

## New taxonomical data in the genus *Tortula* (Pottiaceae, Bryophyta)

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**Abstract:** The taxonomical position of three Pottiaceae species present in the Mediterranean area have been reconsidered according to the criteria introduced by Zander (1993), in order to make the needed taxonomical changes that will be incorporated in the Mediterranean checklist of mosses that is being compiled. Two new combinations in the genus *Tortula* are proposed: *Tortula vlassovii* for *Phascum vlassovii* and *Tortula acaulon* var. *galilaea* for *Phascum galilaeum*. *Pottia gemmifera* is considered to be a synonym of *Tortula caucasica*.

**Keywords:** Mediterranean area, *Phascum vlassovii*, *Phascum galilaeum*, *Pottia gemmifera*, taxonomy, *Tortula*.

### Introduction

In his monograph of the Pottiaceae, Zander (1993) proposed a taxonomic revision of the family. His treatment differed from the previous concepts of some genera and remained controversial. Heyn and Herrnstadt (2004) did not follow Zander's new systematics, but many of his proposals were supported later by other kind of evidence; e.g. molecular data (Spagnuolo et al. 1997; Werner et al. 2002, 2004) and protonematal development (Duckett et al. 2004). Especially innovative was the non-segregation in different genera of species with cleistocarpous capsules and those with stegocarpous capsules, but with very similar gametophytes. On the contrary, he proposed the segregation of the species of the genus *Phascum* Hedw. in two genera, some of them in *Microbryum* Schimp. and others in *Tortula* Hedw. Also, the genus *Pottia* (Ehrh. ex Rchb.) Fűrnr. was not recognized by Zander and he proposed to include the species either in *Microbryum* or in *Tortula*. This classification was later recognized in floras and checklists (Flora of North America Editorial Committee 2007, Goffinet et al. 2008, González-Mancebo et al. 2008, Frey & Stech 2009). Some species of *Phascum* and *Pottia* that were not studied by Zander in his monograph require revision in order to establish their actual placement according to the new taxonomical concepts. This is the case of *Phascum galilaeum* Herrnst. & Heyn and *Pottia gemmifera* Herrnst. & Heyn, which have only been treated in the original genera.

*Phascum vlassovii* Laz., on the contrary, was studied by Zander (1993), who considered it belonging to the

genus *Microbryum* and renamed it *M. vlassovii* (Laz.) R.H. Zander. However, his taxonomic treatment is still controversial.

The present work reconsiders the taxonomical position of these three species and makes the needed changes according to the modern criteria introduced by Zander. These changes will be incorporated into the Mediterranean checklist of mosses that is being compiled at present. The authors of this article are participating in producing the checklist.

### Materials and Methods

All the known reports of *Phascum galilaeum* and *Pottia gemmifera*, which correspond to the types kept at HUJ (mentioned below) were studied. As for *Phascum vlassovii* much more reports have been given in the literature but for this study only the Spanish material kept at MUB (Spain, Murcia, Rambla del Hortillo (Lorca), XG 0371, borde de rambla, R.M. Ros, 03.03.1984, MUB 2963), were studied. The type of this species was not studied because the singular morphology of the species precludes the confusion with any other closely related. Morphological comparison studies by light microscopy were carried out. For all the species, 2 complete fructified plants were studied. In all the cases it would have been desirable to use other objective techniques as the molecular ones, but the non availability of fresh material in the two first species and the scarcity of the herbarium specimen in the third prevented to carry out such analysis.

## Results & Discussion

### *Phascum galilaeum* Herrnst. & Heyn

This species was described from Israel by Herrnstadt & Heyn (Herrnstadt et al., 1991) and until now it has only been reported from two locations in this Mediterranean country. The species is characterized mainly by the small size of plants, smooth laminal cells and cleistocarpic subglobose capsules on straight long setae. Later Herrnstadt & Heyn (1993) considered it to be a linking species between the genera *Phascum* and *Pottia*. They compared it with *Phascum longipes* J. Guerra, J.J. Martínez & Ros and *Pottia bryoides* (Dicks.) Mitt., which both have a long seta, although the seta in *P. galilaeum* is relatively shorter with respect to capsule length compared with the two other species. And so it also was treated in the Bryophyte Flora of Israel and Adjacent Regions (Herrnstadt & Heyn 2004). Nevertheless the smooth laminal cells, the immersed to emergent capsule without peristome, together with the size of plants, the plane to recurved margins of leaves, the costa being excurrent in an awn up to 600 µm long, and the spores of 30–36 µm in diameter, place *P. galilaeum* within the variability range described for *Tortula acaulon* (With.) R.H. Zander. In spite of the fact that many infraspecific taxa have been recognized within this species, *P. galilaeum* shows a unique combination of smooth laminal cells and a long seta (up to 0.8 mm long) that have not been observed in the literature nor in specimens of this species studied by the authors of this paper. Therefore we consider that it should be treated at varietal level within *Tortula acaulon* (With.) R. H. Zander, and consequently we propose a new combination:

***Tortula acaulon* var. *galilaea* (Herrnst. & Heyn) Ros & Herrnst. comb. nov.** Type: Israel. Upper Galilee: Gush Halav near the airport, grass meadow, *I. Herrnstadt* 79-93-1, 18.03.1979 (Isotype: HUI 903058/2594!). Golán Hights: roadside 1 km to Nahal Geshur, on moist dark soil, *L. Markus & C. Kuttiel* 77-586-2, 20.04.1977 (Paratype HUI 903060/2595!).

Basionym: *Phascum galilaeum* Herrnst. & Heyn, *The Bryologist* 94: 175. 1991.

***Phascum vlassovii* Laz. (*Microbryum vlassovii* (Laz.) R.H. Zander)**

According to the British Columbia Bryophyte Recovery Team (2009) this species has a disjunct distribution between western North America and western Eurasia. It is rare across its global range. In Eurasia it is known from Spain (Jiménez Martínez et al. 1990, Guerra 2006), Germany (Oesau 2006), Ukraine, Armenia, central Asia (Lazarenko 1938, Savicz-Ljubitzkaja & Smirnova 1970) and Turkey (Cetin 1988). In North America it has been reported

from southern British Columbia (McIntosh 1986, 1989, 1997) and California (Zander 2007).

The species is very easy to recognize morphologically. The most important characteristics are the presence of ovate leaves with distal laminal cells bulging very strongly medially and projecting as “bottle-shaped” cells on the adaxial surface of the costa, and the cleistocarpic capsule. Nevertheless Zander (2007) argued that in spite of the presence of such ampullose adaxial cells also in *Tortula acaulon*, *Phascum vlassovii* can be differentiated by the KOH colour reaction, which is yellow in *T. acaulon* and red in *M. vlassovii* as is the rule in the genus *Microbryum*.

Our morphological investigation of *P. vlassovii* allows the following conclusions: the species shares some characters with *Microbryum*, such as the small habit, a single round semicircular costal stereid band, and the cleistocarpic apiculate capsule, but also shows some differences. The spore ornamentation in *P. vlassovii* is more similar to that of *Tortula acaulon* than of *Microbryum* species, as was described by Carrión et al. (1990), and the KOH colour reaction is a paler red than that of typical *Microbryum* species. Besides, the laminal cells of *Microbryum* species are usually opaque by several dense and massive papillae per cell. In *P. vlassovii* there are long mamillae, but less numerous and dense than those in *Microbryum*; therefore the laminal cells are translucent. Consequently the species would preferably be considered in the genus *Tortula* and the new combination is proposed:

***Tortula vlassovii* (Laz.) Ros & Herrnst. comb. nov.** Type: Turcomania, ad terran in horto urbem Aschkabad, *Vlassov* (not studied).

Basionym: *Phascum vlassovii* Laz., *Zhurn. Inst. Bot. Vseukrajins’k. Akad. Nauk.* 26-27: 196. 1938.

### *Pottia gemmifera* Herrnst. & Heyn

The species was described from, and only collected in, Israel by Herrnstadt & Heyn (1999). The most relevant characters indicated in the diagnosis to distinguish the species from other closely related species are the aggregate leaves with plane margins, the big and smooth laminal cells, the axillary bud-shaped gemmae and the deoperculate capsules with widened mouth. It was considered that among the local *Pottia* species, *P. intermedia* (Turner) Fűrnr., which was also found near the type locality, resembles *P. gemmifera* most. In the Bryophyte Flora of Israel and Adjacent Regions (Heyn & Herrnstadt 2004) it was also treated as a distinct species.

Following reinvestigation of the type material we conclude that *P. gemmifera* belongs to the genus *Tortula* and not to *Microbryum*, because the

protologue is similar to typical *Tortula caucasica* Broth. (= *Pottia intermedia*), which was considered by Ros et al. (2008) to be conspecific with *Tortula modica* R.H. Zander, and must replace that name. Most of the distinguishing characters are commonly found in some closely related species of *Tortula* sect. *Pottia* (Ehrh. ex Rchb.) Kindb. as *Tortula truncata* (Hedw.) Mitt., which is characterized by bad developed peristome teeth, smooth laminal cells and turbinate capsules widest at the mouth (Smith 2004; Casas et al. 2006; Ros & Werner 2006). Nevertheless, the type material shows that capsules are cylindrical when still unbroken as is shown in Figure 2-a of the original description, and only broken empty capsules have a widened mouth. The axillary gemmae the species is named after have also been found in many other species of the former genus *Pottia* with a rostrate lid (Ros & Werner 2006) and therefore they cannot be considered a distinguishing character for *P. gemmifera*. The leaf form is variable and ranges from oblong, oblong-lingulate to spatulate; the leaf apex can be cuspidate but also obtuse. The species is intermediate between *Tortula pallida* (Lindb.) R.H. Zander (= *Pottia pallida* Lindb.) and *T. caucasica* Broth., because the apex usually is rounded or obtuse in the former and acute in the latter (Guerra & Ros, 1988; Casas et al. 2006; Ros & Werner 2006; Ros et al. 2008). On the other hand the presence of intermediate forms between both species have been described previously (Ros & Werner 2006). The certainty of our taxonomic treatment is limited by the scarcity of material in the single locality discovered to date. The reddish setae as well as the habitat of non-saline soil were taken into consideration when deciding that *Pottia gemmifera* should be conspecific with *Tortula caucasica*.

Therefore we propose the following synonymization:

*Pottia gemmifera* Herrnst. & Heyn, *Nova Hedwigia* 69: 232-233. 1999. Type: Bet-Shean Valley (Sakhne), on wet soil, *Bilewsky* (No.94A in Herb. Bilewsky, as *Funaria obtusa* var. *notarisii*) (Holotype HJ 903488/3054!) (= *Tortula caucasica* Broth. in *Acta Soc. Sci. Fenn.* 19(12): 43. 1893 *syn. nov.*)

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