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Felix Platter's Herbarium

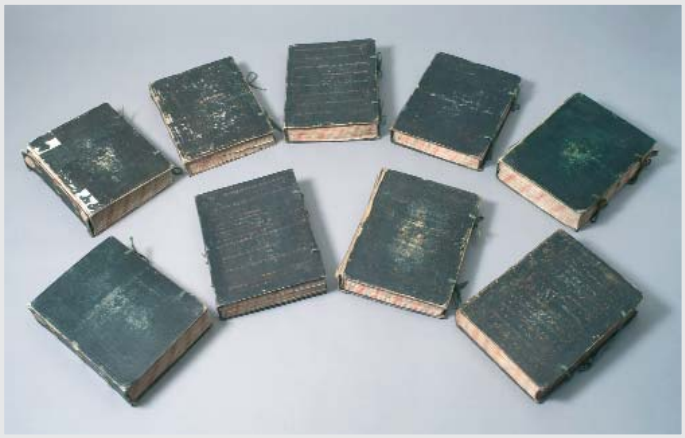
The Preservation of a Historical 'Bound Herbarium'*

Introduction

Eight parchment volumes containing dried and pressed plants along with botanical illustrations from the collection of the Basel-based doctor Felix Platter (1536-1614) were researched within the context of a master's thesis completed at the Bern University of the Arts. Botany evolved into an independent area of study during the 16th century, previously having served exclusively as an ancillary discipline to the medical sciences. Felix Platter's herbaria originate from this moment of upheaval. They count among the oldest herbaria in the world and are the oldest from Switzerland.

The integration of the herbaria in their historical context along with their codicological description should lead to better understanding and decision-making for future preservation measures. The condition of the herbaria was investigated in detail. In the process, the question of the possible presence of biocides played an important roll. The knowledge gained led to the creation of a conservation and restoration plan for the herbaria. A comprehensive review and appraisal of the relevant literature and sources were the primary objectives.

In 1930 a true treasure was discovered in the Institute for Plant Sciences at the University of Bern in Switzerland: Professor Walther Rytz, at that time curator of the institute, discovered nine books bound in green-coloured parchment in the attic (Fig 1). They turned out to be eight historical herbaria [1] and a corresponding volume of botanical illustrations. He discovered that they were part of the renowned herbaria and illustration collection of the physician Felix Platter (1536-1614) from Basel. Rytz recognised that, among the botanical illustrations, there were coloured drawings next to the coeval wood cuts and watercolours. The drawings were designs for wood cuts by Hans Weiditz the Younger for the famed herbal 'Herbarum vivae eicones' (1530) by Otto Brunfels—an even more sensational find within a sensational find!



1 Eight historical herbaria of Felix Platter and a corresponding volume of botanical illustrations still preserved in their original state. Signature ES 70.1-70.9. Photograph by Jürg Bernhardt. © Burgerbibliothek Bern.

After Rytz published on the herbaria and the illustrations by Weiditz (Rytz 1933 and 1936), these valuable objects slid into obscurity but they were not forgotten. In 2010 the volumes were transferred to the ownership of the Burgerbibliothek in Bern, which had served as a storage place for the herbaria for decades. In accepting ownership of the volumes, they were obligated to make the herbaria publicly accessible and to preserve them according to current standards in the field. The former will soon be complete: the herbaria and their metadata will be available over the internet. Furthermore, the objects were assessed within their cultural-historical and codicological contexts and the current state of knowledge regarding the conservation and restoration of herbaria was assembled. The resulting conservation and restoration plan will soon be implemented.

Cultural-Historical Background

In order to grasp fully the significance of Platter's herbaria, we must direct our attention to botany in the 15th, and above all, the 16th century. Botany experienced fundamental transformations during this period, which was marked by upheaval and great advances in learning (the Renaissance, Humanism, the Reformation). Contrary to earlier times, the plants themselves became the object of study and not only their prevailing medicinal usage. Botany began to establish itself as an independent field of study, even as it remained within the domain of medicine. Under the influence of humanism, the naturalists of the time began to observe nature itself as opposed to relying only upon ancient texts. Thus the herbals from 1530 and later form the cornerstone of modern botany—primarily through their illustrations of plants [2]. These illustrations were no longer adopted from earlier works and were not characteristically decorative; rather, they established the primary constituents for the description of plants. The illustrations arose from the direct observation of nature. Through this new approach, the ancient sources in some instances were contradicted.

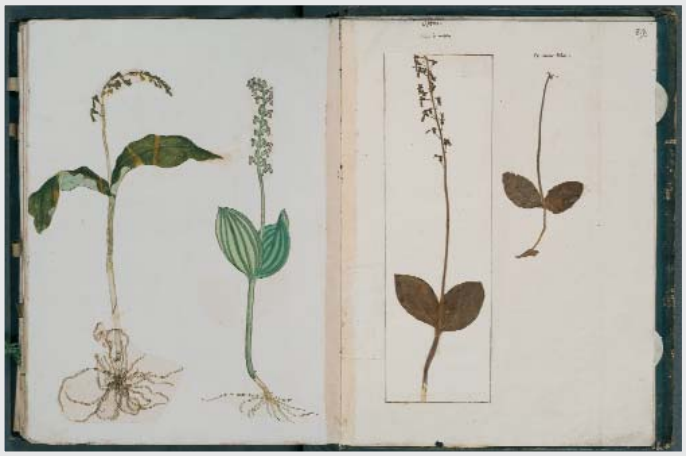
Felix Platter's botanical activities are closely integrated into this moment of change. As a medical student in Montpellier, his education included the study of botany. An active discussion of new discoveries in this field was ongoing between scholars. The herbaria were conceived as a new technique for the exact characterization and as a means of identifying plants. Being a passionate collector, Platter had a broad interest in the plant kingdom. Friedrich Miescher-His, pathologist and university professor from Basel, wrote about Felix Platter in the middle of the 19th century '[...] he searched everywhere for truth, in the texts of the ancients and also in the direct observation of nature [...]' (Miescher-His 1860: 42). This quotation perfectly reflects this early moment in botany and shows that Felix Platter was a man of his time.

Felix Platter was an interesting and multi-faceted individual. His medical accomplishments and his cabinet of natural and rarely seen curiosities, in which the formerly more extensive plant collection [3] was the centerpiece, were widely known.

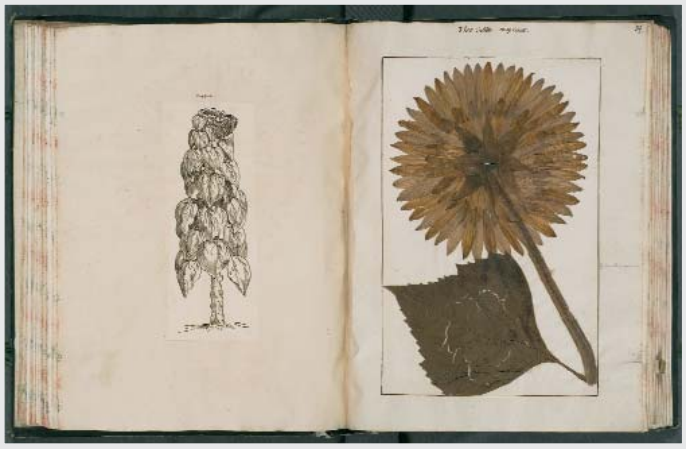
Codicological Consideration

All of the volumes preserved in the Burgerbibliothek in Bern are bound into millboard covered with fragments of parchment that had been coloured green and show blind embossings. The binding technique of the herbaria is the so-called 'secondary tacketing'. Bands of silk were attached as fasteners for keeping the books closed [4]. The plant specimens and corresponding illustrations were mounted on sheets of paper, which were then both centrally adhered to a double-sized sheet of paper. It was not until late in Platter's life (between 1603 and 1614) that they were bound into the present volumes. As a result of trimming the volumes' edges, the tipped-in plants or annotations were occasionally severed.

Close consideration of Platter's herbaria demonstrates that they served a different purpose during this early period of botany than today: Platter included an illustration next to most of the pressed plant samples. Along with wood cuts that he had removed from contemporary herbals, Platter also included coloured ink drawings by Hans Weiditz the Younger (ca. 1495-1536) (Fig 2: left) in his herbaria, along with an until now undiscovered ink drawing, probably by Pierandrea Mattioli (1500-1577) (Fig 3: left).



2 Two pressed herbal specimens (right) and their corresponding illustrations. Left illustration by Hans Weiditz the Younger served as draft for a woodcut in the herbal 'Herbarum vivae eicones'. Second from left: Woodcut from a herbal book by Leonhard Fuchs. Signature ES70.2, pp. 354/355. Photograph by Jürg Bernhardt. © Burgerbibliothek Bern.



3 Sunflower (helianthus anuus) composed of individually pressed petals. Ink drawing (left) supposedly assigned to Pierandrea Mattioli (1500-1577). Signature ES70.6, pp. 154/155. Photograph by Jürg Bernhardt. © Burgerbibliothek Bern.

Platter's herbaria served as reference works. Pressed plants accompanied by an illustration should show an observer of nature 'this is what this plant looks like and this is its name'. Information about morphology and geographical location were not the focus. Platter unarguably emphasised aesthetic appearance. The sunflower in Fig 3 clearly demonstrates this. The flower's petals were individually pressed and placed together so that it appears to be a flower in bloom. The sunflower, however, is known to possess a completely different morphology. Platter mounted the specimens by coating the surface of the dried sections of the plant with an adhesive mixture made from starch and protein-based pastes [5].

When labeling the plants Platter apparently depended on the knowledge of his student Caspar Bauhin (1560-1624). He described plants, unlike earlier practices, through the careful distinction of genus and species. This resembles closely the binary nomenclature and taxonomy used today [6].

Several new discoveries were made through this precise codicological investigation. The edges are sprinkled in a red-green tone, which has left a characteristic speckling on the pages. The exact same speckled effect was also discovered on individual sheets and books with collected illustrations from Felix Platter's bequest bound later in the university library in Basel. The illustrations in Basel therefore must have originally been bound in a manner similar to these herbaria and volume of illustrations.

Condition Survey

The condition survey made clear that the herbaria, when considering their age and fragility, are overall in good condition.

Binding and Text Block

The binding technique makes the books relatively easy to open and the tacketing itself exhibits hardly any damage. The binding technique, as well as both covers being placed too close to the spine, creates a weak area in the binding: the joint between spine and board (Fig 4). Torn joints were later repaired in two of the herbaria, however, the repairs often did not withstand mechanical strain over the long term. The often frayed and torn silk fasteners also exhibit damage. In addition, some of the covers are abraded and slightly deformed.

The paper in the text block is discoloured in places by isolat-

4 Torn joint (Signature ES 70.1). Photograph by Lea Dauwalder.

ed water damages and the occasional seepage of sap from the plant specimens. There are some instances of ink corrosion (with lateral and transversal penetration) from the iron gall ink used for the labeling of the specimens. Losses and tears in the paper were rarely seen.

The plants are brittle and in areas exhibit shrinkage cracks and losses. This can be ascribed to the flat mounting technique and the resulting tension in the materials as well as the mechanical stress on the fragile plants caused by the turning of the pages (Fig 5).

There were no signs of an active pest infestation but there are partial traces of earlier attack by microorganisms and losses incurred through insect frass.

Investigation of Biocide Contamination

The preservation of herbaria inevitably raises the question of pest infestation and possible countermeasures. The danger of a pest infestation in a botanical collection is categorically great. Plants are an attractive food source for many pests. A lack of precautionary measures can mean the introduction of pests, like for example, failing to quarantine newly arrived, contaminated materials.

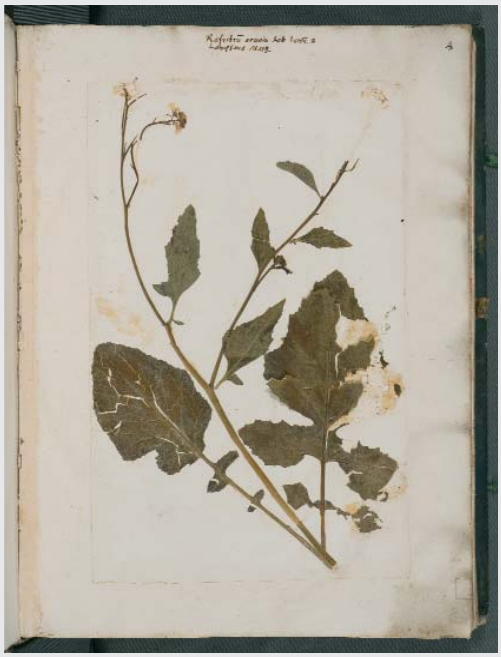
Many different biocides [7] were used in the past to counteract pests, whether as an active measure against existing pest infestations or as a preventive measure. Materials dangerous to human health and the environment were often used, which in addition can induce resistance in the insects. These chemicals, some of which are persistent, still pose a threat today for the users of herbaria [8]. Diverse publications document that the sensitivity in professional circles to the toxic remains of biocides has increased greatly in the last decade [9]. This complex topic demonstrates the importance of interdisciplinary cooperation among curators, colleagues in collections, chemists and physicians.

One has to assume that in a botanical collection biocides have been used. Markedly frequent is the description of treatments using mercury-containing agents (often characterised as '[corrosive] sublimate'). They can be substantiated or disproved through research and analysis. Until the results are known protective measures should be taken [10]. Health problems must be reacted to in all seriousness because they could be incurred through exposure to a biocide contamination.

In order to ascertain whether or not Platter's herbaria are contaminated with harmful and persistent biocides, a review of the literature was carried out and the current and past personnel of the institutions where they were stored were consulted. It was discovered that a biocide treatment in the Botanical Institute of the University of Bern, where the herbaria were discovered in 1930 and stored until the 1980's, was most likely. The most urgent matter was to determine if a DDT containing biocide [11] had been applied. FTIR analysis [12] was carried out on suspected crystallizations of DDT on the plants and in the dust. It became clear, however, that the efflorescence was probably plant-based and did not point to a biocide. In order to confirm the presence of any gas emissions from a chlorinated biocide, GC-MS analysis [13] was undertaken. A passive sampling method was used to collect test samples from the pages of the herbaria (Fig 6). It was developed for the analysis of chlorinated biocide in wooden objects (Mayer et al. 2010) and presented itself as a simply executable method for fragile objects from which material samples cannot be taken and which may not be transported to a scientific laboratory for testing. None of the results indicated the presence of a chlorinated biocide. In order to be able to definitively eliminate the possible presence of biocide contamination of the herbaria, still more analysis would have to be carried out. Possible additional methods of analysis would be portable XRF spectroscopy (X-ray fluorescence analysis, qualitative and semi-quantitative results) or SEM-EDS (scanning electron microscope with energy-dispersive X-ray spectroscopy, qualitative and quantitative results).

Conservation and Restoration Plan

In order to create a plan for the conservation and restoration of the herbaria, the limited supply of existing literature was reviewed and experienced, specialised professionals from all over the world in the areas of conservation and botany were consulted. Thus it was possible to attain a comprehensive picture of what is undertaken today for the preservation of herbaria.



5 The leaves of this plant (Sinapis arvensis) cracked due to mechanical stress, parts of the right leaf flaked and got lost. Signature ES70.3, p. 15. Photograph by Jürg Bernhardt. © Burgerbibliothek Bern.

6 Passive sampling of possible chlorous biozides under a watch glass. Signature ES 70.4, p. 15. Photograph by Lea Dauwalder.

Recommendations were established for conservation and restoration measures for Platter's herbaria, which are briefly summarised here.

Preservation Strategy

A fundamental preservation strategy was defined for Platter's herbaria based upon the consulted sources and the cultural-historical significance of the collection. The disassembly of the bound volumes, as it is occasionally recommended in the relevant literature [14], was discarded as an option for Platter's herbaria after weighing all of the advantages and disadvantages. The original composition of the herbaria remains today a piece of the history of botany, which is worthy of preservation. A written and visual documentation alone of the original condition seemed insufficient because in the future still more questions may be posed in relation to it. In addition, the individual documents of the disassembled herbaria were so fragile that consultation could rarely be granted.

For these reasons, the preservation strategy was defined as 'as little as possible, as much as needed'. By means of minimally invasive conservation measures, only in the case of absolute exceptions, careful handling may be carried by a conservator without causing further damage to the materials.

Digitisation

So that in the future the fragile objects would be used as little as possible, they were carefully digitised on-site by a photographer and the author of this paper. The digital replicas made possible the indexing of the herbaria in a databank that will be available online very soon. This is already an important measure for conservation.

Dry Cleaning, Binding and Text Block Restoration

Because the herbaria are very fragile, the sequence of the restoration treatment had to be well thought out. The stabilization of the damaged joints for the binding is therefore necessary before further treatment of the text block. This can be carried out with Japanese paper, parchment, or sections of cast parchment fibers. The tacketing must in some cases be stabilised, especially where the joint is damaged. It is recommended to dry clean the binding and text block. In order to avoid incurring further damage to the fragile plants, the surfaces should be vacuum-cleaned under the microscope using low suction with a small tube opening in order to remove dirt and microbial-contaminated dust. The removal of contaminated dust must be carried out in adherence with the corresponding health and safety requirements. When dry cleaning, it is important to ensure that no plant fragments are lost. They must be reattached in the following procedure.

The fasteners also have to be conserved. Various methods of stabilization used in textile conservation are considered. Along with the closing of tears and filling of isolated losses in the paper, partially or completely detached illustrations have to be reattached.

Stabilization and Reattachment of the Plant Material

A problem specific to Platter's herbaria is the stabilization of detached plant specimens. Following are the approaches found in the literature and learned through consultation with professionals:

> 1. Stabilisation of loose plant sections with paper straps, which extend over the plant sections and are adhered to the paper support next to the plant.
> 2. Stabilisation of loose plant sections by applying adhesive directly between the plant and the support paper.

Both methods have advantages and disadvantages. Stabilization with Japanese paper straps have the greatest advantage in that no adhesive is coated onto the plant material that could interact with it. When paging through the herbaria the unglued plant specimens have enough space to adjust to the movement of the pages, thereby reducing stress on the plants. This method is very good for longer sections of plant material (long leaves, stems, twigs) (Fig 7). Adhesives commonly used in paper conservation, like wheat starch paste, can be used. Stabilization with paper straps is, however, with larger plant specimens, less practical. The areas loosened by the occurrence of shrinkage cracks cannot be selectively secured (Fig 5). In these cases, a direct attachment with adhesive is recommended. The appropriate adhesive must be applied when choosing to directly attach the plant material to the support paper (a Japanese paper strap could also serve in this instance as a bridge between the plant and the page). Research resulted in a spectrum of applicable adhesives, however, only two specific solutions and their results were used by the author (Gunia 1995: 119-129 and Zigrino 2007: 20-28). An adhesive that possesses a range of properties is required. Here are the most important:

> resistance to ageing;
> high reversibility;
> neutral pH-value around 7 (acidic pH-values may provoke acidic hydrolysis reactions, whereas some plants react with changes to an alkaline environment);
> flexibility, to withstand movements of the paper and plant caused by mechanical and climatic changes;

7 The detached parts of this herb (Salsola soda) may be sufficiently secured with a paper strap. Signature ES70.6, p. 347. Photograph by Jürg Bernhardt. © Burgerbibliothek Bern.

> minimal introduction of humidity (correspondingly minimal penetration of the plant material);
> easy to apply.

The above-mentioned studies determined that Klucel E (a 25% solution in distilled water) is the best-suited adhesive. A second adhesive is considered for Platter's herbaria: a mixture of starch paste (rice or wheat starch) and isinglass. Such a mixture corresponds to the original adhesive and also fulfills the requirements (Springob 2001).

Preventive Conservation

This topic covers pest control, storage and use of the herbaria.

Up until only a few decades ago, pest control in collections was commonly carried out exclusively by chemical means. It was recognised, however, that along with abatement of active or possible infestations, the avoidance of the introduction of pests must become the first line of defense. Without the consideration of all of the areas of a collection—the building structure, storage conditions, access and early identification of a pest infiltration through constant monitoring—such an approach would be unthinkable.

With the eschewal of biocides, negative effects on objects, people and the environment can be prevented. In addition, the danger of insects building up a resistance to certain biocides is reduced. For these reasons, many collections today have established 'Integrated Pest Management' [15].

Pest monitoring has been undertaken in the storage facility of Platter's herbaria and so far has not discovered any traces of an infestation of the herbaria. Should a pest infestation ever occur, the safest method of control for the stability of herbaria must be applied. Deep freezing of botanical specimens is a widely used method of control or prophylaxis against infestation. The survey of various institutions made clear, however, that large differences remain in the execution of this treatment (frequency, duration, speed and temperature of the freezing process, packing of the documents in water-vapor-proof enclosures, process of thawing). It seems that knowledge about climatic stress is partially lacking and its effect on the objects as well as the exact requirements for the death of the insects. Deep freezing as a part of pest management could be in many areas thought through and optimised. In the case of Platter's herbaria and its composition out of many different materials, a deep freezing treatment would not be recommended in case of a pest infestation. A practical alternative would instead be anoxic treatment under controlled climatic conditions by which the insects perish through lack of oxygen.

Platter's herbaria are already stored in durable archival boxes, which protect them from dust, mechanical damage, air pollutants and short-term climatic oscillations. The climate conditions for the storage rooms should remain between 40 and 50% relative humidity at the lowest possible temperature (no short-term oscillations, minimal seasonal changes) [16].

To prevent further damages, the physical use of the herbaria is not allowed. Exhibitions are also not allowed. Extensive scholarly research can be undertaken with the digital replicas.

Conclusion

Historic, bound herbaria like Platter's are rare. Comparable objects, that have undergone a conservation or restoration treatment, can hardly be found. An extensive examination of the content and the materiality of Platter's herbaria was necessary to develop an adequate preservation strategy. The consideration of ethical issues lead to the selection of an appropriate preservation strategy, which subsequently was presented along with concrete treatment recommendations. The deliberations undertaken for the preservation of Platter's herbaria can serve as an example for the approach to similar objects.

The restoration treatments will be carried in the next few years according to the plan. Further suggestions from professional colleagues would be welcomed by the author.

Acknowledgements

Many people contributed to the successful completion of the master's thesis upon which this article is based. In particular, I would like to thank my advisor, Prof. Elke Mentzel and my co-advisor Dipl.-Rest. Petra Hanschke. I would also like to especially thank Dr. phil. hist. Claudia Engler, Director of the Burgerbibliothek and the botanist Lic. phil. nat. Luc Lienhard. I would like to thank Dr. rer. nat. Ingo Mayer of the Bern University of Applied Sciences for completion of the GC-MS analysis. Fellowships from the Hirschmann-Stiftung and the Bernischen Denkmalpflege-Stiftung provided financial support for the research.

Endnotes

* This article is based on the following master's thesis, which contains a comprehensive list of sources, not all of which are included in this article: Dauwalder, Lea (2012): Das Herbarium des Felix Platter — Die Erhaltung eines historischen Buch-Herbariums. Bern: Hochschule der Künste (Masterthesis).

[1] A collection of pressed, dried plants. The term Herbarium is also often used for the characterization of an institution that produces and preserves herbaria (Stafleu 1987: 155-156).

[2] Already referenced is Brunfels (1530), whose preparatory drawings are occasionally found in the herbaria. Other significant works include, inter alia, Fuchs (1542) and Bock (1546).

[3] Platter's entire collection with botanical illustrations and plant specimens was comprised originally of 49 bound books, of which 18 were herbaria (pressed plants and their corresponding illustrations). Today, of the 18 herbaria, eight are preserved in the Burgerbibliothek in Bern, Switzerland, along with one volume of illustrations of plants. Two books with natural scientific illustrations can be found in their original condition in the university library in Amsterdam, the Netherlands. Further illustrations from Platter's collection are stored in the university library in Basel, Switzerland (not in their original bound state). Specimens from his collection of rare curiosities are stored in the natural history museum in Basel, Switzerland.

[4] Material tests in the scientific laboratory of the Bern University of Applied Sciences, Switzerland: green colourant on parchment: a mixture of indigo and orpiment, identified by means of polarised light microscopy (Olympus BH-2) and Fourier Transform Infrared Spectroscopy (Perkin Elmer, System 2000 with evaluation software Spectrum GX v5.3.1.). Fiber analysis of the fasteners: silk, identified with polarised light microscopy (Olympus BH-2).

[5] Material tests in the scientific laboratory of the Bern University of Applied Sciences, Switzerland, by means of Fourier Transform Infrared Spectroscopy, device cf. [4].

[6] Platter applied the nomenclature and taxonomy of his scholar Caspar Bauhin (1560-1624), which Bauhin used in the works 'Phytopinax' (1596) and 'Pinax' (1623).

[7] The term biocide actually means the 'killing of organisms' and includes various chemical substances (above all pesticides) like insecticide, fungicide (against fungi or fungal spores), bactericide and rodenticide (against rodents) (Pfister 2008: 12). When biocides are applied to cultural objects they are chemically bound in differing degrees to materials like wood, plant fibers, leather, fur and feathers. There are often insoluble in water (Tello 2009: 276).

[8] Pfister (2008: 40-54) provides an overview of the toxic effects of various biocides.

[9] Pfister (2008) provides a review of the literature up until 2008 in her master's thesis. Later articles, like for example Péquignot (2008), Tello (2009), Lang (2011), and Brozio (2011) are also concerned with this topic. The journal 'Collection Forum' also regularly publishes articles on this subject.

[10] Cf. e.g., Pfister (2008: 66-74) respectively Odegaard and Sadongei (2005: 87-90).

[11] Dichlorodiphenyltrichloroethane C14H9Cl5.

[12] The test samples of possible DDT crystals were taken from plants and dust. Fourier Transform Infrared Spectroscopy executed in the scientific laboratory of the University of Applied Sciences in Bern, Switzerland with the FT-IR device Perkin Elmer, System 2000 with evaluation software Spectrum GX v5.3.1.

[13] Gas Chromatography Mass Spectrometry executed in the Bern University of Applied Sciences in Biel, Switzerland, by Dr. rer. nat. Ingo Mayer. Analysis parameters: passive sampler (Gerstel-TwisterTM with a polydimethylsiloxane coating PDMS) were thermically desorbed with the help of a thermal desorption system TDS4 (Gerstel) and after cryofocusing at -30°C (KAS4, Gerstel) with a DB-5 ms column, gas chromatographically separated (Agilent 6890, splitless mode) and captured with the help of a mass selection detector (MSD Agilent 5975, scan range 60-300 amu). Analytical references were used (GC grade, Sigma Aldrich) for the multipoint calibration of the system.

[14] Cf., e.g., Margez et al. 2005 and Humphrey 1992.

[15] A comprehensive bibliography on IPM is located at <www.museumpests.net/resources.asp>. Important references are, for example, Pinniger (2001), Kingsley et al. (2001), and Winsor et al. (2011). Information specific to plant collections is provided by Strang (1999).

[16] The climate conditions must always to be considered in the context of the whole collection: very low temperatures cannot be instituted because use of the spaces by people would be practically impossible. Low temperatures also require an increased input of humidity, therefore, in the context of the collection in the Burgerbibliothek, a temperature around 19°C was recommended.

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German Title and Abstract

Das Herbarium des Felix Platter: Die Erhaltung eines historischen Buch-Herbariums

Im Rahmen einer Masterthesis aus der Hochschule der Künste Bern (Schweiz) wurden acht Pergamentbände mit getrockneten, gepreßten Pflanzen sowie Pflanzenabbildungen aus der Sammlung des Basler Arztes Felix Platter (1536–1614) untersucht. Im 16. Jahrhundert entwickelte sich die Botanik als eigenständiges Forschungsgebiet, während die Pflanzenkunde zuvor ausschließlich als Hilfswissenschaft für die Medizin diente. Die Herbarien von Felix Platter entstammen dieser Zeit des Umbruchs. Sie gehören zu den ältesten Herbarien der Welt und sind die ältesten der Schweiz. Die Einbettung der Herbarien in den historischen Kontext sowie ihre kodikologische Beschreibung soll dem besseren Verständnis und der Entscheidungsfindung für zukünftig zu treffende Erhaltungsmaßnahmen dienen. Der Zustand der Herbarien wurde eingehend untersucht. Dabei nahm die Frage nach möglichen Biozidrückständen eine wichtige Rolle ein. Die gewonnenen Erkenntnisse führten schließlich zur Erstellung eines Konservierungs- und Restaurierungskonzepts für die Herbarien. Die Aufbereitung und Auswertung sachbezogener Literatur und Quellen waren hierbei die Hauptziele.

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