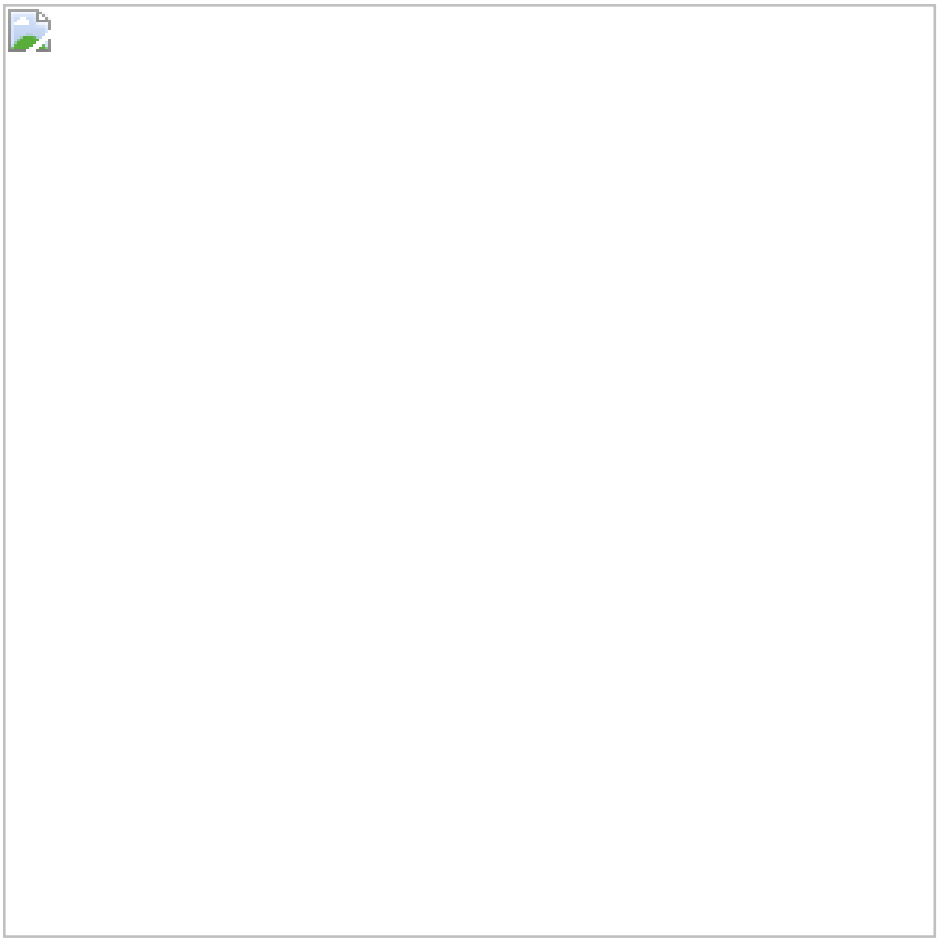

Bryoflora Salvadorensis. 2. Fissidens (Fissidentaceae, Bryophyta), new additions

Authors: Búcaro, Rosa Delia, Bruggeman-Nannenga, Maria Alida, and Stech, Michael

Source: Lindbergia, 39(4) : 24-28

Published By: Dutch Bryological and Lichenological Society and Nordic Bryological Society

URL: https://doi.org/10.25227/linbg.01075

Lindbergia 39: 24–28, 2016
ISSN 2001-5909
Accepted 1 July 2016

Bryoflora Salvadorensis. 2. *Fissidens* (Fissidentaceae, Bryophyta), new additions

Rosa Delia Búcaro, Maria Alida Bruggeman-Nannenga and Michael Stech

R. D. Búcaro (Rosadelia.Bucaro@naturalis.nl) and M. Stech, Naturalis Biodiversity Center, PO Box 9517, NL-2300 RA Leiden, the Netherlands. – M. A. Bruggeman-Nannenga, Griffensteijnseplein 23, 3703 BE Zeist, the Netherlands.

Five species of *Fissidens* are reported new for El Salvador: *Fissidens costivelatus* Brugg.-Nann., *Fissidens gardneri* Mitt., *Fissidens goyazensis* Broth., *Fissidens santa-clarensis* Thér. and *Fissidens subulatus* Mitt. Of these, *Fissidens costivelatus* is also new to the Neotropics. An updated list of the species of *Fissidens* of El Salvador is provided. The total number of species known from the country increases from 23 to 28. This amounts to about one third of the *Fissidens* species reported for the Neotropics. Additional collections efforts will further improve the knowledge of the *Fissidens* flora of El Salvador.

Cinco especies de *Fissidens* se reportan por primera vez para El Salvador: *Fissidens costivelatus* Brugg.-Nann., *Fissidens gardneri* Mitt., *Fissidens goyazensis* Broth., *Fissidens santa-clarensis* Thér. y *Fissidens subulatus* Mitt. *Fissidens costivelatus* es también nuevo para el Neotrópico. Se ha elaborado una lista de especies de *Fissidens* de El Salvador, actualizada. El total de especies se incrementa de 23 a 28. Cantidad que representa casi una tercera parte de las especies de *Fissidens* registradas para el Neotrópico. Esfuerzos adicionales de colecta contribuirán a incrementar el conocimiento sobre la diversidad de *Fissidens* en El Salvador.

The first reports of the bryoflora of El Salvador are those of Calderón and Stanley (1921, 1941). They reported 11 species of mosses and a list of vascular plants. Despite further investigations (Steere and Chapman 1946, Winkler 1965, 1967, Menzel 1991), El Salvador remained among the bryologically least known countries in Central America (Salazar Allen et al. 2006). Recently a series of publications was started to increase the knowledge of the bryophytes of El Salvador. Part one (Búcaro et al. 2012) included an introduction to the status and problems of bryological research in the country and additional records from different moss families.

Fissidentaceae are a family of acrocarpous, haplolepideous mosses in the order Dicranales (Frey and Stech 2009). The family is monotypic with a single genus, *Fissidens* Hedw. Plants of *Fissidens* are characterized by distichous leaves that are differentiated into a vaginant lamina consisting of two lamellae that clasp the stem, a dorsal lamina (opposite the vaginant lamina), and an apical lamina (above the vaginant lamina). With about 450 species (Pursell 2007), *Fissidens* is one of the largest and most diverse genera of mosses (Pursell and Bruggeman-Nannenga 2004), and taxonomically notoriously difficult. Based on the available molecular data the genus seems to be monophyletic. However, so far only few species have been included in phylogenetic reconstructions of haplolepideous mosses (La Farge et al. 2000, Hedderson et al. 2004, Cox et al. 2010, Stech et al. 2012, Fedosov et al. 2016), and molecular analyses of *Fissidens* are still rare (Werner et al. 2009).

Fissidens species are predominantly distributed in the warm, humid tropics of the world (Pursell 2007). About 100 species are reported for the Neotropics, mostly from shady, moist, rarely aquatic sites. They grow on a variety of substrates, e.g. soil, rock, wood and termite mounds, from sea level to 4450 m a.s.l. (Pursell 2007).

Reports of *Fissidens* species for El Salvador are summarized in Table 1. Steere and Chapman (1946) were the first to report *Fissidens* species from the country. Winkler (1965) in a broader study of the bryophytes from El

Table 1. List of the *Fissidens* species reported from El Salvador, including synonyms used in the references cited. Species marked by an asterisk (*) are new reports for El Salvador. The last column includes the number of specimens examined for this study (n = 92).

	Steere and Chapman (1946)	Winkler (1965)	Menzel (1991)	Pursell (1994)	Delgadillo et al. (1995)	Pursell (2007)	Búcaro et al. (2012)	Bruggeman-Nannenga and Pursell (2014)	Specimens examined
Fissidens angustifolius Sull. Syn. *F. svihlae* E.B. Bartram		x	x		x				1
Fissidens asplenioides Hedw. Syn. *F. similiretis* Sull. var. *guadalupensis* (Schimp. ex Besch.) Grout Syn. *F. lingulatus* Müll.Hal.		x	x	x	x	x	x		5
Fissidens bourgaeanus Besch. Syn. *F. austro-adianthoides* Müll. Hal.		x	x		x				
Fissidens bryoides Hedw.							x		4
Fissidens brevinervis Broth.								x	2
Fissidens costivelatus* Brugg.-Nann.									2
Fissidens crispus Mont. Syn. *F. repandus* Wilson	x		x	x	x	x			16
Fissidens dissitifolius Sull.		x	x	x	x	x	x		17
Fissidens elegans Brid.		x	x		x				3
Fissidens flaccidus Mitt. syn. *F. mollis* Mitt.		x	x		x				1
Fissidens gardneri* Mitt.									3
Fissidens goyazensis* Broth.									5
Fissidens hornschuchii Mont.							x		1
Fissidens pallidinervis Mitt. Syn. *F. pusillissimus* Steere			x			x			8
Fissidens palmatus Hedw. Syn. *Fissidens reticulosus* (Müll. Hall.) Mitt.		x	x		x	x			
Fissidens serratus Müll. Hal. Syn. *F. donnellii* Austin, *F. vardei* Thér.	x	x	x			x			
Fissidens pellucidus Hornsch.							x		1
Fissidens perfalcatus Broth.							x		1
Fissidens polypodioides Hedw.		x	x		x				
Fissidens prionodes Mont.			x						
Fissidens radicans Mont.		x	x		x				
Fissidens santa-clarensis* Thér. Syn. *Fissidens allenianus* Brugg.-Nann. & Pursell									1
Fissidens steerei Grout		x	x		x				7
Fissidens submarginatus Bruch							x		2
Fissidens subulatus* Mitt.									1
Fissidens weirii Mitt. var. ***hemicraspedophyllus*** (Cardot) Pursell var. ***weirii***		x	x	x	x				
Fissidens yucatanensis Steere							x		8
Fissidens zollingeri Mont. Syn. *F. kegelianus* Müll. Hal.	x	x	x		x		x		3

Salvador reported 17 species, the three from Steere and Chapman (1946) plus 14 new records. These correspond to 13 currently accepted species (Table 1). Menzel (1991) reported two more species. Delgadillo et al. (1995), however, registered only 13, and Pursell (1994, 2007) only six species of *Fissidens* for El Salvador (Table 1). This may partly be due to the fact that Menzel (1991) was not cited by these authors. Recent updates of the *Fissidens* flora of El Salvador by Búcaro et al. (2012) and Bruggeman-Nannenga and Pursell (2014) added five and one new species, respectively (Table 1). *Fissidens bryoides* Hedw. was in fact another species first reported for El Salvador by Búcaro et al. (2012) but not designated as such in that publication, following Menzel (1991) who reported collections of *F. repandus* under *F. bryoides* instead of under *F. crispus* Mont.

The aim of this study is to increase the knowledge and provide an updated list of the species of *Fissidens* of El Salvador, based on additional collections from the country.

Material and methods

A total of 92 specimens of *Fissidens* were studied, most of which were collected by the first author during three expeditions to El Salvador in the period from 2008 to 2012, and a few by Lic. Carlos A. Elías. These collections originated from 12 of the 14 departments of the country, were collected on a variety of substrates such as soil, talpetate (volcanic ash formation), rock, bricks and cement, tree trunks and bark, and spanned an altitudinal range from 129 to 2335 m a.s.l. Plants were identified morphologically using a binocular (Wild MSA) and compound microscope (Leitz Diaplan, Zeiss Axistar plus). Voucher specimens are deposited at ITIC, with some duplicates at L.

Results and discussion

The 92 *Fissidens* specimens studied included 21 species (Table 1). Of these, five are new for El Salvador: *Fissidens costivelatus* Brugg.-Nann., *F. gardneri* Mitt., *F. goyazensis* Broth., *F. santa-clarensis* Thér. and *F. subulatus* Mitt. *Fissidens costivelatus* is also new to the Neotropics. Details on the newly recorded species are given below. With the addition of these five, *Fissidens* is represented in El Salvador by 28 species (Table 1). This number is comparable to that reported from the other Central American countries (21–33 *Fissidens* species reported per country, Pursell 2007), except Nicaragua (nine species in Pursell 2007). The increase in the number of *Fissidens* species for El Salvador may at least partly be explained by our effort to collect in different habitats, including several urban or disturbed (semi-natural) areas, and may continue when collections from more areas and different habitats become available.

Fissidens costivelatus Brugg.-Nann., J. Bryol. 31: 120. 2009.

Collections from El Salvador: Department San Salvador: Aguilares, bark of *Mangifera indica* L. (mango tree), 299 m a.s.l., 14/4/2010, *Búcaro 978*; Department San Vicente: Parque turístico Tehuacán, bark of *Pithecellobium saman* (Jacq.) Benth. (carreto tree), 270 m a.s.l., 17/4/2010, *Búcaro 991*.

Distribution: African-Neotropical; 270–1650 m a.s.l. (Bruggeman-Nannenga 2009, present paper).

Remarks: *Fissidens costivelatus* was described based on a corticolous specimen from Kenya collected at 1650 m a.s.l. (Bruggeman-Nannenga 2009). The species is characterized by pluripapillose laminal cells and short costae (ending 5–20 cells below the apex) that in all or most leaves are distally covered by chlorophyllose cells. With the key in Pursell (2007), *F. costivelatus* keys out as *F. pallidinervis* Mitt. This variable, pantropical species differs from *F. costivelatus* by costae that are not distally covered. Other pluripapillose species with costae that are or can be distally covered with chlorophyllose cells are the pantropical *F. brevinervis* Broth. (recognized by costae covered over their complete length) and *F. gardneri* (completely open vaginant laminae and costae distally covered or not) as well as the Neotropical *F. brevipes* Besch. (short dorsal laminae ending well above the insertion; all leaves, including the perichaetial ones, elimbate; cells inconspicuously pluripapillose).

Fissidens gardneri Mitt., J. Linn. Soc., Bot. 12: 593. 1869.

Collections from El Salvador: Department Cabañas: Ilobasco, Chiraco, bark of *Mangifera indica* L. (mango tree), 750 m a.s.l., 30/11/2008, *Búcaro 559*; Department Ahuachapán: Laguna Cuscachapa, on bark, 720 m a.s.l., 4/10/2010, *Búcaro 968*; Department San Salvador: Aguilares, Las Delicias, on bark, 299 m a.s.l., 14/4/2010, *Búcaro 982*.

Distribution: Pantropical. Mexico, Central America (Costa Rica, El Salvador), South America, Africa, Asia; 100–1050 m a.s.l. (Pursell 2007, present paper).

Remarks: *Fissidens brevinervis* was synonymized with *F. gardneri* by Pursell et al. (1993), but later treated as a separate species again (Suzuki and Iwatsuki 2010, Bruggeman-Nannenga and Pursell 2014, Schwarz 2014). After the first report of *F. brevinervis* for El Salvador (Bruggeman-Nannenga and Pursell 2014), the report of *F. gardneri* in this study shows that both species occur in El Salvador.

Fissidens goyazensis Broth., Hedwigia 34: 120. 1895.

Collections from El Salvador: Department Ahuachapán: Apaneca, San Ramón, on soil, 1496 m a.s.l., 9/12/2008, *Búcaro 903*; Department Morazán: Chilanga, Quebrada Honda, on talpetate, 302 m a.s.l., 9/5/2010, *Búcaro 922*; Chilanga, El Chaparral, on cement, 407 m a.s.l., 9/5/2010, *Búcaro 975*; Department La Paz: Santiago Nonualco, Río

Jalponga, on soil, 122 m a.s.l., 22/10/2010, *C.A. Elías 986*, *987*.
Distribution: Neotropical. Mexico, Central America (Costa Rica, El Salvador, Honduras, Nicaragua, Panama), Caribbean, South America; 20–1496 m a.s.l. (Pursell 2007, present paper).
Remarks: *Fissidens goyazensis* is widespread in the Neotropics (Pursell 1994, 2007). The presence of five specimens from El Salvador indicates a wide distribution also within the country. The Salvadoran specimens were found on different substrates and at different altitudes, but always in riparian habitats. The record at the highest altitude extends the known upper limit of the altitudinal range from 1350 to 1496 m a.s.l.

Fissidens santa-clarensis Thér., Mem. Soc. Cub. Hist. Nat. "Felipe Poey" 13: 209. 1939.
Collections from El Salvador: Department Sonsonate, Juayúa, road to La Unión, on rock aside road, 881 m a.s.l., 1/12/2008, *Búcaro 1479*.
Distribution: Neotropical. USA (Florida), Mexico, Central America (Belize, El Salvador, Guatemala), Caribbean; near sea level to 881 m a.s.l. (Pursell 2007, present paper).
Remarks: *Fissidens santa-clarensis* was reported to grow on wood and rock from near sea level up to 600 m a.s.l. (Bruggeman-Nannenga and Pursell 1990, Pursell 1994, 2007). The specimen from El Salvador extends the altitudinal range by almost 300 m.

Fissidens subulatus Mitt., J. Linn. Soc., Bot. 12: 589. 1869.
Collections from El Salvador: Department Cabañas, Ilobasco, Quebrada Chiraco, on talpetate in a riparian habitat, 749 m a.s.l., 30/11/2008, *Búcaro 554*.
Distribution: Neotropical. Central America (El Salvador, Panama), South America; 100–800 m a.s.l. (Pursell 2007, present paper).

Acknowledgements – Special thanks are due to all enthusiastic local Salvadoran people who participated in collecting bryophytes during the different expeditions. We express thanks to Lic. Carlos A. Elías for organizing field trips (to Ahuachapán, Apaneca; Chalatenango, Miramundo and Sonsonate, Juayúa, 2008) and for his support. Some trips were accompanied by Lic. Carlos A. Salazar Méndez (to Santa Ana, Cerro Verde, 2010), Lic. Yader Ruiz (to San Miguel, Laguna El Jocotal and La Paz, 2010) and student José Paz Yanes Flores (to Morazán, Chilanga, 2010 and Arambala, 2012), who provided biological information as a collaboration of the Biology School of the National University of El Salvador.

References

Bruggeman-Nannenga, M. A. 2009. Two new African *Fissidens* (subgenus *Aloma*): *F. costivelatus* and *F. curticostatus.* – J. Bryol. 31: 120–124.

Bruggeman-Nannenga, M. A. and Pursell, R. A. 1990. The *Fissidens radicans* complex (section *Amblyothallia*) in the Neotropics and Paleotropics. – Bryologist 93: 332–340.

Bruggeman-Nannenga, M. A. and Pursell, R. A. 2014. *Fissidens brevinervis* (Fissidentaceae, Bryopsida): a pantropical species. – Cryptogamie, Bryol. 35: 423–425.

Búcaro, R. D., Touw, A. and Stech, M. 2012. Bryoflora Salvadorensis. I. Introduction and contribution and the moss flora of El Salvador. – Trop. Bryol. 34: 1–11.

Calderón, S. and Stanley, P. C. 1921. Lista preliminar de las plantas de El Salvador. – Tipografía La Unión, Dutriz hermanos, San Salvador, El Salvador.

Calderón, S. and Stanley, P. C. 1941. Lista preliminar de las plantas de El Salvador, 2nd edn. – Imprenta Nacional, San Salvador, El Salvador.

Cox, C. J., Goffinet, B., Wickett, N. J. et al. 2010. Moss diversity: a molecular phylogenetic analysis of genera. – Phytotaxa 9: 175–195.

Delgadillo, M. C., Bello, B. and A. Cárdenas, S. 1995. LATMOSS. A Catalogue of Neotropical Mosses. – Monogr. Syst. Bot. Miss. Bot. Gard. 56: 1–191.

Fedosov, V. E., Fedorova, A. V., Fedosov, A. E. and Ignatov, M. S. 2016. Phylogenetic inference and peristome evolution in haplolepideous mosses, focusing on Pseudoditrichaceae and Ditrichaceae s.l. – Bot. J. Linn. Soc. 181: 139–155.

Frey, W. and Stech, M. 2009. Marchantiophyta, Bryophyta, Anthocerotophyta. – In: Frey, W. (ed.), Syllabus of pant families. A. Engler´s Syllabus der Pflanzenfamilien, 13th edn, Part 3 Bryophytes and seedless vascular plants. Gebr. Borntraeger Verlagsbuchhandlung, Stuttgart, pp. 13–263.

Hedderson, T. A., Murray, D. J., Cox, C. J. et al. 2004. Phylogenetic relationships of haplolepideous mosses (Dicranidae) inferred from *rps4* gene sequences. – Syst. Bot. 29: 29–41.

La Farge, C., Misher, B. D., Wheeler, J. A. et al. 2000. Phylogenetic relationships within the haplolepideous mosses. – Bryologist 103: 257–276.

Menzel, M. 1991. Bryophyta: Sphagnopsida, Andreaeopsida, Bryopsida. Listado Básico de la Flora Salvadorensis. – Cuscatlania 1: 1–24.

Pursell, R. A. 1994. Fissidentaceae. – In: Allen, B. (ed.), Moss flora of Central America. Part 1. Sphagnaceae–Calymperaceae. Monogr. Syst. Bot. Miss. Bot. Gard 49: 40–80.

Pursell, R. A. 2007. Fissidentaceae. – Fl. Neotrop. Monogr. 101: 1–278.

Pursell, R. A. and Bruggeman-Nannenga, M. A. 2004. A revision of the infrageneric taxa of *Fissidens*. – Bryologist 107: 1–20.

Pursell, R. A., Bruggeman-Nannenga, M. A. and Iwatsuki, Z. 1993. The identity of *Fissidens gardneri* and *Fissidens minutus*. – Bryologist 96: 626–628.

Salazar Allen, N., De Gracia, J. E. and Chung, C. 2006. Aporte al Catálogo de Musgos de Guatemala. – In: Cano, E. B. (ed.), Biodiversidad de Guatemala. Univ. del Valle, Guatemala, pp. 69–146.

Stech, M., McDaniel, S. F., Hernández-Maqueda, R. et al. 2012. Phylogeny of haplolepideous mosses – challenges and perspectives. – J. Bryol. 34: 173–186.

Schwarz, U. 2014. *Fissidens brevinervis* Broth. – New to the Indian Moss Flora. – Frahmia 3: 1–6.

Steere, W. C. and Chapman, D. E. 1946. Mosses of El Salvador. – J. Wash. Acad. Sci. 36: 219–225.

Suzuki, T. and Iwatsuki, Z. 2010. *Fissidens* (Fissidentaceae, Bryopsida) collections made by Mr. T. Kamiyama in South Sulawesi (Indonesia). – Hattoria 1: 7–23.

Werner, O., Patiño, J., González-Mancebo, J. M. et al. 2009. The taxonomic status and the geographical relationships of the Macaronesian endemic moss *Fissidens luisieri* (Fissidentaceae) based on DNA sequence data. – Bryologist 112: 315–324.

Winkler, S. 1965. Beiträge zur Bryologie von El Salvador, C.A. I. Laubmoose. – Rev. Bryol. Lichénol. N.S. 33: 505–540.

Winkler, S. 1967. Die epiphyllen Moose der Nebelwälder von El Salvador C. A. – Rev. Bryol. Lichénol. N.S. 35: 303–369.