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## The Address of the President - A Century of Botany in Iowa

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## THE ADDRESS OF THE PRESIDENT

### A CENTURY OF BOTANY IN IOWA

L. H. PAMMEL

*Ladies and Gentlemen:*

It is certainly a pleasure to greet you here on this occasion, especially so, because of the nature of the honorable work performed by the scientists of the State of Iowa.

It is customary for the retiring president to deliver an address of some kind. In looking over topics which have been chosen by various retiring presidents I find such titles as "Local Problems in Science," "What We Have Been Doing," "The Academy and the People," "Science of One Hundred Years Ago," "Some Problems of Heredity and Evolution," "Two Centuries of North American Lichenology," "Botany in Its Relation to Good Citizenship," "The Mission and Spirit of the Good Scientist," "Conservation," "The Cosmology of the Universe." These titles cover a wide range of subjects, and it seems to me that I might discuss for a little while with you "A Century of Botany in Iowa."

You will pardon me if I should go back a little more than a century. Prior to 1823 there was little in the way of botanical work in the West. We date the anniversary of the State of Iowa from June 17, 1673, when Father Marquette, the French missionary among the Hurons looked upon the shores of Iowa a few miles below McGregor, and accompanied by Louis Joliet landed near the mouth of the Iowa river on June 25, 1673. They beheld here the Iowa verdure with its trees and shrubs winding through prairie meadows and its beautiful spring and early summer flowers. Many years later other explorations were made and these I shall take up later.

This is the thirty-sixth anniversary of the present Iowa Academy of Science and the forty-eighth anniversary of the founding of the "Old Iowa Academy of Science." Nearly half a century ago a small body of scientists, many of them physicians and a few college professors, met at Iowa City and organized the Iowa Academy of Science. This small body of scientific men had a

vision that science would develop in this State. Of the charter members only one remains today, Dr. D. S. Fairchild of Clinton. Some of these founders of the old Iowa Academy rendered the State of Iowa distinguished service in the medical profession, and it is also true that the college professors rendered a valuable service to botany and geology.

The present Iowa Academy of Science was organized on December 27, 1887 in Des Moines. Of the charter members only two are living, Dr. L. W. Andrews, and Dr. Herbert Osborn of Columbus, Ohio. The Iowa Academy had a precarious time during its early history. It was difficult to finance its publication, but a new impetus was given to the Academy when the State printed the proceedings in the Report of the Iowa State Horticultural Society and later as a separate publication. The members of the Iowa Academy of Science have performed a great service to the State. It has enriched the State with many important scientific contributions. This is true not only in botany but in other phases of scientific work as well. The Academy has had a long line of honorable presidents and secretaries. The labor of preparing the reports has devolved upon the secretaries, in which capacity the following men have served the Society most effectively: Herbert Osborn, S. W. Beyer, H. E. Summers, L. S. Ross and James H. Lees. The publication of 29 volumes of 10,000 pages attests to the activity of the Academy.

There are several other agencies in the State which help promote scientific work through publications of various kinds. It will, therefore, be of interest to mention some of these organizations and we should take peculiar pride in the Davenport Academy of Science, organized on December 14, 1867, first known as the Natural History Society, but when the constitution was adopted the name was changed to the Davenport Academy of Natural Science. Dr. C. C. Parry the friend of Dr. Geo. Engelmann and Dr. Asa Gray no doubt stimulated the organization of this Academy. The contributions of that Academy have been many and important, up to date 13 volumes having been published, containing articles by such men as Parry, Putman, Macbride, Wachsmuth, etc. The Davenport Academy took great pleasure in electing as honorary members such men as C. V. Riley, I. A. Lapham, Geo. Engelmann and Asa Gray.

Our sister academy, the Sioux City Academy of Science was organized as "The Sioux City Science Association" in 1885. In its early days it was made up wholly of amateurs. The name of

the organization was changed in 1903 to the Sioux City Academy of Science. Two volumes have been published.

On July 25, 1914 there was organized at Charles City the Calfor Naturalists Club, made up largely of persons interested in natural history, and we find among its list of members the names of Mrs. F. May Tuttle and H. C. Brown. This organization has published papers at irregular intervals.

Quite a number of our educational institutions have some kind of an organization dealing with botany and zoology. Morningside College has a biological club; Grinnell College has an organization, the State University of Iowa has an organization and at Ames there is one known as the Botanical Seminar. This Seminar was organized on March 4, 1898, with its secretary Miss Charlotte M. King who has faithfully kept its records for a quarter of a century. Another organization at Ames, the Osborn Club, meets once a month and discusses botany, zoology, and other scientific subjects. The State University of Iowa and Iowa State College each have a chapter of Sigma Xi.

One of the earliest organizations in the State to foster botanical work was the Iowa State Horticultural Society which was organized in 1866, and up to date has published 58 volumes. This Society was practically the only medium in the State for scientific contributions thirty-five years ago.

The Iowa Conservation Association was organized as the Iowa Park and Forestry Association on November 16, 1901, with T. H. Macbride as president. Later the name of the organization was changed to the Iowa Conservation Association. This has been an active agent in bringing matters pertaining to conservation before the public. The State Agricultural Society which was organized in 1854 has published in its reports many volumes and papers pertaining to botany.

There are still other state agencies which have in a large way contributed to the science of the State. The State University has issued a valuable series of scientific papers in the Bulletin of Natural History of the State University, the first number of which was issued in 1888, and the first paper by Dr. Calvin. These publications are recognized the world over as a valuable contribution to science.

The Iowa Agricultural Experiment Station has published many scientific papers and bulletins on various subjects allied to agriculture and horticulture. The bulletins now number 219 and the research bulletins 81. These bulletins are recognized also as valuable

contributions. The first bulletin of the Iowa Agricultural Experiment Station was published in May, 1888. The Engineering Experiment Station located at Ames has issued publications touching on one phase of botany, namely bacteriology. Material of a more popular nature pertaining to botany has been issued by the Agricultural Extension Service, and these bulletins reach the public at large. Now in speaking of the agencies that touch botanical subjects, nothing but the highest praise can be paid to the Iowa Geological Survey for the valuable material contained in the annual reports and the several bulletins issued by the Survey. The Iowa Geological Survey is rendering the State a fine service.

The Iowa Weather and Crop Service in its annual reports now numbering many volumes has published much on botany. Its first monthly review was published in 1890 and the annual weather service reports first appeared in 1884 and were published by G. Hinrichs and continued by J. R. Sage, Geo. M. Chappel and C. D. Reed. It now issues the Iowa Weather and Crop Bulletin.

Mention may also be made of the Report of the State Apiarist. This contains articles dealing with honey plants which are of interest to the botanist. Two historical publications are issued in the state; the Iowa Journal of Politics and History located at Iowa City is a splendid source of information dealing with Iowa history, and an occasional note pertaining to botany; and the Annals of Iowa, the third series of which was founded by Hon. Charles Aldrich and continued by E. R. Harlan, not infrequently contains papers on the subject of biography of botanists.

Your attention is also invited to the Report of the State Board of Conservation on Iowa Parks which was edited by the Secretary of the State Board of Conservation, and which contains many articles of a botanical nature. The more recent publication, Bulletin Iowa State Parks contains matter of interest to the botanist.

It may be of interest to refer here to some of the botanists, naturalists, and travelers who have been in Iowa. The earliest exploration under the auspices of the U. S. Government was the exploration of Zebulon Montgomery Pike who was to ascertain the sources of the Mississippi river. He made some observations on the plants and animals, but they were very meager. He touched various points in the state and C. C. Parry tells us in an interesting account of the early exploration that he was at Davenport, and we note from the Journal of Pike, he touched Painted Rock and other points. He referred to some of the trees and prairies.

The next important expedition was that of Lewis and Clark,

previous to the acquisition of Louisiana from France. This expedition proved of momentous value to the United States, the purpose being to find a way to the Pacific Ocean. Plants were collected by Lewis and Clark, but their knowledge of the natural history was quite meager. Nevertheless, Elliott Coues who many years later traced this expedition was able to determine the plants referred to by Lewis and Clark. From the standpoint of botany and zoology the work of Coues far surpassed the former in the careful preparation of annotated notes. Henry Schoolcraft a naturalist of the Cass expedition made some notes of the plants found in Iowa, and later Nicollet made a collection of plants found in the lake region of Iowa. Dr. B. Shimek in a paper read some years ago at one of the meetings of the academy gave us a full account of the work of Nicollet, James and Lewis and Clark. Dr. Edwin James who was appointed as physician of the Long's Expedition made quite extensive observations on the plants of the region. James was a keen observer and afterwards published a narrative of this expedition. This expedition was made about 1820, and we are indebted to Dr. James for the best account of the botany of the early times in Iowa. Dr. James died in Iowa and an account of his life can be found in the Annals of Iowa.

Another botanist, Thomas Nuttall, the English printer who settled in Philadelphia did some scientific work, especially geological, in Iowa in 1821. Dr. C. R. Keyes in a paper on "A Century of Geology in Iowa" notes the good work of Dr. Nuttall, and mentions several other botanists who penetrated Iowa. In this connection it might be said that Nuttall with James Bradbury, the Scotch naturalist, made a trip up the Missouri river to Mandan. Many of the plants found by them were afterwards described and so Nuttall's name is indelibly connected with North American botany.

A new era in botanical work was ushered in when the government ordered a survey of the territories of Iowa, Wisconsin and Minnesota under the direction of David D. Owen the geologist. Dr. C. C. Parry was the botanist of the survey, and was the author of the first list or catalogue of plants published for Iowa. Dr. Parry frequently cites localities for plants. The same botanist afterwards returned from the north, made a trip to central Iowa, an account of which was published as a separate. Dr. Parry afterwards became connected with the Mexican Boundary Survey which traversed the southern points of the United States as far as what is now San Diego. He later became connected with the

Union Pacific Railroad Survey. He is well known for his contributions to botany of the Rocky mountains and California, and the many fine collections of plants he made in these regions traversed by him.

Iowa was no doubt visited by many other botanists who afterwards explored in the region of the Rocky mountains and California, probably Geyer, Wyeth and others. It is certain we had as our guest Dr. Sereno Watson who was connected with Grinnell College at Davenport, Iowa. Dr. Watson afterwards became curator of Gray Herbarium at Harvard University, and has left his impression upon the botany of California and the west.

One of the classical papers "Sequoia and its History" was an address delivered by Dr. Asa Gray in Dubuque, Iowa, when he was president of the American Association for the Advancement of Science. This fine address won for him the title of the "philosophical botanist." No doubt there are still living men in Iowa who saw Dr. Gray at this meeting. The writer recalls meeting a Mr. Walker, an insurance agent at McGregor, Iowa, a few years ago who said that it was his pleasure to pilot Dr. Asa Gray and J. D. Dana to the lotus beds at McGregor. Dr. Macbride recently told me that he was present at this meeting and that he was also a member of the party to McGregor. He related Dr. Gray's eagerness to pick the lotus.

Some of the more distinguished scientists at this meeting were Drs. David Starr Jordan, S. Calvin, I. A. Lapham, and T. H. Macbride. A great zoologist and a man we like to look upon as a naturalist was Louis Agassiz who visited Sioux City upon his return from Montana in 1868 or 1869. Audubon the naturalist paid Iowa a visit about 1843. It is of peculiar interest that Iowa should have acted as host to the great naturalist Alfred R. Wallace in the spring of 1887 when he paid Sioux City a visit and delivered three lectures, one on the subject of "The Darwinian Theory," which might almost be considered a present day discussion, considering the great amount of agitation by a distinguished citizen during the last several years. The second lecture given by Wallace was on the "Origin and Uses of Color in Animals," and the third "Oceanic Islands." No one was better able to discuss these topics than was Wallace. It was my pleasure to have casually met this distinguished Englishman in St. Louis where he had come to pay a visit to Dr. William Trelease. Wallace was a man of striking personality and most modest. When he called at the School of Botany he did not even give me his name, but said

he wanted to meet Dr. Trelease. I told him as best I could where to find Dr. Trelease and did not learn until the next day that I had been talking with so distinguished a man. It is probable that we also had in our midst Sir Joseph D. Hooker who with Dr. Asa Gray made a study of the Alpine flora of the Rocky mountains in 1877. I know that the following distinguished botanists have seen Iowa, and carried away some of the treasured plants found in the state; Brewer, Barnes, Coulter, Trelease, Cowles, Crocker, Duggar, McDougal, Von Schrenk, Stevens, Stone, Jones, Webber, Stakman, Freeman, C. R. Ball, Kern, Edgerton, Humphrey, Appel, DeVries, Hitchcock, and Ashe.

The Iowa botanists have been active and have made many large collections of plants and have published many good and fine books and papers. The papers have grown from a handful in 1889 to many hundreds in 1923.

Botanical training in Iowa has kept pace with the times. There was a time not far back when the professor of botany in our colleges took care of every phase of the subject, for instance; morphology, physiology, pathology, taxonomy, and economic botany. I recall that when Dr. Bessey came to Ames in the late sixties he not only had charge of botany and zoology but horticulture as well. Then I recall that Calvin and Macbride both looked after geology, botany and zoology in their respective places in the institutions of this state.

The training of the pioneer botanists in Iowa was limited, of course. Many of the students used that most excellent treatise "Gray's Lessons" and some colleges "Wood's Textbooks" and you may be sure that these students became interested in the great out-of-doors.

A new era came in when C. E. Bessey in 1880 brought out "Botany for High Schools and Colleges," which some of the unkind critics on this campus said was an abridgment of the textbook of Julius Sachs. Those of us who knew Dr. Bessey well felt certain that he brought into his text book many things that were new and original, and thirty-one years later with his son Ernst, who was born on this campus, there appeared "Essentials of College Botany," a most excellent book.

Another most excellent text book of botany was published in 1905, I believe, "Lessons in Elementary Botany" by Dr. T. H. Macbride, a born teacher and writer. This work was used quite extensively in our high schools. In 1919 there appeared a text book by J. N. Martin "Botany with Agricultural Application"



which has found extended use in American colleges and universities. It is the work of a close student and born teacher. I would like to invite your attention also to the work of Macbride who in 1899 published "The North American Slime Moulds" the second edition appearing in 1922. It is the standard work for this group of plants in the world. To this list of books there might be added the writer's "Manual of Poisonous Plants," "Ecology" and "Weeds of the Farm and Garden."

I would like to invite you to read "On the Campus" by my friend and co-worker, Dr. T. H. Macbride. It contains a series of essays and addresses made at various times on the campus. They are full of philosophy and fine thought. Then I would like to have you spend a little time with three nature study books or rather books dealing with nature in its larger aspect, books written by Prof. F. J. Lazell, an amateur who knows both plants and animals. He is in my judgment the modern "Thoreau." He can paint in a real way the picture of the great out-of-doors, and will give you an enthusiasm over the plant and animal life. This naturally takes us to another subject, the park movement.

There is a great movement in the United States which has to do with the great out-of-doors, in other words to communicate with "mother nature." Now this is centered in the park movement. It has for its object the conservation of the wild plants, trees and flowers, the heritage given us for future generations. The wild flowers like the moccasin, anemone, violets, wake robins, etc., should all be preserved so that future generations may enjoy the beauties of nature.

Now as to who started the idea of conservation of trees, my friend Mr. E. R. Harlan found in the archives of the State Historical Society an address by T. S. Parvin made when he was connected with the Land Office more than seventy years ago, in which he made a plea for the preservation of trees. One man cannot, however, make a plea sufficiently strong so that those who make laws will act. However, in this seventy years, and especially during the last thirty, there has been an agitation for parks and trees made by Macbride, Shimek and others, and the work of the State Conservation Association and Federated Women's Clubs, legislatures of Iowa and several governors since the creation of this act deserve the praise for this great movement. The several State Boards of Conservation deserve the credit with the Executive Councils of making possible the creation of these state parks. The generous commonwealth has augmented the state appropria-

tions by numerous gifts and the commonwealth of Iowa is in this work heart and soul. This park work well started will survive if the stewardship is of the right kind, and I am sure it is the honest and sincere wish of those concerned in the work to make the state greater and its citizens happy and content because these parks have been created.

It is no small task to give you a bird's eye view of the productive work of Iowa botanists. It is stupendous. I have been trying for a month to bring this together for the Academy. Every line of botany has received some attention. It will be difficult in this address to review all of the work. I have tried to prepare such a paper for the Academy Report, but am afraid I will have to omit it because of stress of other work.

#### TAXONOMIC WORK

Systematic botany was of course the first type of botany done in Iowa. Many Iowa botanists have contributed to this line of work. Dr. Shimek in a paper has given us an account of the work of the early explorers whose collections were determined by Pursh, Torrey and Gray. Dr. C. C. Parry not only collected in Iowa, but made collections in southwestern United States, the Rockies, the Pacific Northwest and the Great Basin country. *Primula Parryi* of the Rockies commemorates this botanist. Edwin James, botanist of the Long's Expedition made a considerable collection and was the first botanist to ascend Pike's Peak. The genus *Jamesia* commemorates him. Nagle and Haupt of Davenport, Asa Horr of Dubuque were pioneer taxonomists of Iowa. C. E. Bessey the first Professor of Botany at Iowa State College made an early contribution of the flowering plants of Ames. This was followed by J. C. Arthur's Catalogue of plants prepared for the Centennial Exposition in Philadelphia. I notice in this catalogue such names as J. J. Davis now of the University of Wisconsin, C. E. Bessey of Ames, M. E. Jones of Grinnell, later of Utah, R. I. Cratty now of Ames, Fred Reppert of Muscatine, T. H. Macbride of Iowa City, and George Vasey. Later there came such men and women as H. S. Conard who has long been interested in the water lily and papers dealing with native and introduced conifers, T. J. Fitzpatrick and M. L. Fitzpatrick who published floristic papers on ferns and seed plants. The systematic paper on sedges, mustards and aquatic phaeogams of Iowa by R. I. Cratty should be mentioned. Local floras by T. H. Macbride, M. P. Somes and F. Reppert, W. D. Barnes, Morton E. Peck, F. May Tuttle, L. H. Pammel and C. M. King also belong here, as do the local catalogues of the flora of Story county by A. S. Hitchcock which is one of the better of the local floras, local flora by S. W. Stookey, J. L. Tilton, W. Diehl, H. E. Jaques on spring flowering plants of Henry county. The contributions by B. Shimek have been many and important, all substantial papers. There are such monographs by him as the Ferns of Nicaragua and the Prairie Flora. The good List of Alaskan Plants by J. P. Anderson, The Phylogeny of the Araceae by J. E. Gow, the Forest Trees of Adair County, and a posthumous monograph of The Genus Cucurbita by

Fred C. Werkenthin, prepared a short time before his death, should be mentioned here. C. R. Ball published some fine taxonomic papers on willows, of which the first was the basis of all of his other taxonomic work on this group of plants. The author in several joint papers with other botanists published material on grasses, weeds, thistles and numerous notes on local floras of the Uintah, Bitter Root Mountains, etc. R. B. Wylie has published papers on the major vegetation of lake Okoboji and a paper on *Elodea*, somewhat morphologic. Another paper by Mary Nichols on Achenial hairs of Compositae, and the fine paper by J. S. Chamberlain on style characters in Compositae.

### MORPHOLOGY

The morphologists have been active along lines pertaining to the minute anatomy and the development of plants. No doubt the next decade will see much change because the matter has barely been scratched. Morphology is important because it touches so many problems in genetics, taxonomy, agriculture and horticulture. Among the workers in this field attention may be called to an excellent paper by R. B. Wylie on the sperms of the French water eel grass, and one on the bladder wort. A paper by F. W. Faurot "A Developmental Study of the *Astragalus caryocarpus*" indicated the development and fertilization; subsequently, several excellent papers have been published by J. N. Martin on the morphology of some members of the clover family in which he made a study of the development of several species of clover and a joint paper with L. E. Yocum "The Pollen and Pistils of Apples," and with Winifred Perry "The Cutinization of the Apple Skin." There has been much discussion on the dormancy of peach buds which has been worked out by C. H. Farr. R. S. Kirby likewise made a study of fruit bud development with reference to orchard soil management, and F. C. Stewart made an anatomical study of leaves of some trees, to determine whether the number of rows of palisade cells was an indication of hardiness, which was proven not to be well founded. B. D. Halsted made a study of the twigs, pith and medullary rays also with reference to hardiness and reserve food material stored in the plant.

There has been much interest in the development of plum blossoms which was investigated by R. E. Buchanan. J. E. Gow made an investigation of the karyokinetic changes in the *Calla* lily. Some work has been done on the anatomy of the leaves of conifers. It is well known to taxonomists that Dr. Geo. Engelmann long ago recognized the value of anatomical characters of the leaves of conifers as important and L. W. Durrell made an important contribution in his paper "Notes on Some North American Conifers Based on Leaf Characters." A similar contribution was made by D. S. Chamberlain on the style characters in Compositae and a somewhat similar one by Mary A. Nichols on achenial hairs of the same family will be found of much value for taxonomic purposes. The leaf anatomy of grasses is interesting in this connection and mention may be made of some excellent studies by C. R. Ball, Emma Serrine, Emma Pammel, C. B. Weaver, and R. Combs on the anatomy of maize, and an excellent paper by Florence Willey "The Rhizomes of Some Grasses" points out the importance of these organs in classification of grasses. A paper by Estella

D. Fogel and the writer on the "Underground Organs of Weeds" will be found of service in taxonomy.

Many other valuable papers have been published but time will not permit me to take these up in this connection.

### SEEDS

The subject of seeds has been taken up from three standpoints by Iowa botanists; namely morphology, physiology, and seed testing. Much work has been done with seeds. Some of it has a very practical bearing on agricultural practice, namely the question of pure seed for the farmer and gardener. Miss C. M. King for many years has been actively engaged in a study of the purity and vitality of agricultural seeds. Mention may also be made of the work done by Prof. H. D. Hughes. This seed work in Iowa was started thirty-five years ago when such botanists as F. C. Stewart and C. R. Ball studied the problem, and later R. E. Buchanan and Estella D. Fogel continued the work in an investigation of commercial seed sold in Iowa. These papers by Miss King have mostly been published in bulletins of the Iowa Agricultural Experiment Station and the Iowa Academy of Science.

On the general morphology of weed seeds attention may be called to the paper by C. M. King and the writer and a lengthy paper by E. L. Palmer with many fine figures and full descriptions. The latter paper contains a good key. Much attention has been given to the anatomy of seeds, the earliest Iowa paper by P. H. Rolfs describes the seed of some members of the mallow family. This was followed by the writer's paper on the seeds of the spurges, the writer for the first time described the mucilaginous seed coats of some species. Somewhat later the writer described the seed of the mustard family and later a paper with J. R. Burnip and Hannah Thomas on the seeds and fruits of members of the barberry family and later the writer published a paper on the caryopsis and endosperm of grasses and a lengthy monograph on the anatomical characters of seed in the clover family. In this connection mention should be made of a paper by Miss C. M. King and the writer on the anatomical characters of weed seeds in the "Weed Flora of Iowa."

A study of the hard seed coats in several legumes has been made the subject of several papers by J. N. Martin, L. E. Yocum and others. These authors have determined why seeds of this family are hard and do not germinate as rapidly as some others. There have been many germination studies; some of the results of these experiments by C. M. King are published in the bulletin of Iowa Agricultural Experiment Station. Delayed germination in some weeds was the subject of a paper by H. S. Fawcett who found that many weed seeds have a period of dormancy; in a later paper by C. M. King and the writer a large number of seeds were tested, among these the soft maple which has only a short dormant period. In a paper by F. G. Miller and the writer there is a study of large and small seed with reference to vigor of plant, it was found that large seeds produced larger plants. A number of papers dealing with the structure and germination of forest trees and shrubs were published in the Academy by C. M. King and the writer.

## PLANT PHYSIOLOGY

Plant physiology in its various phases is a most important branch of botany with many practical aspects in agriculture and horticulture. What an agricultural or horticultural plant will produce and how the plant responds to fertilizer and other external factors is of prime importance. This phase of the subject of botany has not been cultivated as much as it deserves. One phase however, ecology, has received much attention. Is not however the question of crop ecology important? More and more our civilization will demand that our soil shall produce to its fullest extent. It is not only important to know the nature of the soil but how the plant responds to external factors. We need to know every phase of the subject. The general physiological papers have been largely contributed in recent years. We may enumerate a few of the papers: A. L. Bakke in a paper "Determination of Wilting" made a careful study of the transpiring power of plants, and it is noted in another paper by Bakke and Livingston that there is a lack of synchronism in leaves on the same plant. The value of cobalt chloride to determine the transpiring power of plants is emphasized in another paper by A. L. Bakke. He has also made a study of the desiccation of normal and diseased potatoes, and with H. H. Plagge made a study of absorption and germination of wheat when treated with formaldehyde; with L. W. Erdman a study of sand and solution cultures of Marquis wheat, and with the writer a paper on "The Effects of Weeds and Crop Production." We may note here, though weeds have been studied from several angles, the important crop phase has scarcely been touched. E. B. Watson made a study of securing a stand of clover on southern Iowa loess, which is interesting because it was found that cocklebur retarded the growth of clover due to toxins from cocklebur. The several papers by R. B. Wylie, "The Capacity of Foliage Leaves to Withstand Injury" shows how some plants may adjust themselves to new conditions.

F. C. Werkenthin, J. N. Martin and Elizabeth Hudson in a paper on germination requirements of the pollen of the Easter lily found that as the starch disappears in the pollen the mucilage appears on the outside walls. L. A. Kenoyer in his fine paper on environmental influences on nectar secretion shows how external factors influence nectar secretion. There is also a companion paper "Weather and Honey Production" based on a long record of honey flow and weather conditions. The paper shows how weather has an important influence on secretion of nectar.

The question of hybrids has had some attention by several botanists. R. B. Wylie discusses Ambrosia hybrids and J. N. Martin in a paper on graft hybrids discusses this question. The question of plant breeding naturally should find a place here and much good practical work has been done. The Iowa State Horticultural Society early in its history urged the matter of plant breeding. We may mention the work of J. L. Budd, S. A. Beach, N. E. Hansen, L. C. Burnett and H. D. Hughes. A fine lot of hybrids have been obtained at the Iowa Agricultural Experiment Station under the direction of Prof. Beach and we may especially mention the fine work of Dr. N. E. Hansen who received his inspiration in Iowa, but transferred his activities to South Dakota. The number of valuable fruits produced by him is large. The student will find a valuable resumé on

plant breeding in Fred C. Werkenthin's "Founders of the Art of Plant Breeding."

#### ECOLOGY

I have alluded to the several fine papers by B. Shimek on prairie plants. These contributions are for the ecologist. The author brought to bear every phase of the subject; soil and evaporation of water, especially with reference to prairie plants and the absence of trees on each area. I refer to his studies on the flora of Monona county and his monograph on the plants in the Lake Okoboji region. A companion paper by Boot touches some of the same problems. "The Ecology of a Prairie Province in Central Iowa" by Ada Hayden and an earlier paper; "The Ecologic Anatomy of Some Plants of a Prairie Province in Central Iowa," give a most excellent account of the anatomy of some of our prairie plants. A paper by Ella Shimek on the anatomy of some prairie plants is also a worthy contribution. This author suggests with proof, that the prairie plants are essentially xerophytic. Here we may mention a paper on the algal flora of the Missouri Botanical Garden by Ada Hayden, which is more or less ecological and is a worthy contribution to our knowledge of fresh water algae.

A paper on the plants of the St. Peter Sandstone by B. Shimek and a comparative study of plants of sandstone bog and clay formations in central Iowa, southeastern Minnesota, and southwestern Wisconsin by the writer is somewhat similar. Other papers on physiographic ecology by the writer on western Iowa, and one on the peat bog flora of northern Iowa may be noted.

#### STATISTICAL STUDIES

Winfield Dudgeon made a study of the variations of the ray flowers of a number of Compositae including *Rudbeckia hirta*, *R. triloba* and *Helianthus grosse-serratus* for the purpose of making a comparison of the different species. The author comes to the conclusion that in the first species mentioned, judging from the ray flowers and the statistical studies, there are two distinct species. In dry soil the number of ray flowers raised was eight while in good soil it was thirteen. The paper contains a good bibliography. There is also a similar paper dealing with the variation in red clover by Edna C. Pammel and Clarissa Clark.

#### POLLINATION OF FLOWERS

Some papers have been published on pollination, which engaged the attention of botanists in the eighties; attention may be called to a paper "Pollination of Cucurbits" by Alice M. Beach and the writer and the writer's books on "Ecology" and "Flower Ecology," the excellent paper by L. A. Kenoyer on nectar and one on weather and honey plants should be mentioned. Miss Mary Rolfs published a paper on pollination of some lilies, and various papers on honey plants were published in the proceedings of the Iowa Beekeepers Association by the author and Miss King. Papers were published by Macbride, Bessey, Todd and Halsted on pollination, and by Martin and Coe on sweet clover and red clover, and all these papers are of interest to the botanist and agriculturist, as well as the paper by Kenoyer on *Frasera* and one by R. B. Wylie on *Heteranthera*.

## PHENOLOGY

The phenological observations made by C. M. King cover a period of more than 25 years, these observations being preceded by those made by the writer and Dr. B. D. Halsted. We have perhaps a longer series of these observations than any other place in the country.

## PHYTOPATHOLOGY AND MYCOLOGY

The botanists of Iowa have contributed much of a permanent character to the knowledge of diseases of plants. C. E. Bessey was one of the real pioneers along plant pathological lines in this country. In his papers appearing in the seventies, some contributions were made on the subject, rusts, corn and grain smut, and if I recall correctly, some of these early papers were published in the report of the Iowa State Horticultural Society, and in the biennial report of the Iowa Agricultural College. It was in the early seventies that J. C. Arthur laid the foundation for his future work in plant pathology. When I came to Ames in 1889 I found hanging on the walls in the botanical laboratory some charts illustrating the diseases of plants, which were made by Arthur in the early seventies. A bulletin published in 1884 by C. E. Bessey discusses some diseases of plants with a paper on rusts by J. C. Arthur. The next contribution was another bulletin containing many miscellaneous notes on diseases of plants by B. D. Halsted which was published in 1886. Here we note a paper on powdery mildews by A. S. Hitchcock. Then we may note that C. E. Bessey published an earlier paper on the powdery mildews of Iowa in 1877. Much later J. P. Anderson monographed the powdery mildew family for Iowa. Other papers on these mildews were published by the author as the Powdery Mildew of the Apple, and Cherry Mildew. Other studies of sac fungi are those by Mrs. Flora Patterson, who published an able paper on the *Exoasci* in the Bulletin of Natural History of the State University of Iowa, and in several papers in the same publication Seaver made a fine contribution on *Discomycetes* and other sac fungi. A paper on *Sclerotinia* by the author and one on Illinois canker by C. M. King and the writer might be mentioned here.

Ergot was made the subject of several papers by the author, Bessey and Halsted. The alfalfa leaf spot was the subject of a good paper by R. Combs. The writer and C. M. King published some notes on the Illinois canker and one of our plant pathologists has worked on the black rot of the apple. B. D. Halsted was much interested in downy mildews and in 1886 and subsequently gave an account of these parasitic fungi, especially the relation of these parasites to weather conditions. I. E. Melhus, who became interested in this group of fungi while a student at the University of Wisconsin has made a number of important contributions on the pathology of these organisms. In such papers as the perennial mycelium of the *Peronosporaceae* and a paper on the potato rot fungus I. E. Melhus ably presented a phase of the subject which had been overlooked by plant pathologists. Guy West Wilson, also a close student of the group, published a fine monograph of the *Peronosporales*. Some of the work was done in Iowa. J. M. Raeder has augmented the literature of this group and other *Phycomycetes* by bringing together in an admirable way the plants of this group found in Iowa.

A. T. Erwin, in a paper on the potato rot fungous calls attention to the epidemic in Iowa and its relation to temperature. The same subject was again treated by I. E. Melhus. The downy mildew of millet was treated by B. D. Halsted, the writer, and Miss King. I am safe in saying that this group of plants has been more thoroughly worked up in Iowa than any other state.

The subject of rusts has engaged the attention of many Iowa plant pathologists. An early paper on cedar apple rusts by B. D. Halsted, F. C. Stewart and G. W. Carver and later one by the author discuss the relation of these species to their alternate hosts on the apple. *Crataegus* and *Amelanchier*. In recent years there has been much interest in cereal rusts because of the importance of the group. We may cite the excellent papers by I. E. Melhus and L. W. Durrell, S. M. Dietz, J. H. Parker, and Florence Willey on crown rust of oats and the buckthorn, as well as the importance of crown rust, comparative resistance of varieties of oats to crown and stem rusts, and the relation of barberry bush to the black stem rust. These papers illustrate the important work which may be done to lessen the loss of agricultural crops from these parasites. There are also several papers on clover rust by Davis, who has worked out the life history, and a somewhat earlier paper by the author and Miss C. M. King on the same subject. In this group we may mention also the papers by H. Hume on some peculiarities in *Puccinia teleutospores*. Time will not permit me to enter into details concerning this important economic group of plants.

Many papers have been published on the smuts, the early papers by C. E. Bessey have been alluded to. Several papers in this group are considered in bulletins of the Iowa Agricultural Experiment Station and in bulletins of the Iowa Geological Survey. The papers by I. E. Melhus on treatment of oats smut and one by H. D. Hughes on the same subject show conclusively how the state of Iowa may be enriched by following methods of treatment given by them. A paper on Ustilagineae of Iowa by H. Hume and one by the author and Miss King discuss *Ustilago Crameri* on millet.

The toadstools, puff balls and pore fungi of Iowa have been worked out by several botanists. Some excellent papers by T. H. Macbride have been published. "The Saprophytic Fungi of Eastern Iowa" is published in Bulletin of Natural History of the State University of Iowa in which he discusses the Polyporaceae, considers such species as *Polyporus igniarius* and in another paper takes up the Polyporaceae as a whole. H. S. Conard calls attention to the wide variation of *Secotium agaricoides*. Alice Ward Hess and Harriet Vandervert published a list of the Basidiomycetes of central Iowa.

The imperfect fungi are destructive to many cultivated plants. L. W. Durrell and I. E. Melhus, in an excellent paper on corn rot caused by *Diplodia zeae*, show the importance of this disease to our staple crop, corn, and the manner of infection. Irving Vogel and I. E. Melhus gave an account of cabbage diseases and the importance of the use of seed from resistant stock. We may also mention the paper by Melhus and L. L. Rhodes on the treatment of wheat scab and one by Irving Vogel on a graft disease of the rose, and R. H. Porter published two papers, one on dry rot of corn and its control, and one on control of potato



diseases. An earlier paper by the author, J. L. Seal and C. M. King gives an account of *Fusarium* on maize. The question of parasitic fungi on maize is evidently a most complicated one, different species of fungi are prevalent in different seasons, under varying climatic conditions. The fungicidal value of mercuric chloride and *Rhizoctonia solani* has been ably treated by J. C. Gilman. *Helminthosporium teres* on barley by A. L. Bakke, who traces out its life history, and the infection of the plant is an interesting piece of work. Another species of *Helminthosporium* and barley was treated by the author and A. L. Bakke. There is also an earlier paper by the author on barley stripe in which he calls attention to the manner of infection. We may also note the papers by I. E. Melhus on leaf diseases on the potato, and one by O. Appel on leaf roll diseases, one by W. Diehl on the violet root disease of alfalfa. The *Cercosporaceae* and *Septoria* on currant and root rot of cotton were treated in several papers by the author. G. W. Carver published some notes on a fine collection of *Cercospora* made in Alabama.

We have practically only one investigator who has published extensively on slime moulds, namely T. H. Macbride, whose early contributions on slime moulds of eastern Iowa were published in the State University Bulletin. The work is beautifully illustrated by Mary P. Macbride. Subsequently this author describes some of the Nicaraguan slime moulds and he has enriched science by his book on North American slime moulds of which two editions have been issued. The first list of slime moulds of Iowa was published by C. E. Bessey in bulletin of the Department of Botany, 1884.

#### MISCELLANEOUS PLANT PATHOLOGY PROBLEMS

Certain plant pathological contributions cannot be placed under any of the above headings, such as the paper by A. L. Bakke, "Influence of Smoke on Vegetation." This admirable paper takes up the problem of the smoke nuisance in Des Moines. The mosaic diseases of plants have been investigated by J. H. Muncie and O. H. Elmer. Only short papers have been published, but the careful work of these men will shed new light on these problems. The transmissibility to different hosts is an interesting point brought out by O. H. Elmer. The mosaic problem seems to be engaging the attention of plant pathologists in various parts of the country.

Many lists of fungi have been published, the earliest are the papers by C. E. Bessey, who, in 1884, gave an account of fungi found in the vicinity of Ames, followed by papers of B. D. Halsted and A. S. Hitchcock in 1886 and 1889, and J. P. Anderson on the parasitic fungi of Decatur county, a list by B. Shimek of the plants of the Lake Okoboji region, several papers by C. M. King and G. W. Carver jointly with the author, and separately, and diseases for the season, a line of work now continued by I. E. Melhus.

The important matter of treating the diseases of plants so that a larger crop may be obtained has been ably discussed by I. E. Melhus and S. A. Beach. Some of the earliest recorded experiments made in Iowa were those recorded in the early nineties. These papers by the author reported experiments conducted with cherry spot, currant diseases and powdery mildew.

## BACTERIOLOGY

I shall, of course, discuss some phases of the subject of bacteriology, especially the plant pathology side of the question. The earliest mention made of pear blight is in the Horticultural Society Report for 1871 when the secretary, Mr. Adams, suggested that this disease was caused by a parasitic organism. Since Mr. Adams was not an investigator, it is more than likely that he came to this conclusion from some work done elsewhere. The discussion on the topic in the Horticultural Society was animated in the seventies and eighties and such men as C. L. Watrous, R. P. Speer and J. L. Budd gave their opinions frequently. An early paper by the author described the *Bacillus campestris* which E. F. Smith later changed to *Pseudomonas campestris* and assigned to the organism the roll of causing black rot of the cabbage. The admirable paper by I. E. Melhus and T. J. Maney on crown gall of the apple gives the cause of infection and a rational line of treatment. This work was based on some carefully conducted experiments in the field and laboratory. The papers in the general field of bacteriology have been numerous. I can only mention a few papers: A paper by R. E. Buchanan on *Bacillus radicola* in which structure and cultural characters are considered in a concise and adequate manner. The papers by B. W. Hammer on dairy bacteriology should be mentioned as worthy contributions to this branch of bacteriology as well as the paper by B. W. Hammer and M. P. Baker, "Studies in *Streptococcus paracitrovorus*," and a bacteriological study of blue milk by the same authors, and the many excellent papers by P. Emerson and P. Brown on soil bacteriology. We might mention P. E. Brown on "Bacterial Activities in Crop Production," showing a striking relation between bacterial activities and crop yields; also a paper on bacteria in frozen soil and bacterial effects in liming, and several other papers.

Much has been done along the line of diseases of man and animal caused by bacteria. Mention may be made of the text book of veterinary bacteriology by R. E. Buchanan and C. Murray. It is worthy of a fine place in the history of the subject. Another text by R. E. Buchanan and Mrs. R. E. Buchanan on household bacteriology gives a full discussion of the problem confronting the home maker. Numerous papers have been published by Dr. Albert who discusses the many problems of bacteria and human diseases. Sanitation is an important problem and many papers have been published on this subject by L. R. Walker, Estella D. Fogel and the writer. Max Levine in recent years has done much along this line.

## ALGAE

The papers on algae are not numerous. The earliest paper, a short one, is that by C. M. Hobby who lists some species found in the State. Subsequently C. E. Bessey gives a longer list in his paper on the Cryptogams of Ames. The best of the papers dealing with Iowa algae is one by R. E. Buchanan who has given localities of algae found in the various parts of the State. Shorter lists are to be found in with other scientific floristic papers such as the paper by Shimek on "Plants of the Okoboji Region," and the paper by the writer on "Plants of Sandstone of Central Iowa," etc. F. Myers has published a list of diatoms.

## BIOGRAPHICAL AND BIBLIOGRAPHICAL

The Davenport Academy of Science contains several biographical sketches of botanists. Of these mention may be made of the sketches by C. C. Parry of botanists and men who were active in various lines of scientific work during his lifetime. The Iowa Academy too has published numerous sketches of deceased members of the Academy; of these we may mention the names of A. A. Crozier, G. E. Patrick, B. D. Halsted, Mrs. Emma Hansen, and the *Annals of Iowa* contains a sketch of Edwin James.

Much bibliographical work has been done. Many of the larger scientific papers contain an extensive bibliography—of these we may mention the several floristic papers by Shimek; the papers by Melhus on *Phytophthora*; Melhus, Durrell, Dietz, Florence Willey on crown rust; the writer on the *Sclerotinia* of the sunflower; the phenology by C. M. King; T. H. Macbride, slime moulds; R. B. Wylie on *Vallisneria*; J. N. Martin on *Trifolium*; A. L. Bakke on transpiration and smoke on vegetation; R. E. Buchanan on *Bacillus radiciola*; Miss Harriette Kellogg on weeds and poisonous plants. For a number of years through the interest of Wesley Greene, the writer in the reports of the State Horticultural Society reviewed the current literature on fungous diseases of plants.

## FORESTRY

Forestry is intimately connected with the welfare of the nation and state. Iowa is essentially agricultural, but we have a vital interest in these problems. The Iowa State Horticultural Society was the sponsor for the movement for reforestation during its early history of the Society Judge Whiting of Monona county and J. L. Budd issued a paper on forestry. Later B. Shimek, T. H. Macbride, G. B. MacDonald, H. P. Baker and the writer all made contributions on the subject. The woodlot has been treated by G. B. MacDonald. A paper by the writer, G. B. MacDonald, and H. B. Clarke, discusses the forest trees and their distribution in southwestern Iowa. The several papers by Shimek and T. H. Macbride on the forest trees of different areas in Iowa discuss the problem.

We may enumerate such splendid papers as "Evergreen Trees of Iowa," by G. B. MacDonald as the one on shelter belts which with the following was published in the Iowa Experiment Station bulletin: "Timber Resources in Iowa and Preservative Treatment of Fence Posts," and the paper by C. A. Scott, "The Hardy Catalpa," Hu Maxwell, "Hard Wood Using Industries;" A. T. Erwin and H. P. Baker, "Evergreens for the Iowa Planter;" also papers by R. T. Truax, G. C. Morbeck, C. A. Kupfer, M. L. Merritt, R. W. Hayes, G. B. MacDonald, J. B. Hoffman, Ed. Sherman, R. L. Hensel, E. H. Stephen, F. B. Trenk, and the author on forestry subjects in the *Ames Forester*.

I would like to call your attention also to an important paper by I. T. Bode on the relation of water flow and forest growth in Delaware county. The author shows conclusively that the distribution of trees is determined by the drainage of waters and B. Shimek has shown the relation of trees to evaporation.

## CONSERVATION

The problem of conservation should be of interest to everyone. The subject has many angles. There is the conservation of the forest primeval for scientific purposes; the preservation of some of the original trees, and a few of these are still to be found in Iowa; there is the conservation of the original prairie—and there are a few such areas left in Iowa. There is the conservation of animal life, and much of what we once had is gone forever. There is the conservation of some of the wonderful rock strata with their fossils, and some of this is left and we are trying to preserve the Sioux quartzite in Lyon county. There are some wonderful Indian mounds in Iowa and we are trying to conserve them. There is a wonderful fish area along the Mississippi, north of McGregor, and Iowa is trying to preserve this. There is the water supply so intimately connected with the agricultural industry. This has been adequately discussed in a fine address made before the Academy a few years ago by S. W. Bever, earlier by W. J. McGee and recently in an excellent paper by J. H. Lees.

## ECONOMIC BOTANY

This address would not be complete without some reference to the literature of economic botany, especially that phase pertaining to the botany of agricultural and horticultural plants, such as weeds, poisonous plants, the botany of ornamental plants, fruits, vegetables, cereals, pasture plants, legumes, etc. These papers have appeared in various agricultural journals like the Breeders' Gazette, Iowa Homestead, Orange Judd Farmer, Iowa Farmer, the old weekly Des Moines Register, Rural Life, Successful Farming, and Wallaces' Farmer. These journals are important sources of information. Let me refer to one item on the subject of Russian apples and ornamental plants fully discussed by Prof. J. L. Budd in the old weekly Register, edited by Father Clarkson. Opposite viewpoints are to be found in the Iowa Homestead and Orange Judd Farmer by men like C. L. Watrous and Col. Brackett.

Many issues of the journals mentioned above contain much current material on horticulture, weeds, cereals, pastures, meadows and other plant topics.

*Weeds.* The interest concerning weeds is as great today as it was during the sixties, the farmer is always interested to know the name of a new weed on his place and how best to treat it. We may then call attention to a few of the books and papers. The author's "Weed Flora" is a comprehensive manual, touching many topics such as the description, distribution and eradication of weeds. The work contains special chapters on the Morphology of Weeds by J. N. Martin; Roots and Rootstocks by J. C. Cunningham; Dissemination by Ada Hayden; Weed Seed Anatomy by the author and Miss C. M. King, and Bibliography by Miss Harriette Kellogg. This work was published by the Iowa Geological Survey.

A book by the author, "Weeds of the Farm and Garden," discusses the weed problem of the United States and is published by the Orange Judd Company. The author has also published two smaller booklets on weeds; "Talks on Weeds" which describes a few of the more common weeds, giving a key for their identification, and "Weeds of Pastures and Mea-

dows," in which the author discusses the more important weeds in pastures of Iowa. This appeared in Bulletin 1 of the Iowa Geological Survey. A longer paper, "Some Weeds of Iowa," appeared as one of the bulletins of the Iowa Agricultural Experiment Station; there is also a paper, "Weeds of Corn Fields." Other papers by the author are "Comparative Study of the Weeds of Central Iowa, Northern Minnesota and Wisconsin;" "Weeds of California;" "Weeds of the Clear Creek Canyon Colorado Country," and several popular bulletins on milkweed, Canada thistle, prickly lettuce, horse nettle, quack grass, weeds of the mustard family, squirrel-tail grass, all appearing in circulars or bulletins from the Iowa Agricultural Experiment Station. "Problems in Weeds of the West" discusses the weeds of the prairie country of the northern Mississippi valley. "Unlawful and a Few Other Weeds of Iowa," by the author, describes the unlawful weeds of the state and gives methods for their extermination. This was issued as a bulletin first by the Iowa Experiment Station and subsequently a second edition by the author and Miss C. M. King by the Agricultural Extension Service of Iowa State College. A paper, "Notes on the Eradication of Weeds with Experiments Made in 1907 and 1908," by the same authors, discusses the use of iron sulphate to exterminate weeds. A bulletin on quack grass and Canada thistle, published by the Agricultural Extension Service by R. H. Porter, discusses the newest methods of destroying these weeds. There is also a bulletin on the Russian thistle by James Wilson and the author.

*Poisonous Plants.* C. E. Bessey, in one of the early bulletins of the Department of Botany, discusses ergot and the poisonous nature of the same. The same subject was treated by M. Stalker in one of the early reports of the Bureau of Animal Industry of the U. S. Dept. of Agriculture, as well as in the Report of the State Veterinarian. J. H. McNeil and the author many years ago in a circular of the Iowa Agricultural Experiment Station discussed, under the head of "The Danger of Feeding Hay that Contains Ergot," different forms of ergotism and grasses on which ergot commonly occurs. A list of the poisonous plants of Iowa in the form of a catalogue was published by the author and Estella D. Fogel. A paper by the author on the poisonous plants of Missouri was published by the Missouri State Board of Horticulture. The author's large treatise, "Manual of Poisonous Plants," gives an historical summary of the subject, with chapters on such subjects as locoism, forage poisoning, larkspur poisoning, lupine poisoning, cowbane poisoning, and a chapter on chemistry of poisoning by A. A. Bennett. The main body of the work begins with bacterial poisoning, by R. E. Buchanan, then algae, fungi, gymnosperms and angiosperms, with a catalogue of poisonous plants of the world, and an extensive bibliography by Harriette S. Kellogg. The work is arranged systematically with economic notes under the family and genus.

The author also published a paper on cowbane poisoning in a bulletin of the Iowa Agricultural Experiment Station and one on *Wasserschierling* in *Pharmaceutische Rundschau*; numerous short articles on various poisonous plants, frequent reviews in *Veterinary Medicine*, a paper on Cocklebur poisoning in the *North American Veterinarian*, and one on mould poisoning in the report of the Iowa Veterinary Medical Society, and one on poisonous plants of the range, in the *Ames Forester*.

*Botany of Horticulture.* On pear culture there are papers by Suel Foster, J. L. Budd, M. J. Graham and Mathews in reports of the Iowa State Horticultural Society; on apple culture there are papers in the same reports by E. H. Calkins, M. J. Wragg, J. B. Mitchell, G. H. Van Houten, J. L. Budd, C. L. Watrous, S. A. Beach, and W. E. Whitehouse. Prof. J. L. Budd, in one of his papers, published a list of Russian apples and in one of the early publications of the Iowa Agricultural Experiment Station discusses varieties of apples best suited for Iowa. Mention may be made of "Notes on Newer Apples," by E. E. Little, and "Apple Growing for Northern Iowa," by S. A. Beach, and attention may be called to the two-volume work, "Apples of New York," a monograph with fine illustrations. Wesley Greene discusses the evolution, origin and development of the apple. C. G. Patten, in a paper, gives an account of the origin of some apples produced by cross fertilization. The subject of hybrid apples is also discussed by J. L. Budd and N. E. Hansen. Cultural methods are discussed by M. J. Wragg, N. E. Hansen and G. B. Brackett, and T. J. Maney, in a paper, discusses the effect of certain cultural methods on the growth of the apple. These papers are published in reports of the Iowa State Horticultural Society.

S. A. Beach and F. W. Allen discuss the hardiness of the apple as correlated with structure and composition. B. D. Halsted made an investigation of apple twigs and G. E. Patrick made a chemical study. A continuation of the study by B. D. Halsted was published in Memoirs of the Torrey Botanical Club and later a similar paper by the author appeared in the report of the Iowa State Horticultural Society. The subject of peaches is discussed in the same reports by C. G. Blodgett, A. F. Collman, J. B. Laughlin, Samuel Holmes, and J. L. Budd. The subject of plums is discussed by U. P. Hedrick in a paper, "The Plum in the East," in which he discusses *Prunus domestica*, the Japanese plum, native hybrid plums and sterility.

There are numerous papers on grape by Silas Wilson, Wm. McLaugham, Henry Lau, Wm. Bomberger, and Emily F. Ives, in the Horticultural Society Reports and one by T. J. Maney, "Grape Growing." The "Sprouts and Long Cane System" is an experiment Station bulletin. There are many papers on the strawberry. We may mention those by Captain Gardner on blackberries, the paper by Wm. Laughlin on cherries, also papers by E. E. Little, S. H. Porter, and J. L. Budd. Papers by A. B. Dennis, E. T. Erickson, W. P. Williams, and S. W. Snyder deal with nut culture—the latter discusses hybrid nuts worthy of planting. G. R. Bliss discusses "The Future Development of the Iowa Small Fruits."

*Potatoes and Other Vegetables.* On general horticultural topics the fine paper by A. T. Erwin, "Some Iowa Potato Problems," also "Potato Growing, the Value of Local Seed Strains," and "Improving the Iowa Potato Crop," were published in reports of the Iowa State Horticultural Society. In the Iowa Agricultural Experiment Station papers were published by I. E. Melhus on destructive foliage diseases, by A. T. Erwin on late blight of the potatoes and on Bordeaux spray for tip burn and early blight of the potatoes, by T. J. Maney on the effect of potato seed treatment and seed vitality, by I. E. Melhus and J. C. Gilman on improved method of potato seed treatment, and by G. R. Bliss on potato growing in Iowa. Rachel Mosier discusses the value of roots and tubers for food,

including potatoes, yams, artichokes and carrots. Sweet potatoes are discussed by Enoch Mead. J. E. Hoopes discusses sweet potato and melon culture and storage.

C. L. Fitch discussed onion culture and truck crops in several papers published by the Agricultural Extension Service, and the author published a paper on weeds of onion fields in the report of the Vegetable Growers Association. Late vegetable crops from Iowa have been much discussed in recent years and attention may be called to the papers by I. E. Melhus and others on the diseases of cabbage and resistant strains.

Papers on the common bean have been published by A. T. Erwin under the title "Bean Growing;" also papers on rust of bean by the author in a bulletin of the Iowa Agricultural Experiment Station, and a paper on the bean by S. A. Beach in the Geneva, New York Agricultural Experiment Station.

*Ornamental Plants and Planting.* A list of the native shrubs of Iowa is given by the author. He has also discussed the native trees. Other papers in the Report of the State Horticultural Society are those by B. Shimek, H. S. Conard, Wesley Greene, Harriette S. Kellogg and C. M. King. There are papers on plants for ornamental purposes and planting and care of ornamental shrubs by C. B. Bechtel and K. A. Kirkpatrick, the use of wild flowers for the garden by Miss Harriette S. Kellogg, among many others. A paper by R. J. Pearse was published in Iowa Agricultural Extension Service on "Home Yard and Garden Contests." There is also a paper on hybrid roses by J. L. Budd in the bulletin of the Iowa Agricultural Experiment Station and a paper by G. W. Carver on ornamental plants.

*Dye and Fiber Plants.* Harriette S. Kellogg has published an extended list of native dye plants with notes on other species not native to Iowa, in Proceedings of the Iowa Academy of Science. The same author has an extensive paper on native fiber plants in the Report of the Iowa Horticultural Society.

*Cereals.* In the Experiment Station bulletins the subject of maize has been treated by R. P. Speer; the selection and preparation of seed corn by P. G. Holden; corn by the author and R. Combs, and Silver King corn and germination tests of corn by H. D. Hughes. The subjects treated are seed testing, varieties of corn culture, breeding, etc. The published papers are quite voluminous and are worthy contributions to the literature of economic botany. There is a book on corn by M. L. Bowman and a paper in the Iowa Crop Service Bulletin on the phenology of corn by E. R. T. Hodson, and papers by R. H. Porter on dry rot of corn, and by L. W. Durrell in the Research bulletins of the Experiment Station should be added to the above list.

Oats has been treated by L. C. Burnett under the following topics: "Some Data for Oats Growers," "Improving the Oats Crop," etc. Papers have been published on barley, wheat and breeding of oats by H. D. Hughes, smut in oats, by H. D. Hughes and P. C. Taff, smut in small grains, by James Atkinson who experimented with oats, barley and corn, and one by M. L. Bowman. All of these publications appear in bulletins or circulars of the Iowa Agricultural Experiment Station. In addition there is a paper by John A. Krall, "The Formalin Treatment for Oats Smut;" "Studies of Crown Rust of Oats" by I. E. Melhus and L. W.

Durrell; papers on barley, rye and wheat by L. C. Burnett, James Atkinson and W. R. Hechler, and "Two Barley Blights" by the author and A. L. Bakke.

*Sugar Beets.* The subject of sugar beets is discussed by James Wilson, G. E. Patrick, C. F. Curtiss, and James Atkinson in the Experiment Station bulletins.

*Forage Plants.* Some of the earliest experiments with forage plants were made by S. A. Knapp and published in a bulletin from the Department of Agriculture, Iowa State College. The author published a treatise on Iowa grasses in the Bulletin of the Iowa Geological Survey and a station bulletin on the same subject, including a chapter on chemical analysis by J. B. Weems; also a paper on grasses in the national forests in the Ames Forester.

"Grasses and Forage Plants" is the title of a paper by A. A. Crozier and R. P. Speer. Forage crops for various domestic animals are treated in several papers by J. M. Evvard and W. J. Kildee. W. J. Kennedy and E. T. Roberts, J. M. Evvard and W. R. Hechler have written on the importance of rape; W. R. Hechler on hay and pasture seeding; H. D. Hughes on growing alfalfa; F. S. Wilkins on Hubam clover, and H. D. Hughes and F. S. Wilkins on soy beans; the pasture problem by W. H. Stevenson, L. W. Forman and P. E. Brown, all in the bulletins and circulars of the Iowa Agricultural Experiment Station. "Emergency Hay Crops for Iowa" was published by R. K. Bliss, and "Growing Alfalfa" in the Extension Service Bulletin by F. G. Churchill. Red Clover was treated in a book by Henry Wallace. The work contains a chapter on disease by the author. Fine papers on sweet clover have been published by H. S. Coe and J. N. Martin, and a paper on the relation of moisture to seed production in alfalfa has been contributed by J. N. Martin.

Senator J. C. Fenton called my attention to some most interesting articles in one of the early agricultural journals, *The Iowa Farmer and Horticulturist*, which is of special interest in this connection. This journal was published by Wm. Duane Wilson, Wilson Duane Wilson Company, and M. L. Comstock, Burlington and Fairfield. I am indebted to Mr. E. R. Harlan and Mrs. Ellen D. Spaulding for the permission to see this interesting journal which contains a number of interesting articles on botany; several of these signed Flores on our native plants are the earliest<sup>1</sup> phenological records of Iowa plants. The scientific and common names are given. There are other interesting articles on wheat turning into chess, tares and vetches. The cultivation and preservation of forests.<sup>2</sup> Grasses received much attention. Thomas W. Claggett discusses timothy or cattail grass. An article<sup>3</sup> by Cultor on weeds, the scientific and common names are used. Many of our present day weeds were common, like velvet and milkweed,<sup>4</sup> burdock, *Veronica peregrina*, hedge mustard, *Oenothera biennis*, *Potentilla morvegica*, Shepherd's Purse, Mullein. Cultor also discusses forests and the origin of the prairie.<sup>5</sup> There is an essay on cultivation of Indian corn by S. F. Chubb.<sup>6</sup>

<sup>1</sup> *Iowa Farmer and Horticulturist*, Vol. 1, No. 2, No. 3, No. 4, No. 7. 1853.

<sup>2</sup> L.c. 1856, p. 195.

<sup>3</sup> L.c. p. 186.

<sup>4</sup> L.c. p. 169.

<sup>5</sup> Oct. 1, 1855.

<sup>6</sup> L.c. vol. 1, p. 73.



### CONCLUSION

I have tried at some length to give you a glimpse of what Iowa botanists have done during the last one hundred and twenty-five years. It is a long story beginning with the work of explorers who were primarily not botanists in the modern sense. They were, however, keen observers. Then came the period of systematic botany, but the end of this has not come, for we may expect this subject to be greatly augmented because of the real and vital interest in the great out-of-doors. This human interest is directly connected with good citizenship and I suggest, therefore, to those who have charge of public school botany and college botany to once more turn their attention to systematic botany. After systematic botany came a period of activity in the pollination of flowers. The beginning of plant pathology was in the seventies and is still flourishing and I am certain is destined to be of still greater service to us. Then bacteriology, which began with the botanist, has developed along independent lines though the botanist still claims a vital interest in the subject. Then came morphology, especially that part of the subject, cytology, which requires the highest kind of technical skill and which is on the threshold of greater achievement. Then ecology with its ramification came to share with the other branches of the science an equal place in our knowledge of plant life. Then finally came plant physiology, a subdivision of botany intimately connected with the fundamental principles of crop production, but which has not yet come into its own.