

Contribution to the knowledge of the bryophyte flora of Martinique, Lesser Antilles

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Abstract – Sixty two (62) bryophytes (one hornwort, 36 liverworts and 25 mosses) are added to the flora of Martinique. These include ten new generic records: *Phaeomegaceros*, *Bromeliophila*, *Monodactylopsis*, *Myriocoleopsis*, *Rectolejeunea*, *Anomobryum*, *Brymela*, *Bryohumbertia*, *Lepidopilidium* and *Microcampylopus*. *Campylopus anderssonii* and *C. heterostachys* are newly reported for the West Indies. *Drepanolejeunea fragilis* and *Anomobryum conicum* are new for the Lesser Antilles.

Bryophytes/ Martinique/ New records/West Indies

INTRODUCTION

Martinique (1128 km²) and the Guadeloupe archipelago are the two Caribbean French overseas departments (Fig. 1). Both islands are 150 km distant, and separated by the island of Dominica. Martinique and Guadeloupe are an integral part of the world's biodiversity hotspots (Myers *et al.* 2000). Martinique is located between 14°23' and 14°53' North Latitude, and between 60°50' and 61°15' West Longitude, and its maximum width is 30 km. The island is subject to a tropical moist climate, with average annual rainfall varying between 970 mm on the Caribbean coast, the South and extreme East of the island to more than 6000 mm on the summit of Mount Pelée, an active volcano which with an elevation of 1397 m is the highest peak on the island (Météo France). The other important mountain areas are the five Pitons du Carbet, ancient volcanoes to the south of Mount Pelée: Piton Lacroix (1196 m), Morne Piquet (1160 m), Piton Dumauzé (1109 m), Piton de l'Alma (1105 m), Piton Boucher (1070 m) (Germa, 2008). The ecosystems vary from the coast to the volcanic summits, succeeding one another: dry forests, mangroves, mesophilous forests, rain forests, tall thickets above an altitude of 800 meters and altitudinal savannas with ferns and bromeliads above 1100 m. The great diversity of the bioclimatic, topographical and altitudinal conditions are favorable to many terrestrial ecosystems, especially forest ecosystems and a very rich flora, particularly given the small size of the island. To date, 1450 vascular plants of the native flora are recorded from Martinique and of these 2.5% are endemic to the island and 7.5% are endemic to the Lesser Antilles (Fournet, 2002). The native tropical rain forest occupies a great part of the North of the island, harboring a great richness of

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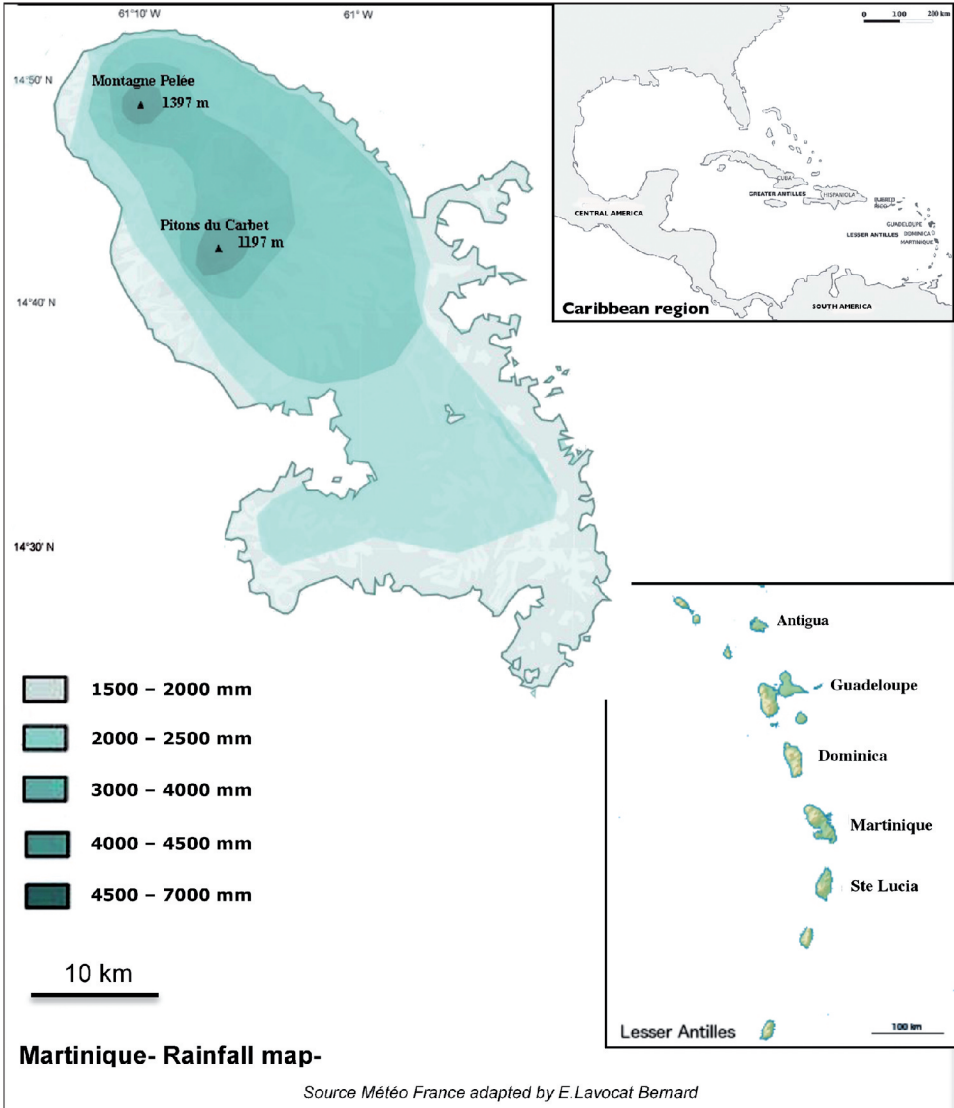


Fig. 1. Geographical map of Martinique.

bryophytes. Some relic rain forests occur also in the central and southern part of the island.

The bryophyte diversity of Martinique has been subject of a recent up-to-date checklist (Lavocat Bernard & Schäfer-Verwimp, 2011), recording 355 species (nine hornworts, 190 liverworts and 156 mosses). From recent studies, three *Plagiochila* and one *Bazzania* are now considered synonyms (Gradstein 2015, Gradstein 2017) and a total of 413 species of bryophytes are now known to occur in Martinique (10 hornworts, 222 liverworts and 181 mosses). Recent noteworthy

additions to the flora include the liverwort *Bromeliophila helenae* Gradst., a rare species with a very specific ecology, growing exclusively on the lower leaves of bromeliads (Gradstein, 1997) and the moss *Anomobryum conicum* (Hornsch.) Broth., hitherto known only from the páramos of Mexico, Central America, tropical Andes, southern Brazil and Hawaii (Allen, 2002). The following list is based on collections made in a diversity of environments by the author and her husband Jean-François Bernard during regular fieldworks in the island. A few species were collected in dry forests, secondary mesophytic forests and swamp forests at lowest altitude. The main collections have been made in the rain forest at submontane level, and in montane rain forest, cloud forest, montane thickets, altitudinal savannas, and summit rocks at the highest elevations (Pitons du Carbet, Mount Pelée). Slightly more than half of the new records (33) are based on collections made during fieldworks conducted between 2012 and 2014 as part of a study on the bryophyte flora of the Ecological Integral Reserve of Mount Pelée. Some new records result in part from extensive investigations in Herbaria (NY and PC) or result from literature searches.

An asterisk (*) refers to species reported as new based on specimens collected by the author, whereas a bullet (°) refers to records discovered based on collections held in the NY and PC herbaria or records found in the literature.

The coordinates are based on the World Geodetic System 1984 (WGS 84).

Brief notes are given on morphology, habitat and geographical distribution of the taxa with special reference to their range in the West Indies.

All voucher specimens are deposited in the private herbarium of the author *ELB* (*Elisabeth Lavocat Bernard*) with some duplicates in NY, MO and PC.

NEW RECORDS

Hornworts (ANTHOCEROTOPHYTA)

**Phaeomegaceros fimbriatus* (Gottsche) R.J. Duff, J.C. Villarreal, D. Cargill & K.S. Renzaglia

Figs 2-5

Specimens examined: Mount Pelée: trail of Grande Savane, on the edge of the Caldera, on soil in open area, 61°10'13"; 14°48'48", 1150 m, 9 August 2012, *ELB 1756*; 61°10'18"; 14°48'34", 1100 m, 6 April 2013, *coll. JF Bernard, ELB 1829, 1830, 1831*. Mount Pelée: trail of l'Aïleron, on a rock, along the path; 14°48'23", 61°09'24", 1011 m, 19 May 2014, *ELB 145-14, ELB 145-23*.

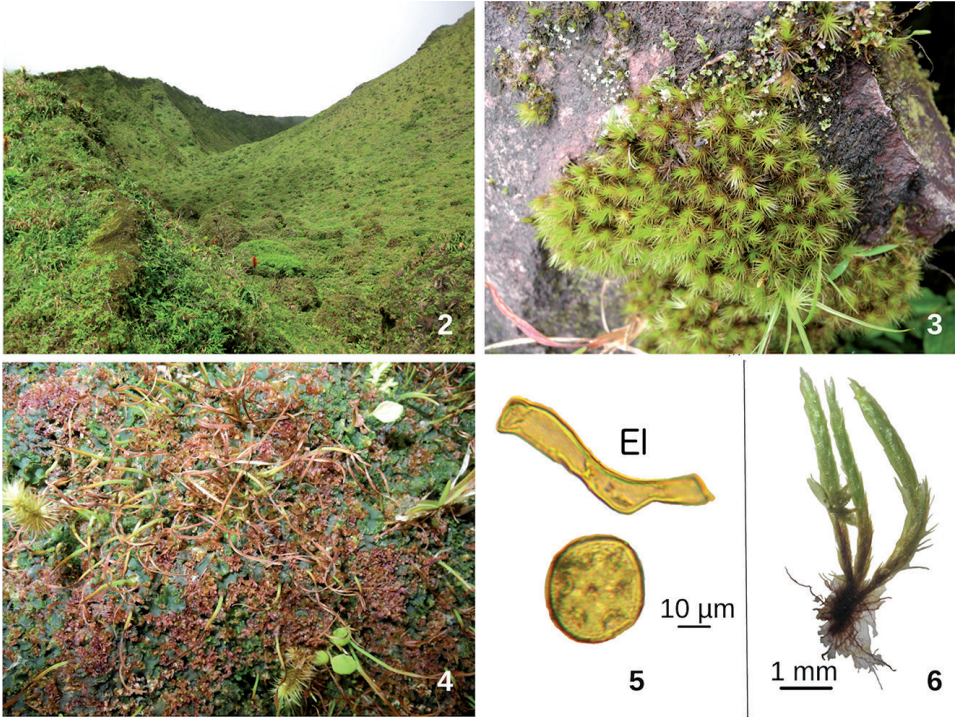
Distribution: Central America (Costa Rica, Panama) the northern part of South America (Colombia, Ecuador, Venezuela) and Bolivia (Hassel de Menéndez, 1989; Hasegawa, 2001; Dauphin, 2005; Villarreal & Renzaglia, 2006; Duff *et al.*, 2007; Cykowska, 2014); in the West Indies, previously only known from Guadeloupe (Villarreal *et al.*, 2010).

Note: The spores in this species are characterized by regularly arranged depressions on the distal surfaces (Fig. 5).

Liverworts (MARCHANTIOPHYTA)

°*Anastrophyllum tubulosum* (Nees) Grolle (Duss, 1903 as *A. adulterinum* Gott.)

Specimens cited but not seen: Pitons du Carbet (Piton de l'Alma): on rocks, 780 m, *Duss 472* (NY). *A. adulterinum* Gott. = *A. tubulosum* (Nees) Grolle (Alba & Riccardo, 2011).



Figs 2-6. 2. Mount Pelée, the caldeira. 3. *Campylopus cygneus*. 4. *Phaeomegaceros fimbriatus* on the edge of the caldeira. 5. *Phaeomegaceros fimbriatus*, distal spore face with seven depressions and an elater (El). 6. *Anomobryum conicum*. (Photographs by E. Lavocat Bernard)

Distribution: Widespread in tropical America: Mexico, Panama, Costa Rica, Bolivia, Colombia, Venezuela, Ecuador, Perú and SE Brazil (Alvaro, 2017); in the West Indies, previously known from Jamaica (Söderström *et al.* 2011), the Dominican Republic (Schäfer-Verwimp & Pócs, 2009) and Guadeloupe (Lavocat Bernard & Schäfer-Verwimp, 2011).

**Bazzania longistipula* (Lindenb.) Trevis.

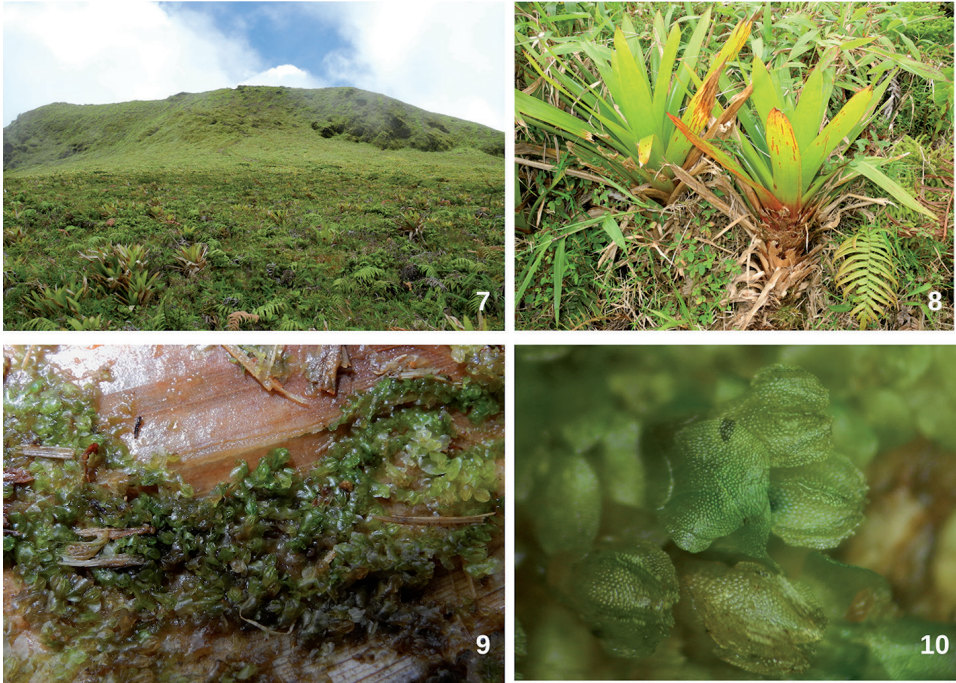
Specimen examined: Pitons du Carbet (Piton Lacroix): epiphyte, 14°41'53"N; 61°07'0"W, 930 m, 8 August 2017, *ELB 17814*.

Distribution: Common and widespread in tropical America (Gradstein, 2017). In the West Indies, previously known from Puerto Rico, Dominican Republic, Dominica, St Vincent, and Guadeloupe (Gradstein, 1989; Schäfer-Verwimp & Pócs, 2009; Schäfer-Verwimp, 2010; Fulford, 1990, 1963).

**Bromeliophila helenae* Gradst.

Figs 7-1

Specimens examined: Mount Pelée: trail of l'Aileron, epiphyllous on the lower leaves of a terrestrial bromeliad *Guzmania plumieri* (Griseb.) Mez., 14°48'33"N; 61°09'42"W, 1222 m, 8 December 2014, *ELB 1412-5*; 14°48'29"N, 61°09'35"W, 1113 m, 29 May 2016, *ELB 16508*.



Figs 7-10. 7. Mount Pelée, altitudinal savannas with ferns and bromeliads. 8. The bromeliad *Guzmania plumieri* (Griseb.) Mez.). 9. *Bromeliophila helenae* Gradst. on lower leaves of *Guzmania plumieri*. 10. *Bromeliophila helenae*, perianths. (Photographs by E. Lavocat Bernard)

Distribution: Probably widespread but widely overlooked, currently known from Northern South America (Venezuela, Andes of Colombia), and in the West Indies, and previously only from Dominica (Gradstein 1997; Benavides & Callejas, 2004).
Note: *Bromeliophila* is a neotropical genus comprising two species. It is unique by its habitat, as it is only known from water-filled leaf axils of bromeliads (Schuster, 1994).

****Cephaloziella granatensis* (J.B. Jack) Fulford**

Specimen examined: Mount Pelée: trail of l'Aïeron, on soil with *Isotachis multiceps* and *Phaeomegaceros fimbriatus*, 14°48'26"N; 61°09'26"W, 1062 m, 7 July 2014, ELB 147-38.

Distribution: Widespread in tropical America; also known from Madeira and the Galapagos Islands (Gradstein & Ziemmeck, 2011).

****Cheilolejeunea oncophylla* (Ångstr.) Grolle & M.E.Reiner**

Specimen examined: Sainte-Luce: departmental state forest of Lépinay, a relic rain forest in the southern half of the island, epiphyte, 14°30'30"N, 60°55'25"W, 300 m, 4 April 2012, coll. JF Bernard, ELB 1629.

Distribution: Widespread in South America (Venezuela, Colombia, Peru, Brazil, Argentina, Cuba, Costa Rica) and in the West Indies previously known from Jamaica, the Dominican Republic, Guadeloupe and Dominica; (Grolle & Reiner-Drehwald, 1997; Dauphin, 2005; Schäfer-Verwimp & Reiner-Drehwald, 2009; Schäfer-Verwimp & Pócs, 2009).

**Cheilolejeunea tonduzana* (Steph.) W. Ye, R.L. Zhu & Gradst.

Specimen examined: Mount Pelée: trail of Grande Savane, epiphyte, 14°48'37"N, 61°10'35"W, 915 m, 9 August 2012, *ELB 1759-2*.

Distribution: Occurring in the canopy in montane cloud forests in Central and South America (SE Brazil, Colombia, Costa Rica, Ecuador, Guyana, Mexico and Venezuela) (Ellis *et al.*, 2013); in the West Indies previously known only from Guadeloupe (Lavocat Bernard & Schäfer-Verwimp, 2011).

**Cylindrocolea rhizantha* (Mont.) R.M. Schust.

Specimen examined: Pitons du Carbet (Piton Dumaüzé): Ravine Saint-Charles, lower part of the Piton, on humid slope, 14°41'28"N, 61°06'16"W, 710 m, 18 August 2016, *coll. JF Bernard, ELB 16839*.

Distribution: North (USA), Central and South America (Pôrto *et al.* 1999, Gradstein & Costa 2003, Dauphin *et al.* 2006); in the West Indies previously known only from Guadeloupe (Lavocat Bernard & Schäfer-Verwimp, 2011).

Note: This tropical and subtropical species can be corticolous, epixylic, epiphytic or terricolous in lowland and moderately high altitudes (Schuster, 1980; Dauphin *et al.*, 2006).

° *Diplasiolejeunea caribea* Tixier

Specimens examined: Fort-de-France: Fontaine Didier, 300-400 m, 28 September 1959, *coll. Le Gallo*, PC 0015313; Colson, 550 m, 30 September 1959, *coll. Le Gallo*, PC 0015322; Absalon, 450 m, 3 October 1959, *coll. Le Gallo*, PC 0015324. Le Vauclin: Montagne du Vauclin, 500 m, 6 September 1960; *coll. Le Gallo*, PC 0015329. Pitons du Carbet: Morne Tranchette, 14°41'53"N, 61°07'13"W; 750 m, 18 August 2016, *coll. JF Bernard, ELB 16822*.

Distribution: Epiphyllous on leaving leaves in rain forests; scattered in South America (Guyana, Brazil, Ecuador), and widespread in the Caribbean region (Schäfer-Verwimp, 2004, 2014).

° *Diplasiolejeunea pellucida* (C.F.W. Meissn. ex Spreng.) Schiffn. (Duss, 1903, as *Lejeunea pallida* Meiss.),

Specimens cited but not seen: Mount Pelée: Morne Calebasse, epiphyllous, 370 m, 1899, *Duss 375* (NY); Bois du Fonds Saint Denis, epiphyte, 1901, *Duss 665* (NY).

Specimen examined: Pitons du Carbet (Piton Lacroix): epiphyllous on *Clusia sp.*, 14°41'5"N, 61°06'57"W; 1100 m, 27 February 2014, *coll. JF Bernard, ELB 1979*.

Distribution: Common and widely distributed in tropical America (Schäfer-Verwimp, 2004).

**Drepanolejeunea fragilis* Bischl.

Specimen examined: Absalon: trail of Rivière Duclos, epiphyllous on *Clusia sp.*, 14°40'38"N, 61°05'49"W, 450 m, 8 August 2012, *ELB 1729*.

Distribution: Known from scattered localities in the neotropics (Guiana, Puerto Rico, Trinidad (Bischler, 1964), Venezuela (Dauphin & Ilkiu-Borges, 2002); in the West Indies, previously known only from Jamaica (Söderström *et al.*, 2011). **New to the Lesser Antilles.**

**Kurzia capillaris* (Sw.) Grolle

Specimen examined: Mount Pelée: trail of Grande Savane, on humid soil, 14°48'46"N, 61°10'14"W, 1140 m, 9 August 2012, *ELB 1758*.

Distribution: Widespread Afro-American species, reported in the West Indies previously from Cuba, Jamaica, Puerto Rico, Guadeloupe, Dominica, Trinidad and the Dominican Republic (Schäfer-Verwimp & Pócs, 2009).

° *Lejeunea aphanes* Spruce (Eggers *et al.*, 2004 as *L. filipes*)

Specimens cited but not seen: Pitons du Carbet: Riviere Blanche waterfall, 450 m, rainforest, epiphyllous, 1987, *Coll. J. Eggers* (MAR 1/21); Gorges de la Falaise, ca 400 m, rainforest; epiphyllous, 1987, *Coll. J. Eggers* (MAR 3/17).

Distribution: Afro-American species reported from West and East Africa, widespread in the Americas from the USA to Argentina; in the West Indies, previously known from Cuba, Dominica, Guadeloupe and Martinique (Schäfer-Verwimp & Reiner-Drehwald, 2009; Schäfer Verwimp & Van Melick, 2016; Eggers *et al.*, 2004).

**Lejeunea asperrima* Spruce

Specimen examined: Mount Pelée: trail of Macouba, epiphyte, 14°49'58"N, 61°09'50"W, 643 m, 20 January 2014, *ELB 1961*.

Distribution: Scattered in the Neotropics (Schäfer-Verwimp, 2014).

**Lejeunea caulicalyx* (Steph.) M.E. Reiner & Goda

Specimen examined: Trois-Ilets: Ravine Caverne, epiphyte, 14°30'52"N, 61°02' 26"W, 50-100 m, 10 October 2012, *coll. JF Bernard & JP Fiard, ELB 1790*.

Distribution: Widely distributed in tropical America (Costa Rica, French Guiana, Ecuador, Bolivia, Guatemala, Brazil, Panama); in the West Indies, previously known from Cuba (type), the Dominican Republic and Guadeloupe (Schäfer Verwimp & Van Melick, 2016).

**Lejeunea cladogyna* A. Evans

Specimen examined: Pitons du Carbet: Plateau Boucher, on decaying wood, 14°43'08"N, 61°06'02"W, 670 m, 31 May 2016, *ELB 16529*.

Distribution: Neotropical species known from the subtropical portions of the southeastern United States (Florida, Mississippi), Mexico; in the West Indies, previously known from Puerto Rico and Barbados (Schuster, 1980).

**Lejeunea controversa* Gottsche

Specimen examined: Mount Pelée: trail of Macouba, epiphyte, 14°49'58"N, 61°09'50"W, 643 m, 20 January 2014, *ELB 1962*.

Distribution: Widespread in tropical America; in the West Indies previously known from Cuba, Jamaica, Guadeloupe, and Dominica (Schäfer-Verwimp & Van Melick, 2016).

**Lejeunea corynantha* Spruce

Specimen examined: Mount Pelée: trail of l'Aïlaron, epiphyte on *Charianthus nodosus*, 14°48'27"N, 61°09'26"W, 1074 m, 19 May 2014, *ELB 145-20*.

Distribution: Known from the West Indies (previously the Dominican Republic, Jamaica, Guadeloupe, Dominica) and only two records from Panama, province of Panamá (Reiner-Drehwald & Schäfer-Verwimp, 2008; Schäfer-Verwimp, 2014).

**Lejeunea obtusangula* (Spruce) A. Evans

Specimen examined: Mount Pelée: trail of l'Aïlaron, cone of 1929, on rocks, 14°48'35"N, 61°10'02"W, 1357 m, 7 July 2014, *ELB 147-29*.

Distribution: Common in the Neotropics, from Florida, Mexico and Costa Rica to Bolivia, northern Argentina, Brazil and Panama; in the West Indies, previously known from Puerto Rico, the Virgin Islands, Jamaica, and Bahamas (Schuster, 1980; Dauphin, 2005; Reiner-Drehwald, 2000; Schäfer-Verwimp, 2014; Gradstein, 1989).

****Lejeunea trinitensis*** Lindenb.

Specimen examined: Le Robert: Pointe Melon, epiphyte on *Haematoxylum campechianum*, 14°41'41"N, 61°54'39"W, 30 m, 5 December 2011, coll. JF Bernard, ELB 1532.

Distribution: Common in tropical America (including Antilles), also reported from Africa (Comores) (Gradstein & Costa, 2003).

****Metzgeria albinea*** var. *albinea* Spruce

Specimen examined: Mount Pelée: trail of Macouba, epiphyte, 14°49'44"N 61°09'57"W; 775 m, 20 January 2014, ELB 1927.

Distribution: Widespread and common in Africa and America; in the Neotropics from Mexico southwards to Chile; in the West Indies, previously known from Puerto Rico, Guadeloupe, the Dominican Republic (Costa, 2008) and Jamaica (Schäfer-Verwimp & Pócs, 2009).

*** *Monodactylopsis monodactyla*** (Spruce) R.M. Schust.

Specimen examined: Anses-d'Arlet: Morne d'Orange, ravine west Rivière Pagerie, on bark, 14°30'49"N, 61°03'48"W, 300 m, 19 June 2012, coll. JF Bernard, ELB 1711.

Distribution: Northern South America and Costa Rica (Gradstein *et al.*, 1994); in the West Indies, previously known from Dominica (Schäfer-Verwimp, 2010), Puerto Rico (Fulford, 1968) and Guadeloupe as *Monodactylopsis minima* (R.M. Schust.) R.M. Schust. (Lavocat Bernard & Schäfer-Verwimp, 2011).

****Myriocoleopsis minutissima*** subsp. *myriocarpa* (Nees & Mont.) R.L. Zhu, Y. Yu & Pócs

Specimen examined: Sainte-Anne: Cul-de-Sac Ferré, on tree trunk of *Tabebuia heterophylla*, 14°28'16"N, 60°49'29"W, at sea level, 8 December 2012, coll. JF Bernard, ELB 1803, conf. S.R. Gradstein, dupl. A. Schäfer-Verwimp.

Distribution: Pantropical species (Yu *et al.*, 2014) growing in dry forests.

****Odontolejeunea decemdentata*** (Spruce) Steph.

Specimen examined: Mount Pelée: trail of Macouba, epiphyte, mixed with other Lejeuneaceae and *Dendroceros crispus* 14°49'44"N, 61°09'57"W, 775 m, 20 January 2014, ELB 1975.

Distribution: Widespread but scattered in the Neotropics, from Costa Rica, French Guiana, along the Andes from Venezuela to Bolivia, to SE Brazil; in the West Indies, previously known from Jamaica and Saba (Gradstein, 1994).

****Prionolejeunea aemula*** (Gottsche) A. Evans

Specimen examined: Mount Pelée: trail of l'Aileron, in the bottom of the Caldera, epiphyte on *Charianthus nodosus*, 14°48'44"N, 61°09'48"W, 1189 m, 19 May 2014, ELB 145-20.

Distribution: Widespread in Central America, northern South America, including the Galapagos Islands, and West Indies (Ilkiu-Borges, 2006).

****Prionolejeunea decora*** (Tayl.) Steph.

Specimen examined: Mount Pelée: trail of l'Aileron, epiphyte on *Charianthus nodosus*, 14°48'46"N, 61°09'49"W, 1214 m, 19 May 2014, ELB 145-68.

Distribution: Widespread in the West Indies, Central America, Colombia and Northern-Andes (Ilkiu-Borges, 2006).

****Prionolejeunea muricatoserrulata*** (Spruce) Stephani

Specimen examined: Mount Pelée: trail of l'Aileron, epiphyte, 14°48'52"N, 61°09'49,2"W, 1245 m, 19 May 2014, ELB 145-62.

Distribution: Central and tropical South America (Ilkiu-Borges, 2006); in the West Indies, previously known only from Guadeloupe (Lavocat Bernard & Reeb, 2016).

****Prionolejeunea trachyodes* (Spruce) Stephani**

Specimen examined: Mount Pelée: trail of l'Aileron, epiphyte on *Didymopanax attenuatum*, 14°48'55"N, 61°10'02"W, 1234 m, 8 December 2014, *ELB 1412-23*.

Distribution: Uncommon in tropical lowland to submontane and cloud forests, in Panama, Colombia, Guyana and French Guiana; in the West Indies previously only known from Dominica (type; Ilkiu Borges, 2006) and Guadeloupe (Lavocat Bernard & Reeb, 2016).

Note: A large papilla covering almost the entire cell surface is characteristic of this species.

****Radula kegelii* Gottsche ex Steph.**

Specimen examined: Pitons du Carbet: Plateau Boucher, epiphyte, 14°43'08"N, 61°06'02"W, 670 m, 31 May 2016, *ELB 16526*.

Distribution: Widespread in Central and South America (Honduras, Costa Rica, French Guiana, Surinam, Colombia, Ecuador, Bolivia, and Brazil); in the West Indies previously known from Cuba, Puerto Rico, Guadeloupe, Dominica, Trinidad and the Dominican Republic (Fulford, 1987; Fulford & Sharp, 1990; León-Yáñez *et al.*, 2006; Schäfer-Verwimp & Pócs, 2009; Yamada, 1988, 2000).

****Rectolejeunea flagelliformis* A. Evans**

Specimen examined: Pitons du Carbet: Morne Tranchette, lower west part of Piton Lacroix, on a twig fallen from the canopy, 14°41'53"N, 61°07'13"W, 750 m, 18 August 2016, *coll. JF Bernard, ELB 16825*, conf. S.R. Gradstein.

Distribution: Central and South America; in the West Indies previously known from Puerto Rico, Cuba, Dominica, Netherland Antilles and Guadeloupe (Reiner-Drehwald & Grolle, 2012).

Note: it is the only *Rectolejeunea* species found growing on upper canopy branches.

****Riccardia cataractarum* (Spruce) Schiffn.**

Specimens examined: Mount Pelée: trail of Grande Savane, epiphyte, 14°48'41"N, 61°10'01"W, 1350 m, *ELB 1753* (dupl. PC), 14°48'36"N, 61°10'14"W, 1160 m, 9 August 2012, det. C. Reeb, GenBank accession numbers (*trnL-F*, *rps4*, *psbA-trnH*). KX512051, KX512241, KX512109 (Rabeau *et al.*, 2017). Mount Pelée: trail of l'Aileron, epiphyte, 14°48'52"N, 61°09'49"W, 1245 m, 19 May 2014, *ELB 145-55*.

Distribution: South America (Brazil, Bolivia, Paraguay); in the West Indies previously known from the Dominican Republic (Meenks, 1987) and Guadeloupe (Lavocat Bernard & Reeb, 2016).

****Riccardia chamedryfolia* (With.) Grolle**

Specimens examined: Mount Pelée: trail of Grande Savane, crossing between the path of the Caldera and the trail of Grande Savane, epiphyte, 14°48'36"N, 61°10'14"W, 1160 m, 9 August 2012, *ELB 1744*; 14°48'38"N, 61°10'37"W, 892 m; *ELB 1760*, det. C. Reeb.

Distribution: Widespread in temperate regions of the Northern Hemisphere; in the Neotropics known only from Brazil and Ecuador (Schäfer-Verwimp *et al.*, 2013); in the West Indies previously known only from Saba (coll. W.R. Buck, 9 March 2007, *51491* NY, det. S.R. Gradstein, 2011) and Guadeloupe (Lavocat Bernard & Schäfer-Verwimp, 2011).

**Riccardia grossidens* (Steph.) Pagán

Specimen examined: Mount Pelée: trail of Grande Savane, on rocks in the caldera, 14°48'46"N, 61°10'14"W, 1140 m, 9 August 2012, *ELB 1757*, det. C. Reeb.

Distribution: Endemic to the Lesser Antilles, i.e., previously only from Dominica (Schäfer-Verwimp, 2010) and Guadeloupe (Lavocat Bernard & Schäfer-Verwimp, 2011).

Note: This species may be closely related to *Riccardia fucoidea*, but differs from the latter by a larger size and stronger teeth. It could be a growth-form of *R. fucoidea* and an ongoing study will try to solve this taxonomical question.

**Riccardia regnellii* (Ångstr.) K.G.Hell.

Specimens examined: Mount Pelée: trail of l'Aileron, on humid slope down to the caldera, 14°48'44"N, 61°09'48"W, 1205 m, 19 May 2014, *ELB 145-39*. Mount Pelée: trail of l'Aileron, on the wall on a mountain refuge, 14°48'46"N, 61°09'47"W, 1245 m, 19 May 2014, *ELB 145-34*; Epiphyte on *Charianthus nodosus*, 14°48'47"N, 61°09'47"W, 1245 m, *ELB 145-25*.

Distribution: Widespread in the Neotropics (Brazil, Colombia, Ecuador, the Guianas, Peru and Venezuela; Meenks, 1987); in the West Indies, previously known only from the Dominican Republic (Schäfer-Verwimp & Pócs, 2009) and Guadeloupe (Lavocat Bernard & Reeb, 2016).

**Telaranea nematodes* (Gottsche ex Austin) Howe

Specimens examined: Mount Pelée: trail of Grande Savane, epiphyte, 61°10'14"; 14°48'36", 1160 m, 9 August 2012, *ELB 1768*; 14°48'37"N, 61°10'15"W, 1175 m, *ELB 1770*.

Distribution: Widespread in Mexico, Guatemala, Honduras, Colombia, Africa (Engel & Smith Merrill 2004), Costa Rica, Panama (Stotler *et al.*, 1998; Dauphin, 2005); in the West Indies, previously known from Cuba, Puerto Rico, Jamaica (Schäfer-Verwimp, 2016) and Guadeloupe (Lavocat Bernard & Schäfer-Verwimp, 2011).

**Trichocolea filicaulis* Steph.

Specimen examined: Pitons du Carbet (Piton Lacroix): epiphyte mixed with *Plagiochila aera*, 14°41'54"N, 61°07'00"W, 980 m, 8 August 2017, *ELB 17839*.

Distribution: Known from Bolivia, Guatemala, Costa Rica (Morales 1991, Dauphin 2005); in the West Indies previously known from the Dominican Republic, Dominica and Guadeloupe (Schäfer-Verwimp & Pócs, 2009; Fulford, 1963).

**Trichocolea floccosa* Herzog & Hatcher

Specimen examined: Pitons du Carbet (Piton Boucher): Plateau Boucher, epiphyte, 14°43'08"N, 61°06'02"W, 670 m, 31 May 2016, *ELB 16520*.

Distribution: Scattered in the Neotropics (Colombia, Costa Rica and Ecuador; Schäfer-Verwimp *et al.*, 2013); in the West Indies previously known only from Guadeloupe (Jovet-Ast, 1960; Lavocat Bernard & Schäfer-Verwimp, 2011).

Mosses (BRYOPHYTA)

**Anomobryum conicum* (Hornsch.) Broth.

Fig. 6

Specimen examined: Mount Pelée: trail of Grande Savane, on soil, 14°48'35"N, 61°10'13"W, 1200 m, 9 August 2012, *ELB 1764*.

Distribution: Central America (incl. Mexico), Western and Northern South America, Brazil, North Central Pacific (Allen, 2002); in the West Indies, previously known only from Cuba (Duarte Bello, 1997) **New to the Lesser Antilles.**

**Brymela websteri* (H.A. Crum & E.B. Bartram) W.R. Buck

Specimen examined: Pitons du Carbet (Piton Lacroix): epiphyte, 14°41'54"N, 61°06'57"W, 1100 m, 27 February 2014, coll. JF Bernard, ELB 1986.

Distribution: Central America; in the West Indies previously known only from Dominica, Guadeloupe and Jamaica (Buck, 1998; Allen, 2010; Lavocat Bernard & Schäfer-Verwimp, 2011).

* *Bryohumbertia filifolia* (Hornsch) J.P. Frahm var. *filifolia*

Specimens examined: Pitons du Carbet (Piton Lacroix): epiphyte, 14°41'54"N, 61°06'57"W, 1100 m, 27 February 2014, coll. JF Bernard, ELB 1989, 1990.

Distribution: Central America (incl. Mexico), Western and Northern South America and Brazil; in the West Indies, previously known from Cuba, the Dominican Republic, Guadeloupe, Haiti, Jamaica, Puerto Rico (Allen, 1994; Frahm, 1991; Lavocat Bernard & Schäfer-Verwimp, 2011).

**Callicostella depressa* (Hedw.) A. Jaeger

Specimen examined: Rivière Trois-Bras: Grand-Rivière, on rocks, 14°50'55"N, 61°12'10"W, 250 m, 3 June 1990, ELB 80.

Distribution: Widespread in northern South America; in the West Indies, previously known from Cuba, Guadeloupe, Hispaniola, Jamaica, Puerto-Rico, St Kitts and St Vincent (Buck, 1998).

**Campylopus anderssonii* (Müll. Hal.) A. Jaeger

Specimen examined: Mount Pelée: trail of l'Aïleron, "Le Chinois" massif, on a shaded volcanic rock, 14°48'34"N, 61°10'01"W, 1354 m, 7 July 2014, ELB 147-20 (dupl. MO), conf. Bruce Allen.

Distribution: Known from Mexico, Central America, Venezuela, Colombia, Bolivia and Galapagos Islands (Frahm, 1991; Allen, 1994) **New to the West Indies.**

**Campylopus cygneus* (Hedw.) Brid.

Fig. 3

Specimens examined: Mount Pelée: trail of l'Aïleron, "Le Chinois" massif, on a rock, 14°48'38"N, 61°10'02"W, 1330 m, 7 July 2014, ELB 147-17 (dupl. MO), 14°48'35"N, 61°10'02"W, 1357 m, ELB 147-18 (dupl. MO), ELB 147-30 (dupl. MO), det. Bruce Allen.

Distribution: Endemic to the Caribbean: previously known from Cuba, Hispaniola (the Dominican Republic, Haiti), Jamaica, Puerto Rico, and only from Saba in the Lesser Antilles (Frahm, 1991).

° *Campylopus heterostachys* (Hampe) A. Jaeger

Specimens examined: Mount Pelée, on soil, alt 1350 m, 1997, Coll. A. Aust & C. Cloos, Herbarium Jean Werner 6496 (dupl. PC), det. J.P. Frahm; Mount Pelée: trail of Grande Savane, on soil, 14°48'40"N, 61°10'03"W, 1330 m, 9 August 2012, ELB 1751.

Distribution: Central America (Costa Rica, Guatemala, Honduras, Mexico and Nicaragua) and South America (Northern Argentina, Brazil, Bolivia, Ecuador, Paraguay, Peru and Venezuela; (Frahm, 1991; Allen, 1994). **New to the West Indies.**

**Daltonia stenophylla* Mitt.

Specimen examined: Pitons du Carbet (Piton Lacroix): epiphyte, 14°41'54"N, 61°06'57"W, 1100 m, 27 February 2014, coll. JF Bernard, ELB 1986.

Distribution: Central (Costa Rica, Honduras and Mexico) and South America (Bolivia and Brazil) (Allen, 1994); in the West Indies previously known from Cuba, the Dominican Republic, Jamaica, Puerto-Rico, St Vincent (Buck, 1998), Dominica

(Schäfer-Verwimp, 1999), Guadeloupe (Schäfer-Verwimp & Reiner-Drehwald, 2009).

**Fissidens oblongifolius* Hooker

Specimen examined: Anse d'Arlet: Morne d'Orange, epiphyte in a small ravine, on west of the River of La Pagerie, 14°30'49"N, 61°03'48"W, 250 m, 19 June 2012, coll. JF Bernard, *ELB 1710*.

Distribution: Central America and South America; in the West Indies previously known from Cuba, Dominica, the Dominican Republic, Guadeloupe, Jamaica, and Puerto-Rico (Pursell, 2007).

**Fissidens weirii* var. *weirii* Mitt.

Specimen examined: Sainte-Luce: Swamp forest of Le Galion, epiphyte on *Hymenaea courbaril*, 14°43'40"N, 60°57'07"W, 10-15 m, 26 May 2013, *ELB 1849*.

Distribution: Widespread in the Neotropics: Central and South America; in the West Indies, previously known from Cuba, Dominica, the Dominican Republic, Guadeloupe, Jamaica, and Puerto-Rico (Pursell, 2007); also reported from Africa (O'Shea 2006).

**Fissidens weirii* var. *hemicraspedophyllus* (Cardot) Pursell

Specimen examined: Le Prêcheur: Rivière Trois-Bras, on rocks, 14°50'55"N, 61°12'10"W, 250 m, 4 June 1990, *ELB 87*.

Distribution: Central (incl. Mexico) and South America and in the West Indies previously known from Cuba, the Dominican Republic, Dominica, Guadeloupe, Haiti, Jamaica, Puerto Rico and St Vincent (Pursell, 2007).

° *Homaliodendron piniforme* (Brid.) Enroth (Duss, 1903 as *Porotrichum piniforme* Brid.)

Specimens cited but not seen: Mount Pelée: Massif de la Basse-Pointe, 800-1000 m, September 1901, *Duss 341* (NY), det. J. Enroth, 1990.

Distribution: Central America (Costa Rica, Mexico, Panama), South America (Ecuador, southern Brazil), West and Central Africa, Madagascar and the Mascarenes; in the West Indies previously known only from Dominica and Guadeloupe (Buck, 1998; Allen, 2010).

**Lepidopilidium portoricense* (Müll. Hal.) H.A. Crum & Steere

Specimen examined: Mount Pelée: trail of l'Aïeron, epiphyte, 14°48'22"N, 61°09'08"W, 850 m, 28 May 2001, *ELB 392*.

Distribution: Central America (incl. Mexico), widespread in Northern and central South America; in the West Indies previously known from Cuba, Guadeloupe, Hispaniola, Jamaica and Puerto-Rico (Buck, 1998; Allen, 2010).

**Lepidopilum longifolium* Hampe

Specimen examined: Mount Pelée: trail of l'Aïeron, near the first refuge, epiphyte on a Solanaceae, 14°48'22"N, 61°09'06,9"W, 838 m, 29 May 2016, *ELB 16509*.

Distribution: Central America (incl. Mexico), widespread in Northwestern South America; in the West Indies previously known from Cuba, Guadeloupe, Hispaniola, Jamaica and Puerto-Rico (Buck, 1998; Allen, 2010).

**Leskeodon auratus* (Müll. Hal.) Broth.

Specimen examined: Mount Pelée: trail of l'Aïeron, epiphyte, 14°48'52"N, 61°10'03"W, 1220 m, 8 December 2014, *ELB 1412-27*.

Distribution: Central America (Belize, Costa Rica, Honduras, Panama), South America (Brazil, Colombia); in the West Indies previously known from Cuba, Dominica, Guadeloupe, Jamaica, and Puerto-Rico, St Vincent and Trinidad (Buck, 1998; Allen, 2010).

**Leucoloma mariei* Besch.

Specimen examined: Pitons du Carbet (Morne Piquet): epiphyte, 14°42'30"N, 61°06'56"W, 1150 m, 2 August 2016, coll. JF Bernard, ELB 16810.

Distribution: Reported from Central America and Caribbean (Allen, 1994).

°*Leucoloma schwaneckeanum* (Hampe) Broth.

Specimens cited but not seen: Along departmental trail 1, between Deux Choux and Morne Bellevue, ca 1 km east of Deux Choux, in forest, on buttress of large tree, 500 m, 18 April 1969, coll. M.R. Crosby & C.A. Crosby 4722 (MO, dupl. NY), det. M.R. Crosby.

Distribution: Endemic to the West Indies, previously known from Cuba (Motito Marin & Potrony Hechavarría, 2010), the Dominican Republic, Guadeloupe (Gama *et al.*, 2015) and Puerto Rico (La Farge, 2002c).

**Macromitrium richardii* Schwägr.

Specimen examined: Pitons du Carbet (Piton Lacroix): Morne Piquet, epiphyte, 14°42'32"N, 61°06'58"W, 1150 m, 9 May 1993, ELB 240.

Distribution: Widespread, Central (incl. Mexico) and South America, Caribbean (incl. USA coastal states) and South Africa (Allen, 2010; O'Shea, 2006).

**Meteorium nigrescens* (Hedw.) Dozy *et* Molk.

Specimen examined: Trois-Ilets: La Pagerie, epiphyte, 14°48'39"N, 61°10'58"W, 50 m, 7 May 2013, coll. JF Bernard, ELB 1841.

Distribution: Widespread in tropical America from lowlands to 1800 m (Allen, 2010).

**Microcampylopus leucogaster* (Müll. Hal.) B.H. Allen

Specimen examined: Mount Pelée: trail of Grande Savane, epiphyte, 14°48'37"N, 61°10"W, 915 m, 9 August 2012, ELB 1759-4.

Distribution: Widespread in Central America (incl. Mexico), Western and Northern South America, Brazil; in the West Indies, previously known from the Dominican Republic, Guadeloupe, Jamaica and Puerto Rico (Allen, 1994; Frahm, 1991; Lavocat Bernard & Schäfer-Verwimp, 2009).

°*Pelekium scabrosulum* (Mitt.) Touw (Ellis *et al.* 2016; Contributors: N. Norhazrina and A. Vanderpoorten)

Specimens cited but not seen: Le Prêcheur: Track between Anse Coulevre and Cascade Coulevre, epiphytic within moist lowland rainforest in a ravine, 14°50'N, 60°12'W, 100 m, 1 April 2016, coll. A. Vanderpoorten MAR1 (LG).

Specimens examined: Sainte-Luce: departmental state forest of Lépinay, a relic rain forest, epiphyte, 14°30'38"N, 60°55'16"W, 230 m, 10 August 2017, ELB 17864.

Distribution: Widely distributed in mostly mesic to humid lowland forest in Central America, Northern South America; in the West Indies, previously reported from Cuba, Guadeloupe, Hispaniola (Haiti and the Dominican Republic), Martinique, Puerto Rico, Ste Lucia and Trinidad (Buck, 1998; Lavocat Bernard & Schäfer-Verwimp, 2011; Ellis *et al.*, 2016).

****Philonotis longiseta*** (Michx.) Britt.

Specimen examined: Mount Pelée: trail of Grande Savane, on soil, 14°48'39"N, 61°10'58"W, 700-750 m, 4 April 2013, coll. JF Bernard, ELB 1833.

Distribution: Widespread in Central to Southern U.S.A., Central America (incl. Mexico), Caribbean, Northern and Western South America (Allen, 2002).

****Sematophyllum tequendamense*** (Hampe) Mitt.

Specimen examined: Bellefontaine: epiphyte, 14°40'47"N, 61°09'40"W, 120 m, 24 May 1990, ELB 78.

Distribution: Northwestern South America; in the West Indies known from Cuba, Jamaica, Puerto Rico and Guadeloupe (Buck, 1998).

****Syrrhopodon prolifer*** Schwägr. var. *tenuifolius* (Sull.) Reese

Specimen examined: Mount Pelée: trail of Macouba, epiphyte, 14°49'54"N, 61°09'52"W, 686 m, 20 January 2014, ELB 1920.

Distribution: Central America and northern South America; in the West Indies, previously known only from Cuba (Motito Marin & Hechavarria, 2010), Dominica and St Kitts (Reese, 1993).

Note: The species is characterized by very long leaves to ca 5 cm in length (Reese, 1993).

****Vesicularia vesicularis*** var. *vesicularis* (Schwägr.) Broth.

Specimen examined: Mount Pelée: trail of l'Aïeron, on soil, 14°48'36"N 61°10'01"W, 1364 m, 7 July 2014, ELB 147-13 (dupl. NY), conf. W.R. Buck.

Distribution: Cuba, Jamaica, the Dominican Republic, Haiti, and St Kitts (Buck, 1998) and Guadeloupe (Lavocat Bernard & Schäfer-Verwimp, 2011).

DISCUSSION

The protected natural rain forests form a large part of the Caribbean French overseas departments. The knowledge of the bryoflora is relatively well advanced in Guadeloupe with 613 species reported (Lavocat Bernard & Schäfer-Verwimp, 2011) and twenty other new species recently added (Lavocat Bernard & Reeb, 2016). In Martinique, 413 species are currently listed. Most of the new records reported here were already cited from Guadeloupe except for three liverworts (*Bromeliophila helenae*, *Cephaloziella granatensis* and *Drepanolejeunea fragilis*) and five mosses (*Anomobryum conicum*, *Campylopus anderssonii*, *Campylopus cygneus*, *Campylopus heterostachys* and *Syrrhopodon prolifer* var. *tenuifolius*). Two species are new to the West Indies (*Campylopus anderssonii* and *C. heterostachys*).

The bryophyte flora of Martinique has been less inventoried in the past than that of Guadeloupe. It may be at least partly explained by the presence of a venomous snake (*Bothrops lanceolatus*, fer-de-lance, a Martinique pit-viper), which does not exist in Guadeloupe. Duss who carried out most inventories at the end of the 19th century, had already mentioned that few botanists did their field research in Martinique because of this field constraint (Stehlé, 1943). The bryoflora of the island is still surely incomplete. Most of our recent inventories of bryophytes in Martinique were mainly conducted in the areas of Mount Pelée and the Pitons du Carbet. Other areas, especially the canyons of the North Atlantic, the volcanic massifs to the north

of Mount Pelée and the wooded limestone hills of the South part of the island remain to be critically explored. Fieldwork is in part planned as part of the research activities of the Botanical Conservatory of Martinique. On the other hand, the author considers to carry out investigations on the bryophyte flora of the island in partnership with the National Forestry Office of Martinique, in the framework of the management program of the Integral Biological Reserve of the Mount Pelée (2018-2023).

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