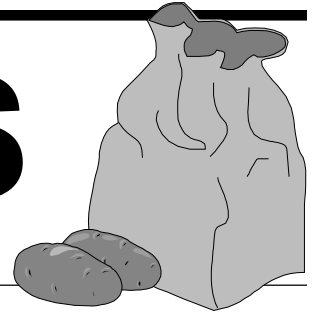


POTATO EYES



Vol. 13, Issue 2, Summer 2001 • Alexander D. Pavlista, Ph.D., Extension Potato Specialist

PAA Thanks Pavlista

At their annual meeting this year, the Potato Association of America presented a special award to Dr. Alexander Pavlista, University Nebraska-Lincoln, in appreciation for his work with PAA graduate students for the past ten years. This is the only time such an award has ever been presented.

New Registrations

Fungicides: Gavel 75DF (foliar applied) by Rohm & Haas is new chemistry, active against early and late blights. (Note in Nebraska trials as RH141457.)

Insecticides: Platinum (soil applied) and Actara (foliar applied) by Syngenta (merger of Novartis and Zeneca) have similar activity to Admire and Provado (Bayer), respectively.

Herbicide: Select 2EC (foliar applied) by Valent controls grasses with similar activity as Poast (BASF).

Relative Water Requirement

Crops differ greatly in their water needs before permanent wilting is reached. Storage crops, such as potato, accumulate storage weight in direct proportion to the amount of water transpired through the plant. Stress at specific stages result in significant reduction in potato yield and quality.

Potato has a medium requirement for water and requires about 500 lb of water to gain one pound of dry weight or 4.4 acre-inches of water per ton (2000 lb) of crop. This is about the same as required by small grains (520-600 lb water/lb dry weight) and soybean (650 lb water/lb), much less than required by alfalfa (870 lb water/lb), and greater than needed by corn and sugar beet (360-380 lb water/lb).

Potato European Corn Borer

Introduced into North America, the European corn borer (ECB) probably came in "broom" corn from Hungary or Italy around 1909. It was first identified in Massachusetts in 1917 from where it spread west to Nebraska in 1944 as a two-year generation ('bivoltine') strain. Corn is its preferred or primary host but it can infest some 200 plants including dry bean, soybean, and Solanaceous crops such as potato, pepper and tomato.



Figure 1: Adult female European Corn Borer (J. Kalisch, UNL)

ECB, *Ostrinia nubilalis* (Hubner) in the Order Lepidoptera, is a major pest on corn. As a result, about one-third of Nebraska's corn acreage is planted with Bt-engineered hybrids. Bt-corn is highly effective in controlling ECB, 99% kill as opposed to 75-80% using insecticides. One might assume that this success in corn would lessen the amount of ECB in potato. But, the last couple of years suggest that this is not the case. Last year, ECB was observed in potato fields in the Nebraska Panhandle. This suggests that ECB may be spending more time in potato fields. Additionally, the increased use of imidacloprid may also play an important role because this active ingredient does not affect ECB larvae (see section on control). Last year's dry summer may have increased the incidence of ECB in potato fields as well (see section on population dynamics).

[Editorial note: Bt-potato has no effect on ECB because the protein produced is specific for the Colorado potato beetle and comes from a gene incorporated from *Bacillus thuringiensis* subspecies *tenebrionis*.]

Description

ECB undergoes complete metamorphosis including all four stages of development: adult, egg, larva, and pupa.

Adult (not damaging) -- ECB are triangular shaped when at rest (Figure 1). They are about three-quarter inch long along their axis. Wings from a distance appear straw colored but male and female vary somewhat in their coloration. Females appear creamy to pale yellow to light brown and have a stout body. Male bodies are smaller and more slender, and the wings are darker than females. The adult wing-span is about one inch and, at rest, they are about a half inch wide. The outer third of the wings are marked by two dark serrated lines running across the wing.

Egg -- An egg of the ECB is about half the size of the head of a pin. Color is white or creamy when laid and change to pale yellow and then darken with a "black head" just before hatching. Eggs are deposited on the underside of leaves in masses of 20 to 30 and are covered with a waxy film (Figure 2). The eggs in the mass overlap giving a fish-scale type of appearance. An egg mass is one-eighth to three-sixteenth of an inch long. A female adult lays 200 to 500 eggs during her 14-21 days at a rate of 24 to 40 per day. The eggs hatch in three to 12 days depending on temperature.

Potato European Corn Borer, Continued from page 1



Figure 2a: Freshly laid egg mass (Kalisch)



Figure 2b: Egg mass black-head stage; near hatching (Kalisch)



Figure 3: Larva ECB (A. Pavlista, UNL)

Larva (damaging stage) -- The larva is light gray to faint pink with a brown to black head, and have small brown to black spots along the sides on each segment and a faint stripe along its back (Figures 3). The body is capsule-shaped and segmented with legs. They grow to about one inch. Larvae are usually found burrowed into potato stems.

Pupa -- Pupae are smooth, reddish-brown, cylindrical and about a half inch long. They are found in a chamber burrowed into the stem.

Life Cycle

The strain of ECB in Nebraska is mostly bivoltine, undergoes two generation cycles (Figure 4) but in the Panhandle the univoltine strain (single generation) also occurs. The overwintering form is the full-grown larva found usually in corn

stalk residue. In Spring, the larva develops and pupates as air temperatures rise above 50 F. The pupal stage lasts two weeks at the end of which the adult emerges. The process is slower at cooler temperatures and accelerates at warmer ones. The adult stage lasts between two and three weeks during which eggs are laid. Egg masses hatch after about seven days depending on temperature. A few days after being laid, the black head of the developing larva can be seen ("black head" stage). Larval development takes about a month. The total life cycle takes seven to nine weeks on the average. Across Nebraska, the first generation or "brood" of adults appears in late May to mid June and damage to potato plants appears toward the end of June. The second-generation adults appear toward the end of July with larval damage appearing in August. The larvae of this generation overwinter. The first generation of the bivoltine strain is normally considered the problem but the second generation can cause storage damage by introducing rot pathogens if they are present in the field (see below). Adults of the univoltine strain appear in early July and their activity is between the two generations of the bivoltine (2-generational) population.

Population Dynamics

ECB populations are lower in dry summers, except in irrigated areas, because of their need for water, after extremely cold winters due to freezing and when heavy rains occur during hatching since the larvae drown.

Once moths emerge, chemical treatment should begin seven to 10 days later depending on temperature. Treatments must be applied before ECB larvae tunnel into the stem. The young larvae feeding on the top of the canopy and tunneling more than once may be killed along with adults but the older larvae tunnel deep into the stem and stay there. Scouting for the second generation on potato can be done using traps as with the first but also looking for egg masses on the underside of potato leaflets.

A Possible Key to Population Movement into Potato:

Since ECB prefer corn and do not care for potato very much, why do they come into potato fields at all? The key is irrigation and the potato's dense canopy ability to hold moisture. The female ECB has a voracious thirst and requires a daily recharge of moisture. Therefore, it will leave dry corn fields at night searching for wet areas such as potato fields. Once there, the female may decide to lay eggs, foregoing its favorite host for a good water supply.

Scouting and Field Detection

ECB activity can be detected by monitoring adults using black-light or pheromone traps. Black-light traps are monitored by the University of Nebraska's Extension Service and reported on Dept. of Entomology's web-site (<http://entomology.unl.edu/fldcrops/>). Sex pheromone traps are specific for the ECB male population. Refer to insert by Dr. Gary Hein, UNL - Extension Entomologist. Additionally, moths may be "flushed out" by walking through the field. As moth activity increases, potato stems should be examined for entry holes made by newly hatched larvae.

If the number of corn borer infested stems exceeds 20 per 100 stems sampled, an insecticide application may be warranted. If corn borer pressure is high, a second application may be required 7 to 10 days after the first application, depending on temperature. Rarely are more than 2 applications needed. As long as the initial insecticide application is made at the beginning of the infestation episode, even if some young larvae have penetrated the plant, the overall infestation will be reduced to a level below that at which time the application was made. Young larvae can move around making several holes for a week or so before tunneling deep into the stem and staying there.

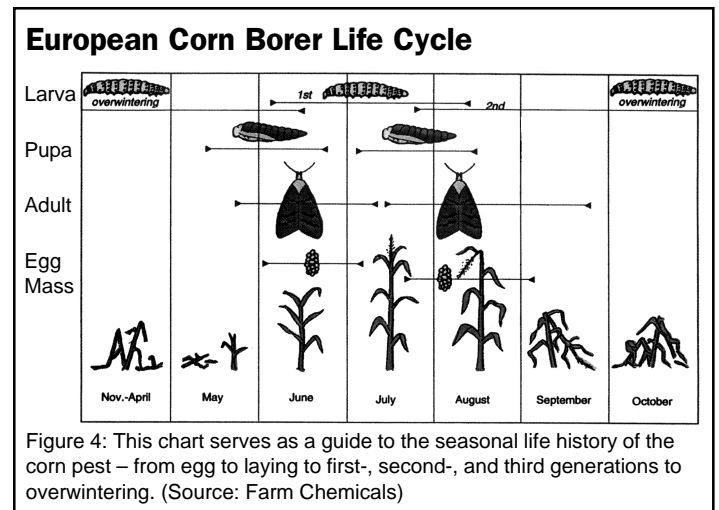


Figure 4: This chart serves as a guide to the seasonal life history of the corn pest – from egg to laying to first-, second-, and third generations to overwintering. (Source: Farm Chemicals)

While scouting a field, the first symptom that catches my attention is a leaf-roll appearance at the top of the plant (Figure 5). Upon approaching the



Figure 5: Leaf roll symptom from ECB in stem (Pavilsta)



Figure 6: Entry of ECB into potato stem (Pavilsta)



Figure 7: Larva in stem chamber (Pavilsta)

plant, I look to see if the whole plant has this appearance or just the leaves of a particular stem. If only the leaves of one stem show this symptom, I look for the hole that marks a ECB tunnel (Figure 6). At the tunnel entrance, I will find the excrement of the ECB termed 'frass.' It is tan-colored and grainy like fine sand. Splitting the stem will often uncover the larva responsible (Figure 7). On occasion the pupa will be found. Since young larva, early instar, may make several tunnels, it may not be present. Young larvae tend to feed mostly in the upper canopy and leave their frass along the leaflet axil. Older larvae, later instar, bore deep into the branch base.

Damage to Potato

There are several types of damage that the ECB can do. The larvae burrow into the stem eating out the pith and, in the process, also eat the vascular tissue thereby disrupting nutrient flow and resulting in reduced vigor and wilt. A more subtle and, possibly, the major damage is that ECB tunnels have been associated with the introduction of bacterial and fungal pathogens into the plant. The key one is the bacteria *Erwinia carotovora* the causal agent of black-leg on vines and tuber soft-rot. ECB has been reported to be a vector of *E. carotovora* and to promote the spread of black-leg in potato fields.

Yield losses due to ECB have been assumed due to the wilting effects of older larvae's burrows. However, published reports from North Carolina concluded that there was no direct correlation between ECB damage and yield of the cultivars Atlantic and Pungo. Yield loss associated with ECB infestation and injury has rarely been observed. Yield losses, when observed on occasion, occurred with early-season, pre-bloom, infestation (first generation) and not with mid or late season, after bloom, infestation. When losses were reported, early-maturing cultivars showed over 20% stem infestation and later-season cultivars needed a minimum of 50% infestation. Current research on the cultivars Atlantic, Snowden and Superior support these observations (Dr. Brian Nault, personal communications).

Quality losses of tubers were reported as vascular discoloration and as soft rot in storage due to *E. carotovora*.

Control

Broad-spectrum insecticides are effective in killing adult ECB. Chemical treatment should begin about a week after peak moth flight in corn and a second application made a week to 10 days later. [The peak moth flight is monitored by black-light traps and the peak reading in the sex-pheromone traps occur about a week later which is when treatment begins.] Chemical

Monitoring European Corn Borer Moth Flight

Gary Hein, UNL Extension Entomologist, Scottsbluff

To determine exact ECB moth activity, sampling for the insect in a given area is needed. The two methods used are black-light and pheromone traps.

Black-light traps are the traditional sampling tool. Night-flying moths are attracted to the light and trapped in the funnel-shaped trap below the light. The greatest benefit of the black-light trap is that it measures moth activity as it occurs. As a result, it is perhaps more accurate than pheromone trap sampling. Its disadvantages are cost (\$500+), access to electrical power and difficulty to maintain and check. Traps can get clogged with the many other insects attracted to the light. Separating out ECB moths can be challenging. Because of possible large insect numbers, samples can be very smelly, especially when wet, and difficult to sort. Traps need to be checked daily.

Pheromone traps use a synthetic sex attractant that attracts male ECB moths. Two pheromone strains are available. For Nebraska ECB, the 'Iowa' strain of pheromone is used. Of several trap designs available, the best for ECB is the Heliothis trap (cost \$50). The major advantage of pheromone traps is that only ECB moths are attracted and sorting of insects is not needed. Traps need to be checked regularly; three times a week is probably sufficient. The major disadvantage is that it only attracts the male moths and is not totally representative of moth activity. The traps have competition during the major moth activity period when the majority of females are also actively emitting their sex pheromone. Therefore, the peak pheromone trap catch tends to occur after this competition from real females is reduced. The result is that the peak catch in a pheromone trap can be delayed several days compared to the actual peak moth activity. To obtain pheromone sources and traps refer to 'Sources of Pest Management Supplies' (NF93-141).

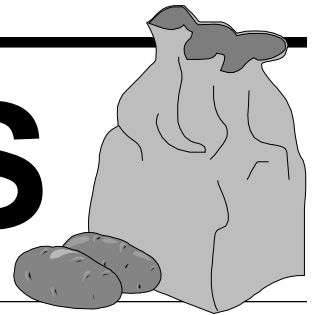
The major egg laying period for the ECB will begin when moths are most active (peak light trap catch) and continue for a period after peak activity (peak pheromone trap catch). The period of peak catch for these two trapping methods generally includes the major egg laying period of moths, up to three weeks.

NOTE; all insect trapping procedures are influenced by weather conditions, especially wind and temperature. Averaging multiple traps reduces this influence and is especially important with pheromone traps which are more influenced by local conditions.



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effectiveness on larvae may be spotty because of the short time that larvae repeatedly tunnel. After adults are first detected in black-light traps, start by examining stems for small entry holes of the young, newly-hatched larvae, first instar. If 20% of the plants have stems with entry holes, treatment is recommended.

The best chemical treatments are reported to be Monitor 4EC at 1.5-2 pt/a and Furadan 4F at 1.5-2 pt/a. Both have systemic and some residual activities. Penncap-M and SpinTor 2SC have also been reported to be effective. Other products that can be used to control adults are Ambush/Pounce, Asana, Baythroid, Guthion, and Thiodan. In-furrow systemic insecticides such as Admire and Platinum will NOT seriously affect ECB.

One reason that ECB populations may have increased in potato fields is the increased use of Admire which has decreased the use of broad-spectrum foliar material against pests such as Colorado potato beetle. These broad-spectrum insecticides applied routinely would lower the ECB population as well.

Biological control by predators introduced from Europe is spotty. Ladybird beetles are predators of ECB eggs as well as Col. potato beetle eggs and its population should be encouraged (see web-site "Potato Education Guides").



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**The Nebraska Potato Eyes is on the
WWW at:
www.panhandle.unl.edu/peyes.htm**