Hermann Von Schrenk and the Rise of Forest Pathology in the United States

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At the turn of the twentieth century, forest pathology first appeared as a new specialty of the discipline of phytopathology in the United States. With origins in Europe in the middle of the nineteenth century, forest pathology manifested itself in the United States as a scattered collection of essays before becoming a recognized subdiscipline by the first decade of the twentieth century. It emerged primarily from the confluence of two sources: taxonomic mycology and the growing conservation movement. In this review, we will examine one individual, botanist and mycologist Hermann Von Schrenk (Fig. 1), who personified the rise of this new specialty through his research on the diseases of trees for the United States Department of Agriculture (USDA). Von Schrenk's career also provides timely lessons by demonstrating that the issues created by the interactions of plant pathologists and industry were present from the early history of the science.

Forest pathology began in Germany during the nineteenth century, primarily through the efforts of the Hartigs. In 1833, Theodore Hartig, forester, educator, and son of G. L. Hartig, chief forester of Prussia, published a report on the effects of mycelium in wood. In tune with the dominant biological theory of spontaneous generation, T. Hartig deduced that the fungi were the result rather than the cause of rotting wood. Nevertheless, the report served to illustrate the destructive nature of fungi. In the 1870s, Robert Hartig, son of Theodore, did foundational research on the etiology of tree diseases caused by fungi and related fungi to the cause of wood deterioration. Through his textbooks and teaching, Hartig established the basis of forest pathology (15).

Forest pathology, however, developed more slowly than other aspects of plant pathology, particularly in the United States, due in large part to the different level of interest in the health and preservation of

trees versus crops grown for food and fiber. Ornamental and forest trees failed to garner much interest, but orchard fruit trees did attract a great deal of attention from the earliest days of plant disease studies because of a myriad of diseases such as fire blight and peach yellows that plagued them. The most notable early work on forest tree diseases in the United States came from William Farlow, the gifted Harvard mycologist, who studied in the early 1870s with Anton DeBary and was certainly aware of the botanical trends in Germany. After he returned to the United States in 1879, Farlow lectured and wrote on "Diseases of forest trees." This paper, however, was his single contribution to the field until 1891, when he wrote the article, "Diseases of trees likely to follow mechanical injuries" (4,5). Farlow's work did not represent the full extent of American interest in tree diseases, but it certainly reflected the most scientifically advanced knowledge available. It also revealed a large degree of attachment to classical mycology at a time when plant pathology was shifting in a more applied direction, particularly at the USDA and the state agricultural experiment stations.

The publication of "Diseases of shade and ornamental trees" by Beverly T. Galloway and Albert F. Woods in the *USDA Yearbook* for 1896 marked the first serious foray into forest pathology by America's foremost institution of agricultural research. The *Yearbook* paper by Galloway, chief of the Division of Vegetable Physiology and Pathology, and Woods, his top deputy, highlighted ongoing attempts by the USDA to collect data on tree diseases. The article was intended only as a brief introduction to the young field of forest pathology, although it did provide some cultural control information. The paper aroused a noticeable interest in tree diseases, as indicated by the large number of requests for information and specimens (37).

For the next several years, the USDA maintained an interest in tree diseases, but the inclusion of forest pathology as a truly significant area of USDA pathological research would have to await the next century. By 1900, the demand for concerted attention to tree diseases came conspicuously "from owners of forest and shade trees" as well as "superintendents of

parks and streets" (6). The Secretary of Agriculture declared that "the rapidly growing interest in forestry problems has created a widespread demand for information as to diseases affecting trees, and in recognition of this fact the work has been pushed forward as rapidly as possible" (36).

The growth of forest pathology can be seen as part of an overall expansion of the Department's attention to forestry, in part sparked by a national rise of interest in conservation (21). This trend was highlighted by the appointment of the legendary Gifford Pinchot (Fig. 2) as chief of the Division of Forestry in 1898. Pinchot was a national figure of growing influence, and he, more than any other American, would frame the definition of the Conservation Movement of the early twentieth century. Unlike the understanding of "conservation" today, Pinchot's concern for conservation was to understand and monitor natural resources, not for the pur-

Fig. 1. Through his research on forest tree diseases and timber preservation for the U.S. Department of Agriculture, Hermann Von Schrenk was instrumental in establishing forest pathology in the United States during the late nineteenth and early twentieth centuries. Photo courtesy of the Hunt Institute for Botanical Documentation, Carnegie Mellon University, Pittsburgh, PA.

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pose of preserving natural areas in a pristine condition, but so that natural resources like timber could be used in a wise and well-regulated way. While he loathed the wasteful exploitation of timber by industrial interests, his intention was to manage their cutting wisely rather than to declare forests off-limits (19).

This was a time known as the Progressive Era, when the uncontrolled growth of industry was seen as a potential threat to natural resources, which for the first time were feared to be limited. As a quintessential representative of this era, Pinchot felt that the only institution able to act as a rational steward of national resources was the federal government. Seeking to understand the diseases of forest trees was a natural part of the Progressive concept of conservation, although not an item high on Pinchot's priority list. It is, in fact, indicative of the relatively low priority of forest pathology in the mind of the nation's chief conservationist that tree diseases merited only one brief mention in his autobiography. That one mention, however, made note that "field studies of some of the more destructive diseases were already being made" by Hermann Von Schrenk (18).

In 1899, Hermann Von Schrenk was an instructor in botany at the Henry Shaw School of St. Louis and had just become a special agent for the USDA's Division of Vegetable Physiology and Pathology to study tree diseases. Von Schrenk's educational background made him well qualified for a USDA position. Born in College Point, Long Island, New York on 12 March 1873, he was encouraged to pursue an early interest in plants by his father, an instructor of botany, physics, chemistry, and physiology at the nearby Hoboken Academy. After attending the Hoboken Academy and the Oswego Normal School of New York, he entered Cornell in 1889, where he focused his studies on botany under the guidance of Albert N. Prentiss. Von Schrenk also studied cryptogams with George F. Atkinson and William R. Dudley. Each of these professors played an important role in the growth of plant pathology in the United States. In 1893, Von Schrenk earned his B.S. with a thesis entitled "Parasitism of *Epiphegus Virginia*" or broom-rape (3). Von Schrenk decided to follow his studies at Cornell with a year of botanical instruction at Harvard under notable plant physiologist George L. Goode and William Farlow. He earned an A.M. degree in 1894. Perhaps his studies with Farlow at Harvard stirred Von Schrenk's interest in forest pathology as he became aware of the work of Robert Hartig.

In 1895, William Trelease, another Cornell and Harvard alumnus who was then the Director of the Missouri Botanical Garden in St. Louis and George Englemann Professor of Botany at Washington University, assisted in locating a position

for Von Schrenk as an instructor in biology at the Manual Training School of Washington University. Trelease, a botanist of national repute, became Von Schrenk's friend, confidant, and supporter. In 1897, with Trelease's help, Von Schrenk became an instructor in botany at the Shaw School in St. Louis, a position he would hold for 6 years.

Von Schrenk rapidly became more involved in research on tree diseases. His early focus was on cypress, cedar, and pine trees, and his approach was descriptive rather than experimental. In 1898, he presented a paper, "Notes on some diseases of southern pines," at the annual meeting of the American Association for the Advancement of Science (24). The next year, the same year in which he earned his Ph.D. from Washington University, he published "A sclerotoid disease of beech roots" in the *Missouri Botanical Garden Tenth Annual Report* (25). His dissertation was on a heart rot problem and was entitled "A Disease of *Taxodium distichum* known as peckiness, also a similar disease of *Libocedrus decurrens* known as pin-rot" (26).

It was also in 1899 that Von Schrenk became associated with the USDA, thanks in part to the intercession of Louis H. Pammel, a fellow Washington University Ph.D. candidate and professor of botany at the Iowa Agricultural College. Pammel, a specialist in plant disease research, had been working as a special agent of the USDA since 1889. Pammel recommended to Galloway that an arrangement be devised for Von Schrenk to study tree diseases. On 1 July 1899, Von Schrenk was appointed as a USDA special agent to con-

duct investigations relating to diseases of forest and shade trees while he maintained his position as instructor in botany at the Shaw School (2).

For the first several years of his assignment, Von Schrenk served as a USDA special agent for the Division of Plant Physiology and Pathology, and to an increasing degree, for the Division of Forestry. The USDA special agent system was an institution passed down from the earliest days of federal plant pathology. In 1885, Frank Lamson Scribner became the first federal employee assigned to study and ameliorate the plant diseases that plagued American farmers, but he found himself with limited personnel, laboratory space, greenhouses, and field sites. To overcome these limitations, he turned to the very agriculturists he was charged with serving. Scribner knew that the United States had an active segment of growers interested in how science could improve agriculture, so he solicited their labor and land for use in experiments. These grower "special agents" helped make notable breakthroughs in plant disease control, particularly in the field of fungicidal sprays (17). However, under Scribner's successor, Beverly Galloway (Fig. 3), the range and complexity of federal plant pathology expanded beyond the grasp of volunteer growers. Galloway had budgets and institutional support far greater than Scribner's, so he scoured American colleges and agricultural experiment stations for the best talent in the expanding discipline of plant pathology. Even if he could not afford to hire them permanently, he offered them temporary contracts as special agents to study specific disease problems, and quite often these

Fig. 2. As much as any single individual, Gifford Pinchot, an ardent champion of the early Conservation Movement in the United States, guided the rise of forestry at the U.S. Department of Agriculture at the turn of the century. Photo courtesy of the Forest History Society, Durham, NC.

Fig. 3. As an administrator and scientist, Beverly Galloway was arguably the most influential figure in the early growth and development of plant pathology and the plant sciences in the U.S. Department of Agriculture. Photo courtesy of the National Archives.

contracts would eventually become staff positions. He also expanded the number of special agents by developing cooperative research programs with other institutions. In this way, Galloway created a widespread corps of special agents, directly or indirectly controlled from Washington, situated around the country and dedicated to researching an ever growing variety of plant disease subjects (16).

In Von Schrenk's dual capacity as a special agent for the bureaus of Plant Industry and Forestry, he single-handedly launched the study of forest tree diseases on a na-

tional level. His research centered on forest fungi and decays in timber trees, reflective of ongoing work in Europe, and included reconnaissance trips into major timber regions. Soon after his appointment, two pioneering USDA bulletins appeared: "Two Diseases of Red Cedar, caused by *Polyporus juniperinus* n. sp. and *Polyporus carneus* Nees" and "Some Diseases of New England Conifers" (28,29). They were followed by a summary paper published in the *USDA Yearbook* for 1901 entitled "Fungous diseases of forest trees." All three publications emphasized the

largely uncataloged destruction of forest trees by fungi that rendered them "unfit for lumber" and the paucity of forest pathology research in America (27).

The USDA's primary objectives of using scientific research to foster applied benefits for agriculture appeared to fit well with how Von Schrenk viewed his mission as a special agent. He told an audience in February 1901, "To see that the work of the laboratory is of direct practical application is often a source of pleasure to the scientific man" (3). In USDA Bulletin 25, he insisted on a shift from existing mycological studies in the United States that had mostly considered "fruiting structures" of forest-tree fungi to the "effects which they bring about." If these effects were understood, he held, then a rational approach to forest management, such as Pinchot advocated, could be implemented. Focusing on a number of *Polyporus* spp., for example, Von Schrenk, in these early papers, described some of "the characteristic changes which their mycelia induce in the wood of trees in which they grow," and he offered practical solutions to counter these effects (28). Above all, he warned lumbermen to be aware of diseased and dead trees and not to be hesitant about culling large tracts for the good of the whole plantation. He also advised growers to harvest trees before old age to prevent destruction due to insects and fungi that commonly attacked older stands.

Secretary of Agriculture James "Tama Jim" Wilson was impressed with the initial work from Von Schrenk, and he authorized in 1901 the creation of the Mississippi Valley Laboratory in St. Louis for research not only on forest trees but also on fruit trees and ornamentals. The Mississippi Valley Lab was a joint venture of the USDA and the Shaw School of Botany in cooperation with the Missouri Botanical Garden. Von Schrenk was placed in charge. In addition to his assignments from the newly created Bureau of Plant Industry, he also served as Timber Agent for the Division of Forest Products in the Bureau of Forestry (7,12).

With the new laboratory came additional staff. When the USDA sent Von Schrenk to Europe in early 1902 to study methods for controlling forest tree diseases and treating construction timber, two staff members, George Hedgcock and Perley Spaulding, were added to the new laboratory. Hedgcock, a native of Illinois, had earned his bachelor's degree under the well-known American botanist Charles Bessey at the University of Nebraska. Spaulding had studied plant pathology with L. R. Jones in Vermont and had earned his undergraduate degree in 1900. Both men would receive their Ph.D. degrees in 1906 from Washington University in St. Louis (12,23).

Research at the Mississippi Valley Laboratory was conducted along two main lines after 1902. The first area involved the

Fig. 4. Illustrations of mycelium and fruiting bodies of the "blue" and "red-rot" fungi from Von Schrenk's research on diseases of western yellow pine in the Black Hills Forest Reserve of South Dakota. From H. Von Schrenk, 1903, The "Bluing" and the "Red Rot" of the Western Yellow Pine, with Special Reference to the Black Hills Forest Reserve, USDA, Bureau of Plant Industry, Bulletin 36, Washington, GPO, Plate VII.

study of diseases of fruit trees such as apple crown gall and bitter rot. The second and more unique area of research focused on fungal pathogens of live trees and structural timber. Von Schrenk remained the principal investigator on forest fungi and decays in timber trees, although both Hedgcock and Spaulding contributed important early work. Von Schrenk pioneered research on diseases of the catalpa, white ash, pine, redwood, and red gum. One particularly significant area of timber investigation involved explorations by Von Schrenk and Hedgcock into the understanding and control of the staining of sapwood and lumber by fungi, with Von Schrenk doing some of the earliest work on the “blue stain” of the western yellow pine (Fig. 4). Responding to reports of nearly 600,000 board feet of timber affected in the Black Hills Forest Reserve of South Dakota, he found that the fungus, *Ceratomyces pilifera*, followed the attacks of beetles and resulted in a blue coloration of the wood (31). Later, Hedgcock performed important cultural studies of wood-staining fungi and experimented on their control through chemical dips (8,14). Perley Spaulding also made significant strides in the culture of wood-decaying fungi and initiated major studies on damping-off of conifer seedlings that would lead to the first successful use of inorganic acids for disease control (10,22,32).

With time, Von Schrenk became increasingly interested in the chemical preservation of wood from an engineering and business perspective. He had been exposed in the late 1890s to wood preservation technology through his acquaintance with John Johnson, professor of civil engineering, and Gelent Alleman, instructor of chemistry, in St. Louis. By the time he delivered his paper “Factors which cause the decay of wood” before a meeting of the Western Society of Engineers on 6 February 1901, Von Schrenk “had definitely turned his attention to the subject of railroad ties as a natural extension of his studies of the diseases of trees” (3). He also had gathered more advanced information on the impregnation of timber with chemical preservatives during his European trip in 1901. The next year, he wrote Bureau of Plant Industry Bulletin 14, “The Decay of Timber and Methods of Preventing It,” highlighting the “annual destruction by decay of forest timber and of timber used for construction purposes...” as “one of the greatest drains on the timber resources of the country” (30). Two years later, at the 1904 World’s Fair, his advocacy of creosote for the preservation of railroad cross ties was heralded as a major event (Fig. 5).

It was only natural that timber and lumber interests would come to see the value of this research. Railroad managers, in need of vast quantities of cross ties to keep up with the rapidly expanding track mile-

age in the West, were particularly impressed. By 1903, railroads and other timber-using companies had begun to underwrite the federal research on timber decay (9).

Von Schrenk’s shift in focus to engineering and business had major consequences for his career and influenced the direction of events for forest pathology in the USDA. Research priorities became a major issue of contention between Von Schrenk and his superiors in Washington as his strong ties to industry troubled both Pinchot and Galloway. Pinchot’s vigorous beliefs about government’s role in safeguarding the nation’s natural resources from short-sighted industrial concerns were well known, and he took pride that his bureau was in the forefront of conservation. He later wrote that “it is the honorable distinction of the Forest Service that it has been more constantly, more violently and more bitterly attacked by the representatives of the special interests in recent years than any other Government Bureau” (19). Von Schrenk’s close ties to industry, particularly the railroads, led to Pinchot’s desire to dismiss him. However, Galloway stepped in, fearful of an embarrassing public row and, true to his political nature, offered to remove the controversial pathologist from the rolls of the Division of Forestry and leave Von Schrenk totally under the Bureau of Plant Industry. Galloway, however, had become increasingly disturbed by the ties of federal plant pathology to private industry, confiding to his assistant A. F. Woods that “I do not see how we can accept money from the railroads without laying ourselves open to criticism in a number of directions” (11). The conflict between Von Schrenk and the

two administrative colossi raged for 2 years. Pinchot did not want Von Schrenk to be involved in any federal research on timber, particularly timber preservation. Galloway rejected this extreme solution, but he did demand that Von Schrenk refuse all research funding from railroads as he attempted to prevent his pathologist from further antagonizing the powerful Pinchot.

For his part, Von Schrenk continued to pursue his research and maintained close ties with the railroad and timber industries. The fluid situation in Washington concerning his future sometimes resulted in confusion and an interruption of funding (20). In March 1905, Von Schrenk wrote to A. F. Woods to complain that timbers he had requested from local business interests were going to waste because the “money for carrying on these tests is now in the hands of the Bureau of Forestry in Washington and without some funds we cannot carry on this work.... While you are making investigations, I would likewise like to know whether I am going to get any salary from the Bureau of Forestry. Everyone has received their salary for the month of February except myself” (34). Von Schrenk began to search for creative ways to bolster his finances, floating the idea of approaching “outside interests” to fund the construction of a “large laboratory” with the cooperation of the Missouri Botanical Garden, from whom he also was seeking “some sort of honorary connection” (35). The plans for this laboratory came to nothing, but Von Schrenk continued his work as best he could.

Finally in 1907, the situation came to a critical juncture over an issue more significant than apparent conflicts of interest—the control of forest pathology itself. Pin-

Fig. 5. Logs treated with creosote to preserve the wood from decay. From H. Von Schrenk, 1907, Sap-Rot and Other Diseases of the Red Gum, USDA, Bureau of Plant Industry, Bulletin 114, Washington, GPO, Plate V, Fig. 2.

chot made public his wishes that the Forest Service assume all forest pathology work. This galvanized Galloway, who was normally disposed to gradual political accommodation, to begin acting with great dispatch. He wrote to Von Schrenk that the Bureau of Plant Industry did not intend to lose forest pathology, but expected to cooperate with Forestry in order to conduct meaningful research. "The Forest Service," Galloway said pointedly, "was very frank in stating that the difficulty, so far as they were concerned, lay in their ability personally to cooperate with you" (3). Therefore, the Mississippi Valley Lab was to be closed and its operations brought to Washington. Galloway expressed the desire for Von Schrenk to come to Washington and take up the work, assisted by Ernst Bessey. This was obviously a half-hearted invitation given the fact that he had just explained that the Forest Bureau refused to work with Von Schrenk.

Rather than leave St. Louis, his home of many years, Von Schrenk chose to leave federal service. He wrote to his friend and colleague R. A. Harper of the University of Wisconsin that (33):

I beg to say that I have almost definitely decided to sever my connection with the Bureau of Plant Industry, and am making efforts at the present time towards establishing myself here in a consulting position. There have been many developments...which made remaining in the Government service almost an impossible matter for anyone anxious to do independent scientific work. I am very glad to have come to this conclusion, because I expect to have a pretty good time from now on.

Fig. 6. Hermann Von Schrenk later in his career. Photo courtesy of the Missouri Botanical Garden, St. Louis, MO.

Von Schrenk was thus left behind as federal forest pathology shifted to Washington. His career was by no means over, however. He was recruited by Harper to join the staff at the University of Wisconsin, but he chose to stay in St. Louis as the pathologist for the Missouri Botanical Gardens (13,33). His abandonment of federal service also freed Von Schrenk to continue in private industry the work on which he had been concentrating: the care and preservation of timber. He no longer had to concern himself with placating the competing interests of Washington. He quickly joined numerous railroads like the Rock Island, the Santa Fe, and the Frisco System as a timber consultant at a salary far above his government stipend. He traveled the nation for the railroads and continued to lecture on timber issues at prestigious venues such as Yale and the Biltmore School (1,3).

Von Schrenk's career highlighted several trends in the development of plant pathology around the turn of the century. The first was the development of subspecialties in the science of phytopathology such as bacteriology and nematology. Forest pathology fit well into this model of professional expansion. From its roots in taxonomic mycology and the resource management concepts inherent in the early conservation movement, forest pathology arose to explore the destructive diseases of forest trees, their understanding and control. By so doing, this subdiscipline might aid in the rational management of timber resources. This led to another trend of early twentieth century plant pathology seen in Von Schrenk's work, that of the growth of agribusiness and the potential controversies involved in performing objective research based on funding from interested industrial parties. Or, more precisely, the issue was that of cooperation between government, with its assumption of conducting research for a higher goal of the public good, and industrial concerns linked to research with a profit motive. This dichotomy was particularly strong in terms of forest trees, which were often located on public lands but were being utilized by private concerns. In Von Schrenk's case, the situation was settled by his moving, perhaps through nearly forcible relocation, into private industry. The inclusion of direct research in private industry was, in itself, a developing trend in plant pathology for the twentieth century.

On 1 July 1907, the Laboratory of Forest Pathology was established in Washington. Hedgcock and Spaulding were brought from Missouri, and Haven Metcalf, state botanist of South Carolina and former associate professor in botany and bacteriology at Clemson Agricultural College, was named pathologist-in-charge (2). Metcalf and his staff of federal forest pathologists would soon be involved in monumental work that would cement the place

of their specialty, particularly in a governmental context, in the larger scientific discipline. Prior to 1920, the United States experienced epidemics of massive proportions involving tree diseases, notably chestnut blight and white pine blister rust. These diseases would ingrain themselves in the public consciousness by forever altering the appearance of the North American landscape. As much as any other single event, these epidemics would force forest pathologists into a place of prominence that no one could have anticipated during the difficult days around the turn of the century when forest pathology rested almost solely in the hands of Hermann Von Schrenk (Fig. 6).

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