Mycology and Plant Pathology in Iowa from 1854 to 1974

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A historical survey such as this cannot be satisfying to the author. It demands too much compression of the incompressible and dictates deletion of many interesting incidents. A mountain of file cards and notes may translate into a tedious listing of authors, titles and sources. It may, on the other hand, capture the spirit of the times and the people. This summary of mycology and plant pathology in Iowa from 1854 to the present tries to do the latter. It is documented sparsely and informally, with most of the information coming from the *Proceedings of the Iowa Academy of Science*, and the *Records and Proceedings* of the Iowa Society of Agriculture. W. F. Buchholz and Jack Wallin wrote a very interesting and inclusive record, "Plant Disease Research and Extension in Iowa," published in the June, 1951, *Plant Disease Reporter*. This report is a rich source of information and was used extensively in writing this paper.

The disciplines of mycology and plant pathology have been closely intertwined throughout history. Fungi are the most destructive plant pathogens, and dreaded plant diseases such as late blight of potato, rust of wheat and other cereals, ergot of rye, downy mildew of grape and the common rots of potatoes are all fungus diseases. When the early pioneers came to Iowa and began breaking the prairie, the diseases which had plagued them before were soon to harass them again.

Farming was becoming increasingly important in eastern Iowa in the 1850's, and in 1854 the Iowa State Agricultural Society was formed. In the first issue of the *Records and Proceedings* of the Society, there is no mention of fungi nor of plant diseases. George Dixon, in his address to the Society in October, 1854, quoted from the objectives of the Royal Agricultural Society of England. He referred to destruction of insects injurious to vegetable life, to the eradication of weeds, to promoting the discovery of new varieties of grain and other vegetables and to collection of information with regard to the management of wood plantations and fences, but there was no direct reference to plant disease nor fungi. This may seem strange, but the great discoveries of such men as Paster, Koch, deBary and Millardet were still in the future and plant diseases were feared but poorly understood. The Irish potato famine was just then subsiding and possibly some of the farmers of eastern Iowa were immigrants fleeing the disaster in Ireland.

In 1855, the *Records and Proceedings* of the Society carried summaries of farming activities from some of the counties of the state as well as the winners of the prizes given at the State Fair. In 1856, incidental references to plant diseases can be found. LeGrand Byington of Johnson County noted that "Spanish wheat" rusted badly and his data indicated a yield of about one-fourth of the yield of other varieties. Potatoes were of excellent quality, "there being lately no complaint of the much dreaded rot." The Mahaska County report of 1857 mentioned blight on apple trees as well as reporting an astounding 138 bushels of corn per acre. In subsequent years, the number of references to plant disease increased with more and lengthier discussions of mildew of grape, potato rot, rusts and blight of apple.

Occasionally personal prejudice intruded into the reports. One example is that of L. J. Young whose somewhat dour report of agricultural possibilities in Chickasaw Country was concluded with a criticism of the buying and misuse of farm machinery. Among his pithy comments were: "a mowing machine is a very costly implement for leveling down bogs, uprooting grubs and digging stones" and "agricultural implement dealers have done more to retard progress of Chickasaw County than wet seasons and dry seasons and early frosts and war."

Agriculture continued to grow in Iowa, and in March of 1858 the General Assembly passed an act establishing a "State Agricultural College and Model Farm to be connected with the entire agricultural interests of the State." The first students came in October of 1868. In December of 1869 the position in botany and horticulture was offered to Charles Edwin Bessey of Michigan Agricultural College, and he began his work as Instructor of Botany and Horticulture and secretary of the faculty. Bessey was to devote a lifetime to botany at Iowa State and Nebraska and become one of the most highly regarded plant taxonomists. His first botany student was J. C. Arthur, whose later work on the rusts appeared as the classic books *The Plant Rusts and Manual of the Rusts of the United States and Canada*. J. C. Arthur graduated in the first class in November, 1872, and later, in 1877, received the first master's degree from Iowa State College.

Dr. Bessey published the first paper on plant pathology in Iowa in the Sixth Biennial Report of the College. The publication dealt mostly with rusts and smuts and was entitled "On Injurious Fungi." Dr. Bessey collected fungi as well as other plants and established the Iowa State Herbarium containing flowering plants and fungi. He worked on rusts and wood deteriorating fungi, and also helped teach the veterinary medicine students the "rudiments of medical botany."

Bessey was a prodigious worker, and in addition to his research, teaching, and administrative duties, he helped establish the Iowa Academy of Science in 1875. In 1884 he moved to Nebraska.

Dr. L. H. Pammel became the head of the Department of Botany and Bacteriology at Iowa State in March of 1889 and published two papers on diseases of fruit trees in Volume 1, part 1, of the *Proceedings of the Iowa Academy of Science* in 1890. Pammel, like Bessey, was a man of broad interests and accomplishments. His major interests were in the fields of taxonomy and economic plants, but he contributed fourteen papers on plant diseases to the *Proceedings of the Iowa Academy of Science*. He also described *Xanthomonas (Bacillus) campestris* as the cause of black rot of rutabaga in 1895 and *Helminthosporium sativum* as the cause of barley blight in 1911.

Pammel and Charlotte King in 1909 published a significant and detailed paper, "Notes on Factors in Fungus Diseases of Plants, with Records of Occurrence of Plant Disease at Ames for a Period of Twenty-Five Years." Pammel's records from 1889 to 1909 had noted prevalence of 81 plant...
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A summary of these records and such evidence as was available from the previous years back to 1870 are included in this paper. Much of the evidence of those earlier years must be credited to Charles Bessey and Byron Halstead. Pammel began the practice in 1904 of having farmers and horticulturalists report plant diseases in their areas. This has grown into the Iowa Plant Disease Survey. It is apparent at this point that Pammel recognized the importance of plant diseases.

This concern with plant diseases resulted in the employment of Dr. L. E. Melhus in 1916 to be the first full-time plant pathologist. Pammel had developed the first plant pathology course, Botany 66, and Melhus taught this course. Melhus was to play an increasingly dominant role in plant pathology in Iowa for the next 35 years.

Pammel reported in 1919 on barberry in Iowa and adjacent states. The disastrous wheat rust epiphytotics of 1916 and 1917 had stirred great concern regarding wheat rust. Stakman's work in Minnesota had elucidated physiologic specialization in the rust pathogens, and the importance of control of barberry was becoming evident. Pammel served as president of the Iowa Academy in 1892-93 and also in 1923-24. His presidential speech in 1924 was published in the Proceedings. It was a history of botany in Iowa, and is an interesting document which is recommended. He retired as head of the Department of Botany and Plant Pathology in 1928 and was succeeded by Melhus.

Meanwhile, at The University of Iowa, Dr. Thomas H. Macbride was making remarkable contributions to the studies of botany. He published five papers on fungi in the Proceedings of the Iowa Academy of Science in the period 1895 to 1923, and several more in the University of Iowa Bulletin of Laboratories of Natural History. His collections of homobasidiomycetes were the subject of some of these papers, but he also published papers on his collections of his favorite group of fungi, the slime molds, from the Black Hills and New Mexico. His book, The North American Slime Molds, was published in 1899. Macbride was the first president of the Iowa Park and Forestry Association, which later became the Iowa Conservation Association. This organization was active in early conservation efforts in Iowa. He served as president of the Iowa Academy of Science in 1897. A scholarship endowment for students attending the summer sessions at Iowa Lakeside Laboratory still perpetuates his memory. Macbride submitted his last paper concerning fungi in 1923. It was entitled "A Collection of Fiji and New Zealand Myxomycetes." We can only imagine how much this remarkable scholar enjoyed this journey.

The Macbride-Pammel botanical era produced other remarkable and interesting contributors. Bruce Fink (how fortunate that his name was not an affliction in those halcyon days) contributed much concerning Iowa lichens. George Washington Carver contributed papers from 1895-1899. J. P. Anderson's 1907 paper on the Iowa Erysiphaceae demonstrated the careful work characteristic of his later studies of Alaskan flora. His work and studies there were to lay the foundation academically and financially for the Flora of Alaska by Dr. Stanley Welsh, published in 1974. He continued as a member of the Academy even after moving to Alaska. Guy West Wilson of Upper Iowa University published the first of his ten papers in 1908, entitled "Notes on Peronosporales."

Henry Conard published a brief paper on spore formation in Lycogola in 1910. His career at Grinnell College was to span the next 60 years, in which he would receive national recognition as a bryologist and taxonomist. This gentle scholar is venerated by those who knew him. He was also to serve in 1914 as president of the Iowa Academy of Science.

Another illustrious career was also beginning at Iowa State when A. L. Bakke published his first paper on late blight of barley. Bakke's area was plant physiology, but his interests ranged broadly. His early research on the effect of smoke on plants preceded our current concerns by almost 60 years.

As the Macbride-Pammel era reached its peak, a new era in mycology began in Iowa. It was to be dominated by Dr. George Martin of the University of Iowa and Dr. Joseph C. Gilman of Iowa State.

Gilman came to Iowa State from Washington University in 1919 as a plant pathologist. He had worked with L. R. Jones at Wisconsin. His first published contribution to the Academy came in 1922. Gilman was to contribute to plant pathology and mycology locally and nationally for over 40 years. Gilman was the author of 23 papers concerning fungi and plant diseases published in the Proceedings of the Iowa Academy of Science, more than any other contributor in this area. Gilman's papers covered a wide range of topics. His series on "illustrations of the fleshy fungi of Iowa" appeared from 1940 to 1947 and included nine papers. His Manual of Soil Fungi is a classic reference. It was president of the Iowa Academy of Science in 1945 after serving as secretary of the Academy for many years.

Dr. George W. Martin presented two papers in 1925. One concerned some Ananas species from eastern Iowa. The second paper established a long-standing and cherished tradition of Martin's. It was entitled simply "Notes on Iowa Fungi." This series was to continue 35 years and to end with the publication of "Notes on Iowa Fungi XIV" in 1960. Martin contributed a total of 18 mycological papers to the Academy, a total second only to that of his close friend, Joseph Gilman. He was the senior author of the definitive book The Myxomycetes. Martin combined exceptional scientific talent with an endearing personality. He may well have been the most loved and respected of any of the many people mentioned in this summary. Many of us can remember sensing the very special aura of gentleness and kindness which surrounded Professor Martin.

The first decade (the 1920's) of the Martin-Gilman era produced some well known contributors. S. M. Dietz had two papers concerning rust of oats. Dietz' career spanned 40 years at Iowa State and Oregon State. J. C. Arthur presented his only paper to the Academy, entitled "The Uredinales of Iowa." Forty years previously Arthur had published a preliminary list of the Uredinales of Iowa containing 134 species. The name Jessie Augusta Parish appears in 1928. Parish's paper, "Peronosporaceae, or Black Fungi of Iowa," was the only contribution on fungi which she presented and the only paper she contributed to the Academy. The name Parish continues, however, in Academy history and memory because it was Jessie Parish who endowed the Iowa Academy with the Parish Farm near Reinbeck. Donald Rogers, a student of Martin's, was beginning a career of distinction which was to allow him to serve at the New York Botanical Gardens and the University of Illinois.

Dr. J. E. Sass had joined the staff at Iowa State in 1929 and contributed four mycological papers beginning in 1933. His wide range of interest and competence, especially in the areas of plant anatomy and microtechnique, made him a pillar of the Iowa State faculty for almost 40 years. Dr. Myrle
Burk was also a contributor. She is still active and influential in the Nature Conservancy.

Paul Lentz, another Martin student, began contributing in 1942. Horace Barnett reported on Iowa fungi in 1945 based on Shimek's collections at The University of Iowa. Phyllis Gardner, also a Martin student, contributed an annotated checklist of Homobasidiomycetes of Iowa.

A brief paper in 1946 on producing stromata in Claviceps by Lois H. Tiffany marked the beginning of an illustrious career at Iowa State. This was the first of 17 mycological papers (as of 1974) contributed to the Iowa Academy. Only her major professor, Joseph Gilman, and George Martin have contributed more. Her contributions to the Academy, her university and the state are many. She has a record of perfect attendance at Iowa Academy meetings for the past 29 years. She is now a member of the Board of Directors. Her career at Iowa State includes contributions as a remarkable teacher, graduate faculty member, undergraduate adviser, and director of research. She was honored as faculty member of the year by Lampos in 1974. In addition, her patient contributions when the women at our universities were less enthusiastically rewarded was a constant reminder of the merits of women scholars. Many faculty women at Iowa State enjoy the benefits of the prior pioneering and example of Dr. Tiffany. It is indeed fitting that she follows professors Martin and Gilman as the mycological leader of the succeeding era in Iowa Academy of Science history. Her interests have been primarily in the area of lichens and Ascomycetes.

Another major contributor of the 1950's and 1960's was Harold S. McNabb, Jr. His primary concerns are tree diseases, especially oak wilt and Dutch elm disease. Paul Hoffman, Paul Schulte, and Anthony Marchell also contributed papers to the Academy on tree diseases.

Dr. Martin was succeeded at The University of Iowa by Dr. Constantine Alexopoulos. Alexopoulos was already a well-known and highly respected mycologist when he came to Iowa from Michigan State to become the head of the Botany Department in 1956. His major interest was the Myxomycetes. He was the author of the standard textbook Introductory Mycology and was co-author with Dr. Martin of The Myxomycetes. Alexopoulos went to the University of Texas in 1962 and was succeeded by Dr. Martin Rosinski, who remained until 1974. Sister Mary Annunciata McManus was a consistent contributor during the 1960's, with seven papers concerning fine structure and physiology of Myxomycetes.

A great many contributions of papers, many of which concerned plant pathogens, came from Iowa State during the 1960's. Some of the contributors included John Dunleavy, Marr Simons, J. Artie Browning, Don Norton, Virgil Howe, Mike Woodward and Karen Juhl.

We now stand, in 1975, looking back 120 years to the beginnings of agriculture and the study of plant diseases in Iowa. We see the late 19th century when Bessey and Macbride and Pamml made the study of fungi an essential part of their wide botanical study. We recognize especially the sagacity of their early work and their ability to sense the real nucleus of the fungus problems which beset them. Later we could afford the luxury of having men like Melhus and his many co-workers at Iowa State devoting energy and resources to combating plant diseases while others like Martin and Gilman were concerned with the fungi themselves on a more academically aesthetic level.

The present finds two members of the Academy who are pursuing research on fungi with much activity. Most prominent is Dr. Lois Tiffany at Iowa State, with basic interests in Ascomycetes and lichens but with a broad range of knowledge based on over 25 years of experience and study. She has taught the basic and advanced mycology courses at Iowa State for 15 years. The other current worker is Dr. Robert Franke, a student of Dr. Alexopoulos, who is also the chairman of the Biology Program at Iowa State. His interests are primarily in fungus physiology and the Myxomycetes.

This history has so far been primarily concerned with mycology. There is, of course, a very pronounced and broad-surfaced interface between mycology and plant pathology. We must now pick up the thread of plant pathology as it began far back in the 1850's and as it became interwoven in the work of Bessey and Pammel in the early years. Finally, with the coming of Melhus to Iowa State in 1916, plant pathology was recognized as a major discipline in its own right. Melhus was a vigorous leader, and soon several programs were developed which contributed remarkably to Iowa agricultural efficiency.

The two major grain crops in Iowa in the period from 1915 to 1940 were corn and oats. It is logical that a vigorous program was established to explore the problem of crown rust of oats. The project was actually inaugurated in 1914, and the Iowa Agriculture Research Station and the United States Department of Agriculture have cooperated in continuing the work for the last 60 years. S. M. Dietz was an early leader from 1917 to 1927, and he was followed by H. C. Murphy, who was responsible for the project until he left in 1955 to work in Washington. Dr. Marr Simons and Dr. J. Artie Browning are now responsible for the work of the program. Some of the achievements of this program included: the determination of the range of Bhammus species as alternate hosts of Puccinia coronata; the development of sources of genetic resistance to crown rust; and the production of Clinto oats which revolutionized oat growing in Iowa twice. They were of Victoria genetic derivation and their excellent yield characteristics made them an almost unanimous choice of the farmers of Iowa in 1945. The second revolution came in 1947 when it became apparent that Clinto oats were very susceptible to Helminthosporium victoriae. This genetic factor was tied directly to resistance to Puccinia coronata, and Victoria-based oats were dropped in favor of other genetic bases which did not show this linkage. Thus the recurring lesson of plant breeding was taught again: a narrow genetic base for a widely grown crop can be very dangerous.

Corn is king in Iowa and diseases of corn are of great concern.

L. H. Fammel was an early student of the ear rotting diseases. Others involved with ear rotting organisms included L. W. Durrell and W. P. Raleigh. G. L. McNew and George Seminiuk have been major contributors in the study of stalk rots. Dean Foley has also contributed, especially in the study of resistance to stalk rots and stalk breakage.

Root rots are a major corn disease problem in Iowa. Dr. W. F. Buchholtz was the major contributor in this area from 1945 to 1967. He was succeeded by Dr. Charlie Martinez.

Corn smut, purple leaf sheath spot, and Helocus leaf spot are other corn diseases which have received attention. It is, however, interesting that corn generally does not have a single disaster-producing pathogen. Complacency often follows continued success. Thus corn yields in the 1950's and 1960's seemed to climb upwards with little really serious disease damage. Occasionally a leaf blight might damage the crop mildly, but neither farmers nor plant pathologists were pre-
pared for the disastrous invasion of America's cornfields by southern corn leaf blight in 1970. Almost perfect weather conditions were coupled with an unfortunate genetically controlled susceptibility and a 25% yield loss resulted. Martinson, Foley, Wallin, Nyvall, Tiffany, Horner, and Knaphus, as well as other members of the department, were involved in various aspects of this urgent new problem. The major defense lies in changing the genetic makeup of the plant. The experience of 1970 lies in history but it is a grim reminder of the lesson learned previously in 1947 with Clinton oats. A narrow genetic base can be a doorway to disaster.

One of the problems of many crop plants is rotting of the seed before it can establish a vigorous new seedling. Iowa State contributions, especially those of C. S. Reddy, in the development of seed treatments are indeed massive. Many crops, and especially corn, can be planted earlier and a longer growing season utilized if the seeds are treated with fungicides.

The roots of seedlings also are susceptible to attack by fungi. Buchholtz was a long-time leader in studies by several graduate students concerning root rots of sugar beets, barley, corn, and crested wheat grass.

Soybeans are the other major grain crop of Iowa, and their production has grown from almost nothing in 1930 until, in 1973, the cash value of soybeans sold compared with the cash value of corn. A. W. Welch began the legume and forage crop program in 1946. J. M. Crall, J. C. Gilman and Lois Tiffany were active contributors. John Dunleavy and Hideo Tachibana are now the chief contributors in the area of soybean diseases.

Many plant diseases are affected greatly by the vagaries of weather. Iowa State contributions, especially those of Jack Wallin and I. E. Melhus, have elucidated the disease-weather relationships and made possible a "disease-forecasting" program which enables Iowa growers to spray more effectively at the times when disease is most likely to appear. The program is not only very valuable to Iowa, but principles of weather effects on disease spread have been elucidated which aid other researchers in the rest of the world.

Nursery crops are not as prominently recognized as corn or soybeans in Iowa. However, they are important, with large nurseries in southwest Iowa, many commercial orchards and a host of home-grown fruits all needing protection from disease. Fire blight of apple was a problem in 1860 and remains serious today. Melhus worked on nursery diseases in the 1920's. Others who have contributed include J. H. Muncie, D. F. Bliss, G. L. McNew and W. F. Buchholtz. Buchholtz was especially active in studying stone fruit viruses in the 1950's and 1960's.

Shade trees are a part of our lives, and two major diseases of shade trees have caused great concern in the last 25 years. Oak wilt was the earlier disease; it received attention from S. M. Dietz, J. W. Barrett, R. A. Young, G. L. McNew, W. H. Bragonier and H. S. McNabb, Jr. It has not had the disastrous effects which have attended the advent of Dutch elm disease. Dutch elm disease came into Iowa in the late 1950's. H. S. McNabb, Jr., has been the leader in the study of this disease and the battle has been very difficult. The effectiveness of spore transfer by the elm bark beetle, root grafts and the apparently increasing virulence of the pathogen have reduced the elm population, and probably only a few individual trees will be able to survive. The relentlessness of the disease and its decimation of a much-loved tree population does not detract from the dedication and ability of those who have wrestled with this problem, including McNabb and Abraham Epstein.

An arm of plant pathology of great importance has been the Extension Program. Plant pathologists such as Melhus began early the spreading of knowledge about plant diseases and their controls. The Extension Program continued and formalized these procedures. Many disease problems were greatly reduced because of the very active program of education. R. H. Porter, Duke Layton, J. H. Standen, E. L. Waldee, D. M. Coe, A. F. Sherf, Malcolm Shurtleff, Gayle Worff, Robert Lambe, Jim Reynolds, Abraham Epstein and Bob Nyvall have been members of the extension group. E. P. Sylwester, who began work as Extension Botanist in November of 1935, has also contributed to the plant pathology extension work during the past 40 years.