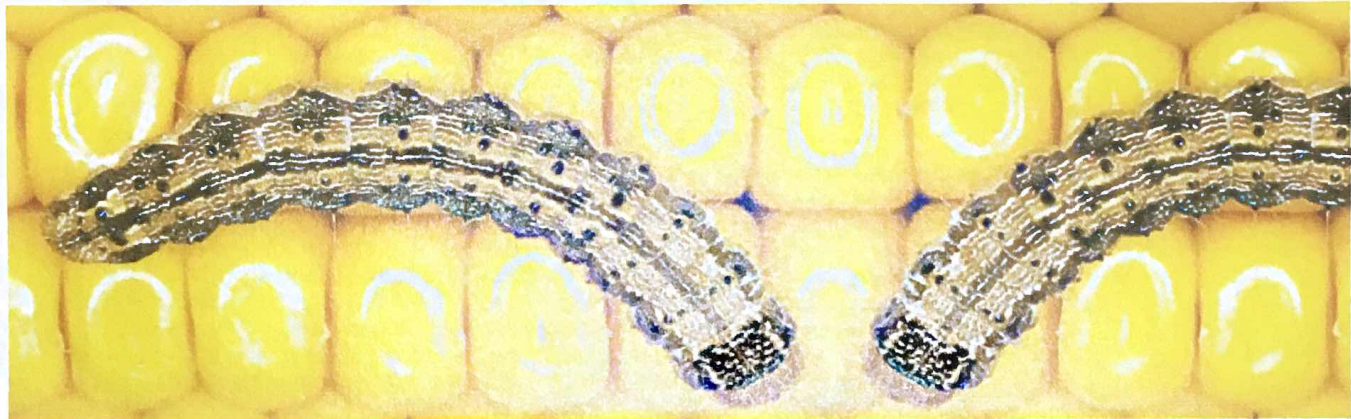




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Why you should study the corn earworm with your students.

The Big Picture: This activity familiarizes students with the complete metamorphosis life cycle of the corn earworm which is similar to that of many insects. The life cycle consists of four stages: egg, larva, pupa and adult which is in contrast to those with gradual (incomplete) metamorphosis that only undergo 3 stages: egg, nymph and adult. Students will also be able to alter parameters such as temperature, food and other environmental factors to study the influence of these independent variables on development of the insects.

Brief background on the worms themselves: The corn earworm, (*Helicoverpa zea*), is one of the most destructive insect pests of corn in the United States. American farmers have to plant, on the average, about two million acres of corn each year just to feed corn earworms! Earworms prefer corn, (*Zea mays*), but also feed on tomato, cotton, sorghum and strawberries to name the major crops. On these crops, they are called tomato fruit worms, bollworms (cotton), sorghum head worms and strawberry fruit worms, respectively. These insects occur throughout most of the Americas, but particularly in North and Central America. It has coevolved with corn in its place of origin.

Brief overview of the lessons: Several example lessons are provided. The hardest part of science is coming up with the question to be investigated. Examples are provided of questions that students have already investigated. It is perfectly acceptable to replicate research but the goal is for your students to be so intrigued by the worms that they will come up with their own questions. Student activities, depending on grade level, can range from the very simple observations of the different stages in the life cycle to the very complex understanding of morphology or physiology of the different stages and how these are affected by different factors. Sample data sheets are also provided.

Why the worms make great subjects for inquiry learning: In classrooms, any living creature usually intrigues students and piques their interest and curiosity. The corn earworm is a great model because it can be observed through its life cycle relatively easily and activities are aimed at involving every participating student by providing each student with their own worm. Absolutely no concerns have been identified with the handling by students of the insects and the rearing materials. The corn earworm is cold-blooded so it only takes about 35 days from egg to egg

depending on temperature (ideal temperatures being between 24-30 degrees Celsius/75-85 degrees Fahrenheit).

Potential guided inquiry questions:

- What will happen if we feed some worms on corn and some on strawberries?
Hypothesis: The worms that eat corn will grow faster and pupate sooner.
- If we grow some worms at room temperature and some under a heat lamp set at about 30 degrees Celsius, will that affect the length of their life cycle?
Hypothesis: The worms that develop at 30 degrees Celsius will have a shorter life cycle.

It is a real-world problem: The damage to field crops caused in the United States alone is about \$2 billion dollars annually. For example, strawberry growers in California incur losses that run into the hundreds of millions of dollars annually. The USDA/Agricultural Research Service (ARS) scientists are charged with finding ways to reduce the amount of damage. Perhaps your students can contribute to that research?

It is a balancing act: Despite the very real damage caused to agricultural crops, the corn earworm poses a dilemma because, ironically, it is the main source of food for the millions of Brazilian Free-tailed bats (*Tadarida brasiliensis*) that migrate annually into Texas from Mexico. The bats supplement their diet by eating and therefore reducing the numbers of moths and other insects including mosquitoes and devour half their body weight in insects every night. With this knowledge, students can link their corn earworm research to environmental studies such as: food chains and food webs. Appreciation of the ecosystem paradigm of the interrelatedness of everything on our earth is a first step in understanding the importance of science knowledge as a basis for being good stewards of the sustainability of our world.