

FRANK LAMSON-SCRIBNER: Botanist and Pioneer Plant Pathologist in the United States

James W. Hilty

Department of Entomology and Plant Pathology, The University of Tennessee,
Knoxville, Tennessee 37996; e-mail: hilty@utkvx1.utk.edu

Paul D. Peterson Jr.

Department of Plant Pathology, The North Carolina State University, Raleigh, North
Carolina 27695

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ABSTRACT

Frank Lamson-Scribner, in 1885, became the first scientist commissioned by the United States Department of Agriculture with the responsibility to study diseases of economic plants. His innovative approach established the foundation for applied plant pathology at the USDA. In an early international cooperative effort in plant pathology, he detailed the life history of the grape black rot pathogen. His early studies with the Bordeaux mixture introduced the American farmer to the modern era of chemical control. Scribner became the botanist and director of the University of Tennessee Agricultural Experiment Station. He published the first book written on the subject of plant diseases in the United States, and described a new nematode disease of potato. He asserted that the practical value of plant pathology to farmers would only follow meticulous studies of the life history of pathogens.

Introduction

Frank Lamson-Scribner, the first botanist employed by the federal government of the United States with the responsibility to investigate plant diseases, charted his course in botany from a very early age. His enduring interest and curiosity led to remarkable accomplishments in this country's fledgling science of plant pathology. He introduced the American farmer to the modern era of chemical

fungicides, and authored the first book on the subject of plant pathology published in the United States. Scribner participated in one of the first international cooperative efforts in plant disease research and helped to elucidate the life history of the grape black rot fungus. He also described a new disease of potato which resulted in one of the first publications in the United States concerning a nematode-incited plant disease. Scribner demonstrated that the value of plant pathology to practical agriculture is based on detailed scientific studies of the pathogen.

Born Franklin Pierce Lamson (1) on April 19, 1851, to Joseph Sanborn and Eunice Ellen (Winslow) Lamson in Cambridgeport, Massachusetts, he was orphaned at age 3, adopted by the Virgil Scribner family, and moved to their home near Manchester, Maine. Later, he took as his surname the hyphenated form of both his biological and adopted families. Scribner's new home, located on the eastern slope of the area called Scribner Hill, was a very prosperous farm with an apple orchard, cider mill, and fields crisscrossed by well-built stone walls, and surrounded by tree-laden slopes (30). The farm house, filled with the family's "enriching and gentle sounds of content," was a large, open structure with a great hall lined from floor to ceiling with bookshelves (12). Young Frank, his adopted sister Lillian, and their parents were active in the Scribner Hill Baptist Church, which was constructed by his grandfather, Jotham Allen, on land given by the family (30).

Scribner's mother, Isadore, had been educated in science and the classics and conducted a private school in the home. She recognized her son's inclination to learn and encouraged his early interest in natural history, particularly his interest in plants. As a young boy he had an extraordinary array of botanical works and was aware of the work of many botanical scholars. His favorite pastime was roaming the fields and woods near his home, observing the variety of plants. He was particularly taken by the wild flowers. On his 15th birthday in 1866, using Mrs. Lincoln's "Botany" (11) and maneuvering through the keys of the manual of botany by Gray (6), he identified his first plant, the trailing arbutus (*Epigaea repens* L.). He later said that learning the names and characters of those plants "quickened my observation and inspired an enthusiasm, and the number and variety of wild flowers was a continual surprise and pleasure" (28). In the spring of 1866 he collected diseased specimens from his family's garden and sent them to JB Ellis (a well-known amateur mycologist in New Jersey), who identified the pathogens as *Ophionectria* and *Cladosporium* species. Scribner claimed that "this was the beginning" of his interest in plant pathology (23).

At age 18, and still on the family farm, Scribner began his voluminous contributions to botanical literature with the publication of his first manuscript, an illustrated treatise on the weeds of Maine (10). He prepared a number of short articles for *The Maine Farmer* listing wild flowers of the season, making a floral calendar. He also published a list of ornamental and useful plants native to his

state (16). The practical and utilitarian aspect of his interests, which would continue throughout his life's work, was evident even at the beginning of his career.

Scribner received a classic preparatory education at Hebron Academy, Kents Hill School, and Coburn Classical Institute before entering The Maine State College of Agriculture and Mechanic Arts in Orono in 1870. The curriculum in elective studies allowed him to pursue his interests in botany and to continue his extensive collecting of local flora. While concentrating in systematics, as was common for students of botany in that period, he had some exposure to the rusts and smuts using MC Cooke's work (22). As a student he defrayed some of his educational expenses by teaching botany in area schools. Scribner's role model became George Vasey, an authority on North American grasses and Chief of the Division of Botany in the United States Department of Agriculture (USDA). Scribner had developed a special interest in the grasses and was overheard professing a desire to one day know as much about the subject as Professor Vasey (3).

Following graduation in 1873 he served as secretary to the Maine State Board of Agriculture for two years and before embarking on a teaching career that would last nearly twelve years. He taught botany in private classes to Bangor-area high school teachers and, in the summer of 1876, was hired to teach botany in a Summer Institute of Science at Bowdoin College. Scribner's letter of application for the Bowdoin position expressed a mature self-confidence as it asserted that he was second to none in the state in his ability to teach botany (25).

Scribner moved to Philadelphia in 1877 and remained until 1885 as an officer and teacher of botany at Girard College, a small school for orphaned boys. He became very active in a number of botanical organizations and his reputation grew. Philadelphia was a center of botanical and horticultural activity and his associates were all botanists of more than local repute (8). Concentrating on the study of the grasses and publishing extensively, he was catapulted to national prominence. His revision of the North American Melicaceae was among the most significant taxonomic works in American botany during this period (15).

During the summer of 1883 Scribner was granted a leave of absence from Girard to serve as botanist on the Northern Transcontinental Survey. His specific duty was to inventory the grasses and other forage plants in the Montana Territory. This effort, administered by the USDA, placed him in close association with George Vasey. Although Girard wished his return, Scribner, having scored well on the government civil service exam, had other plans.

The United States Department of Agriculture

In 1885, plant disease research was a new scientific venture for the USDA. The Department had reported on plant diseases and conducted scattered investigations since its creation in 1862; however, these efforts were of limited value to practical agriculture. Serious outbreaks of plant diseases and a drive to

increase yields, combined with the development of scientific plant pathology, encouraged a movement for a more substantial federal commitment to botanical research along the lines of that already devoted to entomology and animal science. In May 1885, Commissioner Norman Colman, supported by the forceful advocacy of some of the nation's leading botanists (7), appointed Scribner as an assistant in the Division of Botany for "the investigation of parasitic fungi—those species that affect injuriously our field & garden crops" (24). Thus, Scribner became the first scientist commissioned by the USDA specifically to study plant diseases. Shortly thereafter, in 1886, the USDA Section of Mycology was created in the Division of Botany and Scribner was installed as its chief.

As encouraging as the new institutional arrangement appeared, Scribner faced a precarious situation. Not only had he become part of an institution with few precedents or models for plant disease research, but he had joined an organization dedicated to practical service to farmers rather than to fundamental science. The survival of USDA plant pathology depended on the expeditious and tangible demonstration of its value to American agriculture. Scribner realized, however, that dependable, practical assistance to farmers would come only after careful scientific research. As he asserted in his first annual report, knowledge "that a disease . . . is due to a species of fungus" does not provide enough information "to advise remedies or preventives." Reliable and efficacious treatments would only follow meticulous studies of "the life history of the parasite, its method of nutrition, growth and propagation, and the varied forms or conditions under which it perfects its spores or fruit; the manner of distribution, exactly how it comes upon or enters the affected plant, and its means of continuing its existence from year to year" (17). Scribner had to find a way to fuse science with practical agriculture.

Adroitly, he increased the odds of quick success by focusing the work of his Section on the diseases of one crop, the grape. Scribner's decision was not made arbitrarily. Grape diseases, especially downy mildew (*Plasmopara viticola*) and black rot (*Guignardia bidwellii*), were among the most visible and injurious plant diseases in America during the second half of the nineteenth century. Moreover, news of French success with a chemical remedy for downy mildew had arrived in the United States during 1885, and Scribner tentatively endorsed the copper sulfate and lime treatments in his first annual report. In 1886, he positioned the Section of Mycology to take the lead in fundamental research on grape-disease fungi and the adaptation of chemical fungicides to an American agricultural setting.

Much remained to be learned about the nature of grape diseases in the United States, as well as the use of the experimental copper treatments, before the USDA could offer much useful aid to the American grower. Scribner continued with the same thoroughness and attention to detail that he had exhibited since

his youth and met this challenge with a well-developed plan. He first took advantage of existing information on grape diseases and chemicals by gathering and assimilating published research from Europe and the United States. More importantly, he began his own original investigations.

For the next two years, under Scribner's guidance, researchers of the USDA conducted valuable applied and fundamental research in the field and in the laboratory (13, 14). Scribner's program embodied a number of novel ideas. Without the facilities in-house for field trials of the different chemicals being advanced for grape diseases, he went to the American grower for assistance. This began as a series of circulars designed to gain grower cooperation for chemical testing as well as to gather statistical evidence on the range and extent of the grape diseases in the country. Later, special vineyard "stations" were established in regions hardest hit by downy mildew and black rot, with their owners designated as "special agents" for the purpose of more controlled experimentation. Information from these growers gave Scribner justification for affirming the efficacy of one of the copper sulfate remedies, the Bordeaux mixture, against downy mildew by 1887. On the other hand, black rot proved to be much more problematic.

With field work under way, Scribner shifted his attention to the life-history research that he earlier had asserted held the solution to effective disease control. For years, botanists (Scribner included) had associated black rot on the fruit (*Phoma uvicola*) and the leaf spot disease of grape (*Phyllosticta labruscae*, *Phyllosticta viticola*, etc) with separate fungi. But Scribner began to change his view of black rot during the summer of 1887 when Professor Pierre Viala of the Ecole Nationale D'Agriculture at Montpellier, a French expert on viticulture, arrived in the United States on a special mission from the French Ministry of Agriculture. Scribner's travels with Viala (who earlier had speculated that the leaf spot and the fruit rot might be from a single fungus) through different vineyard regions of the United States, along with additional life-history research in his Washington laboratory, soon convinced him that the black rot on the fruit and the leaf spot were caused by the same fungus. Moreover, Scribner found that the leaves were the initial point of infection, often exhibiting symptoms weeks before the fruit.

Scribner's clarification of the life-history of the black rot fungus had a major impact on disease control. As he revealed, the "confusion has been unfortunate from a viticultural point of view" because growers had "not troubled themselves at all about the form on the leaves" in their efforts to control black rot with copper fungicides (29). They simply had sprayed too late. Wasting no time getting this information into the field, Scribner focused experiments during the 1888 growing season at the Vineland, New Jersey, station with the cooperation of its owner, the able viticulturist, Alexander W Pearson. Impressive results

there with the Bordeaux mixture gave Scribner ample justification to announce success at last. He reported that the test at Vineland proved that “we may successfully combat the Black Rot” (19, 29).

Agricultural interests perceived the results during the 1888 growing season as a highly significant achievement for USDA plant pathology. Within three years, Scribner had lived up to the promise to American farmers to control some of their most troubling plant disease problems. He did so by showing that the value of science to practical agriculture—in this case, the study of the nature of the fungal life cycle—was central to plant disease control. In the process, he established the foundation for applied plant pathology at the USDA.

The Section of Mycology became the Section of Vegetable Pathology in 1887 with a larger appropriation and more assistants, and it would continue to grow in the coming years. Scribner had assured this prospect not only through his work on the controlling of black rot and downy mildew with copper fungicides, but also with his innovative use of growers for gathering crop health statistics and for field experimentation. He also made judicious use of circulars, bulletins, annual reports, and the agricultural press to disseminate the results of USDA plant disease research.

The University of Tennessee, Knoxville

When Charles Dabney assumed the presidency of the University of Tennessee, one of his principle goals was to reshape the institution as a modern research university. A corollary aim was to infuse the university with an emphasis on the new practical subjects of engineering and agriculture, and with Hatch Act funds, to organize the agricultural experiment station. Like many presidents of land grant universities at that time, Dabney initiated a search for someone with a practical bent to organize botanical research and service in the experiment station. In February 1888, he wrote Scribner for a recommendation: “We will not care so much what his special line of work is—whether grasses, horticultural, mycology or what, just as he is a first rate worker and his line is appropriate to the station. We want good work, and can fit the harness to the man. Will probably give him some teaching to do in botany or horticulture, but not heavy work. Where is your friend Erwin Smith? Name me a man and tell me about him” (5).

Although the job description fit a man of Scribner’s talents, he did indeed recommend Erwin F Smith (27). Smith, however, declined the offer. With USDA plant pathology launched successfully, and able scientists like Beverly T Galloway, EF Smith, and Effie A Southworth on staff, Scribner accepted the position. In November of 1888, with his wife Ella and four children, he moved to Knoxville and became professor of botany and horticulture and botanist to the agricultural experiment station of the University of Tennessee, joining a notable

roster of pioneer plant pathologists taking positions in the new state experiment stations. The Tennessee position offered considerable latitude, and being well-grounded in botany in the broad sense, Scribner was fully appreciative of the needs of agriculture. Scribner's task at the university was not unlike the one he had faced in Washington, although the university climate was more conducive to plant pathology at the outset.

The facilities at the University of Tennessee were probably superior to those Scribner had utilized while at the USDA. The better facilities, together with a higher salary, may have been major enticements in luring him away from the USDA. The experiment station was housed in a new building, and as Scribner wrote to an acquaintance in Nashville, "There will be a laboratory supplied with microscopes and other accessories open to the students, and we are now considering the purchase of the best helps in the way of botanical books. I shall have a private office or laboratory, and a culture room for botanical investigations and the study of the parasitic fungi" (26).

This was a new era at the University of Tennessee, and Scribner immediately set out to mold the place into a leading center for botany in the South. It was a fortuitous union and the university benefited greatly from his USDA experience. Scribner knew that he could make immediate and great strides in the experiment station by embracing his areas of expertise: plant disease control and taxonomy of the grasses. His work took on a broad approach that eventually encompassed research, teaching, public service, and administration. Within two years Dabney had appointed him director of the experiment station, a position he would hold simultaneously with that of leader of the botany division. Every moment was devoted to his work and even his spare time was spent collecting and cataloging plants to build one of the largest herbaria in a southern university.

Scribner continued the practice of making direct contact with growers. He led the effort to organize them into the East Tennessee Horticultural Society and made lists of each person's needs and special interests. Numerous field trips were made to enlist cooperators and to establish demonstration experiments to advance the understanding of diseases. He provided instruction on the use of the knapsack sprayer and emphasized the adoption of copper fungicides. Scribner's popular-styled manuscripts appeared in experiment station bulletins and, in most instances, he avoided the use of Latin names and concentrated on life cycles, detailed descriptions and symptoms of the common diseases, and control measures. Most of his pathology research continued to focus on grape diseases and was purely of an applied nature. On the university farm he established a vineyard containing nearly 80 cultivars to ascertain what degree of resistance to diseases might be present and to further demonstrate the success of the copper fungicides.

Within two months of this arrival in Tennessee, Scribner described an apparently new disease of the Irish potato in the United States. Tubers harvested from the University farm had developed numerous eruptions or pimples over the surface. The cells beneath the surface were somewhat withered and his microscopic examination revealed nematodes in several stages of development. Scribner thought that his specimens were *Tylenchus devastatrix* (= *Ditylenchus dipsaci* Kühn) as described by Kühn (9). He named the disease "potato pimples." He speculated that the university soils were initially infested by planting infected "seed," and issued a warning against using such tubers for future planting. Because the life history of potato nematode was unknown, he advised that there was no other course for treatment other than to refrain from planting potatoes in the infested soils.

Gotthold Steiner, principle nematologist with the USDA, in 1943 examined the same symptoms on potato from Tennessee and determined the cause to be a meadow nematode, and noted that Scribner's drawings were clearly those of a *Pratylenchus* species. Steiner thus named the nematode *Pratylenchus scribneri* Steiner (31). Scribner's work (20), among the first published in the United States, was a pioneering effort in plant parasitic nematology.

Illustration and attention to detail played a very important role throughout Scribner's life. He was probably self-taught in rendering drawings of remarkable reality from microscopic observations. His splendidly detailed camera lucida drawings of plant disease symptoms and mycological features communicated his research to a vast audience. His manuscripts were resplendent with his art. Scribner's father, who was also a professional photographer, and the frequent visits of the noted photographer and artist Wallace Nutting to his boyhood home, undoubtedly influenced his talents with the camera, which later was an important tool in his work. For his illustrations, he made numerous modifications in apparatus and lenses, many of which were tailored to his specifications (18).

Scribner was known as a vigorous teacher who was dedicated to his subject. He taught botany in the "modern style," emphasizing the "laboratory method." He presented the first lectures in vegetable pathology in a course entitled, "Thallophytes, with special attention to fungi of economic importance." The new courses nudged aside the traditional emphasis on systematic botany. Scribner's methods promoted independent study and allowed original investigations of plant diseases and the pathogenic fungi. Students were expected to "devote considerable effort to technical details and work of a purely scientific character," and "all made to serve practical ends." In general, he made botany a more useful subject for Tennessee agriculture. In keeping with his ability to recognize talented people, he hired Samuel M Bain as his assistant. Bain together with Samuel Essary would perform pioneer work with clover anthracnose and disease resistance (2).

The immense popularity of Scribner's work with the Bordeaux mixture and the USDA Bulletin No. 2 prompted him to author a monograph, "Fungus Diseases of the Grape and Other Plants and Their Treatment" (21). It contained accurate, excellently illustrated, and well-written descriptions of symptoms with recommendations for control. Published in 1890, this was the first scientific book on the subject of plant diseases written in the United States. It answered Charles Bessey's call of ten years earlier for the country to join the French and Germans and "give us a treatise on diseases," and avoid the proliferation of "disconnected papers" (4).

Scribner's tenure at the university came to a close in June of 1894 and from this point his attention was directed away from plant pathology. He returned to Washington to become leader of the newly formed Division of Agrostology within the USDA. When Secretary of Agriculture J Sterling Morton received funds for the new division, he sought the most capable person to study and promote the grasses, and he polled the country's top botanists. Their overwhelming recommendation was Scribner, which spoke well for his standing among his colleagues. He remained leader of the Division until 1901 when he was made Chief of the Insular Bureau of Agriculture for the Philippine Islands. He remained in Manila until 1904, tackling the meticulous details of improving island agriculture. Shortly after returning to the United States, he changed his career direction completely when he was appointed as a member of the Government Exhibit Board by the President of the United States. He organized and presented agricultural exhibits for the government at numerous expositions throughout the world, even beyond his retirement in 1922.

Scribner was a vigorous supporter of many botanical organizations throughout his career. He was a charter member of the Botanical Society of America and was honored as a Fellow in the American Association for the Advancement of Science. For his contributions to the study of grape culture and expanding the use of Bordeaux mixture, the French government, in 1890, honored Scribner by awarding him the title Chevalier du Mérite Agricole and presenting him with the Chevaliers' Cross. The University of Maine in 1922 conferred upon him the honorary LL.D in recognition of his contributions to science.

Scribner spent the last years of his retirement in Washington continuing to enhance his reputation as a photographer, illustrator, and taxonomist, and making frequent visits to his colleagues in the USDA. He died on February 22, 1938, and was survived by his second wife, Marjorie Lamson-Scribner, a daughter, and two sons. Dr. Albert Woods, a colleague in vegetable pathology, said of Scribner, "He was straight as an arrow, clear of vision and intellect, interested in his work of collecting and writing until the day of his death."

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