

Aneura maxima (Schiffn.) Steph. new to Norway

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Aneura maxima is a species which was described from Java and reported from various parts of Asia (India, Indonesia, New Caledonia and Japan). It was recently found new to Thailand (Frahm et al. 2009). Schuster (1992) reported this species from the Appalachian Mountains in North America and Andriessen et al. (1995) for the first time for Europe from the Belgian Ardennes. I (Frahm 1997) reported the species a second time for Europe from Finland. Subsequently, the species was reported from many other regions of Europe including Denmark (Thinggaard 2002), Poland and Luxemburg (Werner 2003), Corsica (Ros et al. 2007), France (Sotiaux et al. 1996), Czechia (Kucera 2004) and Germany (Meinunger & Schröder (2007). In Scandinavia, the species is known only from Finland and Denmark (Damsholt 2002). Recently this species was found also in Norway:

Hordaland: Tysnes, Reksteren, west coast N Sunde, swampy place in a small ravine leading to the sea, ca. 3 m alt., Frahm 31.8.2011 no. 2011662. (fig. 1-5)

Aneura maxima is easily recognized by the thallus margins which are undulate and unistratose in several rows. In other respects it looks more like *Pellia epiphylla* (a synonym of *A. maxima* in Japan is *A. pellioides* Horik.) and can be distinguished from the latter by unicellular slime hairs at the thallus apices, whereas *Pellia* has multicellular slime hairs (Schuster 1992, Damsholt 2002). Confusingly, *Aneura maxima* has even some kind of midrib like *Pellia* and unlike *Aneura pinguis* (Damsholt 2002), see also fig. 1.

Considering the enormous morphological and genetical variability of *Aneura pinguis*, the taxonomic value of *A. maxima* is questionable. The latter species seems to be connected with luxuriant forms of *A. pinguis* by plants with a smaller unistratose margin consisting of 4-5 rows of cells, which I called a pseudomaxima expression of *A. pinguis* (Frahm 2004, fig. 6), which grow in similar habitats and share the appearance with *A. maxima* by having undulate thallus margins. Paton (1999) describes plants with locally unistratose cells for a width of 1-6(-10) cells and includes them in *A. pinguis*. Also Meinunger & Schröder (2007) attribute these *Pellia*-like forms to *A. pinguis* and separate *A. maxima* by 40-60 oil bodies per cell in clusters, whereas *A. pinguis* shall have less than 30 which are evenly distributed over the cell. The observation was, however, made on one specimen. Damsholt (2002) indicates 15-45 oil bodies for *A. maxima* and 6-30 for *A. pinguis*. The Danish material (Thinggaard 2002) has (14-)15-25(-35) oil bodies and would belong to *A. pinguis* if the character used by Meinunger & Schröder is applied.

Similar expressions with unistratose thallus margins consisting of less than 10 cell rows were reported from North America by Darigo (2004). This could mean that there are gradual transitions between certain forms of *A. pinguis* and *A. maxima* or all expressions with unistratose thallus margins have to be included in *A. maxima*. According to Andriessen et al. (1995), *A. pinguis* shall have less than 5 rows of unistratose cells, however, according to Schuster (1992) and Damsholt

(2002), the thallus margins are 1-3 stratoze and in my experience, they are hardly unistratoze. Also Paton (1999) describes the margins of typical thalli of *A. pinguis* as 2-3stratoze or more. Thus unistratoze margins would separate *A. maxima* (not depending how many rows) from *A. pinguis* with multistratoze margins.

The indications of the width of the unistratoze thallus margins varies:

Damsholt (2002): (5-)8-18

Schuster (1992): (6-)8-18

Andriessen et al. (1955): 8-15

Thingsgaard (2002): 4-11

Paton (1999): (3)-6-12

In my personal experience I would rather divide the complex into *A. pinguis* with middle green, fat, succulent thallus, which is multicellular to the margin and obtuse (fig. 7), and *A. maxima* with dark green, flat, *Pellia*-like thallus independent of how many rows of unistratoze cells are present (fig. 6). The first is characteristic for wet sand, peat, rotten wood and wet rocks, the latter for moist soil in forest and swamps with stagnant water.

Molecular studies contributed nothing to the solution of this problem. According to Wicket et al. (2008) and Wickett & Goffinet (2008), *A. maxima* suggests a "polyphyletic" origin, that means it shows up several times in a tree intermingled with *A. pinguis*.

- Andriessen, L., Sotiaux, A., Nagels, C., Sotiaux, O. 1995. *Aneura maxima* (Schiffn.) Steph. in Belgium, new for the European liverwort flora. *J. Bryol.* 18: 803-806.
- Damsholt, K. 2002. *Illustrated Flora of Nordic Liverworts and Hornworts*. Lund.
- Darigo, V. 2004. *Aneura maxima* (Hepaticae: Aneuraceae) and *Marchantia aquatica* (Hepaticae: Marchantiaceae) New to Missouri and Interior Highlands of North America. *Evansia* 21: 76-78.
- Frahm, J.-P. 1997. A second European record for *Aneura maxima* (Schiffn.) Steph. in Finland. *Lindbergia* 22: 99.
- Frahm, J.-P. 2004. Zu achten ist auf: *Aneura maxima*. *Bryol. Rundbriefe* 77: 7.
- Frahm, J.-P., Pollawatn, R., Chantanaopint, S. 2009. New records to the bryoflora of Thailand. *Tropical Bryology* 30: 17-18.
- Kucera, J. 2004. Surprising bryophyte records in the old-growth forests Žofínský prales and Hojnovodský (in Czech). *Bryonora* 34: 4-13.
- Meinunger, L., Schröder, W. 2007. *Verbreitungsatlas der Moose Deutschlands Bd. 1*. Regensburg.
- Paton, J. 1999. *The liverwort flora of the British Isles*. Martins (Harley Books).
- Schuster, R.M. 1992. *The Hepaticae and Anthocerotae of North America, vol. 5*. Chicago.
- Sotiaux, A., O. Sotiaux & M. Sotiaux, 1996. *Aneura maxima* (Schiffn.) Steph. hépatique nouvelle pour la flore française. - *Bull. Soc. Bot. Centre-Ouest* 27: 513-516.
- Thingsgaard K. 2002. *Aneura maxima* (Schiffn.) Steph.: an addition to the Danish hepatic flora. *Lindbergia* 27: 79-80.
- Vácínová I. (1998): Epixylické mechorosty NPR Žofínský prales a NPP Hojná Voda v NovohradskýchWerner, J. 2003. *Aneura maxima* (Schiffn.) Steph. au Luxembourg, et quelques autres bryophytes remarquables observées en 2001. *Bull. Soc. Nat. luxemb.* 103 p. 25-30.
- Wicket, N.F., Goffinet, B. 2008. Origin and relationships of the myco-heterotrophic liverwort *Cryptothallus mirabilis* Malmb. (Metzgeriales, Marchantiophyta). *Botanical Journal of the Linnean Society*, 2008, 156: 1-12.
- Wicket, N.F., Fan, Y., Lewis, P.O., Goffinet, B. 2008. Distribution and Evolution of Pseudogenes, Gene Losses, and a Gene Rearrangement in the Plastid Genome of the Nonphotosynthetic Liverwort, *Aneura mirabilis* (Metzgeriales, Jungermanniopsida). *J Mol Evol* (2008) 67:111-122.



Fig. 1-3: *Aneura maxima* from the Norwegian locality.



Fig. 4: Thallus of *Aneura maxima* in translucent light showing the unicellular thallus wings.



Fig. 5: Habitat of the *Aneura maxima* locality in Norway in the upper part of the small ravine bottom left.



Fig.: 6: So called pseudomaxima expression of *A. pinguis* from the Vosges, France, with a border of 5 unistratose cells at undulate thallus margins. I would refer this expression to *A. maxima*, too.



Fig. 7: Typical *A. pinguis* with flat, obtuse multistratose thallus margins .