NOTES ON THE BRYOPHYTES OF MADAGASCAR 2.
NEW LIVERWORT AND HORNWORT RECORDS

Tamás Pócs

Institute of Biology, Eszterházy Károly University, Eger, Pf. 43, Hungary, H-3301;
E-mail: pocs.tamas33@gmail.com

Abstract: During the identification of the epiphyllous liverworts collected in Madagascar for the purposes of description of foliicolous communities, 11 species turned out as new to the flora of the island, one of them (Cololejeunea ocelloides) to the whole of Africa. In addition, 8 other species hitherto known only from one place in Madagascar became known from other localities. Finally two new synonyms were established.

Keywords: biodiversity, endemics, Indian Ocean islands, Madagascar, new species

INTRODUCTION


**MATERIALS AND METHODS**

In the following the author wishes to display records from his most recent investigations done mostly on epiphyllous liverwort communities. Some of them are widely distributed in the continental part of Africa but somehow were not yet reported from Madagascar. For the nomenclature the ‘World checklist of hornworts and liverworts’ (Söderström et al. 2016) was considered. In the Madagascar and total African distribution apart from smaller reports we took in account the publications of Marline et al. (2012) and of Wigginton (2018). Specimens of the collection are deposited in the herbarium of Eszterházy Károly University in Eger, Hungary (EGR), in the Tsimbazaza Botanic Garden Herbarium (TAN), partly also in the Missouri Botanic Garden Herbarium (MO) and in the Herbarium of Field Museum in Chicago (F). Our present records originate from only a few localities and almost all are epiphylls (if not otherwise stated), therefore it seemed to be reasonable to enumerate the localities first in details than in the list just to mention them by their collecting numbers:

**The collecting localities**


9883. Toamasina prov., Atsinanana reg., Coastal dune forest with stilt rooted *Uapaca* trees and *Memecylon* bushes along the road between Andovoranto and Ambila-Lemaitso, 4-5 m, 18°54.2-55.4’S, 49°7.3-6’E. S. & T. Pócs and A. Szabó, 22. Aug. 1998.


04128. Fianarantsoa prov., Atsinanana reg; parc National de Ranomafana. On the summit ridge of Mt. Vatolampy (with a telecom aerial), 2.3 km W of Ambatalohy village. Disturbed, relatively open montane rainforest with 5-10 (-20)m high trees, rich in micro-epiphytes, 1200 m, 21°15.10’S, 47°24.44’E S.& T. Pócs, 30 July 2004.

04130. Fianarantsoa prov., Atsinanana reg; beyond the W boundary of Ranomafana National park. 1.6 km E of Ambatovaku Avaratra village, on the S side ridge of Mt. Namatoana. Dense, but not too shady microphyllous elfin forest of
thin, 6-8 (10) m tall trees, 1250 m, 21°17.10'S, 47°19.14'E. S. & T. Pócs, K. Tuba, 24 July 2004.

RESULTS

Records new for Madagascar

*Caudalejeunea africana* (Steph.) Steph. 90111/BB, 9875/CC. Widespread epiphyll in continental Africa, new to the Indian Ocean islands, including Madagascar.

*Cheilolejeunea adnata* (Lehm.) Grolle var. *autoica* Gradst. & Ilk.-Borg. (Syn.: *Cheilolejeunea larsenii* Mizut., *Cheilolejeunea exinnovata* E.W. Jones (fide Bastos & Gradstein 2020). 90111/CE, a pantropical species hitherto known from several places in continental West-Africa and Zimbabwe under the name of *C. larsenii*, but new for all East African islands (Wigginton 2018). It is characterized by its bottle shaped lobule and the variability of its teeth often crossing each other.

*Cheilolejeunea ventricosa* (Schiffn. ex P.Syd.) Xiao L. He. 9472/BV, on dry, dead leaf. Malesian-Pacific species known in Africa only from Mauritius (Pócs 1997 as *Pycnolejeunea ventricosa*, Pócs et al. 2019).

*Cololejeunea haskarliana* (Lehm. et Lindenb.) Schiffn. 90113/FL, 9472/AS, 9473/GV, 9474/AA. A widespread species in Asia and in the Pacific, but in Africa only known from the Seychelles and from Réunion Island.

*Cololejeunea ocelloides* (Hook.) Mizut. (Syn.: *Cololejeunea leonidens* Benedix). 90114/KE. Hitherto known as a Malesian species known from Sumatra to New Guinea (Pócs and Piippo 2011), new for Africa.

*Cololejeunea pteroporum* Tixier 90111/BR. A species described and hitherto known only from Rodrigues Island (Tixier 1985, Grolle 1995), new for Madagascar.

*Dendroceros borbonicus* Steph. 9888/F. Quite widespread in Mauritius, Réunion and the Seychelles, not yet known from Madagascar. A species equally occurring on leaves, bark and twigs in wet habitats.

*Lejeunea exilis* (Reinw. et al.) Grolle 90114/HA. A widespread Indomalesian-Pacific species, known only from Réunion in Africa, new for Madagascar.
Plate 1. Figure 1. Caudalejeunea africana (Steph.) Steph. (from Pócs & Szabó 9875/CC). Figure 2. Cheilolejeunea andnata var. autoica Gradst. & Ilkiu-Borges, ventral view (from Pócs 90111/CE). Figure 3. Cheilolejeunea ventricosa (Schiffn. ex P.Syd.) Xiao L. He, ventral view (from T. Pócs & Kis 9472/BV). Figures 4–6. Cololejeunea haskarliana (Lehm. & Lindenb.) Steph., 4 = ventral view, 5 = lobule with crossing teeth, 6 = lobe margin (from Pócs & Kis 9472/AS).

Leptolejeunea maculata (Mitt.) Schiffn. 94111/BC,BW, 9883/BA. A palaeotropic species, widespread in mainland Africa and tropical Asia and the Pacific, known also from the Seychelles, Réunion and Rodrigues Island but not yet in Madagascar (Müller and Pócs 2002).

**Radula flaccida** (Lindenb.) Gottsche 90111/BH, 9883/BR. A common Afro-American epiphyll. From the Indian Ocean region it was known only from Anjouan (Dzouani) Island in the Comores (Castle 1939).

Records of species known before only from one area in Madagascar

**Cololejeunea mariana** Tixier 90111/CG. Known only from its type locality in St. Marie Island.

**Colura obvoluta** Jov.-Ast 9875/CN. Apart from its type locality in St. Marie Island of Madagascar it was known only from the Seychelles Islands (Pócs 1995).

**Colura humbertii** Jov.-Ast 9890/DB. In Pócs (2020b) this record by mistake under the name of *C. calyptrifolia* was communicated. 04126/QC. In Madagascar it is known only from its type locality (Jovet-Ast 1954). Since became known from Mauritius and Réunion (Grolle 1995) and from Tanzania (Pócs 2020b).

**Diplasiolejeunea magnistipula** Tixier 04128/AT. The species was described from Cameroon (Tixier 1975) and later only one other record was published from the Lokoho Basin in northern Madagascar (under the synonym of *Diplasiolejeunea drepanolejeuneoides*, Tixier 1977).

**Drepanolejeunea cultrella** (Mitt.) Steph. 04128/AT. On dry, dead leaf. A very widespread tropical African species known only from one locality in north-western Madagascar (Pócs and Geissler 2002).

**Leptolejeunea epiphylla** (Mitt.) Steph. 94111/BC. Palaeotropical species, widespread from tropical Africa through tropical Asia to the Pacific. It is known in the Indian Ocean Islands from the Seychelles, Comores and Mauritius and in Madagascar only from the Manongarivo Reserve (Pócs and Geissler 2002).

**Otolejeunea moniliata** Grolle. 9448/K, 9472/AD, AZ epiphyllous, BW On dry, dead leaves. It was previously known only from the type area of Marojezy Reserve in northern Madagascar. Now it becomes known also from the Masoala Peninsula and further south in the Andringitra mountains. It is worth to mention
that the original description does not mention the scattered ocelli, which can be observed only on fresh material (and also seen on the micrograph of Bechteler et al. 2015: fig. 1c and f). Furthermore there are specimens with denticulate lobes, where the teeth are tipped by hyaline papillae.


Figure 11. Lejeunea exilis (Reinw. et al.) Grolle, ventral view (from Pócs et al. 90114/HA). Figure 12. Leptolejeunea maculata (Mitt.) Schiffn., ventral view (from Pócs & Szabó 9883/BA).
**Radula pinnata** Pócs 9875/CK. New record of the recently described species (Pócs 2020a) at 5 km distance from the type locality. It was supposed that it is mainly corticolous and only facultative or incidentally epiphyll, but at the new locality *R. pinnata* occurred also only on leaf surface.

New synonyms of Madagascar liverworts

During the study of many epiphyllous material from different Madagascar localities was found that some species described on the base of only few specimens are interconnected by transitional forms. Hence is impossible to demarcate species limits between them. On this base the following new synonyms were established:


Type: MADAGASCAR Leloutre, 13 July 1898 (G).
Other synonyms see in Tixier (1985).

Tixier (1985: 52) had already mentioned the difficulties to distinguish *Cololejeunea cristata* from *Cololejeunea cuneata* and from some other species. The difference between the two species is established on the lobule dentition, whether 1 or 2 lobule teeth are present. In our collections (90111/BQ, 90113/FU, 9473/HJ, 9875CH, 9883/BC, 9887/Y), even within one specimen, both cases occur and the development of second tooth is very variable, from very well developed to obsolete or nothing. This indicates that the two species are practically not separable.


Type: MADAGASCAR, Fianarantsdoa, forêt du Tsarafidy, *Tixier 8908* (holotype PC).
According to Tixier (1979:212) *D. auriculata* is close to *D. kraussiana*. To distinguish the two species, he used the formation of lobule apex and the shape of perianths. In the original diagnosis of *Diplasiolejeunea kraussiana* (Lindenberg in Gottsche et al. 1845), the lobule apex is described as “*lobulo magno bidentato (dente margini propinquo maiore) inflexo*”. Tixier writes in the diagnosis of *Diplasiolejeunea auriculata*: “*dente media cum duoibus cellulis ad apicem*”. The T shaped teeth, like for *Diplasiolejeunea cornuta* Steph., is a very unreliable character occurring on many lobules indeed and missing in others, within the same or in other plants. The perianth shape is also very variable, even on the Tixier’s drawings of (1979: 211-212, figs. 1:11 and fig 2: 10–12) from obcordate with auriculate wings to simple obconic with narrow, straight wings. According to the author’s observation several specimens are transitional between the two. The combinations of these two characters at different degree can occur. Hence there is no reason to distinguish them at the species level. For example in our specimen 04116/H the shape of the perianth is typically “auriculate”, while the majority of the apices of the lobule teeth are simple.

**DISCUSSION**

The diversity of Madagascar bryoflora is very high, compared even to continental Africa. From the near 1200 bryophyte species almost 400 are liverworts and hornworts, although the greater part of the island is under high anthropogenic influence. A great proportion of the former primary vegetation types are lost. Many rainforests, which house the highest proportion of the bryophyte species, are already converted to pastures, to secondary savoka bushes, as the result of shifting, slash and burn cultivation and of illegal timber cutting. Even so, careful collection and identification work every year brings to light many new records and even taxa new to science. Therefore the existing protected areas, as national parks and biosphere reserves have great significance and merit international aid to be saved.

As it is seen from the above enumeration, the bryoflora of Madagascar is still inadequately known. From a moderate amount of collections 11 species turned out to be new for the flora of the island and the same amount were known only from one locality. It
should be mention, that from these few localities already 7 species were described as new to science and further 4 are waiting for description. The herbarium of Eszterházy Károly University in Eger (EGR) has an immense amount of collected specimens (mostly shared with the Herbarium of Tsimbazaza Botanical garden, Antananarivo: TAN). We are looking for specialists of the different groups, especially of mosses and are ready to send the specimens to them for identification and revision, as we already did before.

Acknowledgement – The author wishes to express his gratitudes to all institutions and sponsoring agencies mentioned in his last Madagascar contribution (Pócs 2020b), who supported his travel costs and collecting activities. He is also grateful to his late wife and to his Hungarian and Malagasy colleagues, who participated in the collecting expeditions and finally to the careful reviewers, Catherine Reeb (Sorbonne Université and PC) and to Alfons Schäfer-Verwimp (Herdwangen-Schönach, Germany) for their useful advises and corrections.

REFERENCES


DORR, L.J. (1997). Plant collectors in Madagascar and the Comoro Islands: A biographical and bibliographical guide to individuals and groups who have collected herbarium material of algae, bryophytes, fungi, lichens, and vascular


