the owner of the fish pond destroyed the habitat with a bulldozer.

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Fig. 1. Mixed stand of *Trematodon ambiguus* (left) with *Bruchia vogesiaca* and their hybrid (right).

## MATERIAL

Interestingly, both species were found growing together in another locality in the Vosges at the Plateau des Milles Etangs in 2006 (Frahm, unpubl.), the region where they were found before. The two species grew together on a humid open path at the Etang des Cuves along the route des Forts between Col de Mont de Fourche and Coil de Croix. The presence of the two species at this newly discovered locality was confirmed in 2007. During a recent fieldtrip with students of the University of Bonn, the above site was revisited on September 12, 2008. When both species were demonstrated to the students and it was explained that *Bruchia* has inoperculate capsules, the second author realized that there were capsules with a distinct mouth. A closer examination revealed that there was a mixture of (1) typical sporophytes of *T. ambiguus* with long light yellowish brown setae, each ending with a long neck and a long curved capsule, as well as (2) few typical sporophytes of *B. vogesiaca* with very short setae, each ending in a short dark brown, erect cleistocarpous capsule and (3) numerous sporophytes with setae of intermediate length and slightly larger operculate capsules. This observation led to the suspicion that the latter plants could be hybrids between the former two species. The patch of plants was about 20 cm wide and covered by *T. ambiguus* at one end and *B. vogesiaca* at the other (Fig. 1). The intermediates grew in the middle in the stand of *Trematodon* and *Bruchia*.

Table 1. Comparison of sporophyte morphology of *Trematodon ambiguus*, *Bruchia vogesiaca* and their hybrid.

Character	♀ <i>Bruchia vogesiaca</i>	*hybrid	♂ <i>Trematodon ambiguus</i>
Seta	1.5-3 mm long Dark reddish brown	3-4 mm long Dark to light brown	At least 8 mm long Light yellowish brown
Neck	Shorter than urn, long-tapering	Ca. as long as urn, short-cylindric	Longer than urn, long-cylindric
Urn	Straight Peristome & operculum not differentiated	Straight operculate, peristome poorly differentiated	Inclined, curved Peristome & operculum well-differentiated
Calyptra	mitrate	mitrate	cucullate
Spore	Warty (verrucose)	Warty (verrucose)	Papillose

\* Few hybrid sporophytes are with 6 mm seta slightly inclined and curved dark brown capsule but inoperculate

Sample material was taken back to the Nees Institute for Biodiversity of Plants, University of Bonn, for more detailed study under the microscopes. The dried herbarium sample is deposited in the herbarium Frahm (BONN).

## RESULTS

Although the gametophytes of the both autoicous species borne perigonia, the sporophytes with intermediate morphology only sprout on the gametophytes of *B. vogesiaca*, indicating that female plants of *Bruchia vogesiaca* were fertilized by spermatozoids of *Trematodon ambiguus*. Relatively few sporophytes of true *B. vogesiaca* are found. The characters of the sporophytes of both, *Trematodon ambiguus*, *Bruchia vogesiaca* and their hybrid are compared in Tab. 1.

After a comparison of the sporophytes (Tab. 1), it becomes clear that the intermediate sporophytic plants are intergeneric hybrids with mixed characters between the parent species. The hybrid could be easily distinguished by the intermediate morphology of the sporophytic characters (seta length, neck, urn) of the parent species (Fig. 2). Only the shape of the calyptra as well as the spore morphology is shared with *Bruchia vogesiaca*.

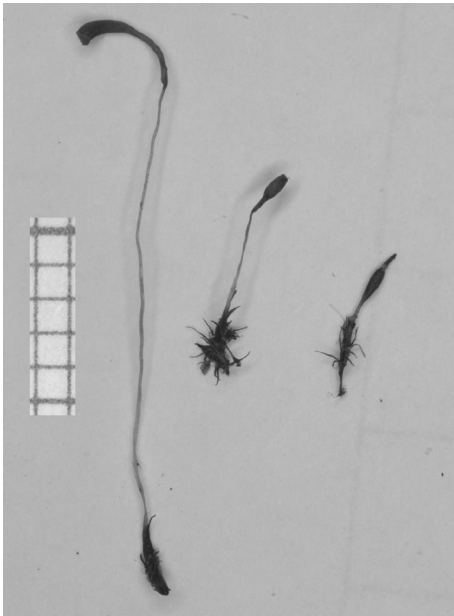


Fig. 2. Single plants of *Trematodon ambiguus* (left), *Bruchia vogesiaca* (right) and their hybrid (middle) (Scale: millimetre grid).

The peristomes of the hybrid plants are very poorly developed. Only few teeth are observed, the majority part of the peristome exist as remnants with only the basal part developed.

The hybrid capsules contain as many spores as the parent species but about half the number of spores are collapsed and irregular in shape. The normal looking spores are expected to be abortive and non-viable. Spores of all three are similar in size, falling in the range of 26–32 µm in diameter.

## DISCUSSION

Naturally occurring hybrids among bryophytes, especially between different genera, have rarely been described in scattered publications. A compilation of these can be found in the recent review paper by Natcheva & Cronberg (2004). The majority of the reported hybrids are found to be terrestrial, bisexual, short-lived moss species occurring in disturbed open habitats, belonging to the Funariaceae, Ditrichaceae, Pottiaceae and Bryaceae (Natcheva & Cronberg, 2004). Noteworthy, von Wettstein (1932) has shown that hybrids in the Funariaceae, both interspecific and intergeneric, can be artificially raised. This points to the fact that hybrids can easily be induced in nature if “conditions” (such as phenology, habitat specificity, distribution etc.) are just right by chance.

The present report of the generation of a hybrid, ♀ *Bruchia vogesiaca* × ♂ *Trematodon ambiguus*, was made possible by several premises, similar to many previously reported hybrids. Although both species are generally very rare, they occur in the same region in the Vosges Mountains (in an area of 10 × 15 km<sup>2</sup>) and also in similar habitats (on very damp soil especially near water bodies in opened places). Moreover, both species are summer annuals and show up between end of June and beginning of September, thus have very similar reproductive phenology.

Interestingly, within the Bruchiaceae, there is already a known natural hybrid, *Bruchia microspora* Nog. × *Trematodon longicollis* Michx., reported to occur in Japan and China (Rushing & Snider, 1985; Gao *et al.*, 1999). Hence, the present report represents the second known bigeneric hybrid between *Bruchia* and *Trematodon* but with an entirely different species pair.

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