Newsletter of the FRIENDS OF THE FARLOW

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G. E. Tocci, Interim Editor
D. Haelewaters, Assistant Editor

90 Years of the Farlow

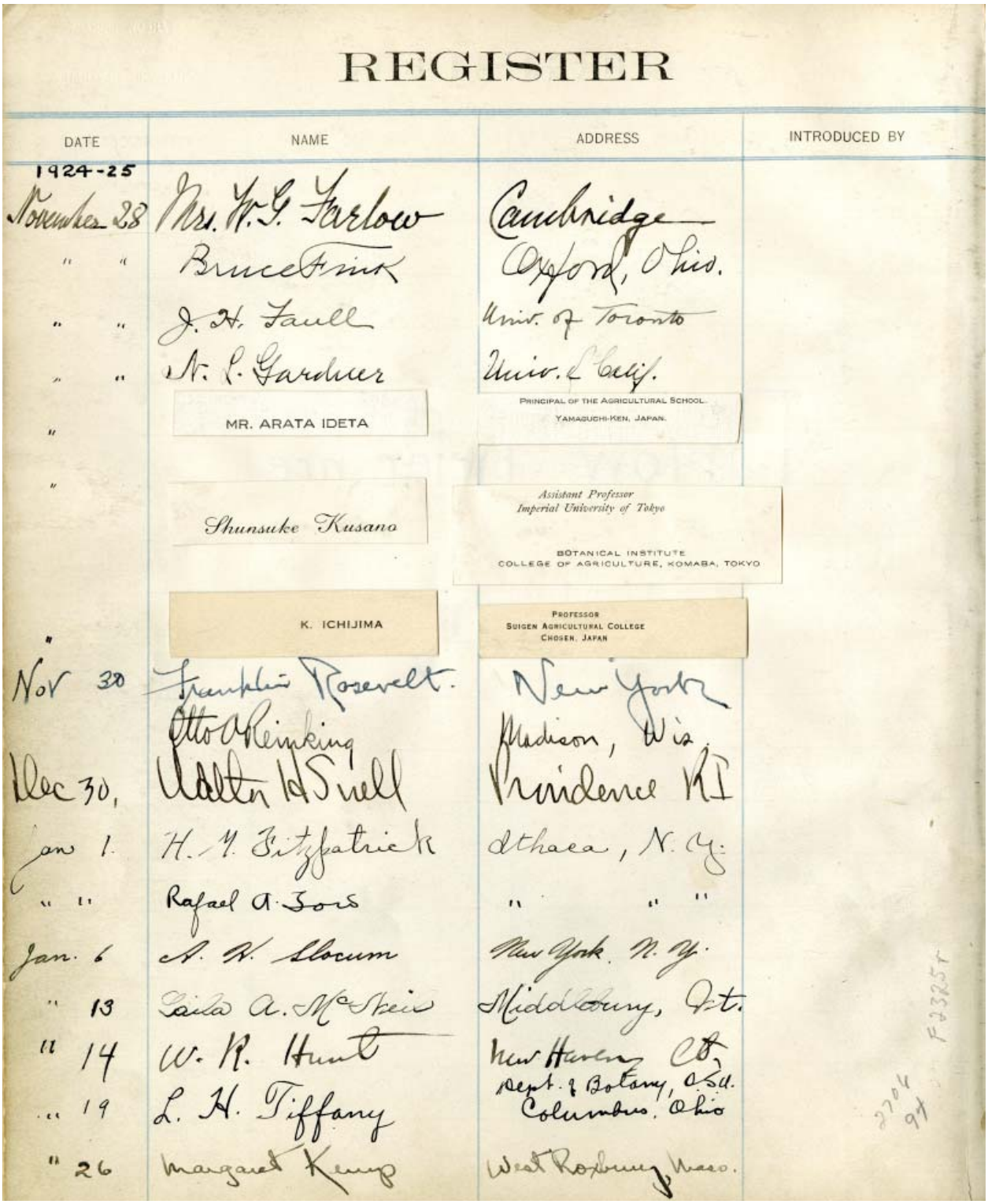
by Donald H. Pfister, Asa Gray Professor of Systematic Botany,
Curator of the Farlow Library and Herbarium

I remember clearly my first visit to the Farlow Library and Herbarium of Cryptogamic Botany. I was in my third year of graduate studies at Cornell and had made the trip to Cambridge to consult the herbarium. The place was hard to find. Indeed, standing in front of the Harvard University Herbaria building, I asked a passerby where the herbarium was despite the signage on the front of the building – that I missed too – and the person had no idea where it was. A well kept secret then, and what a secret it remains.

On entering the building I was taken by the beautiful Reading Room. I signed the guest book and joined the army of mycologists, lichenologists, bryologists, and phycologists from the past who had visited and used the collection. Then of course there are those collections. I was far enough along in my thesis research that I thought there would be a few items to see, but little did I suspect the range of specimens and data that awaited me. What is perhaps even more exciting is that I can say even today there are surprises and wonders that I encounter as I delve into various parts of the herbarium and the library. Even at 90 the place has not given up all its treasures.

The first signature in the guest register is that of Lilian Horsford Farlow. Although W. G. Farlow had died in 1919, the formal opening was in 1924. In that interval a building was prepared, the old Divinity School Library with its classrooms and offices; books were catalogued; an addition to the building was erected to house the specimens; new cabinets were installed and materials were moved from Farlow's home and from the Botanical Museum, previously home of the Cryptogamic Laboratory. One might think or hope that such transformations came naturally at a place like Harvard, but then, as now, this was not the case. First, there was debate about where on the campus the library and herbarium could be housed according to terms of Farlow's will. Then came the work of fitting out and relocating. Orchestrating all of this was Roland Thaxter, Farlow's student and long-term colleague. Thaxter raised the money needed for the renovations, and he had in this a partner, Mrs. Farlow. She set funds aside to purchase items for the library and another fund was established to bind journals. Thaxter solicited funds and succeeded in obtaining an en-

Special Farlow Lecture on Nov. 13th at 6pm. Crowdsourcing Workshop on Nov. 15th at 1pm. See page 9 for details!



REGISTER

DATE	NAME	ADDRESS	INTRODUCED BY
1924-25			
November 28	Mrs. W. G. Farlow	Cambridge	
" "	Bruce Fink	Oxford, Ohio.	
" "	J. H. Faull	Univ. of Toronto	
" "	N. L. Gardner	Univ. of Calif.	
"	MR. ARATA IDETA	PRINCIPAL OF THE AGRICULTURAL SCHOOL. YAMAGUCHI-KEN, JAPAN.	
"	Shunsuke Kusano	*Assistant Professor Imperial University of Tokyo* BOTANICAL INSTITUTE COLLEGE OF AGRICULTURE, KOMABA, TOKYO	
	K. ICHIJIMA	PROFESSOR SUIGEN AGRICULTURAL COLLEGE CHOSEN, JAPAN	
Nov 30	Franklin Roosevelt.	New York	
	Otto A. Reinking	Madison, Wis.	
Dec 30,	Walter H. Snell	Providence RI	
Jan 1.	H. M. Fitzpatrick	Ithaca, N. Y.	
" "	Rafael A. Toro	" " "	
Jan. 6	A. W. Slocum	New York. N. Y.	
" 13	Laila A. McStein	Middlebury, Vt.	
" 14	W. R. Hunt	New Haven Ct.	
" 19	L. H. Tiffany	dept. of Botany, O.S.U. Columbus. Ohio	
" 26	Margaret Kemp	West Roxbury Mass.	

First page of the Farlow visitor register courtesy of the Archives of the Farlow Library and Herbarium of Cryptogamic Botany.

dowment for a librarian and for the renovation expenses. Through the 1920s Thaxter, with Mrs. Farlow's help, attempted to purchase every private collection that came along; his overtures succeeded in most cases. This was a period of dramatic growth in the collections. Mrs. Farlow provided

the money, as she still does, through the endowments she left.

Now as we celebrate it is important to look forward. The many digital projects that we are involved in, both in the library and in the herbarium, will give us some new insights since we will have location and other data to analyze. Collections such as the Farlow's are treasures because they can show us the earth as it no longer exists. As climate changes so, too, do vegetational patterns. For example, the extensive collection of Antarctic lichens gives us a picture of that continent from the first moment of land exploration. Are those species still to be found, are their ranges expanding or contracting? Will they literally be pushed off the face of the earth as the planet warms? Here in the Farlow are the base line specimens for studies that might answer these questions. Here, too, we find the materials that helped flesh-out the tree of life. Indeed, in the Farlow there are four kingdoms represented, wider coverage than any other natural history collection at Harvard. The tree of life is still growing and it is through study and comparison of collections that the tree will come to maturity.

So, as we take a moment to thank our forebears and to reflect on their accomplishments, it is a moment as well when we can ask how best might we use and steward the materials they left for us.

News from the Farlow

Ingrid McDonough, our Farlow assistant who helped to keep the Farlow running, retired at the end of June. One of Ingrid's projects was to help rehouse the North American Fungi card files. She moved the cards from wooden boxes to archive quality boxes.

Don Pfister ended his position as Interim Dean of Harvard College on June 30th. After 6 years as Dean of the Harvard Summer School and this past year as Interim Dean of the College, he returned to the Farlow full time as of July 1st and began a year-long sabbatical leave.

Lisa DeCesare, the archivist in the Botany Library, has installed an exhibit in the Farlow outlining the history of the institution.

Graduate student **Danny Haelewaters** spent a week in Bryon, GA in March working with USDA collaborator Ted Cottrell collecting laboulbeniales fungi of the area. He was also awarded the 2014 Bayard Long Award of the Philadelphia Botanical Club to allow him to screen insects at the Academy of Natural Sciences of Drexel University, PA. In June he traveled to Peninsular Malaysia for 2 weeks for field work accompanied by Harvard undergraduate **Tristan Wang**. Lastly, he became student councilor for the New England Botanical Club and is Chair of the Mycological Society of America Student Section.

Refinishing the Farlow Floors – A Thanksgiving to Remember!

Judith Warnement, Librarian

The building located at 20 Divinity Avenue was designed for the Harvard Divinity School by the Boston architectural firm of Peabody and Stearns and constructed in 1886 at a cost of $41,191. Robert Swaim Peabody (1845-1917) and John Goddard Stearns, Jr. (1843-1917) were Massachusetts natives and Harvard graduates. Peabody studied architecture in Paris and his buildings reflect the Beaux-arts influences. Stearns was an engineer who contributed practicality and business acumen to the partnership.

Patching the library floor. Photo courtesy of the Archives of the Farlow Library and Herbarium of Cryptogamic Botany.

The building has withstood the test of time but not without signs of age and the impact of construction projects, util-

Staining the floors. Photo courtesy of the Archives of the Farlow Library and Herbarium of Cryptogamic Botany.

ity upgrades, and changes in the surrounding landscape. Thankfully many efforts have been made to restore the building to its original beauty.

The reception at the Friends of the Farlow annual meeting in the Farlow Library Reading Room on November 9, 2013 marked the last public event for the room's shabby floor. Less than two weeks later the room was empty except for the bookcases swathed in plastic. All of the furnishings were packed and stowed in the stacks or stacked in the hallway. Service was suspended on November 22 and a crew of craftsmen from Hunt Custom Milled Wood Floors arrived early on the Friday after Thanksgiving to repair and refinish the floor.

Finished library floors. Photo courtesy of the Archives of the Farlow Library and Herbarium of Cryptogamic Botany.

Visitors to the library will recall several poorly patched areas that appeared to be the sites of registers from the old heating system. The wood was mismatched in size and color so the department's facilities managers, Irvin Dumay and Phil Norton, secured the funds to replace the wood and restore the floor to its original appearance. The pictures show the extent of the repairs. The woodworkers uncovered old newspaper, nails, and other odd materials that were used to shim and secure the old floor. The floors were sanded before and after the repairs which took three full days before the application of three coats of polyurethane. The process was remarkably clean, but all of the shelves and furniture were dusted and felt strips were applied to the legs and feet of most of the furniture. The library reopened on December 9 and everyone agrees that the floors are not only beautiful, but they brighten the room and should last another 128 years.

Gift to FoF from the estate of Emory G. Simmons

In his will Emory Simmons included a gift to the Friends of the Farlow. This gift will be added to the general FoF endowment and will contribute to our ongoing programs of inviting scholars to study our collections. Simmons worked on several genera of primarily asexually reproducing fungi; he is best known for this work on and the monograph of *Alternaria*. This is the first such bequest received by the Friends and we appreciate that such gifts assure that the institution will continue to be central to research on fungi, lichens, bryophytes and algae and the stewardship of these collections.

Visitor thanks for support from Friends of the Farlow

Naveed Davoodian, New York Botanical Garden graduate student

I am very grateful to have had the opportunity to examine specimens of *Gyroporus* at the Farlow

Herbarium this past August. *Gyroporus*, the subject of my dissertation, is a genus of ectomycorrhizal Boletales found on every major continent except Antarctica. My week at FH, made possible by a Friends of the Farlow Graduate Student Fellowship, allowed me to further untangle complications in this well-known but poorly understood group of fungi.

In addition to types and other essential collections, I had the opportunity to study *Gyroporus* material from Rolf Singer's work on Florida boletes. While at the Farlow in the 1940s, Singer received a Guggenheim Fellowship "for studies of the mycological flora of subtropical America" (http://www.gf.org/fellows/13613-rolf-singer), subsequently producing his classic treatments of the boletes of Florida. I found these specimens to be in excellent condition, providing me further insights into morphological diversity and rarely collected taxa in the genus.

Many thanks to FoF and everyone at the Farlow for a great week!

More news from the Farlow

Sarah Verhaeghen finished creating labels and sorting through the remaining Reid Bryophytes. They are now all ready to be repackaged so they can be filed in the Farlow Collections. She has recently completed recurating and filing approximately 1,000 moss specimens in the general herbarium.

FoF member **Jason Karakehian** was lead author and had the cover photograph in *Mycologia* with his article entitled "Placement of the genus *Angelina* within Rhytismatales and observations of *Angelina rufescens*," with co-authors **Kathy LoBuglio** and **Don Pfister**.

Chang-Lin Zhao, a Ph.D. candidate at the Institute of Microbiology, Beijing Forestry University, arrived and will spend one year studying the polypore genus *Perenniporia*.

Xu Feng is back at the Farlow from the Beijing Academy of Agriculture and Forestry. He was here 2 years ago is and continuing now his work on the genus *Wynnea*.

Teresa Iturriaga is a visiting scholar and continues her work on Venezuelan collections in the Farlow's historical herbaria. In addition, Teresa is working on sorting out and updating the taxonomy the Farlow collections of *Hyaloscyphaceae*.

Nousheen Yousaf, a graduate student at the University of Punjab, Lahore, Pakistan, visited the Farlow for 6 months from December 2013 until early May 2014. While here, she worked on her molecular research and imaging of gasteroid fungi for her Ph.D. thesis that has now been accepted at her University.

Hai-sheng Yuan from the State Key Laboratory of Forest and Soil Ecology, Institute of Applied Ecology, Chinese Academy of Sciences, spent a year at the Farlow studying polypores. Among the projects he undertook was the identification of many of the unprocessed polypores from Asia. He also worked on a manuscript on the biogeography of polypores in China.

Pop-Up Exhibit Cases on Curation in the Farlow

In conjunction with **Don Pfister's** lecture on November 13th commemorating 90 years of the Farlow Herbarium, there will be a pop-up exhibit in the Thoreau Gallery in the Harvard Museum of Natural History. Stop by the afternoon of the 12th or all day the 13th to see examples of how specimens in the Farlow are stored. We've searched the collections for some of our more unusual examples and hope you enjoy them as much as we do!

A note on FoF officers

We need individuals to serve as officers of FoF. The officers serve as an executive board and approve fund expenditures and review fellowship applications.

We are not having a formal business meeting this year and as a result will not be formally electing and requesting volunteers. In the meantime we have accepted the offer of **Jason Karakehian** to serve as Vice President. Jason replaces Toby Fleiblman who has relocated to Louisiana. Jason has been active at the Farlow and we appreciate his willingness to devote time to this activity.

We still need others, particularly for the positions of Treasurer and Newsletter editor. Please let any of us know if you are willing to join us in this way.

Get Involved... Remotely!

With both the Lichen & Bryophyte, Macroalgae and the Macrofungi digitization projects in full swing, there is now a way for everyone to help out the Farlow (and the other herbaria involved in the projects). People can now transcribe data from specimen labels online.

For the Macrofungi project head here: http://www.notesfromnature.org/#/archives/macrofungi. You can jump right in and start transcribing.

For the Lichen & Bryophyte project head here: http://lbcc1.acis.ufl.edu/, then head over to "volunteer," and decide if you want to start with lichens or bryophytes. Right now there are lots of lichen records available and the hepatics are going up. Mosses will be available soon! Our own **Hannah Kusinitz** even has a post on data entry tips to help you with data transcription: http://lbcc1.acis.ufl.edu/node/45.

So, spread the word and help get specimen data transcribed! Stay tuned for information on the Macroalgae project. See page 9 for information on our workshop on November 15th.

The Bibliographic Cards of the Farlow

by Lisa DeCesare, Librarian

In 1870 Asa Gray asked a promising pupil of his, William Gilson Farlow, to serve as his assistant.

According to Farlow in his "A Sketch of Cryptogamic Botany at Harvard University", Gray felt that there should be more thorough instruction in cryptogamic botany and asked Farlow to teach these classes.

Harvard was the first institution in the United States to make special provisions for instruction in cryptogamic botany. Farlow writes, "...at the time when such instruction was first offered, it was almost necessary to apologize to the public for teaching anything but phaenogamic botany, the only branch of science hitherto recognized in our colleges"(1). Here in Cambridge, Farlow worked to expand his own knowledge of the subject but found it almost impossible.

To learn more he needed to study in Germany and France, where modern research was being done. Farlow left Cambridge during the summer of 1872 and arrived in Strasbourg, France in October 1872 to study with Anton De Bary.

Thousands of bibliographic cards in wooden boxes stored in specially sized metal cabinets. Photo courtesy of the Archives of the Farlow Library and Herbarium of Cryptogamic Botany

Farlow remained in Europe for close to two years. During this time he not only studied but also began to gather the foundations of his personal library and herbarium.

Upon his return Farlow was appointed Assistant Professor of Botany and sta-

tioned at the Bussey Institution in Jamaica Plain, Massachusetts. He turned his attention to more local fungi but he found it impossible to figure out what species of fungi occurred in the United States. Most accounts of North American fungi were scattered throughout difficult-to-obtain society publications and state reports.

Farlow was determined to bring together all references to North American species that "concern the systematic mycologist"(2). This omitted materials on fungicides and other agricultural or technical topics. The references gathered in this index would have morphological and classification implications. The index was originally to include only fungi north of Mexico, but it soon became apparent that those found along the southern border are closely connected to species in Mexico and Central America, and so the range was expanded to all countries north of Panama.

The index itself was in the form of a card catalogue, organized by genus and species. Each fungus had a main sheet with small reference labels attached to them. These were housed in small wooden boxes clearly labeled with the fungi names.

From 1874-1883 the indexing was actually done by Farlow himself. After 1883 he had too many other responsibilities and he was forced to entrust the indexing to others while he retained a supervisory role. Arthur Bliss Seymour handled the indexing after this point, excepting a single year when he was away and Professor L. H. Pammel took over.

As the index continued to grow it became obvious that this should be printed and distributed, but the cost of such an undertaking was prohibitive. By the early 1900s there were approximately 150,000 references in the file and, while Farlow hoped the Harvard Library would print it, they would not come forward with the money.

By early 1902 Farlow had letters of support from many prominent botanists and institutions, urging him to find funding for printing his index, a few even suggested that he contact The Carnegie Institution in Washington D.C. On February 12, 1903, Farow wrote to Mr. Billings outlining the scope and characteristics of the index, the estimate for printing costs, and requesting that the Carnegie consider funding the project.

Ingrid with cabinet full of completed cards and a box in progress. Photo courtesy of the Archives of the Farlow Library and Herbarium of Cryptogamic Botany.

The Carnegie quickly saw the need for this printing and, in less than a week from receiving Farlow's request, they replied that they were willing to publish the index with the understanding that only $3,000 would be spent in 1903.

Work began, and by late 1906, the first section, *Abrothalus – Badhamia*, was printed. Due to myriad difficulties no other sections were published. Seymour and other Farlow Herbarium staff continued to add to the index until the 1930s when work stopped.

At this point the cards filled 811 wooden boxes and more than 40 small card file drawers. These boxes were stored in special cabinets as well as in any other space in the herbarium they would fit.

In 2014 a project was begun to integrate all the references, arrange them by genus and species, remove duplicates, rehouse them in archival boxes, and create an online finding aid.

The materials were scanned and then Library Assistants began cleaning and interfiling the cards before placing them in archival boxes.

These boxes were then given to **Ingrid B.**

McDonough, Assistant to Professor Donald H. Pfister. Ingrid conducted a second pass through all of the cards, checking the organization, deaccessioning duplicate references, and creating an electronic list of just what each archival box contained. She then labeled the boxes and they were filed upstairs in the Farlow collections space. As of Spring 2014 Ingrid processed approximately 240 wooden boxes of cards as well as 16 file drawers of small bibliographic cards.

References

1. Thaxter, Roland, 1858-1932. William Gilson Farlow (with portrait). Botanical Gazette LXIX: 83-87. 1920.

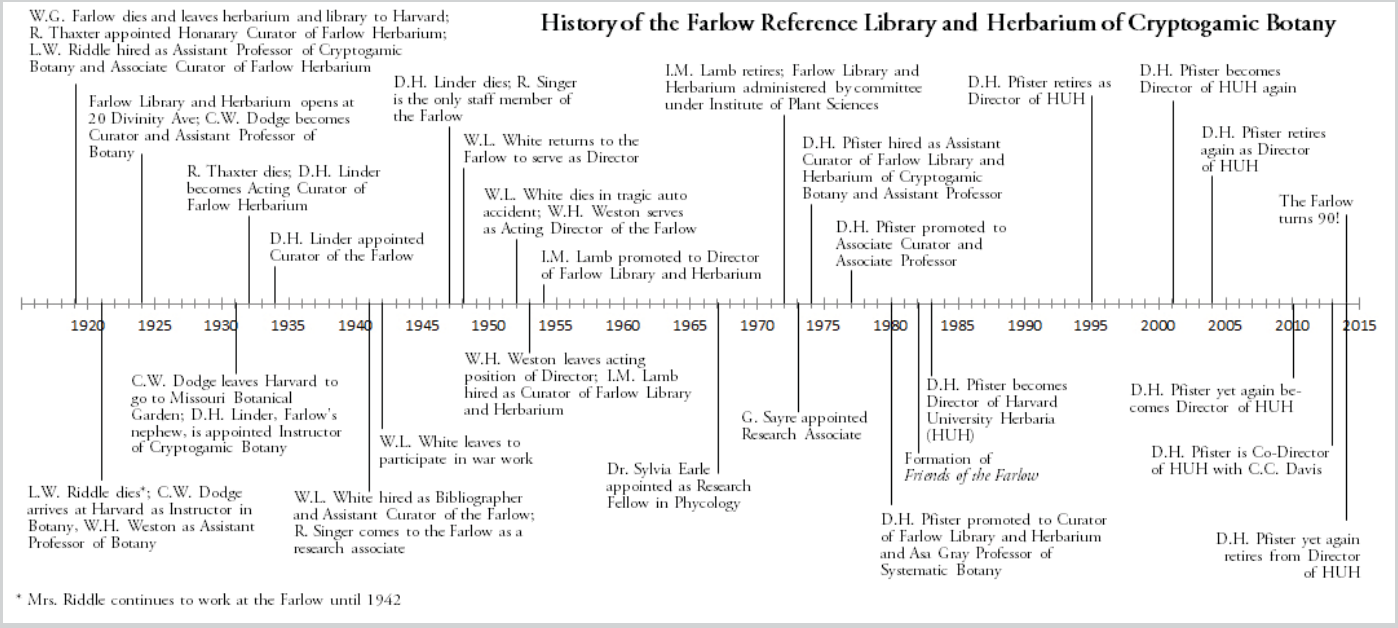
2. Farlow, W. G. (William Gilson), 1844-1919. Bibliographical index of North American fungi / by William G. Farlow.

"University Acquires Ownership of Farlow Botanical Library: Library Bequeathed by Professor W. G. Farlow '66"

To read the original article from 1922 in The Harvard Crimson please head over to: http://www.thecrimson.com/article/1922/10/30/university-acquires-ownership-of-farlow-botanical/

Some notes on other figures at the Farlow

During World War II the mycologists at Harvard were engaged in work on fungi, contributing particularly to work on tropical deterioration of military goods. W. L. White, W. H. Weston, and D. H. Linder all played a role. During the mid-1940s mycologist Rolf Singer arrived and worked in the Herbarium and Library and also traveled



to Florida. His work on Florida fungi was published in *Farlowia*. *Farlowia*, a journal of cryptogamic Botany, was founded in 1943. These were difficult years at the Farlow and it is a tribute to Linder and his small staff that they both contributed to the on-going stuggles of a country at war and at the same time promoted studies of cryptogams through this new journal.

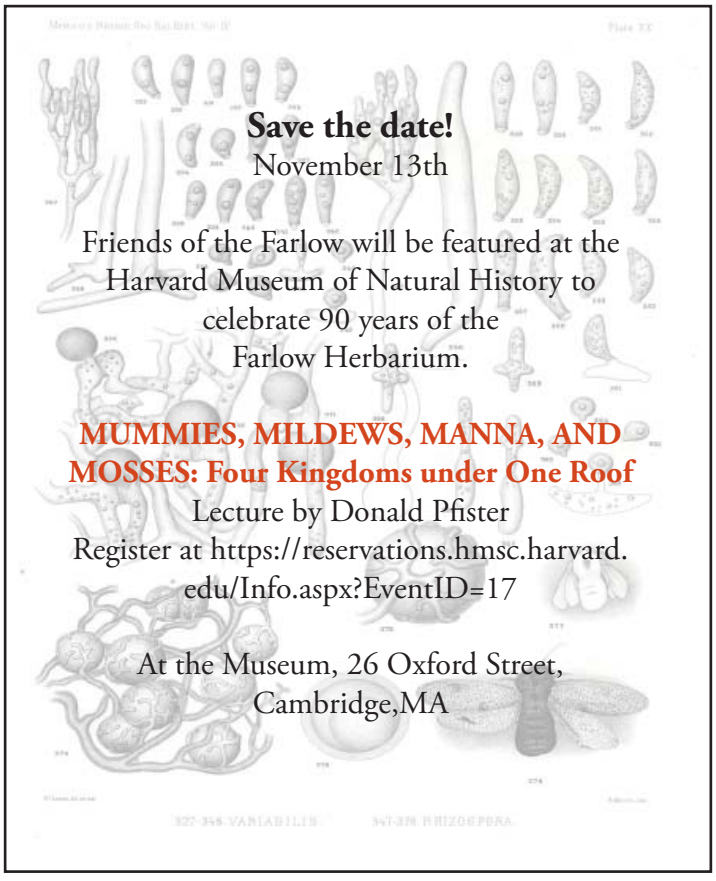
Equally important were the contributions of Geneva Sayre. She came to the Farlow in 1973 after her retirement from Russell Sage College. Here she oversaw major rejuvenation of the bryophyte collection. These collections remain some of the best documented and most accessible of the Farlow's holdings. A special volume of the Occasional Papers of the Farlow Herbarium was dedicated to her on the occasion of her 70th birthday.

As milestones accumulate for the institution, it is also fitting to point out the founding of the *Friends of the Farlow* in 1982. With the support of then librarian at the Farlow, Geraldine Kaye and Elio Schaechter, then Professor of Microbiology at Tufts University, a community of supporters came together. Happily the *Friends* are still with us and still contribute in many ways.

Crowdsourcing Workshop at the Farlow November 15th

Please join us on Saturday, November 15th for a session on on-line label transcription at the Farlow. This will be the perfect opportunity for those who want to learn the drill or hone their skills.

Join us at 1PM for instruction, a tour, and refreshment. If you would like to try transcribing yourself then please bring a laptop or tablet with you.



The Habits of Truffles and other Ectomycorrhizal Cup Fungi; Reading Tree Roots for Clues

by Rosanne Healy, Ph.D., Sargent Scholar at the Arnold Arboretum with matching support from the Harvard Forest, and Postdoctoral Researcher with Donald Pfister

Something to ponder: The health and regeneration of the grand old oak trees and majestic pine trees is dependent on the well-being of the tiny fungi that associate with their roots. But the truth is that not only oaks and pines rely on their fungal partners to get them through lean and dry times. An estimated 86% of plant species benefit from (or are even dependent on) fungal root associates that exchange water and nutrients for carbon (Brundrett, 2009).

Figure 1: *Scleroderma* ectomycorrhizal red oak root tip. The color and "furry" appearance are due to the fungal symbiont.

These are the mycorrhizal (*myco*=fungus, *rhiza*=root) fungi. They can be roughly sorted into two types based on how they associate with the roots. This article focuses on ectomycorrhizal fungi, which can be seen as a mantle surrounding the root tip (Figure 1). The ectomycorrhizal fungi are mostly in association with trees rather than herbaceous plants. They make their presence known to us not only because we see them on the roots, but also because we see their fruiting bodies – particularly from mid-summer into fall here in New England.

Which fungi are they? Thanks to ever more ingenious methods of molecular fingerprinting of fungi, and a growing database of sequences for fungi of all kinds, we now know much more about what species are involved in these relationships. The ectomycorrhizal fungi include some of the largest and most colorful of the fleshy basidiomycete fungi like *Cortinarius* and *Russula*, as well as prized edibles like the king bolete and chanterelle, and deadly poisonous species such as the death cap *Amanita*. Far less is known about the cup fungi that form ectomycorrhizae despite their long history of study. The term "mycorrhiza" was coined by Albert Frank in 1885 while he studied the relationship of *Tuber*, a truffle cup fungus, with its host tree roots in order to determine how to cultivate this gastronomically important fun-

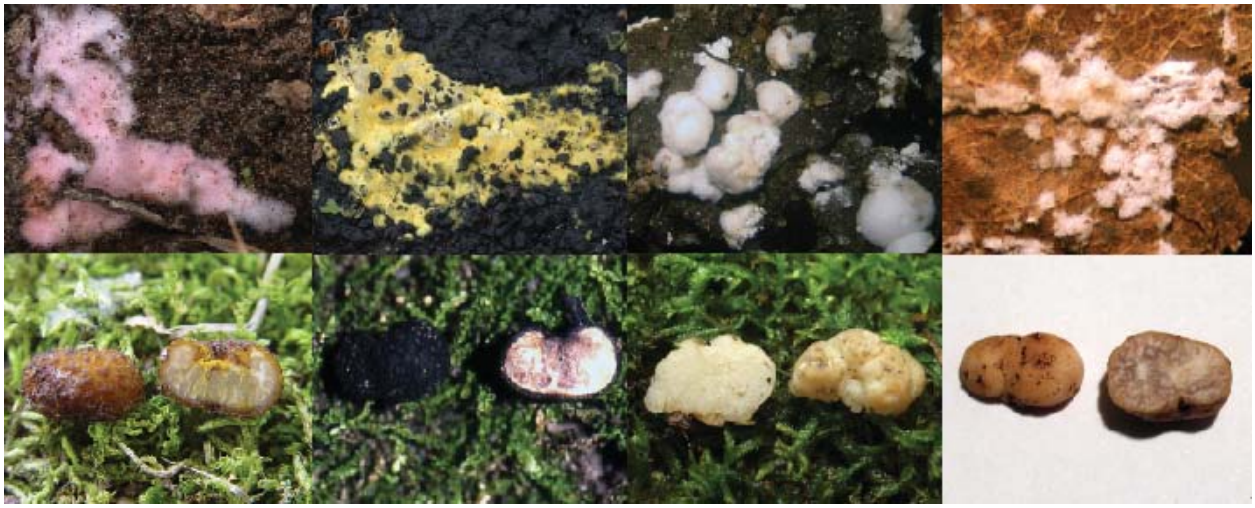


Figure 2: Truffles and their mitospore mats left to right: *Pachyphlodes ligericus* sporemat (above), fruiting body (below); *Pachyphlodes annagardneri* nom prov. sporemat (above), fruiting body (below); *Hydnobolites* sp. nov spore mat (above), fruiting body (below); *Tuber* sp. nov. sporemat (above), fruiting body (below).

gus (Trappe, 2005).

Most truffles, including the economically and gastronomically important *Tuber* species that interested Frank, are ectomycorrhizal. I have been studying *Pachyphlodes*, a common but generally ignored truffle genus, for the past 15 years. During these studies I collaborated with Farlow cup fungus experts Don Pfister and Matthew Smith (University of Florida) and FoF scholar Gregory Bonito (Royal Botanic Garden, Melbourne, Australia). We noticed that the asexual form of truffles, termed sporemats here (top row of Figure 2), occur most abundantly on bare or nearly bare soil. This was consistent with reports that fruiting bodies of ectomycorrhizal Pezizales (the nomenclatural order for cup fungi) tend to occur in disturbed habitats such as dirt paths or roads in the forest (Petersen, 1985). I am now working with Don Pfister to test the hypothesis that ectomycorrhizal Pezizales are more prevalent in disturbed environments. To do this, we are comparing the ectomycorrhizal fungi on roots of red oaks (*Quercus rubra*) in the Arnold Arboretum with those on red oaks in Harvard Forest.

Why choose these two sites for this study? There are some important differences between the arboretum and the forest. The arboretum habitat is more like a residential area, where much of the understory is kept clear of non-intended plant life, and the grass is kept short. The soil organic layer is comparatively shallow, and there is not much variety in the litter layer. In contrast, the forests here in New England are characterized by an understory of regenerating trees, native shrubs, vines, and herbs. The ground under the trees is covered by woody and leafy litter, and under that layer is a deep organic layer composed of roots, soil, and partially broken down organic matter that together form a dense mat that requires a knife to cut through it.

Compared to the forest, there is not much in the arboretum habitat to obstruct the passive transfer of spores produced by fungi on the soil surface to roots and mycelia in or below the organic layer. This is possibly an important feature for the cup fungi because in order to fruit, the hyphae of outcrossing species such as *Tuber* must come in contact with a compatible mating type nucleus in another hypha. This is in contrast to most ectomycorrhizal basidiomycete species that form their mycelia with both nuclei soon after germination of their sexual spores. How do compatible mating types of truffles get together if the mycelia are underground? Perhaps the sporemats on the soil surface play a role in this event. If so, mating may be facilitated in an environment such as found in the arboretum over that found in a forest.

Let's explore this idea a bit. The sporemats are produced on the soil surface, presumably from the ectomycorrhizal roots below the soil surface. They in turn produce massive numbers of spores that are small, light-colored, and thin-walled, and therefore probably not designed to function

Figure 3: Ectomycorrhizal basidiomycete fruiting bodies (above) and their root tips (below) left to right: *Lactarius imperceptus*; *Byssocorticium* sp.; *Russula* sp.; *Scleroderma areolatum*; *Cortinarius armillatus*.

as survival structures. We don't know what their function is, but it makes sense that they might be involved in the mating of truffles and other cup fungi that produce them. With this in mind, as part of the study of ectomycorrhizal communities, we also collected sporemats and fruitbodies in the vicinity of the trees we sampled from (Figure 2).

Figure 4: *Cenococcum* ectomycorrhizal root tips.

Our study is not yet complete, but here I share several interesting vignettes that have come to light. Basidiomycetes were the most frequently sequenced from the root tips in both habitats (as expected), and some of these could be matched to described species or at least sequenced fruitbodies (Figure 3). *Russula* species were the most frequently sequenced in both habitats. The *Russula* depicted in Figure 3 has a sequence that matches root tips in this study, as well as root tips and fruit bodies from a previous study that Don and Silvia Yang conducted in 2006 where they determined many *Russulas* exploited by the Indian pipe plant, *Monotropa uniflora*. A number of our other sequences matched *Russula* sequences from their study, but not sequences of any described species. A distant second place for most commonly sequenced genus was tied between *Cortinarius* and *Lactarius*. Even less common: *Boletus, Byssocorticium, Clavulina, Craterellus, Entoloma, Inocybe, Laccaria, Piloderma, Pseudotomentella, Scleroderma, Sistotrema, Strobilomyces, Tomentella, Trechispora*, and *Tylopilus*.

Ascomycetes were also sequenced. *Cenococcum*, which is not known to make a fruiting body but forms a very characteristic black ectomycorrhiza (Figure 4) was ubiquitous on roots in both habitats. The cup fungi detected on roots in the Arboretum included *Hydnotrya*, two species of *Pachyphlodes*, two species of *Tuber*, and two things that we have no sequences to match to a fruitbody. From Harvard Forest we detected *Leotia lubrica* (commonly known as jelly babies) and *Elaphomyces* (hart's truffle). Cup fungi detected included *Tuber separans*, and the same species of *Tuber* (sp 46) as found in the arboretum (Figure 5). We also recovered a sequence that matches that of a lovely blue sporemat for which no fruiting body is known (Figure 6). This sporemat may be *Chromelosporium coerulescens* or a close relative.

We collected a number of truffle sporemats on the soil surface in the arboretum, but in Harvard Forest they were found on top of the leaf litter, and even on the lower trunk of trees. Although we know from other ectomycorrhizal root studies that these species colonize roots, few of their sequences were detected on the roots sampled in this

Figure 5: Ectomycorrhizal ascomycete fruiting bodies (above) and their root tips (below) left to right: *Elaphomyces muricatus* (Harvard Forest); *Pachyphlodes* sp. nov.(Arnold Arboretum); *Tuber separans* (Harvard Forest).

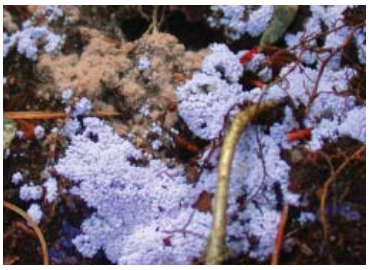


Figure 6: *Chromelosporium* cf. *coerulescens* sporemat.

study, and none of their fruiting bodies found. The only evidence of their presence using our sampling technique was their sporemats. This may be because the Pezizales tend to be patchy in their colonization of roots, so they could easily be missed during sampling. The fact that they developed on the surface of the substantial organic layer in the forest shows that the originating mycelium is capable of navigating through the root mat and litter layer from the root tip. Where do the spores from the sporemat go and to what purpose? We don't know. We now see that they are quite capable of being formed atop heavy woodland litter, but we don't know how efficient is their dispersal, and ultimate journey into the soil in a forest vs an arboretum setting.

A second mystery came to light when one of the *Tuber* species detected on roots of a native red oak in the arboretum was nearly identical in sequence to a species native to Europe, *Tuber borchii*. To our knowledge, this species has never been detected outside of cultivation in North America. Hannah Zurier, a Harvard undergraduate, recently received a Microbial Sciences Initiative to (in part) attempt to reconstruct how this truffle came to reside in the Arnold Arboretum.

A third interesting story involves another *Tuber* species. We detected a species (termed by Bonito, who is a Tuberaceae expert, as "species 46") on the roots of several trees scattered throughout the arboretum, as well as from one of the trees sampled in the forest. Our sequences match those for an undescribed species, known previously only from orchid root tips in NY and red oak root tips from an urban area in NJ. We were fortunate to recover some fruiting bodies from the arboretum so that we will now be able to describe this taxon (Figure 7). The Arnold Arboretum staff has been tasked with naming it.

In addition to further analyses of the root tip data for fungal community differences in the two types of habitat there is one final task I must do: sequence the root tip hosts to ensure that the same host was examined in all cases. Tree roots are not as easy to identify as their leaves and trunk. So, while I am busy reading the roots for their stories, I want to make sure that the oak roots are...well...red.

Figure 7: *Tuber* sp. nov. fruiting body (above) and root tips (below).

References

Brundrett MC. 2009. Mycorrhizal associations and other means of nutrition of vascular plants: understanding global diversity of host plants by resolving conflicting information and developing reliable means of diagnosis. Plant Soil 320: 37-77.

Petersen PM. 1985. The ecology of Danish soil inhabiting Pezizales with emphasis on edaphic conditions. Opera Botanica 77:1-38.

Trappe JM. 2005 A.B. Frank and mycorrhizae: the challenge to evolutionary and ecologic theory. Mycorrhiza 15:277-281.

Yang S, Pfister DH. 2006. *Monotropa uniflora* plants of eastern Massachusetts form mycorrhizae with a diversity of russulaceae fungi. Mycologia 98:535-540.

Charming *Hymenogloea papyracea*: An ideal fungus for the study of climate change

by Teresa Iturriaga, Ph.D, Research Scholar at the Farlow Herbarium, Harvard University and Departamento Biologia de Organismos, Universidad Simon Bolivar, Caracas, Venezuela

"….the most charming species with which I am acquainted" (Berkeley, 1857).

Craterellus papyraceus Berk. & M. A. Curtis

was described by Berkeley in a letter to Curtis as "one of the most beautiful fungi [he] ever saw." This was in reference to a collection made by Augustus Fendler in Venezuela. When describing the fungus, he stated that "it is altogether one of the most charming species with which I am acquainted." Impressing Reverent Berkeley must have not been easy since he had seen so many from around the world!

Between 1854 and 1858, Fendler, a German immigrant in the United States, collected botanical specimens and fungi in Venezuela. During those years he lived in Colonia Tovar, a small German colony west of Caracas. He was in correspondence with Asa Gray at Harvard University, and offered to make "15 sets" of botanical collections to be sold. He kept correspondence with many other important botanists as well, to some of which he sold sets of his collections. Moses A. Curtis, one of the few botanists studying fungi in North America at the time, purchased one of Fendler's sets of fungi and it was through Curtis that this and other specimens made their way to Berkeley.

Such impressive specimens as this might suggest to us how to deal with fungal conservation. Generally information on which fungi occur in a certain area or which substrates fruit bodies grow onto reside in herbaria. Historical collections of fungi are an important source of information; they constitute a record of when a species was collected, what it was growing on and how often it is encountered. Using collection information the rarity of a species can be assessed, as well as its geographical distribution. In the Farlow Herbarium several historical collections of Venezuelan fungi are housed. The earliest of the collectors involved was A. Fendler, who collected 304 specimens of fungi between the years 1854-1856 in the northern part of Venezuela. Exact localities for Fendler's mycological collections are not precise on labels nor have been further refined through correspondence. Presumably the fungi were collected from

Specimen of *Craterellus papyracea* in the Sprague Herbarium of the Farlow. Photo courtesy of the Farlow Library and Herbarium of Cryptogamic Botany.

the forests at la Serranía de La Costa mountain range, near Colonia Tovar, Aragua, around 1856.

Craterellus papyracea has been transferred to other genera, and today is considered to be a marasmioid fungus in the genus *Hymenogloea* (Singer 1951). Singer collected the fungus in Bolivia, in a forest at 2000 altitude, and in Colombia. Both in 1961 and 1970, Dennis collected the fungus on litter in a dense wet forest above La Mucuy, Mérida, above 2500 height, in Venezuela. It has also been collected in Ecuador (holotype of *Stereum riofrio* (Pat.) Pat.). This specimen is in the Patouillard Herbarium at the Farlow. Several collections have been made from Colombia, at 1800 m. a. s. l. (Franco-Molano, 2002), Sierra Toro (211), at 2200 m. a. s. l.

Hymenogloea papyracea is considered to be endemic to lowland and submontane Central and South America (Halling & Mueller 2002). The large size (6-10 cm diam) of the cap and its bright yellow to reddish colors make it a candidate for assessing climate change and changes in phenology.

References

Berkeley MJ. 1857. VIII. On some new Fungi. Transactions of the Linnean Society of London: 22:129-132.

Dennis RWG. 1961. Fungi venezuelani: IV. Agaricales.

Kew Bulletin 15 (1):67-156.

Franco-Molano AE. 2002. Hongos, in Mecanismo de Facilitación. In IAvH (eds.) Resultados del Segundo Día de la Biodiversidad. Filandia y quimbaya, Quindío.

Halling RE, Mueller GM. 2002. Agarics and boletes of neotropical oakwoods. Tropical Mycology 1:1-10.

Toro JDS, et al. 2011. Preliminar Report of Macrofungi (Ascomycetes and Basidiomycetes) in the Romeral's Montain Humid Forest (Angelopolis, Antioquia - Colombia). Revista Facultad Nacional de Agronomía - Medellín 64 (2):6159-6174.

Singer R. 1951. The Agaricales mushrooms in modern taxonomy. Lilloa 22:1-832.

Visitors to the Farlow from Winter 2013 - Fall 2014

We had several visitors to the Farlow over the past several months, including **Otto Miettinon** from Clark University in Worcester (by way of Helsinki) to look at polypore types, **Jay Cordeiro** from the New England Natural History Museum, **Kendra Driscoll**, **Karen Vanderwolf** and **Donald McAlpine** of the New Brunswick Museum to look at lichens, and **Valter Rossi** of the University of L'Aquila visited us again to work with Danny Haelewaters on Thaxter's Laboulbeniales.

Thaxter's Treasure Trove

by Danny Haelewaters

The earliest observations on the Laboulbeniales took place in the 1840s (Rouget 1850), but it was not until Roland Thaxter's [1858-1932] research that they were studied in depth. In 1890 he published the first in a series of twenty-one non-illustrated papers describing hundreds of new species. Although he characterized 1,260 species*, many other undescribed species are left behind in his enormous permanent slide collection of over 10,000 slides. This is mostly because he was unable to finish his work; he died before being able to publish a sixth volume of his monograph that was intended as a comprehensive treatment of the genus *Laboulbenia*. Recent interest in Thaxter's slides at the Farlow Herbarium resulted in the description of several new species of *Laboulbenia* on carabid (*L. poplitea*), erotylid (*L. erotylaria*), and chrysomelid hosts (*L. bilobata*, *L. longipilis*, *L. pfisteri*) (Haelewaters and Rossi 2014, Haelewaters and Yaakop in press). Further examination revealed yet another undescribed species of *Laboulbenia* on *Curculio* sp. (family Curculionidae) from Cameroon (Figure 1) and a beautiful new species of *Zodiomyces* on a "hydrophilid" beetle from Trinidad (Haelewaters and colleagues in prep.).

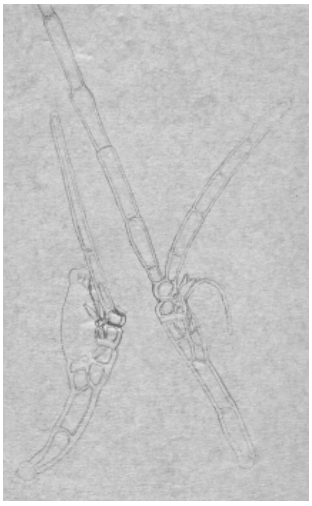


Figure 1. While Roland Thaxter left no manuscript behind for this final, sixth volume, his hand-drawn sketches are part of the archives of the Farlow Reference Library of Cryptogamic Botany. This is a scan of Thaxter's original sketch of *Laboulbenia* sp. nov. on *Curculio*. Image courtesy of the Archives of the Farlow Library and Herbarium of Cryptogamic Botany.

*Note that as of today there are 2,000 described species, not even double the number described by one man, our very own Roland Thaxter.

References

Haelewaters, D. & Rossi, W. 2014. Three new species of Laboulbenia from Roland Thaxter's backlog of slides and a brief review of Laboulbeniales associated with Chrysomelidae. Mycologia.

Haelewaters, D. & Yaakop, S. In press. New and interesting Laboulbeniales from Southeast Asia, I. Mycotaxon.

Rouget, A. 1850. Notice sur une production parasite observée sur le Brachinus crepitans. Annales de la Société Entomologique de France (Sér. 2) 8: 21–24.

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