

THE AFRICAN SPECIES OF *DREPANOLEJEUNEA VESICULOSA* GROUP WITH DESCRIPTION OF *DREPANOLEJEUNEA* *VANDERPOORTENII* SPEC. NOVA (JUNGERMANNIOPSIDA) FROM MADAGASCAR

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Drepanolejeunea clavicornis and *D. friesii* were previously synonymised with *D. physaefolia* or all of them with *D. vesiculosa*. In the meantime, *Drepanolejeunea vandenberghenii* was described from the same species group, as new. In this paper many African specimens are compared with the original descriptions of the above species. Morphological investigations of these and their distributional patterns suggested that the former synonymisation was not justified. In addition, a new, rheophytic species from the same group: *Drepanolejeunea vanderpoortanii*, is described, as new to science. As a result, from the taxa related to *Drepanolejeunea vesiculosa*, now six species are recognised from Africa, including its Indian Ocean islands. For these 6 morphotaxa an identification key is provided. The results need confirmation by a future molecular analysis.

Key words: Africa, endemism, Madagascar, Mascarenes, new species, phytogeography

INTRODUCTION

I already observed during our first collecting trip to Madagascar (March 1990) that most specimens identified as *Drepanolejeunea physaefolia* (Gottsche) Steph. or more properly *D. physifolia* (Gottsche) Pearson differ from the specimens collected in continental East Africa under the name of *D. clavicornis* Steph. and *D. friesii* Vanden Berghen, which were synonymised later with *D. vesiculosa* (Mitt.) Steph. (Tixier 1995, Wigginton and Grolle 1996) or with *D. physifolia* (Jones ex Wigginton 2004, formally not yet done). The main difference of Madagascan specimens is their dentate, sometimes serrulate leaf border and their ciliato-dentate perichaetial leaves.

I came to the conclusion, that the former synonymisations of the above *Drepanolejeunea* species were not well-founded. To clarify the matter, I started to study the more than 60 related African *Drepanolejeunea* specimens from our herbarium (EGR) and compare them with the original descriptions, illustrations and type specimens. I could successfully classify them into the species originally distinguished as *Drepanolejeunea clavicornis*, *D. friesii*, *D. physifolia*, *D. vesiculosa* and to the not long ago described *D. vandenberghenii*. At the same

time, I tried to establish their different distribution pattern. Further molecular investigation has to confirm their separate existence at the species level.

Recently I received very interesting rheophytic specimens collected in Madagascar by prof. Alain Vanderpoorten (Liège University), which we started to study together with prof. Stephen Robbert Gradstein (Göttingen University), comparing it with *Drepanolejeunea vandenberghenii* Buchbinder et E. Fischer, not long ago described from dripping rocks in Rwanda and we describe it as *Drepanolejeunea vanderpoortenii* Gradstein et Pócs, a species new to science.

AFRICAN TAXA RELATED TO *DREPANOLEJEUNEA VESICULOSA*

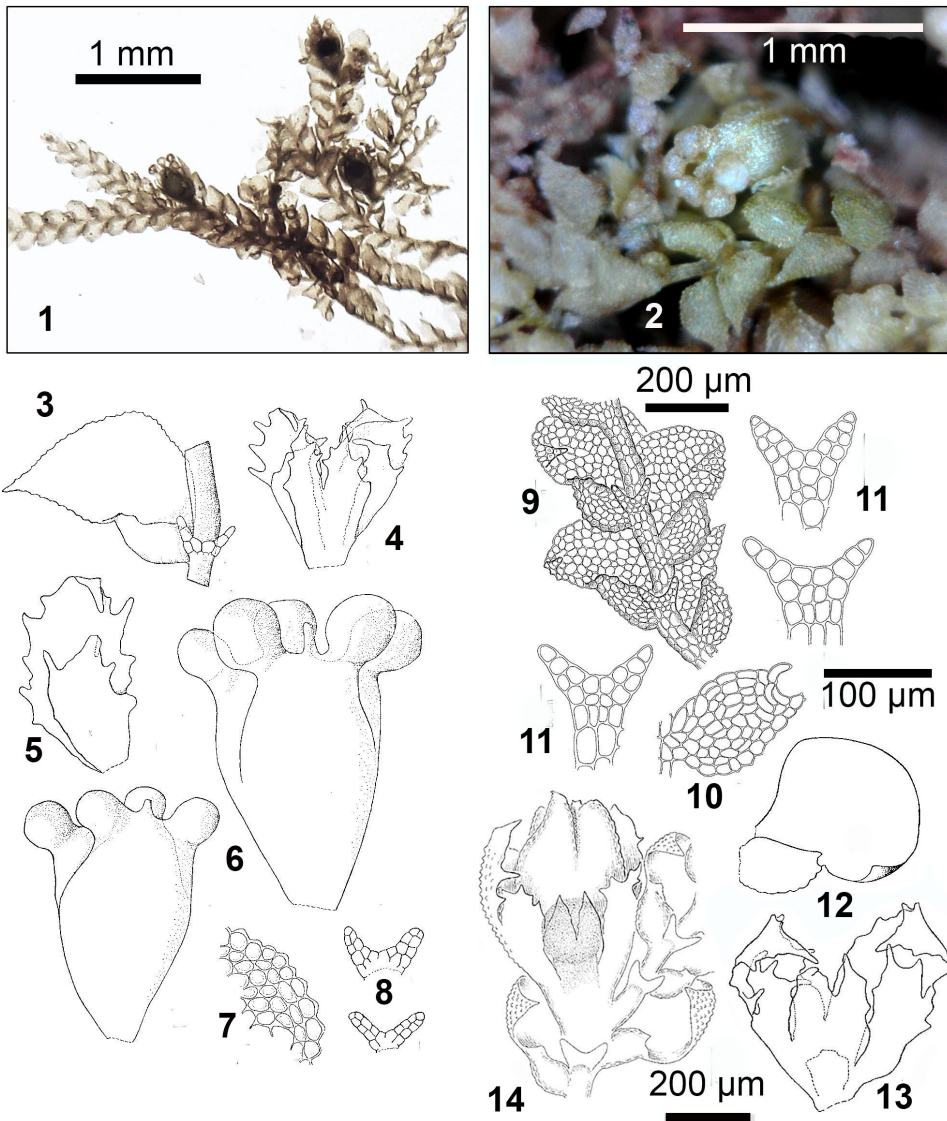
Drepanolejeunea clavicornis Steph., Hedwigia 35: 81 (Stephani 1896). – (Figs 1–8) – Type: Insula São Tomé, Moller (holotype G!).

The species was distinguished on the base of the inflated, globose perianth horns, which according to Stephani (1896: 82) is a unique and very interesting shape in the genus. The description and illustration (except for the misspelling of species name as *D. claviformis*) supplied by Vanden Berghen (1960: 61–62, fig. 7, shown in our Figs 3–8) agrees with, and more detailed than that of Stephani. Investigating many African and Asian specimens of this species group, I have never found transitions between this globose horned and the usual 4–5 keeled perianths and consider this character adequate to distinguish it at the species level.

The distribution of this taxon is also special, as it is restricted to West Africa (Fig. 15) except for one record from Madagascar (Cremers 3422 in Wigginton). It is recorded from São Tomé (Moller 385, holotype G) and Príncipe Islands (*Monod* 12114, BR in Vanden Berghen 1960), Camerun (*Dusén*, G). Our specimen (Figs 1–2) originates from Príncipe Island, along trail of Pico Papa-gaio above roça Santa Trindade along summit ridge. NAD 83, 01° 36' 38.6" N, 07° 23' 32" E, 680 m, in mixed hardwood forest. On small diameter hardwood trunk. *Shevock* 42066 (CAS!, EGR!, previously identified by me, as *D. physaefolia*).

Drepanolejeunea friesii Vanden Berghen, Svensk Bot. Tidskr. 45: 366 (1951). – (Figs 9–13). – Type: Kenya, Mount Kenya occid: regio bambusina inferior in truncis *Arundinariae alpinae*, ca 2,500 m, 28 Jan. 1922, R. et T. Fries (holotype BR!).

When Vanden Berghen (1951) described it, underlined its similarity to *Drepanolejeunea claviformis* Steph., distinguishing by the missing ocelli and by the peculiar perianth shape. As ocelli of *Drepanolejeunea* species are often not observable on old herbarium specimens (Jones and Harrington 1983, Jones in Wigginton 2004), this is not a good character. In addition, when in fresh



Figs 1–14. 1–8: *Drepanolejeunea clavicornis* Steph. – 1–2 = habit, (from Shevock 42066, photo: Pócs); 3 = leaf; 4 = female perichaetium, 5 = bract; 6 = perianths with 4 or 5 globose horns; 7 = leaf margin; 8 = underleaves (slightly modified, from Vanden Berghen 1960, under the name of *D. claviformis*). 9–13: *Drepanolejeunea friesii* Vanden Berghen – 9 = habit, ventral view, 10 = lobule; 11 = underleaves; 12 = leaf; 13 = female perichaetium; 14 = gynoeceium (9–11 and 14 modified from Buchbender and Fischer 2004, under the name of *D. physaefolia*, 12 from Vanden Beghen 1961, 13 from Vanden Berghen 1951)

material they are still visible, in all species of this group 2–3 (to –5) suprabasal ocelli can form a short vitta. But the perianth shape remains as a useful distinguishing feature, as it is so strikingly different. Jones & Harrington (1983) mention another difference, apart from the perianth, in the shape of female bracts, which has only a few coarse teeth in *D. friesii* and laciniately dentate in *D. clavicornis*. They only tentatively identified their specimens from Sierra Leone and from Ghana, as *D. friesii*. The specimens examined by me from a great part of East Africa confirm their opinion. I have found on several specimens the same perianth type and perichaetial leaf shape, as described and illustrated by them. Buchbender and Fischer (2004: 279, fig. 5A, B, reproduced on our Figs 9–11 and 14) also published good illustrations of *Drepanolejeunea friesii* (under the name of *D. physaefolia*). The differences from the real *D. physaefolia* will be discussed under the latter species.

Drepanolejeunea friesii is the most widespread species of the group related to *D. vesicaria* all over the mountainous areas of continental Africa, and sporadically also on the Indian Ocean Islands (Fig. 15). It occurs on very different substrates, but prefers living leaves, ericaceous bark and twigs. It is published from Sierra Leone: Loma Mts., on sheltered boles, 1,680 m, *Jones 1474 p.p.*, 1477 *p.p.*, 1650 m, *Jones 1491* (Jones and Harrington 1983). Ghana: Atewa Hills F. R., boughs in crown of *Cassipourea*, *Jones 1299d*; boughs in crown of *Lophira*, *Jones 1319a*; upper part of bole of *Antiaris*, *Jones 1320b* (Jones and Harrington 1983). Rwanda: 27 km E of Shangugu, on roadcut surface, 1930 m, *Symoens 5366* (BR); 30 km E of Shangugu, on the Kamiranzovu bog, 1,950 m, *Erica* bark, *Symoens 5380* (Vanden Berghen. 1961). Kenya: Mt Kenya, bamboo belt, 2,500 m, *R. & T. Fries 1922* (holotype, BR!); Tanzania: Mt Kilimanjaro (Vanden Berghen 1961); former Zaïre: Kivu (Vanden Berghen 1961).

Specimens seen and revised in our herbarium (EGR), which previously were identified mostly as *D. physaefolia* or as *D. vesiculosa*: former Zaïre: Kivu Prov., Kahuzi-Biega Nat. Park, dry *Hagenia* forest near Kaziruziru park gate, 2,300–2,370 m, on *Agauria* bark, *Pócs 7268*. – Kenya: Mt Kasigau, on the lower slopes of the peak, epiphyllous in mist forest, 1,400–1,600 m, *Faden, Evans, Kariuki & Smeenck sn.* 1971. Aberdare National Park (Nyandarua Range), around Chania Falls, 3,040–3,080 m, on *Erica* bark, *Pócs 02030/AB*. – Tanzania: Mt Meru, SW ridge along Engare Narok, 2,700–3,100 m, on *Erica* bark, *Pócs, Mnyonga & Nsolomo 89194/W*. Mt Kilimanjaro along Marangu Route, 2,130–2,650 m, on *Erica* bark, *Jones & Pócs 6365/K*, *Pócs & Orbán 89142/W*, *S. & T. Pócs 6240/O*; Umbwe Route 2,850 m, on *Erica* twigs, *Pócs 6929/NA*; above Nkweseko, 1,800 m, *Jones & Pócs 6359/E*. W-Usambara Mts, NW slope of Magamba N of Lushoto, *Ocotea-Podocarpus* forest at 2,000–2,150 m, on bark, *Pócs 6953/O*; SE slope of Mt Kwagoroto, on shady rocks creeping on other liverworts, 1,750 m, *Pócs 6957/V*; Mazumbai, University Forest Reserve, mossy forest on Sagara

ridge, 1,750–1,980 m, on *Erica* bark and epiphyllous, *Pócs & Jones 6372/DU*, *Pócs 6960/Z*; Balangai West For. Res., Secondary heath, 1,550 m, on Ericaceae bark, *Pócs 8509/D*. N-Uluguru Mts, Lupanga ridge above Mbete village, elfin forest, 1,850–2,000 m, on twigs and epiphyllous, *Pócs*, *Nchimbi 6285/BQ*, *6287/N*; Bondwa Peak above Morogoro town, elfin forest, 2,100 m, epiphyllous, *Pócs 6233/N*; on the top of Magari peak above Mzinga village, elfin forest, 2,340 m, epiphytic on *Frullania*, *Pócs*, *Kondela*, *Nchimbi 06300/AS*. S-Uluguru Mts, in bamboo (*Sinarundinaria alpina*) forest on the W slopes of Lukwangule Plateau, 2,250 m, on bamboo stem. Nguru Mts, Mt Kanga, S slope, 136 m at waterfalls, epiphyllous. *Pócs 60140/AH*, *AI*. – Réunion: Mare Longue Réserve Naturelle, Sentier Botanique, lowland rainforest on 4–500 years old lava flow, 280–320 m, on bark, *Pócs 08056/B*. W edge of Basse Vallée, along trail to Piton Larde, secondary *Psidium cattleyanum* bush, 750–985 m, on bark, *Kis 9651/CG*. S slope of Piton de la Fournaise volcano, alternating *Pandanus montanus* bush and mossy forest, 1,000–1,390 m, on palm trunk, *Pócs 9612/CV*; E edge of Cirque de Mafate, elfin forest on the SW ridge and summit of Piton Marmite, 1,820–1,878 m, on *Erica* bark, *Szabó 9424/T*. – Madagascar: Prov. Antsiranana, Réserve Intégrale Nationale de Marojezy. Elfyn forest on the SE ridge near Camp III, 1,830 m, epiphyllous. *Pócs*, *Magill & LaFarge-England 90114/KG*.

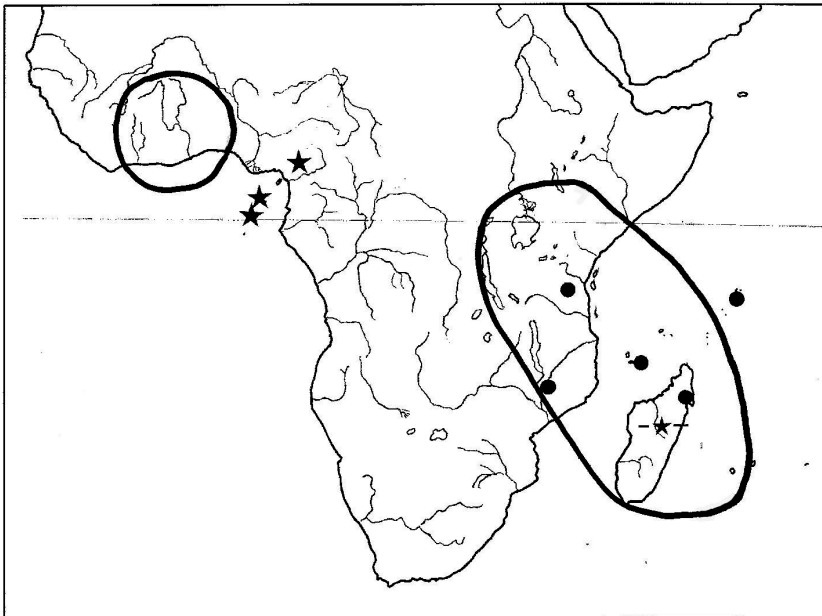
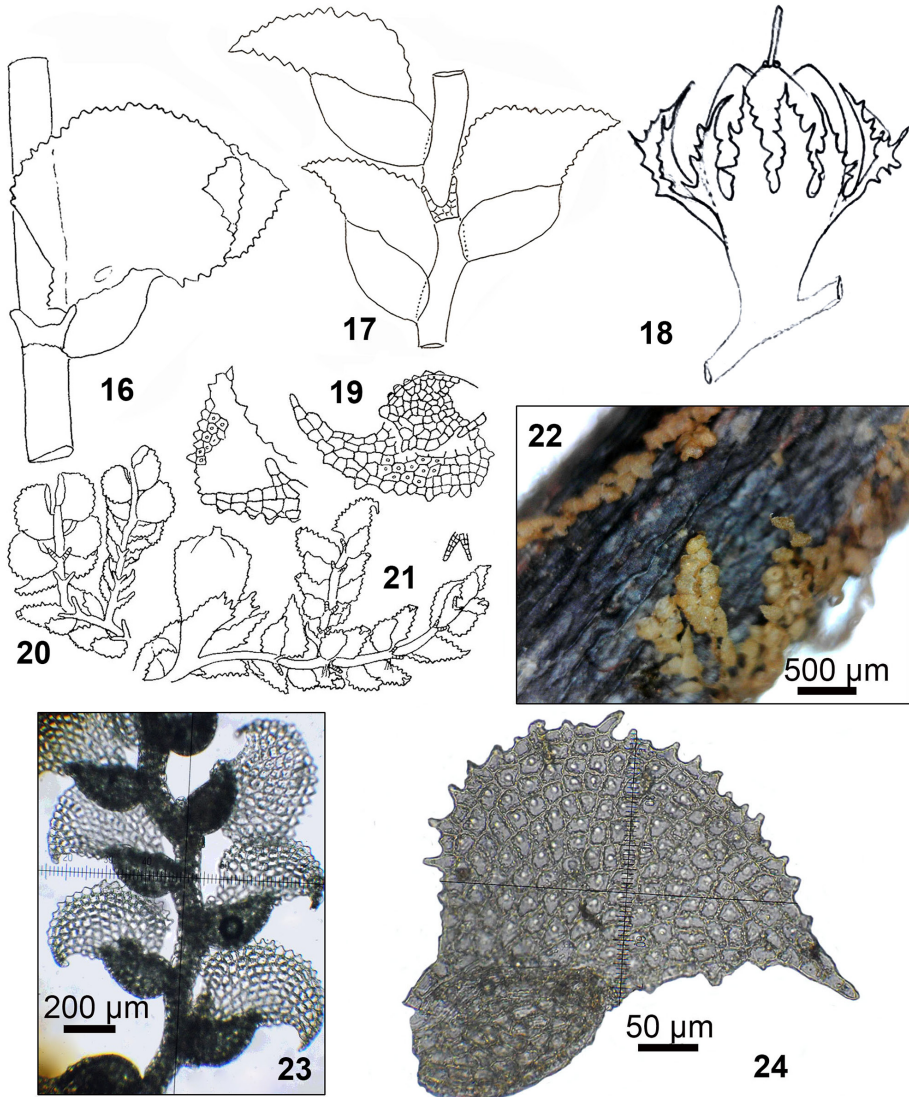


Fig. 15. Distribution of *Drepanolejeunea clavicornis* (stars); of *D. friesii* (thick line) and of *D. vesiculosa* in Africa (dots)

Drepanolejeunea physifolia (Gottsche) Pearson, Forh. Vidensk.-Selsk. Kristiania 1892 (8): 8. – (Figs 16–30) – Basionym: *Lejeunea physaefolia* Gottsche, Abh. Naturwiss. Vereins Bremen 7: 357 (1882). Type: Madagascar, in silva Ambatondrazaka sterilem inter alias Lejeunias repentem. *Rutenberg* 6. Dec, 1877. = *Lejeunea securifolia* Gottsche, Abh. Naturwiss. Vereins Bremen 7: 360 (1882). Type: Madagascar, in silva Ambatondrazaka inter alias Lejeunias. *Rutenberg*, probably at the same date. = *Lejeunea intorta* Besch. et Spruce, Bull. Soc. Bot. France 36, Suppl. CLXXXVIII. “1889” (1890). ≡ *Drepanolejeunea intorta* (Besch. et Spruce) Steph., Spec. Hep. 5: 323 (1913). Type: Réunion, *Richard* 641 ex Hb. Spruce (isotype G-17348).

Lejeunea physifolia (originally described, as “*physaefolia*”) sensu stricto is a species different from the previous taxa described from the African mainland and Sao Tomé Island. As the type material would have been destroyed during the 2nd World War in B (Grolle 1995) we can only relay on Stephani’s *Icones* (1985, figs 002450 and 002451), which depict both *Drepanolejeunea physaefolia* and *D. securifolia* based most probably on Gottsche’s types, as in Stephani’s time no other specimens were known. The illustration of *D. intorta* (Stephani 1985, fig. 002448, copied to our Figs 16 and 18) confirms Grolle’s concept synonymising it with *D. physifolia*. Both the Stephani *Icones* (1985) and the pictures by Arnell (1963: 181, fig. 132) illustrate the same species: a plant with obviously dentate lobe margin and with pinnately ciliato-laciniate perichaetial leaves. In fact, the acute papillae are turning outwards at the lobe margin forming acuminate teeth. Even the perianth keels are finely dentate as can be seen both on Arnell’s picture and on our microphoto (Figs 19–21 and 23–24). On the contrary, the lobe margins of *Drepanolejeunea friesii* (and of *D. vesiculosa*) are smooth or only minutely crenulate and the perichaetial leaves and perianth keels are almost entire or have a few coarse teeth (Figs 9–14). Concerning its distribution, *D. physiformis* s. str. in the original sense was published only from Southeast Africa and the Indian Ocean islands: Mozambique, Ngorongosa Mts. (Arnell 1957). South Africa: Transvaal, Pietersburg (now Polokwane); Basutoland, Woodbush; Natal, Ngome Forest (Arnell 1963). Comoros, Ndzouani island (Johanna or Anjouan, Herzog 1947); Ngazidja and Dzouani (Pócs 1993, 1995). Madagascar: type of *Lejeunea physaefolia* Gottsche (1882), Pearson (1892), and of *L. securifolia* (Grolle 1995), Pócs (1997). Réunion: Bescherelle and Spruce (1890) as type of *Lejeunea intorta*, W of Plaine des Palmistes, forest with tree ferns, above St. Paul, ca 2,000 m (Arnell 1965); Mauritius: Perrier Nature Reserve near Mare aux Vacoas; Le Pouce, rocks on old way between St. Pierre and Port Louis, ca 1,800 ft; Mt Cocotte, the top; the plateau N of Mt Cocotte (Arnell 1965). Seychelles: Mahé Island 100–800 m, not rare (Arnell 1957, Norkett, Onraedt in Grolle 1978); Praslin Island (Norkett in Grolle 1978).

Specimens seen and revised in our herbarium (EGR, duplicates of Madagascar specimens are deposited in TAN): I have found sporadic occurrence also in the mountains of East Africa, similarly to many other Lemurian flora



Figs 16–24. *Drepanolejeunea physifolia* (Gottsche) Pearson – 16 = habit and 18 = gynoecium (after Stephani Icones 1985: 2447 and 2448, as *D. intorta*); 17 = habit (after Stephani Icones 2450. type of *D. physaefolia*); 19 = leaves; 20 = male branches; 21 = habit with gynoecium (after Arnell 1963); 22 = plants creeping on ericaceous twig (from Pócs, Orbán & Szabó 9486/H); 23 = habit, ventral view (from Pócs 08071/A); 24 = leaf (from Pócs, Orbán & Szabó 9486/H)

elements: Kenya: Mt. Kenya E slope along Chogoria Trail, 2070 m, montane rainforest, on mosses, *S. & T. Pócs, Chuah-Petiot 04002/X*. – Tanzania: N-Uluguru Mts, NW slope and SW ridge of Lupanga above Morogoro town, mossy cloud forest at 1,700–2,000 m, on bark, *Nchimbi & Pócs 6130/P, 6285/BY*; NNE slope of Mnyera, below its western peak, mossy cloud forest, 1,900 m, epiphyllous, *Pócs 6870/BF*. S-Uluguru Mts, eastern ridge above Kibungo Mission, montane rainforest, 1,500–1,700 m, epiphyllous, *Pócs & Lundqvist 6475/AD*. W-Usambara Mts, Kambi falls, 1,680 m, on bark, *Pócs et al. 8528/Q*. – The further records are all from the Indian Ocean islands: Comoro, Ndzuani Island, SE summit ridge of Mt Ntringi (N'Tingui), mossy elfin forest, 1,200–1,593 m, epiphyllous. – Madagascar: Antsiranana Province, Réserve spéciale de Manongarivo Ambahatra, cours supérieur, crête entre les deux bras de l'Ambahatra, forêt montagnarde, 1,250–1,300 m, sur tronc, *Geissler 19698/2*; Réserve Intégrale Nationale de Marojezy, elfin forests on the SE ridge, 1,830 m, *Pócs, Magill, LaFarge-England 90114/GQ and HN*; Sava Region, Masoala National Park, summit ridge SE of Ambanizana village, 660–720 m, montane rainforest, on *Pandanus* leaf, *Pócs & Kis 9449/AN, AT*; Antanarivo Prov., forêt primaire dégradée, au lac de Mantasoa, 1,400 m, sur l'écorce, *Onraedt, 74.M.2281*; granite summits at the N end of Lake Mantasoa, near Anjozoro village, S of Manjakandriana town, ericaceous heath, 1,500 m, on bark, *Pócs, Szabó, Ranaivojanoa 9851/B*; Toamasina Prov., Andasibe-Mantadia Nat. Park, rainforest E of Andasibe village, 900–970 m, on branches, *S. & T. Pócs, A. Szabó 9889/AC*; rocky ridge 5 km ESE of Andasibe, montane rainforest, 950–1,050 m, epiphyllous, *Szabó 9487/JL*; NE of Andasibe, rainforest in a rocky streambed along tributary of Saharanga stream, 1,000 m, on twigs, *Pócs, Orbán, Szabó 9486/H*; Toamasina Prov., Maromizaha Forest Res. S of Andasibe Nat. Park, 2 km SW of Anevoka village, summit ridge of Mt Maromizaha, montane rainforest with bamboo (*Nastus* sp.), 1,080–1,214 m, on *Pandanus* leaves, *S. & T. Pócs 9890/CJ*; Prov. Fianarantsoa, Ranomafana Nat. Park, near Ambodiamontana settlement, in the Valley of Namorona River, degraded submontane rainforest with relatively low (8–18 m tall) canopy, at 865–1,015 m, epiphyllous, *S. & T. Pócs et al. 04118/CL*; W slope of Mt Vatolampy 2.5 km W of Ambatolahy village, montane rainforest, 1,080–1,200 m, on branches, *S. & T. Pócs 04128/AB, 04129/BA*; Haute Matsiatra Reg., Andringitra Mts and Nat. Park, W side of Korokoro River around Camp II, 750–1,000 m, on twigs, *Kis 9472/BQ*; N–S ridge running 6 km E from Pic Bory, near camp IV, mesic forest dominated by bamboos, 1,450–1,700 m, on decaying bamboo stem, *Pócs 9475/AH*. – Réunion: Plaine des fougères 3 km from Bois Rouge village, on the N slope of Piton Bé Massoune, ericaceous heath alternating with mossy elfin forest, 1,200–1,320 m, on decaying wood, *Pócs 08071/EA*; Cirque de Cilaos, forêt de la Mare a Joseph, E from Le Bloc, 1,370–1,380 m, on bark, *Szabó, 9638/CA*; Piton de la Fournaise, ericaceous elfin

forest on the S slope of Piton Larde, 1,450–1,650 m, on twig; Forêt de Belouve, 1 km E from the Forest Station, *Acacia heterophylla*–*Cyathea glauca* woodland, 1,450–1,500 m, Szabó 9614/CJ; Forêt de Belouve, cliff at the SE edge of Cirque de Salazie, *Acacia heterophylla*–*Cyathea glauca* woodland, 1,500–1,555 m, Pócs 08061/L; Forêt de Belouve, montane mossy forest along the trail from the Forest Station to Pic de Chèvres, 1,560–1,610 m, on decaying wood, Gyarmati & Kis 9617/AF.

Drepanolejeunea vandenberghenii Buchbender et Eb. Fisch., J. Bryol. 26: 273 (2004). – (Fig. 25) – Type: Rwanda: Forêt de Rugege (= Nyungwe), rochers suinants à *Sphagnum* et *Breutelia*, 2,020 m, 20 Décembre 1971, J. L. De Sloover 12535 (holotype BR, paratypes KOBL, EGR!).

This species can be separated from *Drepanolejeunea friesii* and of *D. vesicaria* by its widely obtusely rounded leaf and underleaf lobe apices and by its fully edentate bracts. It was described from dripping rocks, growing among *Sphagnum* and *Breutelia*, accompanied by detailed illustrations. The detailed and well-illustrated protologue describes 5 other paratypes near to the type locality collected from different substrates in Nyungwe Forest by Buchbender, Fischer, Solga and Pócs. Later on it was reported also from Malawi (Pócs 2008).

Additional specimen in EGR: Réunion, SSW slope of Piton de la Fournaise volcano. N of Piton Larde, 1,650–1,850 m, open montane evergreen forest with *Acacia heterophylla* in the canopy, on bark. Szabó 9655/CO.

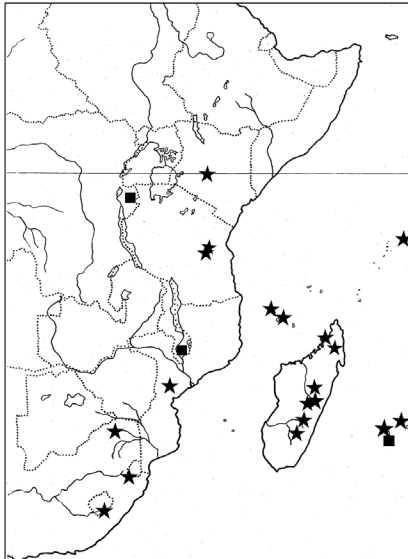
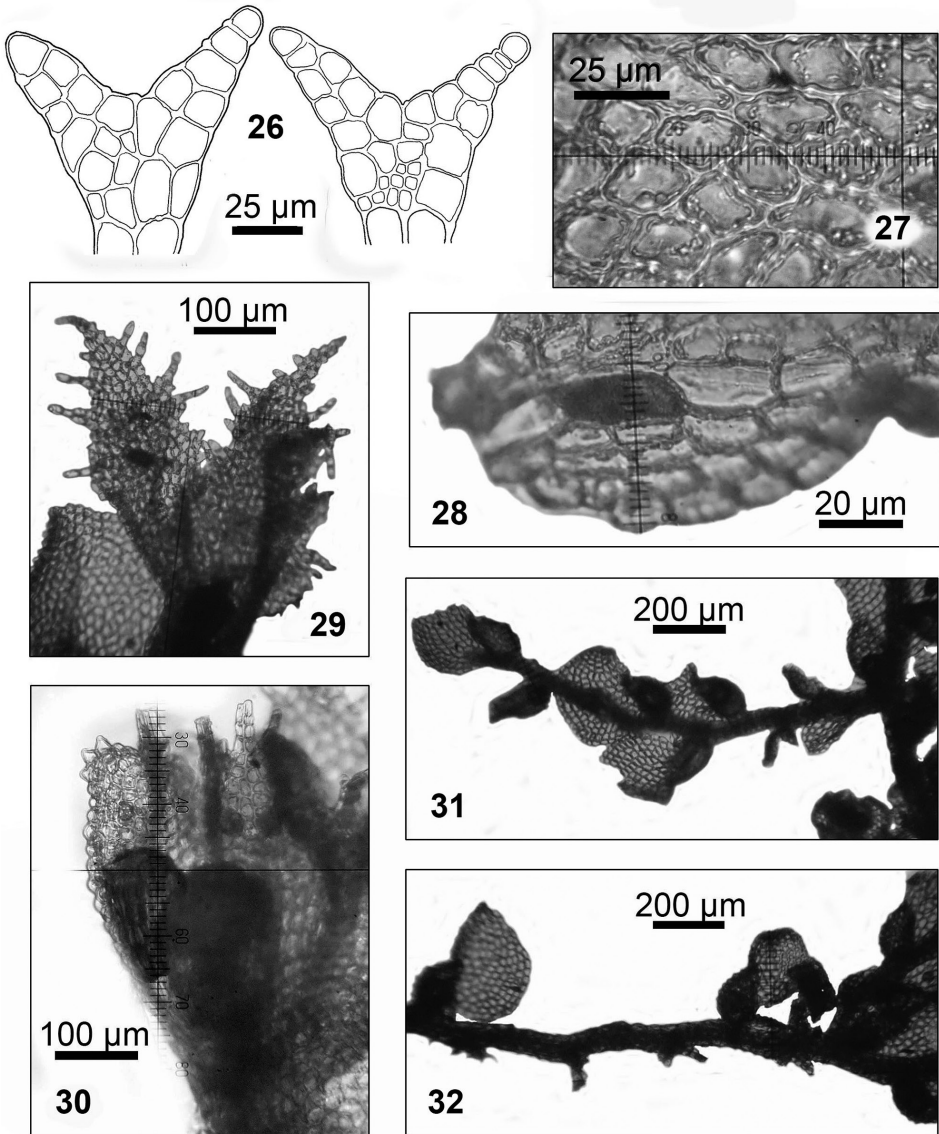


Fig. 25. Distribution of *Drepanolejeunea physifolia* (stars) and of *D. vandenberghenii* (squares)

Drepanolejeunea vesiculosa (Mitt.) Steph. s. str., Spec. Hep. 5: 356 (1913). – (Figs 15, 30–31) – Basionym: *Lejeunea vesiculosa* Mitten, J. Proc. Linn. Soc. Bot. 5: 116 (1861). Type: Insula Ceylon, ad *Macromitrias*, Gardner (NY).

I consider the African synonyms of *D. vesiculosa* enumerated in Wigginton and Grolle (1996: 73), insufficiently justified, based on Tixier's synonymisation (Tixier 1995). Although only *Drepanolejeunea friesii* is similar in all other aspects, *Drepanolejeunea vesiculosa* has a character, the caduceus leaves, which do not occur in the majority of species described from Africa. But it is still a problem, whether this character is stable or not by the type and by all Asian specimens of *D. vesicu-*

losa. If any, then only *Drepanolejeunea friesii* of the African species can be synonymous with it. This finally can be decided after molecular investigation will have been done on many populations (not on one or two specimens).



Figs 26–32. *Drepanolejeunea physifolia* (Gottsche) Pearson – 26 = underleaves (from S. & T. Pócs, Szabó 9889/AC); 27 = median lobe cells (from Pócs 08061/L); 28 = suprabasal ocelli (Pócs & Kis 9449/AT); 29 = female perichaetium (2 bracts + bracteole on the right, from S. Pócs 9890/CJ); 30 = perianth (Pócs & Kis 9449/AT). – Figs. 31–32. *Drepanolejeunea vesiculosa* (Mitt.) Steph. s. str., habit with caduceus leaves – 31 (Pócs, Magill & Rupf 9274/S); 32 (Pócs 9188/A)

For the moment I kept *D. vesiculosa* and *D. friesii* separated and was checking, whether any African specimens have caducous leaves. If this only specific distinction is right, I have found a few of them corresponding to this character, with caducous leaves, as follows:

Supposed African *D. vesiculosa* specimens in the herbarium EGR: Tanzania: N-Uluguru Mountains, elfin forest on Bondwa peak above Morogoro town, 2,120 m, on bark, Pócs 6889/M. – Malawi: W part of Mulanje Mts, fire effected, rocky *Agauria*–*Protea* woodland on the steep NW slopes of Likabula Valley along Lichenya path, on the N slope of Mt Chilemba, 1,800 m, on *Agauria* bark. – Comoro: Ngazidja Island, SE ridge of Mt Karthala above Nioumamilima village, submontane rainforest, 750 m, epiphyllous, with perianth, Pócs, Magill, Rupf 9266/BL; Ndzouani island, montane rainforests on the SE ridge of Mt Ntringi (Tingui) on the N side of Lake Dzilandze, 920–1,200 m, epiphyllous and corticolous, Pócs, Magill, Rupf 9273/I and 9273/BL. – Madagascar: Prov. Antsiranana, Réserve Intégrale Nationale de Marojezy on the ridge N of Andampibe Falls, montane rainforest, 780–1,050 m, epiphyllous. Pócs, Magill, LaFarge-England 90113/FY.

Drepanolejeunea vanderpoorteenii Gradstein et Pócs, spec. nova
(Figs 33–47)

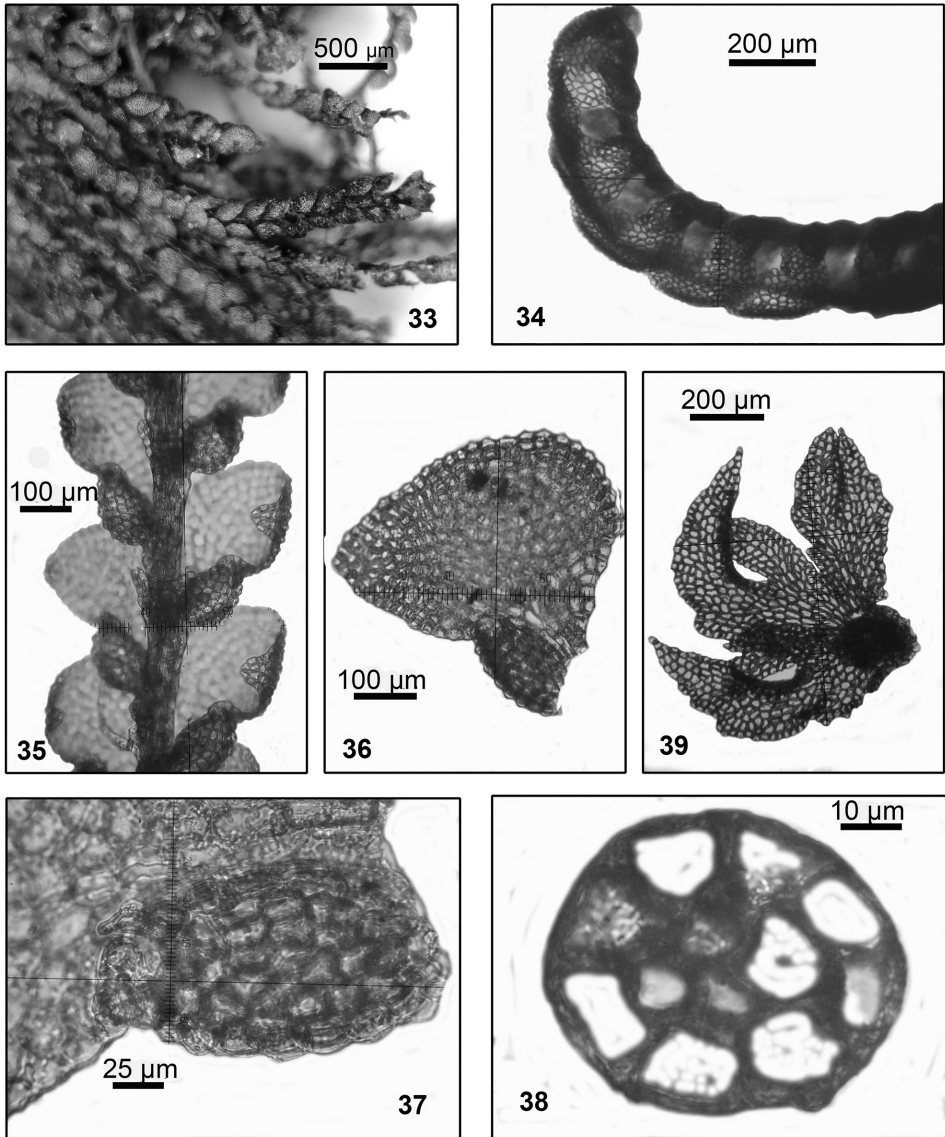
Close to *D. vandenberghenii*, but well different by its blackish pigmentation, julaceous habit, thick-walled stems and, especially, the large preapical tooth almost touching the apical (= first) lobule tooth. The blackish pigmentation of the plants and the thick-walled stems may be interpreted as adaptations to the rheophytic habitat (Gradstein and Vidal 1975, Pócs 2010).

Type: Madagascar, Toamasine Province, Andasibe (Périnet) Mantadia National Park. Chutes Sacrées 4, 1,029 m, 18° 49' 52" S, 48° 26' 12" E, on flooded stone in stream in submontane rainforest, October 2018, *A. Vanderpoorteenii* MD 67 (holotype EGR!, isotype GOET!).

Forms dense, shiny blackish brown, sepia or rusty mats on streambed stones often under water. Shoots irregularly branching, 3–5 mm long, arcuately ascendent, the leaves even in wet stage upwards incurved, laying over the stem, forming an almost julaceous shoot of 2–300 µm width (with open leaves up to 450 µm wide). Stem diameter 50–80 µm, with 3–4 medullary and 7–8 cortical cells, with evenly incrassate (2–2.5 µm thick) and brownish pigmented walls.

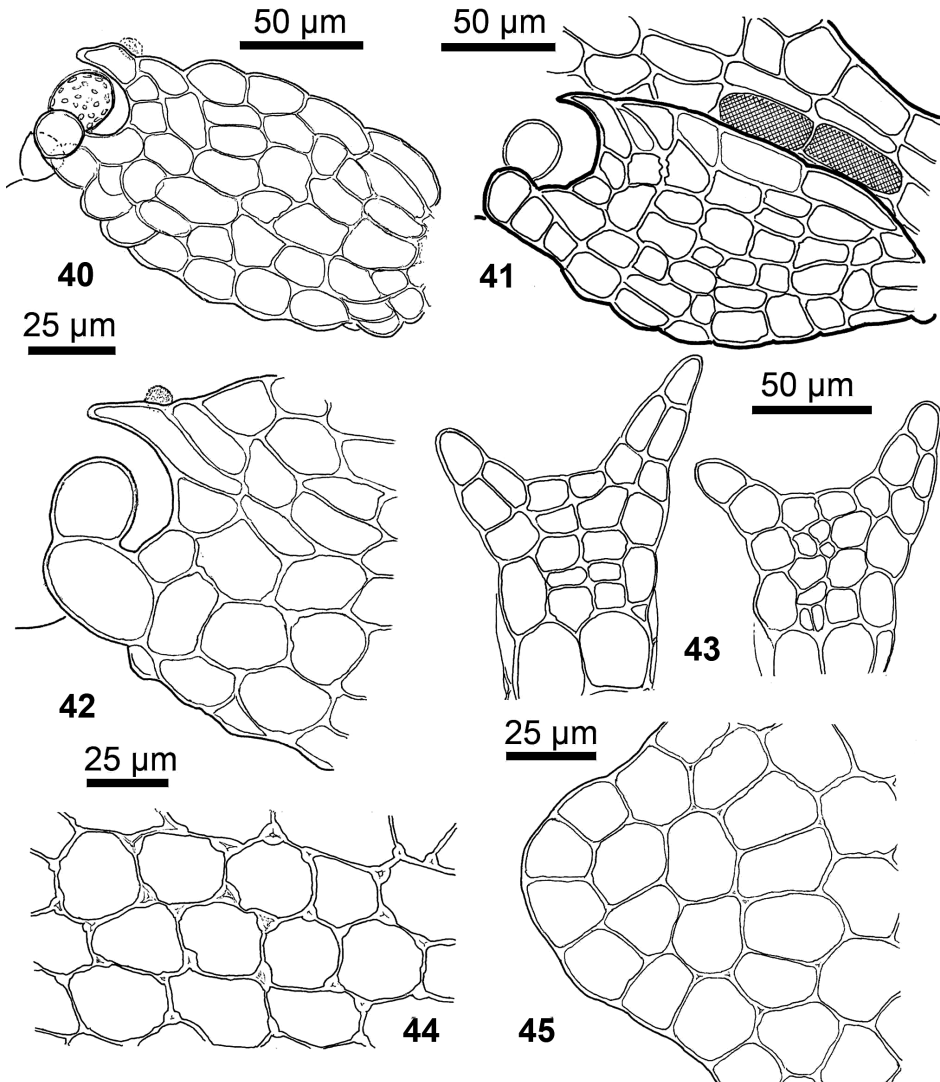
Leaves strongly convex, asymmetrically triangular-ovate and falcate, 400–500 µm long and 300 µm wide when flattened, spreading at an angle of about 40° to the stem. Lobe with entire or finely crenulate margins and obtuse apex. Median lobe cells 25–29 µm, apical lobe cells 22–24 µm, isodiametric, with thin to moderately incrassate walls, at the base with trigones and on

their dorsal side slightly mamillose-papillose with a low, acute papilla. Ocelli 2–3 suprabasal, forming a short vitta, cells of ocelli $50\text{--}55 \times 22\text{--}25 \mu\text{m}$. Lobules $100\text{--}150 \mu\text{m}$ long and $70\text{--}90 \mu\text{m}$ wide, apical (first) lobule tooth 1-celled, fal-



Figs 33–39. *Drepanolejeunea vandenpoorteenii* Gradstein et Pócs, spec. nova – 33 = habit, dorsal view (photo: Pócs); 34 = habit, side view; 35 = habit, ventral view, 36 = leaf, ventral view; 37 = lobule, ventral view; 38 = cross section of stem; 39 = perichaetium, bracteole on upper right side. (33–34, 36–39 from the holotype, *Vanderpoorten MD 67*, 35 from paratype, *Pócs & Szabó 9878/AB*)

cate, acute, lobule mouth semi-circular, distal end of the lobule with a large, 20–25 μm long, subglobose pre-apical tooth that is almost touching the apical tooth, the pre-apical tooth with chloroplasts and with walls of similar thickness to the other lobule cells (Figs 37, 39); keel curved, crenate in the upper half, angle between keel and ventral lobe margin sharp. Underleaves hardly



Figs 40–45. *Drepanolejeunea vandenpoorteenii* Gradstein et Pócs, spec. nova – 40 = chloroplasts are shown in the pretooth; 41 = lobule with pre-tooth, behind its antical margin the ocelli are visible; 42 = lobule apex with pre-tooth and hyaline papilla; 43 = underleaves; 44 = median lobe cells; 45 = lobe apex (40, 44 and 45 drawn from paratype, *Vanderpoorten* MD 62; 41–43 from paratype, *Pócs & Szabó* 9878/AB).

wider than the stem, $50\text{--}75 \times 70\text{--}80 \mu\text{m}$, with an obtuse to subquadrate lamina, a U-shaped sinus and two short, 1-cell wide, diverging lobes, the lobes two cells long and two cells wide at the base, ending in one cell. Female bract about $300 \mu\text{m}$ long, bilobate to its $2/3$ length, acute with a few obtuse teeth. Bracteole $240 \mu\text{m}$ long, bilobate to its half-length. Perianth and androecium not seen. Vegetative reproduction not known.

Etymology: The species is dedicated to its collector, Prof. Alain Vanderpoorten of Liège University, renowned expert on tropical mosses and bryophyte conservation.

Additional specimens examined: Madagascar, Toamasina Prov., Andasibe-Mantadia National Park, Chutes Sacrées 4, 1,029 m, $18^\circ 49' 52'' \text{ S}$, $48^\circ 26' 12'' \text{ E}$, on wet boulder in stream in submontane rainforest, October 2018, *A. Vanderpoorten MD 62* (paratype EGR!, isoparatype GOET!). Toamasina Prov., Mananara Nord Biosphere Reserve and National Park. Lowland rainforest on the E slopes of Mahavoho Hill, On streambed stones of Mahavoho River, at 220 m alt. $16^\circ 27' \text{ S}$, $49^\circ 47.00' \text{ E}$, *T. Pócs & A. Szabó 9878/AB*, 14 Aug. 1978 (paratype EGR, isoparatype GOET! TAN!).

DISCUSSION

The group of taxa I summed up under the name of '*Drepanolejeunea vesiculosa* group' exemplifies very well the problem arising from the difficulty to distinguish infraspecific variability (often influenced by environmental conditions) from the species level of genetical isolation. We have to take in account the morphological malleability, the distribution pattern and the cryp-

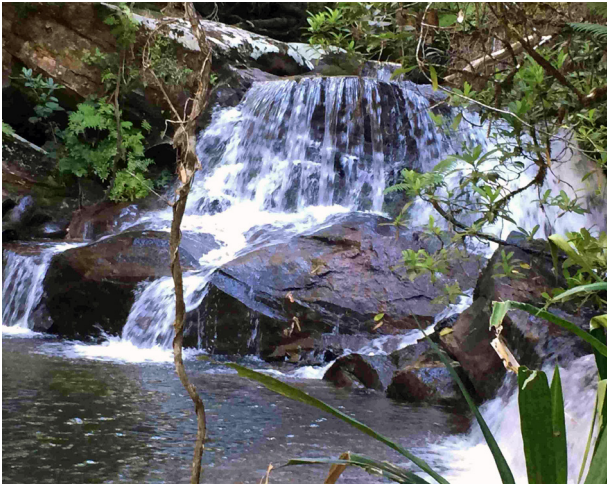


Fig. 46. The type locality of *Drepanolejeunea vanderpoorteenii*, Chutes Sacrées in Andasibe-Mantadia National Park (photo: Andrea Sass-Gyarmati)

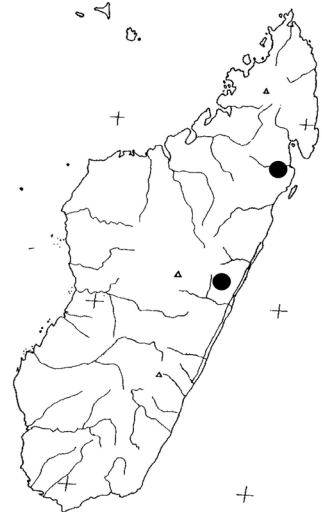


Fig. 47. Distribution of *Drepanolejeunea vanderpoorteenii*

tic species formation. Doubtless, molecular investigation is an answer, but only, if before the DNA investigation and its statistical analysis we try to define well the units to be investigated. I tried to do this, by the help of careful morpho-taxonomic and area-geographical investigation of the primarily described species before their premature and unjustified synonymisation. A future molecular analysis can prove the rightness of the formerly defined species concepts.

In case of *Drepanolejeunea clavicornis* I am quite sure about the good definition of this species, being allopatric and having a very different perianth shape. The latter property is not so much exposed to the environmental conditions than the vegetative body, therefore I attach great significance to it.

Drepanolejeunea physifolia in strict sense is more or less an allopatric vicariant of *D. vesiculosa* or *D. friesii*. It probably evolved when Madagascar was still united to mainland Africa or isolated later in the Indian Ocean islands and reached the continent by air dispersal. It is an interesting fact, that most plants are female with perichaetium, very rarely fertilised, as perianths and sporophytes are extremely rare.

Drepanolejeunea vanderpoortenii is an allopatric and at the same time a peripatric species. The niche isolation seems to act very well, because rheophytic life form is not known among other *Drepanolejeunea* species. At the same time this taxon occurs only in Madagascar and has two morphological properties (lobule pre-tooth and blackish pigmentation) unknown by its relatives.

The cases of *Drepanolejeunea friesii* and *Drepanolejeunea vandenberghenii* are not so clearcut. They are sympatric and their morphological differences against the very widespread *Drepanolejeunea vesiculosa* are not so sharp and some transitions seem to occur between them. In their case indeed only molecular investigation can clarify if they can be distinguished at the species level or not. The distribution of these three species, if they are really distinct, in Africa is still inadequately known.

Identification key

Based on the above morphological characters, I composed an identification key for the concerned taxa:

- 1a Perianth inflated, terete with 4–5 globose horns. Leaf margin crenulated. West African species. In all other aspects similar to *Drepanolejeunea friesii* *D. clavicornis*
- 1b Perianth in its upper half with five equal keels each ending up in an apiculate or rounded rostrum 2

- 2a Lobe margin with leaf margin dentate by the outward turning, high, acute papillae on (almost) each marginal cells. Female perichaetium leaves pinnately ciliato-laciniate, with teeth in length reaching or exceeding the half width of the bract or bracteole and ending in 2–3 uniseriate cells. Perianth keels regularly dentate at least on their rostrum. *D. physifolia*
- 2b Lobe margin entire or finely crenulated, acute papillae restricted to the lobe surface. Female perichaetium leaves almost entire or coarsely dentate with teeth shorter than half width of the bracts or bracteoles and not ending in uniseriate ciliae. Perianth keels entire or coarsely dentate 3
- 3a Leaves and underleaf lobes acuminate or acute. Female bracts coarsely toothed 4
- 3b Leaves and underleaf lobes with broad, rounded apex. Female bracts with almost entire margins 5
- 4a Leaves usually caducous, imbricate to distant. Denudate stems with remaining underleaves and fallen leaves for vegetative propagation often seen. Palaeotropical species, widespread in tropical Asia and the Pacific, scattered in Africa *D. vesiculosa*
- 4b Leaves never caducous, leaves densely imbricate, vegetative reproduction unknown. The commonest species in the mountainous areas of Africa *D. friesii*
- 5a Plants yellowish to light brownish-green, without blackish pigmentation. Stem with moderately thickened, colourless cell walls. Leaves imbricate, at apex often incurved, but the shoot never julaceous. Underleaves trapezoid in shape. Only the first lobular tooth is well developed, acute, falcate, one celled. There is no pretooth present. Although prefers wet habitat, never occurs in running water *D. vandenberghenii*
- 5b Plants with blackish pigmentation, sepia or dark rust brown. Stem with incrassate (2 µm), brownish pigmented walls. Leaves densely imbricate, fully incurved towards the stem, forming julaceous habit. The apical (first) lobule tooth 1 celled, falcate. On each lobule a 20–25 µm large, almost globose pretooth is attached to the last cell at the distal end of lobule margin, almost touching the apical tooth. Rheophytic species, occurring on stones in running water or on irrigated streambank *D. vanderpoorteni*

*

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