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1 **Earliest herbarium evidence of the occurrence of *Lewinskya acuminata***  
2 **(Orthotrichaceae) in East Africa**

3

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25

26 *Lewinskya acuminata* (H.Philib.) F.Lara, Garilleti & Goffinet ( $\equiv$ *Orthotrichum*  
27 *acuminatum* H.Philib.; Lara et al. 2016), is considered one of the most representative  
28 and widespread species of Orthotrichaceae in the Mediterranean basin (Lara & Garilleti,  
29 2014). The species occurs in almost all the main islands and in both the European and  
30 African sides of the Mediterranean Sea, from Anatolia to the Iberian Peninsula (Jelenc  
31 1967; Draper et al. 2006, 2008; Ros et al. 2013; Vigalondo et al. 2016), as well as in  
32 Macaronesia (Lara et al. 1999; Sim-Sim et al. 2008; González-Mancebo et al. 2009).  
33 Described in the 19<sup>th</sup> century (Venturi 1887), and in spite of its prevalence in the wild,  
34 *Lewinskya acuminata* remained poorly recorded and relatively unknown until the late  
35 1980s (Lara and Mazimpaka 1992). The main reason for it having been overlooked for  
36 so long could be its morphological similarity with other Orthotrichaceae species,  
37 especially with *L. affinis* (Schrad. ex Brid.) F.Lara, Garilleti & Goffinet,  
38 ( $\equiv$ *Orthotrichum affine* Schrad. ex Brid.) and *L. striata* (Hedw.) F.Lara, Garilleti &  
39 Goffinet ( $\equiv$ *O. striatum* Hedw.), with which it usually coexists (Mateo et al. 1990; Lara  
40 and Mazimpaka 1992). Nevertheless, *L. acuminata* is a very distinctive moss, and its  
41 peculiar features have been clearly described and highlighted (Lewinsky 1993; Lara et  
42 al. 2009; Lara and Garilleti 2014).

43 In the last two decades, *Lewinskya acuminata* has been recorded beyond the  
44 Mediterranean Region, from scattered localities in north-western and central Europe  
45 (van der Pluijm 2001; Ahrens 2004; Sotiaux et al. 2007; Blockeel 2009; Ellis et al.  
46 2014; Eckstein 2016). These new records in previously well studied areas suggest a  
47 pattern of recent expansion that could be explained by several reasons. For instance, in  
48 addition to better floristic exploration, central and northern Europe have experienced a  
49 significant reduction of environmental acidification (SO<sub>2</sub> deposition), which has  
50 allowed the return of bryophytes (especially epiphytes) that had disappeared from these

51 areas for several decades (e.g. Bosanquet 2012). Likewise, global warming may be  
52 promoting the northward spreading of xerophytic bryophytes from the Mediterranean  
53 Region (van der Pluijm 2004; van der Pluijm and Siebel 2017).

54 Unexpectedly, Vigalondo et al. (2016) also discovered populations in California and  
55 Ethiopia that were the first records for America and East Africa, and thus significantly  
56 expanded the geographical range of *Lewinskya acuminata*. Their subsequent  
57 morphological and genetic study led to conclude that the Mediterranean, American and  
58 African populations constituted a monophyletic lineage. Vigalondo et al. (2016)  
59 rejected the hypothesis of an ancient fragmentation of its range and suggested that the  
60 intercontinental disjunct distribution of this moss could be a consequence of long-  
61 distance dispersal events from the core area, the Mediterranean basin. However, the age  
62 of these dispersal events is a key question that remains unresolved, without excluding  
63 the scenario of an ongoing process.

64 The possible vagrant status of *Lewinskya acuminata* in America can be ruled out. The  
65 species was found in several natural protected areas across the Peninsular Range of  
66 southern California, encompassing a geographic range of more than 100 km in latitude  
67 (Vigalondo et al. 2016). In contrast, the African records of the species correspond to a  
68 single area of the Jimbar (Guimbar) valley, in the remote Simien Mountains (Vigalondo  
69 et al. 2016). In this case, a very recent colonization or even a transient or vagrant status  
70 could be plausible. However, a study of original materials of *Orthotrichum leptocarpum*  
71 Bruch & Schimp. ex Müll.Hal. has unexpectedly revealed relevant data on the presence  
72 of *L. acuminata* in eastern Africa.

73 Mosses in the Orthotrichaceae quite often form mixed cushions that lead to incomplete  
74 identification or misidentifications of samples (see for example, Caparrós et al. 2016).  
75 This has been the case of *Lewinskya acuminata*, long overlooked in Ethiopia in spite of

76 having been collected by Schimper in the 19<sup>th</sup> century. We have detected it in four  
77 herbarium specimens out of 41 revised from PC and BM.

78 [\[Figure 1 near here\]](#)

79 The specimens BM000982240 (“W. Schimper pl. Abyssen 429b *Orthotrichum*  
80 *leptocarpum* Bruch et Schimp. M. Silke”) (Figure 1), BM001244100 (“*Orthotrichum*  
81 *leptocarpum* B & S, Simen Abyssinica, Schimper”), BM001244111 (“N.H.M. London,  
82 Herb Hampe, 1881, *Orthotrichum semense* Schimper, Sem Abyssiniae Schimper, mis  
83 Schimper”) and PC0134987 (“Schimper iiter Abyssinicum, sectio secunda, 429b,  
84 *Orthotrichum leptocarpum* Bruch et Schimper. In regione superiori ericarum montis  
85 Silke ad truncus *Erica acrophyae* Fresen, d. 16 Febr. 1840”) comprise shoots of  
86 *Lewinskya acuminata* intermixed with other species, mainly *L. firma* (Venturi) F.Lara,  
87 Garilleti & Goffinet ( $\equiv$  *O. firmum* Venturi) and *Orthotrichum leptocarpum*. All of them  
88 were sampled on trunks of *Erica* sp. from Mt Silke on 16<sup>th</sup> February 1840. We lack  
89 further accurate data on the sampling site, but Mt. Silke is located some 15–16 km NE  
90 from the locality reported by Vigalondo et al. (2016). Specimen BM001244100 also  
91 contains some examples of *L. galiciae* (F.Lara, Garilleti & Mazimpaka) F.Lara,  
92 Garilleti & Goffinet ( $\equiv$  *Orthotrichum galiciae* F.Lara, Garilleti & Mazimpaka), a rare  
93 and endemic species so far only known from the type locality, Bwahit (Lara et al.  
94 2006), also in the highlands of the Simien Mountains, but some 8 km distant from the  
95 locality sampled by Schimper.

96 The occurrence of *Lewinskya acuminata* in four herbarium sheets suggests that it could  
97 be common, at least at a local scale, on Silke Mountain. In addition, Vigalondo et al.  
98 (2016) also found the species in three different sites in Jimbar Valley through an  
99 altitudinal range of 200 m, growing on *Erica* sp. within the woody communities of the  
100 afro-montane belt (Bussmann 2006). Hence, because this species was found among

101 Schimper's collections, the theories of it being a very recent arrival promoted by global  
102 warming, or a transient occurrence, should be discarded.

103 The origin and phylogeographic history of *Lewinskya acuminata* in East Africa remain  
104 poorly understood (Vigalondo et al. 2016). However, all the available pieces of  
105 evidence from Schimper's Ethiopian collections and more recently collected samples of  
106 *L. acuminata* (Vigalondo et al. 2016) indicate a well-established species in East Africa  
107 for at least nearly two centuries.

108

### 109 **Notes on Contributors**

110 *Juan A. Calleja* has a PhD in Botany and Plant Ecology, his research interests include  
111 molecular phylogenetic and systematic studies on vascular and non-vascular plants  
112 (bryophytes), riparian forests diversity, and plant-animal interactions at different spatial  
113 scales.

114 *Beatriz Vigalondo* has a PhD in Botany. Her research includes bryophyte taxonomy and  
115 biogeography from an integrative perspective, with focus on the Orthotricheae.

116 *Vicente Mazimpaka* is a recently retired Professor of Botany, whose scientific trajectory  
117 mainly includes research on diversity, ecology, taxonomy and biogeography of  
118 epiphytic bryophytes, especially on members of Orthotrichaceae (Bryopsida).

119 *Isabel Draper* is an Associate Professor of Botany. Her research has focused on  
120 resolving the phylogenetic relationships and biogeographical patterns of mosses,  
121 particularly on the Orthotrichaceae.

122 *Ricardo Garilleti* is a Professor of Botany with a main research interest on taxonomy,  
123 systematics, biogeography and conservation biology of the Orthotrichaceae, currently  
124 focused on unveiling cryptic species by using integrative taxonomic approaches.

125 *Francisco Lara* is a Professor of Botany. His research has been centred on the  
126 taxonomy, phylogeny and biogeography of the Orthotrichaceae, with especial interest in  
127 solving complexes of cryptic species. He also focuses on understanding the ecological  
128 drivers that shape the richness and composition of the epiphytic bryophyte communities  
129 in temperate zones.

130

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### 217 **Figure legend**

218 Figure 1. *Lewinskya acuminata* in the BM000982240 specimen. It is present only in  
219 cushion 2 (a and b), intermixed with *L. firma* (c) and *Orthotrichum leptocarpum* (d).  
220 Cushions 1 and 3 only comprise *L. firma*. Uppermost image from Natural History  
221 Museum (2014). Scale bars: grey = 10.0 mm; black (a, b) = 1.0 mm.

222