Economic Insects of Chile

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Economic infestations of insect pests in chile have historically been limited to seedling plants. Early season chile pests include thrips, leafminers, flea beetles, flea hoppers, and in some parts of the state, darkling beetles. Although less frequently encountered, economic infestations of false chinch bugs and cutworms have been observed damaging seedling chile fields. Pest pressure in seedling chile increases in fields planted adjacent to desert (especially after a wet winter) and small grains, and in fields that previously were planted to alfalfa. Leafminers, flea beetles, and flea hoppers tend to be the most common insect pests in early chile season.

Economic infestations of insects in post-bloom chile fields are less often encountered than early season pest problems. Fruit-feeding insects include corn earworm, fall armyworm, and pepper weevil. Post-bloom vegetative feeding insect pests include hornworm, beet armyworm, and leafminers. In principle chile-growing regions of the state, pepper weevil is the pest most likely to reach economically damaging populations in post-bloom chile fields.

With the exception of fields infested with pepper weevil, insecticides applied to chile are primarily directed at early season insects. New Mexico growers typically apply systemic insecticides to the soil during planting and again as a side-dressed application after thinning. These soil applications are made as insurance treatments against thrips, flea beetles, and flea hoppers.

Because the biological control systems in chile are especially effective, foliar applications of insecticides that suppress one pest typically result in the outbreak of others. The outbreak of secondary pests, especially leafminers and aphids, may occur when repeated applications of insecticides are made. Insecticide selection should not be based solely on the target insect, but also on the presence of secondary insect pests and their potential to reach economically damaging populations.

Although economic infestations of insects in New Mexico chile tend to be limited, fields still should be scouted weekly. The duration and effectiveness of systemic, soil-applied insecticides are difficult to predict. Diversity in soil type, number of irrigations, and plant size all impact the efficacy of soil-applied insecticide. Many of the early season insects are small and restless. Using a sweep net while scouting fields helps identify the cause of insect-damaged plants.

Economic threshold levels are not included in this publication. The number of inputs required to make control decisions for chile do not fit well into standard economic threshold levels for many of the insect pests. Control decisions should include end-use of the chile, days to harvest, level of infestation (high, low, widespread, or isolated), presence of secondary pests, and safety of weeding and harvest crews. For example, it may not be economically sound to treat late-season infestations of low populations of pepper weevil in chile destined for salsa, but it would be if the crop was marketed for whole jalapeños.

EARLY SEASON PESTS

Thrips

Thrips are always present in New Mexico chile fields. Both nymphs and adults feed in the terminal and buds of the chile plant, causing expanding leaves to distort and wrinkle. Heavy thrips

feeding may slow development of young seedlings due to loss of leaf area for photosynthesis, particularly during cool periods when chile is growing slowly. Under normal growing conditions, chile will outgrow most early season thrips damage. Damage becomes less serious as the chile plant matures. Thrips also may cause damage to chile by transmitting tomato spotted wilt virus.

Thrips populations are most often comprised of more than one species, including western flower thrips and onion thrips. For control purposes, species identification is usually not important. Thrips may be found year-round in many New Mexico weeds and crops including small grains, alfalfa, onions, and mustard weeds.

Thrips deposit eggs in plant tissue, and the nymphs hatch several days later. Nymphs are light-green to yellow in color, cylindrical, and approximately 1/32 in. long. They pupate on the plant or at the base of the plant in the soil. The life cycle from egg to adult can take place within a 10-day period.

Check terminal development during the seedling stage, paying particular attention to fields adjacent to onions, small grains, or alfalfa. Thrips populations may increase significantly following the cutting of adjacent alfalfa fields.

Flea Beetles

Adult flea beetles feed primarily on young leaves and cotyledons. They typically chew small, round holes through leaf tissue. Adults also may chew into the stem, which may cause complete loss of the seedling. Most chile grown in New Mexico shows some sign of flea beetle damage on both the cotyledons and leaves. Typically, this damage is not economically important until 5 to 10 percent of the foliage is removed or stand losses become economic. Larvae feed below ground where the damage cannot be seen nor is it generally of economic importance.

Adults overwinter in soil, crop refuse, or on other host plants. As temperatures warm in the spring, adults move from overwintering sites to crop land. Adults live for several months and deposit eggs in the soil. Larvae may feed on belowground parts of the host plant for up to three weeks. Development from egg to adult beetle takes approximately six to seven weeks. Adults are small (1/16 in.), metallic beetles with enlarged femurs on the hind legs. They are very motile, jumping frequently when they detect movement. They can be found feeding on chile, certain weed species, or resting in the soil.

The economic impact of flea beetles is less severe in older plants. Considerations for control should include the size of the plant, number of seedlings damaged by stem feeding, and amount of leaf material removed from each plant. Thinning plants will concentrate flea beetle populations on the remaining plants. Therefore, flea beetle populations and damage should be checked before thinning. Flea beetle populations can be reduced by using either registered foliar or soil-applied, systemic insecticides.

Fleahopper

Fleahoppers feed on a number of weeds and crops grown in New Mexico. Both nymphs and larvae can be found feeding on the undersides of chile leaves. Plant damage is caused by fleahoppers sucking the sap. Light damage may appear as small, discolored areas on the leaf, with heavier feeding causing the leaf to wilt and die. Uncontrolled fleahopper populations result in slow growth of the plant or loss of the seedling due to excessive feeding. Fleahoppers are not normally of economic concern in older plants.

Fleahoppers typically overwinter as eggs, and hatch in the spring with the green to dark-colored nymphs migrating to green vegetation. Winged adults are about 1/10 in. in size and are often mistaken for flea beetles. Eggs are deposited in the plant tissue, with a life cycle completed in about 10 days. Similar to flea beetles, fleahoppers are very motile and may be difficult to identify or capture.

Both at-planting and foliar applied insecticides have proven to be effective in reducing fleahopper populations. A sweep net significantly increases the chances of monitoring fleahoppers in the field.

Darkling Beetles

Economic infestations of darkling beetles are usually limited to chile grown in the Pecos Valley

of New Mexico. Darkling beetles may feed on foliage, cutting off seedling plants near the base. Damage is most severe on field margins, where adults walk from neighboring weedy areas or adjacent infested crops. Larvae feed on the roots of host plants but are not generally of economic concern.

Adults are large (up to 1/4 in. long), black to gray beetles that feed primarily at night and hide during the day in soil and vegetation. They deposit eggs in the soil, and larvae feed on plant roots. Adult darkling beetles are easily confused with predaceous ground beetles. However, ground beetles tend to be more oval in shape and have a shiny black color rather than the dull dark color of darkling beetles.

Before making treatment decisions, calculate the percent stand loss and area of infestation. Darkling beetle populations can be reduced by using either systemic soil-applied or foliar insecticides. In many instances, spot treatment in the field may provide satisfactory results. Disking nearby weedy fields before planting may reduce darkling beetle populations.

Cutworms

Cutworms damage chile by cutting off seedlings at or near ground level. Larvae are not usually visible during the day but can be found by digging in the soil near the base of damaged plants.

"Cutworm" is a name given to a number of like-feeding insect species. Specific species identification is not crucial to control decisions. The adults are nondescript gray moths as adults. Cutworms overwinter as pupae in the soil or migrate from surrounding areas. Larvae feed almost exclusively at night and return to the soil at the base of the plant prior to light. The larval stage generally lasts about 25 days. Life cycles are generally completed in about 35 days. Larvae can be longer than 1 in. and are gray to black in color. Larvae usually curl into a "C" shape when disturbed.

Chile planted adjacent to weedy fields, pastures, or in previously weedy fields is particularly at risk. Economic populations can be controlled with at-planting systemic and foliar insecticides.

False Chinch Bug

Both adults and nymphs damage seedlings by sucking plant juices, which retards growth. If populations are heavy or prolonged, seedlings can die. In most instances, insects are easy to see because hundreds of nymphs and adults can be found on each plant. Damage usually begins on field margins adjacent to maturing weedy fields.

False chinch bugs overwinter in small grains and winter annual weeds, such as mustards. Populations increase in the early spring, and as their hosts dry down, the bugs migrate to surrounding chile fields. Eggs are deposited either in the soil or on foliage and hatch within one week. The nymphs feed for about three weeks. Adults are about 1/8 in. long and dark brown in color. False chinch bugs have a very characteristic odor when crushed.

Check chile fields adjacent to winter grains or weedy fields twice a week. False chinch bug populations typically migrate in large numbers, so early detection is important. At-planting systemic insecticides have not been effective for large populations, so growers should consider foliar applications. Spot applications may provide sufficient control.

POST-BLOOM PESTS

Leafminers

Leafminer larvae feed within the chile leaves and cotyledons. Larval feeding in leaves results in a winding, light-colored trail, or mine, just under the upper leaf surfaces. Economic damage is caused by loss of leaf area for photosynthesis, desiccation, and leaf loss due to excessive mining. Leafminers feed only on leaf material, not on fruit.

Adults are small (1/16 in. long), black flies. They are usually found depositing eggs on leaves, or they are picked up in sweep net samples. Eggs hatch in approximately three days. Larvae are legless and can easily be seen feeding within the leaf. Larvae feed for one to three weeks, depending on the temperature, and pupate either attached

to the leaf or on the soil. Adults emerge seven days later.

Although the presence of leafminers in New Mexico chile fields is common, economic infestations are rare. Most cotyledons exhibit subeconomic levels of leafminers regardless of the presence of at-planting insecticide. Leafminer populations are controlled naturally by several species of parasitic wasps. Repeated foliar applications of nonsystemic insecticides will reduce parasite populations and may induce economic leafminer infestations. Economic leafminer infestations have been found in both seedling and post-bloom chile. Populations can be controlled by using systemic insecticides.

Green Peach Aphids

Aphids feed in the terminal bud areas and on the undersides of leaves. Terminal feeding causes distorted and curled leaves. Feeding by heavy aphid populations reduces plant growth, and aphid excrement can reduce pod quality. Green peach aphid also can cause damage indirectly by transmitting potato "Y" virus from infected weeds surrounding chile fields. Although many different aphid species can inhabit New Mexico chile fields, green peach aphid tends to predominate.

Aphid populations are usually controlled by various parasites and predators that inhabit chile fields. Foliar applications directed at pests also reduce the beneficial insect complex, often causing outbreaks in the aphid population. Green peach aphid is resistant to many insecticides. Consult your field advisor or Extension representative before selecting an insecticide.

Pod Worm Complex

This complex is comprised primarily of fall armyworm and corn earworm, with corn earworm predominating. Chile damage is caused by larvae feeding in and on pods, reducing both quality and yield due to early maturation and pod drop. Both species lay eggs on the terminal growth of the plant. Eggs usually hatch three to four days after being laid. First instar larvae feed on foliage for several days before boring into pods. Larvae may feed in one or more pods for approximately 20 days prior to pupation.

Fall armyworm larvae have four spots on the eighth abdominal segment and a dark head capsule with a distinct inverted "Y" suture. Corn earworm larvae have a lighter colored head capsule and appear more hairy than fall armyworms.

Pod worm infestations are common in New Mexico chile fields, but rarely are they of any economic concern. Fields planted adjacent to grain corn are more likely to have economic infestations. Scout fields by checking for splitting pods and for egg deposits on terminals, and by using pheromone traps (which are available for both species). Control measures must be initiated before larvae bore into the pods, and multiple applications may be required if egg laying is extended. Fall armyworm tends to be more resistant to insecticides than corn earworm. Species identification is therefore required before selecting an insecticide.

Pepper Weevil

The recent reintroduction of pepper weevil into New Mexico demonstrates the adverse impact this insect has on the chile industry. Pepper weevils cause direct damage by reducing both yield and quality. Repeated pesticide applications for suppressing pepper weevil can promote the outbreak of secondary pests such as aphids and leafminers, resulting in additional losses.

Adult weevils deposit eggs within the tissue of chile buds, flowers, and fruit. Although adults prefer to lay eggs in small, immature fruit, they occasionally deposit eggs in larger, more mature fruit. Eggs hatch in three to four days. Larvae are small, cream colored, and C-shaped with a dark head capsule. They feed on flowers or burrow into buds or fruit. Within the fruit, larvae feed primarily on seeds and placental tissue. Under cooler conditions, larvae may burrow into the upper placental tissue, so you'll have to dissect the tissue to locate them. Larval feeding normally discolors the calyx and causes fruit to drop to the ground.

Larvae feed for two to three weeks, depending on the temperature, and then enter a pupal stage. Adults emerge approximately one week later.

Adults are small, light to dark brown insects with a long snout protruding from the head. Adults feed in the pods under cooler conditions or emerge from the pods to feed on terminal growth. Small circular holes in the terminal leaves and/or petiole damage are signs of adult feeding. Adults also may feed on the calyx of immature fruit.

Pepper weevil does not overwinter or diapause in the egg stage. Therefore, adults and larvae require both a food source and shelter from cold to survive the winter months.

Chile fields are susceptible to pepper weevil infestations at any time during the season, but New Mexico populations are generally a middle- to late-season problem. Scouting for early infestations of pepper weevil is difficult. Early populations tend to cluster and are normally present on the field margins. Scout for adults early in the morning, inspecting the terminals of plants throughout the field. Look for evidence of feeding damage in the plant materials and, if possible, run a sweep net across the tops of plants to collect foraging adults. If small fruits are present, look for a discolored calyx, exit holes, and fallen fruit on the ground or at the end of the furrow where water collects. Collect suspect fruit and split it, inspecting for larvae, adults, feeding damage, or exit holes.

Several insects in New Mexico, such as pod worms and cotton square borer, also feed in chile pods. Consequently, the presence of pepper weevil in a field must be confirmed by finding either adults or larvae. Once fruit becomes available, they will be difficult to trap.

Although pheromone traps for pepper weevil are available commercially, scout fields weekly up to the first pesticide application and twice a week afterward in order to determine pesticide effectiveness. Also check for any increase in secondary pest populations.

Determining whether pepper weevil populations are of economic importance depends on the interaction of several factors. End-use of the product is the primary factor. Due to quality control restraints set by the processor, jalapeños sold for a whole or sliced market have a very low threshold for pepper weevil damage. For red chile, economic damage is determined primarily by yield loss rather than quality loss. Late-season pepper weevil infestations may not be an economic threat if infested chile pods do not mature by harvest.

Infested fields usually require a minimum of two pesticide applications made at 7- to 10-day intervals to disrupt the pepper weevil's life cycle. Remember that larvae and adults in pods will not be killed by pesticide applications. Pesticide applications are directed at exposed adults in order to protect foliage and fruit.

Table 1. Insect control products and rates for commercial peppers.

Insecticide	Aphids	Armyworms	Cutworms	Flea beetles	Corn earworms	Leafminers	Mites	Pepper weevils	Thrips	Wireworms & darkling beetles
	----------pounds of active ingredient/acre----------									
Acephate	0.5-1[a,b]									
Azinphos-methyl				0.5		0.375–0.5				
Bacillus thuringiensis		SL	SL		SL					
Carbaryl		1–2	2	0.5–1					1–1	
Carbofuran	1–2			1–2					1–2	
Cyromazine						125				
Diazinon	0.25–0.33					0.25–0.5				3–4 PP
Dicolol							0.375–0.75			
Dimethoate	0.25–0.33					0.25–0.33				
Disulfoton 15G	1–2 AP									
Endosulfan	0.5–1[a]	0.5–1		0.5–1						
Esfenvalerate		0.03–0.05		0.03–0.05	0.03–0.05			0.03–0.05***		
Fonofos										4 PP
Lindane	0.2–0.4	0.4	0.8 PP	0.2–0.4		0.2–0.4			0.2–0.4	
Malathion	0.625–1.56									
Methamidophos	0.5[a]			0.5		0.5**			0.5	
Methoxyclor		1–2.25		1–2.25						
Methomyl	0.45[a]	0.225–0.45	0.225–4.5							
Mevinphos	0.125–0.25						0.25–0.5			
Oxamyl	0.5–1[a]					0.5–1[a]		0.5–1***		
Oxydemeton-methryl	0.5									
Permethrin			0.1–0.2	0.1–0.2	0.1–0.2	0.1–2*		0.1–0.2***		
Pyrethrins	SL	SL		SL	SL	SL			SL	
Sulfur							SL			

[a] Labeled for use against green peach aphid
[b] Rates lower on non-bell-type peppers

* PP =Preplanting
** AP = At planting
*** SL = See label

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