THE ILLINOIS STATE FLAG

From a painting by Mrs. Frances Summers Ridgely
BLUE BOOK
OF THE
State of Illinois

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Report Further Gains in Grim War on Parasites and Insects

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Most of us at some time or other speak with pride of our Illinois fruit, or have enjoyed the shade of a tree in our favorite park, or glowed with pride at our own or another's fine stand of corn. In every case we were the beneficiaries of the patient and scientific labor of the State Natural History Survey. How widely reaching is the Survey's relentless fight against parasites and insects is explained here in everyday terms as well as strikingly illustrated.

Are you fond of fishing? You'll find good news on page 370. Are you fond of sweet peas, snapdragons, and roses? You'll find good news on page 361. Are you a farmer, a gardener, a horticulturist, a hunter, a botanist, a biologist? You and others will find much good news and valuable information in this highly condensed account of the activities of the Illinois Natural History Survey, an agency that in a single biennium can save the public as much as the Survey's upkeep would cost for 50 years.

* The State Natural History Survey is a Division of the Department of Registration and Education.
actual records of control work performed, that the work of the Survey in connection with the grasshopper control campaign alone, one of many hundreds of projects, returned to the State during the last two summers in the form of income to farmers much more than the total cost of all Survey studies and investigations over the last 50 years.

1936 Grasshopper Outbreak Worst in Many Years

The summer of 1936 saw the worst outbreak of grasshoppers in Illinois in years and they caused an estimated loss of between 14 and 17 million dollars. Early in June, 1936, a Federal appropriation for grasshopper control was made and the Chief Entomologist of the Survey was appointed chairman of the State Grasshopper Control Committee in charge of the campaign in Illinois. During the campaign 1,200 tons of bait were used, 1,000 tons supplied by individual farmers and 200 tons by the Federal government, all of which were used in the worst infested part of the State with almost uniformly good results.

The potential grasshopper population for 1937 was so great, judged by the number of eggs in the soil during the winter, that a carefully-planned campaign was again promoted for poisoning the hoppers in that year. A grasshopper control agency, therefore, was organized in each infested county and farmers were advised regarding the best method for the control of this pest. This made possible a very extensive campaign during the spring and early summer of 1937. In 1937, farmers who followed carefully Survey instructions regarding the poisoning of grasshoppers again got good control.

Along with the control program, considerable experimental work was done in developing new and more effective grasshopper poisons, which resulted in many improvements in technique.

Survey Continues Battle to Exterminate Termites

An increasing number of property owners in Illinois have become aware during the last few years that termites are one of our most destructive insects. Although termites are most abundant in tropical countries, there are four kinds native to Illinois, and one of these has adjusted itself too well to a life in association with our wooden structures. The damage is caused by their habit of feeding upon wood and vegetable products.
Roots of individual corn plants growing in close proximity to each other in field where damage by the southern corn root-worm was severe. The upper row shows the damaged roots of an open-pollinated variety, the lower the healthy roots of a resistant hybrid.

Survey entomologists have continued experiments with soil treatments for control of termites. This work consists of treating soil in plots and of testing in the laboratory the power of various chemicals to penetrate the soil. Considerable time was spent also in studying infested buildings in an attempt to determine the important factors contributing to infestation in different types of structures. Here again many more observations are necessary before any general deductions can be made. An exhibit on this insect was made in co-operation with the State Farmers' Institute at the Illinois State Fair. A great deal of interest was shown in the exhibit and an increasing amount of time is now given to the termite control work.

**Greenhouse Insect Control Improved**

Insects attacking greenhouse crops were the subject of much experimentation with new insecticides which seemed to offer greater economy or increase killing efficiency. As a result of our work on red spider control, spraying has largely supplemented syringing as a means of control of this pest on greenhouse crops.

An outstanding contribution to insect control in Illinois greenhouses was the development by one of our entomologists of a method of sterilization of bench soil by the use of an especially devised appliance for heating water by steam and its forceful injection into bench soil.

Following the development of this appliance in 1936, its operation was demonstrated at florists' meetings at Urbana, Pekin, West Chicago, Allandsisie, and Cicero, Ill., during 1937. Treatment of greenhouse soils with hot water is for the purpose of controlling soil pests, and at the same time to leach out excess salts accumulating in the soil. As a result of the hot water treatment, yields from such crops as sweet peas, snapdragons, and roses have shown production increases of 20 to 50 per cent. In addition, the quality of the flowers was better than from plants grown in untreated or new soil. The cost of the hot water treatment is approximately one-half of the cost of the old practice of changing soil every one to five years. There are now over 100 of these heaters in operation in Illinois greenhouses. This is one of the outstanding contributions of the research work of this section of the Survey during the past several years.

**Develop Corn Hybrids Highly Resistant to Pests**

One phase of our insect investigation meriting special comment at this time is the work in co-operation with the Federal Bureau of Plant Industry and the Department of Agronomy of the Illinois Agricultural Experiment Station in the development of various strains and hybrids of corn. This work involves the handling of a very large amount of data, taking yields,
moisture tests, and various other information on a great many individual
plants in strip test plantings and crop performance fields scattered over
Illinois. The success obtained in the development of highly-resistant and
productive corn hybrids has already had a marked influence upon corn-
growing in this State, and the demand for such seed is very great. Some
of the more important results of our part of this work have been published
in Illinois Agricultural Experiment Station Bulletins dealing with “Illinois
Corn Performance Tests.”

Strike Death Blows at Insects Damaging to Orchards

Codling Moth.—The codling moth occupied, as usual, a very large place
in the experimental work of 1936-37. In 1937 experiments were carried on
at three principal places, namely, New Burnside, Urbana, and Quincy.

At New Burnside the object of the experiments was mainly to develop
a satisfactory control of the codling moth that would not leave an objection-
able residue on early apples. For many reasons it is impracticable to wash
early apples and therefore there is a special need for a substitute for lead
arsenate on this crop. Results indicate that several methods of codling
moth control can be used which will not leave the dangerous residue on the
early fruit. All of the analytical work on this project was done by the
Department of Horticulture of the University of Illinois.

The work at Urbana consisted largely of tests with new fluorine com-
pounds and that at Quincy was entirely for the testing of nicotine com-
pounds for codling moth control. These compounds involve the use of
nicotine in combination with certain chemicals which retard the usual
rapid rate of nicotine volatilization. Results at the end of the biennium
were very promising, and from these we hope to develop certain types of
fixed nicotine which will give a lasting and protective spray coating to fruits
or vegetables. Sprays of this type control a number of insects and do not
leave a poisonous residue at the time of harvest.

Oriental Fruit Moth.—Because of the serious damage caused by the
Oriental fruit moth in 1935, a considerable program of experimental work
was performed in an attempt to further improve oil dusts or if possible to
develop a satisfactory control by spraying. This work was carried on by
our Southern Field Entomologist in four orchards in southern Illinois. Oil
dusts continued to give a very satisfactory control, reducing the infestation
from 66 per cent in some orchards to 95 per cent in others. Dust treatments
started in mid-June gave only slightly better results than those started
20 days before peach-picking time. The addition of rotenone or nicotine to
oil dusts failed to improve the control.

The use of summer oils at 1½ per cent with sulfur gave a fair degree
of control but resulted in spotting of the fruit and, therefore, cannot be
considered commercially safe. Late applications of phenothiazine dusts gave
at least a 50 per cent control of the fruit moth and offered sufficient promise
to warrant testing the next year. Sprays containing nicotine sulfate and
fixator and one of the commercially-fixed nicotine gave satisfactory com-
mercial control.

In co-operation with the Federal Bureau of Entomology and Plant
Quarantine a large number of parasites of the Oriental fruit moth were
liberated in orchards in southern Illinois. Forty-six colonies of these
parasites were put out in 10 different counties. While no very satisfactory
check of the benefit from these liberations can be made at present there are
some indications that the parasites exerted an appreciable control by the
end of the 1936 season.

Investigations that Protect Your Shade Trees

Nearly everyone who owns city or country property, or who uses the
streets and parks of the State, has a direct or indirect interest in preserving
shade trees. One of the principal enemies of shade trees, especially of those
newly set, is the flat-headed borer. The study of methods to prevent damage
by this borer has been one of the important pieces of work of the Section
of Economic Entomology of the Survey during this biennium. As the borer
applies to practically all the shade trees set in the State, regardless of the
location of the tree, it is highly important that we have a cheap and effective method of protecting newly-set trees.

During the biennium studies have been made for the purpose of developing a really effective, cheap, and simple method of borer control. In the course of this work many supposedly repellent washes and paints have been tested by applying them to the bark of the trunks of trees. These paints and washes were supposed to prevent borers from laying their eggs on the trees or to kill the young borer grubs after they hatch from the eggs. Studies
Many Other Injurious Insects Receive Attention

A list of all the injurious insects now under scrutiny by the Survey or the subject of special investigations would seem to many like an index of an entomological textbook. Some of these are of major importance in our agricultural economy, while others are the subject of only a few letters of inquiry. Climatic conditions have a great influence on fluctuations in insect populations with the result that years which are favorable to the rapid development of some kinds are comparatively unfavorable for the increase of other kinds.

The chinch bug, often our most serious pest of wheat and corn, did not occur in serious numbers in most localities during 1936-37. In 1937, the rainy, cool spring weather was largely responsible for this. The Hessian fly, another major pest of wheat, was at low ebb in most places because of extremely hot and dry weather while the fly was in the summer or flaxseed stage. Corn rootworms were severe in certain fields and were the subject of much field study because of the increasing evidence that certain hybrid strains of corn are more resistant to the lodging caused by the larvae of these beetles than are open-pollinated varieties.

Forecasting of Insect Outbreaks

Further work has been carried on in the matter of forecasting insect outbreaks. This is a very important activity of the Survey. By making use of data obtained from regular observations carried on throughout the entire year, it is possible to predict with a high degree of accuracy the relative abundance of many injurious species of insects. This prediction can often be made far enough in advance so that serious outbreaks of such crop pests as the army worm, chinch bug, codling moth, Hessian fly, white grub, onion maggot, and a number of others, can be forecast in advance. The knowledge that a certain insect will probably be present in destructive numbers makes it possible for the grower to prepare to meet the insect menace before it actually occurs, and thus to forestall most of the damage. This project is one on which the entomologists of the Survey have been working for a number of years. Its scope is being widened each year, and the accuracy of the forecasts has been considerably increased during the biennial period just passed. This information is made use of very generally over the state and is a means of preventing many hundreds of thousands of dollars in crop losses each season.

Insect Diagnostic Service Valuable

Going hand in hand with the work in economic entomology are the investigations of the section of insect survey. Its job is twofold: first, to determine the identity of insects which individuals and institutions send in as suspects concerned in insect damage or for other reasons, and secondly, to discover and classify the many and varied kinds of insects occurring in Illinois and to establish their relationship to our present system of economic development.

In the first instance it is sometimes found that many insects suspected of doing damage are really beneficial since they play an important part in keeping many of our serious pests under natural control and, therefore, should not be killed. On the other hand, many such insects submitted for naming are definitely known to be pests and their proper identification enables correct control methods to be recommended.

Briefly summarized, the second job of this section of the Survey is to find the exact distribution of insect species in the State, what they feed on,
their seasonal fluctuations, and so forth; thus establishing their relationship to other insects, plants and animals, including man. As an illustration of how this varied biological information can be of value, let us cite the example of the potato leafhopper. This small insect is one of our worst pests on beans and potatoes. Our field surveys reveal, however, that it feeds in great numbers not only on these crops but also on many herbs and shrubs and such trees as oaks and cypress. In the light of such knowledge it becomes evident that it is impossible to attempt even a partial control of this insect by agricultural practices such as rotation of crops, co-operative non-planting of certain crops, and so on, and that other methods must be devised.

Aquatic Insects an Important Source of Fish Food

In our river and lake systems aquatic insects provide the most abundant food for fish and we are now in the midst of biological and ecological investigations of such insects. The stoneflies, or Plecoptera, were studied several years ago. Two other important stream and lake groups, the caddis flies, or Trichoptera, and the Mayflies, or Ephemeroptera, are being stressed at present. It is only by untangling their identities and biology that we are able to place ourselves in a position to explore the possibilities of their utilization, if such is possible.

We have found that the caddis flies have at least 120 species within the State and can be used as a valuable index to the conditions and type of water in the various streams and lakes. Large collections totaling over

Records of the distribution of insects are kept by the Natural History Survey on maps, each dot representing actual records of occurrence. Map No. 1 gives the incidence of a cypress-feeding species, and No. 2 the wide spread of the destructive tarnished plant bug. Associated with other information concerning their habits, such charts give the answers to many questions about insect pests.
Caddis flies form an important item of fish food in Illinois streams and lakes. The two extreme left figures show a caddis fly which inhabits the rapid streams of southern Illinois. The larva, shown below, spends its life in the water; when mature it changes into the adult fly shown above. The fly is, of course, terrestrial but lays its eggs in the water. The right hand drawing shows another kind of caddis larva which builds a house or case of grains of sand and carries it about.

200,000 specimens have been made, revealing in Illinois more than 40 kinds new to science.

Leafhoppers Attack Many Crops

Field work has now been completed for a survey of the leafhoppers or Cicadellidae of Illinois. Members of this family feed by sucking the juices from many kinds of plants. Fully half a million specimens were captured and sorted, of which 45,000 have been pinned for the reference collection. Over 600 kinds have been found, data secured on their distribution in the State, their abundance, and the number of plants they attack. The crops which they damage, often seriously, include rose, potatoes, horse-radish, grapes, apples and other fruits. A potential new enemy was discovered in 1936, the sugar beet leafhopper. This species was found around the vicinity of East St. Louis and may develop into a menace to our tomato crop.

Forestry Program Advanced

The activities of the Survey Forester have been entirely of an educational extension nature, in co-operation with the College of Agriculture of the

Plantations are part of the farm forestry program of Illinois so as to utilize land not suitable for annual crops or pasture. Above is a European Larch plantation, 60 years old, in Tazewell County
The potato leafhopper, belonging to a large insect group on which field surveys have been completed, often causes the severe damage shown in the upper picture. Potato growers who follow the rigid control program advocated by the Natural History Survey have the vigorous potatoes shown in the lower picture.

University of Illinois and the United States Department of Agriculture. The greater part of the summer months was spent in answering a large number of calls for assistance in farm forestry problems. Co-operating with the State Agricultural Conservation Committee, forestry recommendations for the 1936-37 Agricultural Conservation Program were drawn up. These recommendations included the fencing of farm woodlands as a soil conservation practice. Several farms have also been visited to line up demonstration projects in woodland improvement. During the winter months approximately 35 of these demonstrations were set up.

Great impetus has been given to the planting of windbreaks about farm
The Prairier Chicken, one of the finest game birds in the world, is now the subject of Natural History Survey studies. It was formerly abundant but now is greatly reduced in numbers and present only in restricted areas.

buildings by the publication of a Survey circular entitled "Windbreaks for Illinois Farmsteads." Demand for this circular has been so great that another edition is now being prepared.

Wildlife Resource Studies Expanded

The end of the biennium covered by this report signaled a new era in the wildlife program of the Survey due to the appropriation of a special fund for the Survey, with the approval of the Governor, for the establishment of outside experimental laboratories.

The justification for the establishment of outdoor experimental laboratories under the control of the Survey rests upon our renewable natural resources program having to do with submarginal land utilization, agriculture, and a combination of forestry and wildlife resource management, by wildlife being meant: fish, furbearers, upland game, migratory waterfowl, useful birds, etc. The recent emphasis, Federal, State and local, upon broad conservation programs demands that new and practical types of data be available for the guidance of State policies and projects. This new type of information can be acquired only by scientific studies on areas strictly devoted to these special purposes. Laboratory studies are still fundamental but there must be testing grounds where ideas can be obtained. Certain phases of agricultural experiment station work went through this same development, with great returns to the nation, many years ago.

Counting of Prairie Chicken and Quail Will Aid Hunters

Our Game Specialist devoted nearly all of the summer and fall of 1936 to a study in Jasper county of prairie chicken and quail. This study, made during the breeding season, represented the second consecutive year for this type of work on the same area. It is only by the repetition of such studies in the same area over a span of years that reliable data and generalizations may be obtained upon which to build a practical and sound game management program.
Counts of adult and young quail and prairie chicken were made on a 2,560-acre study area near Hunt City, Jasper county, at intervals from May 1 to Sept. 1, 1936. This work, in addition to the census studies, included more or less continuous observation of 16 nesting attempts of prairie chicken and 8 nesting attempts of quail, the collection of adults and young prairie chicken for disease and food studies, and observation of the food habits of other birds and mammals resident on the area which might be considered as predators.

Weather Extremes Make Study Important

Estimates of the population of quail and prairie chicken on this area during the summer are of interest and importance because of severe weather conditions during the winter of 1935-36. The quail population declined approximately 80 per cent between September, 1935, and May, 1936. This reduction gives a picture of the combined hunting season and winter losses. That winter losses were considerably heavier than normal was indicated by the fact that the present quail population is about half as large as that of September, 1935, which followed what we have considered as an average breeding season.

Losses on this area were much less severe in the case of prairie chicken because the May, 1936, population is estimated at about two-thirds of that of the previous September. By September, 1936, the population had increased again to 164 birds, which is approximately 85 per cent of the 1935 population on this area. The survival of young birds during the summer of 1936 was considerably below that of 1935, a decreased survival apparently due to disease or parasites.

Low humidity and high temperatures prevailing during late June and July, 1936, probably did not affect the clutches of eggs of either quail or prairie chicken. The eggs of prairie chicken under observation all hatched before the drought was far advanced. Only one clutch of quail eggs was under observation in mid-July and in this instance nine of the eleven eggs hatched successfully during a prolonged period of high temperatures. No

Muskrats are Illinois’ most important furbearers, sale of their pelts yielding an average annual income of more than $500,000, as shown by the Natural History Survey’s analysis of trappers’ reports made to the Department of Conservation
Lifting a hoop-net which had been set in Maple Lake in the Cook County Forest Preserves. Practical recommendations for proper fisheries management of our rivers and lakes depend on the kind of information gathered by the Natural History Survey.
evidence was found in late summer to indicate that quail eggs or young were seriously affected by drought.

Nesting studies show that red-top grass fields are not, as was believed last summer, important nesting places for prairie chicken. In Jasper county the chief nesting places are areas reverting to prairie in which a growth of low shrubs is present. These red-top hay lands are important, however, as cover, roosting places and feeding grounds for broods of young birds.

Little evidence was obtained that furbearers are important as enemies of the nests of young quail or prairie chicken in this region. Although some destruction of quail can be traced to marsh hawks, they do not appear to be important enemies of young or adult prairie chicken.

During the fall and winter months three to five prairie chickens were collected each month for the purpose of obtaining data on seasonal food habits and for disease studies. Pheasant and quail stomachs were also secured from hunters for the same purposes.

Survey Analyzes Reports from 6,000 Trappers

We have returns now from over 6,000 trappers reporting catches of fur-bearing mammals covering a five-year period. A study of these records shows that at least four large types of population centers are present in the State as follows: (1) one of exceptional abundance in the northeastern corner of the State due to numerous lakes, ponds and marshes which provide stable water levels and an abundance of aquatic herbs for food; (2) another of exceptional abundance due to the lake-like conditions of the Mississippi River in Henderson county above the great Keokuk dam; (3) one of moderate abundance associated with relatively stable northern streams whose shores are lined with semi-aquatic food plants; and (4) one of marked scarcity associated with southern streams which flood violently and whose banks are relatively infertile and bare. A knowledge of such population centers of fur-bearing animals is becoming of increasing importance in land utilization programs.

Fish Investigations Reveal Basic Facts

Over a period of many years there has been an increasing amount of interest in and discussion of the management of fish resources in Illinois waters. As a result of our investigations and impartial fact-finding in many parts of the State, the following points regarding fish conservation seem established:

1. The decline in the amount of fish in Illinois during the past half century or more is the result of a decrease in water area. The average amount of fish per acre of water at the present time is not demonstrably different from what it was 50 or more years ago.

2. A general increase in the turbidity of all waters of the State in recent decades has resulted in a shift in abundance from the game species which feed by sight toward bottom-feeding species which feed by touch and taste. Turbidity can be controlled in small lakes and management practices maintained which will give high yields of game fishes.

3. The highest concentration of fishes is found in the Illinois River and its connecting bottomland lakes. There, it is believed, diseases and parasites are the most important limiting factors of fish population and of fish yield. Diseases and parasites are occasionally important limiting factors in other waters with moderate population concentrations. No effective methods have been devised either in Illinois or in other states and countries to combat diseases and parasites of fishes in natural waters. Since fishes transported from other waters do not increase the fish yield of the State (beyond the original stocking of newly-constructed lakes) it is recommended that all such transportation of fishes, particularly from waters outside the State into Illinois, be stopped. There are a number of known fish diseases and parasites which are capable of doing great damage to the fishes of Illinois, if introduced. Owing to the relatively small amount of research which has been done on fish diseases and parasites, there is undoubtedly a much larger number of unknown organisms capable of creating much havoc among our fishes.
4. Comparison of fishing in Illinois with other states in the Middle West shows that our waters generally are seriously under-fished. Fish management people are beginning to learn that fish must be thinned out in order for them to grow to satisfactory sizes and to furnish palatable food. About 300,000 hook-and-line fishing licenses are sold annually in Illinois. Creel census work carried on during the past few years shows that the average catch per license is certainly less than five pounds per year and probably less than two pounds per year. Accepting two pounds as an average, the hook-and-line catch amounts to 600,000 pounds or between 1½ and 2 pounds per acre of water. (We have estimated that the snapping turtle takes more fish than the hook-and-line fishermen.) We have found that under proper amounts of fishing, Illinois waters are capable of yielding 50 or more pounds of hook-and-line fish per acre. In other words, our waters are capable of furnishing many times as many fish as they now do. There is no considerable body of water in Illinois which has been demonstrated to be over-fished by hook and line. The best fishing in the State is in the Fox Lakes which are fished heavily by Chicagoleans.

5. Introduction of new species holds little promise for the general improvement or increase of Illinois fishing.

6. The hatcheries maintained by the State have a negligible effect on the fish yield. We estimate that the yield per acre in the seven-odd acres of hatchery water is no greater than the yield per acre of the average of the best natural waters in the state.

7. The most practicable way of increasing fish yield in Illinois is to increase water area. This can be done most efficiently by damming small streams to form lakes. Potential fish-forming substances in the water are translated into fish more completely in lakes than in streams. The construction of artificial lakes will furnish fishing to large areas of Illinois in which it is scanty or entirely lacking.

8. The natural fertility of Illinois waters is so great that the practice of artificial fertilization seems unnecessary, except in a few instances involving artificial bodies of water.

9. Much improvement has resulted from the abatement of pollution, particularly in the Illinois River.

10. Now that the pollution of the Illinois River has been cleaned up, the development of the Illinois Valley as a recreation and resort area may be urged.

Botanical Section Performs a Multiplicity of Duties

The botanical work done by the Survey covers many aspects of purely scientific and applied phases of the science. Besides maintaining a comprehensive fund of information regarding the botany of the State, efforts are made to advance the knowledge of plants through research, and service is rendered in many ways to other State agencies and in other activities conducted by the Survey.

One of the most important of the botanical activities is the work with plant diseases. Field surveys are made annually of crops of all kinds, to discover any new diseases that may occur, whether in the beginning such diseases are important or not, in order that information about them may be at hand. A second phase is the actual field study of epidemics of crop plant diseases which, by being correlated with weather data, should be the basis for carrying into practical application the results of controlled laboratory research.

A field in which important progress has been made is that of shade and forest tree diseases. This includes both the difficult research required to establish the cause of diseases and the economically valuable development of practical treatments.

The Survey also maintains a continually growing fund of information and an exemplary collection of the plants of the State, and in addition gives attention to the great numbers of parasitic fungi which attack both economic and wild plants throughout the State.
Studies in Crop Disease Epidemiology

The annual examinations made by the Survey's plant disease expert in the fields and orchards of the State results in the accumulation year by year of information, largely in the form of statistics, that is comparable to the statistics which constitute fundamental information in human epidemiology. In the study of human epidemics, distinction is made between the prevalence of a disease, that is, the number of persons in a given population who contract it, and mortality, that is, the number of persons who die as a result of having become ill. In the study of plant epidemics, a similar distinction is made, prevalence being regarded as the number of plants attacked by disease. Instead, however, of emphasizing mortality, the intensity of the attack is measured in terms of fruit injured, number of leaves or stems attacked, and the amount of leaf or stem tissue actually destroyed.

Illinois Has 16 Year Seasonal-Plant Disease Record

This presents, in a definite sense, the economic importance of the various diseases that attack crops and provides material upon which to base studies in the correlation of disease with seasonal and annual weather changes. Such records are now on file in the Natural History Survey for important diseases of the cereal and fruit crops grown in the State of Illinois, covering a period of 16 years.

Track Down New Diseases of Crop Plants

In the yearly examinations of fields and orchards throughout the State, careful watch is kept always for diseases not hitherto known to occur within the State. Several new diseases, and new hosts or localities for previously recorded ones, were discovered during 1937.

When a new disease is found, studies of it may have to be continued over several years, as has been the case with a small toadstool fungus first observed on wheat in 1935. Laboratory and field studies of the fungus itself and reviews of reports and descriptions of similar fungi have led to the preparation of manuscript in which the symptoms of the host are described, the fungus itself proposed as a species new to science, and an analytical study presented of other similar species of fungi.

Find Five Hitherto Unknown Diseases of Korean Lespedeza

In the case of new crops, field surveys reveal the presence of diseases before they become serious. For example, Korean Lespedeza, which is relatively new as an extensive acreage crop in Illinois, is generally thought to be quite free from disease attack. Yet a single season's examination revealed the presence of five diseases not hitherto known to occur on it in this State. Information such as this furnishes an understanding of the disease hazard that a farmer must face in attempting to grow such a crop and also points the way toward the use of control or preventive measures as a part of cultural practice.

Study Control of Tree Disease on Special Plot

While diseases of elm trees still demand major attention, the Survey has recently established a four-acre experimental plot in which many other kinds of trees are being grown as subjects for research on diseases of all kinds important as shade and as forest trees.

Of special importance during the past year, and for several years, has been the widespread wilt disease caused by the particular fungus, Verticillium albo-atrum, which has been especially destructive to Norway and hard maples in the State, but also importantly destructive to elms and a number of other trees and shrubs. Of special interest during the 1937 season was the discovery that this same disease, besides being destructive to shade trees, was a destructive parasite also of the smoke tree, Rhus cotinus, and of a Viburnum widely used as a decorative shrub.

Discover Fungus Responsible for Killing Oaks

In the study of diseases of oak trees, which are important both as native and as planted and cultivated shade trees, a discovery of exceptional
Importance is declining and the condition commonly known as stag-head is commonly associated in both northern and southern Illinois with the shoe-string fungus, *Armillaria mellea*.

This study of oak tree diseases has resulted in the definition of field symptoms for many kinds of disease, including cankers, die-back, and trunk and root rots; and laboratory studies made of sample material have resulted in the obtaining of more than 150 fungus cultures known to represent at least 17 fungus genera.

Studies of diseases of evergreens have been limited chiefly to a disease of pines which we have called pine canker, first found in the State as apparently an important disease of white pine, and subsequently found attacking short-leaf pine, Austrian pine, pitch pine, and Norway spruce also.

**Test Value of Spraying Diseased Shade Trees**

Observations on the practical control of shade and ornamental tree diseases are gradually leading to the conclusion that the use of sprays for disease control alone is often dubious. Certain types of disease, such as the anthracnose of sycamores and white oaks and leaf spots of elms and other trees, can be controlled adequately by sprays, but for those types of disease in which the disease-producing organism attacks the internal body of the tree, application of sprays appears to be futile. In such cases treatment is best limited to feeding and watering, to stimulate growth and a generally healthful condition. With this conclusion inescapable, the Natural History Survey has prepared directions for such treatment, according to the latest and best approved methods, and has distributed several thousand mimeographed copies.

*Wheat and barley plants killed by a parasitic toadstool which was first found in Illinois fields and proved to be a new parasite of small grains as well as a fungus new to Science*
In the research on tree disease control, various sprays have been tested through several years, giving rise to the general conclusion that fungicides based on sulfur are more effective in preventing internal, wilt-producing infections than those based on copper. It appears also that even the less effective copper-containing sprays, such as Bordeaux mixture, and some of the ineffective sulfurs may be made effective by combining with them careful pruning.

Within the Survey's own organization, the botanical work has been made useful in connection with game management, in food studies of game birds,
by making available collections of seeds of food plants as the basis for the identification of foods used by birds, and also in direction of the botanical survey of the game sanctuary recently established in the southern end of Calhoun County.

**Study Possible Eradication of Chinch Bugs in Winter**

Co-operation has been given also to the Section of Economic Entomology in the study of fungi which attack chinch bugs. This was undertaken with a view to determining to what extent the "chinch-bug fungus" attacks the bugs in their winter quarters, and whether or not the fungus may thus be carried over winter and into the succeeding year, and finally whether it and other fungi have any appreciable effect upon the succeeding year's outbreak of chinch bugs.

As for many years, co-operation has been given during the past biennium to the Plant Disease Survey of the U. S. Department of Agriculture in the estimation of losses in commercial crops due to the attack of important diseases. Information thus furnished is collated with information from other states and serves as a record of the damage done annually by crop diseases throughout the nation.

**Descriptive Circular Aids Weed Control Program**

During the past year the Survey has given co-operation to the State Department of Agriculture particularly in the matter of weed control by furnishing one of its staff as a member of the State advisory committee on weed control and by preparation and publication of a circular descriptive of methods of weed control and of weeds important on the farm and in public health. The demand for this circular has been heavy; an indication that it has filled a real need.

**Extension Activities**

All sections of the Survey promote an extension program by means of radio talks, publication of findings in State publications and trade journals,

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*Canker disease of evergreen trees is shown above, the Phomopsis fungus having invaded the branches where they emerge from the main stem. The injuries are often so severe that the entire tree dies.*
A bottle culture of the Shoestring fungus which causes staghead of oaks. The strands of the fungus, which looks like an octopus, first invade the roots and then the trunks of trees. As the roots and trunk die the tree top dies back also leaving branches bare of leaves that look like horns

news releases, direct correspondence, and appearances on the programs of a wide variety of organizations. Leading our extension work is the Section of Economic Entomology whose staff in 1936 attended 143 agricultural meetings 61 different counties with a total attendance of 8,416 people.

PUBLICATIONS FOR BIENNIIUM 1935-1937

**Illinois Natural History Survey Bulletin, Volume 20**  

**Illinois Natural History Survey Bulletin, Volume 21**  

Article 2.—Responses of the large-mouth black bass to colors. By Frank A. Brown, Jr. and David H. Thompson. 22 pp., colored frontis., 10 figs. May, 1937.

**Illinois Natural History Survey Circular**  

**Illinois Natural History Survey Biological Notes**  

Biological Notes 7.—Control of Elm Diseases in Nursery Elm Planting. By J. C. Carter. 16 pp., May, 1937.

**Illinois Natural History Survey Booklist**  

**Illinois Natural History Survey Manual**  

**Contributions to Other Publications**  


Food and Shelter for Birds. From material contributed by the late Jesse L. Smith and by William J. Lyon, W. L. McAtee and R. E. Yeatter. The Illinois Audubon Society, Special Publication.


