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DOMINION OF CANADA
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C. GORDON HEWITT, DOMINION ENTOMOLOGIST.

BORING CATERPILLARS AFFECTING CORN
AND OTHER CROPS AND WHICH ARE
LIABLE TO BE MISTAKEN FOR
THE EUROPEAN CORN
BORER

BY
ARTHUR GIBSON
Chief, Division of Field Crop and Garden Insects

CIRCULAR No. 14
[TECHNICAL]

Published by direction of the Hon. S. F. Tolmie, Minister of Agriculture,
Ottawa, Canada

OTTAWA
J. DE LA ROQUERIE TACHÉ
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1920

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Issued April 9, 1920.

WE SHALL BE PLEASED to hear from anyone concerning damage or trouble of any kind due to insect pests. No postage is required on any such letters of enquiry when addressed :

**DOMINION ENTOMOLOGIST,
Department of Agriculture,
OTTAWA, ONT.**

Such enquiries should be accompanied in all cases where it is possible by specimens of the insects. The insects should be sent packed with their food plant in a strong wooden or tin box to prevent loss in transit. Packages up to 12 ounces in weight may be mailed free and every package should bear or contain the sender's name and address and be accompanied by a letter.

OTTAWA, February 18, 1920.

To the Honourable
The Minister of Agriculture,
Ottawa, Ont.

SIR.—I have the honour to submit herewith for approval Entomological Circular No. 14 (Technical), entitled: "Boring Caterpillars Affecting Corn and other Crops and which are Liable to be Mistaken for the European Corn Borer", which has been prepared by Mr. Arthur Gibson, Chief, Division of Field Crop and Garden Insects.

As a result of the efforts which we are making to prevent the introduction and establishment in Canada of the European Corn Borer we have received numerous boring caterpillars which have been mistaken for that insect. In view of the fact that a number of the caterpillars are of economic importance, and in order to have available information concerning them, this circular has been prepared for distribution as occasion may demand, and for the purpose of enabling agricultural workers and others to distinguish between the various species of caterpillars which may be found boring in corn and other crops.

I have the honour to be, Sir,
Your obedient servant,

C. GORDON HEWITT,
Dominion Entomologist.

DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

WARNING

THE EUROPEAN CORN BORER

This pest attacks CORN, POTATOES, OATS, FODDER AND GARDEN CROPS and has recently been found in the United States where it is doing great damage.

THERE IS GRAVE DANGER OF THIS SERIOUS FOREIGN PEST BEING BROUGHT INTO CANADA.

	<h3>HOW TO RECOGNIZE IT</h3> <p>Holes in the stalks of the above mentioned plants with sawdust-like material issuing from them indicate the presence of the borer or caterpillar. In the case of corn broken tassels also show where the borer is at work.</p> <p>If the infested stems are split open the caterpillars will be found at work. These are often found just above the roots.</p> <p>The insect spends the winter as a caterpillar in old stalks of corn or other food plants and changes to a reddish-brown pupa late in the spring. The pupa soon turns into a moth.</p> <p><small>Illustrations reproduced by courtesy of the Bureau of Entomology, U. S. Department of Agriculture.</small></p>	

All persons are urgently requested to keep a constant lookout for this most dangerous pest and to report immediately all suspicious cases. Infested plants together with the insects themselves should be forwarded to the DOMINION ENTOMOLOGIST, DEPT. OF AGRICULTURE, OTTAWA, ONT. Packages under twelve ounces in weight may be sent free of postage.

Published by the direction of the Hon. Thomas A. Crerar, Minister of Agriculture.

Boring Caterpillars Affecting Corn and other Crops and which are Liable to be Mistaken for the European Corn Borer.

By ARTHUR GIBSON,
Chief, Division of Field Crop and Garden Insects.

INTRODUCTORY.

There are a number of different kinds of caterpillars which bore into and work inside of the stems of plants and which in 1919 attracted more than usual attention in view of the warning poster relating to the European corn borer, *Pyrausta nubilalis* Hbn., which poster was distributed widely by the Entomological Branch in May last. Injury by these boring caterpillars is usually confined to a limited number of plants, but occasionally the infestation is of a serious nature. Their presence may usually be detected by the unhealthy appearance of the plants, the tops of which in most instances become withered and fall down at one side.

THE EUROPEAN CORN BORER, *Pyrausta nubilalis* Hbn.

The name European corn borer has been applied indiscriminately by farmers and gardeners generally to the various kinds of boring caterpillars discussed in this circular. The European corn borer, however, is quite different. Its work may be judged by the plate herewith which is a reduction of the poster referred to and in which the insect is represented in its various stages of development.

In view of the fact that this insect has, since 1917, established itself in certain of the eastern United States, as for instance, in Massachusetts, New Hampshire, New York, and Pennsylvania, the Dominion Department of Agriculture established, on May 20, 1919, a quarantine against the infested states, which quarantine prohibits the importation of corn on the cob, corn stalks, packing, green sweet corn, etc. Inspectors have traced shipments of corn from the affected districts imported into Canada during the past two years. Certain sections of southern Ontario adjacent to infested districts in northern New York State, have been examined in an endeavour to find out if this notorious pest had been introduced. We are glad to state that so far the European corn borer has not been found in Canada.

In addition to corn, the caterpillars readily feed on many other plants such as celery, bean, beet, spinach, potato, tomato, turnip, rhubarb, dahlia, chrysanthemum, gladiolus, ragweed, burdock, pigweed, etc. All parts of corn, which is the most favoured food plant, are attacked, except the fibrous roots. The most serious damage is caused to the stalks and ears which the borer partially or totally destroys. D. J. Caffrey¹ states that the borers generally enter the stalk at the upper end near the base of the tassel and at first tunnel upward. The damage so weakens the tassel stalk that it breaks over before the tassel matures, resulting in loss of pollen and the lack of normal grain formation on the ears. After destroying the tassel the borers tunnel downward through the stalk, gradually increasing the size of their tunnels as they develop. The plate herewith well illustrates the damage caused by this borer.

When mature the European corn borer is about one inch long. It is of a light brownish or flesh colour, some specimens being darker than others. The head is dark brown, the thoracic shield paler brown, as are also the tubercles on the body.

Mr. Carl Heinrich, of the U. S. Bureau of Entomology, has recently published² a paper on the European corn borer, *Pyrausta nubilalis*, and its nearest American allies, namely *Pyrausta ainsliei* and *Pyrausta penitalis*. Larval and pupal descriptions are given as well as a key to separate the three species in adult, pupal and larval stages. The last two named species are found in Canada;

THE BURDOCK BORER, *Papaipema cataphracta* Grt.

This borer is, on the whole, the one which is most frequently complained of as a garden pest, and during 1919 was the caterpillar which was most often sent to us as being possibly the European corn borer. It is a general feeder and although found commonly in eastern Canada in the stems of burdock, owing to which we gave it the common name of the burdock borer, it by no means

FIG. 2. The Burdock Borer, *Papaipema cataphracta* Grt.; natural size. (Original)

confines its attention to that plant, being found in a great variety of plants having succulent stems. In the Ottawa district, in addition to burdock, we have found the larva in the stems of larkspur, sunflower, goldenglow, dahlia, Joe-pye weed, hollyhock, meadow rue, rose, iris, lily, houseleek, tomato, potato, thistle, cabbage, rhubarb and corn. We have, also, one record of the larva boring in the fruit of gooseberry. On one occasion (1910) the larvae were specially abundant at Ottawa, particularly in burdock, and in about an hour's time, we collected nearly fifty specimens.

FIG. 3. Stem of larkspur destroyed by the Burdock Borer. (Original).

The burdock borer when mature is about $1\frac{1}{2}$ inches in length. In general, it is a smooth, cylindrical, pale-brownish caterpillar with a whitish dorsal stripe and a lateral band of the same colour, both continuous, the latter about twice the width of the former. The tubercles on the body are dark brown and on some

specimens conspicuous. The head is shiny, yellowish-brown, with a wide dark brown or blackish band running from the ocelli to back of head. This band when the segments are drawn together joins the blackish lower margin of the thoracic shield. Thoracic shield, otherwise, similar in colour to the head. In the earlier stages the ground colour of the larva is much darker, the pale longitudinal markings consequently being more contrasting. Some adult examples are almost wholly creamy-white in colour, with inconspicuous markings.

Injury by this borer, in some years, is observable in the middle of June. More often, however, the work of the larva is not detected until July during which month, as well as in early August, the withered tops of infested plants may be apparent in gardens or fields. As a rule, only one larva is found in the same plant. In the case of the burdock, however, two or even more, larvæ may be present. In cultivated plants, one individual, of course, is capable of causing the plant to wilt and die. This is especially so when young corn is attacked.

When the larva is full grown it usually pupates in the stem where it has been feeding. In 1904, a pupa was found exposed but attached to an outside leaf of an iris plant, about two inches from the ground. The moth emerged on September 4. The pupal stage of specimens collected in the Ottawa district ranged from 30 to 39 days.

THE STALK BORER, *Papaipema nitela* Gn.

This well known borer which is some years seriously abundant in Illinois and other northern states, has not been responsible for important losses in Canada. In 1905, the larvæ were present in Kent county, western Ontario, and caused some injury in corn fields. In addition to corn, the borer was found in potatoes, tomatoes, Canada thistle, elder, lamb's quarters, garden beans, rag-weed, pigweed, sweet clover, as well as in the stems of flowering plants in gardens. In 1912, Mr. H. F. Hudson, found a borer in corn at St. Ives, Ont. Unfortunately no adult moths were reared by Mr. Hudson but it was assumed that the species was *P. nitela*. From material received from Fargo, Ont., in 1905, the adult was reared on September 6, the larva, in confinement having left the food plant and entered the earth for pupation on August 2.

The stalk borer when mature is about $1\frac{1}{2}$ inches in length. It is, in general, very similar to the burdock borer. Usually it may be separated by the fact that the reddish-brown stigmal band is absent on the first four abdominal segments.

Like the burdock borer, too, it generally changes to the pupal state in the stem in which it has been feeding.

THE POTATO-STEM BORER, *Gortyna micacea* Esp.

This European insect has, of recent years, developed into a pest of some importance. Since it was first recorded in Canada in 1908, it has spread considerably, particularly within the provinces of New Brunswick and Nova Scotia. While it is known to have caused important damage under field conditions its injuries have, as yet, been practically confined to gardens.

While the potato is a favourite food plant, the caterpillar readily bores in the stems of corn. In the Maritime Provinces it is also known to attack rhubarb, beet, tomato, pumpkin, pods of garden peas, iris, lily and dahlia. In addition, in Europe, the larva is known to tunnel in horse-tail, sedges, dock, valerian, plantain, hollyhock, etc. In Nova Scotia, in 1917, young corn plants had been destroyed by the end of the first week in July. In 1919, in the same province, similar plants had been ruined by June 26.

The following description of the caterpillar was made from a specimen received from Mahone, N.S., in July, 1906.¹

"Length, 32 mm. Head, rounded, chestnut-brown, shining, mouth parts darker. Body: a dirty creamy colour, with a pinkish tinge on dorsum, except at intersegmental folds. Thoracic shield pale brown, margined anteriorly with dark brown. Tubercles pale brown, each with a single pale hair. Tubercle iv on seventh abdominal segment is almost as large as the upper half of the spiracle, the upper edge being slightly above the upper edge of the spiracle. Spiracles black. Anal shield blackish. Dorsal vessel distinct. No markings whatever on the body. Feet all pale."

The decided pinkish or rosy tinge of the upperside of this borer is characteristic, and in this differs from any of the other borers discussed in this circular.

FIG. 4. Young corn plants destroyed by the Potato-stem Borer, *Gortyna micacea* Esp. (Original).

The full life-history of the insect in Canada is not, as yet, known. Prof. W. H. Brittain, Entomologist, Department of Agriculture for Nova Scotia, has found the eggs at Truro, N.S. in the end of August and in September on the stems of couch grass, *Agropyron repens*. This grass was abundant in a rhubarb plantation the plants of which had been very seriously injured by the borer. He states² that although he only found the eggs on couch grass, they are doubtless

¹Rep. Ent. Soc. Ont. 1908, 49 (1909.)

²Cir. 26, Prov. N.S., College of Agric., Dec., 1917.

deposited on various weeds. "They are very small pinkish-coloured eggs, faintly ribbed, and are laid loosely, sometimes in rather large numbers on the stems partially surrounded by the leaf sheath. The larvæ hatch in June and make their way to a suitable food plant where they bore a tiny entrance hole in the stem, usually at the surface of the ground. They bore in the stem or in the crown of the plant until some time in August and then enter the ground where they transform to a pupa, emerging in late August or September as an adult moth."

Since 1914, we have received many complaints of the work of the potato-stem borer, these referring chiefly to injury to potatoes and corn. During 1919, we received from Nova Scotia half-grown larvæ in the middle of June. From then until the end of July larvæ from the Maritime Provinces continued to arrive, most of the specimens sent being thought to be the European corn borer. In Ontario, in 1905, larvæ were found as late as August 31. Running through the different years we have records of the emergence of the moths from August 6 (1906) to September 18, (1905). The pupal stage is about 19 days.

A WESTERN CORN BORER, *Helotropha reniformis atra* Grt.

In June, 1919, we received at Ottawa larvæ of a noctuid boring in corn. Mr. Norman Criddle, Entomologist, in charge of our field laboratory at Treesbank, Man., under date of June 22, forwarded a larva which he had received from Winnipeg, Man., with the statement that it had been found in considerable numbers attacking growing corn, first the leaves and later the stem into which it bored. On June 23, we received a further communication, this time from Mr. A. V. Mitchener, Lecturer in Horticulture, Manitoba Agricultural College, Winnipeg, Man., which stated that the larva had been found injuring corn about a foot high. Further, that "the larva cuts a hole in the outside of the stalk and bores its way up into the centre." The injured plants had been detected from their wilting and consequent drooping. About June 18, Mr. Mitchener visited the infested corn fields immediately north of the city of Winnipeg and found several affected plants. The owner of the field reported that previous to Mr. Mitchener's visit he had seen considerable injury. Several other fields were similarly infested.

Mr. Criddle also reported that injury to corn by apparently the same caterpillar had taken place at Virden, Man., which is close to the western boundary of Manitoba.

The following description was made from a larva received from Mr. Mitchener:

Length extended $1\frac{1}{2}$ inches. Head yellowish-brown; ocelli black; mandibles reddish-brown. Thoracic shield concolorous with head, margined rather widely anteriorly with brown and thinly with same colour posteriorly and laterally. Body flesh-coloured with a faint indication of a pale brownish ground colour and continuous pale whitish dorsal and lateral stripes. Tubercles brown, i and ii round, of similar size; iii slightly larger than ii; iv and v close to spiracle, the former about four times the size of iii and v about the size of iii but elongate in shape; vi and vii similar in size and about twice the size of v. Anal plate yellowish-white margined rather widely with brown anteriorly; narrowly edged with brown posteriorly.

Apparently little is known of the early stages of *Helotropha reniformis atra* Grt. to which this larva is supposed to belong. The only previous record of injury to corn by the caterpillar of this moth is a short note by A. J. Cook⁵ which

⁵27 Ann. Rep. (1887-1888) Sec. State Bd. Agr., Mich., p. 166.

states that the larva, during two seasons, had been destructive to corn in some localities in Michigan. The caterpillar was described as being "grey in colour and striped with dark lines".

In Manitoba, in 1919, the borer was referred to by Mr. Criddle as the "Western corn borer". Unfortunately he was not able to rear any of the moths of *Helotropha reniformis atra* Grt. but reported that they were rather abundant in Manitoba in the latter part of July. This fact along with other evidence strengthens our supposition that the larva described above belongs to this moth. The larva which he forwarded to Ottawa is somewhat different from the one described above, being younger, and more whitish in colour. The probability is, however, that it belongs to the same species.

A NEW EASTERN CORN BORER, *Apamea nictitans americana* Speyer.

On July 14, 1919, we received from Mr. A. W. McDonald, of Pietou, N.S. two larvæ, both of which had been found boring in corn. The following description was made from one of the specimens:—

Length 31 mm. ($1\frac{1}{4}$ inches), colour dull greenish-grey, with conspicuous, wide, subdorsal band of dull pale red, and a thin lateral stripe of the same colour. Tubercles black, i and ii of similar size, iii larger than ii, iv very large immediately behind the spiracle, v smaller and elongate in shape, vi and vii about same size as iii. Ventral surface paler than dorsal and lateral areas. Head yellowish-brown. Cervical shield pale brown margined with black. Anal shield pale brown.

This noctuid larva in confinement pupated about July 19 in the earth near the corn plant at a depth of one-half inch, and the moth emerged on August 1, 1919.

Both the larvæ received had eaten the centre of the young corn plants and their work in general was noted to be similar to that of the potato-stem borer, *Gortyna micacea* Esp.

In England the caterpillar of *Apamea nictitans* Borkh., the moth of which is known as the ear moth, is recorded as feeding upon the roots of grasses in May.

The above is the only breeding record we have of *A. nictitans americana* Speyer.

THE CORN EAR-WORM, *Heliothis obsoleta* Fab.

During 1919, this insect was more than usually abundant in Manitoba, Ontario and Quebec. In August and September, even as late as October 16, ears of corn infested by the caterpillars were received, with the supposition that the "worm" was the European corn-borer. In its younger stages it is known to bore into the bud and feed upon the tender leaves as they unfold.

The corn ear-worm has not as yet caused serious losses in Canada. One of the most important records of injury which we have refers to an outbreak which occurred in 1898 in the district of Orillia, Ont.; the report received stated that the larvæ had been very destructive injuring as much as 95 per cent of the ears of both sweet corn and yellow field corn. This caterpillar has also been found in Canada, boring into the fruit of growing tomatoes.

When mature, the corn ear-worm is from about one and one-quarter to one and one-half inches in length. It varies in colour from a light green to dark brown, with rather indistinct stripes on the back and a wider, conspicuous, pale-coloured band along the side. The head is of a yellowish-brown colour. In the darker coloured examples the dorsal stripe is brownish divided in the centre by a thin whitish line. The stigmatal band is wide, mostly cream-coloured, mottled

FIG. 5. Ear of corn showing the work of the Corn ear-worm, *Heliothis obsoleta* Fab. Photo by W. Robinson (Original).

with pink, the lateral area immediately above being brownish. The rather, indistinct, additional, thin, longitudinal striping of the whole upper surface of the body and the numerous short spines which cover the skin readily separates this caterpillar from other corn-feeding species.

THE SPINDLE-WORM, *Achatodes zeae* Harr.

The larva of this insect known as the Spindle-worm is some years not uncommon in Ontario and Quebec provinces. In the United States it is known to bore in the stems of corn, but we have no record of it causing injury to this plant in Canada. In the Ottawa district we have found the larvæ rather plentiful in some seasons, boring in the young shoots of elder, *Sambucus*. In 1901, we reared a number of the moths, the date of issue being July 6.

The caterpillar is unlike any of the other borers discussed in these pages. When mature it is about one inch long. In colour it is yellowish-white with conspicuous blackish-brown tubercles. On the abdominal segments tubercle i is round and almost twice the size of ii which is elongate; iii, iv and v are close to and about the same distance from the spiracle; iii is about the same size as ii but rounded; iv behind the spiracle rather smaller than iii; v immediately in front of and about half the size of the spiracle which is jet black; vi about the size of i but not rounded; vii smaller than vi and more elongate. Head black, thoracic and anal plates blackish-brown; the latter bear six conspicuous cone-like protuberances.

THE GLASSY CUTWORM, *Sidemia devastator* Brace.

This well known cutworm which feeds upon the roots and lower stems of various kinds of grasses, has some years been responsible for serious injury in corn fields. In June, 1918, Mr. H. F. Hudson and I investigated an outbreak in a corn field, near Strathroy, Ont. The larvæ were present in noticeable numbers and had destroyed many plants. This larva is not, of course, a borer, but owing to the fact that it commonly injures corn, its work may be mistaken for that of the European corn borer; in fact individuals were received in 1919 as being possibly this latter borer.

The glassy cutworm is of a dirty-whitish colour, with a greenish tinge. The head is reddish or reddish brown, the shield on the first segment being conspicuous and brownish. The only markings on the body are the dull brown tubercles, each of which bears a single hair. The front feet are pale brownish, the hind ones being of the same colour as the body. Full grown specimens are about an inch and a half in length.

FIG. 6. Young parsnip plant showing work of the Parsnip Webworm, *Depressaria heracliana* De G. (Original).

THE PARSNIP WEBWORM, *Depressaria heracliana* De Geer.

This well known pest of parsnips has also been received as being possibly the European corn borer. It owes its common name to the habit of webbing the

inflorescence or flowering part of the plant. The parsnip webworm does not feed on corn, but confines its attention to umbelliferous plants such as the wild and cultivated parsnips feeding upon the forming seeds and leaves of the flower-heads, and later upon the whitish lining of the hollow stems of the plant, into which it burrows and where it pupates. The illustration, herewith, shows typical injury to young parsnips.

When full grown this larva is about two-thirds of an inch in length. In colour, it is yellowish or greenish-yellow with conspicuous blackish tubercles of similar size on each segment. The head is jet black; the thoracic shield blackish; the spiracles small, round and jet black. Thoracic feet blackish. Anal shield yellowish-brown.

The pupal stage is about three weeks. We have reared the moths from the last week of July until the middle of August. The winter is passed in the adult stage.

CULTURAL PRACTICES ASSIST IN THE CONTROL OF BORING CATERPILLARS.

Insects such as the borers cannot be reached by outside applications of spray material. When a valuable garden plant is found to be infested it may be possible to locate and remove the borer by cutting a slit in the side of the stem. Tomato and other thick stemmed plants have frequently been saved by this method, thread or light string being afterwards tied around the stem where the slit was made. Usually, however, it is a wise procedure to remove all weakened stems which indicate the presence of a borer.

Clean culture is the main preventive measure in the control of boring caterpillars. It is known that the adults of some of the borers deposit their eggs on weeds, and very often important injury to plants is effected near the edges of fields and gardens close to which weeds of various kinds have been allowed to grow. It is important, therefore, that weeds of all kinds should be kept down as much as is possible, throughout the entire growing season. Remnants of crops, old stems of garden plants and weeds, should be removed regularly and burned.

IMPORTANT TO IDENTIFY BORERS FOUND IN PLANTS.

In view of the close resemblance of the European corn borer to its nearest allies, and also generally, to other borers when in their younger stages, it is urged that farmers and gardeners report at once the presence of any borer found in plants, particularly if in corn, such reports to be sent to the nearest Entomological Laboratory, Provincial Entomologist, or Dominion Entomologist. Packages containing the caterpillars and their work, up to 12 ounces in weight, may be mailed to Ottawa, without postage, if addressed

Dominion Entomologist,
Department of Agriculture,
Ottawa, Ont.