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Corn Earworm (CEW), *Helicoverpa zea*;

Distribution and Host Range

The origin of the corn earworm is uncertain, but likely is native to North America. It can be found throughout the desert southwest and is active throughout the year where it is a serious pest in head lettuce. CEW has a fairly broad host range, and can be found developing on cabbage, cantaloupe, collards, corn, cucumber, lettuce, melon, pumpkin, spinach, squash, and watermelon. Other crops injured by these pests include alfalfa, clover, cotton, sorghum, and wheat. Larvae can also be found developing on a number of common weeds including common mallow, groundcherry, horsenettle, lambsquarters, morningglory, pigweed, purslane, ragweed, sunflower, and velvetleaf.

Description and Seasonal Development

Female moths usually lay their eggs singly on the upper surface of leaves. Eggs are pale green when first deposited, but darken before hatching. Deeper ridges and a more hemispherical shape distinguish earworm eggs from those of cabbage loopers. One female moth will lay 500 to 3000 eggs. In general, eggs are preferentially laid in the crown portion of the plant on younger leaves. Eggs hatch in 2 days under ideal temperature (86 F) and up to 10 days under cool temperatures. Upon hatching, larvae move within the plant until they find a suitable feeding site (Plate 7B). Younger larvae of these two species are difficult to distinguish. Older larvae in the third and later instars can be identified under the microscope by comparing the spines on the base of the abdominal tubercles and by looking for a tooth on the inside of the mandible. On corn earworm, the spines are absent or up to one-fourth the height of the tubercle. Larvae usually develop distinct stripes on the body as they mature. Overall, the color of caterpillars is variable, ranging from brown, green, pink, or sometimes yellow or mostly black. Mature larvae drop to the ground and pupate below the surface of the soil. They will pupate in the soil for 10 to 25 days, depending on temperature. Corn earworm moths vary in color but most have light grayish brown front wings with irregular lines and dark

areas towards the tip of the wings (Plate 7A). Moths are active at night and can live for up to 15 days. Female moths begin laying eggs about three days after emergence.

Economic Damage

Some consider corn earworm the costliest crop pest in North America. It often attacks harvested portions of valuable crops such as tomato fruit, cotton bolls or corn ears. On desert vegetables, corn earworm is primarily considered a pest of head lettuce. When early season populations are high, larvae can defoliate seedling stands of lettuce like damage caused by beet armyworms. The risk of economic damage is low between thinning and head formation, but larvae will sometimes feed in the plant's crown leaving holes and gouges in the midrib and sometimes killing the growing point. However, *once head formation begins larvae will usually bore into the head 1-2 days upon hatching.* Corn earworm is much more likely to bore into lettuce heads than other Lepidoptera larvae, rendering the heads unmarketable. Larvae may enter the head from any point, although lately they seem to be entering heads near the butt of the plant. If fields are not watched closely, infestations may not be noticed until the head is harvested. Once inside the head, it is essentially impossible to control the larvae with currently available insecticides. On leaf lettuce, romaine, baby spinach and baby leaf mixes, larvae will feed in the crown of the plant and can severely stunt or kill seedlings like beet armyworm. The potential for damage and contamination is possible at harvest.

Management of corn earworm

Monitoring/Sampling Pheromone traps can be used to detect adult moth activity but are not generally thought to be reliable in determining in-field larval infestations. Rather, sampling individual plants is recommended because moths frequently migrate from surrounding crops or weeds. Visual sampling for damage and larvae is the most reliable method to detect larval infestations. In leafy vegetables, this generally entails destructively sampling whole plants and carefully looking for signs of recent feeding and the presence of eggs and small larvae. During head formation, sampling should include examining wrapper leaves and dissecting heads.

Fields should be sampled at least 2-3 times per week depending on the crop and the crop stage. Ideally, monitoring for all Lepidoptera pests on vegetables should begin before seedlings emerge. Examine weeds on field borders for larvae and eggs prior to stand establishment. Once seedlings emerge, sample plants randomly across the entire field. Additional samples should be taken from areas of the field most likely to be infested (i.e., field edges near cotton or alfalfa), or areas where larvae have previously been found. Sampling should be done separately for fields with different plant varieties, planting dates, or other unique areas within the field. Sampling frequency should also take into account irrigation schedules, field-labor activities, insecticide applications and re-entry intervals.

Natural / Biological Control Lepidopterous larvae in the desert are attacked by numerous natural enemies. Parasitic wasps and tachinid flies are generally thought to be the most effective control agents, but a nuclear polyhedrosis virus will also kill larvae when humidity is high during the summer. *In practice however, these control agents are not adequately effective in preventing Lepidopterous larvae from damaging high value crops such as leafy vegetables or melons.* Biological insecticides, such as *Bacillus thuringiensis* (Bt) can provide short-residual suppression of cabbage looper but only provides marginal control of beet armyworm and corn earworm.

Insecticidal Control Applications of insecticides should be considered during critical crop growth stages when sizable populations of larvae are present or when control of ovipositing moths is desirable. Larvae are generally easier to control while they are still small, and their control prevents excessive less feeding damage. Action thresholds for initiating insecticide sprays for Lepidopterous larvae have been developed but can vary with crop and market demands. In general, leafy vegetables, particularly grown for fresh-cut bagged salads, have a very low tolerance for damage and insect. Production practices such as irrigation, cultivation, labor crew activity, harvest date projections and pre-harvest intervals for insecticides will often influence chemical choices and spray timing.

The following nominal action thresholds have shown to be effective in preventing economic damage from Lepidopterous larvae in desert crops. Because cabbage looper, beet armyworm and corn earworm/tobacco budworm often occur at the same time, thresholds should consider all larvae present, regardless of species. At stand establishment, treat when larvae can be found on more than 2 plants per 100 sampled. Timing insecticide applications when egg masses are beginning to hatch will improve control and prevent damage to small plants. The action

threshold after thinning but before heading is 4 larvae infested plants / 100 plants sampled. During head formation, treat if larvae reach 1-2 / 100 plants. Repeated insecticide treatments may be required to maintain low population levels near harvest.

Correct species identification is useful in determining which insecticides to use for control of Lepidopterous larvae. Insecticides effective against one species may be less effective against another. When multiple Lepidopterous species are present in large numbers, tank mixtures of insecticides may be required. Several insecticide products are available for Lepidopterous larval control. Products such as Radiant (spinetoram), Proclaim (emamectin benzoate), Coragen/Besiege (chlorantraniliprole), Exirel/Minecto Pro(cyantraniliprole) and Harvanta (cyclaniliprole) have translaminar activity, cause mortality primarily through ingestion, and are fast acting and provide quick knockdown control. Intrepid (methoxyfenozide) and Avaunt (indoxacarb) are slower acting products that act primarily through ingestion. All these compounds are relatively selective for Lepidopterous larvae and have good residual activity. Application with ground applied equipment will provide the most consistent control. Residual control of larvae with the products will depend on the rate applied, Lepidopteron species present, size of plant, type of application and growing conditions. Older products such as Lannate (methomyl), Orthene (acephate), and pyrethroids kill larvae through contact activity and typically provided less residual activity. These compounds are often used in combination with the more selective compounds to provide broad spectrum control of adult moths.



A) Corn earworm (CEW) moth, B) Second instar CEW and feeding damage on mid-rib of lettuce leaf, C) Third instar CEW and feeding damage to immature lettuce head



A) CEW feeding damage at base of mature lettuce head , B) CEW feeding damage within mature lettuce head , C) CEW and feeding damage within mature lettuce head