Leaf-born gemmae in *Syntrichia virescens* (DE NOT.) OCHYRA - a neglected feature in bryological literature

THOMAS HOMM[1]

[1] *Thomas Homm, Dipl.-Biol., Biological Surveys & Consulting, Dalsper 12, D - 26931 Elsfleth*

Abstract: Homm, Th. (2017): Leaf-born gemmae in *Syntrichia virescens* (DE NOT.) OCHYRA - a neglected feature in bryological literature. *Frahmia* x:y-z.
Leaf-born gemmae have been detected in specimens of *Syntrichia virescens* from Northwest Germany. This feature is not mentioned or even denied to exist in most of the recent European bryological literature. This paper provides a short description and illustrations of the gemmae.

1. Introduction

While recording and studying epiphytic bryophytes in the coastal lowlands of Lower Saxony (Northwest Germany) the author repeatedly came across *Tortula virescens*. Under the microscope leaf-born gemmae have been detected rather regularly in several collections by the author during the last three decades. This feature is not mentioned or even denied to exist in most of the recent European bryological literature. Therefore the aim of this paper is to recall this element of vegetative propagation and to provide a short description of the gemmae.

2. Material and Methods

The studied specimen of *Syntrichia virescens* was collected recently (28th October 2017). The collection site is an alley (Bettingbührener Straße) in a rural area in the marshlands of the river Weser (Wesermarschen, Lower Saxony, Northwest Germany) west of the city of Bremen north of the village of Berne between the settlements Ranzenbüttel and Bettingbühren (Coordinates, WGS84, E 8.48389 N 53.195869, Altitude 1 m). The species was growing on bark of a rather exposed tree of *Acer platanoides*. Other epiphytic bryophytes growing on the same tree were *Orthotrichum affine*, *O. diaphanum*, *O. lyellii*, *Grimmia pulvinata*, *Tortula papillosa* and *Hypnum cupressiforme*. The material was studied with a compound light microscope on which a DLSR has been mounted for taking photographs. The specimen is stored in the herbarium of the author.

3. Description of the gemmae found in *Syntrichia virescens*

The gemmae are formed as outgrowths of the epidermal cells on the ventral side of the nerve. When stripping off upper leaves or lightly beating on the plants in a drop of water on a microscopic slide they can be observed free floating.

Gemmae formation is best observed in the upper part of the nerve shortly below the leaf tip but can be observed also further the down the mid rip. In juvenile stage the gemmae are attached to the nerve and are of a rounded shape consisting of only a few cells (see figure 1). They soon grow to

elongated ovoid-cylindrical to club shaped structures consisting of several cells (see figure 2). They are similar in shape to the gemmae observed e.g. in some *Zygodon*-species. Measured dimensions of mature gemmae as shown in figure 2 (B, C and D) are 141-149 x 38-45 µm. Occasionally deviating gemmae are observed. These are shorter, irregularly rounded and also consist of several cells. Their shape then approaches that of gemmae found in *Syntrichia papillosa* or *S. latifolia*. Finally the gemmae are germinating to form secondary protonema (see figure 2, E).

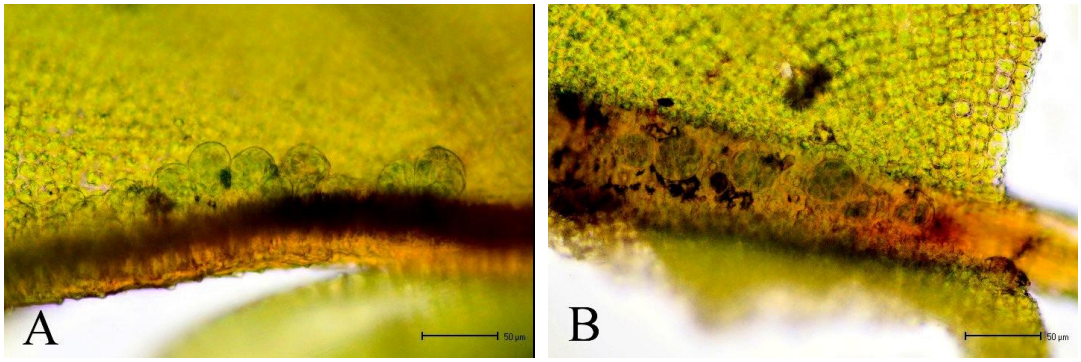

Figure 1: Juvenile gemmae of *Syntrichia virescens* developing on the ventral side of the nerve in the upper part of a leaf. A - side view. B - surface view.

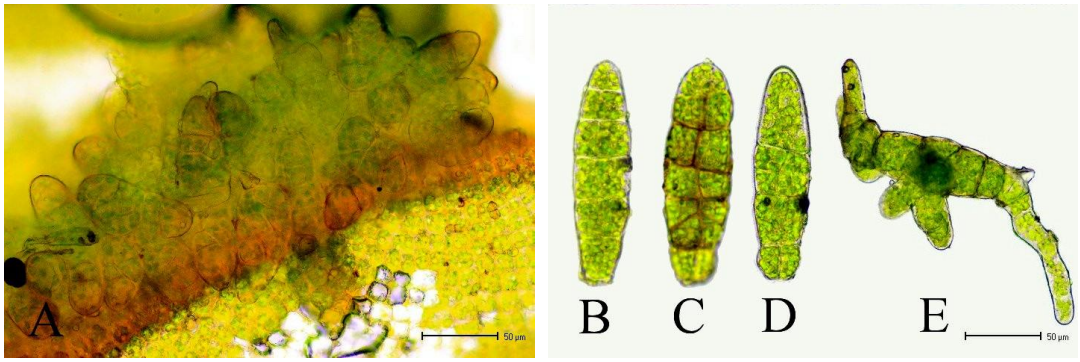

Figure 2: A - Premature gemmae of *Syntrichia virescens* developing on the ventral side of the nerve in the upper part of a leaf. Surface view. B, C, D - Mature gemmae of *Syntrichia virescens* detached and free floating (x 400). E - Mature gemma of *Syntrichia virescens*, germinating.

4. Discussion

In his description of *Tortula pulvinata* (now a synonym for *Syntrichia virescens*) LIMPRICHT (1890, p. 683) already mentioned the gemmae of this species as leaf-born and cylindrical in shape ("Brutkörper blattbürtig, cylindrisch"); also CORRENS (1899) mentions the gemmae. But some decades later in the succeeding supplement ("Ergänzungsband") to Rabenhorsts Kryptogamen-Flora the author MÖNKEMEYER (1927, p. 313) postulated, that there was no definite proof of vegetative propagation by rounded gemmae in this species ("Vegetative Vermehrung durch rundliche Brutkörper nicht sicher nachgewiesen"). Since then most European and widely used bryological works do not mention gemmae (brood bodies, propagula) in *Syntrichia virescens* anymore (e.g. NYHOLM 1989, NEBEL & HEINRICHS 2000, CORTINI PEDROTTI 2001, FRAHM & FREY 2004, SMITH 2004, LUETH 2006, SIEBEL & DURING 2006, ATHERTON et al. 2010).

HALLINGBÄCK et al. (2008, p. 143) even declare that a specialized vegetative propagation is not known ("Specialisierad vegetativ förökning är inte känd").

In some of the keys the user even has to deny that there are any gemmae present to proceed with determination (e.g. NYHOLM 1989, NEBEL & HEINRICHS 2000, SMITH 2004, SIEBEL & DURING 2006, HALLINGBÄCK 2016). While this might not bother the experienced, it could be quite misleading for the beginner.

Recently only the in many respects excellent Iberian bryophyte flora (Flora briofitica Iberica) mentions the propagula of *Syntrichia virescens* in the species description (GALLEGO 2006, p. 132). They are described as multicellular, spherical, ovoid or otherwise rounded, 50-70 x 30-40 µm long, sessile, green to brown, with smooth surface, developing in the ventral furrow of the leave nerve. Unfortunately no illustrations are given. In the additional notices ("observaciones") the authors explain that the position and structure of the gemmae provide another character to separate *Syntrichia virescens* from *Syntrichia laevipila*, with which it often grows in the same habitat. The above description is adequate for some of the gemmae found in collections in Lower Saxony although they can become more cylindrical in shape as illustrated above and already described by LIMPRICHT (1890).

It remains open to question why the gemmae of *Syntrichia virescens* have rarely been mentioned in bryological literature. The species is dioicous and according to the reviewed literature (see above) sporophytes are rare, at least in Western und Northern Europe (so they are in Lower Saxony). Certain means of vegetative propagation should have been expected. Perhaps the gemmae have been simply overlooked. As a matter of fact they have hardly ever been illustrated. This paper tries to fill this gap.

5. Acknowledgments

nihil

6. Bibliography

ATHERTON,I., BOSANQUET, S., LAWLEY, M. (eds.) (2010). Mosses and Liverworts of Britain and Ireland - a field guide. British Bryological Society, Plymouth.

CORRENS, C. (1899). Untersuchungen über die Vermehrung der Laubmoose durch Brutorgane und Stecklinge. Verlag G. Fischer, Jena.

CORTINI PEDROTTI, C. (2001). Flora dei muschi d'Italia, Spagnopsida - Andreaeopsida - Bryopsida, Vol. 1. Antonia Delfino Editore, Roma.

GALLEGO (2006). *Syntrichia*. In: Flora briofitica Iberica, Vol. III. Universidad de Murcia & Sociedad Espanola de Briologia.

FRAHM, J.-P., FREY, W. (2004). Moosflora, ed. 4. Ulmer UTB, Stuttgart.

HALLINGBÄCK, T., LÖNNELL, N., VON KNORRING, P., KOROTYNSKA, M., REISBORG, C., BIRGERSSON, M (2008). Nationalnyckeln till Sveriges flora och fauna. Bladmossor: Kompaktmossor - kapmossor. Bryophyta: *Anoctangium* - *Orthodontium*. ArtDatabanken, SLU, Uppsala.

HALLINGBAECK, T. (2016). Mossor - en faeltguide. Naturcentrum, Stenungsund.

LIMPRICHT, K. G. (1890). Rabenhorst's Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz, ed. 2, Vol. 4(1), Die Laubmoose. Verlag Eduard Kummer, Leipzig.

LUETH, M. (2006). Bildatlas der Moose Deutschlands, Fasc. 3, Pottiaceae. Freiburg.

MÖNKEMEYER, W. (1927). Rabenhorsts Kryptogamen-Flora von Deutschland, Österreich und der Schweiz, Vol. 4, Ergänzungsband: Die Laubmoose Europas. Akademische Verlagsgesellschaft, Leipzig.
NEBEL, M., HEINRICHS, J. (2000). *Tortula*. In: Die Moose Baden-Württembergs, Vol. 1. Ulmer, Stuttgart.
NYHOLM (1989). Illustrated Flora of Nordic Mosses, Fasc. 2, Pottiaceae - Splachnaceae - Schistostegaceae. Nord. Bryol. Soc., Lund.
SIEBEL, H., DURING, H. (2006). Beknopte Mosflora van Nederland en Belgie. KNNV Uitgeverij, Utrecht.
SMITH, A. J. E. (2004). The moss flora of Britain and Ireland, ed. 2. Cambridge University Press, Cambridge.

7. Addendum

A short time after publication of the above paper the author was able to observe additional means of propagation of *Syntrichia virescens*. Another specimen of *Syntrichia virescens* was collected recently (16th January 2018). The collection site is a railway bridge in Hude (Kirchstraße), a small town situated in the pleistocene lowland (Delmenhorster Geest, Lower Saxony, Northwest Germany) south of the city of Bremen (Coordinates, WGS84, E 8.4522124 N 53.1181974, Altitude 6 m). The species was growing on mortar joints of an old brick wall.

Under the microscope again rounded multicellular gemmae could be observed as well as innovations in form of young shoots formed on the ventral side of the nerve (see figure 3 below). The rounded gemmae are again not unlike those of *Syntrichia latifolia*. The innovations in form of young shoots have already been mentioned by CORRENS (1899), who on the other hand did not observe the rounded or cylindrical gemmae.

It should be added that gemmae and innovations are particularly formed on leaves that are often not intact but variously damaged (sometimes virtually at the verge of decomposition). Also gemmae forming at the broken edges of the lamina could be observed occasionally. These gemmae bearing leaves are usually situated in the lower part of the stems deeper within the cushions or tufts. They are perhaps often overlooked because of their position. This might have led to the little attention they had gained in the past. Gemmae are very rarely (if at all) formed on upper ("healthy") leaves.

(Addendum submitted 2018/01/24)

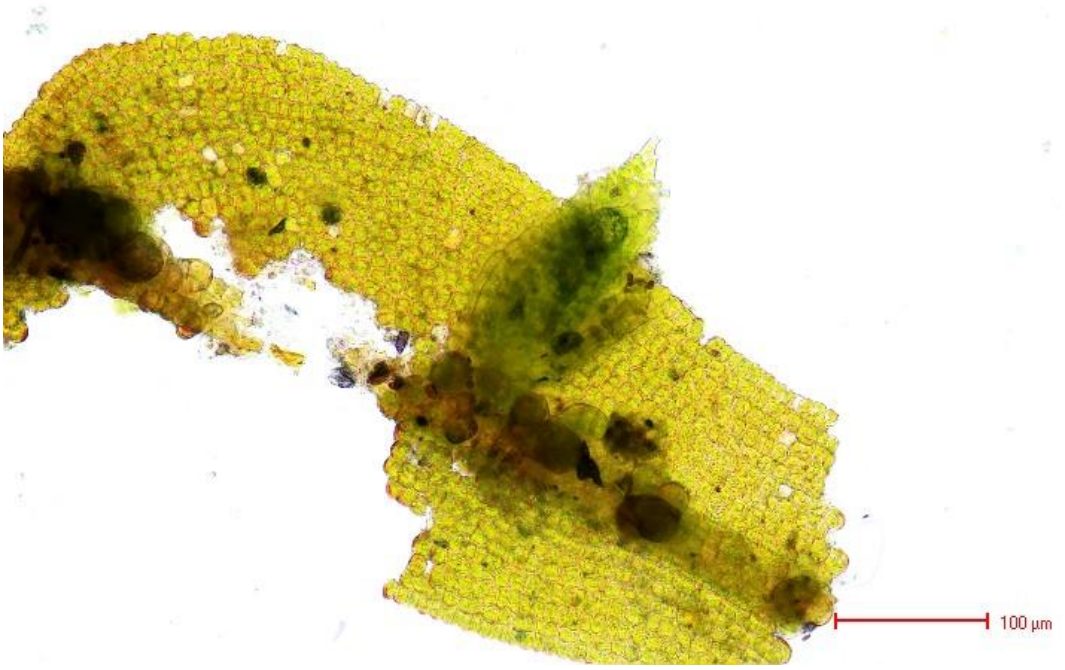

Figure 3: Rounded gemmae of *Syntrichia virescens* and a young shoot developing on the ventral side of the nerve of a partly damaged lower leaf. Surface view (x 200).