

Bryophytes from the Republic of Equatorial Guinea (West-Central Africa)

I. Introduction and preliminary checklist.

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Abstract: A preliminary list consisting of 159 bryophyte taxa (82 liverworts and 77 mosses) has been compiled from the bryological literature on the Republic of Equatorial Guinea (Central-Western Africa) until 1995. A general overview of the physical features and vegetation of the country, and an account of the history of its bryological exploration are also included.

Resumen: Se han reunido en un catálogo preliminar los 159 táxones de briófitos (82 hepáticas y 77 musgos) de la República de Guinea Ecuatorial (Africa Centro-Occidental) conocidos a partir de la bibliografía hasta 1995. Se ha actualizado la nomenclatura y se incluye una descripción general del medio físico y de la vegetación del país, así como un resumen de la historia de su exploración briológica.

1. INTRODUCTION

1.1.- Location

The Republic of Equatorial Guinea is a tiny country in west-central Africa (fig. 1), whose area is little more than 28,000 km², located between Cameroon to the north and Gabon to the east and south.

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The country includes a continental region (Muni) of 26,000 km² (1°-2°20' N, 9°20'-11°20' E) and two islands: Bioco (formerly Fernando Poó), with 2,000 km² (3°12'-3°47' N, 8°25'-8°56' E) and Annobón (or Pagalu), with 17 km² (1°24'-1°28' S, 5°37'-5°39' E). Three other tiny islands, which lie very close to the continental coast, are also included: Corisco (15 km²) and the Elobeyes, right in the mouth of the Muni River estuary.

Until its independence on 12 October 1968, the country remained a Spanish colony (provinces of Fernando Poó and Río Muni).

1.2.- Topography, geology and climate

Fig.1.- Location map of the Republic of Equatorial Guinea.

Bioco and Annobón are both of volcanic origin and, together with Sao Tomé and Príncipe and Mount Cameroon, are the most obvious geological manifestations of the Cameroon Rift.

Both are very mountainous islands. Basilé Peak, 3011 m elevation, is the highest summit in Bioco; two other craters, Luba and Biao, are above 2000 m high.

In Annobón, the mountains are also steep, but the altitudes are much lower: Pico do Fogo (455 m), Quioveo (631 m) and Santa Mina (655 m).

Muni or the continental region has a very different nature and morphology. It is much lower and two morphological units can be distinguished (Martínez Torres & Riaza 1996, Martínez Torres & Heras 1995): the coastal zone and the craton.

The coastal zone, with altitudes under 200 m, is formed of Meso-Cenozoic rocks and Quaternary coastal and alluvial deposits. The existence of an ill-defined river network is characteristic.

A cliff or escarpment separates the coastal zone from the Congo craton, which occupies two thirds of the Continental Region. In this unit, four subunits can be distinguished, lying parallel to the coast:

- a.- The coastal range, at altitudes below 500m
- b.- The Uoro rift, surrounded by alluvial

and volcanic sediments

- c.- The interior ranges, where the highest altitudes in the region are found, Mounts Alen and Mitra, each above 1000m

- d.-The interior peneplain, with an average altitude of 600 m

The interior and coastal ranges are composed mostly of granites, whilst the interior peneplain is more complex, including metamorphic rocks (gneiss and schist), granite and gabbro, as well as several intracratonic basins or grabens, due to distensive processes, which have been filled up with Cenozoic alluvial deposits.

The Uoro rift and the faults and fractures in the Congo craton have determined the river network in the Continental Region, especially its main river: the river Uoro or river Benito. On its southern edge, the tectonic line of the Muni made possible the formation of one of its most marked features: the Muni estuary (Martínez Torres & Alonso 1993).

There are no great rivers in Annobón or Bioco, but some interesting lakes occur in the interior of old volcanic craters.

The uniform temperatures and high rainfall, and the absence of a cold season are the distinctive

features of the climate. The mean annual temperature remains around 24° - 25 °C, variation in the mean monthly temperature being lower than the daily one. However, the daily range of temperature is wider on the highest areas of Bioco, especially on Basilé Peak, and the mountainous areas of the interior of the Continental Region (Muni).

Although atmospheric humidity is high all the year round (above 80%), there are two seasons of lower rainfall: a long and marked one, the so called 'seca' (June to September in the continental region and December to February in Annobón) and a second one, the 'sequilla', which is much shorter (around January in the continental region and around August in Bioco).

However, maximum cloud cover occurs during the dry seasons, when the sky may remain overcast all day. On the other hand, during the rainy periods bright skies alternate with pouring rain.

During the night in the dry seasons, the cooling of the lower layers in the atmosphere causes dew to appear.

1.3.- Vegetation and man

1.3.1.- Bioco

Only 32 km off the Cameroon coastline, Bioco has a flora which is not of an insular character. In fact, it is closely related to the flora of Mount Cameroon on the African mainland.

The marked relief of Bioco creates a clear altitudinal zonation. According to Guinea (1949: 281-287), in Bioco, up to four vegetation zones can be recognized, but because it is mainly a coastline of cliffs with few beaches and estuaries, coastal vegetation is poorly represented.

Up to an altitude of 600 m (or 900 m, depending on the orientation), there is the belt of **rain forest**, where *Ficus* trees are abundant, as well as *Sapotaceae* and *Euphorbiaceae*. This is the vegetation belt which receives the strongest human influence, being the most fertile land where coffee and cocoa plantations were established with a great activity during colonial times.

Between 600 (900) m and 2300 m is the **cloud forest** zone of *Araliaceae* (*Polyscias fulva*, *Schefflera mannii*, *S. ledermannii*) and tree ferns (*Cyathaea usambarensis*), and abundant pteridophytes and epiphytic orchids. In the Moka Valley, between 1000 and 1500 m, this type of forest was cleared to create pastures where typical plants from the summit of Basilé Peak now grow, such as *Lobelia*

columnaris or *Senecio mannii*.

From approximately 2400 to 2800 m, three belts of **scrub** can be distinguished:

- *Hypericum lanceolatum*, parasitised by mistletoe (*Loranthus* spp.), dominates from 2300 to 2500 m

- The ericaceous species *Agauria salicifolia* and *Blaeria mannii*, together with *Adenocarpus manii*, are abundant between 2500 m and 2700 m. Also characteristic is the presence of the lichen *Usnea articulata*, hanging from trees

- *Philippia mannii* dominates close to the summit of Basilé Peak, about 2600-2800 m high

From 2800 m to the top of Basilé Peak, with a cold and dry climate, **grassland** predominates together with ferns and *Swertia basileana*.

1.3.2.- Annobón

The only published description of the vegetation of Annobón is that of Mildbraed (1922: 146-157), summarized later by Exell (1944), based on a transect from the northern end of the island to the top of the Quioveo.

Behind the **coastal vegetation** ('Sandstrand') there is an open **bushy formation** ('Vorland'), with the appearance of a savannah, consisting of coconut trees, oil palms and farmland, which is followed by a dense and **dry scrub** ('Buschwald'), with *Vernonia amygdalina*, *Turraea glomeruliflora* and oil palm (*Elaeis guineensis*).

On higher ground, a **dry forest** ('trockener Wald') is established, mainly composed of *Lannea welwitschii* and *Steganthus welwitschii*, together with other trees such as *Ceiba pentandra* and quite a number of ferns, very few of which belong to the *Hymenophyllaceae*.

The **cloud forest** ('Nebelwald') extends from about 450-500 m up to the summits of Quioveo and Santa Mina, as a result of the humid winds from the southwest blowing against their slopes. The scrub, consisting mainly of *Schefflera mannii*, *Aegelea ovalis*, *A. annobonensis*, *Cyathaea manniana* and other plants, is extremely rich in ferns, *Hymenophyllaceae* and epiphytic bryophytes.

1.3.3.- Muni (continental region)

The Continental Region is located right in the heart of the Gabon-Zaire rain forest belt of west-central Africa. The area is of a great importance

since it was a refuge for the equatorial rain forest during Pleistocene climatic changes.

Lowland rain forest is the typical vegetation of the continental region. Approximately 24% of the area is still covered by primary forest, especially in the mountainous and scarcely populated regions of the interior.

In the mountain ranges, from 900 -1000 m and upwards, this type of forest changes its character, becoming less dense and more mossy, giving way to the lowest belt of a **submontane tropical forest**. The commonest cause of destruction of the primary forest is native agriculture, for which areas in the forest are cleared for the cultivation of yucca, peanuts and other tropical crops.

The 'bicoro' colonizes clearings abandoned after cultivation. It is a very dense vegetation, composed of herbaceous plants (*Paspalum conjugatum*, *Eleusine indica*, *Digitaria velutina*, *Aframomum alboviolaceum*, etc.), climbing plants (*Gleichenia linearis*, *Lycopodium scandens*, *Scleria barteri*, etc.) and small trees (*Vernonia conferta*). It is the most widespread formation in the continental region (approximately 42.5% of the area).

Then the secondary forest follows, with a greater number of trees, among the most abundant being *Fagara macrophylla*, *Pycnanthus kombo*, *Cola acuminata* and, above all, *Musanga smithii*. This secondary forest covers 31.8% of the surface of the Continental Region.

Mangroves grow in the mouths of the greatest rivers (Ntem, Uoro and mainly in the Muni estuary), with *Rhizophora mangle* and *Avicennia nitida* being the most characteristic species.

Between the mangroves and the rain forest, a ***Pandanus candelabrum* formation** is locally developed. **Riparian vegetation** along river banks is noteworthy for its stands of bamboo (*Oxytenanthera abyssinica*) and *Nipa* spp.

Littoral vegetation is characterized by the presence of coconut trees (*Cocos nucifera*), 'egombegombe' (*Terminalia catappa*) and, on sandy beaches, *Ipomoea pes-caprae*.

Places which naturally lack rain forest may also be of bryological interest. All along the shore, on very sandy soils, **coastal grasslands** appear. In the wettest parts, *Drosera indica* and *Lycopodium sarcocaulon* can be found (Guinea 1946) and *Sphagnum* spp. have also been recorded.

Other non-forested places are the '**cerros cúpula**'

(inselbergs), promontories formed by eruptive rock, extremely resistant to erosion and colonized by herbaceous plants (*Graminae*, ferns, orchids), lichens and mosses, including species of *Sphagnum*.

1.4.- **History of the bryological exploration of the Republic of Equatorial Guinea.**

The botanists who have collected equatoguinean mosses and liverworts are shown in Table 1.

As can be seen, Bioco and Annobón islands are the only bryologically explored regions of the country.

Bioco has been visited by Europeans since the end of the 15th century. In the 19th century, it was a strategic port on long distance sea routes. Disputed by the Portuguese, Spanish and British, it was visited by a number of scientists, mainly German and English.

The first collection of an equatoguinean bryophyte (*Lejeunea caespitosa*) was made by the German Vogel, in Bioco, on 30 November 1841 (Jones 1972: 40). Further expeditions were made in the 1860s, 1880s and 1890s, mostly by German botanists. The largest collections were made by Mann and Mönkemeyer, both in Bioco. In September 1883, Danckelmann made the first and only published collection in the continental region: *Fissidens danckelmannii*. This specimen comes from one of the islets of the Elobeyes, in the mouth of the Muni estuary, at that time more accessible than the unknown and dangerous interior.

In the 20th century, the German expedition to Central Africa from 1910 to 1911 produced the first records for Annobón.

The next collection was made between 1932-33 by Exell, who participated in a botanical expedition from the British Museum of Natural History to the islands in the Gulf of Guinea. The expedition was of little benefit from a bryological point of view; only one specimen was collected in Annobón, being the very common species *Octoblepharum albidum*.

In 1953, the Scandinavian Knut Byström carried out the most significant sampling ever made in Equatorial Guinea. He collected in Bioco and Annobón, mostly lichens, but also some bryophytes. Work on his liverworts by Arnell produced a list of 33 species for Bioco and 34 for Annobón, containing 170 records in all. Byström's collections were the basis for the descriptions by

Arnell of several new species and varieties, although most of these were later reduced to synonymy.

M. Monod gave Potier de la Varde some bags containing five mosses from Bioco collected in 1951. In the same year, C.A. Thorold collected five liverworts and two mosses during a phytosanitary study of the cocoa plantations in Bioco.

2. PRELIMINARY CHECK-LIST OF THE BRYOPHYTES OF THE REPUBLIC OF EQUATORIAL GUINEA

The following preliminary list includes **159 taxa**, **82 liverworts** and **77 mosses**, published until 1995. In the list of valid taxa, localities, collectors and bibliographic references are indicated. Synonyms and invalid taxa as they appear in the bibliography are given in the second list.

Table 2 shows the number of known taxa for each of the three territories of Equatorial Guinea.

VALID TAXALIST LIVERWORTS

Adelanthus decipiens (Hook.) Mitt. **Bioco**: Basilé Peak, 2600 m, between *Andrewsianthus bilobus*, Mann, NY, (Mitten 1863: 166, Grolle 1972: 359).

Andrewsianthus bilobus (Mitt.) Grolle **Bioco**: Basilé Peak, 2600 m, Mann, NY type, G + K isotype, (Mitten 1863: 166, Grolle 1963: 437, Augier 1985: 40).

Anthoceros dilatatus Steph. **Bioco**: *Mönkemeyer* 15, 27, (Stephani 1886: 95); Moka, 1450 m, *Byström* 1001, (Arnell 1956: 527).

Anthoceros fuciformis Mont. **Annobón**: Quioveo, rain forest, on branches, *Byström* 422, 428; 200-300 m, *Byström* 447, (Arnell 1956: 532, Augier 1985: 17).

Arachniopsis diacantha (Mont.) M. Howe **Annobón**: Santa Mina, at the summit, on decaying wood, *Byström*, (Arnell 1956: 529).

Archilejeunea africana Steph. **Bioco**: s. loc., *Buchholz* s.n., G type, (Stephani 1911: 705, Vanden Berghen 1951: 115, Augier 1975: 70).

Bazzania decrescens (Lehm. & Lindenb.) Trevi-

san ssp. *molleri* (Steph.) E.W. Jones **Annobón**: Santa Mina, rain forest, 640 m, *Byström* 50; ditto, summit, on decaying wood, *Byström* s. n., (Arnell 1956: 529).

Calypogeia annabonensis Steph. **Annobón**: Santa Mina, summit, *Mildbraed* 6758, (Mildbraed 1922: 158).

Calypogeia fissa (L.) Raddi **Annobón**: Santa Mina, rain forest, *Byström* 628, (Arnell 1956: 529).

Caudalejeunea africana (Steph.) Steph. **Bioco**: on bark, *Mönkemeyer* 4, (Stephani 1886: 93); s. loc., *Mönkemeyer* 545, G type, (Vanden Berghen 1948: 97); Moka, 1600 m, *Byström* 1005, (Arnell 1956: 527); (Augier 1985: 75).

Cephalozia connivens (Dicks.) Lindb. spp. *fissa* (Steph.) Váña. **Bioco**: *Moller* (Váña 1988: 185).

Ceratolejeunea calabariensis Steph. **Annobón**: Quioveo, 500 m, *Mildbraed* 6686, (Mildbraed 1922: 158).

Ceratolejeunea jungneri Steph. **Bioco**: Moka, 1600 m, *Byström* 657, 681, 1005 p.p. (sterile, probably *C. jungneri*), (Arnell 1956: 527); epiphyte on cacao, *Thorold*, (Thorold 1955: 223). **Annobón**: Santa Mina, 650 m, on stem of *Cyathea*, *Byström* 611; northern crater, west margin, 350 m, *Byström* 310; lowland, *Byström* 191, (Arnell 1956: 529).

Ceratolejeunea umbonata Steph. **Bioco**: epiphyte on cacao, *Thorold*, (Thorold 1955: 223).

Ceratolejeunea zenkeri Steph. **Bioco**: epiphyte on cacao, *Thorold*, (Thorold 1955: 223).

Cheilolejeunea cordistipula (Steph.) Grolle ex E.W. Jones. **Bioco**: 2000 m, *Newton*, G 13885 type of *Pycnolejeunea angustiflora* Steph., (Stephani 1914: 601, Jones 1985: 397).

Cheilolejeunea serpentina (Mitt.) Mizut. **Bioco**: Moka, *Byström* 682, (Arnell 1956: 527); Ureka, on cacao stems, 150 m, *Thorold* 120, TF 120, (Thorold 1955: 223, Jones 1954b: 385). **Annobón**: Quioveo, rain forest, *Byström* 421, Crater Lake, shore, on stones, 275 m, *Byström* 209; northern crater, west margin, 350 m, *Byström* 327; Pico de San Pedro, 400 m, *Byström* 497, 566, (Arnell 1956: 529).

Cheilolejeunea surrepens (Mitt.) E.W. Jones **Annobón**: Pico de San Pedro, on bark, 400 m, *Byström* 566, (Arnell 1956: 534).

Cheilolejeunea trifaria (Reinw., Blume & Nees) Mizut. **Bioco**: *Mönkemeyer* 33, (Stephani 1886: 94). We have some doubts about this record.

- Jones (1954a: 379) commented that this sample, recorded in Stephani (1886) as *Lejeunea grandistipula* Steph., is a very different plant from the Sao Tomé *L. grandistipula* in Stephani's herbarium and might not be a *Cheilolejeunea*.
- Colura digitalis* (Mitt.) Steph. **Annobón:** Centro, on *Theobroma*, Wrigley, (Jones 1979: 387, Augier 1985: 92).
- Cyathodium africanum* Mitt. **Bioco:** Mönkemeyer 19, 26, (Stephani 1886: 94). **Annobón:** S. Juanca, near water, *Byström* 252; lowland, *Byström* 192; ditto, 200-300 m, *Byström* s. n., (Arnell 1956: 529).
- Drepanolejeunea vesiculosa* (Mitt.) Steph. **Bioco:** Moka, *Byström* 1005 p.p., (Arnell 1956: 527).
- Dumortiera hirsuta* (Sw.) Nees. **Bioco:** Mann, (Mitten 1863: 169); Mönkemeyer 11, (Stephani 1886: 94).
- Frullania angulata* Mitt. **Bioco:** Newton, G holotype of *F. newtonii* Steph., (Vanden Berghen 1976: 71). **Annobón:** Quioveo summit, *Mildbraed* 6582, G, (Mildbraed 1922: 158, Vanden Berghen 1976: 71).
- Frullania apicalis* Mitt. **Bioco:** Mann, NY, (Vanden Berghen 1976: 52); surroundings of Moka, *Byström* 837, UPS holotype of *F. laceriloba* var. *acutifolia* S. Arnell, (Arnell 1956: 528, Vanden Berghen 1976: 47-56).
- Frullania arecae* (Spreng.) Gottsche **Bioco:** Moka, 1600 m, *Byström* 559, 650, 657, 797, 799, 1003, 1006; northern slopes of Basilé Peak, between Basilé and Refugio, *Byström* 137, (Arnell 1956: 527).
- Frullania cafferaria* Steph. **Bioco:** Moka, *Byström* 791b, (Arnell 1956: 528).
- Frullania diptera* (Lehm.) Drège **Annobón:** northern crater, west margin, 400 m, *Byström* 345, (Arnell 1956: 532).
- Frullania ericoides* (Nees) Mont. **Bioco:** Mönkemeyer 29, (Stephani 1886: 94). **Annobón:** dry shrub forest, common on stones, 100-300 m, *Mildbraed* 6593, 6690, (Mildbraed 1922: 158); northern crater, west margin, *Byström* 332; Santa Cruz, from high altitude, *Byström* 247; lowland in the North, on *Jathropa*, *Byström* 167, (Arnell 1956: 532).
- Frullania obscurifolia* Mitt. **Annobón:** Crater Lake, dry forest, *Byström* 464, UPS sub *F. laceriloba* Steph., (Arnell 1956: 532, Vanden Berghen 1976: 147).
- Frullania trinervis* (Lehm.) Drège **Bioco:** Moka, *Byström* 643, 1007; Basilé Peak, between Basilé and Refugio, *Byström* 37, (Arnell 1956: 527).
- Lejeunea acuta* Mitt. **Bioco:** on lichens, Mann, (Mitten 1863: 168); Moka, *Byström* 667, 674, 1005; northern slopes of Basilé Peak, Loreto, 1400 m, *Byström* 528, 529; between Basilé and Refugio, *Byström* 132, 137, (Arnell 1956: 528, 529). **Annobón:** Crater Lake, dry forest, *Byström* 459, 515; Quioveo, rain forest, pendant from all trees, 630 m, *Byström* 403, 405, 406, 412, 419,

- (Arnell 1956: 532).
- Lejeunea autoica* Schuster **Bioco**: Bokoko Estate, on cocoa, *Thorold*, TF 1156, (Jones 1987: 506).
- Lejeunea caespitosa* Lindenb. **Bioco**: Moka, *Byström* 643, 674, 676, 797, 799, 809, 1006, (Arnell 1956: 528); 'ad saxa maritima aqua dulci irrigat', *Vogel*, K type of *L. vogelii* Tayl., (Jones 1972: 40); Laka, on *Cacao*, 150 m, *Thorold* 119 p.p., (Jones 1972: 40). **Annobón**: Crater Lake, dry forest, *Byström* 305, 373, 376, 377; Crater Lake, eastern side, 260 m, *Byström* 349; northern crater, western margin, 350 m, *Byström* 324; Quioveo, rain forest, 630 m, *Byström* 408, 419, 438 and 200-300 m, *Byström* 443, (Arnell 1956: 532).
- The records from Annobón and Bioco cited in Arnell (1956: 528 and 532) are based on *Lejeunea saccatiloba* Steph. But Jones (1972) commented that most plants named *L. saccatiloba* by Stephani are *L. confusa*. However the type of *L. saccatiloba* is *L. caespitosa*. Are the plants cited by Arnell *L. caespitosa* or *L. confusa*? We cannot be sure without re-examining the original material.
- Lejeunea camerunensis* (Steph.) E.W. Jones **Annobón**: Santa Mina, rain forest, *Byström* 627, (Arnell 1956: 532).
- Lejeunea flava* (Sw.) Nees ssp. *tabularis* (Sprengel) S. Arnell **Bioco**: *Mönkemeyer* 8, 9, 12, 14, 24, (Stephani 1886: 94); *Mönkemeyer*, G 7896 as *L. capensis*, (Jones 1968: 552); Moka, 1600 m, *Byström* 667, 674, 797, 1002; Basilé Peak, 2500 m, *Byström* 109, (Arnell 1956: 528).
- Lejeunea grossecristata* (Steph.) E.W. Jones **Bioco**: Moka, *Byström* 660b, (Arnell 1956: 529). **Annobón**: Quioveo summit, *Mildbraed* 6582, (Mildbraed 1922: 158); Quioveo, rain forest, 630 m, *Byström* 407, 412; northern crater, west margin, 350 m, *Byström* 316a; Santa Mina, stem of *Cyathea*, 650 m, *Byström* 614, (Arnell 1956: 534).
- Lejeunea ramosissima* Steph. **Bioco**: Moka, 1500 m, *Byström* 850, 650, 657, (Arnell 1956: 529, Augier 1985: 81). **Annobón**: Quioveo slope, on *Elaeis*, *Mildbraed* 6549, G 7902, (Mildbraed, 1922: 158, Jones 1967: 303); Quioveo summit, *Mildbraed* 6580 (G 10386), 6707 (G 10379), (Mildbraed, 1922: 158, Jones 1967: 303); northern crater, west side, 350 m, *Byström*, (Arnell 1956: 534); (Augier 1985: 81).
- Lepidozia succida* Mitt. **Bioco**: *Mann*, (Mitten 1863: 166); *Mönkemeyer* 18, 28, (Stephani 1886: 92).
- Leptoscyphus infuscatus* (Mitt.) E.W. Jones ex Grolle **Bioco**: Basilé Peak, on decayed wood, 2430 m, *Mann* 186, G type, (Mitten 1863: 165, Jones 1953: 198, Augier 1985: 37).
- Leucolejeunea xanthocarpa* (Lehm. & Lindenb.) Evans **Bioco**: (Jones 1973: 546, Evans 1907).
- Lophocolea bidentata* (L.) Dum. **Bioco**: Basilé Peak, on trees, 2430 m, *Mann*, (Mitten 1863: 165, Jones 1953: 185).
- Lophocolea concreta* Mont. **Annobón**: s. loc., *Byström* 209, (Arnell 1956: 532).
- Lophocolea difformis* Nees. **Bioco**: Moka, 1600 m, *Byström* 680, (Arnell 1956: 528).
- Lophocolea muricata* (Lehm.) Nees **Bioco**: Basilé Peak (a few fragments only), 2430 m, *Mann*, (Mitten 1863: 165).
- Lopholejeunea jonesii* Vanden Berghen **Bioco**: Moka, *Byström* 681, 797, 808, 1002; Basilé Peak, between Basilé and Refugio, *Byström* 133, (Arnell 1956: 528).
- However, Vanden Berghen (1984: 433-434) did not seem to accept the Bioco record of Arnell.
- Lopholejeunea nigricans* (Lindenb.) Schiffn. **Bioco**: (Vanden Berghen 1984: 425, as *L. abortiva* var. *fragilis*), s. loc., v.d. *Bosch* s.n., L 910.215-1669, sub *L. sagraeana*.
- Lopholejeunea subfusca* (Nees) Steph. **Bioco**: s. loc., *Mönkemeyer* 31, (Stephani 1886: 94), 4 holotype of *L. moenkemeyeri* Steph., (Stephani 1886: 94, Vanden Berghen 1984: 444). **Annobón**: Crater Lake, dry forest, *Byström* 378; Quioveo, rain forest, on bark, *Byström* 421, (Arnell 1956: 532).
- Marchantia pappeana* Lehm. **Bioco**: Bischler-Causse (1993) confirms one voucher of this species, *Mildbraed* 6275, type of *M. flavescens*.
- Arnell (1956: 528) cited *Marchantia chevalieri* Steph. from Bioco: Moka, *Byström* 643, 657, but the identity of these vouchers is uncertain. *M. chevalieri* is one synonym of *M. debilis* Goebel, but in the past there has been much inconsistency in the naming of specimens of *Marchantia*. Most authors have treated *M. chevalieri* as a synonym of *M. wilmsii* Steph. (= *M. pappeana*), but both *M. pappeana* and *M. debilis* have been described in the literature

- under the name *M. wilmsii*. Bischler-Causse (1993) did not confirm *M. wilmsii* in Bioco.
- Marchesinia excavata* (Mitt.) Schiffn. **Bioco**: Mönkemeyer 7, 32, (Stephani 1886: 94, Augier 1985: 77). **Annobón**: Quioveo summit, *Mildbraed* 6584; Santa Mina summit, *Mildbraed* 6757, (Mildbraed 1922: 158).
- Mastigolejeunea auriculata* (Wils.) Schiffn. **Annobón**: Crater Lake, dry forest, *Byström* 375, 378; lowland, *Byström* 190, 196, (Arnell 1956: 532).
- Mastigolejeunea turgida* Steph. **Bioco**: (Augier 1985: 72).
- Mastigophora diclados* (Brid. ex Web.) Nees **Bioco**: Mann, (Mitten 1863: 166). **Annobón**: Quioveo summit, *Mildbraed* 6581, 6685, (Mildbraed 1922: 158).
- Probably, the records cited by Arnell as *Mastigophora africana* S. Arnell var. *annobonensis* S. Arnell *nom. inval.* belong to *M. diclados* (Grolle 1978: 13 synonymised *Mastigophora africana* with *M. diclados*): **Annobón**: Quioveo, rain forest, on tree root, *Byström* 416; Santa Mina, summit, on tree, *Byström* 625, 626; ditto, on stem of *Cyathea*, abundant, 650 m, *Byström* 605, (Arnell 1956: 532, Augier 1985: 36).
- Metzgeria bystroemii* S. Arnell **Bioco**: Loreto, 1400 m, *Byström* 821, (Arnell 1956: 528, Augier 1985: 26).
- Metzgeria saxbyi* Pears. **Bioco**: Moka, 1450 m, *Byström* 1002, (Arnell 1956: 528).
- Metzgeria camerunensis* Steph. **Annobón**: Crater Lake, dry forest, *Byström* 459, (Arnell 1956: 533).
- Microlejeunea africana* Steph. **Bioco**: Moka, *Byström* 640, 660b, 667, 1003, 1004, 1005, 1006, (Arnell 1956: 528). **Annobón**: Santa Mina, rain forest, Marugo, *Byström* 567; northern crater, west margin, 350 m, *Byström* 305; Quioveo, rain forest, on trees, 630 m, *Byström* 412, (Arnell 1956: 533).
- Odontolejeunea lunulata* (Web.) Schiffn. **Bioco**: s. loc., Mann s. n., NY 1868, (Teeuwen 1989: 23).
- Phaecoceros jollyanus* (Steph.) S. Arnell **Bioco**: Moka, roadbank, *Byström* 643, (Arnell 1956: 528).
- Plagiochila africana* Steph. **Bioco**: Mönkemeyer, BM sub *P. praemorsa*, (Jones 1962: 295).
- Plagiochila barteri* Mitt. **Bioco**: Mönkemeyer, BM sub *P. mauritiana*, (Jones 1962: 278, Augier 1985: 53).
- Plagiochila bidentula* Steph. **Annobón**: Santa Mina, rain forest, 650 m, *Byström* s. n.; Quioveo, rain forest, on branches, *Byström* 424, (Arnell 1956: 533). Jones (1962: 261) considered this is probably a depauperate form of another species.
- Plagiochila effusa* Steph. **Bioco**: *Mildbraed* 7116, 1911 (G 1881) type of *P. oblon-gotrigona* Steph., (Jones 1962: 321).
- Plagiochila integerrima* Steph. **Bioco**: Mann, K sub *P. sarmentosa*, (Jones 1962: 269).
- Plagiochila monkemeyeri* Steph. **Bioco**: Mönkemeyer, G 1436 type, (Jones 1962: 323); Moka, *Byström* 681a, (Arnell 1956: 528).
- Plagiochila praemorsa* Steph. **Bioco**: Mönkemeyer 10, 17 on trees (G type) (Jones 1962: 301), 29 (Stephani, 1886: 92); 'Pico de Fernando Po' (Basilé Peak?), 2700 m, *Byström* s. n., (Arnell 1956: 528); (Augier 1985: 36). **Annobón**: Santa Mina, rain forest, 650 m, *Byström* s. n., (Arnell 1956: 533).
- Plagiochila punctata* Tayl. **Bioco**: Moka, *Byström* 837 p.p., (Arnell 1956: 528).
- The occurrence of this predominantly European species seems most unlikely. It is probably a misidentification (see Jones 1962: 274).
- Plagiochila loloensis* Steph. **Bioco**: Moka, 1500 m, *Byström* 779, 1006; Loreto, 1400 m, *Byström* 832, (Arnell 1956: 529).
- Plagiochila squamulosa* Mitt. **Bioco**: Moka, *Byström* 666, 800; between Basilé and Refugio, *Byström* 131, (Arnell 1956: 529).
- Plagiochila strictifolia* Steph. **Annobón**: Quioveo, 400-600 m, *Mildbraed* 6571, 6572, 6682, (Mildbraed 1922: 158); Santa Mina, rain forest, on bark, *Byström* 563, 618; Crater Lake, dry forest, *Byström* 379, 459; Quioveo, on tree trunks, *Byström* 427; lowland, *Byström* 194, (Arnell 1956: 533).
- Plagiochila terebrans* Nees & Mont. ex Lindenb. **Annobón**: Santa Mina, summit, *Mildbraed* 6758, (Mildbraed 1922: 158); *Mildbraed* 6583, G 5384 type of *P. pallidivirens* Steph., (Jones 1962: 307); Quioveo, rain forest, in the fog region, 360 m, *Byström* 390, 418, 424; Crater Lake, west margin, dry forest, 350 m, *Byström* s. n.; Crater Lake, west side, dry forest, *Byström* 267, 370, 378, 467; the shore, *Byström*

- 207, 233; northern crater, shore, eastern side, on stones, 275 m, *Byström* 212; n. loc., *Byström* 445, (Arnell 1956: 533, Augier 1985: 55).
- Plagiochila tricuspis* Steph. **Bioco:** Moka, *Byström*, 787, 791, 799, (Arnell 1956: 529). An omitted species in the Jones' revision of African *Plagiochila* due to poorly developed examples (Jones 1962: 261).
- Porella subdentata* (Mitt.) E.W. Jones var. *camerunensis* E.W. Jones **Bioco:** *Mönkemeyer*, BM, (Jones 1963: 458).
- Prionolejeunea grata* (Gottsche) Schiffn. **Annobón:** Santa Mina, rain forest, *Byström* 627, (Arnell 1956: 529).
- Radula appressa* Mitt. **Bioco:** *Mönkemeyer* 13, (Stephani 1886: 93). **Annobón:** Santa Mina, rain forest, *Byström* 507, 618, 627; Marugo *Byström* 567; Quioveo, rain forest, *Byström* 419, (Arnell 1956: 534).
- Radula boryana* (Web.) Nees **Bioco:** *Mönkemeyer*, BM, (Jones 1977: 497). **Annobón:** Quioveo slope, *Mildbraed* 6681, (Mildbraed 1922: 158).
- Radula stipatiflora* Steph. **Bioco:** Santa Isabel Peak, 2500 m, *Byström* 109, (Arnell 1956: 529); 2000 m, *Newton*, G 17557 type of *R. newtoni* Steph., (Jones 1977: 488, Augier 1985: 32).
- Radula tamariscina* Mitt. **Bioco:** Moka, *Byström* 667, 674; between Basilé and Refugio, *Byström* 132, 137, (Arnell 1956: 529).
- Riccardia limbata* (Steph.) E.W. Jones **Annobón:** Santa Mina, rainforest, stem of *Cyathea*, 650 m, *Byström* 601; 200-300 m, *Byström* 444, (Arnell 1956: 534).
- Riccia moenkemeyeri* Steph. **Bioco:** *Mönkemeyer* 3, (Stephani 1886: 95).
- Schiffneriolejeunea pappeana* (Nees) Gradstein. **Bioco:** *Mann*, (Mitten 1863: 167); *Mann* 694 p.p., K + NY, (Jones 1954c: 400, Gradstein & Vanden Berghen 1985: 183); Moka, *Byström* s. n., UPP, (Gradstein & Vanden Berghen 1985: 183). **Annobón:** Northern Crater, western side, on bark, 350 m, *Byström* 271, (Arnell 1956: 534, Gradstein & Vanden Berghen 1985: 183).
- Schiffneriolejeunea polycarpa* (Nees) Gradstein **Bioco:** Moka, *Byström* 660, 674a, 791b, 837, (Arnell 1956: 529).
- MOSSES
- Brachymenium nepalense* Hook. **Bioco:** *Mann*, (Mitten 1863: 155, Schultze-Motel 1975: 495, O'Shea 1995: 101).
- Bryum apiculatum* Schwaegr. **Bioco:** on ground, *Dusén* 71, (Brotherus 1897: 245, Schultze-Motel 1975: 496, O'Shea 1995: 104).
- Bryum coronatum* Schwaegr. **Bioco:** (Schultze-Motel 1975: 496, O'Shea 1995: 105).
- Bryum rhypariocolon* C. Müll. **Bioco:** on tree trunk, *Mönkemeyer* s.n., H isotype, (Müller 1886: 507, Ochi 1972: 67, Schultze-Motel 1975: 496, O'Shea 1995: 107).
- Callicostella africana* Mitt. **Bioco:** *Mann*, (Mitten 1863: 161, Schultze-Motel 1975: 507, O'Shea 1995: 108).
- Callicostella brevipes* (Broth.) Broth. **Bioco:** (Demaret & Potier de la Varde 1952: 371, Schultze-Motel 1975: 508, O'Shea 1995: 108).
- Callicostella constricta* (C. Müll.) Kindb. **Bioco:** on ground, *Mönkemeyer*, (Müller 1886: 515, Demaret & Potier de la Varde 1952: 391, Schultze-Motel 1975: 508, O'Shea 1995: 108).
- Callicostella parvula* Broth. in *Mildbraed, nom. nud.* **Annobón:** Santa Mina summit, *Mildbraed* 6706, (Mildbraed 1922: 159, Schultze-Motel 1975: 509, O'Shea 1995: 108).
- Callicostella seychellensis* (Besch.) Kindb. **Annobón:** (Demaret & Potier de la Varde 1952: 364, Schultze-Motel 1975: 509, O'Shea 1995: 108).
- Calymperes annobonense* Broth. in *Mildbraed, nom. nud.* **Annobón:** 400 m, *Mildbraed* 6692, (Mildbraed 1922: 158, Schultze-Motel 1975: 487, O'Shea 1995: 109).
- Calymperes subtenellum* Broth. in *Mildbraed, nom. nud.* **Annobón:** above San Pedro, dry forest, on stones, *Mildbraed* 6755, (Mildbraed 1922: 158, Schultze-Motel 1975: 489, O'Shea 1995: 110).
- Campylopus hensii* Ren. & Card. **Bioco:** *Adams* 18c, (Frahm 1985: 91). Inaccurately cited in O'Shea (1995: 113) from Equatorial Guinea rather than Bioco.
- Chryso-hypnum frondosum* (Mitt.) Buck **Bioco:** on stones up the mountain, 915-2430 m, *Mann*, (Mitten 1863: 158, Schultze-Motel 1975: 523, O'Shea 1995: 116).
- Cyclodictyon annobonense* Broth. in *Mildbraed, nom. nud.* **Annobón:** Santa Mina summit, *Mildbraed* 6705, (Mildbraed 1922: 159, Schultze-Motel 1975: 509, O'Shea 1995: 117).
- Cyclodictyon laete-virens* (Hook. & Tayl.) Mitt. **Bioco:** Basilé Peak, on trees, 2430 m, *Mann*, (Mitten 1863: 163, Schultze-Motel 1975: 510, O'Shea 1995: 117).

- Daltonia longinervis* Mitt. **Bioco:** with *Lepidopilidium devexum*, Mann, (Mitten 1863: 163, Demaret 1955: 378, Schultze-Motel 1975: 511, O'Shea 1995: 117).
- Daltonia mittenii* Kis. **Bioco:** Basilé Peak, with *Neckera pennata*, 1130m, Mann, (Mitten 1863: 162, Demaret 1955: 378, Schultze-Motel 1975: 511, O'Shea 1995: 117).
- Daltonia splachnoides* (Sm.) Hook. & Tayl. **Bioco:** Basilé Peak, with *Plagiothecium nitidifolium*, Mann, (Mitten 1863: 163, Schultze-Motel 1975: 511, O'Shea 1995: 117). This voucher is fragmentary and it should be cited with doubts (Demaret 1955: 377).
- Dicranum obliquatum* Mitt. **Bioco:** Basilé Peak, on trees, Mann, (Mitten 1863: 148, Schultze-Motel 1975: 484, O'Shea 1995: 118).
- Distichophyllum annobonense* Broth. in Mildbr., *nom nud.* **Annobón:** Santa Mina summit, *Mildbraed* 6704, (Mildbraed 1922: 159, Schultze-Motel 1975: 511, O'Shea 1995: 119).
- Distichophyllum procumbens* Mitt. **Bioco:** Mann, (Mitten 1863: 163, Demaret 1955: 380, Schultze-Motel 1975: 511, O'Shea 1995: 119).
- Ectropothecium diffusum* (Mitt.) Jaeg. **Bioco:** Barter, (Mitten 1863: 157, Schultze-Motel 1975: 521, O'Shea 1995: 120).
- Ectropothecium taxiforme* (Brid.) Broth. **Annobón:** Quioveo, *Mildbraed* 6684, (Mildbraed 1922: 159, Schultze-Motel 1975: 522, O'Shea 1995: 121).
- Ectropothecium triviale* (C. Müll.) Kindb. **Bioco:** on ground, *Mönkemeyer*, (Müller 1886: 521); Moka lake, *Monod* 10501, (Potier de la Varde 1953: 485, Schultze-Motel 1975: 522, O'Shea 1995: 121).
- Entodontopsis nitens* (Mitt.) Buck & Irel. **Bioco:** on decaying wood, Barter, (Mitten 1860: 51, Schultze-Motel 1975: 516, O'Shea 1995: 121).
- Fissidens danckelmannii* C. Müll. **Continental Region:** Elobey Island, mixed with small liverworts, on tree bark, *Danckelmann*, (Müller 1886: 505, Schultze-Motel 1975: 475, O'Shea 1995: 125).
- Fissidens zippelianus* Dozy & Molk. **Bioco:** in wet place, *Mönkemeyer*, PC type, (Müller 1886: 504, Schultze-Motel 1975: 478, Pursell *et al.* 1992: 53, O'Shea 1995: 130). Confusingly cited in O'Shea (1995) from Equatorial Guinea as well as from Bioco.
- Hookeriopsis mittenii* P. Varde **Bioco:** Mann, (Mitten 1863: 159, Potier de la Varde 1927: 138, Schultze-Motel 1975: 510, O'Shea 1995: 134).
- Hypnella abrupta* (Mitt.) Jaeg. **Bioco:** Mann, (Mitten 1863: 161, Demaret 1955: 388, Schultze-Motel 1975: 507, O'Shea 1995: 136).
- Hypopterygium laricinum* (Hook.) Brid. **Bioco:** Mann, (Mitten 1863: 164, Schultze-Motel 1975: 512, O'Shea 1995: 137).
- Hypopterygium tenellum* C. Müll. **Bioco:** on the ground, *Mönkemeyer*, (Müller 1886: 514, Schultze-Motel 1975: 512, O'Shea 1995: 137).
- Isopterygium submicrothecium* Broth. & Par. **Annobón:** Quioveo, 450m, *Mildbraed* 6547 expte., (Mildbraed 1922: 159, Schultze-Motel 1975: 522, O'Shea 1995: 138).
- Lepidopilidium devexum* (Mitt.) Broth. **Bioco:** see *Daltonia longinervis* in Mitten (1863: 163). However it is not cited in page 159 nor picked up by Schultze-Motel in his list (Schultze-Motel 1975).
- Lepidopilum callochlorum* C. Müll. ex Broth. **Bioco:** Moka, *Monod* 10500, (Potier de la Varde 1953: 483, Schultze-Motel 1975: 510, O'Shea 1995: 139).
- Leptodontium flexifolium* (Dicks.) Hampe **Bioco:** Basilé Peak, rocks inside the largest crater, Mann, (Mitten 1863: 150, Schultze-Motel 1975: 492, O'Shea 1995: 140).
- Leucomium strumosum* (Hornsch.) Mitt. **Bioco:** (Potier de la Varde 1936: 183, Schultze-Motel 1975: 511, O'Shea 1995: 143).
- Leucophanes annobonense* Broth. in Mildbr., *nom nud.* **Annobón:** Quioveo, 500-600m, *Mildbraed* 6570, (Mildbraed 1922: 158, Schultze-Motel 1975: 486, O'Shea 1995: 144). Species not included in the *Leucophanes* world revision of Salazar (1993).
- Macromitrium sulcatum* (Hook.) Brid. **Bioco:** (Mitten 1863: 152, Schultze-Motel 1975: 500, O'Shea 1995: 146).
- Mittenothamnium pallescens* Broth. in Mildbr., *nom nud.* **Annobón:** Quioveo path, decaying wood, 450 m, *Mildbraed* 6548, (Mildbraed 1922: 159, Schultze-Motel 1975: 523, O'Shea 1995: 147).
- Mittenothamnium reptans* (Hedw.) Mitt. **Bioco:** 915-2430m, Mann, (Mitten 1863: 158, Schultze-Motel 1975: 523, O'Shea 1995: 147).
- Neckera pennata* Hedw. **Bioco:** Basilé Peak, on

- trees, 1830 m, *Mann*, (Mitten 1863: 160, Schultze-Motel 1975: 505, O'Shea 1995: 148). However, De Sloover (1977: 44) indicated that this identification may be an error.
- Neckeropsis disticha* (Hedw.) Kindb. **Bioco:** *Mann*, (Mitten 1863: 160, Schultze-Motel 1975: 505, O'Shea 1995: 149).
- Octoblepharum albidum* Hedw. **Annobón:** Pico do Fogo, 430 m, *Exell* 907, (Exell 1944: 391, Schultze-Motel 1975: 487, O'Shea 1995: 149).
- Orthostichella pentasticha* (Brid.) Buck **Bioco:** Basilé Peak, on trees, 2430 m, *Mann*, (Mitten 1863: 156, Schultze-Motel 1975: 504, O'Shea 1995: 150).
- Orthostichidium involutifolium* (Mitt.) Broth. spp. *involutifolium* **Bioco:** (Argent 1973: 595, Schultze-Motel 1975: 503, O'Shea 1995: 150).
- Orthostichidium involutifolium* spp. *thomeanum* (Broth.) Argent **Bioco:** (Argent 1973: 595, Schultze-Motel 1975: 503, O'Shea 1995: 150).
- Philonotis annobonensis* Broth. in *Mildbr.*, *nom. nud.* **Annobón:** 'Vorland', stream bed, on lava, *Mildbraed* 6689, (Mildbraed 1922: 158, Schultze-Motel 1975: 498, O'Shea 1995: 152).
- Philonotis cernua* (Wils.) Griffin & Buck **Bioco:** Basilé Peak, 2500 m, *Mann*, (Mitten 1863: 153, Richards 1952: 69, Schultze-Motel 1975: 498, O'Shea 1995: 152).
- Philonotis flavinervis* (C. Müll.) Kindb. **Bioco:** in spring, *Mönkemeyer*, (Müller 1886: 511, Schultze-Motel 1975: 499, O'Shea 1995: 152).
- Pilotrichella communis* C. Müll. ex Dus. **Bioco:** Moka, *Monod* 1050, (Potier de la Varde 1953: 483, Schultze-Motel 1975: 504, O'Shea 1995: 153).
- Pinnatella minuta* (Mitt.) Broth. **Bioco:** Southwestern coast, Bokoko, 14 km to the North from Punta de Sogre, under tropical forest, *Mildbraed* s.n., H-BR, (Enroth 1994: 37).
- Plagiomnium rhynchophorum* (Hook.) T. Kop. **Bioco:** *Mann*, (Mitten 1863: 162, Schultze-Motel 1975: 498, O'Shea 1995: 155).
- Plagiothecium nitidifolium* (Mitt.) Jaeg. **Bioco:** Basilé Peak, on trees, 2430 m, *Mann*, (Mitten 1863: 158, Schultze-Motel 1975: 515, O'Shea 1995: 155).
- Pogonatum gracilifolium* Besch. **Bioco:** Moka, 1150 m, s. coll. 18, (December 1951), BM, (De Sloover 1986: 286); Moka, 1200 m, s. coll. s.n., (December 1951), BM, (De Sloover 1986: 295, O'Shea 1995: 156).
- Polytrichum commune* Hedw. var. *commune* **Bioco:** Basilé Peak, on the very summit, *Mann*, (Mitten 1863: 164, Schultze-Motel 1975: 525, O'Shea 1995: 157). However, this species was not included in De Sloover (1986: 256-260).
- Polytrichum subpilosum* P. Beauv. **Bioco:** Basilé Peak, *Mann* s. n., BM, (De Sloover 1986: 262).
- Porothamnium stipitatum* (Mitt.) Touw ex De Sloover **Bioco:** 2280 m, *Mann*, (Mitten 1863: 156, Schultze-Motel 1975: 507, O'Shea 1995: 157); 2500 m., *Mann* 1483, NY holotype; Basilé Peak, 1150 m, *Mönkemeyer*, BR, H-BR(2), PC-TH, parts of *Hypnum moenkemeyeri* C. Müll. type; Basilé Peak, 2000 m, *Newton*, H-BR; *Dusén* 102, BR, H-BR, PC-TH, probably, parts of *Thamnobryum serpenticaulis* C. Müll. ex *Dusén* type, (De Sloover 1983: 138, O'Shea 1995: 157).
- Porothamnium variifolioides* De Sloover **Bioco:** s. coll., NY, (De Sloover 1983: 132, O'Shea 1995: 158).
- Porotrichum annobonense* Broth in *Mildbraed*, *nom. nud.* **Annobón:** Quioveo, 400 m, *Mildbraed* 6683, (Mildbraed 1922: 158, Schultze-Motel 1975: 506, O'Shea 1995: 158).
- Porotrichum elongatum* (Welw. & Duby) Gepp **Bioco:** Basilé Peak, 1060 m, *Mönkemeyer*, (Müller 1886: 517); on shaded stone, near Malabo, *Dusén*, (Dusén 1895: 49, Schultze-Motel 1975: 506); s. coll., BM, (De Sloover 1983: 105, O'Shea 1995: 158). **Annobón:** Quioveo, 400 m, *Mildbraed* 6683, H-BR, (De Sloover 1983: 105, O'Shea 1995: 158).
- Pyrrhobryum spiniforme* (Hedw.) Mitt. **Bioco:** *Mann*, (Mitten 1863: 162, Schultze-Motel 1975: 498, O'Shea 1995: 160).
- Racopilum tomentosum* (Hedw.) Brid. **Bioco:** *Barter*, (Mitten 1863: 162, Schultze-Motel 1975: 502, O'Shea 1995: 161).
- Radulina borbonica* (Bel.) Buck **Annobón:** Quioveo path, decaying wood, 450 m, *Mildbraed* 6547, (Mildbraed 1922: 159, Schultze-Motel 1975: 520, O'Shea 1995: 161).
- Regmatodon newtonii* C. Müll. ex Broth. **Bioco:** Basilé Peak, 2000 m, *Newton*, type, (Brotherus 1897: 281, Richards 1952: 69, Schultze-Motel 1975: 513, O'Shea 1995: 161).
- Renauldia dusenii* (Broth.) Broth. **Bioco:** Basilé Peak, 2500 m, sterile, *Newton*, (Brotherus 1897:

- 255, Argent 1973: 584, Schultze-Motel 1975: 504, O'Shea 1995: 161).
- Sematophyllum annobonense* Broth. in Mildbr., *nom. nud.* **Annobón:** Santa Mina, 600m, *Mildbraed* 6756, (Mildbraed 1922: 159, Schultze-Motel 1975: 518, O'Shea 1995: 167).
- Syrrhopodon lamprocarpus* Mitt. **Bioco:** Mann, type, (Mitten 1863: 151, Schultze-Motel 1975: 490, Orbán 1981: 173, O'Shea 1995: 173).
- Taxithelium chloropterum* (C. Müll.) Ren. & Card. **Bioco:** on tree trunk, *Mönkemeyer*, (Müller 1886: 522, Schultze-Motel 1975: 519, O'Shea 1995: 173).
- Thuidium gratum* (P. Beauv.) Jaeg. **Bioco:** *Mönkemeyer* 10, S-PA; s. n., FH, S-PA, UPS, (Touw 1976: 156). **Annobón:** *Mildbraed* 6691, H, Laguna Apata, *Newton*, (Touw 1976: 156, O'Shea 1995: 173).
- Thuidium ramosculosum* (Mitt.) Jaeg. **Bioco:** Basilé Peak, *Mann* s. n., NY holotype, K, (Mitten 1863: 161, Schultze-Motel 1975: 513, Touw 1976: 183, O'Shea 1995: 175).
- Thuidium tenuissimum* Welw. & Duby. **Bioco:** *Mann* 249, NY, (Touw 1976: 151, O'Shea 1995: 175).
- Trachypodopsis serrulata* (P. Beauv.) Fleisch. var. *serrulata* **Bioco:** *Mann*, (Mitten 1863: 156, Schultze-Motel 1975: 503, O'Shea 1995: 177).
- Vesicularia annobonensis* Broth. in Mildbraed, *nom. nud.* **Annobón:** stream bed near Santa Cruz, wet stone, *Mildbraed* 6597, (Mildbraed 1922: 159, Schultze-Motel, 1975: 524, O'Shea 1995: 180).
- Vesicularia codonopyxis* (C. Müll.) Broth. **Bioco:** on tree bases, *Mönkemeyer*, (Müller 1886: 518, Schultze-Motel 1975: 524, O'Shea 1995: 180).
- Vesicularia scaturigina* (Brid.) Broth. **Bioco:** *Mann*, (Mitten 1863: 157, Schultze-Motel 1975: 525, O'Shea 1995: 181).
- Vesicularia terrestris* (C. Müll.) Broth. **Bioco:** on ground, *Mönkemeyer*, (Müller 1886: 520, Schultze-Motel 1975: 525, O'Shea 1995: 181).
- Warnstorfia fluitans* (Hedw.) Loeske var. *fluitans* **Bioco:** Moka lake, *Monod* 10501, (Potier de la Varde 1953: 483, Schultze-Motel 1975: 514, O'Shea 1995: 181).
- Arachniopsis madagascariensis* Steph. = *Arachniopsis diacantha* (Monk.) M. Howe. (Arnell 1956: 529).
- Aspiromitus dilatatus* (Steph.) Steph. = *Anthoceros dilatatus* Steph. (Arnell 1956: 527).
- Bazzania moelleri* Steph. = *Bazzania decrescens* spp. *molleri* (Steph.) E. W. Jones (Arnell 1956: 529).
- Cheilolejeunea principensis* Steph. = *Cheilolejeunea serpentina* (Mitt.) Mizut. (Arnell 1956: 527, 529, Jones 1954b: 385).
- Cyathodium cavernarum* Kunze = *Cyathodium africanum* Mitt. (Stephani 1886: 94).
- Cyclolejeunea annobonensis* S. Arnell = *Prionolejeunea grata* (Gottsche) Schiffn. (Arnell 1956: 529).
- Dicranolejeunea annobonensis* S. Arnell = *Marchesinia* sp. (Arnell 1956: 531).
- Drepanolejeunea africana* Steph. (?) No further references, (Arnell 1956: 532. **Annobón:** Quioveo, rain forest, on trees, 630 m, *Byström* 412).
- Drepanolejeunea clavicornis* Steph. = *Drepanolejeunea vesiculosa* (Mitt.) Steph. (Arnell 1956: 527).
- Frullania angustifolia* Steph. = *F. trinervis* (Lehm.) Drège (Arnell 1956: 527).
- Frullania bangiensis* Steph. = *Frullania ericoides* (Nees) Mont. (Mildbraed 1922: 158).
- Frullania laceriloba* Steph. = *Frullania obscurifolia* Mitt. (Arnell 1956: 532).
- Frullania laceriloba* var. *acutifolia* S. Arnell = *Frullania apicalis* Mitt. (Arnell 1956: 528).
- Frullania moelleri* Steph. = *Frullania caffraria* Steph. (Arnell 1956: 528).
- Frullania squarrosa* Dum. = *Frullania ericoides* (Nees) Mont. (Stephani 1886: 94, Arnell 1956: 532).
- Gymnanthe biloba* Mitt. = *Andrewsanthus bilobus* (Mitt.) Grolle (Mitten 1863: 166).
- Gymnanthe decipiens* (Hook.) Mitt. = *Adelanthus decipiens* (Hook.) Mitt. (Mitten 1863: 166).
- Hygrolejeunea pulcherrima* Steph. = *Lejeunea acuta* Mitt. (Arnell 1956: 528, 532).
- Hygrolejeunea staudtiana* Steph. (?) No further references, (Arnell 1956: 528. **Bioco:** Moka, 1600 m, *Byström* 676; northern slopes of Basilé Peak, 1400 m, *Byström* 821).
- Leioscyphus repens* Mitt. = *Leptoscyphus infuscatus* (Mitt.) E. W. Jones ex Grolle (Mitten 1863: 165).
- Lejeunea eplicata* Steph. = *Lejeunea ramosissima* Steph. (Mildbraed 1922: 158, Jones 1967: 303).
- Lejeunea grandistipula* Steph. = *Cheilolejeunea trifaria* (Reinw., Blume & Nees) Mizut. (Stephani 1886: 94).
- Lejeunea holtii* Spruce (Arnell 1956: 533. **Annobón:**

SYNONYMS AND EXCLUDED TAXA
LIVERWORTS

- Crater Lake, dry forest, *Byström* 372, 373; northern crater, eastern shore, *Byström* 223). Reported by Arnell as *Potamolejeunea holtii* (Spruce) Greig-Smith, but it is surely a very dubious record of this predominately European species (Greig-Smith 1948).
- Lejeunea isomorpha* Gottsche = *Lejeunea flava* spp. *tabularis* (Sprengel) S. Arnell. (Arnell 1956: 528).
- Lejeunea pappeana* (Nees) Mitt. = *Schiffneriolejeunea pappeana* (Nees) Gradstein (Mitten 1863: 167).
- Lejeunea sagraeana* (Mont.) Gottsche *et al.* = *Lopholejeunea subfusca* (Nees) Steph. (Stephani 1886: 94).
- Lejeunea saccatiloba* Steph. = *Lejeunea caespitosa* Lindenb. (Arnell 1956: 528, 532).
- Lejeunea tabularis* (Spreng.) Gottsche = *Lejeunea flava* spp. *tabularis* S. Arnell (Stephani 1886: 94).
- Lejeunea variabilis* Lindenb. (?) This is an American species, (Stephani 1886: 94. Bioco: *Mönkemeyer* 5, 23, 29).
- Lophocolea cuspidata* (Nees) Limpr. = *Lophocolea bidentata* (L.) Dum. (Jones 1953: 185).
- Lophocolea moelleri* Steph. = *Lophocolea difformis* Nees (Arnell 1956: 528).
- Lophocolea subrotunda* Mitt. = *Lophocolea concreta* Mont. (Arnell 1956: 532).
- Lopholejeunea abortiva* var. *fragilis* (Steph.) Vanden Berghen = *Lopholejeunea nigricans* (Lindenb.) Schiffn. (Vanden Berghen 1984: 425).
- Mastigolejeunea carinata* (Mitt.) Steph. = *Mastigolejeunea auriculata* (Wils.) Schiffn. (Arnell 1956: 532).
- Mastigophora africana* S. Arnell var. *annobonensis* S. Arnell. = *Mastigophora diclados* (Brid. ex Web.) Nees (Arnell 1956: 532).
- Megaceros lacerus* (Nees) Steph. = *Anthoceros fuciformis* Mont. (Arnell 1956: 532, Augier 1985: 17).
- Phragmicoma excavata* (Mitt.) Steph. = *Marchesinia excavata* (Mitt.) Steph. (Stephani 1886: 94).
- Plagiochila batangensis* Steph. = *Plagiochila praemorsa* Steph. (Arnell 1956: 533).
- Plagiochila bomanensis* Steph. = *Plagiochila terebrans* Nees & Mont. ex Lindenb. (Arnell 1956: 533).
- Plagiochila cacuminis* Steph. = *Plagiochila praemorsa* Steph. (Arnell 1956: 528).
- Plagiochila pallidivirens* Steph. = *Plagiochila terebrans* Nees & Mont. ex Lindenb. (Mildbraed 1922: 158).
- Plagiochila rotundifolia* Steph. = *Plagiochila loloensis* Steph. (Arnell 1956: 529).
- Plagiochila thomeensis* Steph. = *Plagiochila terebrans* Nees & Mont. ex Lindenb. (Arnell 1956: 533).
- Potamolejeunea holtii* (Spruce) Greig-Smith = see above: *Lejeunea holtii* Spruce (Arnell 1956: 533).
- Ptychocoleus moelleri* (Steph.) Steph. = *Schiffneriolejeunea polycarpa* (Nees) Gradstein (Arnell 1956: 529).
- Ptychocoleus pappeanus* (Nees) Steph. = *Schiffneriolejeunea pappeana* (Nees) Gradstein (Jones 1954c: 400).
- Ptycholejeunea pappeanus* (Nees) Steph. (a typographical error for *Ptychocoleus pappeanus*) = *Schiffneriolejeunea pappeana* (Nees) Gradstein (Arnell 1956: 534).
- Pycnolejeunea africana* Steph. = *Cheilolejeunea surrepens* (Mitt.) E.W. Jones (Arnell 1956: 534).
- Pycnolejeunea angustiflora* Steph. = *Cheilolejeunea cordistipula* (Steph.) Grolle ex E.W. Jones (Stephani 1914: 601).
- Radula angustata* Steph. = *Radula appressa* Mitt. (Stephani 1886: 93).
- Radula bipinnata* Mitt. = *Radula boryana* (Web.) Nees (Mildbraed 1922: 158).
- Radula moelleri* Steph. = *Radula appressa* Mitt. (forma *moelleri*) (Arnell 1956: 534).
- Radula multiramosa* Steph. (not in Jones 1977) (Mildbraed 1922: 158. Annobón: Quioveo, 500-600 m, Mildbraed 6576) = *Radula boryana* (Web.) Nees.
- Radula newtonii* Steph. = *Radula stipatiflora* Steph. (Arnell 1956: 529).
- Sendtnera diclados* (Brid. ex Web.) Gottsche *et al.* = *Mastigophora diclados* (Brid.) Nees (Mitten 1863: 166).
- Sprucella moenkemeyeri* Steph. = *Lepidozia succida* Mitt. (Stephani 1886: 92).
- Taxilejeunea acuta* (Mitt.) Steph. = *Lejeunea acuta* Mitt. (Arnell 1956: 529).
- Taxilejeunea dusenii* Steph. = *Lejeunea ramosissima* Steph. (Mildbraed 1922: 158, Arnell 1956: 529).
- Taxilejeunea longirostris* Steph. = *Lejeunea grossecristata* (Steph.) E.W. Jones (Mildbraed 1922: 158, Arnell 1956: 529, 534).
- Taxilejeunea ramosissima* (Steph.) Steph. = *Lejeunea ramosissima* Steph. (Arnell 1956: 529, 534).
- Thysananthus africanus* Steph. = *Caudalejeunea afr.* (Steph.) Steph. (Stephani 1886: 93).

- Bartramia flavinervis* C. Müll. = *Philonotis flavinervis* (C. Müll.) Kindb. (Müller 1886: 511).
- Bartramidula cernua* (Wils.) Lindenb. = *Philonotis cernua* (Wils.) Griffin & Buck (Schultze-Motel 1975: 498).
- Bartramidula wilsoni* B. & S. = *Philonotis cernua* (Wils.) Griffin & Buck (Richards 1952: 69).
- Brachymenium suberectum* (Mitt.) Jaeg. = *Brachymenium nepalense* Hook. (Schultze-Motel 1975: 495).
- Bryum areoblastum* C. Müll. = *Bryum apiculatum* Schwaegr. (Brotherus 1897: 245, Schultze-Motel 1975: 496).
- Bryum suberectum* (Mitt.) Jaeg. = *Brachymenium nepalense* Hook. (Mitten 1863: 155).
- Callicostella abrupta* Mitt. = *Hypnella abrupta* (Mitt.) Jaeg. (Mitten 1863: 161).
- Calypothecium dusenii* Broth. = *Renauldia dusenii* (Broth.) Broth. (Brotherus 1897: 255).
- Daltonia patula* Mitt. = *Daltonia mitteni* Kis (Mitten 1863: 162, Demaret 1955: 378 Schultze-Motel 1975: 511).
- Didymodon flexifolius* Hook. & Tayl. = *Leptodontium flexifolium* (Dicks.) Hampe (Mitten 1863: 150).
- Drepanocladus fluitans* (Hedw.) Warnst. var. *monodii* P. Varde = *Warnstorfiافلuitans* var. *fluitans* (Hedw.) Loeske (Potier de la Varde 1953: 483, Schultze-Motel 1975: 514) (see O'Shea 1995:120).
- Fissidens monkemeyeri* C. Müll. = *Fissidens zippelianus* Dozy & Molk. (Müller 1886: 504, Schultze-Motel 1975: 478, Pursell *et al.* 1992: 53).
- Hookeria constricta* C. Müll. = *Callicostella constricta* (C. Müll.) Kindb. (Müller 1886: 515).
- Hypnum chloropterum* C. Müll. = *Taxithelium chloropterum* (C. Müll.) Ren. & Card. (Müller 1886: 522).
- Hypnum codonopyxis* C. Müll. = *Vesicularia codonopyxis* (C. Müll.) Broth. (Müller 1886: 518).
- Hypnum mönkemeyeri* C. Müll. = *Porotrichum elongatum* (Welw. & Duby) Gepp (Müller 1886: 517).
- Hypnum terrestre* C. Müll. = *Vesicularia terrestris* (C. Müll.) Broth. (Müller 1886: 520).
- Hypnum triviale* C. Müll. = *Ectropothecium triviale* (C. Müll.) Kindb. (Müller 1886: 521).
- Hypopterygium falcatum* C. Müll. = *Hypopterygium tenellum* C. Müll. (Müller 1886: 514).
- Lepidopilum devexum* Mitt. = *Lepidopilidium devexum* (Mitt.) Broth. (Mitten 1863: 163).
- Lepidopilum versicolor* Mitt. = *Hookeriopsis mittenii* P. de la Varde (Mitten 1863: 159).
- Leskea ramusculosa* Mitt. = *Thuidium ramusculosum* (Mitt.) Jaeg. (Mitten 1863: 161).
- Leucomium golungense* Gepp. in Hiern. = *Leucomium strumosum* (Hornsch.) Mitt. (Potier de la Varde 1936: 183, Schultze-Motel 1975: 511).
- Macromitrium levatum* Mitt. = *Macromitrium sulcatum* (Hook.) Brid. (Schultze-Motel 1975: 500).
- Macromitrium menziesii* Mitt. = *Macromitrium sulcatum* (Hook.) Brid. (Mitten 1863: 152).
- Meteorium imbricatum* (P. Beauv.) Mitt. = *Pilotrichella pentasticha* (Brid.) Wijk. & Marg. (Mitten 1863: 156).
- Meteorium serrulatum* P. Beauv. = *Trachypodopsis serrulata* (P. Beauv.) Fleisch. (Mitten 1863: 156).
- Mnium rostratum* Schwaegr. = *Plagiomnium rhynchosporum* (Hook.) T. Kop. (Mitten 1863: 162, Schultze-Motel 1975: 498).
- Mittenothamnium frondosum* (Mitt.) Card. = *Chrysohypnum frondosum* (Mitt.) Buck (Schultze-Motel 1975: 523).
- Mittenothamnium fruticellum* (Mitt.) Card. = *Mittenothamnium reptans* (Hedw.) Mitt. (Schultze-Motel 1975: 523).
- Neckera disticha* Hedw. = *Neckeropsis disticha* (Hedw.) Kindb. (Mitten 1863: 160).
- Philonotis wilsonii* (B., S. & G.) Mitt. = *Philonotis cernua* (Wils.) Griffin & Buck (Mitten 1863: 153).
- Pilotrichella pentasticha* (Brid.) Wijk. & Marg. = *Orthostichella pentasticha* (Brid.) Buck (Schultze-Motel 1975: 504).
- Pogonatum molleri* (C. Müll.) Paris = *Pogonatum gracilifolium* Besch. (De Sloover 1986: 286).
- Pogonatum rubenti-viride* (C. Müll.) Paris = *Pogonatum gracilifolium* Besch. (De Sloover 1986: 295).
- Porothamnium comorense* (C. Müll.) Sim = *Porotrichum elongatum* (Welw. & Duby) Gepp. (Schultze-Motel 1975: 506).
- Racopilum mucronatum* P. Beauv. = *Racopilum tomentosum* (Hedw.) Brid. (Mitten 1863: 162).
- Rhizogonium spiniforme* (Hedw.) Bruch = *Pyrrhobryum spiniforme* (Hedw.) Mitt. (Mitten 1863: 162, Schultze-Motel 1975: 498).
- Stereodon diffusus* Mitt. = *Ectropothecium diffusum* (Mitt.) Jaeg. (Mitten 1863: 157).
- Stereodon frondosus* Mitt. = *Chrysohypnum frondosum* (Mitt.) Buck (Mitten 1863: 158).
- Stereodon fruticellus* Mitt. = *Mittenothamnium reptans* (Hedw.) Mitt. (Mitten 1863: 158).
- Stereodon nitidifolius* Mitt. = *Plagiothecium nitidifolium* (Mitt.) Jaeg. (Mitten 1863: 158).
- Stereodon scaturagineus* Brid. = *Vesicularia scaturigina* (Brid.) Broth. (Mitten 1863: 157).

Stereophyllum nitens Mitt. = *Entodontopsis nitens* (Mitt.) Buck & Irel. (Mitten 1860: 51, Schultze-Motel 1975: 516).

Thamnum serpenticale C. Müll. = *Porotrichum elongatum* (Welw. & Duby) Gepp (Dusén 1895: 49).

Thamnum stipitatum (Mitt.) Broth. ex Par., *nom. illeg.* = *Porothamnium stipitatum* (Mitt.) Touw ex De Sloover (Schultze-Motel 1975: 507).

Thuidium annobonense Broth. in Mildbr., *nom. nud.* (Mildbraed 1922: 159. Annobón: stream bed, dry, 200 m, *Mildbraed* 6691), (Schultze-Motel 1975: 513) = *Thuidium gratum* (P. Beauv.) Jaeg. In the paper of Touw (1976) this name was omitted.

Trachyloma stipitatum Mitt. = *Porothamnium stipitatum* (Mitt.) Touw ex De Sloover (Mitten 1863: 156).

Trichosteleum perhamosum Broth. = *Radulina borbonica* (Bel.) Buck (Mildbraed 1922: 159, Schultze-Motel 1975: 520).

INCOMPLETELY IDENTIFIED TAXA

Brachymenium sp. Bioco: epiphyte on cacao, (Thorold 1955: 223).

Cheilolejeunea sp. Bioco: epiphyte on cacao, (Thorold 1955: 223).

Cyathodium sp. Annobón: Santa Cruz, stream bed, splashed stone, sterile, *Mildbraed* 6598, (Mildbraed 1922: 159).

Marchesinia sp. Annobón: Santa Mina, on stem of *Cyathea*, together with *Mastigophora africana* var. *annobonensis* *nom. inval.*, 650 m, *Byström* 605, (Arnell 1956: 531, as *Dicranolejeunea annobonensis* S. Arnell). According to Kruijt (1988), sterile specimens cannot be determined to species level.

Pilotrichella sp. Bioco: epiphyte on cacao, (Thorold 1955: 223).

Vesicularia sp. Bioco: Moka lake, *Monod* 10501, (Potier de la Varde 1953: 485, Schultze-Motel 1975: 525).

Acknowledgements We are enormously grateful to Drs. Harrington, O'Shea and Wigginton for their advice and help on the search for literature, the making of the species list and their revision of the English in this paper.

References

- Argent, G.C.G. (1973)** A taxonomic study of African Pterobryaceae and Meteoriaceae. II. Pterobryaceae- continued. *Journal of Bryology* 7 (4): 563-602.
- Arnell, S. (1956)** Hepaticae collected by K. Byström in Fernando Po and Annobon, West Africa, 1953. *Svensk Botanisk Tidskrift* 50: 527-534.
- Augier, J. (1985)** *Clés de détermination pour les Hépatiques et Anthocérotes au Cameroun forestier*. I. Texte - tables - glossaire. 123 pp. Paris.
- Bischler-Causse, H. (1993)** *Marchantia* L. The European and African taxa. *Bryophytorum Bibliotheca* 45: 1-129.
- Brotherus, V.F. (1897)** Musci africani. II. Engler's botanischen Jahrbüchen 14 (1-2): 232-284.
- Demaret, F. (1955)** Étude préliminaire de *Hookeriaceae* africaines intertropicales. *Bulletin Jardin Botanique de l'État à Bruxelles* 25 (4): 375-390.
- Demaret, F. & Potier de la Varde, R. (1952)** Les espèces africaines du genre *Callicostella* (C. Müll.) Jaeg. *Bulletin Jardin Botanique de l'État à Bruxelles* 22: 323-396.
- De Sloover, J.L. (1977)** Note de bryologie africaine VIII: *Neckera*, *Neckeropsis*. *Bulletin du Jardin Botanique National de Belgique* 47: 31-48.
- De Sloover, J.L. (1983)** Note de bryologie africaine XII: *Porotrichum* et *Porothamnium*. *Bulletin du Jardin Botanique National de Belgique* 53: 97-152.
- De Sloover, J.L. (1986)** Note de bryologie africaine XIII: *Polytrichaceae*. *Bulletin du Jardin Botanique National de Belgique* 56 (3/4): 241-300.
- Dusén, P. (1895)** New and some little known mosses from the West Coast of Africa. I. *Kongl. Svenska Vetenskaps-Akademiens Handlingar* 28 (2): 1-56.
- Enroth, J. (1994)** A taxonomic monography of the genus *Pinnatella*. *Acta Botanica Fennica* 151: 1-90.
- Exell, A.W. (1944)** *Catalogue of the Vascular Plants of S. Tomé (with Principe and Annobon)*. British Museum (Natural History). London.
- Evans, A.W. (1907)** *Leucolejeunea*, a new genus of Hepaticae. *Torreyia*, 7 (12): 225-229.
- Frahm, J.-P. (1985)** Afrikanische *Campylopus*-Arten (Dicranaceae - Musci). *Bryophytorum Bibliotheca* 31: 87-91.

- Gradstein, S.R. & Vanden Berghen, C. (1985)** *Schiffneriolejeunea* sect. *Pappeanae* en Afrique. *Nova Hedwigia* 80: 173-193.
- Greig-Smith, P. (1948)** *Potamolejeunea Holtii* (Spruce) nov. comb. *Transactions of the British Bryological Society* 1 (2): 108-109.
- Grolle, R. (1963)** Zwei Gattungen der Lophoziaaceae neu für Afrika. *Transactions of the British Bryological Society* 4 (3): 437-445.
- Grolle, R. (1972)** Zur Kenntnis von *Adelanthus* Mitt. *Journal of the Hattori Botanical Laboratory* 35: 325-370.
- Grolle, R. (1978)** Die Lebermoose der Seychellen. *Wiss. Z. Friedrich Schiller Univ. Jena*; 27: 7-17.
- Guinea, E. (1946)**, *Ensayo geobotánico de la Guinea Continental española*. Dirección General de Marruecos y Colonias. Madrid.
- Guinea, E. (1949)**. *En el País de los Bubis. Relato ilustrado de mi primer viaje a Fernando Poo*. Instituto de Estudios Africanos. C.S.I.C. Madrid.
- Jones, E.W. (1953)** African Hepatics. V. *Lophocolea*, with Notes on *Chiloscyphus* and *Leptoscyphus*. *Transactions of the British Bryological Society* 2 (2): 172-202.
- Jones, E.W. (1954a)** African Hepatics. VI. *Euosmolejeunea*. *Transactions of the British Bryological Society* 2 (3): 375-379.
- Jones, E.W. (1954b)** African Hepatics. VII. The Genus *Cheilolejeunea*. *Transactions of the British Bryological Society* 2 (3): 380-392.
- Jones, E.W. (1954c)** African Hepatics. IX. Some species of *Ptychocoleus*. *Transactions of the British Bryological Society* 2 (3): 396-407.
- Jones, E.W. (1962)** African Hepatics. XV. *Plagiochila* in Tropical Africa. *Transactions of the British Bryological Society* 4 (2): 254-325.
- Jones, E.W. (1963)** African Hepatics. XVI. *Porella* in Tropical Africa. *Transactions of the British Bryological Society* 4 (3): 446-461.
- Jones, E.W. (1967)** African Hepatics. XVIII. *Taxilejeunea* and *Lejeunea* with eplicate perianths. *Transactions of the British Bryological Society* 5 (2): 289-304.
- Jones, E.W. (1968)** African Hepatics. XIX. The *Lejeunea flava* complex. *Transactions of the British Bryological Society* 5 (3): 548-562.
- Jones, E.W. (1972)** African Hepatics. XXIII. Some species of *Lejeunea*. *Transactions of the British Bryological Society* 7 (1): 23-45.
- Jones, E.W. (1973)** African Hepatics. XXIV. Lejeunaceae: some new or little-known species and extensions of range. *Journal of Bryology* 7 (4): 545-561.
- Jones, E.W. (1977)** African Hepatics. XXX. The genus *Radula* Dumortier. *Journal of Bryology* 9 (4): 461-504.
- Jones, E.W. (1979)** African Hepatics. XXXI. Some new or little-known Lejeunaceae and extensions of range. *Journal of Bryology* 10 (4): 387-400.
- Jones, E.W. (1985)** African Hepatics. XXXIV. Some little-known or new Lejeunaceae. *Journal of Bryology* 13 (3): 385-398.
- Jones, E.W. (1987)** African Hepatics. XXXVII. Some little-known species and extensions of range. *Journal of Bryology* 14 (3): 503-509.
- Kruijt, R.,CH. (1988)** A monograph of the genera *Dicranolejeunea* and *Acanthocoleus*. *Bryophytorum Bibliotheca* 36: 1-135.
- Martínez Torres, L.M. & Alonso, J. (1993)** Cartografía morfoestructural de la Guinea Ecuatorial continental a partir del análisis de la red de drenaje. *Estudios del Museo de Ciencias Naturales de Alava* 8: 43-54.
- Martínez Torres, J.L. & Heras, P. (1995)** Thematic cartography of Continental Equatorial Guinea. *International Cartographic Conference, XVII, Barcelona 1995. Proceedings, vol. II: 2110-2113*. Institut Cartogràfic de Catalunya.
- Martínez Torres, J.L. & Riaza, A. (1996)**. *Geological map of Continental Equatorial Guinea*. Asociación Africanista Manuel Iradier - A.E.C.I. (Ministerio de Asuntos Exteriores).
- Mildbraed, J. (1922)** *Wissenschaftliche Ergebnisse der Zweiten Deutschen Zentral-Afrika-Expedition 1910-1911 unter der Führung Adolf Friedrichs, Herzogs zu Mecklenburg. Band II. Botanik*. Leipzig.
- Mitten, W. (1860)** On some new species of Musci and Hepaticae in the Herbarium of Sir W.J. Hooker, collected in tropical Africa, chiefly by the late Dr. Vogel and Mr. Barter. *Transactions of the Linnean Society London* 23 (1): 51-58.
- Mitten, W. (1863)** On the Musci and Hepaticae from the Cameroons Mountain and from the River Niger. *Journal the Proceedings of the Linnean Society London* 7: 147-169.
- Müller, K. (1886)** Beiträge zu einer Bryologie West-Afrikas. *Flora* 69: 499-525.
- Ochi, H. (1972)** A revision of the African Bryoideae (Musci). First part. *J. Fac. Educ. Tottori Univ.*,

- Nat. Sci. 23: 1-126.
- Orbán, S. (1981).** Studies on African *Calymperaceae*, III. Conspectus of the African species of *Syrrhopodon* Schwaegr. Acta Botanica Academiae Scientiarum Hungaricae 27 (1-2):169-177.
- O'Shea, B. (1995).** Checklist of the mosses of sub-Saharan Africa. Tropical Bryology 10: 91-198.
- Potier de la Varde, R. (1927)** *Hookeriopsis mittenii* nom. mutat. Archives de Botanique 1: 138-139.
- Potier de la Varde, R. (1936)** Mousses du Gabon. Mém. Soc. Nat. Sci. Nat. Math. Cherbourg 42: 1-270.
- Potier de la Varde, R. (1953)** Petite contribution à la flore bryologique de Fernando-Poo. Bulletin de l'Institut Français d'Afrique Noire 15 (2): 483-486.
- Pursell, R.A., Bruggeman-Nannenga, M.A. & Iwatsuki, Z. (1992).** Species of *Fissidens* (Fissidentaceae, Musci) common to the neotropics, Asia and Africa. Bryobrothera 1: 49-55.
- Richards, P.W. (1952)** Notes on African mosses. I *Andreaea camerunensis* sp. nov. and other Mosses mostly from Nigeria and the British Cameroons. Transactions of the British Bryological Society 2 (1): 66-70.
- Salazar, N. (1993)** A revision of the Pantropical moss genus *Leucophanes* Brid. Bryophytorum Bibliotheca 46.
- Schultze-Motel, W. (1975)** Katalog der Laubmoose von West-Afrika. Beiträge zur Flora von West-Afrika, Nr. 1. Willdenowia 7: 473-535.
- Stephani, F. (1886)** Hepaticae africanae. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 8: 79-95.
- Stephani, F. (1911)** *Species Hepaticarum* vol IV.
- Stephani, F. (1914)** *Species Hepaticarum* vol V.
- Teeuwen, M. (1989)** A revision of the genus *Odontolejeunea* (Spruce) Schiffn. (*Lejeunaceae*: Hepaticae). Nova Hedwigia 32 (1-2): 1-32.
- Thorold, C.A. (1955)** Observations on *Theobroma cacao* in Fernando Po. Journal of Ecology 43 (1): 219-225.
- Touw, A. (1976)** A taxonomic revision of *Thuidium*, *Pelekium* and *Raiiella* (Musci, Thuidiaceae) in Africa South of the Sahara. Lindbergia 3: 135-195.
- Vanden Berghen, C. (1948)** Notes sur quelques Lejeunéacées de l'Afrique centrale. Revue Bryologique et Lichénologique 37 (1-4): 92-100.
- Vanden Berghen, C. (1951)** Contribution a l'étude des espèces africaines du genre *Archilejeunea* (Spruce) Schiffn. Revue Bryologique et Lichénologique 20: 112-121.
- Vanden Berghen, C. (1976)** *Frullaniaceae* (Hepaticae) africanae. Bulletin du Jardin Botanique National de Belgique 46: 1-220.
- Vanden Berghen, C. (1984)** Le genre *Lopholejeunea* (Spruce) Schiffn. in Afrique. Bulletin du Jardin Botanique National de Belgique 54: 393-464.
- Vaña, J. (1988)** *Cephalozia* (Dum.) Dum. in Africa, with Notes on the Genus (Notes on some African Hepatic Genera 10). Nova Hedwigia 90: 179-198.