The European corn borer (ECB), Ostrinia nubilalis (Hübner), was first identified near Boston, Massachusetts in 1917. It appears to have been introduced into the United States on broom corn imported from Hungary and Italy. Since its introduction, it has established itself as a pest in most states east of the Rocky Mountains. In Pennsylvania, ECB has been present as a pest for over 80 years. ECB has a very wide host range including tomatoes, potatoes, snap beans, peppers, sorghum, corn, and many weed species. It is more commonly a pest of corn in Midwestern states, whereas losses in Pennsylvania field corn due to ECB are variable depending on historical infestation levels, weather conditions, and management. Instead, economic levels of ECB damage in Pennsylvania occur more commonly in sweet corn, peppers, and snap beans; however, occasional moderate damage in corn occurs in some southern Pennsylvania fields. Previous research in Pennsylvania suggested that corn borer was responsible for about a 5.5% yearly yield reduction in field corn; however, because of widespread adoption of insect-resistant, transgenic corn hybrids (i.e., Bt hybrids) beginning in 1996, ECB populations appear to have declined in many parts of Pennsylvania, reflecting national declines.

The adults are yellowish to light tan in color. They have several dark zigzag marks across the wings, and their wingspan is 3/4 to 1 inch. During the day, adults take shelter in grass, weeds, and crop residue in and around crop fields. Adults are most active during late evening.

The eggs are usually glued to undersides of leaves, in small irregular-shaped clusters that are white and very flat, containing about a dozen or more individual eggs. Clusters resemble fish scales overlapping one another. Each egg is about half the size of a pin head. After 3 to 5 days, the eggs change from white to a yellowish color, and then, just before hatching, a dark spot appears in each egg.

The larvae are dirty white, often having a pinkish tinge. The skin is smooth and free of hairs. There are numerous dark spots scattered over the sides and top of the body. The head is dark brown to black. It is the larval (borer) stage that causes damage to crops.

The pupal stage of the corn borer is rarely visible. Pupae remain inside the host plant, and adults emerge in late spring and in July. The pupae are smooth, light to dark brown in color, and 1/3 to 5/8 of an inch in length.

In Pennsylvania, there are two separate strains of ECB. One strain is univoltine (one generation per year) and is generally found in the mid-state and northern regions, and the other strain is bivoltine (two or more generations per year) and is found throughout the state, though more so in southern portions. In spring, diapausing larvae emerge from dormancy and pupate from late April to early June with the univoltine population tending to emerge later than the bivoltine population. First gen-

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DAMAGE
Corn borer larvae will feed on many crop or weed species that have suitable stems or fruit sufficiently large for a boring larva. Evidence of corn borer infestation on corn plants appears a few days after first generation egg hatch. Early damage is characterized by small pin holes in the leaves and fine sawdust-like frass (excrement) scattered over the upper surface of damaged leaves. Another typical symptom is a noticeable amount of chewing damage and frass in the whorl of the plant. When larvae enter stalks, they leave visible, small, round holes with wet frass exuding from the holes. Stalk feeding can weaken the stalk to the point of breaking. Damage to field corn resulting from first generation corn borer larvae is seldom great enough to warrant insecticide application.

Activity of the second generation larvae, which appear from mid-July through August, is similar to the spring generation with several exceptions. Second generation larvae commonly move to the tassel area, causing infested tassels and the upper portion of the plant to break. Some larvae also enter the shanks and ears. Weakening of shanks often results in dropped ears that cannot be harvested. Greatest field corn losses from second generation corn borer appear to occur on either late-planted or late-maturing varieties. Field corn planted before May 20 is generally not damaged by the second-generation while corn planted later than May 20 is much more susceptible to damage because these plants are still attractive hosts.

CONTROL
Cultural Methods
Select a hybrid that performs well in your area, and avoid late planting as much as possible. The second generation is apt to attack late-maturing plants. Use good weed control programs. Adult ECB hide in grass and weeds during the day, thus a good herbicide program will keep many moths out of the fields. Keep weedy field edges and fence rows clipped to avoid harboring the moths. Many growers insist on shredding or burying old stalks to kill many of the overwintering larvae, however, the control benefit of this method is questionable.

Transgenic Varieties
If you have a known corn borer population in your area, the use of transgenic corn hybrids resistant to ECB can be very effective. Hybrids targeting ECB generally express at least one of the following Bt proteins for insect control: - Cry1Ab, Cry1F, Cry1Ac, Cry9c, or the newer Vip3A. Trade names for varieties that express these proteins and control ECB include YieldGard, Knockout, Bt-Xtra, Herculex, and SmartStax, and Viptera. Keep in mind that use of Bt varieties requires planting of non-Bt refuges as an insect resistance management strategy. Refer to the label of Bt varieties for specific requirements and read carefully because different varieties have different refuge requirements. Non-Bt refuge acres should be scouted for ECB damage and protected with insecticides if economic thresholds are exceeded. Refuge acreage can be useful for gauging the size of local ECB populations and assessing the need for insect-resistant varieties.

Chemical control
There is seldom appreciable economic loss from ECB to corn harvested for ensilage. Thus, insecticides are not recommended to control this pest on silage corn in Pennsylvania. Grain losses
from corn borer infestation have been relatively low in the state over the long term, particularly since widespread adoption of Bt varieties. However, a number of fields, especially in south-central Pennsylvania, have occasionally suffered moderate stalk breakage. Unfortunately, yield losses associated with stalk damage are not documented, so the value of insecticide application to control the pest is uncertain. There is some doubt on the level of infestation above which it is profitable to apply an insecticide. This minimum level of infestation is seldom reached in Pennsylvania corn fields for the first generation corn borer larvae, so it appears that insecticide applications against first generation larvae would seldom be profitable.

Yield losses can be associated with the second generation larvae, but it is difficult to predict when an insecticide application will be profitable. Recommendations from several neighboring and Midwestern states suggest applying insecticide when approximately 75 percent of the plants show pinhole feeding on the leaves and have sawdust-like frass in the whorl and tassel area.

Numerous insecticides are registered for corn borer control. Granular formulations are preferred. Aerial application is the most practical means of applying insecticides to large corn fields for second brood corn borer. Check the Agronomy Guide (http://agguide.agronomy.psu.edu/) or consult your county agent for details of pesticide use.