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Insects in Vegetables

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ACKNOWLEDGMENTS

The control of insects and mites which attack vegetables assumes more impor tance than the control of those which attack most other crops because even minor damage may either lower a vegetable crop's value or render it unfit for sale. Commer cial vegetable growers should

recognize the different insects in their various growth stages in order to begin control measures before damage occurs.

The insect pests presented in this publication are the most common ones encoun tered in the state's vegetable industry. However, since some insects attack other vegetable crops than the ones described here, and new or uncommon insects may occur on various crops, trained entomologists should be consulted when questions arise.

Beneficial insects often are also found on vegetables, but seldom are abundant enough to keep destructive insects below damaging levels. Learn to recognize benefi cial insects and avoid destroying them.

Specific control measures for individual pests are not included in this publication. For control recommendations, consult one of the current Texas Agricultural Extension Service publications: MP-675 "Texas Guide for Controlling Insects on Commercial Vegetable Crops," MP-1257 "Vegetable Garden Insects and Their Control," or MP 1284 "Insect Controls for Organic Gardeners. " These guides can be obtained from your county Extension agent or from the Department of Agricultural Communications, Texas A&M University, College Station, Texas 77843.

SOIL INSECTS THAT ATTACK VEGETABLES

BLACK CUTWORM, *Agrotis ipsilon* (Hufnagel)

Description: The larvae are gray to brown in color with faint lighter-colored stripes. They have a greasy appearance. Their skin is dotted with isolated, convex rounded granules of varying sizes.

Life History: Eggs are deposited singly or in small batches on low leaves or stems. There may be four or more generations in a year. They overwinter as larvae or pupae.

Damage: This species is widespread. It is nocturnal and feeds on a large number of grasses and weeds, as well as many vegetable crops. They are solitary, surface feeders and cut off plants at or slightly above the soil level. A single larva may destroy a number of seedlings in a single night.

VARIEGATED CUTWORM, *Peridroma saucia* (Hubner)

Description: The larvae have smooth skin. They are gray to brownish and are somewhat mottled with darker color. Distinguishing characteristics include a pale yellow dot on the middle of most abdominal segments and a crown or W-shaped mark on the dorsal area of the eighth abdominal segment.

Life History: Eggs are deposited in batches on low stems and leaves. There may be three or four generations in a year. They overwinter as pupae. The larvae are often found on the soil surface, beneath leaves and other debris.

Damage: This species may climb plants or move along the ground in large numbers. They feed on the foliage, buds and fruit of many plants, causing severe damage to many vegetables.

GRANULATE CUTWORM, *Feltia subterranea* (Fabricius)

Description: The larvae have a rough skin with many bluntly conical granules of varying sizes. It is brownish in color with granules darker in color.

Life History: This species, which is subterranean in habit, may overwinter as larvae and completes up to four generations per year.

Damage: These cutworms cut plants off at, or slightly below, the ground level. They will also feed on roots and underground stems. Since they remain in the soil, they may be difficult to control. This species will attack and damage many different vegetable crops.

WIREWORMS, several species

Description: Wireworms are larvae of click beetles. There are more than 800 species in North America, many of which cause severe damage to vegetables.

Most species damaging vegetables range from 1/4 to 1/2 inch in length. Wireworms, cylindrical and elongate in shape, are smooth, shiny and hard-bodied. Color varies from yellow to brownish.

Life History: Wireworms may be found at all times of the year. Adults lay eggs in the soil and a generation is completed in from 1 to 6 years depending upon the species .

Damage: Wireworms attack virtually every vegetable crop. Damage to planted seeds and plant roots results in poor stands or complete loss. They will also bore into large roots, stems and tubers reducing yields and quality. Growing the same crop on the same land year after year tends to increase wireworm populations.

FALSE WIREWORMS, several species

Description: Although these larvae resemble wire worms in size, shape and color, they can be distinguished by their prominent, thickened antennae and their very large front legs. Adults, called darkling bee tles, are dark-colored beetles about 1 inch long. The beetles, long-lived general feeders, can cause damage to vegetables.

Life History: Adults may live up to 3 years and a life cycle may be completed in from 1 to 2 years, depend ing on the species.

Damage: Wireworms are subterranean, feeding on seeds and underground plant parts. Feeding activity increases in the fall. Injury is generally more severe in dry years. False wireworms can reduce seedling stands of many vegetable crops.

WHITE GRUBS, *Phyllophaga spp.*

Description: Adults are called May or June beetles. They are robust and range in size from 1/2 to 1 inch in length. They vary in color from light brown to almost black. The larvae are white with brown heads. They are C-shaped and have three pair of legs. The hind part of their body appears darker because of soil particles which show through the body wall.

Life History: Their life cycle varies with species, ranging from 1 to 3 years. Eggs are deposited in the soil. Larvae will migrate up and down through the soil with seasonal changes in temperature. Adults emerge from the soil during the spring when mating and egg laying take place.

Damage: As many as 100 species may cause damage to vegetables. Grubs will feed on roots and other underground plant parts of many vegetable crops. Most severe infestations occur on crops following grass.

CABBAGE MAGGOT, *Hylemya brassicae* (Weidemann)

Description: Adults are similar to the house fly but about half the size. Larvae are white and about 1/4 inch long when full grown. They are blunt at the back end and taper to a point at the front end.

Life History: Eggs are deposited on the plant at the soil level. Larvae feed on plant tissue for 3 to 4 weeks. They overwinter as a pupae and produce two to four generations in a year.

Damage: This species primarily attacks crucifers such as cabbage, cauliflower, broccoli and radishes. It will damage many other vegetables, as well. The larvae eat off small roots and tunnel into roots or fleshy parts of the plant. Infested plants wilt and leaves turn yellow. If not killed, plants have their market value destroyed.

ONION MAGGOT, *Hylemya antigua*(Meigen)

Description: Adults resemble small house flies with slender bodies and long legs. The white larvae are slightly over 1/4 inch when full grown. They are blunt on the rear end and tapered to a point at the front end.

Life History: Eggs are deposited in leaf axles or in the soil near the base of the plant. Upon hatching, larvae crawl down the plant and feed for 2 to 3 weeks. They overwinter as pupae in the soil. There may be two to three generations a year. Cool, wet weather favors development of serious infestations.

Damage: This insect is a serious pest of onions but rarely attacks other vegetable crops. The larvae tunnel into onion bulbs, which may turn yellow and die before maturity. The maggot often will move from plant to plant, thus damaging several bulbs and thinning stands of young onions. Cull onions left piled on the ground are an important source of infestation.

SEEDCORN MAGGOT, *Hylemya platura*(Meigen)

Description: Adults resemble house flies but are smaller and more slender. Full-grown larvae are about 1/4 inch long and are yellowish white. They are blunt on the rear end and taper to a point at the head end.

Life History: Eggs are deposited in moist soil containing decaying plant material. Maggots are attracted to sprouting seed. Developing larvae feed on plant tissue for 2 to 3 weeks. They overwinter as larvae in the soil. Cool, wet weather is favorable for the development of this pest. Four to five generations may occur in a year.

Damage: This maggot will attack many vegetable crops including corn, beans, peas, melons, onions and crucifers. Infested seeds will fail to sprout or develop weak plants. This pest feeds between the cotyledons of sprouting seed and bores into the roots and under ground stems of larger plants.

SOUTHERN CORN ROOTWORM, *Diabrotica undecimpunctata howardi* Barber

Description: Called the spotted cucumber beetle, the adult is about 1/4 inch long, greenish yellow in color and has 12 black spots on its back. The adults have a black head and relatively long dark antennae. The larvae are long and slender and are about 1/2 inch long when full grown. White to yellowish in color, they have a distinct brown head and a brown patch on top of the last abdominal segment.

Life History: This pest is very widely distributed. Adults overwinter in ground trash and plant debris become active in the spring and are capable of moving long distances in a very short time. Eggs are deposited in the soil at the base of plants. Upon hatching, the larvae feed from 2 to 4 weeks before pupating. In Texas there may be three or more generations in a year.

Damage: This species is known to feed on more than 200 different plant species including many cultivated crops. Adults are general foliage feeders and often occur in large enough numbers to cause consider able leaf damage . Damage appears as irregular holes in leaves, damaged growing tips and occasionally the girdling of seedling at or near ground level. Larvae feed on plant roots and bore into germinating seed, large roots and underground stems. Larval damage may result in wilting and stunting of plants or a loss of stand.

NORTHERN CORN ROOTWORM, *Diabrotica longicornis* (Say)

Description: Adults are about 1/4 inch long. They are uniformly pale green or yellowish green. Their antennae, head and legs are slightly darker in color. The larvae, white with a brownish head, are about 1/2 inch long when full grown, very slender and somewhat wrinkled in appearance.

Life History: This pest overwinters in the egg stage. Eggs hatch in late spring and the larvae migrate through the soil in search of corn roots. Larvae mature in late summer and pupate in the soil producing 1 generation a year. Adults emerge in the fall and lay eggs in corn fields.

Damage: Adults feed on pollen and corn silks. Heavy feeding on silk may result in ears with few kernels developed. Larvae burrow through the roots and crown leaving small dark-colored tunnels. Heavy infestations often result in loss of stand or extensive lodging. This pest is effectively controlled by crop rotation.

WESTERN CORN ROOTWORM, *Diabrotica virgifera* Leconte

Description: Adults, which are about 1/4 inch long, have a dark stripe down the middle and on each side of the back. Some are pale green and may be mistaken for the northern corn rootworm. Larvae are elongate and white with a darker-colored head.

Life History and Damage: The life history and dam age from this pest are very similar to that of the northern corn rootworm.

SWEETPOTATO WEEVIL, *Cylasformicarius elegantulus* (Summers)

Description: Adults are about 1/4 inch long and ant-like in appearance. Their head, snout and wings are a dark metallic blue and their thorax and legs are bright red-orange. Larvae are legless grubs almost 1/2 inch long when full grown. They are white with brown heads.

Life History: Females deposit eggs in plant tissue near the soil surface. The eggs hatch in about a week and burrow into the vines and tubers. The larvae feed for 2 to 3 weeks and then pupate in the sweet potato. Adults emerge in about 1 week. After feeding on leaves and stems for awhile, the females begin to lay eggs. As many as eight generations can occur in a year, and the weevils can continue to feed and reproduce all year long in stored sweet potatoes.

Damage: Larvae tunnel through the tubers, causing discoloration and imparting a bitter taste to the tuber. Infestations of this pest render sweet potatoes unfit for human consumption.

MOLE CRICKETS, several species

Description: Mole crickets are about 1 1/2 inches long, golden to chocolate brown in color and covered with fine velvety hairs. They are distinguished by their strong, heavily sclerotized front legs which are adapted for digging. Their small winding borrows of loosened soil on the surface reveal their presence.

Life History: Although good fliers, mole crickets are subterranean, spending most of their time tunnel ing through the soil. Females lay eggs in the soil where nymphs develop to maturity. The life cycle of most species requires about 1 year. Mole crickets will migrate up and down in the soil with seasonal changes in temperature. This pest is usually more common in sandy soils.

Damage: Two common mole crickets attacking vegetables are the northern mole cricket, *Neocurtilla hexadactyla* (Perty) and the southern mole cricket, *Scapteriscus acletus* (Rehn and Hebard). Almost all vegetable crops may be damaged by these pests. Mole crickets feed at or slightly below the soil surface on roots, tubers and underground stems. They will also attack strawberries and other fruit which come in con tact with the soil.

PILLBUGS AND SOWBUGS, several species

Description: These arthropods are not insects but crustaceans and are more closely related to crayfish than to insects. Fully grown, the different species range in size from about 3/8 to 3/4 inch long. They are elongate-oval, light to dark gray in color and are distinctively segmented. They have seven pair of legs, prominent antennae and two tail-like appendages on the posterior end of the abdomen. Some are capable of rolling up into a ball.

Life History: Pillbugs reproduce by means of eggs. The females retain the eggs in a specialized body structure until they hatch. The young are similar to the adults except in shape. About 1 year is required for the young to mature. All sizes can be found throughout the year.

Damage: Sowbugs and pillbugs are mainly nuisance pests. They will occasionally feed on and damage roots and seedlings or foliage and fruit which come into contact with the soil. They are seldom damaging under field conditions but can cause severe damage in green house operations.

CHEWING INSECTS

INSECTS THAT EAT FOLIAGE AND/OR FRUITS OF PLANTS, LEAVING VISIBLE SIGNS OF DAMAGE

CATERPILLARS

CORN EARWORM, *Heliothis zea* (Boddie) (Also known as bollworm and tomato fruitworm.)

Plants attacked: General feeders on sweet corn, beans, peas, lettuce and tomatoes.

Description: Adults generally have front wings which are a light grayish-brown, marked with dark gray to olive-green irregular lines. Each wing has a darker band near the tip. Hind wings are light with slightly wavy dark bands, especially near the extremities. The moths have a l1/2-inch wing expanse. Larvae vary in color from light green or pink to brown or nearly black. Alternating longitudinal dark and light stripes mark its body, but colors are so variable that such characteristics are not dependable for identification. Short microspines (visible through a hand lens) on the skin and feeding habits are very useful identifying characteristics.

Life History: The corn earworm spends the winter as a pupa 2 to 6 inches below the soil surface. It emerges as a moth during spring and early summer and soon deposits eggs. Freshly laid eggs are waxy white but soon turn yellow. About half the size of a pinhead, they are hemispherical with ridges along their sides. A female oviposits 500 to 3,000 eggs singly on foliage and fruits of many plants. Fresh corn silk is a favorite place for egg deposition, but eggs commonly are deposited in the whorl of young corn. The larval stage lasts from 2 to 4 weeks. Full-grown larvae crawl

down the host plant or drop to the ground where they burrow, forming a walled cell and pupate. The adult or moth emerges 10 to 25 days following pupation. Time required from egg to adult varies from 1 to 2 months, depending upon weather conditions. Four to seven generations occur annually in the southern states.

Damage: Newly hatched larvae begin feeding immediately on that part of the plant where eggs were laid. On corn silk, larvae burrow into and eat the developing grains. It also feeds in whorls of young corn plants, but usually is not considered an economic threat there. Larvae are cannibalistic and usually only 1 larva reaches full growth in each ear.

CABBAGE LOOPER, *Trichoplusia* ni (Hubner)

Plants Attacked: Cabbage, cauliflower, broccoli, brussels sprouts, lettuce and occasionally beans, tomatoes and other crops.

Description: Adults are light-grayish-brown moths with a small, lighter colored spot near the center of each forewing. Moths have a wingspread of about ll/2 inches. Larvae are light-green caterpillars with a few white or pale yellow stripes. Larvae travel with a characteristic looping motion.

Life History: There are continuous generations in the Lower Rio Grande Valley with reproduction slowing down during cold periods. In colder areas, the insect overwinters as pupae in flimsy silken cocoons attached to food plant residue. A complete generation occurs in 4 to 6 weeks in warm weather.

Damage: Cabbage loopers are voracious feeders, which can strip foliage from infested plants in a short time. Often, when populations become crowded, a virus disease strikes, causing high larval mortality.

IMPORTED CABBAGEWORM, *Pieris rapae* (Linnaeus)

Plants attacked: Cabbage, cauliflower, broccoli, brussel sprouts and related crops.

Description: Adults are white butterflies which have a few black spots on the front wings and black to gray wing tips. Hind wings have a single spot at the front edge. Wingspread is about 1 1/2 inches. Larvae are dark-green caterpillars up to 2 inches long. They travel like typical caterpillars without a looping motion.

Life History: Their life cycle is similar to the cabbage looper but pupae do not have a silken cocoon.

Damage: This pest's attack is similar to and easily confused with the cabbage looper. Related species, including the great southern white, may also be pests.

DIAMONDBACK MOTH, *Plutella xylostella* (Linnaeus)

Plants Attacked: Cabbage, cauliflower, broccoli and similar crops.

Description: Adults are grayish moths, about 1/3 inch long, which have folded wings flaring outward and upward toward their tips. In the male, the wings form a row of three diamond-shaped yellow spots where they meet down the middle of the back. The hind wings have a fringe of long hairs. Larvae, which rarely exceed 1/3 inch, are pale yellowish-green with fine, scattered, erect black hairs over the body. They wiggle actively when disturbed. The pupa is in a gauzy sack 3/8 inch long, which is so thin and loosely spun that it hardly conceals the pupa.

Life History: Adults lay minute, yellowish-white eggs, 1 to 3 at a time. In a few days the eggs hatch and larvae feed on the underside of leaves. These larvae become full grown in 10 to 30 days. The pupa usually is fastened to the leaf's underside. The small moth emerges in 7 to 14 days and starts another generation. There may be two or three generations per year.

Damage: Larvae feed on the underside of leaves, leaving shothole type damage. Usually, outer leaves are attacked.

ARMYWORM, *Pseudaletia unipuncta* (Haworth)

Plants Attacked: Sweet corn, beans and peas.

Description: Adults are pale-brown or brownish gray moths with wing expanse of about 1 1/2 inches and a small but prominent white dot near the center of each forewing. Young larvae are pale green and have looping habits; older larvae do not loop while crawling. The mature larvae are about 1 1/2 inches long, greenish brown with three stripes on each side of the body. The upper stripe is pale orange, the middle one is dark brown and the bottom stripe is pale yellow. The larvae have a smooth skin, honeycombed head, three pairs of true legs and five pairs of prolegs.

Life History: These insects usually pass the winter as larvae in soil around grass clumps. After a short feeding period in early spring, they pupate in the soil and moths emerge about 2 weeks later. The moths remain hidden during the day, but are active at night and are attracted to lights. Females lay greenish-white eggs in long rows or clusters on the lower leaves of host plants, but they frequently are deposited on clothes hung to dry. Each mass is composed of about 50 eggs. Each egg cluster is covered with a white adhesive fluid, fastening them together and drawing the leaf edges together. Eggs hatch in 3 to 14 days, depending upon prevailing temperatures. The larval period usually ex tends from 20 to 30 days. There are three to five generations yearly.

Damage: Newly hatched larvae begin feeding immediately upon foliage, eating the epidermis first, causing a skeletonized appearance. Older larvae straddle the outer leaf margins, especially grass blades, and cut holes reaching to the mid-rib. They often cut heads off small grain plants. Although the insects prefer grass crops, they also feed on legumes. After devouring the feed supply in their hatching area, the larvae move in armies to nearby fields. Usually, most damage to field crops is caused during the spring by first generation larvae. Armyworms may migrate from lawns, pastures or small grains into vegetables.

BEET ARMYWORM, *Spodoptera exigua* (Hubner)

Plants Attacked: Beets, asparagus, peas, beans, peppers and several weed hosts.

Description: Adults have forewings which are mottled grayish brown and have an expanse of about 1 1/4 inches. Hind wings are silver white with a darker front margin. Bright green with dark lateral stripes, the larvae are about 1 1/4 inches long.

Life History: In South Texas, all stages may be found throughout the year. In colder areas, the insect overwinters in the adult stage. Eggs are deposited in irregular masses of about 80 eggs, covered with scales or hairs from the adult's body, until 500 to 600 eggs have been laid. Eggs hatch in 2 to 5 days and larvae feed about 3 weeks before pupating in the soil. Egg-to adult stage requires 24 to 36 days and there may be four generations per year.

Damage: Larvae may defoliate plants.

FALL ARMYWORM, *Spodoptera frugiperda* (J. E. Smith)

Plants Attacked: Sweet corn, beans and peas.

Description: Adult moths are about 3/4 inch long and 1 1/2 inches across outspread wings. Male forewings are gray and have an irregular white spot near the tip. Female forewings usually are duller than those of the male. The hind wings of both sexes have a pinkish white luster, bordered by a smoky-brown band. The newly hatched larva has a jet-black head and light body, turning darker when about 3 days old. A fully grown larva is 1 1/3 inches and varies from light-green to almost black. The head's front is marked with a prominent inverted Y, but this characteristic is not always reliable identification. Larvae have three yellowish white lines down the back from head to tail. On each side next to each outer dorsal line is a wider dark stripe below which is an equally wide, wavy, yellow stripe, splotched with red.

Life History: Moths lay eggs at night in clusters of 50 to several hundred, most often on grass blades and frequently on lawn grass. Eggs hatch in 2 to 4 days. Larvae become full grown in 2 to 3 weeks. Then they burrow into the soil 1 to 2 inches and pupate, remain for 8 to 10 days and emerge as adults. They can, however, overwinter as adults along the Texas Gulf Coast and fly north in the spring. Cold weather deters production of many insect enemies of the larvae and moisture provides conditions for luxuriant plant growth, where larvae thrive. Fall armyworm out breaks usually follow wet seasons, especially during the summer and early fall. There may be five to ten generations annually.

Damage: The tiny larva begins feeding on its egg shell immediately after hatching, but soon attacks plants near the soil surface. Larvae grow rapidly and within 2 or 3 days begin devouring plants. They frequently do considerable damage to corn ears, similar to that caused by corn earworms. Unfolding leaves from whorls of such attacked crops are perforated with holes. Like the armyworm, they move in groups to other fields after devouring plants in the hatching area.

YELLOWSTRIPED ARMYWORM. *Spodoptera ornithogalli* (Guenee)

Plants Attacked: General feeder on many plants, including vegetable crops.

Description: Adult moths have a 2-inch wing spread. Front wings are dark-gray to brown with zigzag lines of light and dark areas. Hind wings are pearly white with dark margins. Adults are very similar to the fall armyworm. Full-grown larvae are 1 1/2 to 1 3/4 inches long, with a pair of dorsal, triangular, black spots on most segments. There are three lines on the back - an outer, bright-orange stripe on each side and a median, yellowish-white line.

Life History: The female deposits eggs in masses on foliage of many plants, including trees, or on buildings and covers them with body scales. There are two to four generations yearly. Winter is spent in the pupal stage in the soil.

Damage: Larvae generally are day feeders on foliage of forage plants. They are solitary feeders, but otherwise their habits are similar to armyworms.

TOBACCO HORNWORM, *Manduca sexta* (Linnaeus) and the TOMATO HORNWORM, *M. quinquemaculata* (Haworth)

Plants Attacked: Tomatoes and peppers.

Description: Adults are large, fast-flying hawk moths, sometimes mistaken for hummingbirds, with a 5-inch wingspread. The large larvae are similar with seven diagonal light stripes on the tobacco hornworm and eight curved stripes on the tomato hornworm.

Life History: Overwintering occurs in the soil as dark-brown pupae, nearly 2 inches long. Adults emerge in late spring and deposit spherical green eggs on the undersides of leaves. In 5 days, hatching occurs and larvae molt 4 to 5 times, reaching full development in 3 to 4 weeks. Pupation occurs in the soil and 2 to 4 weeks later, adults emerge and lay eggs for a second generation. There may be one to four generations per year depending on the latitude.

Damage: Larvaefeed voraciously on tomato and pepper foliage.

TOMATO PINWORM, *Keiferia lycopersicella* (Walsingham)

Plants Attacked: Tomatoes.

Description: Adults are gray moths 1/4 inch long. Larvae are light orange at first, becoming purplish black with maturity and attaining a length of 1/4 inch.

Life History: The moths, more active at dusk, de posit tiny oval eggs at random over the plant, but mostly on the underside of leaves. Hatching occurs in 1 week. After larvae complete development, pupation may occur in the soil, in folded leaves or in tomato fruit. The entire life cycle may occur in 3 to 6 weeks.

Damage. Larval feeding is similar to leafminer damage to plants. Larvae later invade stems and fruits. Invaded fruit are useless for canning purposes.

SERPENTINE LEAFMINER, *Liriomyza brassicae* (Riley) and others

Plants Attacked: Peppers, all cucurbit crops, beans, southern peas, tomatoes, potatoes and egg plant.

Description: Adults are small flies which are 1/8 inch long with a yellow and black thorax and a black head. Adults fly quickly for short distances

when disturbed. The maggot is 1/8 inch long, white, legless and wedge shaped. Pupae are light brown, oval and ringed with ridges.

Life History: Ten to 20 generations occur in a year in the Lower Rio Grande Valley. Fewer generations per year occur in northern Texas where the growing season is shorter. Adults deposit small eggs into leaf tissue. Under optimum conditions, eggs hatch in 4 days, larvae feed in the leaf tissue 14 days, pupate in the soil, remain there 5 days and then emerge as adults. The life cycle, under optimum conditions, is completed in 23 days.

Damage: Maggots live by eating leaf tissue between the upper and lower surfaces, leaving slender, white winding trails through the leaf's interior. Leaves, especially peppers, are weakened greatly.

SQUASH VINE BORER, *Melittia satyriniformis* (Hubner) and related species.

Plants Attacked: Pumpkins and squashes. A great variation exists in the susceptibility of squash and pumpkin varieties. Hubbard squash is highly susceptible.

Description: The adult moth is one of the "clear wing" types because the hind wings lack scales. It has a 1 1/2-inch wing expanse, metallic green-black colors and hind wings fringed with black and orange hairs and similar colored markings over much of the abdomen. The moths are day fliers. Larvae are white, heavy bodied and over 1 inch long when full grown.

Life History: This insect overwinters in soil as a larva or pupa enclosed in a cocoon. Moths emerge in early summer and lay eggs on plant stems, usually during April and May in the south, where two generations occur. On hatching, larvae bore into vines, complete development in 4 or more weeks, leave the plant, crawl into the soil, spin a cocoon and transform to pupae.

Damage: Larvae bore into vines. Where larvae are found together, the vine is destroyed.

LESSER CORNSTALK BORER, *Elasmopalpus lignosellus* (Zeller)

Plants Attacked: Beans, Southern peas, turnips, corn, peanuts, Johnsongrass and other grass weeds.

Description: Adult moths are brownish gray with less than l-inch wing expanse. Female forewings are darker than those of the male. Caterpillars are slender, about 3/4 inch long, light green with faint stripes and more prominent, transverse brown bands.

Life History: Winter is passed in the soil as larvae or pupae. Adult moths emerge in spring and lay eggs on host plants. Hatching larvae feed first on leaves and then bore into stalks, resulting in damage similar to that of the southern cornstalk borer. After feeding about 3 weeks, they leave their burrows and pupate in silken cocoons under debris at the soil level. There are two or more generations yearly. Larvae are active wigglers when disturbed.

Damage: Larvae bore into corn and bean stems at ground level or 1 inch below the soil line and tunnel upwards causing plant death. Injury is usually more severe in fields that had a previous growth of Johnsongrass or sorghum rather than fallow fields. Soils moist enough to germinate seed are optimum for adult emergence from pupal cases.

PICKLEWORM, *Diaphania nitidalis* (Stoll)

Plants Attacked: Summer squash is the favored host, but cucumber and muskmelon are also attacked.

Description: Adult moths have dark-brown wing margins merging into lighter areas toward the center, with the abdomen tip tufted with hairs. Larvae, bright green and black-dotted, do not exceed 3/4 inch long.

Life History: New adults emerge after hibernating in the pupal stage and are active at night, laying tiny eggs in small clusters on leaves, buds, vines and fruits. Hatching occurs in a few days and larvae feed for approximately 2 weeks, then pupate inside silken cocoon on leaves. In 5 days or more, adults appear. Activity is continuous in the Lower Rio Grande Valley. There may be five generations per year.

Damage: Larvae feed on blossoms and vines and mine into the underside of fruits.

SOUTHWESTERN CORN BORER, *Diatraea grandiosella* (Dyar); STALK BORER, *Papaipema nebris* (Guenee) and others.

Plants Attacked: Corn, southern peas, bean and others.

Description: Several species occur. These are usually caterpillars of small moths but a few beetle grubs do similar damage. Caterpillars are usually cylindrical, elongate and have few hairs. Legs are very short.

Damage: Feeding takes place inside the stalk or roots of the plant. The insects are difficult to treat since the plant shields them so well.

MELONWORM, *Diaphania hyalinata* (Linnaeus)

Plants Attacked: Muskmelon, cucumbers and squash.

Description: Adult moths have velvety black wing margins with lighter, pearly-white areas. Larval stages have two dorsal white stripes running the length of the body; otherwise, they resemble the pickleworm. Larvae can grow to 1 1/4 inches long.

Life History: Similar to pickleworm.

Damage: Larvae feed on foliage rather than blossoms before they tunnel into stems and fruits. Other wise, they are similar to pickleworm.

SALTMARSH CATERPILLAR, *Estigmene acrea* (Drury)

Plants Attacked: Most garden crops, weeds and shrubs.

Description: Adults are white moths with wings freckled with black spots. In females, wings are yellow on the underside. Males have hind wings, yellow above and below. When full grown, larvae are up to 2 inches long, and covered with dense hairs ranging from yellowish to brown and nearly black.

Life History: The insect overwinters in the pupal stage within thin silken cocoons. Adults emerge in spring and mate. Females then lay spherical eggs in patches on host plant leaves. Larvae feed for 1 to 2 months before pupation. There may be up to four generations yearly.

Damage: Larvae are present in large numbers and migrate similar to armyworms, stripping foliage from plants they attack.

GARDEN WEBWORM, *Achyra rantalis* (Guenee)

Plants Attacked: General feeder, attacking beans and peas principally.

Description: Adults are buff moths with shadings

and irregular markings of light and dark gray. Wing spread is about 3/4 inch. Generally, they are active at night and attracted to lights, but often are found in fields during the day, darting away in short flights when disturbed. Larvae are about 1 inch long, yellowish or pale to dark greenish with a light stripe down the back. Three dark spots form a triangle on each segment's side.

Life History: Webworms pass the winter as pupae or larvae within silk-lined cells in the soil or under plants fed upon by the fall generation. Some may be

found in nearly every season in the Lower Rio Grande Valley. Eggs are laid in masses of 2 to 50 on leaves and hatch in 3 to 5 days. Larvae feed on foliage and mature in about 1 month. There are from three to six generations annually.

Damage: Larvae feed primarily on the underside of leaves, skeletonizing them. They spin webs and draw additional leaves within the web as needed for food.

BEET WEBWORM, *Loxostege sticticalis* (Linnaeus)

Plants Attacked: Beets, cabbage, beans, peas, car rots, potatoes, spinach and other crops.

Description: Adults are brown moths with a 1-inch wing expanse and are mottled with lighter and darker spots. Larvae, slender, yellowish to green with a dorsal black stripe, are about 2 inches long.

Life History: Eggs are laid in rows, end to end, usually on the underside of leaves. After hatching, larvae spin webs over the leaves. Pupation occurs in the soil. There may be up to four generations yearly.

Damage: They web leaves and devour foliage, often migrating like an armyworm, leaving stripped crops behind.

GRUBS

COWPEA CURCULIO, *Chalcodermus aeneus* Boheman

Plants Attacked: Southern peas or cowpeas, string beans, lima beans, young cotton seedlings and wild beans.

Description: Adults about 1/4 inch long and black, possess a distinct typical weevil snout and many rows of distinct pits on the elytra and dorsal surface of the thorax. Larvae are legless, white, C-shaped grubs. about 1/4 inch long.

Life History: Overwintering adults emerge from hibernation in early summer and deposit eggs in feeding punctures as peas develop inside pods. Hatching occurs in about 3 days and larvae molt three times inside the developing pea. Larvae emerge, drop to the soil, pupate and emerge approximately 17 days later. The entire life from egg to adult may be completed in 30 days. Two generations per year may be produced.

Damage: Damage occurs from the chewing larvae feeding within the developing seed. Each larva feeds on 1 to 2 seeds within the pod tissue. Adults feed and oviposit on the pod tissue.

PEPPER WEEVIL, *Anthonomus eugenii* Cano

Plants Attacked: Pepper

Description: Adults are black weevils about l/s inch long with a sparse covering of tan-to-gray hairs. Larvae are white grubs with brown heads.

Life History: Adults lay eggs in buds or young pods. Young larvae feed and develop in young pods where they pupate. There may be five to eight generations which appear to be continuous in the Lower Rio Grande Valley.

Damage: Tunnels damage the seed mass in the center of pepper pods.

VEGETABLE WEEVIL, *Listroderes costirostris obliquus* (Klug)

Plants Attacked: Carrots, turnips and similar crops.

Description: Adults are grayish snout beetles about 1/3 inch long with lighter V-shaped marking near hind end of wing covers. Larvae are light green, legless grubs.

Life History: Eggs are laid on plants or in nearby soil and require 2 weeks or more to hatch. Larvae feed on buds, stems and roots of plants. Larvae require 3 to 6 weeks to complete development and pupation is in the soil, from a few days to 2 weeks, depending on temperature. Only

females of this species exist. There is one generation per year.

Damage: Both larvae and adults feed on the plants principally at night. Damage may resemble that of cutfworms.

CARROT WEEVILS, *Listronotus oregonensis* (LeConte) and *Hyperodes texana* Stockton

Plants Attacked: Carrots, parsley and dill.

Description: Tannish-gray adults are about 1/4 inch long. Larvae are white C-shaped grubs. Eggs are laid in the leaf petioles or in the crown of the plant. Several generations occur in a single season. About 5 weeks are needed for development from egg to adults. *H. texana* is a pest in south Texas.

Damage: Grubs feed on the exterior or burrow into carrots. Damage usually occurs near the top of the carrot.

COLORADO POTATO BEETLE, *Leptinotarsa decemlineata* (Say)

Plants Attacked: Potatoes, tomatoes, eggplants and solanaceous weeds. The potato is highly preferred.

Description: Adults are robust yellow and black striped beetles about 3/8 inch long. Larvae are reddish and humped with 2 rows of black spots on each side of the body.

Life History: About 500 eggs are deposited in batches of about 24 on the underside of leaves. Eggs hatch in 4 to 9 days and larvae become full grown in 2 to 3 weeks, consuming the leaves. Pupation occurs in the soil and requires 5 to 10 days. Two to three generations occur in Texas.

Damage: Larvae and adults devour foliage.

GOLDEN TORTOISE BEETLE, *Metriona bicolor* (Fabricius)

Plants Attacked: Eggplant, sweet potato and other plants in the morning-glory and night shade family.

Description: Adults are oval, flattened, golden and nearly 1/4 inch long. Larvae are short, flattened, and margined with a forked posterior appendage bent for ward over the body, which holds a mass of cast skins and excreta.

Life History: Adult beetles hibernate in winter, become active in spring and feed on *Solanum* weeds until eggplants are available. Eggs are laid on foliage with larvae later pupating on leaves. New adults appear by summer, feed all fall and produce one to two generations yearly.

Damage: Adults and larvae feed on foliage, cutting holes and sometimes consuming entire leaves.

FLEA BEETLES, several species

Some important species are the tobacco fleabeetle, *Epitrix hirtipennis* (Melsheimer), the eggplant flea beetle, *E .fuscula* Crotch, and the potato fleabeetle, *E . cucumeris* (Harris).

Plants Attacked: Potatoes, eggplant, radishes and several leaf vegetables.

Description: Adults are approximately l/16 inch long. Some are entirely black, others brown-black with faint, lighter markings. Larvae are small, slender and white with a black band and 3 pairs of legs.

Life History: Adults hibernate in the soil, or in crop remnants. They become active in spring, feeding on host plants as new growth appears. Eggs are laid on or in soil near the plant base. They hatch in about a week and larvae feed on plant roots or tubers for 2 to 3 weeks, followed by pupation and adult emergence. Life cycle from egg to adult may be completed in 6 weeks or less. One to four generations develop each year depending on species. Adult feeding may extend over 2 months.

Damage: Plant foliage has numerous, very small, rounded or irregular holes eaten through or into the leaf, so that leaves look as though they have been peppered with fine shot. When these small holes are numerous, leaves may wilt and turn brown, killing or stunting the plant.

BLISTER BEETLES, *Epicauta* and others

Plants Attacked: Potatoes, tomatoes, eggplants, beans, peas and others.

Description: Several species of these insects may be present. All adults are long and slender with distinct body divisions and may be black, gray or striped. Life cycle is complicated, with several larval stages. Some species are beneficial because larvae feed on grasshopper eggs. Larva, seldom visible, are not damaging to vegetables.

Life History: Eggs, elongate and cylindrical, are laid in clusters in the soil. Eggs hatch in 2 to 4 weeks. Larvae seek out grasshopper egg masses which they devour, passing through five larval stages. Some species have two generations per year, others but one.

Damage: Adults feed on the foliage of host plants.

GRASSHOPPERS, several species

Grasshoppers feed on a wide range of crops. Of approximately 600 species occurring in the United States, few are of economic importance. Most grass hoppers pass the winter in the egg stage. Eggs are laid during summer and fall in packet-like masses below the soil surface of pasture land, field margins and road sides. Eggs hatch into small nymphs in April, May and June. Exact time and percentage of eggs hatching depend on weather conditions and locality.

TEXAS LEAFCUTTING ANT, *Atta texana* (Buckley)

Plants Attacked: Trees and crops in general. These ants occur principally in the eastern part of Texas.

Description: The leafcutting ant is rusty brown. There are several castes or forms and considerable variation in size. The queen is approximately '3/4 inch long. Common worker ants range from 1/4 to 1/2 inch in length. Colonies usually are found in well-drained sandy soils and may consist of a few small mounds or those which are several feet across. The mound interior has several chambers and may descend 15 feet.

Life History: Winged males and females develop in May and June, fly from their colony and mate. After mating, females lose their wings, establish nests beneath the soil and become queens of new colonies. They may continue reproduction within one nest for years. In such a case, they may build a nest 10 to 20 feet in diameter with numerous "craters." Each nest may contain many thousands of individuals.

Damage: Worker ants are active from May to September. They forage during the night on field crops as well as many other plants. They often defoliate plants, carrying severed leaves to their nest. Leaves are used to maintain their "fungus garden," which eventually is used for food. Well-defined foraging trails, resembling miniature highways, are established by ants traveling to and from nests.

SUCKING INSECTS

INSECTS AND MITES THAT SUCK THE JUICES FROM FOLIAGE, FRUITS, STEMS AND ROOTS, CAUSING DISCOLORATION, STUNTING, DEFORMED FRUIT AND OTHER DAMAGE

SQUASH BUG, *Anasa tristis* (De Geer)

Plants Attacked: All cucurbits with preference for squash.

Description: Adults are brownish gray to dark gray bugs about 5/8 inch long. When first hatched, nymphs have a green abdomen with crimson head, thorax, legs and antennae, later becoming grayish-white with nearly black legs and antennae.

Life History: Adults overwinter unmated in any type of shelter. They appear and mate in the spring as plants begin to vine. Yellowish to bronze-brown eggs are laid in clusters on the underside of leaves, usually in vine angles. Eggs hatch in 1 to 2 weeks and nymphs feed in groups on the stems of the plant for 6 to 8 weeks before transforming to adults.

Damage: Leaves attacked by the squash bug wilt rapidly and soon become blackened, crisp and dead. Attacked plant stems often are enlarged but later wither and die.

HARLEQUIN BUG, *Murgantia histrionica* (Hahn)

Plants Attacked: Cabbage, cauliflower, collards, mustard, turnips, brussels sprouts, radishes and many others.

Description: Adults are red- and black-spotted, shield-shaped bugs about 3/8 inch long. Nymphs are yellowish to red- and black-spotted, oval in outline and without adult wings.

Life History: They feed and mate throughout the winter in warmer areas and adults hibernate in crop residues and other debris in colder areas. Eggs are laid on end in double rows on leaf undersides and look like white kegs with two black hoops. Hatching occurs in 4 to 30 days. Nymphs feed for 1 to 4 weeks before becoming adults. Three or more generations may occur yearly.

Damage: Insects congregate in large numbers on host plants, sucking juices until the plants wilt and die.

STINK BUGS

Several species of stink bugs attack vegetable crops in Texas. Some important species are the southern green stink bug, *Nezara viridula* (Linnaeus); conchuela, *Chlorochroa ligata* (Say); rice stink bug, *Oebalus pugnax* (Fabricius), and Say stink bug, *Chlorochoroa sayi* Stal.

Plants Attacked: Beets, okra, squash, beans, peas, corn, cowpeas, tomatoes and many weeds.

Description: Adults are approximately 1/2 inch long and each has a triangular-shaped scutellum that extends from just back of the "shoulders" narrowing posteriorly to a point. Front wings are thickened and stiff about the base, but the distal half is much thinner and membranous. These membranous wing areas overlap on the back when not in use. Crushed bugs have an odor fitting their names. Nymphs are without wing covers and smaller but otherwise similar to adults.

Life History: Life history and habits of each of the stink bugs are similar. Generally, barrel-shaped eggs are deposited in clusters usually on the underside of foliage. Eggs often are beautifully colored and ornamental. Development from egg to adult occurs in 4 to 6 weeks. From one to three, or perhaps four generations may occur annually. They overwinter as adults in places affording protection from cold weather.

Damage: Damage is caused by nymphs and adults sucking sap primarily from pods, buds, blossoms and seeds. Removing the liquid contents of developing seeds causes them to become flattened and shriveled. If the fruit is attacked at an early stage of development, "catfacing" or pitted holes will occur on bean pods, tomatoes and squash.

FALSE CHINCH BUG, *Nysius raphanus* Howard

Plants Attacked: Lettuce, beets, cabbage, turnips and other greens. A number of winter weeds also serve as host plants.

Description: Adults are small, slender brownish bugs about 1/4 inch long with grayish-brown wings. Nymphs are reddish brown and slightly smaller than adults.

Life History: These insects overwinter as nymphs and adults, moving in large numbers to young plants where they congregate to feed. Eggs are laid in the soil where they hatch in about 4 days. Nymphs feed for about 4 weeks before becoming adults.

Damage: Usually, these bugs congregate behind the leaf or around the plant base, sucking plant sap. Plants often wilt and dry out until death occurs.

LEAFFOOTED BUGS, *Leptoglossus* spp.

Plants Attacked: Tomatoes and other vegetables.

Description: These large (3/4 inch) bugs are generally gray-colored with a white line across the back. The hind legs are expanded with jagged edges. All stages may be present at certain times of the year.

Damage: Feeding is typical of sucking insects. Tomatoes pierced by them are pockmarked or misshapen.

GARDEN FLEAHOPPER, *Halticus bractatus* (Say)

Plants Attacked: Southern peas, many other garden crops and weeds.

Description: Male adults are winged and females are short-winged; both are nearly black. Maximum length of winged forms is about 1/10 inch. Large hind legs enable them to hop actively. Nymphs look like adults; however, they are smaller, greenish and do not have wings.

Life History: Fleahoppers hibernate as adults and five generations usually occur in southern states.

Damage: They suck sap, making small discolored areas on the foliage. These areas often become numerous enough to coalesce and cause the death of the leaf, injuring the plant seriously.

APHIDS

Aphids are small, sluggish, soft-bodied insects often called plant lice. A number of species attack various crops, sucking plant sap, causing stunting, leaf curling and leaving undesirable honeydew deposits. Most species give birth to living young and build up very rapidly.

PEA APHID, *Acyrthosiphon pisum* (Harris)

This aphid attacks most leguminous crops, sucking sap from leaves, stems, blossoms and pods. This feeding transmits several virus diseases. Adults are large, light to deep green with red eyes and legs. There may be twelve or more generations yearly if host plants are available.

POTATO APHID, *Macrosiphum euphorbiae* (Thomas)

A general feeder, this aphid often concentrates on potatoes and tomatoes. Adults are either winged or wingless, nearly 1/8 inch long and clear green or pinkish. Aphids suck plant juices, curl leaves in a typical aphid fashion and on tomatoes devitalize blossom clusters, preventing fruit set. Disease transmission is probably of more importance than actual feeding damage.

CABBAGE APHID, *Brevicoryne brassicae* (Linnaeus)

This insect is a pale-green aphid covered with a dusty wax secretion. Infestations usually appear in late winter or early spring crops.

TURNIP APHID, *Hyadaphis erysimi* (Kaltenbach)

It resembles the cabbage aphid in appearance and feeds on many of the same crops. Life history is similar to the cabbage aphid and from 15 to 45 generations a year may occur.

BROWN AMBROSIA APHID, *Macrosiphum ambrosias* (Thomas)

This aphid is larger and more slender-bodied than the melon aphid and is dark, rusty red. Infestations build up rapidly although often unnoticed until damage appears. It is impossible to remove aphids from infested lettuce heads and these heads are not acceptable to shippers.

POPLAR PETIOLEGALL APHID, *Pemphigus populitransversus* Riley

Known as the cabbage root aphid in the Lower Rio Grande Valley, this aphid feeds on roots of cabbage, turnips, broccoli and cauliflower. Infestations are not found easily until the dwarfed and misshapen plants are noticed.

MELON APHID or COTTON APHID, *Aphis gossypii* Glover

This aphid, usually about 1/16 inch long, attacks most cucurbits, is pale yellow to dark green or dark brown with black leg joints, eyes and cornicles. Aphids build up very rapidly and leave lots of honeydew on leaves. Adults and nymphs suck juices from leaves, sapping the plant energy and causing leaves to curl, become malformed and eventually die. A dark sooty mold grows on the honeydew these aphids excrete. A particularly important aspect of this aphid damage is the spread of plant viruses.

COWPEA APHID, *Aphis craccivora* Koch

Plants Attacked: Peas, southern peas, beans, and many other plants.

Description: These aphids are shiny black with white bands on the legs. They are seldom confused with other species. Winged and wingless forms occur.

Damage: Plants may be heavily attacked, especially in early spring. Leaves will become misshapen, curl and wilt.

GREEN PEACH APHID, *Myzus persicae* (Sulzer)

This bright-green aphid with a slender body attacks a wide variety of crops including melons, peppers and tomatoes.

SWEETPOTATO WHITEFLY, *Bemisia tabaci* (Gennadius) and the GREENHOUSE WHITEFLY, *Trialeurodes vaporariorum* (Westwood)

Plants Attacked: Tomato, potato, eggplant, pepper and sweet potato.

Description: Adults, about 1/16 inch in length have 4 wings which, along with the dorsal part of the body, are covered with white waxy powder. Nymphs are light green, oval, flattened and about the size of a pinhead. They are attached to the leaf surface until mature, with the last instar more elevated and slightly segmented. Their bodies are covered with radiating, long filamentous threads, resembling young soft-scale insects.

Life History: Overlapping generations occur in the Lower Rio Grande Valley during spring, summer and fall. Adults emerge, mate and begin depositing elongated, yellow eggs, attaching them to the host plant by a short stalk. Before hatching, the eggs darken. Nymphal period is 1 month.

Damage: Both nymphs and adults feed by sucking plant juices. Heavy feeding gives plants a mottled appearance or causes them to turn yellow and die. The sticky honeydew excreted by the insect often glazes the lower leaves and permits the development of black sooty mold on plants, thus detracting from the appearance.

LEAFHOPPERS

Several species of leafhoppers attack vegetable crops in Texas. Some more important species are the southern garden leafhopper, *Empoasca solana* Delong, (known as the bean leafhopper in the Lower Rio Grande Valley); the aster leafhopper, *Macrostelesfascifrons* (Stal); the potato leafhopper, *E.fabae* (Harris); the western potato leafhopper, *E . abrupta* Delong and the beet leafhopper, *Circulifer tenellus* (Baker).

Plants Attacked: Hosts of *Empoasca* are lettuce, eggplant and rhubarb. Hosts of the aster leafhopper include lettuce, carrots, parsley and celery. Hosts of the beet leafhopper are beets, tomatoes, snap beans and weeds.

Description: Empoasca adults and beet leafhoppers are green to pale green, somewhat wedge-shaped, 1/8 to 1/4 inch in length. The aster leafhopper adult is brownish gray and has 6 spots on the face above the antennae. Nymphs are green with wing buds instead of wings, smaller than adults, but the same shape.

Life History: Females deposit slender, white eggs into stems and larger veins of plant leaves. Hatching occurs in 6 to 9 days during summer; nymphs molt 4 times before becoming adults. Shortly after adults appear, mating takes place, followed by oviposition. Several generations overlap each season. Adults are very active, jumping or flying when disturbed. Both adults and nymphs can run backwards or sideways as rapidly as they move forward. In general, the same history applies to the aster leafhopper and the beet leafhopper.

Damage: Leafhopper feeding causes curling, stunting and dwarfing, accompanied by a yellowing, browning or blighting of foliage. Injection of saliva into the phloem during feeding results in a physiological disturbance producing disease-like symptoms. On beans and eggplant, a marked curling-under of leaf edges is produced and a crinkling effect of the upper surface, along with the usual stunting. The only damage caused by the aster leafhopper is the transmission of the virus disease, aster yellows, occasionally evident in South Texas. Beet leafhoppers sometimes transmit the curly top disease, which stunts or kills plants. Leaf veins become warty, veinlets transparent and petioles kinked. Leaves roll upward at the edges, becoming brittle and shriveled.

SHARPSHOOTERS, *Homalodisca* spp. and *Oncopmetopia* spp.

Plants Attacked: A wide variety of plants.

Description: These large 1/2 inch leafhoppers have blue, yellow or white patches. Very active, they will avoid humans by running around a plant stem. They are also very capable and direct fliers.

Damage: Feeding consists of sucking plant juices. These insects are very common but seldom abundant enough to justify control. They can migrate in and out of a garden to avoid sprays.

WESTERN FLOWER THRIPS, *Frankliniella occidentalis* (Pergande) and the ONION THRIPS, *Thrips tabaci* Lindeman

Plants Attacked: General feeders, vegetables, flowers and field crops.

Description: These are slender, spindle-shaped, active insects varying from pale yellow to yellowish brown. Adults average about 1/25 inch long. Four slender wings are present on females, fringed with long hairs on back margins. Males are wingless. Larvae resemble adults, but have no wings and are smaller.

Life History: The minute eggs are inserted into leaves or stems. These hatch in 2 to 10 days. The larval stage lasts from 5 to 30 days. Adult females can reproduce regularly without mating with the rarely found males. All stages can be found during warmer months but during colder months only adults and larvae can be found. It is probable that five to eight generations occur per year, but more may occur in the warmer parts of the State.

Damage: Thrips puncture plants, rasp the surface and then suck the juice. This causes the formation of whitish blotches that first appear as dashes. Severely attacked plants develop a gray or silver appearance and may become distorted. Damage may be found first in the leaf sheaths

and stem or on the undersides of a bent leaf where the insects always are most abundant.

SPIDER MITES

Twospotted Mite, *Tetranychus urticae* Koch, *Tetranychus marianae* (Linnaeus), *Oligonychus* spp. and others.

Plants Attacked: The twospotted mite occasionally attacks several vegetable crops including tomatoes, eggplants, beans and corn. *Oligonychus* may damage sweet corn seriously.

Description: The twospotted mite is green with a dark spot on each side. Other common adult mites are carmine. Nymphs of several species are yellowish. *Oligonychus stickneyi is* yellowish in all stages. All these mites are about 1/60 inch long.

Life History: Adult mites lay eggs on leaf underside and spin webs beneath which eggs hatch and mites feed. Spider mites reproduce rapidly during hot, dry weather.

Damage: Mites pierce leaf tissues and suck sap in larval, nymphal and adult stages. Plants attacked begin to lose color, fading from green to yellow and eventually turning reddish. Heavy infestations can kill peanuts.

TOMATO RUSSET MITE, *Aculops lycopersici* (Massee)

Plants Attacked: Tomatoes and occasionally other solanaceous crops.

Description: Mites are microscopic, orange-red and wedge-shaped.

Life History: Reproduction may be continuous under warm conditions, but slows down in cool weather. Complete development from egg to adult requires about a week.

Damage: Leaves and stems begin to turn bronze and the whole plant may turn brown and die if mites are not controlled.

BENEFICIAL INSECTS

PREYING MANTIDS, several species

Prey Attacked: Mantids feed on a variety of insects including grasshoppers, caterpillars, flies and bees. Prey size must be appropriate for the mantid to handle. While the mantid chews on the prey, he holds it with his forelegs. Prey is captured by a rapid thrust as it moves by. The mantid hunts by waiting or very slow stalking.

Description: Adults have elongate, stick-like bodies with long legs. Front legs are enlarged and fit together to hold prey. Range in size from 1/2 inch to over 6 inches. Body color usually green but may be brown or pink. Adults have wings which are normally folded over the abdomen. Adults are capable fliers, but seldom do so. All stages are well camouflaged with vegetation.

Life History: Mantids overwinter as eggs in a hard frothy egg case. Egg cases are placed on sticks, fences or even buildings. Young nymphs hatch in spring. Size increases through the season by a series of molts.

ASSASSIN BUGS, *Zelus* spp. and others

Prey Attacked: Caterpillars and probably other insects are attacked. Body fluids are extracted from the prey by sucking mouthparts.

Description: These insects are similar in appearance to leaffooted bugs. Often brightly colored, these insects are related to the bloodsucking conenose.

Life History: Development is simple, from egg to nymph to adult. Adults are winged.

MINUTE PIRATE BUGS, *Orius* spp.

Hosts attacked: Feeds by sucking on insect eggs, aphids and other small soft bodied pests.

BIG-EYED BUG, *Geocoris* spp.

Prey Attacked: Similar to that for Minute Pirate Bug.

Description: This bug has conspicuous large eyes which, as the name implies, are characteristic.

Life History: This insect is active, quick moving. Development is simple so adults and nymphs are similar.

LADYBIRD BEETLES, several species

Prey Attacked: Adults and larvae use chewing mouthparts to feed on aphids and other small insects.

Description: Adults are hemispherical-shaped beetles. Typically colored red with black spots, they may be black or black with red spots. Several species exist with variable spotting. Antennae are clubbed. Adults are usually 1/4 inch or less in size. Larvae are elongate flattened grubs with moderate legs near the front. Actively moving about the plant, they often live in aphid colonies. Pupae are sedate cases attached to plants.

Life History: A four-stage life cycle is completed: eggs, larvae, pupae and adults. No feeding occurs in the egg and pupal stage, but beetles may be readily found on garden plants and confused with pests.

GROUND BEETLES, several species

Prey Attacked: Predators on a variety of insects insect eggs and other arthropods. One species, the seed corn beetle, occasionally damages germinating seeds or seedlings.

Description: Adults are typically black. Some species have red legs, are brown or have iridescent-green to blue elytra. Very active and fast moving, the beetles have long unclubbed antennae. Larvae are seldom seen grubs with large jaws. Usually they have a fleshy appearance and are found in the soil.

Life History: Adults are normally the only stage seen. Common in soil or at the soil surface, they are attracted to lights.

A SOFT-WINGED FLOWER BEETLE, *Collops balteata* LeConte

Prey Attacked: General predator on smaller insects.

Description: A conspicuous red cross marking on the back of this beetle is characteristic. Beetles are about 1/4 of an inch long. Several related species may be found in gardens.

Life History: Adults are commonly seen on plants or flowers, especially in the sunlight. Adults are fast-running predators, which may aid in pollination by carrying pollen between flowers.

SYRPHID FLIES, several species

Hosts Attacked: Adults feed on nectar from flowers and aid in pollination in the process. Larvae prey on aphids.

Description: Adults are attractive black and yellow flies which resemble bees. They can be readily distinguished from bees since flies only have two wings and bees have four. Commonly, they hover around flowers. These flies do not sting or bite. Sizes range up to 3/4 inch. Larvae are slimy green maggots found on leaf surfaces, often in aphid colonies.

LACEWINGS, several species

Prey Attacked: Adults and larvae feed on aphids and other small soft-bodied insects.

Description: Adults have four large glossy netveined wings on a thin body. Antennae are nearly an inch long for some specimens. Larvae are often called aphislions. Generally elongate and flattened, they are wider at the middle with large hooked mandibles. They are active on long legs. Small white eggs are laid singly on a stalk.

HONEYBEE, *Apis mellifera* Linnaeus

Description: Orange and black, this husky bee is about 1/2 inch in size.

Life History: This is the common honeybee of beekeepers. Wild colonies may occur in tree hollows and other sites. Active by day, the bees return to the colony at night.

Importance: This is an important pollinator of vegetables. Supplemental colonies may be advantageous to insure good fruit set on vegetables which need to be pollinated.

WILD BEES, several species.

Description: Adult colors vary with black, yellow and orange common. Some are metallic green or blue.

Life History: Adults nest in a variety of locations. Many nest in the ground, such as bumble bees. Some prefer holes in wood or sticks as nesting sites . Bees may be either solitary or colonial.

Importance: These bees perform much needed pollination. They are overlooked in importance but should be considered a valuable complement to cultivated honeybees. Some native bees are better pollinators than honeybees on certain crops. For example, bumble bees are better pollinators of legumes.

PARASITIC WASPS, several species.

Description: Color and size are highly variable in this large group of thousands of species. Adults are commonly minute or microscopic with black or metallic colors on the body. Seldom seen, parasites are usually overlooked.

Life History: Adult wasps lay eggs in a variety of insects of all stages. Wasp larvae develop in the insect egg, caterpillar, beetle or other hosts.

Importance: The larvae of these wasps feed inside the bodies of other insects. Caterpillars, grubs and other pests are attacked. Parasites reduce feeding or vitality of the host and usually kill it. Pupae of a small braconid wasp may be found commonly on the outer surface of hornworms.

PREDATORY WASPS, several species.

Description: Adult wasps are generally 1/4 inch or more in length. They are present in a wide variety of colors, shapes and sizes. Many are brightly colored Some are robust while others have thread "waists. " All have four wings.

Life History: Solitary and colonial species occur. Nests are provisioned with a variety of insects or spiders as food for the wasp larvae. Paper and potter wasps are included here.

Importance: A few of these predators can remove a large number of insects from a garden when actively provisioning their nests. Most species are capable of stinging humans. Some are helpful as pollinators.

SPIDERS, several species.

Description: Eight legs and two body regions distinguish spiders from insects. No spiders are winged. Spiders range from microscopic size to over 3 inches in length.

Life History: Nearly all spiders form some webbing as snares, retreats or draglines. Other webbing may be formed by caterpillars or spider mites. Spiders migrate by walking, running or jumping. Young or small spiders may be blown in the wind by extending a silk line that aids in lifting the spider.

Importance: All spiders are beneficial predators on smaller creatures. Many are quite effective at reducing pests.

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