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## *Anacolia menziesii* (Bartramiaceae, Musci) a New Species to the European Bryophyte Flora

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**Abstract.** *Anacolia menziesii* (Turn.) Par. is reported for the first time from Europe at different localities. Hitherto, it was known on the American and Asian continents. The species is described and illustrated and its distribution given.

For the last few years we have been studying the bryophyte flora and vegetation of Almeria Province in southeastern Spain which includes the Sierra Alhamilla (García-Zamora et al., 1998). A specimen belonging to the genus *Anacolia* (Bartramiaceae) was found in this range whose features did not match *A. webbii* (Mont.) Schimp., the only previously known species of the genus in Europe and the Mediterranean Basin.

It was concluded that the plant was *Anacolia menziesii* (Turn.) Par. that was described by Turner from the western coast of North America. In a monograph of the genus *Anacolia* (Flowers 1952), these species are distinguished by the development of papillae on both sides of the leaf cells (prominent in *A. webbii* and absent, weak, or prominent in *A. menziesii*); length of the seta (mostly short, generally 1 mm long in *A. webbii* and 5–12 mm long in *A. menziesii*), and peristome (lacking in *A. webbii* and mostly lacking in *A. menziesii*, when present variously developed, occasionally as a low, thin membrane within the mouth; sometimes with a few high joints arising well within the mouth; pale yellowish to reddish-brown; often strongly jointed, smooth, fragile, and often broken). Nevertheless, Flowers said about *A. webbii* that “. . . in some cases the papillae are not apparent in the surface view but good cross sections of the leaves show them”.

Obviously, both species are morphologically close and cannot be easily distinguished by their gametophytes. Furthermore, due to their dioicous sexual condition both species are usually found without sporophytes. With the goal of determining which are the best gametophyte characteristics by which to distinguish them, a comparative morpho-

logical study of both species by LM and SEM has been carried out.

Interestingly, Townsend (1965) during a study of the bryophytes from Cyprus found a specimen of *Anacolia* with almost smooth leaves, and with “. . . facies of the plant much more like the American *A. menziesii* than the usual forms of *A. webbii*, and in the absence of fruit would be referred to the former species if the place of origin were unknown”.

For this work we have studied this specimen kindly loaned by C. C. Townsend, and some others from the Spanish localities in which *A. webbii* was cited (Casas et al. 1985).

### RESULTS

After the comparative morphological study of the holotype of *Anacolia menziesii* (BM) with the specimens from Sierra Alhamilla (Almeria) and Cyprus, we think that all of these specimens correspond to *A. menziesii*. The identity of the Almerian specimen was confirmed by Dana Griffin, III (U.S.A.). It has also been found in another locality of southern Spain (Sierra de Baza, Granada Province). A description of the gametophyte of *A. menziesii* is included here, since this species is not found in any of the European floras.

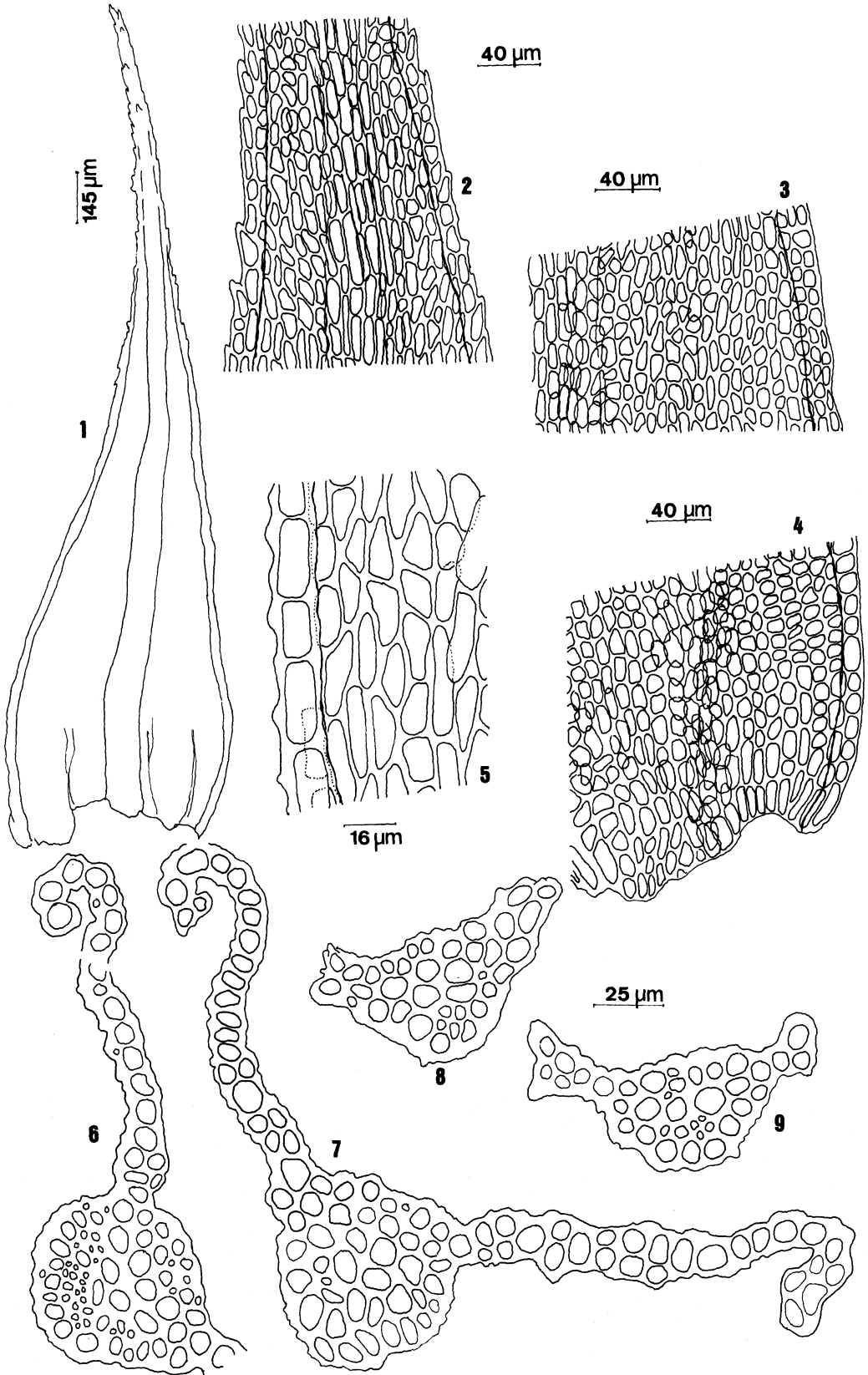
*ANACOLIA MENZIESII* (Turn.) Par., Index Bryol. 27. 1894. FIG. 1–21

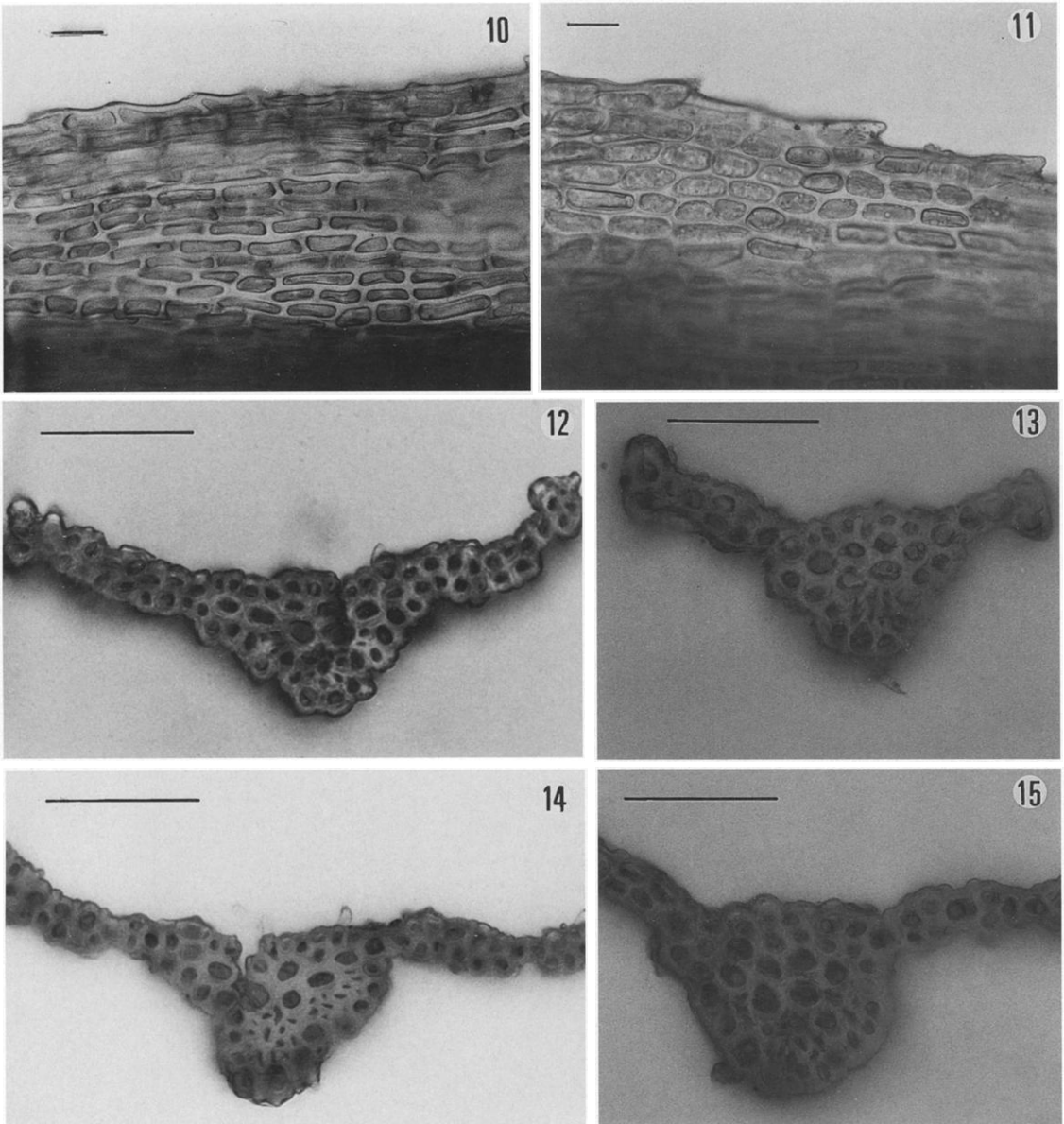
*Bartramia menziesii* Turn., Ann. Bot. 1: 525. 1805. TYPE: Northwest coast of America, *Menzies*, 1804 (holotype, BM!).

Plants in dense tufts, 1.5–5.0 cm high, sometimes

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FIGURES 1–9. *Anacolia menziesii*. — 1. Leaf at middle part of stem. — 2. Upper laminal cells. — 3. Middle laminal cells. — 4. Basal laminal cells. — 5. Detail of upper laminal cells. — 6. Transverse section at base of the leaf. — 7. Transverse section at lowest quarter of leaf. — 8. Transverse section at apex of leaf. — 9. Transverse section at upper part of leaf.



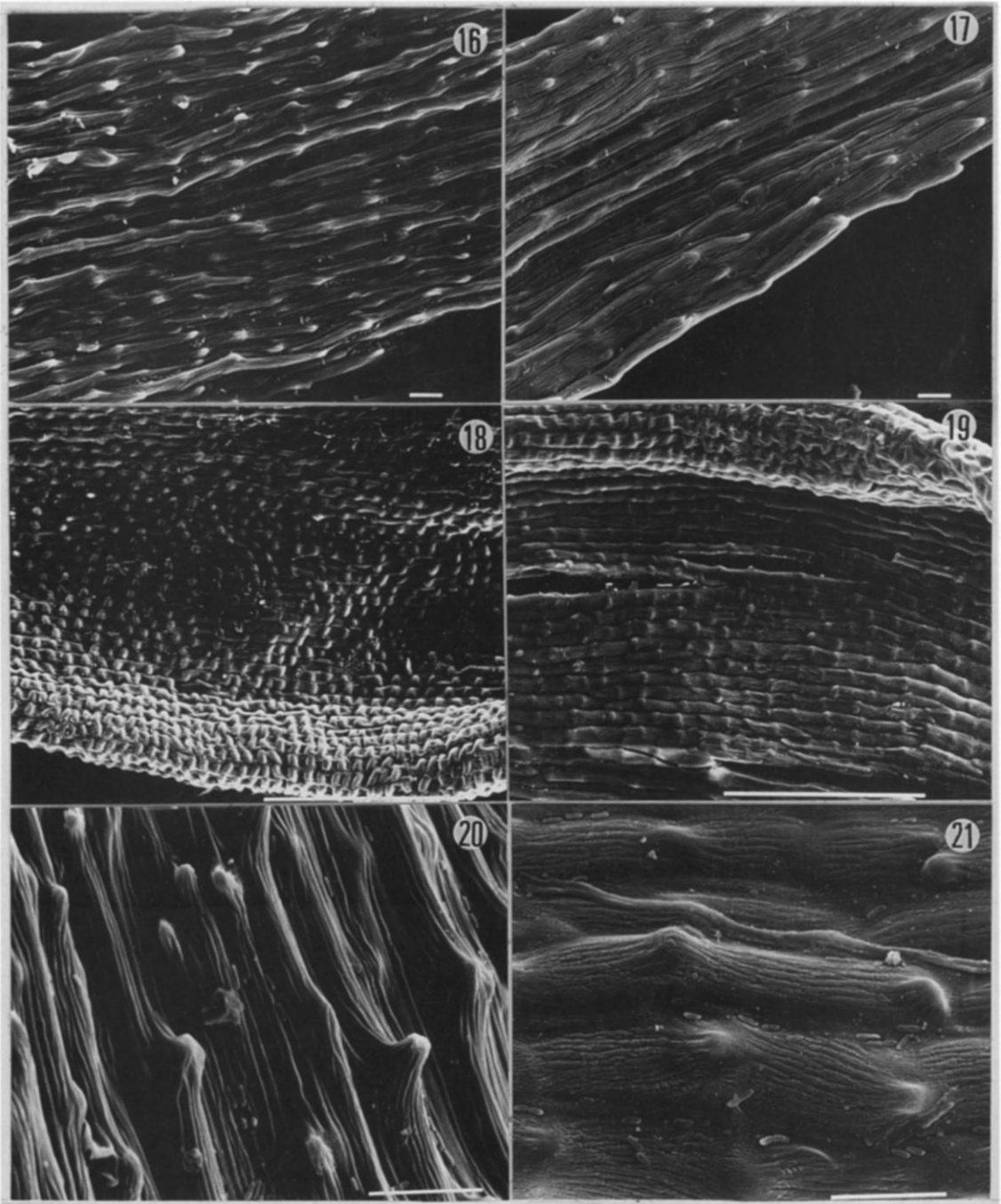


FIGURES 10–15. Light micrographs of *Anacolia webbii* and *A. menziesii*. — 10. Upper laminal cells of *A. webbii*. — 11. Upper leaf cells of *A. menziesii*. — 12. Transverse section at upper part of leaf of *A. webbii*. — 13. Transverse section at upper part of leaf of *A. menziesii*. — 14. Transverse section at basal part of leaf of *A. webbii*. — 15. Transverse section at basal part of leaf of *A. menziesii* (*A. menziesii* from MUB6595 and *A. webbii* from GDA13242). Scales: 10–11 = 12  $\mu\text{m}$ ; 12–15 = 50  $\mu\text{m}$ .

up to 8 cm, branched near base, with dense reddish tomentum extending over plant; leaves erect when dry, erect-patent when moist, lanceolate in middle part of stem, occasionally falcate, (0.3)0.5–0.7 mm wide and 2–3(4) mm long, plicate, wider at base; costa (60)80–110  $\mu\text{m}$  wide at base, excurrent in long and  $\pm$  dentate subula, smooth in basal dorsal part and slightly papillose in upper part; in transverse section showing 1–2 rows of ventral cells, 2 rows of guide cells, and dorsal band of stereids

formed by 2–4 rows of cells; margins bistratose from middle to apex, dentate except for base and recurved through almost entire length; upper part of leaves variably bistratose, often bistratose in longitudinal lines; upper laminal cells rectangular, 6–10(12)  $\times$  8–20(32)  $\mu\text{m}$ , thick-walled, with low papillae on both sides of leaf visible only in transverse section by light microscope.

Because of the difficulty of separating both species without sporophytes, comparisons are shown



FIGURES 16–21. SEM micrographs of *Anacolia webbia* and *A. menziesii*. — 16. Upper laminal cells of *A. webbia*. — 17. Upper laminal cells of *A. menziesii*. — 18. Basal laminal cells of *A. webbia*. — 19. Basal laminal cells of *A. menziesii*. — 20. Detail of leaf papillae of *A. webbia*. — 21. Detail of leaf papillae of *A. menziesii* (*A. menziesii* from MUB6595 and *A. webbia* from GDA13242). Scales: 16, 17, 20, 21 = 10  $\mu\text{m}$ ; 18–19 = 100  $\mu\text{m}$ .

with the distinguishing characteristics (Table 1). Although in this work many characters have been used to differentiate both species, we conclude that the most useful are cell width from the upper part of the leaves (6–12  $\mu\text{m}$  in *A. menziesii* and 4–6  $\mu\text{m}$

wide in *A. webbia*), and the papillae of the leaves that are low and not prominent in *A. menziesii* (Fig. 17, 19, 21) and more prominent and easy to observe in *A. webbia* (Fig. 16, 18, 20). The remaining gametophytic characteristics are difficult to observe

TABLE 1. Comparison of *Anacolia menziesii* and *A. webbii*.

Character	<i>Anacolia menziesii</i>	<i>Anacolia webbii</i>
Upper laminal cells	6–12 × 8–32 μm	4–6 × 10–36 μm
Leaf papillae	not prominent, very few, and only visible in transverse section by LM	prominent, abundant, and easily visible by LM
Leaf apex immediately below subula	partially bistratose	uniformly bistratose
Leaf margins	bistratose from middle to apex	bistratose from near apex to near base
Length of seta (Flowers 1952)	5–12 mm	approximately 1 mm
Peristome (Flowers 1952)	present, but often fragile and broken off	always lacking

and variable. From the two sporophytic features found to be different, only the length of the seta can be considered to be useful because the peristome is quite rare.

*Habitat and phytosociology.*—This species occurs on ledges of acidic rocks (quartzites and mica-schists) where a small quantity of acidic soil has accumulated and usually protected by herbaceous plants.

*Anacolia menziesii* has usually been found with *Bartramia stricta* Brid. and *Tortula ruralis* (Hedw.) G. M. S. and many other indifferent terricolous species such as *Didymodon insulanus* (De Not.) M. Hill, *Homalothecium aureum* (Spruce) Robins., *Pleurochaete squarrosa* (Brid.) Lindb., and *Targionia hypophylla* L. and constitute a well defined community made of dense and tall turfs in which *Anacolia menziesii* dominates (García-Zamora 1997). In Sierra Alhamilla, *A. menziesii* has been found at 1,100 m, with cormophyte vegetation characterized by *Quercus rotundifolia* and *Adenocarpus decorticans*. In general, this habitat accords with that found on Cyprus (among igneous rocks and ca 1,400 m) and on Sierra de Baza (acidic soil near a rivulet, 1,650 m).

*Distribution.*—Hitherto, *Anacolia webbii* was the only species of *Anacolia* known from Europe. According to Agnew & Vondracek (1975) and Düll (1985, 1992), this species has been reported from Africa 1 and 5 (the Canary Islands and Madeira); Asia 1, 2, and 5 (Cyprus, Iraq, and Turkey); and Europe (Corsica, Portugal, Sardinia, Sicily, and Spain).

*Anacolia menziesii* is known in North America from Mexico (Baja California) to Alaska and eastward to Colorado (Griffin 1994) and in Asia from eastern Nepal (Gangulee 1969–1980). We have not been able to review the Asian collections, consequently, we are not sure that the Nepal records are correct. In this work, this species is reported from the south of the Iberian Peninsula (Almeria and Granada) and from Cyprus.

It could be that *A. menziesii* is more widespread in Europe, if more specimens from a wide range of

herbaria were revised. If the two species are sympatric in Spain, they could also be sympatric in other parts of the Mediterranean Basin.

*Specimens examined.*—*Anacolia menziesii* (Turn.) Par. CANADA. Nanoose Bay, Vancouver Island, 49°20'N, 124°10'N, Schofield, 26.4.1976 (FLAS60280). CYPRUS. Trypilos Peak, 1,402 m, Meikle, 28.4.1962 (Herb. Townsend), sub *Anacolia webbii*. MEXICO. BAJA CALIFORNIA NORTE. Sierra de San Pedro Mártir, abajo de la Hda. Meling al este de Colenett, A.J. & E.B. Sharp & Radlow, 22.6.1973 (FLAS6083). SPAIN. ALMERÍA. Tabernas, Sierra Alhamilla, rambla de la Sierra, WF6095, 1,100 m, García-Zamora & Ros, 17.5.1991 (MUB6595); GRANADA. Sierra de Baza, camino del Raposo, 1650 m, Mateo & Varo, 26.1.1984 (GDA19177), sub *Anacolia webbii*.

*Anacolia webbii* (Mont.) Schimp. ITALY. SICILY. Ficuzza-Pizzo Nero, Dia, 11.1988 (PA). MOROCCO. Rif Cordillera, Lalla Outka, 1,310 m, Ros & Cano, 20.6.1997 (MUB6873). SPAIN. GRANADA. Sierra Nevada, Vereda de la Estrella, Gil, 1.11.1980 (GDA13242); GRAN CANARIA. San Bartolomé, bco. de Tirajana, 1,000 m, Koppe, 20.4.1976 (MUB4885); LA PALMA. Los Saucos, reserva 'El Canal y los Tiles', nacientes de Marcos y Cordero, 28RBS2586, Losada et al., 1.4.1989 (MUB4589); SALAMANCA. Puerto de la Molinera, Majaditas del Polvo, Hinojosa de Duero, 29TPF9144, 290 m, Rupidera, 28.1.1993 (MUB6203), Mieza, 29TPF9361, Rupidera, 6.12.1992 (MUB6204); SEVILLA. Peñón de Algamitas, Casas & Oliva, 1982 (BCB460); TENERIFE. Las Lagunetas, Fuente Fría, 28RCS6244, Losada & Beltrán, 19.2.1986 (MUB1663).

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