

THE VISITOR

Devoted to the Interests of Agricultural Education in Minnesota Schools

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A TIMELY WARNING

Mr. Ellinger's¹ statement that "The corn crop of this country is endangered by the spread of the corn borer into the Mississippi Valley. Its advance is marked by devastated fields and impoverished farms. When the destruction is complete it is too late to act. The immediate situation calls for an awakening from apathy and a mobilization of all forces to fight off the assassin" sounds like a battle cry. It is the purpose of this issue of the Visitor to remind the teachers of agriculture that a relatively new enemy is on its way to challenge the right of the Minnesota farmer to grow corn. A year ago this month the Visitor presented an article by Dr. H. K. Hayes, Professor of Plant Breeding, University of Minnesota, entitled "What Can the Farmer Do to Improve His Corn." This issue presents material prepared by A. G. Ruggles, Professor of Entomology, University of Minnesota, designed to enlist the help of teachers in spreading information about what appears to be a dangerous future enemy of the Minnesota corn crop.—A.M.F.

The European Corn Borer

Corn, the staple farm crop in most parts of the United States, is menaced by the European corn borer. In a few short years the destructive powers of this imported insect have so impressed those most closely concerned that Congress has just recently appropriated ten million dollars, in addition to large sums previously appropriated by state and organizations, for the purpose of fighting it and saving a crop and an industry which are indispensable to American agriculture.

Since the borer is headed toward Minnesota and has even reached Illinois on its march westward, it is well that our corn growers should gird themselves for the fight that impends by studying the pest and the losses which it is known to be capable of inflicting.

In Minnesota the growing corn is often attacked by a number of insect pests such as the corn ear worm, white grubs, grasshoppers, cutworms, army worms, and wire worms, but only occasionally does an injurious insect become generally distributed over the state.

Just now the name of the European corn borer is on everyone's tongue and speculation is rife as to just what it will mean to the corn growers of the state if this new pest reaches Minnesota.

It is impossible to predict at the moment just what will happen. We know that in several counties in Ontario where the insect has been established, it has been impossible to raise corn profitably for the last two or three years. The same may be said of two counties in Ohio and possibly one in Michigan. Also in parts of New York State, particularly in sweet corn areas, the profitable growing of corn is problematical. It is probable that in the Corn Belt certain areas will have to raise other crops than corn when this pest once becomes established. Still other areas will continue to grow corn profitably. It is unquestionably the worst corn pest with which the American farmer has ever had to contend. The problem before us, therefore, is to learn "how to live with" the borer when it reaches us.

History

It is fairly well established that the borer made its entry into this country from Europe about 1909 and 1910. It was first found near Boston in 1917, where it was doing considerable damage to sweet corn. There were three or four separate infestations, one in the Massachusetts area, one in eastern New York, another in western New York in the Lake Erie region and another, possibly a still earlier infestation, in upper Canada or Ontario. At any rate the three latter infestations are now practically continuous and the spread from these is rapidly approaching the larger corn belt area of the middle west. In December, 1926, the borer was found in Illinois. If the spread continues at the same rate it will be found in Minnesota before many years.

The danger of the continuous spread of the corn borer is indicated by Flint² in the statement that "There has never been a case in which an insect that has become established over so great an area has not spread over all adjoining territory in which conditions were favorable for its existence. The adult moth is capable of flying at least twenty miles, and with a good wind to carry it, can

¹Ellinger, Tage U. H. The Corn Borer Assassin of the Corn Field Dept. of Livestock Economics, Union Stock Yards, Chicago.

²Flint, W. P., Hackleman, J. C. Begin to Fight the Corn Borer Now. Ill. Agr. Ext. Sta. Cir. 274. 1925.

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probably go several times that distance. Other moths similar to the corn borer are known to travel for hundreds of miles when carried along by the wind. The strict quarantines, both state and federal, that have been in force preventing the shipment of material which it is thought might carry the corn borer have apparently prevented any commercial spread of the insect, but the moth cannot be stopped by quarantines."

The insect most likely to be confused with the European corn borer in Minnesota is the native corn ear worm. The corn ear worm feeds on the silk and kernels on the corn cob, often eating off the silk before fertilization and producing "nubbin" ears. Sometimes these caterpillars are not mature at corn picking time and the worms may still be seen on the cob among the kernels. If harvested with the corn, they usually die in the process. Where these larvae have been, mold and bacteria develop and the ear has a musty appearance. The larvae of the European corn borer, on the other hand, burrow among the kernels as well as inside the cob, in the tassels and in the stalks, sometimes as many as twenty or more being found on a single stalk.

"The caterpillars of the corn earworm are about $1\frac{1}{2}$ inches long when full grown and very variable in color, ranging from tints of green, pink, rose yellow, and brown to almost black. They may be beautifully striped, or spotted, with brown, black, or yellow along the side and back, or they may be entirely free of stripes or spots. In appearance they can be readily distinguished from the corn borer by the fact that they are nearly twice the size of the latter. The hairs arising from the black tubercles, or warts, on the back of the earworm are much longer and stouter than those arising from the brown tubercles on the back of the corn borer. The castings of the earworm are coarse, wet and foul, while those of the corn borer are more finely divided and usually dry."³

Life Cycle of European Corn Borer

The insect hibernates as a larva inside any part of the corn plant. It is often found overwintering in the cob, but more often in the lower part of the stalk. The larva at this time is about one inch in length and about one-eighth of an inch in diameter. It has a dark brown head, a slightly gray inclined to pink body with two dark brown spots on the back of each body segment. Indistinct stripes run down the middle of the back. The under side of the body is clear and flesh colored.

In the spring this overwintering borer changes to a pupa in the burrow and of course does not feeding. During the last of June and the first of July the adult moth emerges. The corn borer adult is a small moth having a wing expanse of about one inch. It is rather light in color varying from pale to dark brown. Often irregular lines or streaks of yellow are noted. These moths are strong fliers. Very soon after emergence mating takes place and immediately the eggs are laid. The eggs are usually deposited on the under side of the leaves of corn and other food plants. In about two weeks the eggs hatch. The young larvae begin feeding on the surface of the leaf, but soon hunt around for places into which they can tunnel into the stem and larger veins of the leaf. Their work for the most part consists in tunneling through the different tissues of the plant, often leaving one part and boring in at some other point. Five to six weeks after hatching from the eggs the worm is full grown.

Caffrey,³ says that the larger borers are able to live for at least a month without food, even during their active period of growth. This habit is especially significant as the insects can be easily carried in infested material which may be transported considerable distances or may be kept in storage for a long period. A further indication of the resistance power of the borer is indicated by Caffrey in his statement that "Experiments have shown that many of the full grown borers are able to survive total or partial submergence in either fresh or salt water for a period of at least 40 days during their inactive period in the late autumn, winter or early spring."

³ Caffrey, D. J. and Worthy, L. H. The European Corn Borer and Its Control. U. S. Dept. of Agr. Farmers' Bulletin No. 1294, p. 28.

³ Caffrey, D. J. and Worthy, L. H. The European Corn Borer and Its Control. U. S. Dept. of Agr. Farmers' Bulletin No. 1294, 1922.

If the borers are left undisturbed, they will remain in the old infested plant, particularly the lower 18 inches of the stalk, during the fall and winter months. If disturbed by collecting cornstalks in the field or when corn stalks are left in shocks in the field, they migrate and crawl under rubbish, stones, fences and there construct a little silken covering for themselves, in which they remain over winter.

In the New England states the insect has two generations each year, the second generation becoming full grown larvae passing the winter as described. In the area nearest to us, the insect has only the one generation.

Damage

The damage done by the insect is produced entirely by the larvae while boring into all parts of the stalk and ears of the corn plants. The central portion of the stalk is eaten out and hence the plant is not properly nourished, and the ears cannot fill out and mature, or the shanks are tunneled and weakened so that the ears fall off before fully matured or harvested. The weakened stalks fall over and where the worms have worked, decay sets in. Ears thus injured do not keep well in storage. In the older infested areas complete destruction of the crop often results.

Food Plants

Another unfortunate thing from the growers' standpoint is that this insect will feed on many plants. It seems to be particularly fond of sweet corn but any kind of corn will do. The worms will burrow in millet, soy beans, dahlia, cosmos, celery, beans, rhubarb, spinach. They will burrow also in potatoes, tomatoes, asters, and zinnias. In fact many more plants including several weeds are attacked by the pest.

Enemies of the Borer

No native insect enemies of importance have appeared to attack the pest. At the present time government entomologists are searching in Europe for the natural parasites and several have been obtained and set free in this country. But it undoubtedly will be several years before the parasites make themselves felt effectively. In their native country the parasites already found do not reduce the insect over 15 to 30 per cent. It is hoped that they may be more effective here or that more efficient parasites may be found in this country or in other countries.

Control

The most important thing to consider now is how this imported pest can be controlled when it once gets a start in the state.

In the first place, it has been shown that although no farm crop is immune, there are some crops that are not damaged to any extent by the borer. Such crops are clover and alfalfa, sugar beets, small grains and curcubits. Crop diversification, therefore, will be one of the lines along which to study.

The most effective direct methods of control are low cutting of the corn, the utilization of the corn stalks, and plowing under the stalks at least six inches in the fall or very early spring. Burn or otherwise destroy all corn stalks and other plant rubbish in the fall or before May 1 of each year.

Commercial firms have been at work developing machinery for cutting corn close to the ground, so that most of the borers will be taken in the cut stalks.

Shredding machines are being developed to care for the crushing of all the stalks taken from the field. When the stalks can be shredded or cut and fed into the silo, the borers are destroyed.

Conclusion

As the European corn borer will reach Minnesota sooner or later, we must be prepared to meet it by improving our agricultural practices. Methods known to be effective must be put into practice immediately by all corn growers.

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—A. G. Ruggles

SUMMER SESSION

The University of Minnesota offers in its Summer Session of 1927 many attractive courses in the fields of education, of agriculture and of other subjects. The first term of the Summer Session extends from June 17 to July 30; the second term, from July 30 to September 3.

Agricultural Education and most of the courses in agriculture are offered the first term only. Many other departments in the College of Education and in the other colleges make offerings for the second term also. A special folder of the College of Education contains all the education courses for both terms and can be obtained by request addressed to the Visitor. The full Summer Session Bulletin containing all the courses offered by the University during the summer quarter in all departments can be obtained from the Registrar of the University, Minneapolis.

Below is found a list of those courses in the College of Education and the College of Agriculture that will probably be most interesting for teachers of agriculture. This is only a small portion of the offerings made in these two colleges.

Courses in Agricultural Education

82. Agricultural Extension Field Work. Actual field practice in extension work on part salary in addition to credits. Number admitted to course limited by positions available. Usually will cover summer quarter, may extend into fall quarter. (3 to 10 cred.; prereq., 81.) Mr. Storm.
144. Course Organization and Instruction for the Individual in Vocational Agriculture. Subject matter content for the individual should be based on farm activities. Individuals should progress according to abilities and needs. Accepting these principles, this course includes selection and organization of content, administration and teaching technique. (3 cred.; prereq., 131, 151.) Mr. Lathrop.
224. Graduate Problems. Making investigations, gathering data, and formulating plans regarding agricultural education. Mr. Storm, Mr. Field, Mr. Lathrop.
242. Organization and Administration of Teacher-Training for Vocational Agriculture. Development of teacher-training institutions, agricultural college curricula, professional needs of high school teachers, professional courses and their content, equipment, itinerant teacher-training, practice teaching, teacher evaluation. (3 cred.) Mr. Field, Mr. Storm.

Courses in Agriculture

Agricultural Economics: 140 Principles of Marketing, 206 Seminar in Agricultural Policy, 210 Seminar in Agricultural Product Economics, 220 Seminar in Economics of Consumption, 237 Methods of Price Analysis; Agronomy and Farm Management: 124 Advanced Farm Crops, 218 Classification and History of Crop Plants, 201 Research in Plant Breeding, 219 Laboratory in Plant

Breeding Methods; Dairy Husbandry: 114 Problems in Dairy Husbandry, 208 Research in Dairy Husbandry, 209 Research in Dairy Products; Entomology and Economic Zoology: 197 Introduction to Research; Horticulture: 190-01 Special Problems; Plant Pathology and Botany: 206 Special Problems.

Courses in Education

(Other than Agricultural Education)

Educational Administration and Supervision and Technique of Teaching: 15 Technique of High School Instruction, 38 Methods and Problems in Secondary School Science, 65 The High School, 110 Educational Diagnosis in Secondary Education, 113 High School Curriculum, 124 Educational Administration: Organization of State and Local School Systems, 157 Administration and Supervision of Rural Schools, 164 High School Administration, 167 The Junior High School, 193 Foundations of Secondary School Methods; Educational Psychology: 111 Educational Diagnosis, 116 Statistical Methods in Education, 117 Advanced Statistical Methods in Education, 134 Mental Tests; Trade and Industrial Education: 11 Special Class Woodwork, 30 Graphic Presentation, 110 Guidance in the Schools.

A special form will be sent to all agriculture teachers in Minnesota. It will be sent to agriculture teachers in other states who write requesting a copy. On this form those who expect to attend the summer session can indicate their preference of the courses offered.

—A. V. S.

THE ANNUAL SUMMER CONFERENCE

This year the Annual Summer Conference called by the State Department of Education in co-operation with the department of Agricultural Education, University Farm, will be held the week beginning June 13 and ending June 17. The meeting is to be held at Northern Pine Camp located eight miles north of Park Rapids on highway number four. Excellent accommodations are furnished by the proprietors of this camp in the way of cottages, meals, lodgings, and so forth at the special rate for teachers of agriculture.

The camp is not very large and can accommodate only 65 or 70 persons, so we shall have to know at a later date definitely how many are expecting to attend.

It is hoped that superintendents of schools maintaining departments of agriculture will be interested enough in our work to attend all or a part of this conference. We always welcome the superintendents on these occasions and we look forward to having many of them in attendance at the annual conference this year.—Paul Calrow, State Supervisor, Agricultural Education.