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A new specimen-based checklist of ferns and lycophytes from Rotuma (Fiji)

John C. Game\textsuperscript{a,b}, Sarah Pene\textsuperscript{c} and Alan R. Smith\textsuperscript{a}

\textsuperscript{a}University Herbarium, University of California, Berkeley, CA, USA; \textsuperscript{b}National Tropical Botanical Garden, Kauai, HI, USA; \textsuperscript{c}School of Geography, Earth Science and Environment, University of the South Pacific, Suva, Fiji

ABSTRACT
The island of Rotuma lies about 580 km north of the main archipelago of Fiji, and while politically part of that country, it differs culturally and floristically. It has not typically been included in botanical treatments for Fiji as a whole despite visits from several botanists. Pteridophytes of Rotuma were described by St. John in 1954 based on a visit there in 1938, but little additional information is available since then. Much of the original Rotuman forest has been altered by human activity, but pockets of original vegetation persist and substantial areas of secondary forest currently occur there. In June 2019, the first two authors of this report visited Rotuma to study ferns and lycophytes. We added six native species to the total of 31 found by St. John, and we found three species that have become naturalised since St. John was there. We revise the identification of several of those that he found, based on studying his specimens as well as our own, and we update nomenclature for many others to reflect current taxonomy. We conclude that 37 native and three naturalised pteridophyte species are confirmed for Rotuma, and two others may be present as natives based on unconfirmed reports. We discuss geographic relationships of the pteridophyte flora and note that at least four native species on Rotuma are not known from elsewhere in Fiji, but almost all Rotuman pteridophytes are known from Samoa. We speculate that additional pteridophytes remain to be found on Rotuma, and we note that declining coconut cultivation is leading to increased recovery of secondary forest on the island. Additionally, we confirm that the endemic angiosperm \textit{Cyrtandra rotumaensis} H. St.John [Gesneriaceae] persists on Rotuma.

Introduction
The island of Rotuma is politically part of Fiji but differs from the rest of that country in its distinct culture and language. It lies about 580 km north of the main Fijian archipelago, at 12.5° south of the equator. It is an isolated island with about 1600 inhabitants and a number of uninhabited offshore islets. Rotuma is situated about where the boundaries of Micronesia, Melanesia and Polynesia converge, with the main Fiji archipelago to the
south, Wallis & Futuna and Samoa to the east, Tuvalu to the north, the Solomon Islands to the west and Vanuatu to the south-west. It is about 13 km long and up to 4 km wide, with an area of about 47 square km. It has volcanic geology with many fairly small but steep hills, the highest of which is Mount Suelhof at 256 m. It has an equatorial climate with an annual rainfall of about 320 cm, falling throughout the year with slightly more in the summer months. Temperatures are mostly similar throughout the year, with minima of ~24°C and maxima of ~30°C (Weather and Climate.com). Despite major alterations to the original vegetation, Rotuma remains a place of great beauty with tropical wooded hills and pristine beaches (see Figure 1).

Surprisingly, only a small number of publications have addressed the flora of Rotuma, despite visits from a number of botanists (see St. John 1954, 1970a, 1970b, 1975; McClatchey et al. 2000). The island was excluded from the angiosperm floras of Fiji written by Parham (1964) and Smith (1979–1991) and from the Pteridophyte Flora of Fiji by Brownlie (1977). However, a detailed account of the ferns and lycophytes of Rotuma was published by St. John (1954), based on extensive plant collections there during a single two-month visit in 1938. He recorded 27 native ferns and four lycophytes on the island, and one species in cultivation. Bartram (1945) listed seven moss species for Rotuma including one newly described endemic, based on St. John’s collections from 1938. McClatchey et al. (2000) published a checklist of vascular plants of Rotuma, with a focus on Rotuman names, together with the moss species noted by Bartram (1945). The list is described as compiled from the authors’ own collections and available prior reports and collections. It includes three additional pteridophytes not listed by St. John.

*Figure 1.* A view looking east along the south coast of Rotuma from the summit of Kilinga (near Anmosega Point). Solnoku Island is visible to the right. June 2019.
(1954), but specimens are not cited and information documenting taxa on the island is not provided.

In June 2019, the first two authors of this report visited Rotuma, collecting and observing ferns and other plants. Specimen sets were returned to the South Pacific Regional Herbarium (SUVA) and to the United States at the University of California Berkeley Herbarium (UC), where A. R. Smith aided with and confirmed identifications.

Our collections included 26 native and three naturalised taxa as well as one specimen of uncertain identification that may be an addition. In addition, we examined specimens or online images of specimens collected by St. John and by later botanists to confirm or correct identifications. We combined the information obtained into a specimen-based checklist comprising all pteridophyte species collected from Rotuma that we know of, currently 37 accepted native and three naturalised species, and three possible additions based on an incomplete identification or undocumented reports. In the list, we update names to reflect current taxonomy, while including alternative names used by others.

**Materials and methods**

The first two authors of this report visited Rotuma from June 14th to 21st, 2019. Fieldwork was undertaken on five and a half days, during which we visited many places on the main island, including Afoa Bay, Huo, Itumuta Farm Road, Jarua, Kilinga, Lulu Beach, Maftoa Village, Motusa District, Mt. Paho, Paptea, Solroroa and Solmafua, as well as a region near the edge of the southeastern part of the offshore islet of Solkope. Many of these places are

![Figure 2. A map of Rotuma showing many of the places visited in June 2019.](image)
shown on the accompanying map (Figure 2). Due to weather and logistical issues, we were unable to visit the offshore island of Uea, which has the best-preserved Rotuman forest (St. John 1954). Observations were made and herbarium specimens were collected. Drying of specimens was completed after we returned to the South Pacific Regional Herbarium in Suva. Specimen sets were deposited at SUVA or returned to the United States and deposited at the University of California Berkeley Herbarium (UC) where they were additionally studied by A.R. Smith. Available duplicate specimens have been given to the National Tropical Botanical Garden (PTBG) on Kauai, Hawaii, and to the University of Vermont Herbarium (VT), at Burlington, Vermont (USA).

Separately, we examined at least one Rotuman herbarium specimen or high-resolution specimen image for each pteridophyte taxon collected on the island in 1938 by St. John (1954). Many of these specimens were examined at the UC herbarium, where St. John deposited duplicates. In taxa without UC duplicates, images were viewed online from other herbaria. We used online databases (Consortium of Pacific Herbaria 2019; GBIF.org 2019; Smithsonian Institution 2019) and other information to locate pteridophyte collections from Rotuma by other botanists. Critical taxonomic evaluation was done to confirm or correct the taxon identifications reported by St. John (1954) and others. In addition, the most recent accepted names for each taxon are substituted in the checklist for the earlier names where changes have occurred, mostly following generic and family assignments proposed by the Pteridophyte Phylogeny Group (PPG1 2016). St. John’s original names and other synonyms are also given. Information given about the ranges of Rotuman species outside Rotuma was obtained from our own knowledge and from literature, herbarium records (particularly UC), and online databases.

Results and discussion

In the checklist, we report a total of 37 native and three introduced pteridophytes from Rotuma. These numbers include *Angiopteris evecta* (G. Forst.) Hoffm. as native, although as noted below this may have been an introduction from mainland Fiji. We separately list two unconfirmed species that were reported for Rotuma by McClatchey et al. (2000), for which we have been unable to trace specimens. Also, a juvenile *Nephrolepis* collection (Game 19/071, UC) may represent an additional species. The native total includes 31 species that were reported by St. John based on his 1938 visit to the island, plus six additional species that we found during our visit in June 2019, including one, *Nephrolepis hirsutula* (G. Forst.) C. Presl, that was also listed by McClatchey et al. (2000). In addition to our new records, we collected 20 of the 31 species that St. John found, confirming that they are still present on the island. It is of little significance that we did not find the other 11 of St. John’s species, since we were on the island for only one week compared to eight weeks for St. John, and we were not able to visit all of his localities.

Of the six confirmed additions not found by St. John in 1938, four are broadly similar to other species on Rotuma in the same genus, and he may plausibly have encountered them but failed to recognise them as distinct. These are *Antrophyum callifolium* Blume, *Nephrolepis hirsutula* (G. Forst.) C. Presl, *Sphaerostephanos invisus* (G. Forst.) Holttum and *Tectaria dissecta* (G. Forst.) Lellinger. A fifth species, *Didymoglossum tahitense* (Nadeaud) Ebihara & K. Iwats, has small appressed peltate fronds and could have been mistaken
by St. John for a thallose liverwort. Only one new species in our six, *Bolbitis quoyana* (Gaudich.) Ching, is obviously distinct even to a non-specialist. We found this in only one place, and apparently St. John simply did not encounter it.

At least four native pteridophyte species and one variety on Rotuma are not known from elsewhere in Fiji. These include the possibly undescribed *Phlegmariurus* species represented by *St. John 19295* (BISH), and the ferns *Pneumatopteris rodigasiana* (T. Moore) Holttum, *Schizaea dichotoma* (L.) Sm. var. *sellingii* Fosberg, *Tectaria repanda* (Willd.) Holttum and *Tectaria stearnsii* Maxon. If *Bolbitis quoyana* (Gaudich.) Ching and *Bolbitis vanuaensis* Brownlie are maintained as separate taxa, then *B. quoyana* represents a sixth Rotuman taxon absent from mainland Fiji. The plant we list as *Microlepia aff. speluncae* (L.) T. Moore may also differ from taxa elsewhere in Fiji, and *Antrophyum plantagineum* (Cav.) Kaulf. plants from Rotuma are more similar in form to plants from Samoa than they are to plants of this variable species from elsewhere in Fiji. The different species composition doubtless reflects the distance (∼580 km) between Rotuma and the rest of Fiji. The species mentioned above provide an element that connects the pteridophyte flora to that of Samoa, ∼1080 km to the east, and to islands north and west of Fiji including Papua New Guinea, the Solomon Islands, Vanuatu and the Caroline Islands. All but two of the confirmed and unconfirmed native pteridophyte taxa known from Rotuma are also native to Samoa. The exceptions are *Tectaria repanda* (Willd.) Holttum, known from the Philippines, Indonesia, Papua New Guinea, Vanuatu, the Solomon Islands and extending east to Wallis & Futuna, and *Schizaea dichotoma* (L.) Sm. var. *sellingii* Fosberg, known from Micronesia (GBIF.org 2019).

It is likely that more pteridophytes remain to be found on Rotuma, given our additions plus the fact that many places on the island were not visited by us. It may be productive to visit the off-shore islet of Uea, since this is said to have the most intact vegetation on or adjacent to Rotuma (*St. John 1954*) and an elevation almost equal to that of the main island. Comparing the pteridophyte flora of Rotuma to that of other islands comparable in size, elevation, and tropical latitude, we might expect more than the 39 confirmed and unconfirmed species listed. Major disturbance of the original vegetation may have caused loss of some species from the island or may have simply confined remaining populations to small pockets, making their discovery there more difficult.

We note that on many parts of the island, secondary forest appears to be recovering and replacing former coconut plantations that are no longer actively managed. *St. John* (1954) reported that in 1938 more than ninety percent of the island was planted with coconut trees, but he remarked that ‘many of these areas were little worked or tended’ and suggested that they may be reclaimed by the native forest. McClatchey et al. (2000) reported that coconut growing had declined in importance over the years, and that human population pressures on Rotuma had decreased owing to heavy migration to other countries. Based on our 2019 observations, this trend is continuing, with residual coconut trees intermingled with secondary native vegetation in a number of places. We also observed the endemic angiosperm *Cyrtandra rotumaensis* H. St.John [Gesneriaceae] growing in two places, near Lulu Beach and on the southeast side of Solkope Island. At the latter location, there were at least many hundreds of individuals, including some in flower and fruit with many young plants and seedlings present. One of our guides, Janiva Tatino, reported also having seen this plant on Uea, one of the locations mentioned by *St. John (1970b)* from his 1938 visit.
Checklist of Rotuma Ferns and Lycophytes

The checklist is alphabetical by genus and species. We list native species first, followed by naturalised species and then reported species that we consider unconfirmed. The family is given in square brackets after each taxon name, using the family assignations given for each genus by the Pteridophyte Phylogeny Group (PPG1 2016). After this, the names used for the taxon by St. John (1954) and McClatchey et al. (2000) are given if they differ from ours, followed by the letters St. J. and/or McC in square brackets to denote these publications. We then indicate where the different name is also used by Brownlie (1977) or Brownsey and Perrie (2011) in their accounts of ferns of Fiji (which exclude Rotuma) by the letters B and/or B&P respectively. Where Brownlie (1977) or Brownsey and Perrie (2011) used names that differ from ours, St John’s and McClatchey’s, these are given next, also followed by B and/or B&P as appropriate.

For each taxon, we next list all numbered specimens (if any) cited by St. John (1954) based on his 1938 visit to Rotuma. St. John (1954) did not individually indicate the herbaria in which he deposited his specimens, but we list these herbaria when they are known to us, and indicate by an exclamation mark when we have examined a specimen or an online image of a specimen, in addition to summarising locality information from observations by St. John. Where St. John (1954) listed three or fewer localities where a species was observed but not collected, we list these, but simply summarise the number of such localities where there are more than three.

After this, for each taxon we list any other Rotuman specimens known to us apart from our own, followed by our own specimens and observations (if any) based on our 2019 visit, giving locality information and the herbaria where specimens have been deposited. Where GPS coordinates are given, they are based on the WGS84 datum. We do not give individual collection dates for St. John’s specimens or for our own, since all of his specimens were collected during a single visit in June to August 1938, and all of our specimens were obtained during a single week in June 2019. Individual dates are available on the specimen sheets. Finally, and if appropriate, in some cases we provide taxonomic discussion and notes on the distribution of taxa.

Apart from listing synonyms used, we have not included information from the paper by McClatchey et al. (2000) in our main checklist (but see “unconfirmed species” below this), since details of collections or observations are not given for the individual taxa listed there. We do cite McClatchey specimens that we know of in herbaria.

Lycophytes

*Palhinhaea cernua* (L.) Franco & Vasc. [Lycopodiaceae]

*Lycopodium cernuum* L. [St. J.; McC; B]; *Lycopodiella cernua* (L.) Pic.Serm. [B&P].

*St. John:* Jarua, 19251 (BRI; UC!; US image!).

*Phlegmariurus carinatus* (Desv. ex Poir.) Ching [Lycopodiaceae]

*Lycopodium carinatum* Desv. ex Poir. [St. J.; McC; B]; *Huperzia carinata* (Desv. ex Poir.) Trevis. [B&P].

*St. John:* Huo, 19299 (BRI; UC!; US image!); Pepjei, 19479; Solnahu Island, 19539; observed at Satarua.

*Phlegmariurus phlegmaria* (L.) Holub s. l. [Lycopodiaceae]
Lycopodium phlegmaria L. [St. J.; McC; B]; Huperzia phlegmaria (L.) Rothm. [B&P].
St. John: Huo, 19298 (BRI; BISH; US image!).

We note that P. phlegmaria in the Pacific is an unresolved complex and we treat it here in a broad sense.

Phlegmariurus sp. [Lycopodiaceae]
Lycopodium hamiltonii Spreng., misapplied [St. J.; McC].
St. John: Huo, 19295 (BISH image!).

We did not re-find this plant on Rotuma. A high-resolution image of the St. John specimen provided by Barbara Kennedy from the Bishop Museum, Hawaii, reveals that it differs from Phlegmariurus hamiltonii (Spreng.) Á. Löve & D. Löve, which is known elsewhere only from Asia. Ashley Field at the Australian Tropical Herbarium, James Cook University, Queensland, has studied the image and states (pers. comm. 2019) that it resembles a specimen from Samoa that probably represents an undescribed taxon in the same group as P. tetrastichoides (A.R. Field & Bostock) A.R. Field & Bostock from Australia.

Ferns

Acrostichum aureum L. [Pteridaceae].

St. John: Kilinga, 19095; Hoi, 19349; Solkope Island, 19705; Uea Island, 19661 (UC!); observed at seven other listed places.

In rocky soil just above the ocean just east of Sumara Point at GPS point 12° 31’ 1.4” S, 177° 1’ 42.6” E, Game 19/082 (UC; PTBG); Afoa Bay, just around cliff face from Fapufa Beach, Pene 19-036 (SUVA); observed at Afoa Bay (east); Paptea, ponds and swampy area near primary school; southeast side of Solkope Island.

Angiopteris evecta (G. Forst.) Hoffm. [Marattiaceae].
Angiopteris erecta (Forst.f.) Hoffm. [McC].
St. John: Paho, 19445 (BISH; US image!).

Lum, 4 Nov. 1991, W.C. McClatchey s.n. (SUVA): this specimen is listed as present at SUVA in the Consortium of Pacific Herbaria, but we have been unable to locate it there.

Although we are listing Angiopteris evecta as native, which is plausible based on suitable habitat and its wide distribution elsewhere, we note that St. John [1954] considered that it may well have been introduced from mainland Fiji, and stated in detailed notes that some islanders had thought it to be introduced. St. John stated that he saw it only once, and we did not find it during our visit.

Antrophyum callifolium Blume [Pteridaceae].
Antrophyum alatum Brack. [B; B&P].
Epiphytic on trees along the road to Fapufa Village, at GPS point 12° 30’ 53.26” S, 177° 1’ 50.81” E, Game 19/077 (UC; PTBG); loc. cit., Pene 19-030 (SUVA); Jarua, under canopy in secondary forest with former pig-retaining walls, Pene 19-038 (SUVA); epiphytic in secondary forest, Jarua, Game 19/098 (VT); observed at Huo, under canopy in secondary forest with former pig-retaining walls.

Antrophyum plantagineum (Cav.) Kaulf. [Pteridaceae].
St. John: Kilinga, 19051 (BRI image!; US image!); observed at 14 other listed localities, but St. John did not distinguish the two Antrophyum species that occur on Rotuma, so these observations are reliable to genus level only.
Epiphytic in forest along a trail off Itumuta Farm Road, within a hundred metres of GPS point 12° 30’ 3” S, 177° 1’ 30” E, *Game 19/067* (UC); epiphytic in secondary forest, Jarua, *Game 19/078* (UC); Kilinga, base of track to summit, *Pene 19-031* (SUVA); Solroroa, *Pene 19-046* (SUVA); observed on slope to summit of Kilinga and at Huo, under canopy in secondary forest with former pig-retaining walls.

These plants differ sharply from *A. callifolium* in having stipitate fronds typical of *A. plantagineum*, but the fronds are consistently narrower than *A. plantagineum* specimens from elsewhere in Fiji. They closely resemble specimens from Samoa that have been named *A. plantagineum ß angustatum* (Brack.) T. Moore (Index Filicum Part 5, p. 82, 1858), but given the variation in *A. plantagineum* in the Pacific, we believe that more research is needed before accepting this name as a valid taxon. Cheng-Wei Chen at the Taiwan Forestry Research Institute, Taipei, Taiwan has concluded based on DNA analysis from samples we supplied that *Game 19/067* and *19/078* from Rotuma are both well-nested in a clade with other *A. plantagineum* samples from Malesia and the Pacific (pers. comm. 2019). We note that the type specimen of *A. plantagineum* from Guam (*Chamisso s.n.*, (LE image!)) also has narrow fronds resembling our plants from Rotuma.

**Asplenium nidus** L. [Aspleniaceae].

*St. John*: Kilinga 19097 (BRI; UC!; US image!); Haau Meamea Island 19367; Solnahu Island 19605; Solkope Island 19693; observed at 16 other listed locations.

Itu’ti’u, 1994, W.C. McClatchey 735 (BISH; US image!).

Epiphytic in secondary forest near Lulu Beach at GPS point 12° 29’ 42” S, 177° 1’ 6” E, low elevation, *Game 19/070* (UC); at Lulu Beach, *Pene 19-022* (SUVA). Common, and also noted at Afoa Bay (east), on Kilinga (slope to summit) and on the southeast side of Solkope Island. We searched for but did not find the closely related species *A. australasicum* on Rotuma.

**Asplenium polyodon** G. Forst. [Aspleniaceae].

**Asplenium falcatum** Lam. [St. J.; McC].

**Asplenium adiantoides** (L.) C. Chr. [McC].

*St. John*: Fapufa, Itutiu District, 19111 (BRI; SUVA; UC!; US image!); Uea Island, 19640; observed at 12 other listed locations.

Epiphytic in forest along a trail off Itumuta Farm Road, probably within a hundred metres of GPS point 12° 30’ 3” S, 177° 1’ 30” E, *Game 19/069A* (UC; PTBG); on large log, Uptiu, Motusa District, *Pene 19-029* (SUVA); Kilinga, slope to summit, *Pene 19-033* (SUVA); observed at Jarua, under canopy of secondary forest with former pig-retaining walls; Huo, under canopy of secondary forest with former pig-retaining walls.

**Blechnopsis orientalis** (L.) C. Presl [Blechnaceae].

**Blechnum orientale** L. [St. J.; McC; B; B&P].

*St. John*: Kongai, 19157 (BISH; BRI; NL, image!; SUVA; UC!; US image!), reported as seen only at this locality.

**Bolbitis quoyana** (Gaudich.) Ching [Dryopteridaceae].

On sloping ground in dense forest near the ridge of Solroroa, estimated elevation ~ 150 m, *Game 19/086* (UC; PTBG); loc. cit., *Pene 19-044* (SUVA).

We observed this species at a single location with only a few individuals and did not find fertile material. We note *Bolbitis vanuaensis* Brownlie from mainland Fiji (Vanua Levu) is at least very similar and may be synonymous with *B. quoyana*. However, as noted by Brownsey and Perrie (2011), the taxa may differ in the width of the fertile
pinnae. If the taxa are distinct, it remains possible that the Rotuman plant is *Bolbitis vanuaensis*, but given the more widespread distribution of *B. quoyana*, and the lack of fertile material, we apply the latter name, which has priority.

**Crepidomanes humile** (G. Forst.) Bosch [Hymenophyllaceae].

*Crepidopteris humilis* (G. Forst.) Copel. [St. J.; McC]; *Trichomanes humile* G. Forst. [B; B&P].

*St. John*: Tuevessi, 19239; Solroroa, 19218 (UC!; US image!); Uea Island, 19645.

Epiphytic in forest, Itumuta District within 100 m of GPS point 12° 30' 3" S, 177° 1' 30" E, low elevation, *Game* 19/068 (UC); Jarua, under canopy in secondary forest with former pig-retaining walls, *Pene* 19-038 (SUVA); Huo, under canopy in secondary forest with former pig-retaining walls, *Pene* 19-042 (SUVA).

**Crepidomanes minutum** (Blume) K. Iwats [Hymenophyllaceae].

*Gonocormus minutus* (Blume) Bosch [St. J.; McC]; *Trichomanes saxifragoides* C. Presl [B]; *Trichomanes minutum* Blume [B&P].

*St. John*: Jarua, 19242 (BRI; UC!; US image!).

Reported by St. John as seen only once, we searched for this at Jarua but did not find it.

**Davallia solida** (G. Forst.) Sw. [Davalliaceae]

*St. John*: Solroroa, 19540; Uea Island, 19643; observed at 12 other listed locations.

Rotuma Island, W part of island, along the road to Losa just after Upu, 1987, L. Jonsson 2492 (UPS); Feavai, 9 Oct. 1991, W.C. McClatchey s.n. (SUVA): this specimen is listed as present at SUVA in the Consortium of Pacific Herbaria, but we have been unable to locate it there.

Near Maftoa Village, *Game* 19/090 (UC); Pögtotoka, Maftoa Village, *Pene* 19-051 (SUVA); observed on Kilinga (slope to summit); on Solroroa; and elsewhere, common on Rotuma.

Rotuman plants are typical *D. solida*. We did not see more finely dissected plants on Rotuma that are well known from elsewhere in Fiji and have been named *Davallia fejeensis* Hk.

**Didymoglossum tahitense** (Nadeaud) Ebihara & K. Iwats [Hymenophyllaceae].

*Trichomanes tahitense* Nadeaud [B; B&P].

On the trunk of a large tree in forest, Jarua, *Game* 19/083 (UC); Jarua, under canopy, secondary forest with former pig-retaining walls, *Pene* 19-037 (SUVA); also observed at Huo under canopy in secondary forest with former pig-retaining walls, and on the southeast slope of Solroroa.

**Diplazium harpeodes** T. Moore [Athyriaceae]

Athyrium polyanthes (Sol. ex Baker) Copel. [St. J.; McC]

*St. John*: Solroroa, 19216 (BRI; UC!; US image!), very rare, seen only once.

Terrestrial fern on sloping ground in dense forest near the ridge of Solroroa, estimated elevation about 150 m., *Game* 19/087 (UC; PTBG); loc. cit., *Pene* 19-048 (SUVA); not seen elsewhere. We note that the stipe colour in our specimens was grey in the living state, as commonly seen in the similar *D. melanocaulon* Brack., rather than the green colour more usual in *D. harpeodes*, but based on other features including the shape and length of the sori we construe Rotuman specimens to be *D. harpeodes*, with which St. John’s (1954) identification of *Athyrium polyanthes* is synonymous.

**Haploopteris elongata** (Sw.) E.H. Crane [Pteridaceae].
Vittaria elongata [St. J.; McC; B; B&P].

*St. John*: Kilinga, 19039, 19056 (BRI; US image!); Uea Island, 19639; observed at 11 other listed locations.

Rotuma Island, E part near Fapofa (sic), 1987, *L. Jonsson 2481* (UPS); Feavai, 9 Oct. 1991, *W.C. McClatchey 108* (BISH); the Consortium of Pacific Herbaria (2019) lists a *McClatchey s.n.* collection of *H. elongata* at SUVA from Feavai on 9 Sept. 1991 but we have been unable to locate this at SUVA.

Epiphytic in forest along a trail off Itumuta Farm Road at GPS point 12° 30′ 2.2″ S, 177° 1′ 31.4″ E, *Game 19/069* (UC); Kilinga, slope to summit, *Pene 19-034* (SUVA); observed at Jarua, under canopy of secondary forest with former pig-retaining walls; southeast side of Solkope Island; summit of Solroroa.

*Lindsaea agatii* (Brack.) Lehtonen & Tuomisto [Lindsaeaceae].

*Lindsaea ensifolia* Sw. [St. J.; McC]; *Lindsaea ensifolia* Sw. subsp. *agatii* (Brack.) K.U. Kramer [B].

*St. John*: Jarua, 19252 (BISH; BRI; SUVA; US image!); seen by St. John only there, not found by Game and Pene. St. John referred to this specimen simply as *L. ensifolia* Sw., but it was annotated as *L. ensifolia* subsp. *agatii* by K. U. Kramer in 1965. The name was subsequently published by Kramer (1967) and *St. John 19252* was cited as this by Kramer (1970). The taxon was raised to species status as *L. agatii* (Brack.) Lehtonen & Tuomisto in Lehtonen et al. (2010).

*Macrothelypteris torresiana* (Gaudich.) Ching [Thelypteridaceae].

*Lastrea torresiana* (Gaudich.) T. Moore [St. J.]; *Lastrea tenericaulis* (Hook.) Moore [McC]; *Thelypteris torresiana* (Gaudich.) Alston [McC].

*St. John*: Solroroa, 19219 (BRI; UC!; US image!); Solmatcha (sic), 19424.

Track to Solroroa (lower portion), *Pene 19-026* (SUVA); also observed near Itumuta Farm Road.

*Microlepia aff. speluncae* (L.) T. Moore [Dennstaeidtiaceae].

*Microlepia scaberula* Mett. ex Kuhn. [St. J.; McC].

*St. John*: Solroroa 19217; Pala, 19161 (NL image!; UC!; US image!); Kongai, 19154.

Further study is required to understand the taxonomy of *Microlepia* in the Pacific. We find that *St. John 19217* (UC) from Rotuma is more similar to Pacific specimens from elsewhere that have been construed as *M. speluncae* than it is to *M. scaberula* from French Polynesia. The Rotuman plant has hairs on the lamina between the veins, whereas these are lacking in French Polynesian *M. scaberula* specimens at UC. We agree with *St. John* (1954) that *St. John 19217* differs from plants elsewhere from Fiji and Samoa that have been called *M. speluncae* but we note that these mainland Fijian and Samoan plants differ from each other and from Asian material of *M. speluncae* at UC. Manton and Sledge (1954) determined that *M. speluncae sens. lat.* is a polyploid complex, and we construe the Rotuman plant as part of this larger complex.

*Nephrolepis hirsutula* (G. Forst.) C. Presl [Nephrolepidaceae].

Open swampy area at the edge of the playing field at the school at Paptea, *Game 19/097* (UC); loc. cit., *Pene 19-043* (SUVA).

This fern was not reported for Rotuma by *St. John* (1954) and appears to be much less common on the island than *N. obliterata*. It was listed for the island by McClatchey et al. (2000) without citing a specimen or other information. We note that *N. hirsutula* is
widespread in the Pacific and we identify our plant as this rather than the similar *N. brownii* (Desv.) Hovenkamp & Miyam.

*Nephrolepis obliterata* (R.Br.) J. Sm. [Nephrolepidaceae].

*Nephrolepis biserrata* (Sw.) Schott, misapplied [St. J., McC]; *Nephrolepis saligna* Carruth. [B].

*St. John*: Ututu, 19166 (BISH); Motusa, 19032 (BISH; BRI; UC!; US image!) Haau Meamea Island, 19386 (BISH); Solnahu Island 19351 (BISH); observed at 17 other listed localities.

Epiphytic near the summit of Solroroa, *Game 19/088* (UC; PTBG).

Although *St. John* (1954) identified his *Nephrolepis* collections from Rotuma as *N. biserrata*, the specimens he deposited at BISH were annotated as *N. biserrata* var. *saligna* by F. Miyamoto in 1986 (BISH online information accessed through GBIF 2019). We can find no valid publication of this name, but it has been used elsewhere (e.g. BRI, P. Bostock, pers.comm. 2020) for specimens currently construed as *N. obliterata*. The name *Nephrolepis saligna* Carruth. has also been previously applied to many *Nephrolepis* specimens now identified as *N. obliterata*, which is the older name. Hence Miyamoto’s identifications are consistent with our finding that both *St. John* 19032 (UC!) and *Game 19/088* (UC) are *N. obliterata* and not *N. biserrata*.

*St. John* (1954) stated that *Nephrolepis biserrata* was abundant on Rotuma. Similarly, we observed *Nephrolepis* plants in additional localities to our collections, including Kilanga; east Afoa Bay; Jarua; Solroroa; and the southeast side of Solkope Island. It is likely that most of these undocumented observations by *St. John* and by us were *N. obliterata*, but since at least *N. hirsutula* is also on Rotuma, it is possible that some of them were a different species.

We note that *Game 19/071* (UC), epiphytic climbing fern on a tree in secondary forest a few yards from Lulu Beach, is a juvenile, sterile *Nephrolepis* plant that may possibly represent a third Rotuman species in this genus.

*Ophioderma pendula* (L.) C. Presl [Ophioglossaceae].

*Ophioglossum pendulum* L. [St. J; B; B&P; McC].

*St. John*: Kilanga, 19085 (BISH); Huo, 19309 (BISH image!); observed at Tuevessi, Paho, and Satarua.


*Phymatosorus grossus* (Langsd. & Fisch.) Brownlie [Polypodiaceae].

*Phymatodes scolopendria* (Burm.) Ching, misapplied [St. J.]; *Phymatosorus scolopendria* (Burm.) Pic.Serm., misapplied [McC, but authority mis-stated there as (Burm.) Ching].

*Microsorum grossum* (Langsd. & Fisch.) S.B. Andrews [B&P].

*St. John*: Motusa, 19034 (BRI image!; SUVA!; UC!; US image!); Haau Meamea Island, 19387; Solnahu Island 19542; Uea Island 16668; observed at 14 other listed localities.

East-facing rocky headland, Itu’ti’u, 15 m, 21 Feb. 1994, *W.C. McClatchey 772* (BISH). Epiphytic on a tree near Maftoa Village, *Game 19/091* (UC); Pögtotoka, Maftoa Village, *Pene 19-051* (SUVA); observed on Kilanga (slope to summit), at forest margin at Jarua, southeast side of Solkope Island; Solroroa. We confirm *St. John*’s observation from 1938 that this fern is abundant on Rotuma.
The Rotuman plant is the widespread South Pacific species *Phymatosorus grossus*, and not *P. scolopendria*, with which *P. grossus* has often been confused (see Brownlie 1977). *Phymatosorus scolopendria* s.s. is a climbing fern with a thinner and much longer rhizome with different scale morphology and smaller, more separated fronds with fewer lateral pinna segments. We diverge from PPG1 (2016) taxonomy in retaining this plant in the genus *Phymatosorus* rather than placing it in *Microsorum*.

*Pneumatopteris rodigasiana* (T. Moore) Holttum [Thelypteridaceae].

*Cyclosorus rotumaensis* H. St.John [St. J.; McC]

*St. John:* Itumutu District, Pala, 19139 (BISH; BM image!; UC!; US image!); Uea Island, 19657 (NL image!).

In steep forest on the way to the ridge top of Solroroa 1/4–3/4 of way up, *Game 19/062* (VT); terrestrial in low-elevation forest near Lulu Beach, *Game 19/073* (UC), *19/074* (PTBG); Itumuta Farm Road on the way to Lulu Beach, *Pene 19-021* (SUVA).

*St. John* (1954) described this fern as a new *Cyclosorus* species endemic to Rotuma, but Holttum (1977) placed it in *Pneumatopteris* as a synonym of the more widespread *P. rodigasiana*.

*Psilotum nudum* (L.) P. Beauv. [Psilotaceae].

*St. John:* Huo, 19302 (BISH image!); Solnahu Island, 19594 (BISH); observed, Kilinga and Satarua.


*Pteris comans* G. Forst. [Pteridaceae].

*St. John:* Solkope Island, 19708 (BRI; UC!; US image!), not seen elsewhere.

Not found by Game and Pene, but only a small part of Solkope Island was visited.

*Pteris ensiformis* Burm.f. [Pteridaceae].

*St. John:* Kilinga, 19044 (BISH), 19069 (BISH; SUVA; UC!; US image!); Solnahu Island, 19537 (BISH); Solkope Island, 19717, 19725 (BISH); observed at six other listed places.

Terrestrial fern in forest near the ridge to Kilinga (on the west side of Hopmafau Bay), at GPS 12° 31′ 6.3″ S, 177° 1′ 59.9″ E, estimated elevation ~ 70 m, *Game 19/079* (UC); Kilinga, slope to summit, *Pene 19-032* (SUVA).

*Pteris pacifica* Hieron [Pteridaceae].

*St. John:* Kilinga, 19075 (BRI; UC!; US image!); Solnahu Island, 19548; Solkope Island, 19717; Uea Island, 19675; not observed elsewhere.

Terrestrial in secondary forest on the southeastern slope of Solroroa, 50–150 m, *Game 19/063* (UC); track to Solroroa (lower portion), *Pene 19-027* (SUVA); Jarua, forest margin, pasture, *Pene 19-040* (SUVA); also observed under canopy in secondary forest with former pig-retaining walls at Huo.

*Pteris tripartita* Sw. [Pteridaceae]

*St. John:* Kongai, Itutui District, 19153 (SUVA; UC!; US image!); Solkope Island, 19728; observed at six other listed places.

Found cut lying along the inland road in the middle of the island, Aug. 31 1989, Whistler 6985 (PTBG, image!).

In disturbed weedy habitat in a forest opening on Solroroa, estimated elevation ~ 115 m., *Game 19/064* (UC); also observed on level ground off the main road at Sauvaea.

*Schizaea dichotoma* (L.) Sm. var. *sellingii* Fosberg [Schizaeaceae].

*Schizaea dichotoma* (L.) Sm. [St. J.; McC]
St. John: Kilinga, 19068 (BISH); Tuevessi 19236 (BRI image!; BISH; US image!); reported at eight additional locations.

On a tuft cone at the west end of the island, Aug. 27 1989, Whistler 6971 (PTBG, image!).

West of Hopmafau Bay near the high point of Kilinga, ~ 70 m, Game 19/080 (UC); loc. cit., Pene 19-035 (SUVA); Huo, under a canopy in secondary forest with former pig-retaining walls, Pene 19-041 (SUVA); also observed at Jarua under canopy of secondary forest with former pig-retaining walls; and on the southeast slope of Solroroa.

Schizaea plants from Rotuma are smaller and more spindly than S. dichotoma specimens from elsewhere in Fiji. They match specimens from Micronesia at BISH, NY, and US to which the name Schizaea dichotoma var. sellingii has been applied (Fosberg 1950). The type is from Pohnpei, Fosberg 26422 (US, image!).

_Sphaerostephanos invisus_ (G. Forst.) Holttum [Thelypteridaceae]

Under trees, Solroroa, estimated elevation ~100 m, Game 19/076 (UC; PTBG); in forest in the vicinity of Lulu Beach, Game 19/072 (VT); also observed on Solroroa on lower part of track and near summit.

_Sphaerostephanos unius_ (L.) Holttum [Thelypteridaceae]

_Cyclosorus unius_ (L.) Ching [St. J.; McC].

St. John: Motusa 19054 (BRI; UC!; US image!); Solmatcha (sic) 19424; observed at 14 other listed localities, but we note that St. John did not distinguish between _S. unius_ and _S. invisus_.

Along track from Maftoa village towards Solroroa, Game 19/089 (UC); at Lulu Beach Pene 19-024 (SUVA); Sa’sina, Maftoa Village, Pene 19-049 (SUVA); observed at Paptea, ponds and swampy area at edge of playing field, primary school.

_Tectaria dissecta_ (G. Forst.) Lellinger [Tectariaceae].

Terrestrial in forest on the southeastern slope of Solroroa, estimated elevation about 175 m, Game 19/096 (UC); loc. cit., Pene 19-047 (SUVA). This species is superficially similar to _T. stearnsii_ and may have been overlooked by other collectors because of this. However, we found it at only one site and few plants were present.

_Tectaria repanda_ (Willd.) Holttum [Tectariaceae].

_Tectaria dimorpha_ H. St.John [St. J.; McC].

St. John: Kilinga, 19038 (BISH; BM image!; HUH image!; L; P image!; UC!; US image!); Hauatia Island (sic), 19410; Solnahu Island, 19533 (BISH); Solkope Island, 19718; Uea Island, 19672; also observed at Kongai, Solmatcha (sic), and Pepjei.

In disturbed secondary forest on the southeastern slope of Solroroa at or near 12° 29’ 44” S, 177° 1’ 37” E, elevation 124 m, Game 19/060 (UC); loc. cit. but lower elevation, Game 19/061 (PTBG); in shady forest near Lulu Beach (Itumutu District) at or near 12° 29’ 43” S, 177° 1’ 2” E, near sea level, Game 19/075 (UC); at Lulu Beach, Pene 19-023, (SUVA); also observed on Kilinga (slope to summit); Afoa Bay (east); Jarua, under canopy in secondary forest with former pig-retaining walls; Huo, under canopy in secondary forest with former pig-retaining walls; Sol Mafua; and southeast side of Solkope Island.

This is perhaps the signature fern of Rotuma (see Figure 3). We observed it in many forested sites throughout the island, in a few places almost forming an understory monoculture, with sterile fronds to 2 m long and less common but sharply differentiated fertile fronds. St. John (1954) described it as a new species, _Tectaria dimorpha_ H. St.John, known from Rotuma and the Admiralty Islands (Papua New Guinea). However, this was
synonymised with *Tectaria repanda* by Holttum. This is known from the Philippines through Indonesia to the Solomon Islands, Wallis and Futuna, and Vanuatu, but not known from elsewhere in Fiji or from Polynesia (Holttum 1991; GBIF.org 2019).

*Tectaria stearnsii* Maxon [Tectariaceae].

*St. John:* Tuevessi, 19137 (UC!; US image!); Kilinga, 19064 (BRI; UC!; US image!); Solkope Island, 19719; Uea Island, 19674; also observed at Solroroaa and Paho.

In forest along a trail off Itumuta Farm Road at GPS point 12° 30′ 2″ S, 177° 1′ 31.7″ E, *Game 19/066* (UC); track to Solroroaa (lower portion), *Pene 19-028* (SUVA); also observed at Lulu Beach; Afoa Bay (east); Sol Mafua; southeast side of Solkope Island; and under canopy of secondary forest with former pig-retaining walls at both Huo and Jarua.

**Naturalised species**

*Adiantum tenerum* Sw. [Pteridaceae].

*Adiantum capillus-veneris* L., misapplied [St. J.; McC].

*St. John:* Sumi, 19493 (BISH image!).

On a roadside bank in Maftoa Village, *Game 19/093* (UC); Pögtotoka, Maftoa Village, *Pene 19-053* (SUVA).

*St. John* (1954) stated that *A. capillus-veneris* was in cultivation on Rotuma in 1938, and seen only in the garden of the Roman Catholic Mission. Images of his specimen 19493 at...
BISH, kindly provided by Barbara Kennedy, show that it is the superficially similar species *A. tenerum*, native to the New World but naturalised elsewhere in Fiji. It is also naturalised in other parts of the Pacific, including in the Philippines, Indonesia, Papua New Guinea, Guam, Vanuatu and Tonga (GBIF.org 2019), and probably elsewhere in Fiji near Suva (P. Brownsey, pers. comm. 2020). It is likely that this species is the source for the McClatchey et al. (2000) unattributed inclusion of *A. capillus-veneris* in their list. We found *A. tenerum* to be sparingly naturalised along road banks in Maftoa Village.

**Nephrolepis** sp., cultivar [Nephrolepidaceae].

Naturalised along roadsides in Maftoa Village, *Game 19/092* (UC); Pögtotoka, Maftoa Village, *Pene 19-052* (SUVA).

This plant has frilly, pinnatifid pinnules and is clearly of horticultural origin, but we are not able to determine the species from which it was originally derived.

**Sphaeropteris lunulata** (G. Forst.) R.M. Tryon [Cyatheaceae].

*Cyathea lunulata* (G. Forst.) Copel. subsp. *vitiensis* (Carruth.) Holttum [B; B&P].

SSE of the village of Ahau, on the south side of the cone, Aug, 31 1989, *Whistler 6986* (PTBG image!). Identified as *Sphaeropteris* sp. by A.R. Smith in 2007, this specimen is incomplete but matches our own specimen of *S. lunulata* from Rotuma.

In sloping secondary forest on south side of Paho Mountain, *Game 19/085* (UC); also observed, probably planted, along the road south of Ahau.

Islanders state that this tree fern was introduced from elsewhere in Fiji several decades ago. It has become sparingly naturalised, and based on the Whistler 1989 collection cited, this may have occurred more than 30 years ago. *Game 19/085* (UC) matches the description of *Cyathea lunulata* subsp. *vitiensis* (Holttum 1964) but the combination for subsp. *vitiensis* has not been made in *Sphaeropteris*.

**Unconfirmed species**

*Cyclosorus interruptus* (Willd.) H.Ito [Thelypteridaceae].

McClatchey et al. (2000) included this fern in their checklist of Rotuman plants, but they indicate that no specimen was collected and give no information concerning locality or the source of information leading to its inclusion. The species is widely distributed in swampy habitats in the Pacific. While there are no large swamps on Rotuma, small swampy patches occur. We searched two of these, near Paptea Primary School. No *C. interruptus* was found but it is possible that it occurs elsewhere on the island.

**Dicranopteris linearis** (Burm. f.) Underw. [Gleicheniaceae].

This was included in the Rotuma list by McClatchey et al. (2000), but no specimen was cited and no location, date or source for the information was given. We have been unable to find a herbarium specimen in online databases or at UC. It has not been recorded on Rotuma by St. John or by us, but given its widespread distribution in the South Pacific, it could plausibly be there.

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No potential conflict of interest was reported by the author(s).

ORCID

Sarah Pene http://orcid.org/0000-0003-1824-0822

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