

British Bryological Society expedition to Mulanje Mountain, Malawi. 15. Lejeuneaceae, and the occurrence and frequency of foliicolous taxa

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Abstract. Details of habitat and location are given for 64 taxa of Lejeuneaceae collected during the BBS expedition to Mulanje Mountain, Malawi in 1991, of which 47 are new to Malawi. The occurrence and frequency of foliicolous taxa are documented.

INTRODUCTION

The background to the expedition, 16-30 June 1991, and details of the localities visited were described in the first paper of this series (Longton, 1993). Prior to this expedition, rather few collections of Lejeuneaceae had been published for Malawi, with only 26 species recorded (O'Shea, 1993). Because of this, a special effort was made to collect Lejeuneaceae during the BBS expedition. The foliicolous collections have all been studied in detail, but only about half of the collections of non-foliicolous Lejeuneaceae have so far been determined to species. As the remaining collections are worked through, it is likely that other species (especially of *Lejeunea*), will be identified, and further collections discovered of species listed in this paper. Our collections of *Colura* were published in Porley (1997). In the following list, for species with few records, the site name, 1 km UTM grid reference, habitat, altitude and specimen number

are given, and for those with more records, the collection data are summarised. The conversion of 1 km UTM grids to degrees and minutes of latitude and longitude is given in Table 2 in order to facilitate any future mapping. The UTM grid references have been derived from the 1:30000 map of Mulanje Mt., published by the British Directorate of Overseas Surveys (1977).

All the collections have been determined by the author unless otherwise indicated. The number on the collections packets are prefixed by the letter M, the letter being omitted in this paper. Collections will be housed at the herbarium of the Royal Botanic Garden, Edinburgh (E), with sub-collections at the National Herbarium, Zomba, Malawi (MAL) and the herbarium of the Botanic Garden, Missouri (MO).

* new to Malawi

** new to mainland Africa.

LIST OF TAXA

The taxa are listed in alphabetic order. For some of the most frequently recorded species, only selected collections are cited. For species previously recorded in Malawi, the place, collector's name and collection date are given.

***Acrolejeunea emergens* var. *emergens* (Mitt.) Steph.** Near Likhubula River, 6936, on dry bark of *Julbernardia* tree, 960 m, *Wigginton 1762a*. Previous record from Malawi: Mulanje Mt. (A.C. Crundwell, 1969).

***Aphanolejeunea capensis* (S.W.Arnell) S.W.Arnell** Chisongoli, 9127, on tree trunk in open forest, 1630 m, *Porley 39c*. Nessa path, Lichenya, 7330, 7429, 7431, 7529, epiphyll on forest shrubs, 1700-1820 m, *Porley 280b, 287b, 311a; Wigginton 1719h*. Between Nandiwo and Nandalanda, 8241, creeping over *Radula boryana* and *Hymenophyllum* sp. on stem of tree-fern in forest patch, 2220 m, *Wigginton 1390b*. Thuchila to Chambe path, 7238, on granitic boulder, 2020 m, *O'Shea 7416b*. Sombani Basin, near Forestry Dept., 9041, on mosses on tree bark in open woodland, 2080 m, *O'Shea 7247b*. Previous record from Malawi: Mulanje Mt. (L. Ryvardeen, 1973)

****Aphanolejeunea microscopica* var. *microscopica* (Taylor) A.Evans** Lichenya Plateau, 7529, epiphyll on forest shrub, 1750-1800 m, *Porley 280d, 287y*, det. T. Pócs.

****Aphanolejeunea microscopica* var. *exigua* (A.Evans) Pócs & Lücking** Slopes of Sapitwa, 7635, creeping over *Tetralophozia cavallii* and other bryophytes, 2770 m, *Porley 250b*.

****Aphanolejeunea microscopica* var. *africana* (Pócs) Pócs & Lücking** Ruo, Nessa path, Lichenya, 7232, 7431, 7429, 7529, 8239, epiphyll on forest shrubs and ferns, 1680-1900 m, *Porley 111d, 271j; Hodgetts 2522d; Wigginton 1719j; O'Shea 7500j*.

****Aphanolejeunea truncatifolia* Horik.** Little Lujeri Forest, 8032, epiphyll on *Dracaena steudneri* and a broad-leaved forest shrub, 1200 m, *Russell 6002a; O'Shea 7047a*, det. T. Pócs.

Originally thought to be new for Africa, but a 1947 collection from Bioko was reported in Infante *et al.* (1997).

****Archilejeunea abbreviata* (Mitt.) Vanden Berghen** The Crater, by Muloza river, 7227, on trunk of large forest tree, 920 m, *Longton 8657a, 8660e*.

***Caudalejeunea* sp.** Shoots of *Caudalejeunea* occurred occasionally in foliicolous collections, but almost all were sterile and indeterminate.

****Caudalejeunea hanningtonii* (Mitt.) Schiffn.** The Crater, 7227, epiphyll on forest shrub, 940 m, *O'Shea 7586a*.

****Caudalejeunea lewallei* Vanden Berghen** Nessa path, Lichenya, 7529, epiphyll on forest shrub, 1800 m, *Porley 280g*. Little Lujeri Gorge, 8032, epiphyll on *Dracaena* in forest, 1200 m, *Russell 6002e*.

****Ceratolejeunea jungneri* Steph.** Ruo Gorge, 8433, epiphyll on *Hymenophyllum* on buttress of forest tree, 1075 m, *Porley 94b*. Chisongoli, 9126, on trunk of small tree with other Lejeuneaceae, *Radula* sp., *Plagiochila* spp., 1230 m, *Wigginton 1022c*. Lower Ruo Forest, 8434, on tree buttress creeping amongst *Anastrophyllum piligerum*, *Bazzania decrescens*, *Lejeunea flava*, *Mastigophora dicladis*, *Plagiochila* sp., 1020 m, *Wigginton 1184e, 1187c*, det. E.W.Jones. The Crater, 7227, on boulder in stream, 900 m, *O'Shea 7546a*. Vanden Berghen (1951) separated *C. jungneri* from *C. calabariensis* by the length of the perianth horns. However, there is a complete gradation in length, and T. Pócs (pers. comm.) considers they cannot be maintained as a separate species, *C. jungneri* taking precedence. Malawi collections also show a range of perianth horn length, and have all been assigned to *C. jungneri*.

****Cheilolejeunea cordistipula* (Steph.) Grolle ex E.W.Jones** S. of Minunu Hut, above Ruo Gorge, 8337, stems and branches of well-lit shrub in grass/shrub community on plateau, 1980 m, *Wigginton 1275b*. Ruo Gorge, 8337, stem of small shrub at forest edge, with *Leucolejeunea*

rotundistipula, *L. xanthocarpa* and *Drepanolejeunea physaefolia*, 1880 m, *Wigginton 1248e*. Malosa Pools, 8740, epiphytic on ericaceous shrub, 2080 m, *Kungu 3086a*. Sapatwa, 7735, on tree bark, with *Cheilolejeunea pluriplicata* and *Diplasiolejeunea cornuta*, 2900 m, *Magombo 4306b*, *4308a*.

****Cheilolejeunea krakammae* (Lindenb.) R.M.Schust.** Lichenya Plateau, 7330, on twigs fallen from forest canopy, creeping over *Macrocoma tenuis*, with *Leucolejeunea xanthocarpa*, *Lejeunea* sp., 1820 m, *Porley 313c*. Thuchila Plateau, 7941, on trunk of small tree in open site, 1970 m, *Wigginton 1400b*. Chambe Basin, 7239, on trunk of *Trichilia emetica* with *Frullania obscurifolia*, *Microlejeunea africana*, *Trichosteleum* sp., in spruce woodland, 1900 m, *Wigginton 1546a*.

****Cheilolejeunea pluriplicata* (Pearson) R.M.Schust.** Sapatwa Mt., 7735, on tree bark, with *C. cordistipula*, 2900 m, *Magombo 4306a*, *4308c*. S. of Minunu Hut, 8433, on tree branch, with *C. usambarana*, 990 m, *O'Shea 7069b*.

****Cheilolejeunea pocsii* E.W.Jones** Chisongoli, 9127, epiphytic on stems of *Papillaria* sp., on shaded trunk of sapling in forest, 1660 m, *Wigginton 1073b*. This collection differs from typical *C. pocsii* in its rather smaller underleaves, often only 1.3-2.0 times the width of the stem.

****Cheilolejeunea surrepens* (Mitt.) E.W.Jones** Chisongoli, 9127, on trunks of small forest trees, 1635 m, *Wigginton 1047d*, *1068c*.

****Cheilolejeunea usambarana* (Steph.) Grolle** The Crater, 7227, on rotten tree trunk lying across stream, 950 m, *Hodgetts 2683a*. S. of Minunu Hut, 8433, on tree branch, with *C. pluriplicata*, 990 m, *O'Shea 7069a*. Madzeka path, 8532, on granitic boulder, with *Schiffneriolejeunea pappeana* and *Lejeunea* sp., 930 m, *Longton 8020a*.

****Cololejeunea appressa* (A.Evans) Benedix** Epiphyll in several localities on the southern slopes of Mt. Mulanje, but in tiny quantity and on very few leaves: The Crater, Upper and Lower

Ruo Forest, Chisongoli, 7227, 8335, 8434, 9127, 920-1625 m, *Porley 38j*; *Hodgetts 2666b*; *Kungu 3073e*; *Magombo 4106c*. The Crater, 7227, on bark of large tree in *Newtonia* forest by river, 920 m, *Longton 8660f*.

****Cololejeunea cardiocarpa* (Mont.) A.Evans** Chisongoli, Lichenya Plateau, The Crater, 7227, 7330, 7332, 7429, 7431, 9127, epiphyll on forest shrubs, usually in very small quantity, 920-1820 m, *Porley 311b*; *Wigginton 1720e*; *Hodgetts 2231b*, *2666d*; *O'Shea 7581f*.

****Cololejeunea distalopapillata* (E.W.Jones) R.M.Schust.** Chisongoli, Thuchila Plateau, Dzole, Minunu, Chambe Basin, Lichenya, 7227, 7240, 7429, 7431, 7840, 7939, 8337, 9127, epiphyll on forest shrubs and ferns, 920-2020 m, *Porley 52b*; *Wigginton 1489q*, *1492b*, *1493a*; *Hodgetts 2389e*, *2403c*, *2666f*; *Kungu 3073a*; *Longton 8401a*. This was one of the most frequent foliicolous species in our collections.

****Cololejeunea duvignaudii* E.W.Jones** Ruo Forest, Nessa path (Lichenya), Little Lujeri, 7529, 8032, epiphyll on forest shrubs, 1020-1820 m, *Porley 287c*; *Hodgetts 2542g*, *2554g*; *Russell 6002d*; *O'Shea 7047d*.

****Cololejeunea elegans* (Steph.) E.W.Jones** Ruo Forest, Nessa path (Lichenya), 7429, 7529, 8433, epiphyll on shaded forest shrubs and ferns, but particularly on *Hymenophyllum* spp. hanging from tree trunks and buttresses, 1020-1800 m, *Porley 94d*; *Wigginton 1185a*; *Hodgetts 2574e*, *2575s*.

***Cololejeunea latilobula* (Herzog) Tixier** Near Likhubula River, 6936, closely appressed to rough-surfaced granitic boulder by river, in humid but moderately exposed location, 980 m, *Wigginton 1755a*. Previous records in Malawi: Mirale Forest Reserve (E.W. Jones, 1955); Limbe (A.C. Crundwell, 1969). Tixier (1985) made *C. himalayensis* a synonym of *C. latilobula* (Herzog) Tixier, but E.W.Jones (in MS) considered that this synonymy requires confirmation.

****Cololejeunea lichenyae* ined.** This foliicolous

taxon, related to *C. harrisii* Pócs, was found on ferns and broad-leaved shrubs within forest and in humid streamside sites, but only in the vicinity of the Nessa path, south of Lichenya: 7429, 7529, 1800-1820 m, *Porley 271h, 279d; Hodgetts 2554hh, 2558a, 2569f*. Some collections were fertile, with mature perianths. The species will be described in a forthcoming paper (Wigginton, Hodgetts & Porley, in prep.).

***Cololejeunea malanjae* Steph.** The most frequent and abundant epiphyll on Mulanje Mt.: Chisongoli, Nessa path (Lichenya), Lichenya Plateau, Thuchila, Ruo Gorge, 7232, 7330, 7429, 7431, 7529, 7840, 8237, 9127, epiphyll on broad-leaved understorey shrubs in forest, 1250-1900 m, *Porley 38d, 54a, 280e, 311c; Wigginton 1492c; Hodgetts 2231e, 2522h, 2554h, 2574c; Magombo 4383a; O'Shea 7500c*. Previous records from Malawi: Mulanje Mt. (W. Scott Elliott, 1894); 'Nyasa See, Ulugura Berge' (Goetze, 1898).

***Cololejeunea minutissima* (Sm.) Schiffn.** Near Madzeka path, Ruo Valley, 8632, on granitic boulder in fire-break, 1080 m, *O'Shea 7031c*. Previous record from Malawi: Limbe (A.C. Crundwell, 1969).

***Cololejeunea minutissima* subsp. *myriocarpa* (Nees & Mont.) R.M.Schust.** Dzole, Chisongoli, 9127, on shaded rock in cleared area of forest, 1540 m, *Wigginton 1107a*, conf. T. Pócs. Lichenya: 7332, 7939, rare and very sparse epiphyll on forest shrubs, 1780-2020 m, *Hodgetts 2378c 7528f*. Madzeka path, 8532, on granitic boulder, creeping over *Cheilolejeunea usambarana* and *Schiffneriolejeunea pappeana*, 930 m, *Longton 8020d*. Previous record from Malawi: Zomba Plateau (T. Pócs, 1991).

****Cololejeunea mocambiquensis* S.W.Arnell** Thuchila Plateau, 7841, epiphytic on *Porotrichum usagarum* on shaded rock in forest, 1760 m, *Wigginton 1430a*, det. T. Pócs. Shoots of *C. mocambiquensis* were found on only c. 20 fronds of *Porotrichum usagarum* in this bulky collection. *C. mocambiquensis* was not observed in any other of our numerous collections of *Porotrichum* or other robust mosses.

****Cololejeunea obtusifolia* (E.W.Jones) Tixier** A local and sparse epiphyll on forest shrubs, and apparently confined to lower altitudes on Mulanje Mt.: Ruo Forest, The Crater, 7227, 8335, 8434, 920-1250 m, *Hodgetts 2666g; Kungu 3073c; Magombo 4106a*.

****Cololejeunea occidentalis* (E.W.Jones) Vanden Berghen** Chisongoli, 9127, epiphyll on shrub, 1625-1710 m, *Porley 38a, 47a*. Lichenya river, 7431, epiphyll on shrub, 1700 m, *Wigginton 1719b*, comm. E.W.Jones. Nessa path, Lichenya Plateau, 7429, epiphyll on forest shrub, 1800 m, *Hodgetts 2574u*. The Crater, 7227, epiphyll on shrub by stream, 950 m, *O'Shea 7581d*. Because the group of similar species including *C. africana* and *C. occidentalis* is poorly understood, naming our Malawi collections has been a little uncertain. However, I have mainly followed Vanden Berghen (1978), and assigned all of them to *C. occidentalis* on the basis of 1) the size of the mature lobes (550-850 x 900-1100 µm), 2) the size of the apical hyaline cells (c.15 x 40-52 µm to 19 x 55-75 µm), and 3) the hyaline cells gradually reducing in size along the postical margin of the lobe and ceasing c. 10-12 cells from the keel. However, all our collections differ in the marginal hyaline cells being mostly deeply crenulate rather than fimbriate, and the apical tooth being blunt or short.

****Cololejeunea platyneura* (Spruce) A.Evans** A very frequent epiphyll on ferns and shrubs in forest and other shaded places; very rare on tree trunks: Chisongoli, Nessa path, Lichenya Plateau, Lower Ruo, 7429, 7431, 7529, 8434, 9126, 1005-1820 m, *Porley 280k, 281c, 287c, 298d; Hodgetts 2522i, 2542b, 2554i, 2574v; Magombo 4387e*.

****Cololejeunea runssorensis* (Steph.) Pócs** Nessa path, Lichenya Plateau; 7232, 7529, epiphyll on forest shrub and fern; 1750-1800 m; *Porley 271f; O'Shea 7500d*.

****Cololejeunea tanneri* Pócs** Little Lujeri Gorge, 8032, rare epiphyll on a forest shrub, 1200 m, *Russell 6002f*, conf. T. Pócs. This is the second record of a species which is otherwise known only from the type collection from the Usambara Mts., Tanzania (Pócs, 1985).

**Cololejeunea tanzaniae* Pócs Thuchila Plateau, 7840, epiphyll on shrub and small tree in forest understorey, 1730-1760 m, *Wigginton 1489k, 1492a*, conf. T. Pócs.

**Cololejeunea tonkinensis* Steph. Upper and Lower Ruo, The Crater, Little Lujeri, 7227, 8032, 8337, 8434, epiphyll on forest shrubs, usually in small quantity, at the lower altitudes on the mountain, 920-1250 m, *Hodgetts 2666h; Kungu 3073d; Magombo 4106d; Russell 6002c; O'Shea 7047b, 7581e*.

**Cololejeunea zenkeri* (Steph.) E.W.Jones A very locally frequent epiphyll on forest shrubs and ferns, found only on the Lichenya Plateau and in forest bordering Nessa path (Lichenya), 7429, 7529, 1800 m, *Hodgetts 2542k, 2569c, 2574a, 2575p*.

**Diplasiolejeunea cornuta* Steph. A fairly widespread epiphyll on forest shrubs and ferns, but always in very small quantity. Chisongoli, Nessa path, Lichenya, Ruo Gorge, 7330, 7332, 7333, 7431, 7840, 8237, 9127, 1680-2900 m, *Porley 52d; Wigginton 1719d; Hodgetts 2242e, 2589t, 2595e*. Near Minunu Hut, 8237, on stem of *Kotschya scaberrima* (Leguminosae) in grass-heath, 2000 m, *Porley 125a*. Sapitwa Mt., 7735, on tree bark, with *Cheilolejeunea* spp., 2900 m, *Magombo 4308d*.

**Diplasiolejeunea kraussiana* (Lindenb.) Steph. A locally frequent epiphyll on leaves of small trees and forest shrubs, but found only on the Thuchila and Lichenya Plateaux, within a small altitude range: 7232, 7840, 1700-1750 m, *Porley 217c; Wigginton 1489r; Hodgetts 2378d; O'Shea 7500g*.

***Diplasiolejeunea subcornuta* Tixier Minunu, 8337, epiphyte on stems of leguminous shrub in shrub-grass community, 2000 m, *Wigginton 1262a*, det. T. Pócs.

**Diplasiolejeunea symoensii* Vanden Berghen Epiphyll on forest shrubs and ferns, Chisongoli, Lichenya, Nessa path, 7330, 7332, 7429, 7529, 9127, 1625-1820 m, *Porley 38g, 52d, 311b; Wigginton 1720c; Hodgetts 2567f, 2569j*.

**Diplasiolejeunea villaumei* Steph. Nessa path, Lichenya; 7330, 7331, on twigs of a forest shrub, with some plants growing on leaf petioles and the blade (but hardly an epiphyll), 1720 and 1780 m, *Wigginton 1662a, Hodgetts 2589s*. Lichenya Plateau, near Lichenya River, 7331, on tree branch in riverine forest, growing with *Leucolejeunea xanthocarpa*, 1720 m, *Kungu 3329a*.

**Drepanolejeunea cultrella* agg. The recognition and delimitation of species within the *D. cultrella* complex is difficult because of 1) the great variability in the morphology of leaves, especially in dentition, even within a single collection, the leaves on strong main axes often being very different from those on branches or weak shoots, 2) the infrequent occurrence of perianths in dioecious species, and 3) the variable number and position of ocelli, which, in addition, are apparently not present in every leaf. Such difficulties have led to a divergence of opinion amongst taxonomists, with some taxa being variously recognised as species, varieties, or merely morphological variants. Taxa in the *D. cultrella* complex occurred mainly in the Mt. Mulanje foliicolous collections, and were well represented there, with only *Cololejeunea malanjae* and *C. platyneura* more frequent in terms of their presence on examined leaves. However, there was considerable variation in leaf form and dentition: in some collections only slight dentition, in others a prominent postical tooth, and in others prominent dentition on the antical margin. Depending on what literature is consulted, such forms could be assigned to *D. cultrella* (Mitt.) Steph., *D. ruandensis* Vanden Berghen, perhaps even to *D. cambouena* Steph. (according to expert opinion). The latter is, however, a poorly-described and little-known species. In one collection (*O'Shea 7455c*), the leaves are remarkable in possessing a long narrow 'tooth' of uniseriate cells on the postical margin near the insertion of the lobule - a similar form to that of the southeast Asian *D. pentadactyla* (e.g. illustration in Herzog (1934), as *D. micholitzii* var. *dactylophoroides*). Because of the taxonomic uncertainties, all collections have been placed in *D. cultrella* agg. for the time being pending further studies of this complex. A

frequent epiphyll particularly on sclerophyllous leaves, rarely on twigs; Chisongoli, Lichenya, Nessa path, Thuchila Plateau, 7232, 7330, 7429, 7431, 7529, 7840, 9127, 1625-1800 m, *Porley 311e*; *Wigginton 1489n, 1493g*; *Hodgetts 2389a, 2595g*; *O'Shea 7455c, 7500b, 7500n*. Several collections are abundantly fertile, with mature perianths.

***Drepanolejeunea physaefolia* (Gottsche) Steph.**

A very frequent epiphyte on tree trunks, branches and twigs, occurring either as scattered stems intricately intertwined in tufts of more robust hepatics and mosses, or in mixed bryophyte mats, or in small 'pure' patches. Rare on rocks, and very rare as an epiphyll. Chisongoli, Crater, Nessa path, Lichenya, Ruo, 7227, 7529, 8337, 9126, 885-1880 m, *Porley 287j, 327b*; *Wigginton 1017a, 1248a*; *Magombo 4052b*; *O'Shea 7164a, 7500h*. Previous record from Malawi: Mulanje Mt. (T. Pócs, 1991). Perianths are rare in this dioecious species, and mature perianths have not been detected in our Malawi collections, although in some collections fully grown bracts and bracteoles are common, but concealing only embryonic, hardly-formed perianths. The relationship of this taxon with the Asian *D. vesiculosa* (Mitt.) Steph. requires further study. Tixier (1995) made *D. physaefolia* its synonym, but Grolle (1995) considered that their conspecificity is still an open question.

****Drepanolejeunea pocsii* Grolle** A rather local epiphyll on broad-leaved shrubs and *Dracaena* in humid forest, sometimes in abundance on individual leaves. Nessa path, Lichenya, and Little Lujeri Forest, 7429, 7529, 8032, 1200-1800 m, *Porley 280f*; *Hodgetts 2522s, M2569r*; *Russell 6002b*; *O'Shea 7047i*.

****Lejeunea caespitosa* Lindenb., in Gottsche et al.** Nessa path, Lichenya, Thuchila, 7232, 7529, 7840, 1730-1760 m, *Porley 287k*; *Wigginton 1489d, 1493e*; *Hodgetts 2574x*; *Magombo 4387c*; *O'Shea 7500p*. Only fertile material has been determined, but the occurrence of similar sterile material suggests this is probably a frequent epiphyll on forest shrubs.

****Lejeunea confusa* E.W.Jones** Chisongoli,

9127, epiphyllous on forest shrubs, 1680 m, *Hodgetts 2231i*. Nessa path, Lichenya Plateau, 7529, epiphyll on forest shrub, 1820 m, *Hodgetts 2554w*. Chisongoli, 9127, on twigs of forest shrub, 1680 m, *Hodgetts 2231h*.

***Lejeunea eckloniana* Lindenb., in Gottsche et al.** Epiphyll on forest shrubs and saplings: Nessa path, Lichenya, between Dzole and Khutu, 7232, 7529, 7840, 7939, 1730-2020 m, *Porley 281g*; *Wigginton 1489c*; *Hodgetts 2403f, 2554x*; *O'Shea 7500k*.

***Lejeunea flava* agg.** Taxa of this group occurred frequently in our foliicolous and other collections, though the material was often sterile and sometimes indeterminate. Most collections appear to be *L. flava* subsp. *tabularis*, but few collections have yet been sufficiently studied.

****Lejeunea hepaticola* (Steph.) Steph.** Near Minunu, 8237, epiphytic on base of leguminous shrub, with *Diplasiolejeunea cornuta*, *Lejeunea flava* agg., *Leucolejeunea xanthocarpa*, *Microlejeunea africana*, *Schiffneriolejeunea pappeana* in grass-shrub community on plateau, 2000 m, *Wigginton 1262b*. Near Minunu firebreak, 8337, stem and branches of shrub in grass/shrub community, 1980 m, *Wigginton 1275d*. Lichenya River, 7431, epiphyll on fern in forest near river, 1700 m, *Wigginton 1719f*. Nessa path, Lichenya, 7330, on twigs and leaves overhanging forest stream, 1780 m, *Hodgetts 2595j*.

***Lejeunea isophylla* E.W.Jones** Chisongoli, 9227, on base of forest tree, 1680 m, *Wigginton 1081c*. Near Lichenya Rest House, 7232, amongst other bryophytes on tree branch, 1720 m, *O'Shea 7490d*. Previous record: Mulanje Mt. (F.G.H. Lupton, 1947).

****Lejeunea "longilobulata" ined.*** Upper Ruo Gorge, 8237, epiphyll on tree-fern, 1900 m, *Porley 111b*. Thuchila, 7840, epiphyll on forest shrub and sapling, 1730 m, *Wigginton 1489g*, *Hodgetts 2389d*. This taxon was described and given this "working" name by E.W.Jones in an unpublished draft account of the *Lejeunea flava* complex. It is similar to *L. tabularis*, differing

mainly in the inrolled free margin of the lobule being bordered by 5-10 cells (normally 4 cells in *L. tabularis*). Jones described this taxon from Kenyan and Tanzanian specimens, where it is known as an epiphyte and epiphyll on a wide range of trees and shrubs, including bamboo. The recorded altitude range is 1700-3070 m.

***Lejeunea tabularis* (Spreng.) Gottsche, in Gottsche et al.** Thuchila Plateau, 7840, epiphyll on forest shrub, 1750 m, *Wigginton 1489f*; *Hodgetts 2378j*. Chambe to Lichenya path, 7233, epiphytic on *Hymenophyllum* on *Widdringtonia cupressoides*, 2045 m, *O'Shea 7426a*.

***Tubata* form:** Near Lichenya River, 7232, on leaves of shrub on stream bank, 1750 m, *O'Shea 7500s*; epiphytic on bamboo, 1720 m, *Longton 8516b*. Previous record from Malawi: Zomba Plateau (A.C. Crundwell, 1969).

***Lejeunea tuberculosa* Steph.** Chisongoli, 9227, trunk of small forest tree, 1680 m, *Wigginton 1091c*. Madzeka path, 8532, bark of *Mangifera* tree, 965 m, *O'Shea 7022a, 7023d*. The Crater, 7227, trunk of large tree in *Newtonia* forest, 920 m, *Longton 8660a*. Only collections with perianths have been determined. Previous record from Malawi: Mirale Forest Reserve (E.W. Jones, 1955). African collections were formerly placed under its synonym, *L. camerunensis* (Steph.) E.W. Jones.

****Lejeunea villaumei* (Steph.) Grolle** Nessa path, Lichenya, 7529, epiphyll on forest shrub, 1820 m, *Hodgetts 2554t*.

****Leucolejeunea rotundistipula* (Lindenb. ex Lehm.) A. Evans** Chisongoli, 9127, on vertical side of granitic rock in cleared area of forest, 1560 m, *Wigginton 1103b*. Chisongoli, 9126, on rock in open area along path, 1220 m, *Magombo 4067a*. Minunu path, Ruo valley, 8435, on rotting log, 1110 m, *O'Shea 7079e*. Ruo Forest, 8337, on stem of small shrub, with *L. xanthocarpa*, *Cheilolejeunea cordistipula*, *Drepanolejeunea physaefolia*, 1880 m, *Wigginton 1248a*, conf. R. Grolle. *L. rotundistipula* can be very similar to *Cheilolejeunea cordistipula* in colour, size and general morphology, and it is possible that one or the other might have been overlooked in other

mixed collections, especially where present in small amounts. The apical tooth in some plants of *L. rotundistipula* varies in length and sharpness, but the lack of a sinus at the junction of the lobule and lobe, and the small underleaves clearly point to this species.

****Leucolejeunea xanthocarpa* (Lehm. & Lindenb.) A. Evans** Frequent on trunks, branches and twigs (including canopy twigs) on a wide range of trees and shrubs, including bamboo, and rare as an epiphyll. Usually in small quantities and often in mixed lejeuneaceous communities, or creeping over mat-forming mosses, often abundantly fertile. Associates included *Cheilolejeunea cordistipula*, *Diplasiolejeunea villaumei*, *Drepanolejeunea physaefolia*, *Leucolejeunea rotundistipula*, *Schiffneriolejeunea pappeana*. Lichenya, Malosa Pools, Minunu, Ruo, 7330, 7331, 7333, 7532, 8237, 8337, 8740, 1700-2080 m, *Porley 313b*; *Wigginton 1248b, 1275a, 1727a*; *Kungu 3086b, 3329b*; *O'Shea 7513a*.

****Lopholejeunea laciniata* E.W. Jones** Chisongoli, 9126, base of small tree in open forest, 1230 m, *Wigginton 1027b*. Chisongoli, 9227, branch of fallen tree in forest, 1680 m, *Wigginton 1099e*.

***Lopholejeunea nigricans* (Lindenb.) Schiffn.** Only plants with mature perianths are cited. Thuchila valley, 7438, on tree trunk in broadleaved evergreen woodland, 1920 m, *Kungu 3244a* (plants in this collection have strongly dentate bracteoles and female bracts, and conform to the former var. *fragilis* of *L. abortica*). Muluzi River, Chisongoli, 9127, on rocks by river, 1220 m, *Porley 9a*. Chisongoli, 9127, closely appressed to granitic rock, 1635 m, *Wigginton 1067a*. Madzeka path, Ruo valley, 8532, on granitic rock by stream in riverine forest, 930 m, *Longton 8009a*. Previous record from Malawi: Zomba Plateau (D.G. Long, 1985).

***Marchesinia madagassa* Steph.** Between Thuchila and Chambe, 7438, tree trunk in forest, 1900 m, *Wigginton 1590a*. Previous records from Malawi: Ndirande (E.W. Jones, 1955); Zomba Plateau (D.G. Long, 1985).

***Microlejeunea africana* Steph.** A frequent epiphyll and bark epiphyte, but often in small quantity. e.g. Lichenya River, 7331, tree trunk in humid forest, 1720 m, *Wigginton 1655a*. By Muloza River, The Crater, 7227, on rotting branch in *Newtonia* forest, 920 m, *Longton 8651a*. Previous records from Malawi: Limbe (A.C. Crundwell, 1969); Ndirande (A.C. Crundwell, 1969); Mpingwe Hill (E.W. Jones, 1955); Zomba Plateau (A.C. Crundwell, 1969); Mulanje Mt. (A.C. Crundwell, 1969, L. Ryvardeen, 1973).

****Microlejeunea kamerunensis* Steph.** A scarce epiphyll, and bark epiphyte. e.g. Lichenya Plateau, Nessa path, 7529, epiphyllous on forest shrub, 1750 m, *Porley 287s*. Madzeka path, 8532, on shaded granitic rock, 1050 m, *Kungu 3013b*.

****Prionolejeunea grata* (Gottsche) Schiffn.** Lujeri Gorge, 8031, creeping over other bryophytes on rotting log in forest, 1180 m, *O'Shea 7063d*.

***Ptychanthus striatus* (Lehm. & Lindenb.) Nees** A common epiphyte of shaded sites, on trunks, branches and small twigs of trees, and on shrubs and lianes; often abundant, and usually abundantly fertile. Rare on shaded rock. Widespread on Mt. Mulanje: Chambe, Chisongoli, Lujeri, Minunu, Sombani, Thuchila, 7239, 7240, 7438, 7840, 8032, 8335, 9041, 9127, 1200-2080 m, *Wigginton 1547a, 1558a, 1582a; Magombo 4241a; Russell 6018b; O'Shea 7056a, 7060a, 7085b, 7248a, Longton 8396a, 8423a*. Previous records from Malawi: Soche (A.C. Crundwell, 1969); Ndirande (E.W. Jones, 1955); Zomba Plateau (A.C. Crundwell, 1969, D.G. Long, 1985); Mulanje Mt. (L. Ryvardeen, 1973, Pócs, 1991).

***Schiffneriolejeunea pappeana* var. *pappeana* (Nees) Gradst.** On twigs and small branches in the forest canopy, and on trees and shrubs at the forest edge; often very widespread and frequent. Chinzama to Sombani path, Chisongoli, Lichenya, Minunu, Ruo, Thuchila, 7239, 7240, 7438, 7939, 8237, 8337, 8441, 1380-2180 m, *Porley 48a, 114a, 224a, 316c; Wigginton 1098e,*

1544b; Russell 6071a; O'Shea 7092a, 7315a; Longton 8168a, 8288a, 8392a, 8460a. Previous records from Malawi: Zomba Plateau (A.C. Crundwell, 1969); Mulanje Mt. (A. Gepp, 1894, F.G.H. Lupton, 1947).

****Schiffneriolejeunea polycarpa* (Nees) Gradst.** Madzeka path, 8532, bark of *Mangifera indica*, 965 m, *O'Shea 7014b*. Lujeri Forest, 8032, on twigs, 1200 m, *O'Shea 7061a*.

***Taxilejeunea conformis* (Nees & Mont.) Steph.** An occasional epiphyll on forest shrubs, and bark epiphyte. Chinzama to Sombani, Chisongoli, Lichenya, Little Lujeri river, 7429, 7529, 7532, 8032, 8441, 9126, 1200-1800 m, *Porley 271k, 280m, 298n; Wigginton 1033a; Hodgetts 2522b; O'Shea 7051d, 7323d, 7519g*. Previous records from Malawi: Limbe (A.C. Crundwell, 1969); Mirale Forest Reserve (E.W. Jones, 1955); Zomba Mt. (E.W. Jones, 1955).

FOLIICOLOUS COLLECTIONS

Background

The study of foliicolous bryophyte communities in sub-Saharan Africa has a long history, the first published being that of Busse (1905), but there was a long interval thereafter until the studies of Thorold (1955), Harrington (1967) and Olarinmoye (1974, 1975). Pócs (1977) published a detailed account of the foliicolous communities of East Africa (Kenya and Tanzania), and compared the African foliicolous flora with that of other continents. A few other studies have been published, notably by Pócs for the Comoro Islands (Pócs, 1993) and for the Seychelles and Mauritius (Pócs & Tóthmérész, 1997). Studies of the occurrence of foliicolous species and endemism in the African liverwort flora were published in Pócs (1997, 1999), and there have been many published accounts of individual foliicolous taxa.

In his study of East African communities, Pócs (1977) recorded the numbers of individual plantlets per leaf, and tabulated the total number of plantlets recorded for each taxon (Pócs, 1977,

Table 3). Plantlets were not counted in the Mulanje collections, so a direct comparison between the two data sets is not straightforward. However, some of the original Tanzanian data which was summarised in Pócs (1977) was presented in Pócs & Tóthmérész (1997) for individual relevés, and this does suggest that there is generally a positive correlation between the total number of plantlets and the frequency of occurrence of the taxon on leaves. A more ready comparison is possible with the constancy of occurrence of taxa in collections (relevés).

The Mulanje Mt. collections

Foliicolous liverworts occurred in most of the forest areas visited on Mulanje Mt. in 1991, though they were generally very localised, and sometimes occurred in only small quantities on only a few host plants in a particular locality. Most collections (42) were from montane forest between 1600-1850 m where most of our collecting was concentrated (Chambe, Chisongoli, Lichenya River and Nessa path, Upper Ruo Gorge, Thuchila Plateau), with only 9 collections from submontane forest between 950-1250 m (The Crater, Lujeri, Lower Ruo Gorge), and only 4 small collections from upper montane forest between 1900-2020 m. It seems likely that further surveys of these forests will reveal additional foliicolous species, in particular from submontane forest in the deepest parts of the most humid valleys on the southern and eastern sides of Mulanje Mt. Most collections were from small, sclerophyllous-leaved shrubs, with some from ferns and *Hymenophyllum* spp. The number of leaves in each collection ranged from 4 to 38, reflecting the frequency and diversity at the collection site and on the particular host plant. At each location, we mostly collected leaves which appeared to have the greatest diversity or amounts of foliicolous species, but also collected leaves on which foliicolous bryophytes were sparse. Only the presence of foliicolous taxa was recorded on each of the 797 leaves examined, and no attempt was made to document either cover-abundance or the number of plantlets.

Data on the occurrence of the Mulanje Mt.

foliicolous taxa are summarised in Table 1, which shows for each taxon the number of leaves on which it occurred, the number of collections in which it was found, and the constancy of its occurrence in collections. By far the most frequently occurring species on leaves was the appropriately named *Cololejeunea malanjeae*, recorded on 323 leaves (40.5% of the total) in 38 collections (75% of the total). The next most common species, *C. platyneura*, occurred at less than half the frequency of *C. malanjeae*, being found on 155 leaves (21% of the total) in 19 collections (19% of the total). The other taxa which were recorded on more than 50 leaves were *Drepanolejeunea cultrella* agg. (101), *Cololejeunea distalopapillata* (85), *Drepanolejeunea symoensii* (84) and *Aphanolejeunea capensis* (81), *Diplasiolejeunea kraussiana* (64) and *Taxilejeunea conformis* (52). The most constant taxa in terms of occurrence in collections (relevés) are shown in columns 2, 5 and 8 of Table 1.

Since sampling of the submontane forest on Mulanje Mt. was limited, comparisons of the floras of submontane and montane forest must be tentative. A rigorous comparison of foliicolous collections from Mulanje Mt. and other areas must also await further sampling. However, the foliicolous flora on Mulanje Mt. had certain similarities with that described for Tanzania and Kenya (Pócs, 1977). In particular, that 1) several of the most frequent species on Mulanje Mt. were also among the most frequent in the collections from Tanzania and Kenya - e.g. *Cololejeunea malanje* (as *C. grossidens*), *Drepanolejeunea cultrella*, *Microlejeunea africana*, 2) some species common to both areas tended to occur at lower elevations on Mulanje Mt. than on mountains in Tanzania and Kenya, 3) *Cololejeunea appressa*, *C. obtusifolia* and *C. tonkinensis* occurred preferentially in submontane forest below 1250 m in both areas, and 4) *Aphanolejeunea capensis*, *A. microscopica* var. *exigua*, *Cololejeunea tanzaniae*, *Colura tenuicornis*, *Diplasiolejeunea cornuta*, *Lejeunea caespitosa*, *L. confusa*, *L. isophylla* and *Metzgeria consanguinea* were recorded only in higher altitude forest in both areas.

Differences are also apparent. For example, 1) the sampled areas of Tanzania / Kenya were richer in foliicolous species, with *ca.* 90 liverworts recorded (compared with *ca.* 70 for Mulanje Mt.), including common species which were rare or not recorded on Mulanje Mt. (e.g. *Cololejeunea duvignaudii*, *Drepanolejeunea pocsii*, *D. trematodes*, *Leptolejeunea* spp., *Radula stenocalyx*), and 2) taxa recorded frequently in foliicolous collections from Mulanje Mt. but not in those from Tanzania / Kenya included *Colura usambarica*, *Diplasiolejeunea kraussiana*, *D. symoensii* (one plantlet only in the Tanzania / Kenya collections).

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Table 1. Occurrence of foliicolous taxa in two altitude ranges

column	950-1250 m. (72 leaves in 9 collections)			1600-2020 m. (725 leaves in 42 colls)			950-2020 m Total (797 leaves in 51 colls)	
	1	2	3	4	5	6	7	8
liverworts								
Aphanolejeunea capensis	1 (1)		1.39	81 (19)	III	11.30	10.29	II
Aphanolejeunea microscopica var. africana				25 (11)	II	3.45	3.14	II
Aphanolejeunea microscopica var. microscopica				6 (4)		0.82	0.75	
Aphanolejeunea truncatifolia	4 (2)		5.55				0.50	
Caudalejeunea hanningtonii	1 (1)		1.39				0.13	
Caudalejeunea lewallei	3 (1)		4.16	2 (1)		0.27	0.63	
Caudalejeunea sp. (sterile)	1 (1)		1.39	6 (5)		0.82	0.88	
Ceratolejeunea jungneri	2 (2)		2.78				0.25	
Cololejeunea appressa	5 (3) II		6.94	2 (1)		0.27	0.88	
Cololejeunea cardiocarpa	14 (2)		19.44	17 (12)	II	2.34	3.89	II
Cololejeunea distalopapillata	14 (4) III		19.44	85 (18)	III	11.72	12.42	III
Cololejeunea duvignaudii	17 (3) II		23.61	23 (4)		3.17	5.02	
Cololejeunea elegans	8 (2)		11.11	9 (2)		1.24	2.13	
Cololejeunea lichenyae*				36 (6)		4.96	4.52	
Cololejeunea malanjae	11 (3) II		15.28	312 (35)	IV	43.03	40.53	V
Cololejeunea minutissima subsp. myriocarpa				8 (3)		1.10	1.00	
Cololejeunea obtusifolia	39 (3) II		54.17				4.89	
Cololejeunea occidentalis	1 (1)		1.39	18 (7)		2.48	2.38	
Cololejeunea platyneura				155 (19)	III	21.38	19.44	II
Cololejeunea runssorensis				5 (3)		0.69	0.63	
Cololejeunea tanneri	1 (1)		1.39				0.13	
Cololejeunea tanzaniae				9 (2)		1.24	1.13	
Cololejeunea tonkinensis	16 (6) IV		22.22				2.01	
Cololejeunea zenkeri				41 (8)		5.66	5.14	
Colura calyptrifolia				16 (2)		2.20	2.01	
Colura digitalis	15 (3) II		20.83	27 (11)	II	3.72	5.27	II
Colura tenuicornis				14 (5)		5.09	1.76	
Colura usambarica	5 (3) II		6.94	7 (6)		0.97	1.51	
Diplasiolejeunea cornuta				36 (16)	II	4.96	4.52	II
Diplasiolejeunea kraussiana				64 (10)	II	8.82	8.03	
Diplasiolejeunea symoensii	1 (1)		1.39	84 (23)	III	11.58	10.66	III
Drepanolejeunea cultrella				101 (22)	III	13.93	12.67	III
Drepanolejeunea physaefolia	1 (1)		1.39	5 (4)		0.69	0.75	
Drepanolejeunea pocsii	12 (2)		16.67	16 (5)		2.20	3.51	
Frullania apicalis				1 (1)		0.13	0.13	

Frullania arecae			2 (2)		0.27	0.25	
Frullania capensis			2 (2)		0.27	0.25	
Frullania gabonensis			1 (1)		0.13	0.13	
Frullania lindenbergii			1 (1)		0.13	0.13	
Lejeunea caespitosa			21 (8)		2.89	2.63	
Lejeunea aff. caespitosa			26 (10)	II	3.59	3.26	II
Lejeunea confusa			5 (3)		0.69	0.63	
Lejeunea eckloniana	3 (1)	4.16	28 (11)	II	3.86	3.89	II
Lejeunea flava agg.	2 (2)	2.78	29 (13)	II	4.00	3.89	II
Lejeunea hepaticola			2 (2)		0.27	0.25	
Lejeunea isophylla	3 (2)	4.16	1 (1)		0.13	0.13	
Lejeunea "longilobulata"			5 (3)		0.69	0.63	
Lejeunea tabularis			35 (8)		4.83	4.39	
Lejeunea villaumei			2 (2)		0.27	0.25	
Lejeunea sp. (sterile)	7(3) II	9.72	30 (16)	II	4.13	4.64	III
Leucolejeunea xanthocarpa			3 (3)		0.41	0.38	
Lophocolea muricata			1 (1)		0.13	0.13	
Lopholejeunea sp. (sterile)			1 (1)		0.13	0.13	
Metzgeria attenuata			1 (1)		0.13	0.13	
Metzgeria consanguinea			2 (1)		0.27	0.25	
Metzgeria decipiens			1 (1)		0.13	0.13	
Metzgeria leptoneura			1 (1)		0.13	0.13	
Metzgeria propagulifera			1 (1)		0.13	0.13	
Metzgeria sp.			22 (11)	II	3.03	2.76	
Microlejeunea africana	5 (3) II	6.94	29 (29)	IV	12.27	4.27	IV
Microlejeunea kamerunensis	1 (1)	1.39	9 (6)		1.24	1.25	
Plagiochila lastii			1 (1)		0.13	0.13	
Plagiochila strictifolia			2 (2)		0.27	0.25	
Plagiochila terebrans			3 (2)		0.41	0.38	
Radula boryana	3 (2)	4.16	1 (1)		0.13	0.13	
Radula comorensis			1 (1)		0.13	0.13	
Radula holstiana			4 (1)		0.55	0.50	
Radula lindenbergiana			2 (2)		0.27	0.25	
Radula stenocalyx			3 (2)		0.41	0.41	
Radula stipatiflora	2 (1)	2.78	5 (3)		0.69	0.88	
Taxilejeunea conformis	1 (1)	1.39	52 (15)	II	7.17	6.65	II
mosses							
Daltonia sp.	1 (1)	1.39	32 (11)	II	4.41	4.14	II
Fissidens sp.			1 (1)		0.13	0.13	
Floribundaria sp.			3 (2)		0.41	0.38	
aff. Lepidopilidium sp.			12 (3)		1.66	1.51	
Pilotrichella sp.			2 (2)		0.27	0.25	
Porotrichum sp.			3 (3)		0.41	0.38	
Syrhobodon asper	1 (1)	1.39				0.13	
Thuidium ramusculosum			1 (1)		0.13	0.13	

Number of taxa per collection (relevé) 1-11 (mean: 6.7) 2-23 (mean 9.9)

* sp. nov. to be published in a forthcoming paper

Columns 1, 4. The number of leaves on which the taxon was detected (no. of collections in which the taxon was detected).

Columns 2, 5, 8. The constancy of occurrence of taxa in collections [only II-V shown].

Column 3, 6, 7. The percentage frequency of occurrence on leaves (950-1250 m alt.).

Constancy: [I = 1-20%]; II = 21-40%; III = 41-60%; IV = 61-80%; V = 81-100%.

Table 2. Conversion of UTM Grid to Latitude and Longitude

UTM Grid	Latitude and Longitude
6736	15° 56' S 35° 29' E
6936	15° 56' S 35° 31' E
7227	16° 01' S 35° 32' E
7232	15° 58' S 35° 32' E
7233	15° 57' S 35° 32' E
7238	15° 55' S 35° 32' E
7239	15° 54' S 35° 32' E
7240	15° 53' S 35° 32' E
7330, 7429	15° 59' S 35° 33' E
7331, 7332	15° 58' S 35° 33' E
7333	15° 57' S 35° 33' E
7431	15° 56' S 35° 33' E
7438	15° 55' S 35° 33' E
7529	15° 59' S 35° 34' E
7532	15° 58' S 35° 34' E
7635	15° 56' S 35° 34' E
7735	15° 56' S 35° 35' E
7840, 7841, 7941	15° 53' S 35° 36' E
7939	15° 54' S 35° 36' E
8031, 8032	15° 58' S 35° 37' E
8237, 8337	15° 55' S 35° 38' E
8239	15° 54' S 35° 38' E
8241	15° 53' S 35° 38' E
8335	15° 56' S 35° 38' E
8433, 8434	15° 57' S 35° 39' E
8435	15° 56' S 35° 39' E
8441	15° 53' S 35° 39' E
8532	15° 58' S 35° 40' E
8740	15° 53' S 35° 41' E
9041	15° 53' S 35° 42' E
9126	16° 01' S 35° 43' E
9127, 9227	16° 00' S 35° 43' E

