Seeds of Knowledge

Unveiling hidden information through letters and gardens in Bologna, Turin and Uppsala

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… il piacere grandissimo dell'animo, che risulta dall'aspetto delle piante. […] Il che tanto piu accresce contento all'animo, quanto piu sono periti questi tali nella cognitione, & vera dottrina de i Semplici. Imperò che non si potrebbe con lingua esplicare il piacere, & la giocondità, che ne risultà nell'animo, quando una pianta, lungamente ricercata, si ritrova;

[... the immense spiritual delight which results from looking at plants; […] The contentment of the soul enhances, the more someone is an expert of the knowledge and the true doctrine of the Simples. For this reason you cannot express with words the pleasure and the jocundity, which springs in your soul, when a plant, long sought for, is found.]

(Matthioli, 1552, in his dedication to cardinal Madruzzo)[1]

ABSTRACT

Travel and exchange of persons, objects, technologies, skills and ideas, though practiced at all times of humankind, are two of the most particular characteristics of the modern Western world. The exchange of seeds and of the information concerning them deserves a special importance in the history of agriculture and botany. On the one hand, seeds were simple and inexpensive to store and to travel, on the other hand they exposed botanists and gardeners to unexpected conceptual and technical challenges. We will first describe some of the particular features of the information contained in seeds, namely their delay in time and space. In the case of Bolognese botanist Ferdinando Bassi (1710-1774) and his extensive correspondence with other botanists like Linnaeus, we highlight how late 18th-century scholars handled the hidden knowledge contained in these plain little objects.

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[1] Pietro Andrea Matthioli, Il Dioscoride dell'eccellente dottor medico M.P. And. Matthioli da Siena; con li suoi discorsi ... (In Vinegia: appresso Vincenzo Valgrisi alla bottega d'Erasmo, 1552), p. 4.

Keywords: biography; Linnaean taxonomy; seeds; exchange; botanical gardens; species

Since the end of the 16th century botanists and commercial nurserymen had been passionately prospecting newly discovered lands for new plants.[2] These travels resulted in the introduction to Europe of many new exotic plants. Most scholars agree that the trade in plants and seeds was, and still is, responsible for some of the most significant changes in global history. Alfred Crosby has shown, for example, that the early modern age saw an exceptional demographic increase because of better nutrition that was a direct product of the introduction of new food plants from overseas.[3]

During the 18th century European scientific travelers and settlers played more important roles than ever in the distribution of new species and the redistribution of known ones.[4] The far-reaching economic, political, and ecological implications of these processes have been the object of many analyses.[5]

Here we would like to focus on both epistemological and technical implications related to the exchange and cultivation of seeds in botanical gardens. In the words of Linnaeus' student Bogislaus Hornborg (1739-1789), 'Qui naturam plantarum rite vult intelligere, necessum est [...] Debet *Hortos* intrare *Academicos*, ubi millena semina, quotannis e plagis remotissimis orbis advecta, seruntur, & videre, quod singula promant suam plantam, nec aliam. [To understand the nature of plants correctly one has to go into botanical gardens, where thousands of seeds collected from the most distant regions of the world are sown out each year, and one will see,

[2] For the importance of gardens, herbaria and exchange during Renaissance botany see Brian Ogilvie, *The science of describing: Natural history in Renaissance Europe* (Chicago: Chicago University Press, 2006).

[3] Alfred Crosby, *The Columbian exchange. Biological and cultural consequences of 1492* (Westport, Conn.: Greenwood Publishing Group, 1972).

[4] See e.g. Staffan Müller-Wille, *Botanik und weltweiter Handel. Zur Begründung eines Natürlichen Systems der Pflanzen durch Carl von Linné (1707-1778)* (Berlin: VWB, 1999); Emma C. Spary, *Utopia's garden: French natural history from Old Regime to revolution* (Chicago: Chicago University Press, 2000); Londa Schiebinger and Claudia Swan (eds.), *Colonial botany. Science, commerce, and politics in the early modern world* (Philadelphia: University of Pennsylvania Press, 2005); Harold J. Cook, *Matters of exchange: commerce, medicine, and science in the Dutch Golden Age* (New Haven; London: Yale University Press, 2007); Regina Dauser, Stefan Hächler, Michael Kempe, Franz Mauelshagen, and Martin Stuber (eds.), *Wissen im Netz: Botanik und Pflanzentransfer in europäischen Korrespondenznetzen des 18. Jahrhunderts* (Oldenbourg: Akademie Verlag, 2008).

[5] e.g. Michael E. Osborne, *The system of colonial gardens and the exploitation of French Algeria, 1830-1852,* in E.P. Fitzgerald (ed.), *Proceedings of the Eighths Annual Meeting of the French Colonial History Society, 1982* (Lanham, MD: University Press of America, 1985), pp. 160-168; Bugos, Glenn E. and Daniel J. Kevles (1992) "Plants as intellectual property: American practice, law and policy in world context", Osiris, 1992, 7: 75-104; David Philip Miller and Peter Hanns Reill (eds.), Visions of Empire: voyages, botany, and representations of Nature (Cambridge: Cambridge University Press, 1996).

how the single plant brings forth its own kind and not others].' [6]

Exchange and skill of cultivation were two of the most essential features of botanical gardens throughout time. In the course of the 18th century both were developed to a degree that most of the gardens can be considered as kinds of proto-laboratories. Staffan Müller-Wille has shown in the case of Linnaeus the two complementary functions of botanical gardens: on the one hand, the flow of plants (by means of seeds) from their original location to the botanical gardens, and their reproduction (by means of seeds) in the gardens; on the other hand, the dense network of mutual exchange of seeds between the botanical gardens. Both aspects rendered the objects of botany continuously observable in their genealogical context, and, at the same time, embedded into a variety of habitats with different conditions, most of them controllable or at least recorded by the botanists. The result was a quasi-experimentally induced abstraction of the phenomena of local conditions. In a relatively short lapse of time a considerable amount of data could be collected, analyzed, and compared, leading to conclusions with a high level of generalization. Therefore, according to Müller-Wille, the system of botanical gardens is to be understood as a botanical means of representation, which effectively abstracts from possible variables such as local habitats.[7] Letters and gardens thus represent two tightly interwoven und mutually dependant 'spaces in between' where botanical and, as we shall see, ecological knowledge was constituted.

Technically, too, traditional methods had been integrated with new ones. Although still not as systematic and integrated into the botanist's work as these instruments would be in the 19th century, in order to scientifically approach the cultivation of exotic plants, new tools – mostly thermometers and the indication of the latitude and longitude of the site where the seeds had been picked up – had already been introduced in the late 18th century.[8] Handling exotic seeds, in fact, exposed gardeners to some unexpected conceptual and technical challenges: 'Indeed, no living

[6] Bogislaus Hornborg, Transmutatio frumentorum [1757], in Carolus Linnaeus, Amoenitates academicae seu dissertations variae physicae, medicae, botanicae, anthec seorsim editae; nunc collectae et auctae, cum tabulis aenaeis (Holmiae: Sumtu & Literis Direct. Laurentii Salvii, 1760), Vol. 5: pp. 106-119, on pp. 109-110; the English translation is taken from: Müller-Wille, Staffan (2001) "Gardens of paradise", Endeavour, 2001, 25: 49-54, on p. 53.

[7] Müller-Wille, Staffan (1998) "'Varietäten auf ihre Arten zurückführen': Zu Carl von Linnés Stellung in der Vorgeschichte der Genetik", Theory of the Biosciences, 1998, 117: 346-374, especially pp. 364-365.

[8] Bourguet, Marie-Noëlle and Christian Licoppe (1997) "Voyages, mesures et instruments: une nouvelle expérience du monde au siècle des Lumieres", Annales. Histoire, Sciences Sociales, 1997, 52: 1115-1151; Marie-Noëlle Bourguet, Measurable difference. Botany, climate, and the gardener's thermometer in eighteenth-century France, in Londa Schiebinger and Claudia Swan (eds.), Colonial botany. Science, commerce, and politics in the early modern world (Philadelphia: University of Pennsylvania Press, 2005), pp. 270-286, on pp. 280-281.

plant or seed can be extracted from its native habitat and transferred elsewhere without some elements of its environment (type of soil, degree of heat or moisture) and some precise information (about mode of cultivation, techniques of preparation, or practices of consumption) being imported along with the sample to its new terrain – whether a greenhouse, a garden, or a plantation. [...] This tension between mobility and embedding lay at the core of 18th-century botanical science and practice.'[9]

Yet, the difficulties began even before the plants reached the botanical garden. The costs of shipping of the oft-voluminous collections were elevated. They became nearly prohibitively expensive, calculating that during prolonged sea voyages living plants were exposed to marine salt spray, shortage of freshwater, and cramped spaces, which resulted – at least until the Wardian case was invented – in the loss of 90% or more of the plants.[10] Even the preparation of dry specimens for the herbaria required special care, special skills,[11] and a great deal of time, especially in tropical regions. The solution to these problems was for plants to travel as seeds. In Europe the seeds could be grown in botanical gardens and the plants obtained then prepared for herbarium collections. This relatively inexpensive method also allowed minor institutions to enrich their live and dried collections of exotic plants.

In the following, we will first describe the particularities of seeds as scientific objects and as carriers of special forms of (hidden) knowledge, and then present the case of Bolognese botanist Ferdinando Bassi (1710-1774), who received seeds from all over the world, his experiences in growing these seeds, and his participation in the information exchange network.

SEEDS AS CARRIERS OF TRANSFERABLE INFORMATION

Seeds are compact carriers of a massive amount of (genetic) information that can be transferred and preserved without particular complications, and that finally express their complexity in the form of living plants in a botanical garden. This means that botanical gardens can be seen not just as a final destination, but also as a place for an additional, pivotal transformation that takes place before selected material becomes part of a museum collection: a 'space in between' that connects the 'information for becoming a plant' with the plant itself.

A seed is, simply speaking, a mature fertilized plant ovule, consisting of three

[9] Bourguet, Measurable difference, pp. 270-271.

[10] See Marianne Klemun's essay in this volume.

[11] See Marcelo Fabián Figueroa's essay in this volume.

basic parts: an embryo, a supply of nutrients for the embryo, and a protective seed coat. The embryo is the immature plant from which a new plant will grow under proper conditions. As will be shown in the case of Ferdinando Bassi, it was not that easy to recreate the proper conditions. Rather it required lifelong experience and extensive and careful experimentation.

The choice of the research organism remarkably influences the development of the research undertaken.[12] In the case of seeds, especially when they come from unknown or poorly known plants, the experimentation requires not only detailed knowledge of both its general and particular features, also its ecological context might influence it greatly. This context is mostly lost when receiving seeds from plants growing in different ecosystems. Thus, at the moment of their cultivation, the exchanged seeds are far from being standardized model organisms. This means that seeds are not only a tool to investigate biological questions, rather they are themselves questions: 'What is it?', 'Do we already know it or is it a new species?', 'How do we have to handle it to have it grow?' Though these questions might seem less than scientific, they were the basic steps toward developing familiarity and thus transforming a previously unknown and undomesticated organism into a scientific object.

From a botanical point of view, too, seeds are special objects. They serve several functions for the plants that produce them. Key among these functions are the nourishment of the embryo, dispersal to a new location, and dormancy during unfavorable conditions. Seeds fundamentally are the means for plants to delay reproduction in both space and time.

Temporal Delay

Seeds remain viable for periods that vary greatly, depending on the species and the storage conditions. A seed of an Oriental Sacred Lotus, *Nelumbo nucifera*, for example, collected from the sediment of a dry lake bottom near a small village in Northeastern China germinated after being dormant for over 1,200 years.[13] Protected by an impenetrable seed coat, and mired in an oxygen-deficient mud, the seed

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[12] Burian, Richard and Muriel Lederman (eds.), (1993) "The right organism for the job", *Journal of the History of Biology*, 1993, 26(2): 235-367.

[13] Shen-Miller, J., Mary Beth Mudgett, J. William Schopf, Steven Clarke, and Rainer Berger (1995) "Exceptional Seed Longevity and Robust Growth: Ancient Sacred Lotus From China", *American Journal of Botany*, 1995, 82(11): 1367-1380.

maintained intact its genetic and enzymatic systems, which reactivated when the seed was split open and soaked in water.

The topic of seed viability became the object of some scientific consideration in the mid-19th century. In 1849 German botanist Carl Friedrich von Gärtner (1772-1850) reported on viable seeds found in graves over 1000 years old. Charles Darwin, too, became interested in the phenomenon, which he discussed with John Lindley (1799-1865) and Charles Lyell (1797-1875)[14]. In one of these letters Darwin expressed his surprise at seeing seeds found in millenary Druidical mounds germinate, especially upon realizing that some of the seeds were from not-indigenous British plants.[15]

But the delay in time is not only between the past and the present. Seeds can also represent a delay between the present and the future in contemporary Seed Banks, which provide insurance against the loss of plant species in the wild. Kew Royal Botanic Gardens' Millennium Seed Bank is the largest *ex situ* (i.e. the seeds are conserved outside their native habitat) plant conservation project in the world. Its focus is on global plant life faced with extinction and on plants likely to be most useful in the future. Kew's Millennium Seed Bank has already saved the seeds from six plant species now extinct in the wild.[16] Similarly, the Svalbard Global Seed Vault, constructed in a cavern excavated into permafrost, is intended to store duplicates of seed collections from gene banks all over the world, and has a storage capacity of over four million different samples. Under this aspect seed banks could probably be considered another 'space in between'.

Spatial delay

Even more incisive than the sometimes considerable temporal discrepancy between the production of a seed and its growing, is the delay in space. Plants, travelling as seeds, were grown in botanical gardens and then prepared for herbarium collections. As we will now illustrate through the informative correspondence between Linnaeus and Ferdinando Bassi, this delay in space often resulted in new discoveries.

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[14] See especially letter 577 to Lyell on September 1843, in: Francis Darwin and Albert Charles Seward (eds.), More letters of Charles Darwin. A record of his work in a series of hitherto unpublished letters (London: John Murray, 1903), vol. 2: pp. 244-245; also: Letter 696: Darwin to Lyell, Charles (15 or 22 September 1843), Darwin Correspondence Database, http://www.darwinproject.ac.uk/entry-696 (consulted 4 April 2012).

[15] Porter, Duncan M. (1986) "Charles Darwin and 'ancient seeds'", *Archives of Natural History*, 1986, 13(2): 165-168.

[16] http://www.kew.org/science-conservation/save-seed-prosper/millennium-seedbank/about-the-msb/seed-banks-save-plants/index.htm

FERDINANDO BASSI

Although even among botanists his name is not well known today, in the 18th century Ferdinando Bassi had been one of the most renowned scientists. In 1772, Antoine Gouan (1733-1821) dedicated his *Illustrationes et Observationes Botanicae* to the ten most distinguished botanists of his time, among them was Bassi. In a letter written in 1769 by botanist Antonio Turra (1736-1797) to Carl Linnaeus, Bassi was listed as one of only four noteworthy contemporary Italian botanists: '*pauci sunt hodie Botanici Itali praeter Montium et Bassium Bononienses, praeter Tillium Pisanum, praeterquae Battarium clodiense amicum meum*' [nowadays there are few botanists in Italy apart from Monti and Bassi in Bologna, Tilli in Pisa and Battarra in Chioggia who is a friend of mine].[17]

Ferdinando Bassi was born in Bologna in 1710, the son of a merchant and shipping agent. During this period, Bologna saw a renewed scientific splendour and became a distinguished centre of the European *Republic of Letters* mainly due to the Institute of the Sciences, founded in 1714 by count Luigi Ferdinando Marsili (1658-1730). In the Institute, the Academy of the Sciences cohabited with the *Accademia Clementina* (named after Pope Clemente XI) of Painting, Sculpture and Architecture. After 1745, under the guidance of pope Benedict XIV, the Academy of Sciences was devoted to experimental science becoming the main reference point of scholars such as Jacopo Bartolomeo Beccari (1682-1766), Giuseppe Veratti (1707-1793), Laura Bassi (1711-1778) and Luigi Galvani (1737-1798) and furnishing an important impulse to university reform as well as to the general intellectual climate of Bologna. Although Bassi did not follow any university curriculum, he was trained in natural sciences by astronomer Eustachio Zanotti (1709-1782) and above all by the botanist Giuseppe Monti (1682-1760), both eminent members of the Academy. Monti held the chair of Botany and the direction of the botanical garden for about 40 years. He introduced Bassi to the scientific world and, by letting him deal with the exchanges of scientific specimens for the academy museum, allowed him to get in touch with the chief Italian and European naturalists.

As time passed, these relationships were maintained and intensified, and Bassi's name became very familiar amongst European scientists. He exchanged

[17] *Antonio Turra to Carl Linnaeus, 28 November 1769*, in: *The Linnaean correspondence*, linnaeus.c18.net, letter L4288 (consulted 4 July 2011).

hundreds of letters with the main scientists of his time.[18] Among them, the most famous botanists: Henri Louis Duhamel du Monceau (1700-1782), Antoine-Joseph Dezallier d'Argenville (1680-1765), Vitalino Donati (1717-1762), Christian Gottlieb Ludwig (1709-1773), Carlo Allioni (1728-1804) and, particularly noteworthy, the Swedish naturalist Carl Linnaeus, but also naturalists and physicians like Lazzaro Spallanzani (1729-1799) and Giovanni Battista Morgagni (1682-1771).
Ferdinando Bassi wrote nine letters to Linnaeus, beginning in 1762 and continuing throughout Bassi's life (until 1773).[19] Correspondent of Linnaeus, Bassi received a massive quantity of seeds from all over the world, grew them in Bologna's botanical garden and developed a valuable herbarium with newly discovered species.[20] In 1763 he obtained the post of Keeper of the Garden of Exotic Plants, a position he held for the rest of his life. Growing of exotic plants represented a special challenge for gardeners. Soon they became aware that many of them required conditions that were not given in European gardens. Bassi however became rather successful. Under his direction the garden became considerably larger and more diverse in species. He succeeded in cultivating new species and first-ever flowering of poorly known plants. The main key of his success was the construction of a new glasshouse to keep exotic plants during the coldest months of the year.[21] The construction of this new facility was firmly requested by Bassi since the first years of his activity as keeper; as he wrote to the city government, in order to complete the garden 'it is necessary a new hot greenhouse, where to grow a larger number of exotic plants, and where the hardier amongst them can fruit'. 'Hot' meant that several stoves were located inside the greenhouse.

Importantly, Bassi associated a request for a new gardener 'who has to live, in winter, in the small apartment over the glasshouse so that he can easily control the heating during the night'. Differently, 'you're always anxious, because the efforts of years could be destroyed in one night'.[22]

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[18] Bassi, conscious of the scientific value of his correspondence gave a special order that after his death the letters should be handed to the University Library of Bologna that still conserves them in ten volumes; see Annalisa Managlia, *Ferdinando Bassi corrispondente di Linneo*, in Donatella Biagi Maino and Giovanni Cristofolini (eds.), *Linneo a Bologna: L'arte della conoscenza* (Torino: Umberto Allemandi & C. , 2007), pp. 63-78.

[19] These letters are part of the Linnaean Correspondence, available on-line at linnaeus.c18.net

[20] http://www.sma.unibo.it/erbario/bassi.html

[21] Umberto Mossetti, *Ferdinando Bassi botanico*, in Biagi Maino and Cristofolini, "Linneo a Bologna", pp. 55-62.

[22] Quoted in Tugnoli Pattaro, Sandra "L'Orto Botanico bolognese di Porta Santo Stefano (con alcuni documenti inediti)", *Natura e Montagna*, 1975, XXII (4): 29-39: "si sta sempre con timore, perché può bastare una notte per far perire le fatiche di molt'anni".

It was Linnaeus, looking for reliable naturalists from the Italian peninsula, who contacted Bassi and invited him to exchange information.[23] Linnaeus received from Bassi at least 13 botanical specimens, along with accurate drawings of newly discovered species: such drawings and specimens helped Linnaeus to illustrate plant species never described before. Nowadays the Linnaean herbarium still preserves six specimens sent by Bassi. Amongst them, the two leaves of *Ambrosinia bassi*, sent in 1770, with Bassi's regret that he could not send a dried flower having just one specimen left;[24] *Alisma parnassifolia* and *Cynanchum viminale* (today known as *Sarcostemma viminale*) were enclosed in a letter in which he accurately described these new species;[25] later he also sent a drawing illustrating the floral structure of *Cynanchum.*

KNOWLEDGE TRANSFER THROUGH SEEDS BETWEEN BOLOGNA, TURIN AND UPPSALA

Although the botanical school of Bologna was rather critical towards the Linnaean nomenclature, considered to contribute more to the confusion rather than to the simplification of taxonomy,[26] Bassi communicated his new findings to the Bolognese Academy of Sciences, as well as to Linnaeus in the hope of receiving his authoritative agreement and support. These notes were often based on a seed's characteristic of being a carrier of hitherto unknown information brought through space: from exotic native localities to botanical gardens. This became especially evident when unknown seeds were sent to Bassi from his friend Vitaliano Donati, Italian explorer, archaeologist, and botanist born in Padua.

In 1750 Charles Emmanuel III, king of Sardinia, had offered Donati the chair of Botany and Natural history at the University of Turin. He held the position of Director of Turin's Botanical Gardens from then until his death in February 1762 on board ship in the Indian Ocean, when travelling to India. In 1759, Donati visited Egypt, where he collected and sent to Turin some antiquities that formed the original nucleus of the city's Egyptian Museum.

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[23] Managlia, "Ferdinando Bassi corrispondente", p. 64.

[24] *Ferdinando Bassi to Carl Linnaeus, 15 March 1770*, in: *The Linnaean correspondence*, linnaeus.c18.net, letter L4456 (consulted 4 July 2011).

[25] *Ferdinando Bassi to Carl Linnaeus, 13 December 1767*, in *The Linnaean correspondence*, linnaeus.c18.net, letter L4012 (consulted 4 July 2011).

[26] Mossetti, "Ferdinando Bassi botanico", pp. 57-58.

While in Egypt he sent Bassi some seeds, the history of which is detailed in a letter to Linnaeus: Bassi told Linnaeus that Donati had asked him to sow these seeds and to see if any of them produced a new species, in which case Donati should be informed when he returned to Europe.[27] Actually, only one seed produced an unknown plant. Bassi intended to conceal this information until Donati's return, but when he learned of Donati's death, he informed Carlo Allioni (1728-1804), who had succeeded Donati in the chair of botany and the direction of the botanical garden in Turin, as the latter's travel had been made at the expense of that university. In early 1763 Bassi sent Allioni the seeds of Donati's plants.

The new plant had travelled as seed from Egypt to Bologna, expressed its genetic information in Bologna where it produced new seeds, which travelled again as seed from Bologna to Turin, where Allioni grew them and named the resultant plant *Bassia aegyptica* after Bassi. Bassi was grateful for the dedication of the new genus – '*unicum et summum praemium laboris*' in Linnaeus' words – but, unfortunately, the story of the plant had not come to its final point. In 1768 the plant travelled again as seed from Turin to Uppsala, sent by Allioni to Linnaeus as the undisputed leader of botanical classification. Allioni hoped to receive authoritative support for the discovery but was disappointed to be told that what he thought to be a new genus was a species already described by Linnaeus himself as *Salsola muricata*.[28]

In this case we can see that the three botanical gardens in Bologna, Turin and Uppsala were the 'spaces in between' that connected the 'information for being a plant', the plant itself, and the (sometimes different) interpretation of the meaning of the information thus expressed. In all of these gardens seeds were grown and plants were cultivated – some of them to produce seeds again and some of them to be prepared as herbarium specimens.

The accompanying letters may be seen as 'spaces in between', too. Interestingly, most of them contain very poor information about how to grow the seeds. Presumably this does not indicate jealously hidden secrets. Rather, most gardeners confided in their colleague's experience. It was simply thought superfluous to add further

[27] *Ferdinando Bassi to Carl Linnaeus, 15 March 1770*, in: *The Linnaean correspondence*, linnaeus.c18.net, letter L4456 (consulted 4 July 2011): "Plantae semina cum aliis nonnullis primus omnium ego accepi a Vitaliano Donato tunc per Aegyptum peregrinatore. Misit Donatus semina casu collecta ut sata nec non germinantia viderem, an aliquid novi esset, quod si aliquid novi, id caute custodirem, eique reduci in Italiam traderem, ut publici juris ille faceret, fiduciam enim suam, et totam in mea tantum honestate illi bene cognita collocaverat. Ex seminibus germinantibus unice tantum illam Plantam novam animadverti, et datam fidem servabam".

[28] www.linnean-online.org/3478/

explanations. These letters, therefore, demonstrate the great importance of 'tacit knowledge' among botanists. However, as we shall see in the next paragraph, sometimes unexpected difficulties arose, revealing differences in handling and making it indispensable for single gardeners to furnish more detailed information about their procedures.

Botanical gardens were also the places where colonial empires exposed exotic plants as symbols of their power. Since Italian states had no colonies at this point, exotic seed growing was less impacted by political and social motives, and the same level of care was given to indigenous and exotic plants, as can be seen in two incidents revealed by the Linnaeus–Bassi correspondence.

Indigenous and Exotic plants

Bassi noted that sometimes plants collected in the wild in different localities of the Apennines around Bologna differed slightly from the cultivated ones. In 1763, considering the classification of the so-called *Papia michelii*, described by Michelangelo Tilli (1655-1740) as a new Italian species, Bassi wrote to Linnaeus that specimens with that name should be considered as specimens of the already-known *Lamium orvala* '*in humidioribus et umbrosis locis proveniens*' [growing in wet and shady places],[29] an explanation that nowadays would be considered ecological. This too was important information hidden in seeds and coming out unexpectedly when grown in the botanical gardens. It constrained botanists to investigate the influence of the environment on the development of plants. Yet, it seems that Bassi did not deepen this aspect but limited himself to talk about 'abnormal variations' and to indicate the different habitats.[30] As in the case of *Lamium*, the two varieties of the same species may indeed differ considerably in shape: in 1) the rim of the leaf, in one case deeply dentate and in the other only lobed, and 2) the shape of the lower part of the flower lip, in one case divided in the other entire.

Seeds were even more longed-for when they came from exotic plants. At least from 1751 Linnaeus was searching for a seed of *Dalechampia scandens*, a Euphorbiacea growing in tropical lowlands. Despite asking all major European gardeners he did not succeed to find any, or, as in the case of the *Jardin du Roy* of

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[29] *Ferdinando Bassi to Carl Linnaeus, 15 March 1763*, in: *The Linnaean correspondence*, linnaeus.c18.net, letter L3691 (consulted 4 July 2011).

[30] Though Bassi refers in this letter to a more detailed study on *Lamium* in the *Acta Bononiensis*, it was impossible to find any trace of it.

Paris, if he received seeds, these were not vital.[31] Finally, in 1770, Bassi sent him the desired seeds. He was sincerely astonished about Linnaeus' difficulties, because in Bologna the plant was flourishing and producing useful seeds every year.[32]

In 1772, Bassi wrote to Linnaeus of his success in obtaining for the first time the flowering of the South-African species *Crassula portulacaria*. He carefully described the cultivation technique: 'the plant grows in a small pot, although it becomes more than three feet high. It is not watered in the winter, when it is kept in a cold greenhouse, and then it is placed outdoors from May to October.'[33]

It is worth noting that thanks to the observation of the flower, Bassi was able to correctly classify the plant: it was not a *Crassula*, belonging to the Linnaean Order Pentandrya Pentagynia, but a species of the genus *Claytonia*, of the Linnaean Order Pentandrya Monogynia. So, in this case, a successfully resolved technical challenge produced a conceptual challenge. The constitution of taxonomic knowledge depended on the interplay between several places, skills and means of communication: vital seeds of a South-African plant had to be sent by letter, arrive safely and intact, and then be induced by special techniques to flower inside a Bolognese garden; the information thus unveiled had to be inserted first into the context of Linnaean classification and then into the network of botanists in order to be confirmed or falsified. Each 'space in between', letters as well as gardens, slightly modified the object and the knowledge about it.

CONCLUSION

Detailed care and constant attention, overcoming climatic and ecological obstacles, grasping and elaborating often unexpected knowledge emerging from the cultivation of seeds, and finally the pleasure of seeing a plant grow, these are the activities that exemplify the intimate relationship between botanists, seeds and plants. For botanists, who travel through time and space to bring to life something new from an unknown

[31] Managlia, "Ferdinando Bassi corrispondente", pp. 64-65.

[32] *Ferdinando Bassi to Carl Linnaeus, 15 March 1770*, in: *The Linnaean correspondence*, linnaeus.c18.net, letter L4456 (consulted 4 July 2011).

[33] *Ferdinando Bassi to Carl Linnaeus, 15 May 1772*, in: *The Linnaean correspondence*, linnaeus.c18.net, letter L4779 (consulted 4 July 2011).

seed, the words of Pietro Andrea Mattioli with which we prefaced this essay, ring as true today as they did half a millennium ago.