On the identity of *Riccia teneriffae* S.W.Arnell (Marchantiophyta: Ricciaceae) and a note on *R. cavernosa* Hoffm. in the Canary Islands

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We revised both the holotype and an isotype of *Riccia teneriffae* S.W.Arnell 1962 and additionally revised our own collections of *Riccia cavernosa* Hoffm. 1795 from the Canary Islands. Since the types of *R. teneriffae* represent *R. cavernosa*, and the latter name precedes the former, *R. teneriffae* should be treated as a synonym of *R. cavernosa*. In the Canary Islands, *R. cavernosa* appears to be rare. It has been found on La Gomera, Gran Canaria, Lanzarote, and Tenerife. We report it as new to Fuerteventura. *R. cavernosa* inhabits ephemeral, thin layers of mud. Very rarely it occurs on basaltic pyroclasts. SEM images of spores are presented. The local distribution is mapped.

Keywords: Canary Islands, *Riccia*, SEM spore images, Taxonomy

Introduction

In 1962, the honoured Swedish bryologist Sigfrid Arnell (Mårtensson, 1972) described *Riccia teneriffae* as new to science (Arnell, 1962). The description was based on a collection from Barranco de Masca, Tenerife (Canary Islands, Spain). No collections are known since then (Eggers, 1982; Jovet-Ast, 1986; Dirkse *et al.*, 1993; Grolle & Long, 2000; Söderström *et al.*, 2002, 2007; Ros *et al.*, 2007). On the basis of the protologue alone, Schumacker & Váňa (2005) provisionally treated *R. teneriffae* as a synonym of *R. canaliculata* Hoffm., and Dierssen (2001) and González-Mancebo *et al.* (2008) marked it as a taxonomically ill-defined or doubtful species.

The unconfirmed status of *R. teneriffae* and our interest in the Canarian bryophyte flora led us to revise the types of *R. teneriffae* and to additionally revise our collections of *R. cavernosa* from the Canary Islands. We report the result of these revisions.

Selected Specimens Studied

R. teneriffae *S.W.Arnell*

Tenerife: Barranco de Masca, *Stork* 1962, S *B45284* (holotype); Barranco de Masca, *Stork* 1962, UPS (*B-045937*) *441899* (isotype).

R. cavernosa *Hoffm.*

Fuerteventura: NE slopes of Montaña Fenduca, *Dirkse* 1992, *Herb. GM Dirkse 14131*; Jandía, Barranco de las Damas, *M.C. León, E. Beltrán, A. García & S. Scholz* 1998, TFCBry *9807*. **La Gomera:** NW of San Sebastián de La Gomera, Barranco del Rincón, *Dirkse* 1988, *Herb. GM Dirkse 14126*. **Gran Canaria:** Barranco de Arguineguín, *Dirkse* 1996, *Herb. GM Dirkse 14140*. **Lanzarote:** Yaiza, Carretera de La Geria a Uga, *Gil-Rodríguez & L. Moro Abad* 2004, TFCBry *17470*. **Tenerife:** Barranco de Masca, *Dirkse* 1984, *Herb. GM Dirkse 4657*; Barranco de Masca, *Dirkse* 1985, *Herb. GM Dirkse 4030*; Barranco de Masca, *Dirkse* 1988, *Herb. GM Dirkse 14130*; Fasnia, *Cruz-Trujillo* 1996, TFCBry *9808*.

Methods

Specimens studied are kept in labelled packets at room temperature and humidity. Dry thalli were inspected with a dissecting microscope. Dissections and spores were studied in a 2% KOH solution in water under a light microscope. Digital SEM images of spores have been taken from air-dried, gold-sputtered material.

Results

The original collection of *R. teneriffae* S.W.Arnell is preserved at S (Swedish Museum of Natural History, Department of Cryptogamic Botany, Stockholm, Sweden). It is kept in a small open-topped paper envelope (8.2 cm long and 6.1 cm broad), within the original herbarium packet which is put in a slightly larger packet. The label of the original herbarium packet bears a type-script, reading: '*Riccia* (*Ricciella*)

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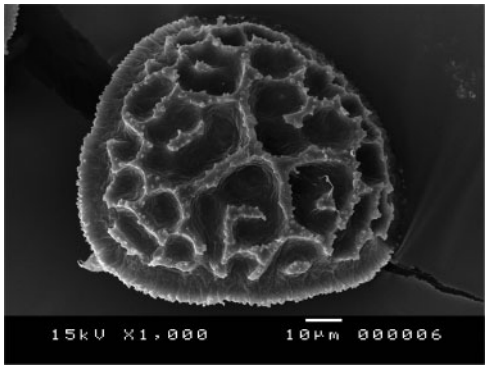

Figure 1 ***Riccia teneriffae*** **S.W.Arnell. SEM image of distal face of spore (from the holotype: S B45284).**

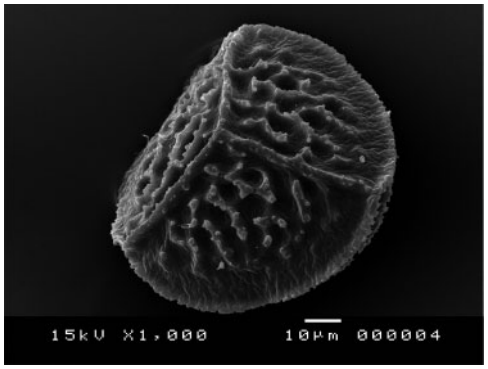

Figure 2 ***Riccia teneriffae*** **S.W.Arnell. SEM image of proximal face of spore (from the holotype: S B45284).**

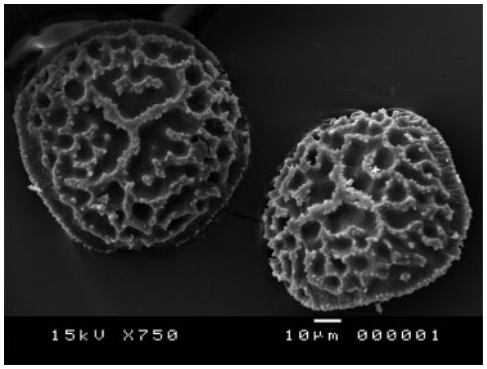

Figure 3 ***Riccia cavernosa*** **Hoffm. SEM image of distal face of spore (from:** ***Herb. GM Dirkse 14140*****).**

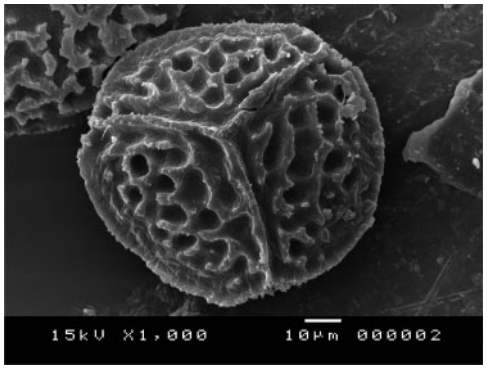

Figure 4 ***Riccia cavernosa*** **Hoffm. SEM image of proximal face of spore (from:** ***Herb. GM Dirkse 14140*****).**

teneriffae S.Arn., Teneriffe, Barranco Masco, halvvägs mellan byn Maso och havet. 31.3 1962, Adelaide Stork'.

Both Masco and Maso are mis-spellings of Masca and have been corrected in the protologue. In the upper right corner of the label, 'type' has been written and highlighted with a red pencil. On the rear of the original herbarium packet, a collection identification number is written: S reg. Nr. B45284. The protologue refers just to this collection, so it is the holotype.

The holotype (S reg. Nr. B45284) consists of a few thalli and many eroded thallus fragments, accompanied by fine volcanic debris. Branches 3–4 mm wide, dorsal face pale green, shallowly concave, perforated by destruction of the epithelium, spongy, margin obtuse. Spores (Figures 1 and 2) dark brown, 80–100 μm in diameter, distally with 3–4 large, incomplete, central alveoli and smaller, irregular incomplete alveoli at the margin. The proximal side has a distinct triradial marking. Wing without pores.

The isotype, preserved at UPS (Uppsala University, Museum of Evolution, Botany Section, Uppsala, Sweden), obviously is a duplicate of the holotype. It consists of a sample of some thalli and two permanent microscope mounts on glass slides, one containing spores and the other thalli.

The size of the thalli, their green colour and spongy structure fit the concept of *R. cavernosa* Hoffm. 1795 as revealed by Jovet-Ast (1965, 1986) and applied by Perold (1989, 1999), Paton (1999), Damsholt (2002), Wigginton (2004), and Casas *et al.* (2009). Moreover, the dark brown or reddish brown spores with 3–4 large incomplete alveoli and several smaller ones near the edges of the distal face, and a strong triradial mark on the proximal face are typical of *R. cavernosa* (Figures 3 and 4) and add to the set of characters identifying *R. cavernosa* (Scott, 1985; Jovet-Ast, 1986; Schuster, 1992; Paton, 1999; Damsholt, 2002; Wigginton, 2004; Casas *et al.*, 2009). We have not been able to find any differences between the types of *R. teneriffae* and specimens representing *R. cavernosa*. According to our experience, the application of both names is not justified. So, both *R. teneriffae* and *R. cavernosa* refer to just one species, to which *R. cavernosa* applies and for which this name has priority:

Riccia cavernosa Hoffm. 1795, *Riccia teneriffae* S.W.Arnell 1962 *syn. nov.*

R. cavernosa is widely distributed in warmer regions of all continents. It was thought to be absent from arctic and highly boreal zones (Jovet-Ast, 1986; Schuster, 1992) but Seppelt & Laursen (1999) report it from Alaska. In the Mediterranean area it occurs in Italy, France, Spain, Portugal, Egypt, Libya, Tunisia and Morocco. (Bischler, 2004; Ros *et al.*, 2007; Ahayoun *et al.*, 2009). In Macaronesia, it is known from all archipelagos, except from the Azores (Patiño

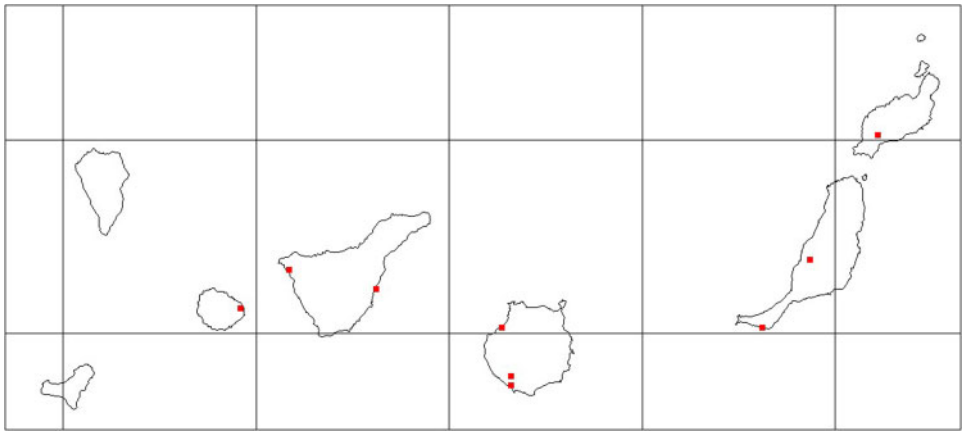

Figure 5 ***Riccia cavernosa*** **Hoffm. Actual distribution in the Canary Islands, based on revised herbarium collections. The species is rare on Gomera, Tenerife, Gran Canaria, Fuerteventura, and Lanzarote. Distance between UTM grid co-ordinates=100 km.**

Llorente & González-Mancebo, 2005; Sérgio *et al.*, 2008; González-Mancebo *et al.*, 2008; Gabriel *et al.*, 2010). In the Canary Islands, *R. cavernosa* is a rarely recorded species (Figure 5), which is almost confined to the lower parts of barrancos, at altitudes below 500 m. It has been found in La Gomera, Gran Canaria, Lanzarote, and Tenerife. It is particularly common in Barranco de Arguineguín on Gran Canaria and in Barranco de Masca on Tenerife, which is the type locality of *R. teneriffae*. We report it as new to Fuerteventura. In the Canary Islands, *R. cavernosa* inhabits ephemeral, thin layers of fresh mud, deposited during winter floods along natural water courses which dry out in spring and stay crusty until next winter. Very rarely it occurs on basaltic pyroclasts.

Discussion

For several reasons, the genus *Riccia* L. is notorious for its difficult taxonomy (Jovet-Ast, 1986; Schuster, 1992). Many species of *Riccia* occupy sites, which are dry during most of the year, except for a few months in winter. Annual and perennial species alike have their growing season some weeks after periods of rain. Then they can be found. After drying, specimens of *Riccia* do not easily regain their turgidity, which hampers proper dissection and study.

Apparently, the small type collection of *R. teneriffae* S.W.Arnell did not allow for splitting off more than one duplicate, nor did the publication (Arnell, 1962) attract much attention, for after its conception, *R. teneriffae* has never been reported again. *R. teneriffae* remained just a name for about half a century. Neither Jovet-Ast (1986) in studying Mediterranean *Riccia* species, nor Dirkse *et al.* (1993) when gathering materials for the Canarian checklist, or Schumacker & Váňa (2005) in preparing keys for European liverworts, saw the type.

According to the protologue, the spores of *R. teneriffae* resemble those of *R. canaliculata* Hoffm. and *R. montaguensis* S.W.Arnell. (=*R. bullosa* Link ex Lindenb.). The protologue does not refer to *R. cavernosa*. Although thalli of both *R. teneriffae* and *R. canaliculata* differ from each other in many ways (Jovet-Ast, 1986; Paton, 1999), indeed, there is a reasonable resemblance between their spores, which are of the same size (Jovet, 1986; Perold, 1989, 1999). Spores of *R. canaliculata* differ from those of *R. teneriffae* in the ornamentation of distal faces being slightly laxer, with up to four large alveoli across and the wing having distinct pores. In *R. teneriffae*, the spore wing is without pores.

R. bullosa markedly differs from *R. teneriffae* not only in thallus anatomy, but also in spore characters (Perold, 1989, 1999). While in *R. bullosa* the spores measure 100–160 μm in diameter, and the distal faces show 10–12 complete alveoli across, in *R. teneriffae* the spores may reach 120 μm, but rarely exceed 100 μm; the distal faces having irregular ridges or incomplete alveoli, up to six across (Perold, 1989).

Both Jovet-Ast (1986) and Schuster (1992) point at the variability of reticulation of spore faces in *R. cavernosa* Hoffm. This also applies to the representatives of the species in the Canary Islands, where distal spore faces may show reduced ridges, except for 3–4 in the centre.

In the Canary Islands, *R. cavernosa* may be less rare than our collections indicate. Careful searches during future springs certainly will reveal more sites.

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Taxonomic Additions and Changes: *R. cavernosa* Hoffm. 1795, *R. teneriffae* S.W.Arnell 1962 *syn. nov.*

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