

The Asian Corn Borer (ACB) (*Ostrinia furnacalis Guenee*) is the most destructive pest of corn.

ACB starts to infest corn plants 20 to 25 days after planting. Within this period ACB will start to lay eggs, usually underneath the leaves. Sometimes the eggs are laid on the upper surface of the leaves near the midrib. These eggs will hatch within three (3) days.

After two hours, the newly hatched larvae will start to feed, causing pinhead-sized holes on the leaves. The young larvae will molt, grow bigger, feed again, then drill larger holes the size of a match head on the leaves. In their third instar (ACB goes through six instars or larval stages), the insect will eat more, this time boring on the leaves holes the size of shots from a gun. When the corn plants bear tassels (flowers), the larvae will go up and infest the tassel, which clump and eventually break.

ACB larvae are most damaging when they are on their late fourth instar. This is when the larvae bore inside the corn stalk and eat their way through. Once inside the stalk, they are difficult to control. The transport of nutrients is disrupted and the stalk eventually breaks.



Corn stalk damaged by corn borer

ACB infestation reduces potential yield by an average of 52%. One major control strategy is to apply chemical insecticides. However, continuous application of insecticides can result to insect resistance, hence the need to identify potential natural enemies as control measure.



Corn ear damaged by corn borer

Among the natural enemies of ACB which can control its population are the earwig (*Euborellia annulata*) and Trichogramma (*Trichogramma evanescens*).

Earwigs

Predatory earwig is elongated, flattened, and is shiny black in color. It is 10–14 mm long and has no wings.

The mobile abdomen extends into a pair of forcep-like structures called cerci. It is capable of



Earwigs

maneuvering as well as opening and closing its forceps which are used for a variety of purpose such as in holding prey. The forceps tend to be more curved in males than in females.

Earwig feeds on eggs, larvae and pupae of leafhoppers, aphids, semi-looper, cutworm, armyworm diamond back moth, cabbage moth and other soft bodied insects.

They are more active at night and prefer to stay in the soil during daytime. They crawl on the plants at nighttime and tend to gather in damp areas like the stalks and underneath the leaves.

Biological Cycle

Earwigs develop from egg to adult in 35 days. It lays 6 egg batches with 40 eggs per batch or total of 240 eggs in its lifetime.

Egg hatches in 6-8 days. The average natural mortality of *E. annulata*

was 10.5% which means that 89.5% of deposited eggs hatched become nymphs. Sex ratio is 6:1 in favor of the female. Survivor from egg to adult is about 90%. Earwig has a life span of 74 days.

Earwigs can be bred in laboratory on artificial media such as dog food. This media is effective and efficient because it is cheap and easily available.

Mass Rearing of Earwigs

A. Collection and Rearing of Founder Population

- Collection of initial earwig population:
 - dissection of corn stalks heavily infested with ACB.
 - pile of decomposing corn cobs
 - request from NCPC
- Place 3-4 cm soil: sand mixture (3:1 by volume) inside an acrylic pan (14.5 cm in diameter and 8.5 cm in height)
- Moisten the mixture to about 27-30% moisture content
- Release adults (12 females and 4 males)
- Feed with corn cob and dog food mixture (about 15 g. each)
- Feed the insect weekly with about 7.5 g food mixture
- Adults will lay about 3-4 egg batches and these offspring will be utilized in the mass rearing.

B. Mass Rearing of Earwigs

- Construct galvanized boxes (73 x 37.5 x 28 cm)
- Place 7.5 cm. high soil: sand mixture (3:1) inside the rearing box
- Maintain soil moisture content to 27 to 30%
- Introduce adult earwigs (150 females and 50 males)
- Feed earwigs initially with 400 g mixture of diet, and 200 g diet every 10 days thereafter. A total of 1 kg diet can be used per box per month.

Steps in Releasing Earwigs into the Field

- Release adult earwigs at the rate of one earwig per square meter, usually in the late afternoon.
- Walk across the rows and place one earwig into the growing point of every plant (hill) along the row, zigzagging through the length of the row and back to the starting point until 10,000 earwigs are released into a 1 hectare lot.

Number of Release	Number of Earwigs per release/ hectare	Age of Corn	Where to Place the Earwigs
2	Yellow corn - 10,000	25-35 days after planting (10 days interval)	Around the corn pant, in random order
	Lagkitan - 10,000 to 20,000	25-35 days after planting (10 days interval)	Around the corn pant, in random order

Effectiveness

Studies have proven that release of earwigs in corn is effective against ACB. In field evaluations of green corn varieties conducted by PCARRD, the interventions of earwig releases increase corn yield by as high as 40%. Cost of production was reduced by 8% in open pollinated varieties (OPV) and 10% in green corn.

Earwigs are voracious corn-borer eating insects, preying on egg masses, early instars, larvae and pupae of ACB. A matured earwig can eat more than 40 newly hatched eggs of Asian Corn Borer in just one hour.

Their sustainability on the field would not be hard to maintain since earwigs can disperse in the fields 3-6 meters away from its release point.

Trichogramma

Trichogramma are tiny black wasps, almost too small to see with the naked eye. These wasps are mass produced in many countries, including the Philippines, for biological pest control.

Laboratory reared Trichogramma are placed in trichocards and distributed to farmers. A trichocard has 1,500-2,000 trichogramma.

Trichogramma lay their eggs inside the eggs of corn borers and other moths. When the Trichogramma hatch, they begin to eat the developing caterpillar inside the egg.

A parasitized caterpillar egg becomes black in color as the young wasp develops inside it. After 8-10 days inside the host egg, the young Trichogramma wasp emerges as an adult. The females are then ready to parasitize other moth eggs. A female wasp can parasitize up to 50 moth eggs during its lifetime of 5-14 days.

Release 50 to 70 cards of Trichogramma per hectare if you see 3 to 4 ACB egg masses per 100 plants. It is important to release Trichogramma within 20 to 25 days after planting, when ACB eggs are newly laid and still full of fluid which the egg parasite can feed on.



It is easy to see if a mass of corn borer eggs has been parasitized by Trichogramma. Parasitized eggs are pale dark and depressed while those that are not, are shiny dark in color. Further, if the egg mass did not hatch within four days after it was laid, then it might be parasitized. If it hatched within four days, then Trichogramma was not able to parasitize the eggs. Trichogramma has a life cycle of 7 to 8 days so if the ACB eggs were parasitized, Trichogramma adults and not corn borer larvae will come out of the eggs. These adults will look for another egg mass to feed on.

Where to Get Earwigs and Trichogramma

The Regional Crop Protection Center (RCPC) of the Department of Agriculture is into mass production of earwigs and trichogramma. These biocon agents can be availed for free by interested individual corn farmers; Local Government Units (Provincial, Municipal, & Barangay level); students from agricultural schools and Non-government Organizations (NGOs).

Cultural Management Tips

Plant before or during the planting season. ACB prefers younger plants. If you plant late, then the newly built population of ACB from other fields will transfer to your field and devour your corn.

To reduce the ACB population, you can also remove the tassel (flowers) of 75% of all corn plants. This technique called detassling, helps to dispose larvae that attack the tassels. This can be done when at least 2 cm of the stem has emerged or prior to pollen shedding. But be sure to properly dispose the tassels you removed by burning them away from the field or feeding them to livestock to prevent the ACB from getting back to the plants.



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Earwig and Trichogramma

*Biological
Control Agents
against*

Asian Corn Borer



Earwig

Trichogramma