**Philonotis minuta** (Bartramiaceae, Bryophyta) is proposed as the correct name for *P. brevifolia*, and recorded for the first time in North America from California (U.S.A.)

Soledad JIMENEZ\(^a\) & David R. TOREN\(^b\)

\(^a\)Instituto de Botánica del Nordeste (IBONE-CONICET-UNNE), Sargento Cabral 2131, Casilla de correo 209, Corrientes, Argentina

\(^b\)Botany Department, California Academy of Sciences (CAS), 55 Music Concourse Drive, Golden Gate Park, San Francisco, California 94118, USA

**Abstract** – The study of the type specimen of *Bartramia minuta* Taylor, a species described based on Ecuadorian samples that predates the recently resurrected Chilean *Philonotis brevifolia* Herzog shows that both names displayed the same set of diagnostic characters. In this contribution, *P. minuta* is proposed as the correct name of this taxon, a lectotype is selected, and its distribution is extended to North America, based on samples collected in California.

**Chile / Distribution / Ecuador / lectotype / Philonotis krausei / taxonomy / Sudamerica**

**INTRODUCTION**

*Philonotis* Brid. is a genus of the Bartramia family easily recognized by the small size of the plants, the ovate to lanceolate leaves, laminal cells quadrate to rectangular, papillose to prorate at the angles; capsules ovoid to sub-globose, rugose to strongly furrowed when dry, and reniform, clavate spores (Allen, 1999). American species are commonly found growing on rocks or soil, usually associated with wet sites such as stream banks or seeps, from near sea level to 4700 m (Gradstein et al., 2001; Jimenez et al., 2014, 2016). *Philonotis* includes ca 180 species worldwide; of them only eleven are recorded from North America (*Philonotis calcarea* (Bruch & Schimp.) Schimp., *P. capillaris* Lindb., *P. cernua* (Wilson) D.G. Griffin & W.R. Buck, *P. fontana* (Hedw.) Brid., *P. gracillima* Ångstr., *P. longiseta* (Michx.) E. Britton, *P. marchica* (Hedw.) Brid., *P. seriata* Mitt., *P. sphaericarpa* (Hedw.) Brid., *P. uncinata* (Schwägr.) Brid., and *P. yezoana* Besch. & Cardot) (Griffin, 2014).

As part of the revision of the genus *Philonotis* in South America, some works have been already published (Jimenez et al., 2014; Ellis et al., 2016), and the analysis of several type specimens have been performed, including the one of *Philonotis brevifolia* Herzog. That is a Chilean species proposed as synonym of *Philonotis krausei* (Müll. Hal.) Broth. by Seki (1974) and recently resurrected by the first author (Jimenez et al., 2016).

* Corresponding author: soledadjimenez@conicet.gov.ar
Bartramia minuta Taylor was established in 1847 based on samples collected in Ecuador by Jameson, latter transferred to Philonotis by Jaeger (1875) and finally synonymized under Philonotis uncinata (Schwägr.) Brid. by Griffin (1994).

In the spring of 2014 a collection of a small, dark green Philonotis species was made by the second author and Edward Dearing from Northern California. It could not be assigned to any of the species recorded from North America (Griffin, 2014) or the known species from Russia (Koponen et al., 2012), China (Koponen, 1998), Mexico (Griffin, 1994) and Europe (Frey et al., 2006; Guerra & Gallego, 2010).

The objectives of this contribution were: i) to know the identity of the specimen collected in California, ii) to study the identity of the Bartramia minuta type and its possible conspecificity with other species of the genus Philonotis in South America, iii) to characterize Philonotis minuta morphologically in order to be distinguished from other nearby species in the USA and to define its current distribution.

MATERIAL AND METHODS

The Californian Philonotis sample was found in a savannah of blue oak (Quercus douglasii Hooker & Arnott) and grey pine (Pinus sabiniana Douglas) interfacing with chaparral dominated by chamise (Adenostoma fasciculatum Hooker & Arnott), toyon (Heteromeles arbutifolia (Lindley) Roemer), and leather oak (Quercus durata Jepson). The population occurred on a partly shaded, calcitic, vernally seepy bank of heavy soil composed of decomposed metabasalt and argillite. Associates at the site included Pohlia wahlenbergii (F. Weber & D. Mohr) A.L. Andrews, a small amount of Ptychostomum pseudotriquetrum (Hedw.) J.R. Spence & H.P. Ramsay ex Holyoak & N. Pedersen, and immature grasses.

The second author observed a similarity with the description and illustrations of the recently resurrected Philonotis brevifolia from South America (Jimenez et al., 2016). On this account, the Californian specimen was sent to the first author for examination.

The sample collected in California was studied and compared with Bartramia minuta type specimens housed at BM, NY and OXF, and also with Philonotis brevifolia type specimens from JE and LIL-Matteri.

The specimens were analyzed morphologically with conventional techniques for bryophytes and mounted on Hoyer’s solution (Anderson, 1954). Microscopic characters were analyzed by using light microscopy (LM) Leica Model CME.

RESULTS

Study of Bartramia minuta type

The type specimens of B. minuta housed at BM, NY and OXF are forming turfs intermixed with two Philonotis species: P. hastata (Duby) Wijk & Margad. and
Philonotis minuta, the correct name for P. brevifolia, is discovered in the U.S.A.

Philonotis osculatiana De Not. They are easily separable from B. minuta because of the distal position of the papillae in P. osculatiana and P. hastata against the proximal turning distal position of the papillae in the laminal cells of B. minuta. The OXF specimen contained scarce mats with a single capsule; also the label includes little information other than collector and locality. Nevertheless, the BM and NY specimens were complete, abundant and well preserved. The specimen used by Taylor was deposited in the Wilson herbarium (currently preserved at BM), so the BM sample was chosen as the most suitable lectotype of B. minuta. Identical characters were observed in Philonotis brevifolia by Jimenez et al. (2016), therefore we concluded that both are conspecific.


Description of Philonotis minuta

Figs 1-6

Plants small (0.7-1 cm), green to yellowish-green, growing in dense turfs. Stem reddish-brown, finely tomentose below; cross section rounded, sclerodermis in 2 rows, central strand weakly developed; axillary hairs 2-celled, brown basal cell short, apical cell hyaline and globose, 11-15 μm long. Rhizoids smooth. Leaves erect when dry, erect-spreading when wet, laxly spaced, ovate-lanceolate, 0.8-1.4 × 0.3-0.4 mm, apex acuminate, margin serrate in the upper half, entire in the lower half, slightly recurved in upper 2/3 of lamina, plane at base; costa well defined, 56-66 μm wide at base of leaf, percurrent to short-excurrent, weakly prorate at both surfaces; in cross-section with one layer of 2-3 guide cells, ventral stereids absent to weakly developed, dorsal stereids in 2-3 layers, epidermis dorsal and ventral present; upper laminal cells short-rectangular to oblong-rectangular, 24-29 × 9-11 μm, with papillae at proximal ends, turning distal to the apex on both surfaces; basal cells rectangular-oblong, 31-39 × 14-19 μm. Sexual traits not seen. Sporophytes not seen.

Identity of the Californian sample

Despite the larger size of the Californian specimen and the stronger expression of the papillae, it could be identified as the South American species P. minuta because of several important shared morphological traits (specially the ovate-lanceolate leaves, weakly recurved at the apex, laminal cells papillose at proximal angles turning distal to the apex on both surfaces).

Specimen examined: U.S.A. California, Lake County, Goat Rock, 2 miles southwest of Harbin Springs and 2 miles northwest of Middletown. 38° 46' 07.45" N, 122° 37' 40.95" W, 3600 m, Blue Oak woodland and chaparral on seepy roadside clay soil in diffuse light, 17/III/2014, Toren & Dearing 10144 (CAS, CTES, NY).
Geographical distribution of *Philonotis minuta*

It is a Neartic-austral Neotropic species distributed along the Andes Region in South America (Morrone, 2001) in Chile and Ecuador; and is now recorded from the California Floristic Province of North America, in the U.S.A. (Fig. 7). In the former region it inhabits lowlands of anthropogenically disturbed areas, and in the latter region it was found in a narrow ravine by an intermittent stream.
**Philonotis minuta**, the correct name for *P. brevifolia*, is discovered in the U.S.A.

**DISCUSSION**

Despite the complexity of the genus and the difficulty to differentiate species, we agree with Zales (1973) that characters derived from the leaf (leaf shape, margin, apex, costa, position of the papillae on the leaf cells, and leaf cell shape) are stable characters that are not modified by the environment. In reference to this, *Philonotis minuta* is characterized by a combination of leaf characters that include the ovate-lanceolate leaves, acuminate apex, serrate margin at the apex, plane at base and weakly recurved towards the apex, percurrent to short-excurrent costa and short-rectangular, papillose at proximal angles turning distal at the apex on both laminal cells surfaces.

This species is included in section *Philonotis* Broth. by the proximal position of the papillae (Koponen, 2015) along with three of the eleven species recorded in North America (*Philonotis calcarea*, *P. fontana*, and *P. seriata*) (Griffin, 2014). *Philonotis calcarea* primarily can be separated from *P. minuta* by the larger size of the plants (9-10 cm long), the margin serrate throughout, geminate at base, weakly recurved at base and the laminal cells mamilllose at base, turning papillose to the apex, papillae proximal on both surfaces. *Philonotis fontana* differs from *P. minuta* by the larger size of the plants (3-6 cm long), the margin serrate throughout, with geminate cells at base, plane to recurved at base, and the linear to oblong-linear shape of the laminal cells at apex. Finally, *P. seriata* is distinguished of *P. minuta*
by the larger size of the plants (3-5 cm long), the denticulate to serrate margin at apex, plane to narrowly revolute at base, the linear to long-rectangular laminal cells at apex, and the papillae position proximal on both surfaces (Table 1).

In recent decades, similar disjunctions to that of *P. minuta* have been noted in several species of hepatics and mosses. Flores et al. (2017) documented *Cephalozia hampeana* (Nees) Schiffn., a widely distributed species along the Holarctic region (Northern Hemisphere of Old and New World) and also present in the northern and southern limits of the Neotropics (Mexico-Guatemala and subtropical Argentina). Mosses have also shown a striking distribution type such as that characterizes *P. minuta*, e.g. *Pleurochaete luteola* (Besch.) Thér. a species with a distribution that extends from the southern U.S.A. along the Andean mountains to northwestern Argentina (Suárez & Schiavone, 2005) and *Pelekium mexicanum* (Mitt.) M. Schiavone & G. Suárez, distributed in Mexico, Guatemala, Costa Rica, and northern Argentina (Schiavone & Suárez, 2007). *Bryum chryseum* Mitt. has been also documented in the U.S.A. from California as far north as Mendocino County (Toren & Heise, 2009) and is also distributed in Mexico (Cárdenas & Delgadillo, 1992), Colombia (Churchill & Linares, 1995), Guatemala (Bartram, 1949), Bolivia (Churchill et al., 2009) and central Chile (Ochi, 1980).

**Acknowledgments.** Grateful acknowledgement is made to the curators of BM, CAS, CTES, NY and OXF for loan of specimens. Special thanks are owed to Dr. Guillermo Suárez (Argentina) for comments on the manuscript. This research was supported by the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), PICT (1838), and PIUNT (G524).
REFERENCES


CHURCHILL S.P., SANJINES ASTURIZAGA N.N. & ALDANA M.C., 2009 — *Catálogo de las briófitas de Bolivia: diversidad, distribución y ecología.* Santa Cruz, Bolivia, Museo de Historia Natural Noel Kempff Mercado and Missouri Botanical Garden, 340 p.


JIMENEZ M.S., SUAREZ G.M. & LARRAIN J., 2016 — Rediscovery and lectotypification of *Philonotis brevifolia* Herzog (Bartramiaceae, Bryophyta), a neglected species from Chile, *Cryptogamie, Bryologie* 37(2): 113-118.


