

Tropical Plant Collections: Legacies from the Past? Essential Tools for the Future?

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Dedication

We dedicate this volume to the memory of Kai Larsen (1926-2012) and Gunnar Seidenfaden (1908-2001), both members of the Royal Danish Academy of Sciences and Letters and deeply committed to the study of tropical plants. They were always convinced that Danish scientists should play a role in the study of botany in the tropics, and they inspired and encouraged us in our work in South America, Africa and South East Asia.

Early Italian Botanists in the Tropics and the Fate of Classical Collections

Riccardo Maria Baldini and Lia Pignotti

Abstract

Classical botanical collections, made before 1940, have been at the basis of the origin and development of plant taxonomy, and still represent essential reference material for future progress in botany. Large parts of these collections are still poorly known and studied. The importance of historical collections for progress in taxonomy and for a comparison between past and present biodiversity is here highlighted, including their potentialities at a global scale (e.g. the study of degradation and loss of habitats, and indirectly, the climate change in the Anthropocene era) as well as the opportunity to promote and facilitate their study by means of online networks of herbaria. Giuseppe Raddi (1770–1829), Antonio Bertoloni (1775–1869), Carlo Giuseppe Bertero (1789–1831), Luigi Sodiro (1836–1909) and Odoardo Beccari (1843–1920) are examples of eminent early Italian contributors to the historical botanical exploration of the Palaeo- and Neotropics.

Key Words: historical collections, Italian collectors, Neotropics, online specimens, Palaeotropics.

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Traditionally a classical plant collection is one that has been assembled and studied by botanists in the 17th, 18th or early 19th centuries. Classical collections often represent early records of plants from remote places, most notably from the tropics. Nowadays – in the early 21st century and taking into account both the dramatic historical events that characterized the 20th Century and the subsequent unprecedented speed of social/environmental transformation at a global level – even collections made as late as the onset of the Second World War, might in our opinion legitimately be considered ‘classical collections’.

Many times, during teaching in Mesoamerica, we have noticed a lack of knowledge of historical botanical collections and a limited awareness of their importance for understanding plant species in the tropics. But verification of names used in biodiversity assessment of a tropical region is not definitive without access to classical collections, in our opinion. On the other hand, when we have had the opportunity to give lectures on subjects such as historical botany and botanical nomenclature in tropical regions, the response of young students has always been enthusiastic. This means that historical information in botany



Fig. 1. Centres where pre-Linnaean books on botany were published (Stearn 1958). The most important early botanical centres are indicated by name. Other important places in the early history of botany are referred to by numbers: 1, Leiden; 2, Middelburg; 3, Arnhem; 4, Louvain; 5, Berlin; 6, Leipzig; 7, Bautzen; 8, Gorlitz; 9, Prague; 10, 11, Nürnberg, and nearby Altdorf; 12, Augsburg; 13, Bergamo; 14, Mantua; 15, Padua; 16, Ferrara; 17, Bologna; 18, Florence; 19, Naples; 20, Salamanca.

may still hold cultural and pragmatic interest and is attractive for young generations as well, as long as they are confronted with its great potential.

Botanical research in tropical regions began a period of important progress since the 16th century and particularly since the 18th century (the century of Carolus Linnaeus), when interest in overseas scientific exploration, although still significantly triggered by political and economic reasons, grew up to an unprecedented measure. We can definitely say that botanical exploration then became the core of botanical research. As stated by Stearn (1958) the birth of modern botany took place where botanical collections from these early scientific expeditions had first been built up and made available for study, i.e. within a relatively small area in central and southern Europe (Fig. 1).

Quite significant botanical exploration of extra-European overseas regions would already take

place in the pre-Linnaean Era as evidenced, for instance, by the early contributors to the knowledge of tropical botany (Stearn 1958; Howard 1975; Baas 2017). Examples of both palaeo- and neotropical pre-Linnaean research activities are mapped in Fig. 2.

Among many contributors, those particularly worth mentioning are, Hans Sloane, one of the most important British botanists and collectors in the pre-Linnaean era, Charles Plumier, a pre-Linnaean French Botanist and illustrator, who gives us one of the first examples of descriptions supported by detailed watercolour plates, still important in the typification of many species described later according to the binomial system (see Baldini 2010), and other pioneers of tropical botany, such as Paul Hermann (Ceylon), Hendrik Adriaan van Rheedee tot Drakenstein (India), Georg Everhard Rumphius (Indonesia), see Baas (2017).



Fig. 2. Overseas botanical exploration before 1732 according to Stearn (1958).

Improvement of knowledge in tropical botany was promoted by Linnaeus and his ‘apostles’, with the important contribution of early world circumnavigations and the subsequent early expeditions into the interior of tropical countries (Friis *et al.* 2013). One instance of a less known circumnavigation of botanical interest is the Malaspina Expedition (1789–1794), financed by King Charles III of Spain (Foggini 2010). The expedition was botanically supervised by Louis Née, a French-Spanish botanist who described, with Antonio José Cavanilles and others, many species supported by very good illustrations (Garmendia 1996). Née’s herbarium – housed in Madrid (MA) – is quite important for the study of tropical botany, although it has some mistakes due to mixed up labels.

Most historical botanical collections from the tropics are nowadays housed in large European (B, BM, BR, C, FI, K, L, LE, P, S, W) and North American (A, GH, MO, NY, US) herbaria (abbreviations here and in the following according to Thiers (continuously updated), although several less known European herbaria also house important historical collections.

Classical Collections and Studies of Tropical Botany: Some contributions by Italy

Several Italian herbaria – like the herbarium of the Istituto ed Orto Botanico in Bologna (BOLO), the herbaria of the Museo di Storia Naturale in Florence (FI), the Erbario Horti Pisani at the University of Pisa (PI), the botanical garden and the herbarium of the University of Turin (TO) and the herbarium of the Dipartimento di Biologia Vegetale of the University of Rome (RO) – have a significant role in the study of palaeo- and neo-tropical areas. Some examples of tropical botanical collections and botanists from Italian herbaria in the Nineteenth Century, often forgotten or at least not enough taken into consideration are:

Giuseppe Raddi (1770–1829)

Raddi (Fig. 3) was a talented Florentine botanist. He was appointed by the Grand Duke Ferdinand III of Tuscany to take part in the Austrian expedition to



Fig. 3. Giuseppe Raddi (1770–1829). Lithograph by G. Galli, reproduced from Savi (1830).

Brazil 1817–1818, promoted by K.W.L. von Metternich on occasion of the marriage of the Austrian emperor's daughter Maria Leopoldina with the Portuguese heir to the throne Dom Pedro de Bragança. Raddi was the only Italian scientist of an eminent team of European naturalists including the Austrian zoologist J. Natterer, the Austrian botanists H.W. Schott, J.B.E. Pohl, J.C. Mikan, and the Bavarian botanist C.F.P. von Martius (Isenburg 1989; Riedel-Dorn 2000; Schultz 2015). Besides Brazil, Raddi collected in Madeira – on the way to Brazil – and later (1828–1829) in Egypt, on a French-Tuscan expedition along the Nile river. He died untimely in Rhodes on 6 September 1829 on the way back from this expedition due to an infection (Pichi Sermolli & Bizzarri 2005; Parrini 2008). His herbarium is housed at Herbarium Horti Pisani, University of Pisa (PI), with main sets of duplicates in herbaria of the Museo di Storia Naturale of the Uni-

versity in Florence (FI, FI-Webb) and in the herbarium of the Istituto ed Orto Botanico (BOLO) of the University of Bologna, but Raddi's duplicates were also sent to herbaria in London (BM, K) and Paris (P) and later by F. Parlatore to Brussels (BR), Geneva (G), Paris (P) and the Natural History Museum in Vienna (W) (Amadei *et al.* 2005; Baldini & Guglielmono 2012).

Among his important works we find the *Agrostografia Brasiliensis* (Raddi 1823), which was the first Monograph on the Brazilian Flora, and *Plantarum Brasiliensium Nova Genera* (Raddi 1825), based on Raddi's fern collection (housed in PI), which was thoroughly studied by the pteridologist Rodolfo Pichi Sermolli (1912–2005). The result of this study was Pichi Sermolli's last work, finished just few weeks before he passed away, and published shortly after his death (Pichi Sermolli & Bizzarri 2005). Other reviews devoted to Raddi's tropical collections are the studies of Begoniaceae (Irmscher 1957), Fabaceae: *Swartzia* sp. pl. (Mansano de Freitas & Rabelo Lima 2007), *Schnella* Raddi (Trethowan *et al.* 2015); Melastomataceae (Goldenberg & Baldini 2002), Poaceae (Baldini & Longhi-Wagner 2006; Longhi-Wagner & Baldini 2007), Cyperaceae (Longhi-Wagner *et al.* 2010) and Orchidaceae (Romero-Gonzalez 1999; Romero-Gonzalez *et al.* 2008). Raddi's collections of Piperaceae and Zingiberaceae are currently under study, but most of his other phanerogams and his cryptogams still lay untouched.

Carlo Giuseppe Bertero (1789–1831)

Bertero (Fig. 4) was a Piedmontese physician. In 1816, after he had studied Antilles Flora on herbarium specimens in Paris, he left as a ship physician to the West Indies and Colombia. From then until 1821 he had visited and collected plants in Guadeloupe, Saint Thomas, Puerto Rico, Haiti, Colombia, and Jamaica. He sailed back to Europe where he stayed until 1827, after which and under suggestion of Augustin Pyrame de Candolle of Geneva, he left for Chile, where he again obtained the permission to practice medicine. He visited and collected in Valparaiso, Santiago, Rancagua, Aconcagua,



Fig. 4. Carlo Giuseppe Bertero (1789–1831). Engraving from a drawing made in 1827, now at the Orto botanico dell-Università, Padova. Reproduced from Delprete *et al.* (2002); also in HI-IAPT Portraits of Botanists 1974a).

Quillota, and the Juan Fernandez archipelago. In 1830 he sailed to Tahiti, where he remained and collected until he left for Valparaiso on 9 April 1831. Unfortunately the small craft in which he was sailing on the way back to Chile never reached its destination, and the ship must have perished with all and everything on board somewhere in the South Pacific Ocean.

Bertero's Chilean collections are included in L. Colla's herbarium at the University of Turin (TO) and according to Munoz Schick (1999) some are in the herbarium of the Museo Nacional de Historia Natural in Santiago, Chile (SGO), while his Tahitian collections are in Paris (P). Nonetheless, about 15,000 Chilean specimens were kept in Paris by Baron De-

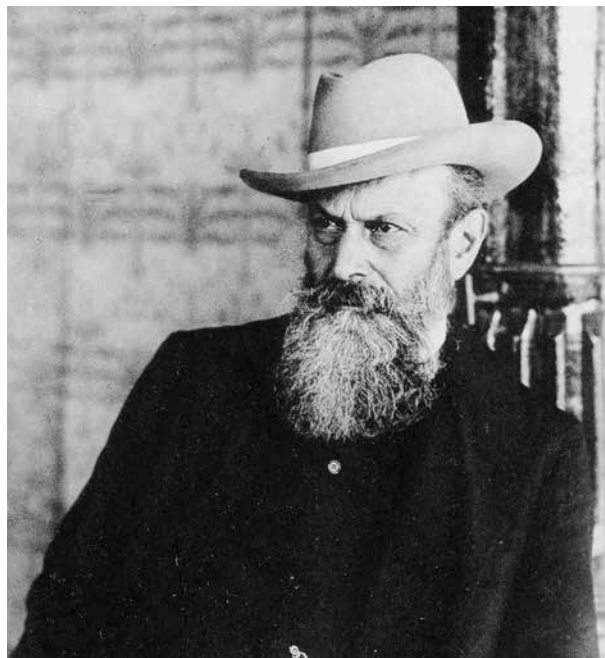


Fig. 5. Odoardo Beccari (1843–1920). Portrait published as the frontispiece in the journal *Webbia* 5 (1921), of which part one is dedicated to the life and work of O. Beccari.

lessert, who kept them for Bertero, until his expected return to Europe. After Bertero's and later Delessert's passing away, the specimens were sold to E. Steudel and C.F. Hochstetter and subsequently distributed to several European herbaria (Delprete *et al.* 2002).

Odoardo Beccari (1843–1920)

Beccari (Fig. 5) was a trained naturalist, born in Florence to a family with roots in the Chianti district of Toscana and educated in Lucca, Pisa, and Bologna. After his graduation, he spent some months at the Royal Botanic Gardens, Kew, where he met William Jackson and Joseph Dalton Hooker, Charles Darwin and James Brooke, who was the first rajah of Sarawak, Borneo. In 1865 he undertook a journey to Borneo together with his friend Marquis Giacomo Doria (Lo Priore 1921; Pichi Sermolli & van Steenis 1983; Pichi Sermolli 1982, 1994). After Doria's homecoming Beccari remained for three years in Borneo, proving to be a talented explorer, an enthusiastic observer and a



Fig. 6. Luigi Sodirot (1836–1909). Lithograph after a photograph in Biblioteca dell’Orto botanico, Università di Padova, here reproduced from Briosi (1914).

brilliant interpreter of nature as a whole (see his most famous travel account, Beccari 1902, 1904).

After that, Beccari went to present-day Eritrea in 1870 (Pichi Sermolli 1988) and was in 1871–1878 again in Malaysia and travelled to New Guinea, Australia, New Zealand, and Madagascar, which inspired him to a monumental work on the palms of that island (Beccari 1902). Beccari’s botanical collections are mainly housed in the Museo di Storia Naturale of the University in Florence (FI) and the herbarium of the Museo Civico di Storia Naturale Giacomo Doria in Genova (GDOR), although scattered specimens also occur in other European herbaria. The most renowned part of Beccari’s collections is definitely the Herbarium Palmarum, housed in FI and still object of study by palm specialists from all over the world (Cuccuini & Nepi 2006).

Luigi Sodirot (1836–1909)

Sodirot (Fig. 6) was an Italian Jesuit priest, born in Vicenza in Veneto. He studied theology, philosophy, languages and natural sciences in Innsbruck, where he had the opportunity to learn botany from A. Kerner von Marilaun (Stafleu & Cowan 1985). Afterwards he moved to Ecuador, where he was appointed botany professor at the engineering school and at the university of Quito, insofar succeeding the Scottish William Jameson in this position, and was charged with the foundation and direction of the first University Botanic Garden in Quito (Briosi 1914). Large sets of his plant collections, mostly from the mountainous province of Quito, are located in several European and North American herbaria (Baldini & Guglielmone 2012) as well as in the herbarium of Instituto de Ciencias Naturales, Universidad Central (Q) in Quito. A very good set of specimens, including types, is housed in the Herbario P. Luis Sodirot in Quito (QPLS), where it is attached to the Biblioteca Ecuatoriana Aurelio Espinosa Pólit (Thiers continuously updated).

Antonio Bertoloni (1775–1869)

Bertoloni (Fig. 7) was born in Sarzana in Liguria and studied medicine in Pavia and Genova. In 1815 he became professor of botany at the University of Bologna. He is famous as the author of the first monumental, critical Italian flora, and he never collected in the tropics, but he received and studied collections of tropical plants, for instance from Raddi. Bertoloni’s tropical specimens (Hortus Siccus Exoticus, 11,000 specimens) are housed in the herbarium of the Istituto ed Orto Botanico (BOLO) of the University of Bologna and still in need of a comprehensive study. The collection includes, for instance, a set of specimens from Guatemala collected by the Mexican military officer J. Velasquez, which was the basis for Bertoloni’s neglected *Florula Guatimalensis* (Bertoloni 1840; Baldini & Guglielmone 2012). We are used to considering a historical collection as the product of a Botanist, who was also the collector. It is not always so! The *Florula Guatimalensis* – together with the collection upon



Fig. 7. Antonio Bertoloni (1775–1869) – in full academic dress – photographed in 1865 when he was 90 years old. (HI-IAPT Portraits of Botanists 1974b).

which Bertoloni based it – is probably one of the least known historical botanical works from the Neotropics (Fig. 8). Although a few critical studies of the contents and material behind the *Florula Guatimalensis* have been done (Blake 1926; Duncan 1983; Cristofolini *et al.* 1987), a more comprehensive investigation is currently underway by the first author of this paper in collaboration with the University of Bologna and Mount Aloysius College (PA, USA).

Historical Collections, Taxonomy and Biodiversity

Poorly studied historical collections from the tropics, including the Italian examples cited above, still ‘hide’ new, undescribed taxa, as well as the type specimens of long ago described but neglected names. Or sometimes these collections contain the type specimens of currently, widely used and/or misinterpreted names, which can definitely be ‘stabilised’ by the reference to their rediscovered type specimens. In this sense his-



Fig. 8. Watercolor plate of *Polyclathra cucumerina* Bert. (Cucurbitaceae) from *Florula Guatimalensis* (Bertoloni 1840).

torical collections are crucial for the progress of tropical botany (Baldini 2011) (Fig. 9).

As a matter of fact taxonomy stands out from other scientific disciplines by relying to a large extent on historical objects (historical type specimens and other collections) and literature (diagnoses and descriptions published in historical papers and monographs), which have maintained their reference value intact through centuries since Linnaeus or even before as background material (Pignotti *et al.* 2015). As a consequence, knowledge of historical sources and comparison of historical and modern texts are probably more common in taxonomy than in any other scientific disciplines. In this regard the optional use of Latin introduced in the International Code of Nomenclature for algae, fungi and plants (Melbourne Code) (McNeill *et al.* 2012) for the publication of new taxa from 1 January 2012 onwards is in our opinion questionable. A Latin diagnosis – besides the Eng-

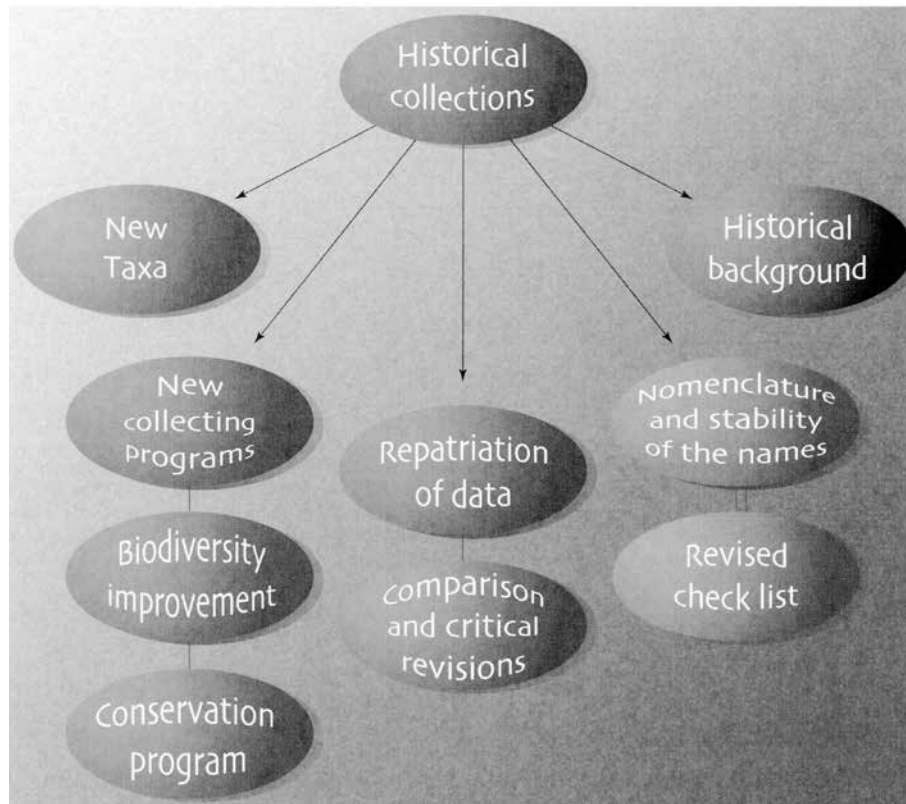


Fig. 9. Historical botanical collections as a tool in modern plant taxonomy research (modified from Baldini 2011).

lish description – would facilitate linguistic comparison between newly and formerly described species. All botanists should remember that the progress of systematic botany cannot avoid the comparison between the the past and the present, including the basic literature.

Most historical botanical collections from the tropics were made in virgin habitats, currently reduced or in some cases completely destroyed. These collections allow us to compare the past and present status of biodiversity in a specific area, with operational implications in a broad sense. One example comes from the Italian botanists G. Raddi, G. Casaretto and L. Buscalioni, who collected in the 19th century in different parts of the Brazilian eastern Atlantic forest, which is now critically reduced and recognised as one of the world's most important hotspots of plant biodiversity (Fig. 10) (Baldini & Guglielmone 2012; Delprete 2016).

In the last half century research emphasis in biology has significantly shifted from herbarium based taxonomy to ecology and conservation, and in this context historical specimens can provide important information for interpreting the dramatic environmental changes that have taken place at a global scale, directly as degradation and loss of habitats, or indirectly as climate change induced by mankind (see Soberón 2017; Feeley 2017). In order to be useful in this sense, historical collections need to be known or sometimes rediscovered, studied, and taxonomically updated (Funk 2014).

Considering the importance of historical tropical collections for taxonomy and current biodiversity assessment, we wish to emphasize the following needs for the future:

1. Improvement of knowledge of classical collections should be a major aim of the taxonomic community.

Fig. 10. Biodiversity hot spots in the Neotropics visited by Italian botanists (from Baldini & Guglielmo 2012).



2. Training of taxonomists, particularly in tropical countries, should cover the crucial importance of classical collections for achieving a modern plant taxonomy, with correct use and nomenclatural stability of names.
3. Free online networks of herbaria should be further improved to promote access to historical data.

Fortunately, many praiseworthy initiatives have recently been carried out, which go in this direction, offering new opportunities in the coming decades (Wen *et al.* 2015). We mention here some significant initiatives. One is the well-known Global Plants Initiative (GPI), Global Plants on JSTOR, devoted to

the digitization of type collections, which started with African plants (African Plants Initiative (API)), carried on with Latin American plants (Latin American Plants Initiative (LAPI)) and finally widened to include plants from all over the world. Digital images and metadata of type specimens were captured from more than 270 institutions in 70 countries, thanks to funding from the Andrew W. Mellon Foundation (<http://about.jstor.org/news/global-plants-initiative-and-jstor-release-online-database-study-plants>). A second example is the Virtual Herbaria-JACQ – (<http://herbarium.univie.ac.at/database/index.php>) an initiative started in 2005 in connection with the API and managed at the university of Vienna, initially involving Austrian and a few Ger-

man herbaria and by now including 15 European and 11 extra-European herbaria (<http://herbarium.univie.ac.at/database/collections.htm>). The system provides a common online database for specimen storage, with linked databases of literature references and nomenclature and the possibility to access digital images independently stored and managed by each institution. By enabling international users to have free and quick access to the botanical collections through the search page (<http://herbarium.univie.ac.at/database/search.php>), JACQ gives a substantial contribution to the fulfilment of the purposes here hoped for.

Of course many other platforms are available and consulted by researchers around the World such as <https://science.mnhn.fr/institution/mnhn/collection/p/item/search> (Muséum National d' Histoire Naturelle, Paris, France), <http://www.tropicos.org/Home.aspx> (Missouri Botanical Garden, St. Louis, MO, USA), <https://science.naturalis.nl/en/collection/naturalis-collections/botany/> (the botanical collections of Naturalis consist of the herbaria from the Universities of Leiden, Utrecht and Wageningen, The Netherlands; see also Welzen & Schollaardt 2017).

The progress of scientific knowledge is based on communication, and this is also true for plant taxonomy and floristic studies (Beentje 2015). That's why it is our duty to conserve and respect the huge work done by our predecessors: it is a matter of intellectual honesty (Lane 1996; Wheeler *et al.* 2004).

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