Journal of Bryology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/yjbr20

Additions and corrections to the bryophyte flora of Ghana, including a new species of *Cololejeunea* (Spruce) Schiffn. (Lejeuneaceae, Marchantiophyta)

Nick G. Hodgetts, Gabriel Ameka, Ransford Agyei & Christopher Dankwah

To cite this article: Nick G. Hodgetts, Gabriel Ameka, Ransford Agyei & Christopher Dankwah (2021) Additions and corrections to the bryophyte flora of Ghana, including a new species of *Cololejeunea* (Spruce) Schiffn. (Lejeuneaceae, Marchantiophyta), Journal of Bryology, 43:3, 251-258, DOI: 10.1080/03736687.2021.1921464

To link to this article: https://doi.org/10.1080/03736687.2021.1921464

Published online: 28 May 2021.

JOURNAL OF BRYOLOGY
2021, VOL. 43, NO. 3, 251–258
https://doi.org/10.1080/03736687.2021.1921464

Taylor & Francis
Taylor & Francis Group

Additions and corrections to the bryophyte flora of Ghana, including a new species of *Cololejeunea* (Spruce) Schiffn. (Lejeuneaceae, Marchantiophyta)

Nick G. Hodgetts[a], Gabriel Ameka[b], Ransford Agyei[c] and Christopher Dankwah[c]

[a]15 Earlish, Portree, Isle of Skye, UK; [b]Department of Plant and Environmental Biology, University of Ghana, PO Box LG55, Legon, Accra, Ghana; [c]A Rocha Ghana, Kaneshie, Accra, Ghana

ABSTRACT

Introduction. The bryophytes of Ghana are under-recorded, but the country has several important and relatively extensive examples of West African forest likely to support an interesting flora. Of these, Atewa Forest was targeted for survey in 2014, resulting in many records, including 58 taxa new to Ghana. This paper reports the results of further fieldwork, both in Atewa and elsewhere, in 2017, and makes some necessary additions and amendments to previously published data.

Methods. Bryophyte fieldwork was carried out in key forest sites in southern Ghana during November 2017, and was followed by targeted herbarium studies.

Key results. A new species, *Cololejeunea ankasica*, is described, and a new site for the rare Ghanaian endemic *C. calcarata* reported; a further 27 taxa new to Ghana are recorded, and amendments made to previously published information.

Conclusions. This study shows that even lowland areas of remaining forest in Ghana are bryologically interesting and that bryophytes are an important but still under-recorded part of Ghana's biodiversity. It also strengthens the case for National Park status for Atewa Forest, which remains the only known site in Ghana for many species characteristic of higher altitude forest.

ARTICLE HISTORY
First Published Online 28 May 2021

KEYWORDS
Africa; *Cololejeunea*; Ghana; liverworts; mosses

Introduction

In 2014, a team comprising NGH and staff from the University of Ghana and the conservation charity A Rocha Ghana made bryophyte collections in Atewa Forest in south-eastern Ghana (Hodgetts et al. 2016). In November 2017, more investigations were carried out in and around Atewa Forest (Eastern Region), in and near Ankasa Forest (Western Region), in and near Kakum Forest (Central Region), and at the Aburi Botanical Gardens near Accra. Herbarium specimens in the Ghana Herbarium, Department of Plant and Environmental Biology, University of Ghana (GC), and the Royal Botanic Garden Edinburgh (E), as well as a collection made by Michael Lüth in 1998, were also examined. These studies led to several new and interesting species being discovered for Ghana, and also to some necessary amendments to the information published by Hodgetts et al. (2016).

The relevant species are listed below, with taxa new to Ghana marked with an asterisk (*). All were collected in November 2017 unless otherwise specified. Specimens *numbered* are lodged in the personal herbarium of NGH, at E and GC, with some duplicates in EGR. There are still many specimens, especially pleurocarpous mosses, requiring further work.

LIVERWORTS

Aneuraceae

Aneura latissima Spruce; specimens collected in 2014 (*9039*, *9043*) were previously assigned to *Aneura pseudopinguis* (Herzog) Pócs (Hodgetts et al. 2016) but have been renamed following Gradstein (2013) and Reeb and Gradstein (2020). This is now considered the only species of *Aneura* recorded in West Africa.

Riccardia angusticosta (Steph.) Grolle; specimens collected in 2014 (*9034*, *9041*) were previously assigned to *Riccardia amazonica* (Spruce) Schiffn. ex Gradst. & Hekking (Hodgetts et al. 2016) but have been renamed following Reeb and Gradstein (2020).

Riccardia longispica (Steph.) Pearson; specimens collected in 2014 (*9035–9038*, *9042*) were previously assigned to *Riccardia limbata* (Steph.) E.W.Jones (Hodgetts et al. 2016) but have been renamed following Reeb and Gradstein (2020). This and *R. angusticosta* are now the only two species of *Riccardia* Gray known in Ghana (and West Africa in general, with the exception of Cameroon, where *R. inconspicua* (Steph.) Reeb & Bardat and *R. saccatiflora* (Steph.) S.W.Arnell have been recorded).

Lejeuneaceae

***Caudalejeunea lehmanniana** (Gottsche) A.Evans; Western Region, Ankasa Forest near Ankasa Gate,

CONTACT Nick G. Hodgetts nick1901@hotmail.co.uk

Published online 28 May 2021

5.21640°N, 2.65003°W (*10007*), Bamboo Cathedral, 5.28339°N, 2.64091°W (*10058*), 5.24755°N, 2.64110°W (*10040*) and Forestry Commission HQ, 5.27511°N, 2.72899°W (*9923*), 40–80 m a.s.l., epiphyllous on trees and shrubs, and epiphytic on branches in forest canopy. West African plants were originally described as *Caudalejeunea tricarinata* E.W.Jones (Jones 1953), but this name was placed into the synonymy of the American *C. lehmanniana* by Schuster (1980). However, African material does differ in some respects from American material (Wigginton 2004), and further study to test the synonymy would be useful.

Cololejeunea ankasica N.G.Hodgetts, ***sp. nov***. (Figure 1)

Diagnosis. Similar in size and general appearance to *Cololejeunea zenkeri* (Steph.) E.W.Jones and *C. obliqua* (Nees & Mont.) Schiffn. in having a strongly crenulate to sharply serrulate dorsal lobe margin and a large lobule 1/4–1/3 the lobe length, but distinct in the apiculate leaf lobes and the compressed perianth with four keels (two lateral and two ventral), all strongly serrulate throughout their length with strongly mamillose and protuberant cells.

Type. Ghana, Western Region, Ankasa Forest, near Bamboo Cathedral, epiphyllous on forest shrubs with *Caudalejeunea africana* (Steph.) Steph., 5.28891°N, 2.64071°W, ca 100 m a.s.l., 15 November 2017, *N.G. Hodgetts 10068*. Holotype: E; isotypes: EGR, GC. Additional specimen seen: Track from Ankasa Gate to Bamboo Cathedral, epiphyllous on palm fronds, 5.24755°N, 2.64110°W, ca 75 m a.s.l., 14 November 2017, *N. G. Hodgetts 10045a*.

Description. Plants pale green, translucent, sparsely branched (*Lejeunea*-type branching), up to 10 mm long and 0.4–0.7 mm wide. Stems 40–60 µm in diameter; cortical cells 5, 20–25 µm × 12–24 µm in cross-section, medullary cells 1, ca 18 µm wide. Rhizoids in small colourless bundles beneath each leaf base. Leaves ± continguous, spreading (ca 60–90° from stem), the lobes ovate, apiculate, 600–900 µm long × 300–550 µm wide, with dorsal margin crenulate to sharply serrulate with conically protruding cells; ventral margin mostly entire, with occasional low, obtusely protruding cells; lobe apex rounded but ending in a small but distinct and sharp apiculus of 1 (or 2) cells; mid-leaf cells 22–38 µm long × 17–30 µm wide, with medium-sized trigones and intermediate thickenings; most cells completely smooth, those near apex and upper lobe margins occasionally conically mamillose; marginal cells smaller, ±quadrate, 12–25 µm, at least those on dorsal margin ± conically protuberant; 2–5 cells at centre of leaf base elongate, up to ca 75 µm long, although scarcely forming a vitta. Lobule ovate, 1/4–1/3 lobe length (or slightly larger, but not reaching 1/2 the lobe length), ± inflated, not pressed flat against lobe distally; apical tooth 1 or 2 cells long, with hyaline papilla ental at base of tooth, and obscured by it; proximal tooth reduced to a single bluntly triangular cell, separated from apical tooth by 1 or 2 cells; cells 25–38 µm long × 12–18 µm wide, smooth, except cells on keel sometimes conically mamillose.

Autoicous; androecia in 2–5 pairs, on short lateral branches or on main shoots, bracts resembling the leaves but with larger, more inflated lobules; gynoecia on short side branches, with a single innovation; female bracts smaller than leaves, lanceolate, crenulate or serrulate with conically protruding cells at margin; perianth 650–800 µm long, obcordate, compressed, dorsally plane, ventrally ± bicarinate; lateral keels sharp; all keels crenulate to sharply serrulate with cells strongly mamillose and protuberant, other perianth cells smooth to ± conically mamillose; beak distinct, 2 or 3 cells long. Sporophyte globose, exserted; spores not seen.

Notes. *Cololejeunea ankasica* is probably part of the complex of species that includes *C. zenkeri*, *C. obliqua* and *C. cuneifolia* Steph. The combination of the apiculate leaf lobe, the relatively strongly serrulate dorsal lobe margin, the lobule 1/4–1/3 the lobe length and the perianth shape distinguish *C. ankasica*. Perhaps closest to *C. obliqua*, *C. ankasica* differs further from that species in its more arched dorsal leaf lobe margin and its larger lobule. However, the relationship between these species is probably complicated, and molecular work will be needed to clarify it. *C. ankasica* may also be close to *C. apiculata* (E.W.Jones) R.M.Schust. and *C. lanceolata* E.W.Jones, but the lobule and perianth shape are different in both those species. The lobule structure is similar to that of *C. hildebrandii* (Austin) Steph., but that species has differently shaped leaves and perianths and lacks the crenulate or serrulate dorsal leaf margin of *C. ankasica*.

Cololejeunea calcarata E.W.Jones; Western Region, Ankasa Forest, from Ankasa Gate to Bamboo Cathedral, 5.24755°N, 2.64110°W (*10036a*) and 5.23667°N, 2.64081°W (*10049a*), 75–95 m a.s.l., epiphyllous on palm fronds, trees and lianas in forest. This is a second site globally for this rare Ghanaian endemic, described from Subri Forest Reserve by Jones and Harrington (1983), highlighting the importance of Forest Reserves for rare and threatened bryophytes.

Cololejeunea capuronii Tixier; Eastern Region, Atewa Forest, pool above Dokyi, 6.12861°N, 0.63278°W (*8687*), 750 m a.s.l., epiphyllous, 17 March 2014. After initially thinking that this specimen might represent a new species (and reported as *Cololejeunea* sp. in Hodgetts et al. 2016), it was eventually noticed that it was identical to *C. capuronii*, photographed in Fischer (2013). Further investigation by NGH and Tamás Pócs confirmed this view, and the specimen was named

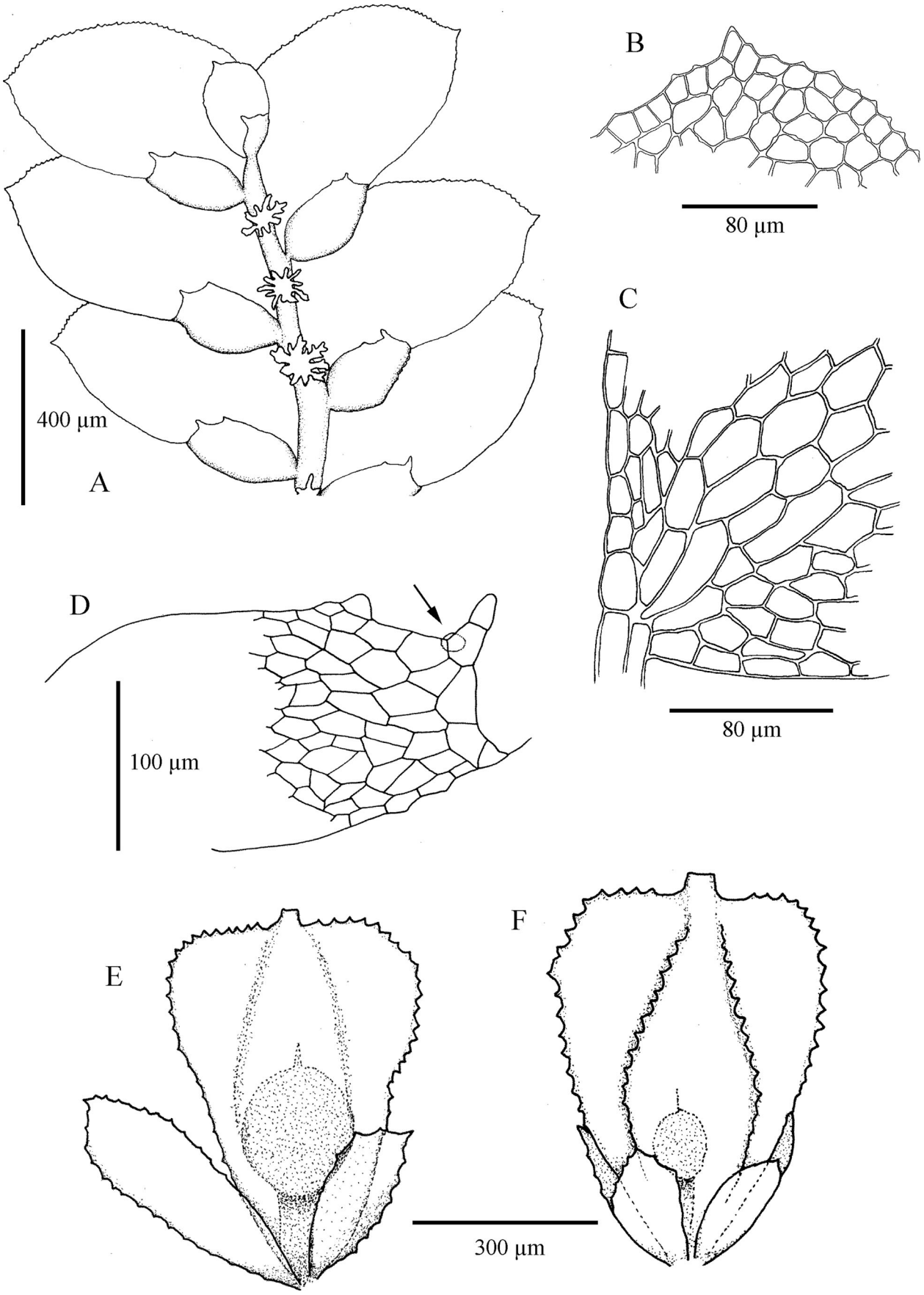

Figure 1. Cololejeunea *ankasica* N.G.Hodgetts. (A) Ventral view of portion of shoot. (B) Leaf lobe apex. (C) Leaf lobe base, showing elongate cells. (D) Lobule, showing position of hyaline papilla at base of apical tooth (arrowed), and small proximal tooth. (E) Dorsal view of perianth. (F) Ventral view of perianth. Drawn from the type, *N. G. Hodgetts 10068*.

accordingly. New to West Africa, and known otherwise only from Rwanda and Madagascar, but very small and easy to overlook, so probably more widespread.

Cololejeunea jamesii (Austin) M.E.Reiner & Pócs; Eastern Region, Atewa Forest, Sagyimase waterfalls, 6.24738°N, 0.53278°W (*9628*), 390 m a.s.l., epiphytic on shoots of *Racopilum* P.Beauv., *Pelekium* Mitt. and *Porotrichum* (Brid.) Hampe on liana by waterfalls. New to West Africa. *Conf*. T. Pócs. Also recorded from Kenya, Rwanda, Tanzania and Uganda.

Cololejeunea occidentalis (E.W.Jones) Vanden Berghen; Western Region, Ankasa Forest between Ankasa Gate and Bamboo Cathedral, 5.24755°N, 2.64110°W (*10038a*), 75 m a.s.l., epiphyllous on small shrubs in forest. One small specimen was collected, and it agrees moderately well with a specimen of *Cololejeunea occidentalis* from Malawi, although it is small and the hyaline margin of the leaf lobe is only rather weakly fimbriate. Principally a species of eastern and southern Africa, otherwise known in West Africa only from Nigeria.

Dibrachiella elobulata (Steph.) X.Q.Shi, R.L.Zhu & Gradst. [*Archilejeunea linguifolia* Steph.]; Central Region, Nimere River, near Akoform and Akwekrom, 5.27760°N, 1.30236°W (*10218*), ca 50 m a.s.l., on riverside rocks; Kakum River, near Akwekrom and Nkwantana, 5.28003°N, 1.28668°W (*10220*), 5.28011°N, 1.28651°W (*10225*), 55–75 m a.s.l., on periodically submerged riverside rocks, tree bases and exposed tree roots in several places along river. Widespread but not commonly collected in sub-Saharan Africa, but probably often overlooked.

Dibrachiella jonesii (Vanden Berghen) X.Q.Shi, R.L.Zhu & Gradst. [*Archilejeunea jonesii* Vanden Berghen]; Western Region, Ankasa Forest near Ankasa Gate, 5.21684°N, 2.65197°W (*9991*), ca 55 m a.s.l., epiphyllous on trees and shrubs in forest. Also recorded from Côte d'Ivoire, Nigeria, Equatorial Guinea (Rio Muni) and the Central African Republic.

Lejeunea cyathearum E.W.Jones; Central Region, Kakum Forest reception area, 5.34888°N, 1.38374°W (*10144*, *10199*), ca 145 m a.s.l., epiphytic on palm tree in tourist reception area. New to West Africa. Also known from DRC, Rwanda, Tanzania, Uganda, Malawi and Comoros, but 'probably more widespread' (Wigginton 2004). Originally collected from *Cyathea* Sm. tree ferns, this species has a much wider ecological amplitude, having also been found on bamboo stems and shady earth banks (Pócs 1993), and rotten logs and tree bases (Enroth et al. 2019).

Spruceanthus abbreviatus (Mitt.) X.Q.Shi, R.L.Zhu & Gradst. [*Archilejeunea abbreviata* (Mitt.) Vanden Berghen]; Eastern Region, Atewa Forest, summit ridge, 6.23747°N, 0.55875°W (*9752*), ca 800 m a.s.l., on fallen branch; all the specimens reported as *Archilejeunea abbreviata* in Hodgetts et al. (2016) that have been re-examined (*8572–8574*, *8576*, *8577*) are *Dibrachiella autoica* (Vanden Berghen) X.Q.Shi, R.L.Zhu & Gradst. [*Archilejeunea autoica* Vanden Berghen]. Apparently widespread in sub-Saharan Africa, but some specimens may need redetermination.

Thysananthus humilis (Gottsche) Sukkharak & Gradst. [*Mastigolejeunea humilis* (Gottsche) Schiffn.]; Western Region, Ankasa Forest near Forestry Commission HQ and Ankasa Gate, 5.27985°N, 2.73596°W (*9965*, *9967*), 5.29014°N, 2.63973°W (*10087a*), 50–65 m a.s.l., epiphytic on tree trunks and in concrete culvert; Eastern Region, near Dompem, 6.17215°N, 0.63084°W (*9758*) and Sagyimase, 6.23011°N, 0.52489°W (*9666*), 230–440 m a.s.l., epiphytic on cocoa trees in plantations. Widespread in sub-Saharan Africa.

Lepidoziaceae

Telaranea diacantha (Mont.) J.J.Engel & G.L.Merr.; the specimen collected in 2014 (*8847*) was previously assigned to *Telaranea coactilis* (Spruce) J.J.Engel & G.L.Merr. (Hodgetts et al. 2016). This was re-examined and compared with specimens in E, along with further specimens collected in 2017 (*9680*, *9794*, *10001*). Ghanaian material conforms to *T. diacantha* in that the leaf lobes are 4–6 cells long, and the cells are relatively long and narrow (*T. coactilis* has leaf lobes 8–10 cells long with the cells relatively short and wide). However, the cells are also thin-walled and bulging, with constrictions at the cell junctions, and thus resemble the related neotropical species *T. sejuncta* (Ångstr.) S.W.Arnell, albeit with shorter leaf lobes. Furthermore, the Ghanaian material is clearly different from *T. diacantha* specimens from Madagascar, which conforms very well to the description in Engel and Merrill (2004). Pócs (1984) treats *T. coactilis* and *T. diacantha* as synonymous (under *Arachniopsis diacantha* (Mont.) Howe), and also comments, '*Arachniopsis capillacea* Steph. presents a transitional form between the two varieties, previously known as *A. diacantha* and *A. coactilis*. Both varieties and transitions occur within the whole range of distribution, being widespread in tropical Africa, South Africa, Madagascar and in the Mascarenes.' It therefore seems likely that the Ghanaian material represents this transitional form, which is not easily assigned to either of the taxa recognised by Engel and Merrill (2004) but can be accommodated in the broader interpretation of *T. diacantha* proposed by Pócs (1984). Alternatively, it could represent a third species, but there is clearly further work to do on African *Telaranea* before a firm conclusion can be reached.

Telaranea redacta (Steph.) J.J.Engel & G.L.Merr.; specimens collected in 2014 (*8843–8846*) were previously assigned to *Telaranea nematodes* (Gottsche ex Austin) M.Howe (Hodgetts et al. 2016). However, on re-examination and comparison with herbarium

specimens, all appear to be *T. redacta*, which was first listed for Ghana (identified from material collected by P. W. Richards in Atewa Forest) by Engel and Merrill (2004). It is therefore doubtful whether *T. nematodes* has been correctly reported from Ghana.

Ricciaceae

***Riccia discolor** Lehm.; Greater Accra Region, Legon, University Plant & Environmental Biology Dept., 5.65409°N, 0.18655°W (*10262*, *10263*), ca 95 m altitude, on bare compacted soil in lawn, with *Riccia congoana* Steph. Widespread in sub-Saharan Africa.

MOSSES

Archidiaceae

***Archidium ohioense** Schimp. ex Müll.Hal.; Greater Accra Region, Legon, University Plant and Environmental Biology Department, 5.65409°N, 0.18655°W (*10261*), ca 95 m a.s.l., on bare compacted soil in lawn, with *Riccia* L. spp. Widespread in sub-Saharan Africa.

Bartramiaceae

Philonotis mniobryoides** Broth. var. ***mniobryoides; Western Region, Kakum Forest, 5.34888°N, 1.38374°W (*10142*), ca 145 m a.s.l., epiphytic on palm tree in tourist reception area; Eastern Region, Atewa Forest, Sagyimase waterfalls, 6.24738°N, 0.53278°W (*9620*), ca 390 m a.s.l., on rocks by waterfalls. Endemic to West and Central Africa.

Calymperaceae

***Syrrhopodon disciformis** Dusén; Western Region, Ankasa Forest near Forestry Commission HQ, 5.27511°N, 2.72899°W (*9953*), 5.27736°N, 2.73459°W (*9887*), 5.27433°N, 2.71994°W (*9962*), Ankasa Gate, 5.21640°N, 2.65003°W (*10005*), and Bamboo Cathedral, 5.28619°N, 2.64168°W (*10061a*), 5.27754°N, 2.64503°W (*10086a*), 40–90 m a.s.l., epiphytic on various trees (including cocoa plantations); Green Palm Lodge, Elubo, 5.29001°N, 2.75437°W (*9875*), 25 m a.s.l., on shrub in hotel garden; Central Region, Kakum Forest, 5.34753°N, 1.38312°W (*10257*), ca 135 m a.s.l., epiphytic on planted *Synsepalum dulcificum* (Schumach. & Thonn.) Daniell shrubs by guest lodge; Eastern Region, near Dompem, 6.17215°N, 0.63084°W (*9781*), ca 230 m a.s.l., on cocoa trees in roadside plantation. Most specimens conf. or *det.* L.T. Ellis. Uncommon but possibly overlooked in West and Central Africa.

Fissidentaceae

Fissidens dasyphus Welw. & Duby; previously reported (Hodgetts et al. 2016) from Atewa Forest as *Fissidens weirii* Mitt. (*8822*, *8823*), and also collected there in 2017 (*9633*, *9647*), as well as in Ankasa Forest (*10059*), Kakum Forest (*10162*, *10221*, *10244*, *10256*) and Aburi Botanical Gardens (*10136*). This species was removed from synonymy with *F. weirii* by Diop et al. (2018).

***Fissidens diaphanodontus** (P.de la Varde) Bizot; Eastern Region, Atewa Forest, above Sagyimase, 6.23194°N, 0.55093°W (*9674*), ca 640 m a.s.l., on tree trunk in forest. *Det.* M.A. Bruggeman-Nannenga. This species, described and illustrated by Potier de la Varde (1951) as *Moenkemeyera diaphanodonta* P.de la Varde, is similar to *Fissidens punctulatus* Sande Lac. but elimbate. New to West Africa, recorded elsewhere from Central African Republic and Tanzania.

***Fissidens harringtonii** Brugg.-Nann.; Central Region, Kakum River, near Nkwantana, 5.28011°N, 1.28651°W (*10223a*), ca 55 m a.s.l., on riverside banks and rocks below bamboo stand. An aquatic species otherwise known only from the type collection from Sierra Leone (Bruggeman-Nannenga 2005).

***Fissidens usambaricus** Broth.; Eastern Region, Atewa Forest, Sagyimase waterfalls, 6.24738°N, 0.53278°W (*9632*), ca 390 m a.s.l., on soil bank near waterfall. Widespread in sub-Saharan Africa.

Hypnaceae

All Ghanaian material of *Vesicularia* (Müll.Hal.) Müll.Hal. collected in 2014 and 2017 was re-examined in the light of studying a wide range of herbarium specimens, mainly in E. This has resulted in the following determinations and redeterminations.

Vesicularia galerulata (Duby) Broth.; Central Region, Kakum Forest, near reception area, 5.35692° N, 1.38789°W (*10167*), ca 200 m a.s.l., epiphytic on shrubs and lianas; Nimere River, between Akroform and Akwekrom, 5.27760°N, 1.30236°W (*10217a*), ca 50 m a.s.l., on riverside rocks. Several specimens collected in Atewa Forest in 2014 have also been confirmed as this species, including from the narrow forest 'neck' from Akimapapam–Larbikrom, 6.17095°N, 0.60866°W (*8966*), above Dokyi, 6.12861°N, 0.63278°W (*8968*), and Sagyimase, 6.23278°N, 0.54986°W (*8962*), 440–680 m a.s.l., epiphytic and on dead wood and soil. Specimens are characterised by the strong differentiation between stem and branch leaves, the ovate-lanceolate stem leaves tapering gradually to a long, fine, weakly toothed acumen, the branch leaves much shorter; and the mid-leaf cells of the stem leaves averaging 70–90 × 20–25 µm.

Vesicularia ischyropteris (Broth.) Müll.Hal.; Western Region, Ankasa Forest, nr. Bamboo Cathedral, 5.28674° N, 2.64226°W (*10052*), ca 90 m a.s.l., epiphytic on exposed tree root; Eastern Region, Atewa Forest, above Sagyimase, 6.23219°N, 0.55308°W (*9682*), ca 670 m a.s.l., on felled log. Very similar to *Vesicularia galerulata* (see Hedenäs and Watling 2005), and perhaps conspecific, but with stem leaves tapering more abruptly to the long fine acumen, and mid-leaf cells narrower, averaging 12–15 µm wide. *V. tenuatipes* (Müll.Hal.) Broth. seems to be very

similar to *V. galerulata* and *V. ischyropteris*, apparently differing only in its entire acumen.

Vesicularia nigeriana Broth. & Paris; Central Region, Kakum River, near Nkwantana, 5.28011°N 1.28651°W (*10226*), ca 55 m altitude, on periodically submerged rocks in river; Eastern Region, Atewa Forest, several localities, including Tete, 6.21040°N, 0.55197°W (*8963*), swamp forest above Bomaa, 6.27299°N, 0.55354°W (*8964*), and above Sagyimase, 6.24690°N, 0.55598°W (*8969*), 290–700 m a.s.l., on rocks and rotten wood by waterfalls. These include revised records from March 2014, previously reported as *Vesicularia galerulata* (Hodgetts et al. 2016). These specimens have little differentiation between stem and branch leaves, both being asymmetrical, ± oval and apiculate or very shortly acuminate, with the mid-leaf cells of the stem leaves averaging 50–70 µm long. *V. glaucula* (Broth.) Broth. is apparently very similar but with symmetrical leaves.

Vesicularia oreadelphus (Broth.) Broth.; Western Region, Ankasa Forest, near Forestry Commission HQ, 5.27792°N, 2.73590°W (*9882*) and 5.27473°N, 2.71894°W (*9959*), ca 65 m a.s.l., epiphytic on tree trunk in secondary forest and on rocks by stream; Eastern Region, Atewa Forest, between Akimapapam and Larbikrom, 6.17032°N, 0.60446°W (*8965*), ca 490 m a.s.l., on dead tree trunk. The latter is a revised record from March 2014, previously reported as *Vesicularia galerulata* (Hodgetts et al. 2016). There is little differentiation between stem and branch leaves, both being lanceolate or narrowly lanceolate and tapering to a very long, fine acumen; the mid-leaf cells of the stem leaves average 80–120 µm long and are up to ca 15 µm wide.

Vesicularia soyauxii (Müll.Hal.) Broth.; Eastern Region, Atewa Forest, above Sagyimase, 6.24641°N, 0.53287°W (*9657*), ca 390 m a.s.l., on rotting log in forest. Very close to *Vesicularia oreadelphus* but the leaves are slightly wider, with the mid-leaf cells of the stem leaves up to ca 20 µm wide.

Notes. There is considerable variation in morphology between these specimens of *Vesicularia*, but whether the differences observed represent different species is another matter, and the assigned names must therefore be regarded as provisional. There are almost certainly too many names in African *Vesicularia*, and a taxonomic revision is required.

Meteoriaceae

Floribundaria vaginans (Welw. & Duby) Broth.; Eastern Region, Aburi Botanical Gardens, 5.85138°N, 0.17277°W (*10102*), ca 460 m a.s.l., epiphytic on Spanish cedar *Cedrela odorata* L. Widespread in in central and eastern Africa but apparently rare in West Africa.

Pilotrichaceae

Hypopterygium tamarisci (Sw. ex Sw.) Brid. ex Müll.Hal.; Eastern Region, Atewa Forest, above Appampatia, 6.23785°N, 0.59400°W (*9790a*), 6.23774°N, 0.59276°W (field record – no specimen), and Sagyimase waterfalls, 6.24738°N, 0.53278°W (*9614*), 390–435 m a.s.l., on rocks by streams and waterfalls. A widespread pantropical species.

Pottiaceae

Chionoloma hyalinoblastum (Broth.) S.Alonso, M.J.Cano & J.A.Jiménez; Eastern Region, Atewa Forest, summit ridge, 6.24301°N, 0.55623°W (*9738*), ca 850 m a.s.l., on rotten log. This species was transferred to *Chionoloma* Dixon by Alonso et al. (2019), who considered *Trichostomum calymperaceum* Broth. & Paris, *T. ligulaefolium* (Broth. & Paris) R.H.Zander and *T. lorifolium* Broth. & Paris to be synonyms. Widespread in sub-Saharan Africa.

Hydrogonium orientale (F.Weber) Kučera [*Barbula indica* (Hook.) Spreng. in Steud.]; Western Region, Green Palm Lodge, Elubo, 5.29001°N, 2.75437°W (*9873*), 25 m a.s.l., on ground in hotel garden; Eastern Region, Kibi, 6.15651°N, 0.55206°W (*9866*), ca 300 m a.s.l., on breeze blocks by road in town. This species was transferred from *Barbula* Hedw. to *Hydrogonium* (Müll.Hal.) A.Jaeger by Kučera et al. (2013). It is a common ruderal species throughout the tropics and subtropics.

Pylaisiadelphaceae

Taxithelium homalophyllum (Mitt.) Broth.; Central Region, Kakum Forest, north of reception area, 5.35569°N, 1.38121°W (*10152*, *10182*, *10192a*), ca 180 m a.s.l., epiphytic on tree trunks and lianas and on wet rocks by river; Eastern Region, Atewa Forest, above Appampatia, 6.23774°N, 0.59276°W (*9816*), ca 445 m a.s.l., epiphytic on lianas over waterfalls; Potroase, Birim-Kenseng stream, 6.11491°N, 0.59542° W (*9033*), ca 450 m altitude, on rock (the latter from March 2014). This species was collected earlier by G. Ameka (Western Region, downstream of bridge on Ankasa River, on road to Game and Wildlife Camp in Ankasa FR, 5°13′N, 2°39′W, ca 15 m a.s.l., on rock in river, 19 February 1995, *G. Ameka 209*, herb. E), and identified by C. C. Townsend as *Taxithelium compressicaule* Broth. *T. glabriusculum* Broth. and *T. compressicaule* are now both considered synonyms of *T. homalophyllum* (Câmara 2011).

Taxithelium ramivagum Broth.; Western Region, Ankasa Forest, near Forestry Commission HQ, 5.27665°N, 2.73173°W (*9888*), 5.27433°N, 2.71994°W (*9960*), and between Ankasa Gate and Bamboo Cathedral, 5.24755°N, 2.64110°W (*10046*), 50–75 m a.s.l., epiphytic on trees and shrubs in forest. Widespread in

West Africa.

Sematophyllaceae

Trichosteleum tisserantii P.de la Varde; Western Region, Ankasa Forest, nr. Forestry Commission HQ, 5.27985°N, 2.73596°W (*9968a*), ca 50 m a.s.l., on earth bank by concrete culvert. The specimen is best assigned to this species, although it appears to be somewhat intermediate to *Trichosteleum microcalyx* Renauld & Cardot: the papillae do not start immediately above the leaf base, but the margins are distinctly (albeit weakly) toothed. Otherwise known only from Côte d'Ivoire and the Central African Republic.

Stereophyllaceae

Stereophyllum radiculosum (Hook.) Mitt.; Central Region, Akwekrom, Kakum River near Asuansi Technical Institute, 5.29469°N, 1.26719°W (*10237*), ca 75 m a.s.l., on periodically submerged rocks by river. According to the Flora of North America (Buck and Ireland 2014), *Stereophyllum* Mitt. contains only two species, with *S. radiculosum* widespread and *S. linisii* Enroth & B.C.Tan restricted to the Philippines (Enroth and Tan 2007), so previous records of *S. andungense* (Welw. & Duby) A.Gepp in Ghana (O'Shea 2006) should probably be transferred to *S. radiculosum*. However, specimens of *S. andungense* have not been examined.

Thuidiaceae

Pelekium investe (Mitt.) Touw; Eastern Region, Atewa Forest, Sagyimase waterfalls, 6.24738°N, 0.53278°W (*9613*, *9631*), ca 390 m a.s.l.., on rocks by waterfalls. Widespread in sub-Saharan Africa.

Trachyphyllaceae

Trachyphyllum inflexum (Harv.) A.Gepp in Hiern; a specimen of this plant, supposedly from Ghana, was found in GC (*GC39304*), but without any further collection details. This species is widespread in eastern and southern Africa and the East African islands but unknown from West Africa, so its provenance should probably be regarded as doubtful in the absence of further information.

Acknowledgements

Thanks are due to the staff of A Rocha (Ghana), especially Seth Ken Appiah-Kubi, for logistical assistance, including personnel, advice, accommodation and food, and Osman Musa for driving us around Atewa Forest; the University of Ghana Department of Plant and Environmental Biology, especially Anthony Adu-Gyamfi (University of Ghana) for help in the herbarium and with exporting specimens; Cletus Balangtaa and his colleagues in the Ghana Forestry Commission for access and guidance in the field; Tomas Hallingbäck and Peter Carlsson for companionship in the field.

We would also like to thank the following bryologists, who helped with identifying or confirming specimens, supplying information or institutional support: Ida Bruggeman-Nannenga, Len Ellis (The Natural History Museum, London), Dr Neil Bell and Dr David Long (Royal Botanic Garden Edinburgh), Dr Catherine Reeb (Muséum National d'Histoire Naturelle, Paris), Martin Wigginton†, and especially Dr Tamás Pócs (Esterházy Károly University, Eger), who suggested that *Cololejeunea ankasica* should be described as a new species.

Funding

The British Bryological Society Bequest provided generous contributions, which covered the cost of NGH's airfare to Ghana and visiting herbaria in the UK.

Notes on contributors

Nick Hodgetts is a consultant bryologist involved in research, survey and conservation in the UK, Europe and Africa.

Gabriel Ameka is Professor of Organismic Biology at the Department of Plant and Environmental Biology, University of Ghana.

Ransford Agyei is a Conservation and Research Development Officer with A Rocha Ghana.

Christopher Dankwah is Community Liaison Officer with A Rocha Ghana.

References

Alonso M, Jiménez JA, Cano MJ. 2019. Taxonomic revision of *Chionoloma* (Pottiaceae, Bryophyta). Annals of the Missouri Botanic Garden. 104:563–632.

Bruggeman-Nannenga MA. 2005. Two new species of Fissidens (Fissidentaceae, Musci) from Africa, *Fissidens harringtonii* and *Fissidens artsii*. Tropical Bryology. 26:13–17.

Buck WR, Ireland RR. 2014. Stereophyllaceae W.R.Buck & Ireland. In: Flora of North America Editorial Committee, editors. Flora of North America north of Mexico. Vol. 28, Bryophyta, Part 2. New York: Oxford University Press; p. 470–471.

Câmara PEAS. 2011. A review of *Taxithelium* subgenus *Taxithelium* (Bryophyta, Pylaisiadelphaceae). Systematic Botany. 36:824–835.

Diop D, Diop D, Bruggeman-Nannenga MA, Mbaye MS, Noba K, Hedenäs L, Gradstein SR, Reeb C, Vanderpoorten A. 2018. Bryophytes of Kédougou (Eastern Senegal), with a key to the *Fissidens* of Senegal. Journal of Bryology. 40:62–67.

Engel JJ, Merrill GLS. 2004. Austral hepaticae. 35. A taxonomic and phylogenetic study of Telaranea (Lepidoziaceae), with a monograph of the genus in temperate Australasia and commentary on extra-Australasian taxa. Fieldiana: Botany N.S. 44:1–265.

Enroth J, Tan BC. 2007. *Stereophyllum linisii* (Stereophyllaceae), a new moss species from the Philippines. Annales Botanici Fennici. 44:146–148.

Enroth J, Pócs T, He X, Nyqvist P, Stam S, Malombe I, Rikkinen J. 2019. An annotated checklist of the bryophytes of Taita Hills region, Kenya. Acta Musei Silesiae Scientiae Naturales. 68:53–66.

Fischer E. 2013. Liverworts and hornworts of Rwanda. ABC Taxa. 14:1–552.

Gradstein SR. 2013. Afro-American hepatics revisited. Polish Botanical Journal. 58(1):149–177.

Hedenäs L, Watling MC. 2005. Bryophyte flora of Uganda. 5. Hypnaceae (Part 2). Journal of Bryology. 27:153–160.

Hodgetts NG, Essilfie MK, Adu-Gyamfi A, Akom E, Kumadoh J, Opoku J. 2016. Bryophytes of Atewa Forest, Eastern Region, Ghana. Journal of Bryology. 38:211–222.

Jones EW. 1953. African hepatics IV. The genus *Caudalejeunea*. Transactions of the British Bryological Society. 2:164–171.

Jones EW, Harrington AJ. 1983. The hepatics of Sierra Leone and Ghana. Bulletin of the British Museum (Natural History). Botany Series. 11:215–289.

Kučera J, Košnar J, Werner O. 2013. Partial generic revision of *Barbula* (Musci: Pottiaceae): re-establishment of *Hydrogonium* and *Streblotrichum*, and the new genus *Gymnobarbula*. Taxon. 62(1):21–39.

O'Shea BJ. 2006. Checklist of the mosses of sub-Saharan Africa (version 5, 12/06). Tropical Bryology Research Reports. 6:1–255.

Pócs T. 1984. Synopsis of the African Lepidoziaceae. In: Váňa J, editor. Proceedings of the third meeting of bryologists from central and east Europe, 14th–18th June 1982. Praha; p. 107–119.

Pócs T. 1993. Taxonomic results of the BRYOTROP expedition to Zaire and Rwanda, 12, Metzgeriaceae, Plagiochilaceae, Lejeuneaceae (the non-epiphyllous collections). Tropical Bryology. 8:105–125.

Potier de la Varde R. 1951. Contribution à la flore bryologique africaine. Revue Bryologique et Lichénologique. 20(1–2):1–9.

Reeb C, Gradstein SR. 2020. A taxonomic revision of Aneuraceae (Marchantiophyta) from eastern Africa with an interactive identification key. Cryptogamie, Bryologie. 41(2):11–34.

Schuster RM. 1980. The Hepaticae and Anthocerotae of North America East of the Hundredth Meridian. Vol. IV. New York: Columbia University Press.

Wigginton MJ, editor. 2004. E.W. Jones's liverwort and hornwort Flora of West Africa. Scripta Botanica Belgica. 30:1–443.