

BRYOPHYTE COLLECTIONS OF ESZTERHÁZY KÁROLY CATHOLIC UNIVERSITY (EGR): THE DIGITAL DATABASE OF MALAGASY SPECIMENS

Andrea Sass-Gyarmati*, **Marianna Marschall** & **Gabriella Fintha**

*Institute of Biology, Department of Botany and Plant Physiology,
Eszterházy Károly Catholic University, P.O.Box 43, H-3301, Eger, Hungary;
E-mail: sassgyarmati@gmail.com

Abstract: The paper describes the Malagasy collections in the cryptogamic herbarium of the Eszterházy Károly Catholic University (EGR), Eger (Hungary), according to its condition in 2022. All specimens were documented: all data from the labels were entered into MS Excel spreadsheet, and in the case of type material digital photographs are also taken. The oldest Malagasy specimens hosted in the herbarium are the isotypes of *Brachymenium borgenianum* Hampe and *Bryum subargenteum* Hampe, both specimens collected by M. Borgen in 1870. The main aim was to digitalize and publish information on the cryptogam herbarium in order to provide an easier access to the data. The digital photographs and the database are property of the Department of Botany and Plant Physiology of Eszterházy Károly Catholic University. Data of Madagascar specimens database are summarized in an electronic appendix including: catalogue number, taxon name, collector, locality, date of gathering and file name of the documentary photograph. Further data can be required from the curator of the herbarium.

Keywords: biological collections, herbarium digitization, Madagascar bryophytes

INTRODUCTION

The herbarium of the Eszterházy Károly Catholic University (acronym: EGR) is the second largest herbarium in Hungary (Takács *et al.* 2014), consisting of two main parts. The cryptogam collection, which is one of the largest in Central Europe (consisted by 200.000 identified bryophytes, and 8000 lichenized and moss parasitic fungi) is widely known among bryologists. It has gained an international reputation for the collections of Prof. Tamás Pócs and his colleagues, who studied and collected bryophytes all over



the tropics. This collection comprises lichens mainly from Europe and Africa, but the main part are the bryophytes collected predominantly in the tropical regions of Africa, India, Indonesia, Vietnam, Papua New Guinea, Australia, Fiji, Cuba, Peru and Venezuela. The vascular collection is quite small in number, but not negligible (Sass-Gyarmati and Vojtkó 2010; Péntesné Kónya *et al.* 2013). It is mainly valued for the age and collectors of its specimens, dating back to the early 19th century. It stores the collections of significant Hungarian botanists of that time, providing information about their trips and interests in certain regions or taxa. The vascular collection includes vouchers collected primarily in the territory of present-day Hungary and the neighboring countries (mainly in the Carpathian Basin), but there are specimens from the Alps, Silesia, the Balkan and from the coastal regions of the Adriatic Sea as well. The vascular collection has been digitized (E. Vojtkó *et al.* 2014), followed by digitization of the *Sphagnum* (peat moss) specimens, as well as the first batch of the cryptogam collection (Kapi and Sass-Gyarmati 2020).

Digitization and analysis of the cryptogamic herbarium is still an actual challenge for us. Digitization process of the Malagasy bryophytes started in 2020. The aim was to create a database of the Malagasy species belonging to the cryptogamic collection of EGR, including all main attributes of each herbarium specimen, accompanied by digital photos of the type specimens. Currently, some other Hungarian herbaria are being processed similarly, e.g. BP (Hungarian Natural History Museum) (Papp and Rajczy 1998), DE (Szarvas *et al.* 2010).

MATERIAL AND METHODS

The database comprises the material collected until 2018. Methods of digitization and database building process mostly followed Molnár V. *et al.* (2012) and Takács *et al.* (2014). The nomenclature of the species follows Söderström *et al.* (2016), Wigginton (2018) for the liverworts and hornworts and O'Shea (2006) for the mosses. First the information on the labels was entered into Ms Excel spreadsheet, where rows correspond to individual records and columns represent attributes of the collected specimens. The following attributes were recorded: (1) taxon name on the label, (2) collector (or collectors) name, (3) collecting number (4)

identifier person name (5) data of gathering and (6) detailed locality data. One record of the database represents specimen(s) of the same taxon collected from the same locality at the same time on one capsule. If a herbarium capsule contains specimens of different taxa, they are treated as same records, the species name are included in brackets. Thus, the number of records (= rows in the database) could represent sometimes more than one species. In the case of type material, digital photographs were taken from the label of each capsules. The digital photos were taken using '.jpg' extension, and their average size is 1.5–2 MB. In the case if collecting dates were given as intervals (very often in case of foreign collections) we record the earlier data. Data of the Malagasy database are summarized in an electronic appendix <https://uni-eszterhazy.hu/biology/m/egr/database>. Further data can be required directly from the curator of the herbarium.

RESULTS AND DISCUSSION

Representations of the Malagasy species and floristically significant records

The database contains 2004 records (evidence based on: 2022) of which 435 species, 14 subspecies and 26 varieties are recorded of more than 100 collectors. The most important are the 115 type specimens (29 holo-, 27 iso-, 4 topo-, 3 isoparatype-, 51 paratype and one specimen with „type” mention). Specimen labels collected from Madagascar, written by typing machine or computer and are easily readable. Anyway, a few problems occurred with those written in Chinese.

The oldest Malagasy specimens are from the 19th century, the isotypes of *Brachymenium borgenianum* Hampe and *Bryum subargenteum* Hampe. Both specimens were collected by M. Borgen in Madagascar with no specification or details of the precise location. These specimens arrived as exchange material (*Figure 1*). All other specimens are collected from 20th and 21st century.



Figure 1. Isotypes of *Brachymenium borgenium* Hampe and *Bryum subargenteum* Hampe, the oldest specimens collected from Madagascar, held in Eger (photos: A. Sass-Gyarmati).

The Malagasy specimens of EGR under study were collected between 1870 and 2018. The intensity of collecting was very uneven, as the vast majority of specimens were obtained between 1990–1999. The collection of the specimens from Madagascar can be dated from the first half of the 1990's and from 2004, when travel and financial conditions made this possible. Professor Tamás Pócs participated in altogether four times (1990, 1994, 1998, 2004), members of the Botanical Department accompanied him once time and collected on the 1994 Madagascar research trip. Before and after this period, materials were sent to our herbarium mainly by gift or exchange. In 2018, another opportunity was opened to collect moss on the island on behalf of the French Museum of Natural History, this time by Andrea Sass-Gyarmati in the frame of „Madbryo” Project. A decade-long breakdown shows that most of the samples, numerically 1520, came from the period 1990–1999 (Figure 2).

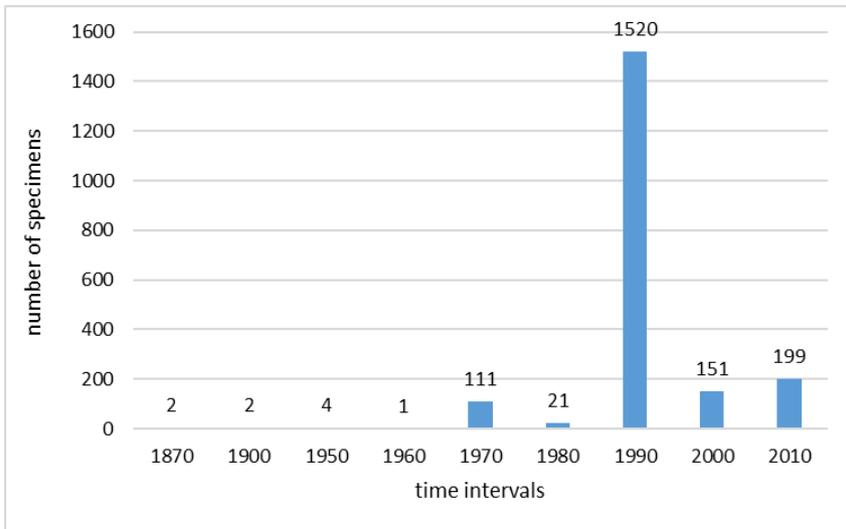


Figure 2. The number of collected specimens by time intervals.

The majority of the specimens belongs to the largest families. The best represented genera are shown in the table below (*Table 1*).

Table 1. The best represented genera in Madagascar, by number and percentage.

<i>Genera</i>	<i>nr.</i>	<i>percentage</i>
Plagiochila	241	11.99%
Diplasiolejeunea	186	9.25%
Bazzania	149	7.41%
Frullania	104	5.17%
Syrrhopodon	107	5.32%
Cololejeunea	89	4.43%
Sphagnum	83	4.13%
Drepanolejeunea	80	3.98%
Radula	66	3.28%
Calymperes	62	3.09%

The species of genera listed in the table are the most numerous also in the other tropics, belonging to the families among others of Lejeuneaceae, Lepidoziaceae, Frullaniaceae, Radulaceae, Calymperaceae, which account for more than 2/3 of the data set. In

fact the identification of many specimens or entire genera is still pending, being in boxes at the stage as they were collected. In some cases researchers are working on them in the present time (eg. *Bazzania*, *Cololejeunea*, *Plagiochila*, *Radula*, *Bryaceae*, *Campylopus*, *Leucoloma* and *Sphagnum*) and hopefully their results will be published soon. So the larger collections of the nineties of past century has only been partially identified and databased. Since the 2000s onwards, the increasingly strict rules for issuing exploration permits and transfer of specimens to their specialists practically slowed down further collections on the island.

Representation of Malagasy collections in the herbarium – important collectors

Table 2. Summary of the collections of Hungarian collectors.

<i>Hungarian collectors</i>	<i>nr. of collected specimens</i>
Tamás Pócs	313
Sándor Orbán	119
András Vojtkó	89
Gabriella Kis	73
Andrea Sass-Gyarmati	42
Sarolta Pócs	10
Tamás Pócs, Sarolta Pócs & András Szabó	103
Tamás Pócs & András Szabó	79
Kata, Sarolta, Tamás Pócs & András Szabó	24
Tamás Pócs & András Vojtkó	2
Tamás Pócs & Sarolta Pócs	49

Table 2 summarizes the activity of Hungarian collectors. Where there are several collectors included on the label this means that they were together at a particular collecting site, however, the name of the collector at that time not always clear, so these combinations appear on the original labels according to the table. Tamás Pócs also participated on several occasions as member of foreign granted projects, so his name appears in 57.4% of the labels.

Important foreign collectors who contributed substantially to the collections enrichment are: C. Lafarge-England, R.E. Magill, P. Geissler, Lü, A. Randrianasolo, M. Onraedt., R. Ranaivojaona and D. A. Callaghan (*Table 3*).

Table 3. Important foreign collectors from Madagascar.

<i>Foreign collectors</i>	<i>Nr. of collected specimens</i>
T. Pócs, C. Lafarge-England & R.E. Magill	272
P. Geissler	152
D. A. Callaghan	127
Lü	57
M. Onraedt	45
P. Tixier	16
D. J. Mabberley	10

Geographical coverage

Based on collected specimen data our results are in concordance with the vegetational diversity of Madagascar (*Figure 3*).

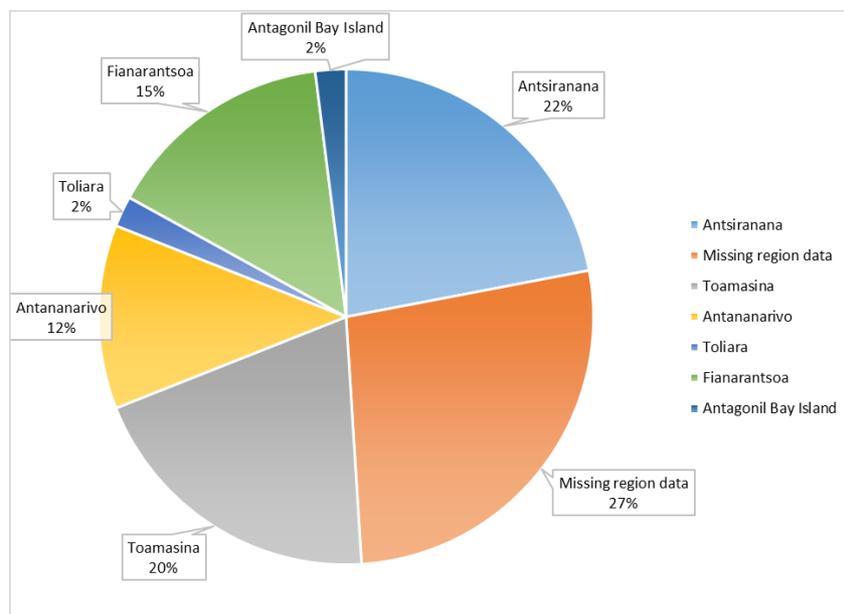


Figure 3. The number of collected specimens and their geographical representation in the regions of Madagascar.

The highest number of specimens occurs in the province of Antsiranana which is justified by the presence of the Reserve Integrale Nationale de Marojejy and the Reserve Speciale de Manongarivo in the province, which are characterized by the relative easy availability and the very high diversity of vegetation and the outstanding number of endemisms. A key target for researchers is to make collections here, but this is facing serious difficulties these days, making them one of the most valuable specimens in our collection. There are two priority areas in the province of Toamasina: one in Andasibe-Perinet, which may be popular due to its proximity to the capital, and all researchers visiting Madagascar visit this National Park. Similarly, special habitats can be found in the same province in the Mananara Nord Biosphere Reserve and National Park, from where we have very rich material. The third well-explored area is the Ranomafana National Park, located in the province of Fianarantsoa and due to its diverse habitats and endemisms, remains a priority area for exploration. In the case of the southern province of Toliara, where the rainy season decreases and dry thorn bush develops, where bryophytes are present in smaller amount and diversity, it is justified that lesser bryophytes were collected from here. In spite of their difficult approach the Masoala Peninsula and Marojejy National Park proved to be very promising areas for future exploration.

CONCLUSIONS

In our herbarium the Malagasy specimens are in the the same storage cabinets with other tropical bryophytes. About 75 % of the Malagasy specimens were collected by Hungarian botanists, mainly by members of the Botany Department (Madagascar 1994, 1996, 1998, 2004, 2018), and the other specimens came in exchange or as gift materials to the herbarium from foreign researchers. The greatest significance of the completed database is that the Malagasy collection of the Herbarium is now electronically searchable, which facilitates the research work and more efficient management of the collection. Based on the database, which is also available online, the species, collector name and year are now searchable. For more detailed data contact of the herbarium curator (the Author of this paper) is required, who can assign additional data and borrow the

material (except for types) if necessary. Domestic and foreign herbariums can also access the data, which can promote the loans between herbaria and provide more detailed information on our specimens.

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