

New moss records for Vanua Levu, Fiji

Senilolia H. Tuiwawa^{1,2}

¹Current Address: Conservation International (Fiji), 3 Ma'afu Street, Suva, Fiji

²South Pacific Regional Herbarium, Institute of Applied Sciences, University of the South Pacific,
Laulala Campus, Suva, Fiji

Correspondence: stuiwawa@conservation.org; senilolia.heilala@yahoo.com

Abstract

Fourteen species of mosses are newly recorded from the Savusa area and the greater Delaikoro area on Vanua Levu, Fiji's second largest island. The fourteen species belong to ten different families, Cyrtopodaceae, Dicranaceae, Hypnodendraceae, Meteoriaceae, Neckeraceae, Orthotrichaceae, Polytrichaceae, Pterobryaceae, Ptychomniaceae and Sematophyllaceae. Four moss species are new records for Vanua Levu, *Pogonatum graeffeanum* (Müll.Hal.) A.Jaeger, *Macromitrium angulatum* Mitt., *Meiothecium hamatum* Broth. and *Papillaria helictophylla* (Mont.) Broth., while the remaining ten species were previously reported from other locations. The novel distribution records for these species are provided, with notes on their extended range of distribution. Field illustrations of all fourteen taxa are provided, with voucher specimens deposited as permanent records at the South Pacific Regional Herbarium in Fiji.

Introduction

The history of moss collection in Fiji has consisted of several enumerations since the late 18th to mid-19th century (von Konrat *et al.* 2011). Most publications from the mid-1900s were reviews of collections undertaken by early expeditions in the 18th century, under the United States Exploring Expedition and the H.M.S. Herald expedition. One of the earliest known studies was by Sullivant (1854, 1859) who reviewed the collections made by Rich and Wilkes from 1838–1842. Müller (1857) reviewed the collections made by Thwaites in 1854, and these were reviewed again by Dixon and Greenwood (1930), who also included collections made by Mitten in 1861 and 1871. Whittier (1975) provides a thorough account of bryophyte collections in the 18th and 19th century and also reviewed collections by later naturalists leading up to the mid-1900s, including Bartram's work (Bartram 1936, 1944, 1950, 1956). According to Müller (2012), Miller *et al.* (1978) published the last comprehensive inventory of mosses in Fiji. In the most recent works by von Konrat *et al.* (2011), Fife and Naikatini (2011), the authors concluded that the moss flora for Fiji remains understudied and poorly documented across most of the islands. Müller (2012) provides a thorough literature overview of key moss references from the mid-1970s to the present, including works by Dixon and Greenwood (1930), Schultze-Motel (1973), Whittier (1975), Miller *et al.* (1978), Lin (1984), Reese and Mohamed (1985), Reese *et al.* (1986), Norris and Koronen (1987), Watanabe (1987), Enroth (1992), Higushi and Iwatsuki (1993), Iwatsuki and Suzuki (1996), Kruijer (2002), and Fife and Naikatini (2011). Müller's work on Taveuni, Fiji's third largest island, has provided the most recent additions to the moss flora for Fiji (Müller, 2012).

A moss checklist and distribution records has yet to be produced specifically for Vanua Levu. Vanua Levu is the second largest island in Fiji, located north-east of Viti Levu (see map). Some of the known collections on the island were undertaken by Greenwood in 1917–1927, Peterson in 1924, Degener in 1940, and Whittier in 1975. With the handful of collections and inventories, there is considerable reliance on published literature by specialists having undertaken research on the Fijian flora to provide the most relevant and updated information, particularly with the local distributions. In Bartram's (1944, 1956) accounts of Fijian mosses, 288 species were listed with annotated collection sites. Whittier (1975) documented 305 moss species in the flora and provided some collection localities on Vanua Levu that included the coast of Macuata, Natewa Peninsula, parts of Labasa and Yanawai River. Other than the collections described herein, even the most recent moss collections have only been site specific: Fife in 2006–2008 on the islands of Viti Levu and Taveuni and Müller in 2012 on Taveuni. Hence, more groundwork remains to be undertaken.

In the present collection, 14 mosses are newly reported from the areas of Savusa and the greater Delaikoro area on the island of Vanua Levu. Four moss species are new records for Vanua Levu: *Pogonatum graeffeanum* (Müll. Hal.) A. Jaeger, *Macromitrium angulatum* Mitt., *Meiothecium hamatum* Broth. and *Papillaria helictophylla* (Mont.) Broth. The remaining ten species have previously been reported from Vanua Levu but with locations that lie beyond the peripherals of Savusa and Delaikoro sites. Nonetheless, the overall new island records show a significant range extension of the currently known distributions of the respective species, both within and outside the Fijian archipelago. Distribution records from earlier collection are also stated. Field photographs were taken by the author and are provided to aid identification and also because the moss flora is often not frequently illustrated in the published literature. All 14 voucher collections have been deposited as permanent records at the South Pacific Regional Herbarium located in Suva, Fiji.

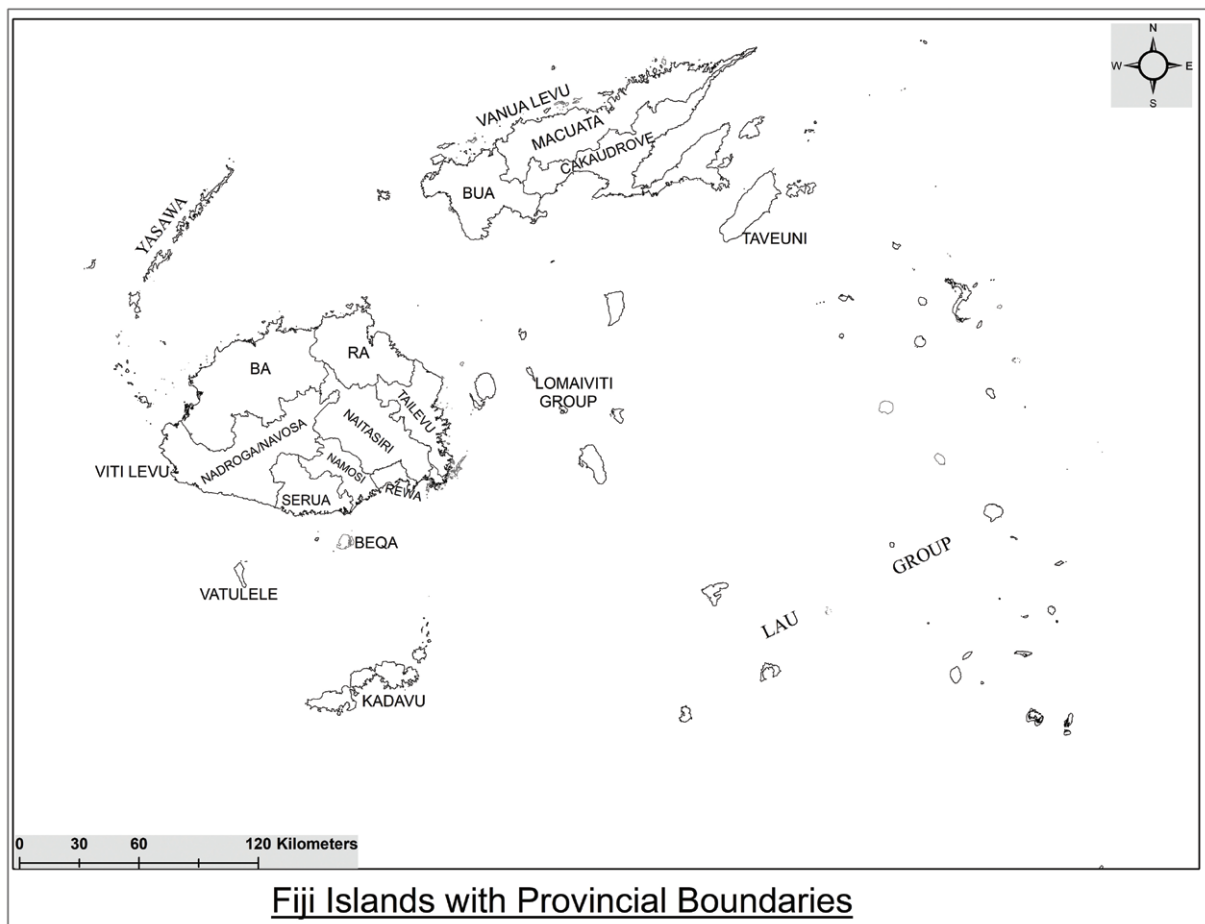


Fig. 1. Map of Fiji Islands with Provincial boundaries. Source: Conservation International (Fiji Program), 2022.

List of new moss records for Vanua Levu

Abbreviations: lat. - Latitude; long. - Longitude; CHR - Landcare Research New Zealand, Allan Herbarium, Lincoln, New Zealand; CNABH - Consortium of North American Bryophyte Herbaria; GBIF - Global Biodiversity Information Facility; SPRH – South Pacific Regional Herbarium, University of the South Pacific, Laucala Campus, Suva, Fiji.

1. *Pogonatum graeffeanum* (Müll.Hal.) A.Jaeger [Polytrichaceae]

Fiji, Vanua Levu, Cakaudrove Province: Vicinity of Savusa, on the slope embankment with a dominant spread on the soil surface, 400 m a.s.l. 16.6353°S, 179.3710°E, S.H.Tuiwawa 5508/2013, Herbarium No.: SPRH 37465. (Fig. 2)



Fig. 2. Fertile specimen of *Pogonatum graeffeanum* sampled off the soil substrate of its natural habitat. A. Live plant. B. Dried specimen (S.H.Tuiwawa 5508/2013). Scale bar = 1 cm.

Specimen Examined: Fiji, Viti Levu, Province of Namosi. On the road in the vicinity of Namosi village, soil embankment of stream bank, 380 m a.s.l. 24 April 2007, A.J.Fife 12321-CHR 595145 [SPRH 28518]. Determined by Allan Fife.

Distribution in Fiji: Vanua Levu: the greater Delaikoro area (new record).

Notes: The specimen is the first known recorded sample of *Pogonatum graeffeanum* from Vanua Levu. Previous collections include those by Fife in 2007 on Viti Levu and annotations by Whittier in 1975 in parts of Viti Levu (Gibbs 1909; Dixon and Greenwood 1930; Greenwood 1946; Bartram 1956); and Ovalau (Müller 1874; Dixon and Greenwood 1930). Bartram in 1936 recorded a specimen from the island of Koro. GBIF has occurrence records of *P. graeffeanum* in the eastern parts of the South Pacific.

2. *Meiothecium hamatum* Broth. [Sematophyllaceae]

Fiji Islands, Vanua Levu, Cakaudrove Province: Upper slopes of Delaikoro. On tree bark. 940 m a.s.l. 16.3514°S, 179.1851°E, S.H.Tuiwawa 5516/2013, Herbarium No.: SPRH 37473. (Fig. 3)

Specimen examined: Fiji, Viti Levu, Ba province. Central highlands, Monasavu dam depot site, Fiji map series 31, map sheet N27, Epiphytic on tree, c. 800 m a.s.l., 16 April 2007, A.J.Fife 12631-CHR 587970 [SPRH 28499]. Determined by Allan Fife.

Distribution in Fiji: Vanua Levu: vicinity of Delaikoro (new record).

Notes: This is the first record of *Meiothecium hamatum* from Vanua Levu. With reference to recent publication by Müller (2012), there is no mention of this species occurring on Taveuni nor Vanua Levu in the previous works by Dixon and Greenwood (1930), Schultze-Motel (1973) or Miller *et al.* (1978). GBIF records occurrences of *M. hamatum* in parts of Asia, New Caledonia, and parts of Polynesia.



Fig. 3. Fertile sample of *Meiothecium hamatum* (S.H.Tuiwawa 5516/2013). Scale bar = 1 cm.

3. *Spiridens aristifolius* Mitt. [Hypnodendraceae]

Fiji Islands, Vanua Levu, Cakaudrove Province: Upper slopes of Delaikoro, on tree trunk, 890 m a.s.l., 16.3514°S, 179.1851°E, S.H.Tuiwawa 5520/2013, Herbarium No.: SPRH 37477. (Fig. 4)



Fig. 4. Live specimen of *Spiridens aristifolius* (S.H.Tuiwawa 5520/2013). Scale bar = 1 cm.

Specimen examined: Viti Levu, Namosi province. Track to Mt. Voma, on trunk of a tree fern, 700 m a.s.l. 25 April 2007, A.J.Fife 12388-CHR 595212 [SPRH 28446]. Determined by Allan Fife.

Distribution in Fiji: Vanua Levu: vicinity of Delaikoro (new locality record).

Notes: Fife describes this species as having been common in abundance within the vicinity of Mt. Voma on Viti Levu. Bartram in 1936 annotates a specimen from Taveuni and a different locality site on Vanua Levu. The new occurrence is a range extension from the known site on Viti Levu. GBIF reports the occurrences of the species in Indonesia and throughout the western and eastern parts of the South Pacific.

4. *Papillaria helictophylla* (Mont.) Broth. [Meteoriaceae]

Fiji Islands, Vanua Levu, Cakaudrove Province: Upper slopes of Savusa, on bark of tree, 850 m a.s.l., 16.6353°S, 179.3709°E, S.H.Tuiwawa 5521/2013, Herbarium No.: SPRH 37477. (Fig. 5)



Fig. 5. Specimen of *Papillaria helictophylla* (S.H.Tuiwawa 5521/2013). Scale bar = 1 cm.

Specimen Examined: Fiji, Kadavu: vicinity of the upper slopes of Mt. Washington, on shaded bark of tree, 500–800 m a.s.l., 17 July 1974, D.H.Norris 45514 [SPRH 29124]. Determined by D.H.Norris.

Distribution in Fiji: Vanua Levu, Savusa area (new record).

Notes: This is the first record of *Papillaria helictophylla* on Vanua Levu. The species was first collected on Kadavu in 1974 by D.H.Norris. With reference to recent publication by Müller (2012) on Taveuni, there is no mention of this species occurring on Taveuni nor Vanua Levu in the previous works by Dixon and Greenwood (1930), Schultze-Motel (1973), and Miller *et al.* (1978). GBIF records the extended range of distribution of the species throughout the South Pacific.

5. *Macromitrium angulatum* Mitt. [Orthotrichaceae]

Fiji, Vanua Levu, Cakaudrove Province: On the track to Delaikoro, epiphytic on exposed tree branch, 800 m a.s.l. 16.5868° S, 179.3145° E, S.H.Tuiwawa 5111/2013, Herbarium No.: SPRH 37468. (Fig. 6)

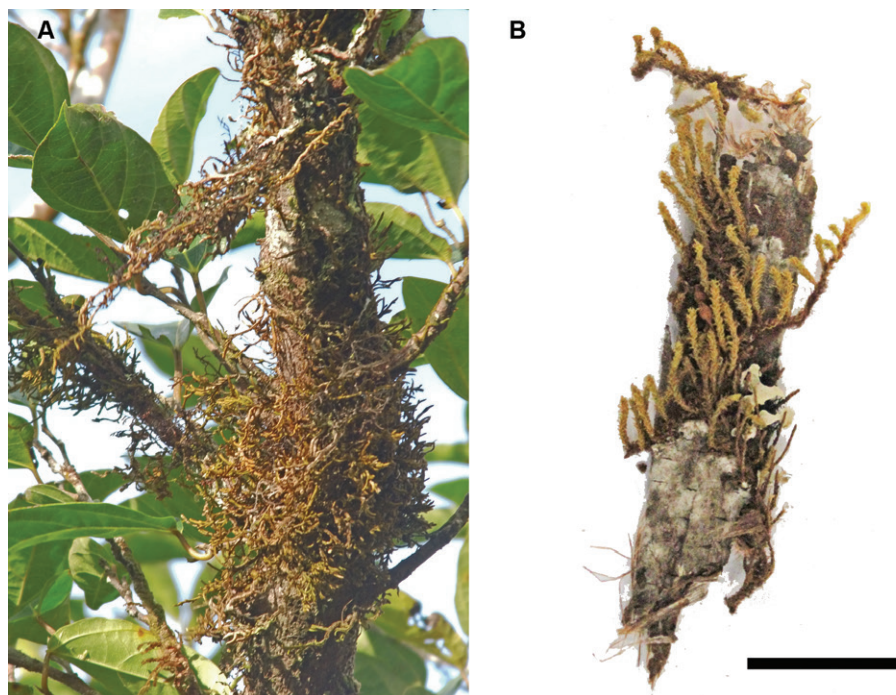


Fig. 6. Epiphytic *Macromitrium angulatum*. A. in its natural habitat. B. Sample of the fertile specimen (S.H.Tuiwawa 5111/2013). Scale bar = 1 cm.

Specimen examined: Fiji, Viti Levu, Ba province: dense rainforest at top of Mt. Lomalagi, east of Nadarivatu, on tree, 1100 m a.s.l., 28 June 1974, *D.H.Norris 44536 [SPRH 28860]*. Determined by D.H.Norris.

Distribution in Fiji: **Vanua Levu:** vicinity of Delaikoro (new record). **Kadavu:** upper slopes of Mt. Washington, *D.H.Norris 45544 [SPRH 28861]*.

Notes: Whittier in 1975 annotated a specimen on Viti Levu at a different location. GBIF has recorded occurrences of this species in Papua New Guinea and New Zealand.

6. *Floribundaria aeruginosa* (Dozy & Molk.) M.Fleisch. [Meteoriaceae]

Fiji Islands, Vanua Levu, Cakaudrove Province: Off the road track to Delaikoro, at the bottom of tree trunk, 800 m a.s.l., 16.5868°S, 179.3145°E, *S.H.Tuiwawa 5514/2013*, Herbarium No.: *SPRH 37471*. (Fig. 7)



Fig. 7. Sample of *Floribundaria aeruginosa* (*S.H.Tuiwawa 5514/2013*). Scale bar = 1 cm.

Specimen examined: Fiji, Viti Levu, Ba province, vicinity of Mt. Koro-O, Fiji map series 31, sheet M27, mid-elevation mixed podocarp and kauri forest with steep clay slopes and several intermittent rivulets over basalt bedrock, 875 m a.s.l., 17 April 2008, *A.J.Fife 12705-CHR 618231 [SPRH 28618]*. Determined by Allan Fife.

Distribution in Fiji: **Vanua Levu:** vicinity of Delaikoro (new locality record). **Viti Levu:** vicinity of Namosi village, *A.J.Fife 12308-CHR 595132 [SPRH 28619]*; vicinity of Monasavu, *A.J.Fife 12592-CHR 618297 [SPRH 28620]*; track to Mt. Voma, *A.J.Fife 12376-CHR 595200 [SPRH 28621]*; lower slopes of Mt. Korobaba, *A.J.Fife 12265-CHR 595094 [SPRH 28617]*. **Taveuni:** lower track of Lake Tagimoucia, *A.J.Fife 12529-CHR 618237 [SPRH 28616]*.

Notes: This is the first record of *Floribundaria aeruginosa* from the Delaikoro site on Vanua Levu. Whittier (1975) annotates several other localities on parts of Viti Levu (Dixon and Greenwood 1930; Greenwood, 1936); Vanua Levu (Bartram 1936) and Ovalau (citation without locality details of the collection, Müller 1874; Dixon and Greenwood 1930). GBIF records this species in the Congo and throughout Polynesia.

7. *Garovaglia elegans* (Dozy & Molk) Hampe ex Bosch & Sande Lac. [Ptychomniaceae]

Fiji, Vanua Levu, Cakaudrove Province: On the slope embankments of Delaikoro. Epiphytic on tree branches. 850m a.s.l. 16.5867°S, 179.3144°E, *S.H.Tuiwawa 5509/2013*, Herbarium No.: *SPRH 37466*. (Fig. 8).

Specimen examined: Fiji: Viti Levu Island: western flank of Mt. Tomaniivi on track from Navai village, Fiji Map series 31, Sheet N27, on fallen branch, 1050 m a.s.l., 18 April 2008, *A.J.Fife 12725-CHR 618183 [SPRH 28623]*. Determined by Allan Fife.

Distribution in Fiji: **Vanua Levu:** greater Delaikoro area (new locality record); vicinity of Mt. Mariko. *D.H.Norris 45272 [SPRH 28932]*. **Taveuni:** vicinity of Mt. Des Voux, *A.J.Fife 12564-CHR 618269 [SPRH 28622]*.

Notes: CNABH records the occurrence of *G. elegans* in parts of Asia.



Fig. 8. Epiphytic *Garovaglia elegans*. A. On tree branches in natural habitat. B. Sample of the fertile specimen (S.H.Tuiwawa 5509/2013). Scale bar = 1 cm.

8. *Macromitrium incurvifolium* (Hook. & Grev.) Schwägr. [Orthotrichaceae]

Fiji, Vanua Levu, Cakaudrove Province: Along the gentle slopes of Delaikoro, epiphytic on tree branches, 900 m a.s.l., 16.5864°S, 179.3160°E, S.H.Tuiwawa 5510/2013, Herbarium No.: SPRH 37467. (Fig. 9)



Fig. 9. Epiphytic *Macromitrium incurvifolium*. A. Natural habitat on a tree branch. B. Sample of the fertile specimen (S.H.Tuiwawa 5510/2013). Scale bar = 1 cm.

Specimen examined: Fiji, Viti Levu, central highland Monasavu lake area, c. 6 km due south of the Monasavu dam on road that passes near Nadelaidovukula peak, Fiji map series 31, sheet N27, on *Freycinetia* leaves, 1230 m a.s.l. 15 April 2008, A.J.Fife 12616-CHR 617435 [SPRH 28597]. Determined by Allan Fife.

Distribution in Fiji: **Vanua Levu:** vicinity of Delaikoro (new locality record); Mt. Mariko, D.H.Norris 45259 [SPRH 28849]. **Viti Levu:** vicinity of the Monasavu dam, A.J.Fife 12545-CHR 618251 [SPRH 28493]; slope of Mt. Tomaniivi, D.H.Norris 44668 [SPRH 28856]; Mt. Lomalagi, D.H.Norris 44535 [SPRH 28855]; Wainikatama stream in Namosi, A.J.Fife 12344-CHR 595168 [SPRH 28495]; vicinity of Nakavu village in Namosi, A.J.Fife 12776-CHR 618306 [SPRH 28491]. **Taveuni:** vicinity of lake Tagimoucia, D.H.Norris 45098 [SPRH 28850]; vicinity of Mt. Des Voux, A.J.Fife 12545-CHR 618251 [SPRH 28493].

Notes: It's habit and morphology in the field closely resembles *Macromitrium angulatum*. Whittier (1975) records the occurrence of this species in other localities on Viti Levu (Gibbs 1909; Dixon and Greenwood 1930), Vanua Levu (Bartram 1936) and Taveuni (Bartram 1936). GBIF has reported occurrences of *M. incurvifolium* from South America, India, parts of Asia, Australia, and other Pacific Island countries.

9. *Bescherellia cryphaeoides* (Müll.Hal.) M.Fleisch. [Cyrtopodaceae]

Fiji Islands, Vanua Levu, Cakaudrove Province: Off the road track to Delaikoro, epiphytic on tree branches, 850 m a.s.l., 16.5870°S, 179.3140°E, S.H.Tuiwawa 5512/2013, Herbarium No.: SPRH 37469. (Fig. 10)



Fig. 10. *Bescherellia cryphaeoides* on a sample tree bark (S.H.Tuiwawa 5512/2013). Scale bar = 1 cm.

Specimen examined: Fiji, Viti Levu, Namosi province. On dry vertical basalt in mid-elevation rainforest, 700 m a.s.l., 25 April 2007, A.J.Fife 12383-CHR 525207 [SPRH 28674]. Determined by Allan Fife.

Distribution in Fiji: **Vanua Levu:** Mt. Delaikoro (new locality record).

Notes: This is the first record of *Bescherellia cryphaeoides* from the locality of the greater Delaikoro area in Vanua Levu. It was collected from a different location on Vanua Levu by Bartram in 1936. Whittier (1975) listed a collection in the island of Ovalau by Müller (1874) and Dixon and Greenwood (1930) however the locality is not specified. Fife in 2007 describe the species as rare in abundance in the vicinity of Mt. Voma on Viti Levu. Currently, neither GBIF nor CNABH has records of this species in any of its databases however TROPICOS lists one specimen from the Philippines.

10. *Leucoloma tenuifolium* Mitt. [Dicranaceae]

Fiji Islands, Vanua Levu, Cakaudrove Province: Upper slopes of Savusa, on the bark of a tree, 310 m a.s.l., 16.6353°S, 179.3709°E, S.H.Tuiwawa 5515/2013, Herbarium No.: SPRH 37472. (Fig. 11)



Fig. 11. Samples of *Leucoloma tenuifolia* (S.H.Tuiwawa 5515/2013). Scale bar = 1 cm.

Specimen examined: Fiji: Viti Levu, Namosi province, Wainikatama Stream, near temporary mining camp, c. 5km SE (via road) of Namosi village on Namosi Road, 380 m a.s.l., 24 April 2007, A.J. Fife 12332-CHR 595156 [SPRH 28598]. Determined by Allan Fife.

Distribution in Fiji: Vanua Levu: Savusa area (new locality record); vicinity of Mt. Mariko, *D.H.Norris 45226* [SPRH 28875]. **Viti Levu:** vicinity of Mt. Victoria, *D.H.Norris 44766* [SPRH 44766]; vicinity of Nadarivatu, *D.H.Norris 44413* [SPRH 28863]; summit of Mt. Korobaba, *D.H.Norris 44857* [SPRH 28870]. **Taveuni:** vicinity of lake Tagimoucia, *D.H.Norris 45072* [SPRH 28890]. **Kadavu:** upper slopes of Mt. Washington, *D.H.Norris 45495* [SPRH 28868].

Notes: Whittier (1975) reports further locality distribution on Viti Levu (Dixon and Greenwood 1930; Greenwood 1946; Bartram 1956), Vanua Levu (Bartram 1936) and Taveuni (Bartram 1936). GBIF reports *L. tenuifolia* in parts of Asia, parts of Polynesia and New Caledonia thus providing an overview of its range of distribution across the South Pacific.

11. *Leucobryum sanctum* Hampe [Dicranaceae]

Fiji Islands, Vanua Levu, Cakaudrove Province: Along upper slopes of Delaikoro, on soil surface, 900 m a.s.l., 16.5868°S, 179.3145°E, S.H.Tuiwawa 5517/2013, Herbarium No.: SPRH 37474. (Fig. 12)



Fig. 12. Samples of *Leucobryum sanctum* (S.H.Tuiwawa 5517/2013). Scale bar = 1 cm.

Specimen examined: Fiji, Taveuni, Cakaudrove province: on moist, rather shaded soil along trail in dense rainforest at top of ridge on west side of Lake Tagimoucia, southeast of Somosomo, 600–900 m a.s.l., 6 July 1974, *D.H.Norris 45099 [SPRH 29062]*. Determined by D.H.Norris.

Distribution in Fiji: **Vanua Levu:** Delaikoro area (new locality record); vicinity of Mt. Mariko, *D.H.Norris 45251 [SPRH 29063]*. **Viti Levu:** upper pool vicinity of Colo-i-Suva, *A.J.Fife 12400-CHR 595224 [SPRH 28585]*; vicinity of Nakavu forest Management site, *A.J. Fife 12757-CHR 618205 [SPRH 28586]*. **Taveuni:** vicinity of the lake Tagimoucia, *D.H.Norris 45099 [SPRH 29062]*.

Notes: GBIF has recorded occurrences of *L. sanctum* in the United States, India, parts of Asia, Australia, and parts of the South Pacific.

12. *Symphysodontella cylindracea* (Mont.) M.Fleisch. [Pterobryaceae]

Fiji Islands, Vanua Levu, Cakaudrove Province: Upper slopes of Delaikoro, on tree bark, 840 m a.s.l., 16.5868°S, 179.3144°E, *S.H.Tuiwawa 5518/2013*, Herbarium No.: *SPRH 37475*. (Fig. 13)



Fig. 13. Specimen of *Symphysodontella cylindracea* (*S.H.Tuiwawa 5518/2013*). Scale bar = 1 cm.

Specimen Examined: Viti Levu, Ba province. In the lower dense rainforest slopes of Mt. Victoria, east of Nadarivatu, 800–1000 m a.s.l., 29 June 1974, *D.H.Norris 44788 [SPRH 29148]*. Determined by D.H.Norris.

Distribution in Fiji: **Vanua Levu,** vicinity of Mt. Delaikoro (new locality record); vicinity of Mt. Mariko, *D.H.Norris 45285 [SPRH 29026]*. **Taveuni:** disturbed forest in the vicinity of lake Tagimoucia, *D.H.Norris 44991 [SPRH 29027]*. **Viti Levu:** vicinity of Mt. Victoria, *D.H.Norris 44788 [SPRH 29148]*.

Notes: This is the first record of *Symphysodontella cylindracea* from Delaikoro in Vanua Levu. Bartram (1936) annotates a specimen at a different site location. CNABH have records of *S. cylindracea* occurring in Indonesia, Australia, New Zealand with a range extension across parts of the South Pacific.

13. *Thamnobryum ellipticum* (Bosch & Sande Lac.) Nieuwl. [Neckeraceae]

Fiji Islands, Vanua Levu, Cakaudrove Province: Slopes of Savusa, on lower tree trunk, 350 m a.s.l., 16.6334°S, 179.3654°E, *S.H.Tuiwawa 5519/2013*, Herbarium No.: *SPRH 37476*. (Fig. 14)

Specimen Examined: Fiji, Vanua Levu, Cakaudrove province. On moist, shaded bark of tree in dense rainforest on middle, eastern slopes of Mt. Mariko. 400–600m a.s.l., 9 July 1974, *D.H.Norris 45206 [SPRH 28940]*. Determined by D.H.Norris.

Distribution in Fiji: **Vanua Levu,** Savusa area (new locality record); vicinity of Mt. Mariko, *D.H.Norris 45152 [SPRH 28941]*. **Viti Levu:** vicinity of Colo-i-Suva, *D.H.Norris 44369 [SPRH 28939]*.

Notes: This is the first record of *Thamnobryum ellipticum* on Savusa. CNABH has record occurrences of the species from parts of Asia and Papua New Guinea.



Fig. 14. Live samples of *Thamnobryum ellipticum* (S.H.Tuiwawa 5519/2013). Scale bar = 1 cm.

14. *Leucobryum scalare* Müll.Hal. ex M.Fleisch. [Dicranaceae]

Fiji Islands, Vanua Levu, Cakaudrove Province: Middle slopes of Savusa area, on soil surface, 410 m a.s.l., 16.6334°S, 179.3654°E, S.H.Tuiwawa 5520/2013, Herbarium No.: SPRH 37477. (Fig. 15)



Fig. 15. Live samples of *Leucobryum scalare* (S.H.Tuiwawa 5520/2013). Scale bar = 1 cm.

Specimen Examined: Vanua Levu, Cakaudrove Province, eastern slopes of Mt. Mariko, on shaded bark of tree, 400–600 m a.s.l., 9 July 1974, D.H.Norris 45241 [SPRH 28873]. Determined by D.H.Norris.

Distribution in Fiji: **Vanua Levu:** vicinity of Savusa (new locality record); vicinity of Mt. Mariko, D.H.Norris 45393 [SPRH 28879]. **Viti Levu:** vicinity of Mt. Lomalagi, Nadarivatu, D.H.Norris 44504 [SPRH 29066]; summit of Mt. Victoria, D.H.Norris 44596 [SPRH 29067]. **Kadavu:** vicinity of Mt. Washington, D.H.Norris 45506 [SPRH 28893].

Notes: GBIF records this species as having a global distribution with an extent that includes parts of the South Pacific – New Caledonia, French Polynesia, and American Samoa.

Acknowledgment

I am grateful to Allan Fife for accompanying me in the field, providing identifications and relevant literature; Sue Gibb (from the herbarium of Landcare Research, Lincoln, New Zealand – CHR) for providing accession numbers for collections lodged in CHR; and Rod Seppelt for many valuable comments. The collection presented is part of the biodiversity RAP assessment across Savusa and the greater Delaikoro area of Vanua Levu in Fiji, funded by the FAO.

References

- Bartram EB (1936) Contributions to the Mosses of Fiji. *Occasional Papers of Bernice P. Bishop Museum* 11(20): 1–30. <http://hbs.bishopmuseum.org/pubs-online/pdf/op11-20.pdf>
- Bartram EB (1944) Additions to the mosses of Fiji. *The Bryologist* 47: 57–61.
- Bartram EB (1950) Additional Fijian mosses II. *Occasional Papers of Bernice P. Bishop Museum*. 20: 27–33. <http://hbs.bishopmuseum.org/pubs-online/pdf/op20-2.pdf>
- Bartram EB (1956) Additional Fijian mosses III. *Journal of the Washington Academy of Sciences* 46: 392–396. <https://www.biodiversitylibrary.org/item/122693#page/440/mode/1up>
- Dixon HN, Greenwood W (1930) The mosses of Fiji. *Proceedings of the Linnean Society of New South Wales* 55: 261–302. <https://www.biodiversitylibrary.org/item/109060#page/367/mode/1up>
- Enroth J (1992) Notes on the Neckeraceae (Musci). 13. Taxonomy of the genus *Himantocladium*. *Annales Botanici Fennici* 29: 79–88. <https://www.jstor.org/stable/23726300>
- Fife AJ, Naikatini A (2011) Significant records of Fijian mosses. *Telopea* 13(3): 495–502. <https://www.biodiversitylibrary.org/item/266876#page/141/mode/1up>
- Gibbs LS (1909) A contribution to the montane flora of Fiji (including cryptogams), with ecological notes. *The Journal of the Proceedings of the Linnean Society Botany* 39: 137–214. <https://doi.org/10.1111/j.1095-8339.1909.tb01193.x>
- Greenwood W (1946) Notes on some Fijian Mosses. *Proceedings of the Linnean Society of New South Wales* 70: 213–218. <https://www.biodiversitylibrary.org/item/108673#page/279/mode/1up>
- Iwatsuki Z, Suzuki T (1996) *Fissidens* on the Fiji Islands. *Journal of the Hattori Botanical Laboratory* 79: 139–162. https://www.jstage.jst.go.jp/article/jhbl/79/0/79_139/_pdf
- Kruijer H (2002) Hypopterygiaceae of the world. *Blumea Supplement* 13: 1–388. <https://repository.naturalis.nl/pub/526321/BLUMSUP2002013001001.pdf>
- Lin S (1984) A taxonomic revision of Phyllogoniaceae (Bryopsida). Part II. *Journal of the Taiwanese Museum* 37: 1–54.
- Matsui T, Iwatsuki Z (1993) Callicostaceae and Daltoniaceae (Hookeriales, Musci) from Fiji and Vanuatu. *Hikobia* 11: 281–284.
- Miller HA, Whittier HO, Whittier BA (1978) Prodrum florae muscorum Polynesiae with a key to genera. *Bryophytorum Bibliotheca* 16: 1–334.
- Müller C (1857) Decas muscorum Oceani Pacifici. *Botanische Zeitung, Berlin* 15: 777–782. <https://www.biodiversitylibrary.org/item/104709#page/403/mode/1up>
- Müller C (1874) Musci Polynesiaci praesertim Vitiani et Samoani Graeffeani. *Journal des Museum Godeffroy* 3(6): 51–90. <https://www.biodiversitylibrary.org/item/151093#page/63/mode/1up>
- Müller F (2012) Additions to the moss flora of Taveuni Island (Fiji, South Pacific). *Polish Botanical Journal* 57(1): 197–203. http://bomax.botany.pl/cgi-bin/pubs/data/article_pdf?id=3578
- Norris DH, Koponen T (1987) Bryophyte flora of the Huon Peninsula, Papua New Guinea. XX. Fissidentaceae, Mitteniaceae, Phyllo Drepaniaceae, Phyllogoniaceae and Sorapillaceae (Musci). *Annales Botanici Fennici* 24: 177–219. <https://www.jstor.org/stable/23725494>
- Reese W, Mohamed H (1985) A synopsis of *Calymperes* (Musci: Calymperaceae) in Malaysia and adjacent regions. *The Bryologist* 88: 98–109. <https://doi.org/10.2307/3243077>
- Reese W, Koponen T, Norris D (1986) Bryophyte flora of the Huon Peninsula, Papua New Guinea. XIX. *Calymperes*, *Syrrophodon* and *Mitthyridium* (Calymperaceae, Musci). *Acta Botanica Fennica* 133: 151–202.
- Schultze-Motel W (1973) Katalog der Laubmoose von Melanesien. *Willdenowia* 7: 47–82. <https://www.jstor.org/stable/3995516>
- Sullivant WS (1854) Notices of some new species of mosses from the Pacific Islands. *Proceedings of the American Academy of Arts and Sciences* 3: 73–81. <https://www.biodiversitylibrary.org/item/22230#page/79/mode/1up>
- Sullivant WS (1859) Musci. In: *United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842 under the command of Charles Wilkes, U.S.N. Vol. XXVII. Botany. Cryptogamia. Phanerogamia*. Gray A (ed.) pp. 1–112. (Sherman & Co.: Philadelphia) <https://www.biodiversitylibrary.org/item/124950#page/8/mode/1up>

- von Konrat MJ, Naikatini A, Tuiwawa M, Söderström L, Fife AJ, Renner MAM, Brownsey PJ, Perrie LR, Hagborg A, Pócs T, Lumbsch HT, Braggins JE, Seneca A, Brown EA (2011) A brief history of the cryptogams of Fiji and prospects for the future. *Telopea* 13: 361–374. <https://www.biodiversitylibrary.org/item/266876#page/7/mode/1up>
- Watanabe R (1987) Dr. Z. Iwatsuki's collection of New Caledonian and Fijian Thuidiaceae (Musci). *Journal of Japanese Botany* 62: 89–93. <http://www.jjbotany.com/getpdf.php?tid=7986>
- Whittier HO (1975) A preliminary list of Fijian mosses. *Biological Sciences* 38(2): 85–102. <https://www.jstor.org/stable/24319632>

Received 3 May 2022, accepted 3 January 2023

