Ants

O & T Guide [T-#01]

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With over 100 ant species in New Mexico, ants are probably the most familiar and most numerous insects found in turf, ornamental plantings and elsewhere. Only three species of this abundant group of insects will be described here. Harvester and southern fire ants are common in our turf. Red imported fire ant (RIFA) is an invasive, exotic species and a threat to New Mexico agriculture, public health and safety.

M**etamorphosis:** Complete
Mouth Parts: Chewing (larvae, adults)
Pest Stage: Adults

Scientifically: Ants are members of the insect order Hymenoptera, Family Formicidae.

Typical Life Cycle: Eggs are incubated in the nursery area of the mound, close to the surface where the soil is sun warmed. → Larvae are kept in the nursery area where growing conditions are maintained at optimal levels. All of these stages are tended, fed and protected by worker ants. Mature larvae of some species such as the fire ants are fed solid foods collected by foraging workers; only these larvae can digest solids, regurgitate them, and feed fluids back to the foragers and other colony members. Harvester ant larvae are fed on bits of fungi from fungus gardens maintained below ground by workers in the colony. → The Pupa is also kept in the nursery below ground in harvester and fire ant colonies. These require 10-14 days to complete development. → During the summer, most adult ants probably complete development from egg to adult in 6-8 weeks during the summer.

Red imported fire ant worker, *Solenopsis invicta*. Photo: April Noble, www.antweb.org, www.forestryimages.org

Ants are social insects living in colonies of several hundred to many thousands of individuals. In its simplest form, a single mated queen produces all of the eggs. Nearly all of these are devoted to production of workers, sterile females responsible for mound digging and maintenance, foraging, defense and care of the queen and nursery. Some ant species may have and tolerate more than one fertile queen per colony; another explanation for this situation is that small colonies are tolerant of each other, forming what appears to be a single large colony. Reproductive or swarmer ants are produced in mature colonies seasonally,

usually after rain events in periods of warmer weather. Dozens to thousands of winged male and female ants may leave a colony during a swarming event. After leaving the parent colony, winged reproductives must find aggregations of their own species and potential mates. Males die fighting over females or soon after mating. Future queens must survive the mating melee and escape to establish, tend and defend a new colony until they raise enough workers to handle all daily colony tasks other than reproduction. Queen ants may live several years, cared for and defended by worker ants in the colony. Worker ants probably survive less than a year.

Egg laying by the queen(s) is temporarily suspended in most outdoor colonies of ants over the winter. Colonies of many species retreat deeper into their underground tunnels and become mostly quiescent at this time.

Description of Life Stages:

Egg: These are minute, white, rounded to elongate and rarely seen.

Larva: Larvae are legless, C-shaped, white, and multi-segmented with poorly defined head capsules. At maturity, larvae of harvester ants may be nearly ¼" long but larvae of most other species including the fire ants will be much smaller.

Pupa: The pupa is an intermediate stage in which dramatic changes in appearance and physiology occur between the larva and adult. The actual pupa is contained in an off-white, elongate oval cocoon commonly seen when ant mounds are disturbed; what many people think are eggs being carried to safety by worker ants are actually the much larger pupae. The actual pupa closely resembles the adult ant in size and appearance only the exterior body parts are white and mostly immobile. External wing buds are visible externally only on future swarmers (future reproductive ants).

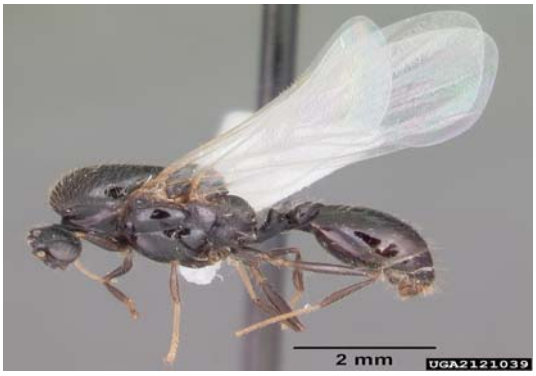
Adults: The adult worker will have a well-defined head, thorax and abdomen. Chewing jaws and prominent, elbow-shaped antennae are primary features of the head; most but not all species have a pair of compound eyes. Three pairs of elongated, slender legs are attached to the thorax. The shape of the thorax as well as shape and location of thoracic spines (if any) are helpful for identification. The slender connection between thorax and abdomen may have one or two segments, another feature used in identification as well as presence or absence of a stinger. For some species, a circlet of small "hairs" around the anus is useful in identification, also. Worker ants in some species are approximately the same size; in others (e.g. fire ants), worker ants vary considerably in size.

Workers of just two of the common ant species in turf are described as follows:

1) Fire ants: The common, native southern fire ant, *S. xyloni*, is ubiquitous in urban and suburban areas across all of the southern U.S. While it can be an aggressive forager and sting repeatedly, its exotic relative (apparently from Brazil), the red imported fire ant (RIFA), *S. invicta*, is even more so. Widespread in the southeastern and south central U.S., RIFA, is a good hitchhiker on commercial trucks and cargoes. It has been found in isolated instances in New Mexico. Presently, only Dona Aña County is under federal quarantine for this pest. This situation requires licensed nurserymen and turf growers to treat their plants with approved

insecticides and take extra security precautions in their growing and shipping areas prior to sending outside the regulated area. Worker fire ants of both species have two-segmented petioles, prominent stingers, no spines on the thorax, and 10-segmented antennae ending in a gradually swollen, 2-segmented club. Other subtle, mostly microscopic features are useful for distinguishing *invicta* from other *xyloni*; more recently, DNA analysis has been used to separate the species in critical identifications.

Red imported fire ant, *Solenopsis invicta*, from egg to larva to pupa to adult. Photo: USDA APHIS PPQ Archives, USDA Animal and Plant Health Inspection Service, www.forestryimages.org



Harvester ants: all workers are nearly ¼" long. Depending upon species group, all ants in a mound are either all red or red and black. All workers have a pair of prominent short spines on the upper rear part of the thorax, a 2-segmented pedicel between thorax and abdomen, a well developed stinger and a "beard" of colorless "hairs" on the underside of the head. Shaped like low pitcher's mounds, some harvester ant nests are up to six feet across and eight feet or more deep. Workers keep the mounds free of plants but generally covered with fine gravel that aids in regulating temperature in the nursery. These ants are native to the Southwest.

Harvester ant workers, *Pogonomyrmex* sp. Photo: H. A. "Joe" Pase III, Texas Forest Service, www.forestryimages.org

Habitat and Hosts: Ants will invade any sunny, well-drained turfgrass area as well as planting areas for ornamentals, including nurseries and greenhouses. Ants will also invade non-crop areas, rights-of-way, roadsides, farm fields, and buildings, searching for food, moisture and shelter. Foraging trails may extend many feet from the mound. Severe disturbance of some ant mounds may prompt the ants to move their colonies or construct new tunnels and entry points near the surface.

Damage: Ant tunneling and nesting can disturb turf roots and increase water loss from soil. Turf stands can thin, allowing weeds to compete. Foraging trails may become well worn and visible. Unattractive, ever-growing mounds can make lumpy areas in turf, affecting quality, appearance and some recreational uses. Large mounds can damage mower blades particularly when ants are

swarming and they make their mounds even higher with debris or clay soils. Some species (especially the fire ants) are well known for the vicious bites and stings which they can deliver repeatedly. While painful and annoying, ant venom also can trigger acute and life-threatening allergic reactions (anaphylactic reactions) in sensitive people.

IPM Notes: Ants are best controlled by treating the mounds and killing the queen(s); treating foraging ants provides very short term relief in most cases. Insecticidal drenches, granules or selected baits containing insect growth regulators (IGRs) are effective as well as broadcast treatments with certain baits. Remove food or shelters favored by ants. Controlling aphids, scales, whiteflies or other honeydew producing insects on ornamentals can be helpful as well as replacing landscape plants prone to these infestations with species not similarly affected by these pests.

Billbugs

O & T Guide [T-#02]

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Several species of broad-nosed weevils called billbugs damage both cool and warm season turf in New Mexico.

M**etamorphosis:** Complete
Mouth Parts: Chewing (larvae, adults)
Pest Stage: Larvae, adults (minor pests).

Scientifically: Billbugs are members of the insect order Coleoptera, Family Curculionidae.

Typical Life Cycle: Eggs are laid in small clutches in the bases of grass stems near the crowns of plants. They are rarely seen. →Hatching in about 2 weeks, the minute larvae feed within the grass stems briefly before burrowing down to feed on the grass crowns. Later, they move to the root zone in the soil, feeding on roots and rhizomes. Generally, larvae are abundant from mid-July to mid-August. → Larvae pupate in late summer in small chambers they create in the soil near infested grass roots, emerging as adults within a few weeks. → New adults are most abundant in late September and October when they are found in considerable numbers on driveways and sidewalks. Adult billbugs may chew on grass blades or cut notches in the margins but generally cause little turf damage in this stage. Adults overwinter in infested turf or sheltered areas nearby. In late winter or early spring, adults begin to walk about (adults are flightless), and are commonly observed wandering around on driveways and

Adult hunting billbug, *Sphenophorus venatus vestitus*. Photo: University of Georgia Archives, The University of Georgia, www.forestryimages.org.

Adult bluegrass billbug, *Sphenophorus parvulus*. Photo: Joseph Berger, , www.forestryimages.org.

Adult Denver billbug, *Sphenophorus cicastriatus*. Photo: Whitney Cranshaw, Colorado State University, www.forestryimages.org.

sidewalks. When disturbed, adults become motionless, making them difficult to find in turf plots while scouting.

Most billbug species in New Mexico have one generation annually; a partial second generation may occur in some warmer areas.

Description of Life Stages:

Egg: minute, spherical, white

Larva: Larvae are C-shaped, off white, legless and up to 3/8" long at maturity. Their head capsules are yellow to brown and are slightly smaller than their rear ends.

Pupa: Pupae look like off-white mummies of the adults they will become. They are flatter on the underside and rounded above. Pupae do not feed and are mostly immobile. Most are about ¼-3/8 inch long.

Adults--- Adults are ¼ to ½" long and dark brown to black with narrow channels on their wing covers. What may appear as a pattern of gray, tan or even reddish dots on the wing covers and thorax of some beetles is actually soil dried in minute dimples in the beetle's integument. The "bill" in billbugs refers to a short, broad "snout" on the head visible from above or the side. The chewing jaws are on the end of the snout.

Habitat and Hosts: Bluegrass billbugs, *Sphenophorus parvulus*, attack cool season Kentucky bluegrass and occasionally fescues and perennial ryegrass in New Mexico. Denver billbugs, *S. cicastriatus*, can be found in Kentucky bluegrass turf in northern New Mexico as well as parts of the Rocky Mountains and northern High Plains. Hunting billbugs, *Sphenophorus venatus vestitus*, and Phoenix billbugs, *S. phoeniciensis*, are occasional pests of Bermudagrass and Zoysiagrass in southern and eastern New Mexico. Although similar to the bluegrass billbug in damage done and life cycle, reproductive activities and developmental periods for these species are less coordinated and most stages can be found throughout the year.

Damage: Billbug larval damage to turf is similar to that caused by white grubs. Patches of grass begin to turn brown due to root damage. Affected turf is easily pulled out by hand with the stems breaking off at the crown. A good indication of billbug presence is a fine, white, sawdust-like material left by larvae feeding in the root zone. Also, look for the larger C-shaped, legless white larvae in the soil around the root zone, especially in spring. Adult billbugs chew small holes in grass blades. In severe infestations, the area around the holes may turn yellow, and the grass may have a speckled appearance.

IPM Notes: Beneficial nematodes or the botanical toxin rotenone may provide quick but expensive short term control of billbug larvae. Commercial formulations of milky spore disease (*Bacillus popilliae* from cultures) perform sporadically or not at all in the alkaline, hot, dry soils of the Southwest. Commercially available insecticides labeled for billbugs and other soil-dwelling turf pests such as white grubs can be effective.

Larva of the Denver billbug. Photo: Whitney Cranshaw, Colorado State University, www.forestryimages.org

Cutworms andArmyworms

O & T Guide [T-#03]

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Cutworms and armyworms are drab, nocturnal, "hairless" caterpillar pests of grass crowns, roots and blades as well as a variety of crops, landscape and rangeland plants. The night-flying adult stages are called "miller moths" because they congregate around outdoor lights. They can be annoying then and also when adults seek shelter during the day in homes and buildings. Their shed wing scales can cause allergic reactions in some people.

M**etamorphosis:** Complete
Mouth Parts: chewing (larvae)
Pest Stage: larvae, adults (minor)

Typical Life Cycle: Eggs are laid in the soil around shallow roots of host plants, on grass crowns or blades, or higher on host plants, depending upon species. → Series of Larvae. Larvae feed and disperse at night, hiding by day in soil crevices, thatch or other cover. →Pupae are usually found in surface litter or several inches below the surface in soil not far from host plants; most require 7-14 days to mature in summer temperatures. →Adults typically emerge, fly, mate and lay eggs at night, seeking shelter by day. Depending upon species, one to many life cycles may be completed annually. Adults of some species are "migratory," especially army cutworms. The insects have annual life cycles, laying eggs in the fall on desert rangelands in the lower elevations. Feeding as temperatures permit over the fall and winter, army cutworms mature and pupate in late winter. As temperatures

Fall armyworm larva, *Spodoptera frugiperda*. Photo: Clemson Univ., USDA-Cooperative Extension Slide Series, www.forestryimages.org

Fall armyworm, showing inverted Y on the head. Photo: Steve L. Brown, Univ. Georgia, www.forestryimages.org

warm, adults fly in large numbers to New Mexico's mountains where they live over

the summer, flying locally at night and seeking shelter in or on buildings, on tree bark or other sheltered areas. By late summer, the adults return to the lower elevation rangelands, flying at night again, where they breed and females lay eggs.

Description of Life Stages:

Egg---minute, spherical or variously flattened, white or variously colored (especially when larvae are ready to emerge), laid singly or in clutches varying in number from several dozen to over 100. Females of some species leave their eggs bare while others ovipositing on foliage may cover their eggs with scales from their bodies.

Larva---all stages are cylindrical with three pairs of short, segmented, thoracic legs and five pairs of stubby, muscular, abdominal prolegs. Mature larvae are "bare" (no prominent "hairs" visible on their bodies) and variously patterned in tones of olive green, tan, brown, black and gray. Mature caterpillars of different species may be 1 ½ to 2 inches long at maturity; cutworms often appear thicker and heavier than other caterpillars of similar lengths. Cutworms commonly chew off host foliage or seedlings at ground level. Armyworms often crawl together in large numbers from one feeding site to another. When disturbed, armyworms and cutworms may remain motionless or roll into a tight curl. Some species are pugnacious or even cannibalistic.

Common species include:

Fall armyworm (FAW), *Spodoptera frugiperda*, is nearly 1 ½ inches long at maturity and olive green with narrow black stripes along either side and down the center of the back. It has a distinct, inverted Y marking on the head.

Fall armyworm adult. Photo: William Lambert, Univ. Georgia, www.forestryimages.org

True armyworm, *Pseudaletia unipuncta*, is similar in appearance to FAW but lacks the inverted Y.

True armyworm larva, *Pseudaletia unipuncta*. Photo: Ronald Smith, Auburn Univ., www.forestryimages.org

Variegated cutworms, *Peridroma saucia*, range in color from dark brown to gray with patterns or markings that may be difficult to see. A line running down the back of the caterpillar is broken, leaving 4-7 whitish to yellowish dashes. A narrow orange stripe may be seen close to the black spiracles and a black irregular W-shaped mark may be present on the top of the 8th abdominal segment.

Variegated cutworm larva, *Peridroma saucia*. Photo: Lacy L. Hyche, Auburn Univ, www.forestryimages.org

Army cutworms, *Euxoa auxiliaris*, are striped with two tones of olive green. Mature caterpillars can be nearly 2 inches long. When numerous, these caterpillars may "march" across roads, pastures and fields, defoliating turf, small grains and certain other herbaceous plants as they go.

Army cutworm adult and larva, *Euxoa auxiliaris*. Photo: G. Keith Douce, Univ. Georgia, www.forestryimages.org

Pupa---lozenge-shaped, dark brown to black, lacking a cocoon, quiescent, about an inch long.

Adults---Adults of most turf pest species have threadlike antennae, relatively plump bodies, somewhat narrowed forewings and broad, rounded hind wings. For species mentioned above, the forewings are mottled brown, gray and/or black, with various subtle patterns useful in identification. Hind wings of these same species are pale, drab and generally lack patterns. Most moths are 1-1 ½ inches long with wingspans of 1 ¾ to nearly 2 ½ inches. Their bodies are densely covered in grayish brown scales and fine "hairs" (modified scales). When at rest, their wings are held at angles to the body like the wings of fighter jets. Some species lack functional mouth parts as adults while others have thin, flexible tubes useful only for fluid intake. Most adults fly, mate, lay eggs and feed (if they do so at all) at night, seeking shelter by day in dense vegetation, under tree bark, cracks in the soil or similar protected areas.

Habitat and Hosts: Most of the caterpillars mentioned above feed on a variety of plants but have obvious preferences for grasses or small grains.

Damage: Larvae of most species are active defoliators capable of killing young or weak turf plants. Damage is almost always spotty across any grassy area of the state and even within one stand of turf. More significant damage may occur when birds or small mammals tear up turf searching for larvae.

IPM Notes: A healthy turf will generally withstand cutworm damage. Natural enemies, including birds and small mammals, may keep cutworm and armyworm populations below damaging levels in some years. Chemical control usually is needed if natural enemies do not keep infestation below the economic threshold of one armyworm per square foot on home lawns or one per square yard on golf greens. *Bacillus thuringiensis (*Bt) or entomophagous nematodes ("insect eating" nematodes) may be effective

biological controls for young larvae of some cutworm species in some limited situations. Cutworms and armyworms on putting greens may require chemical controls to prevent unacceptable damage; thorough scouting and pest risk assessment is essential. For home lawns, thatch removal may be needed. Some people add a little dish or laundry detergent to their irrigation water to drive the larvae to the surface prior to applying pesticides. Results may be better if treatments are applied in late afternoon or early evening.

Ground Pearls

O & T Guide [T-#04]

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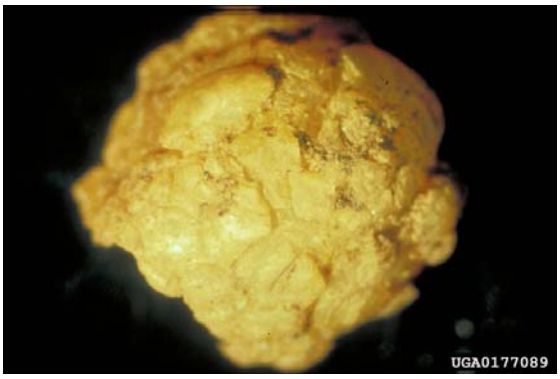
When warm season turf has irregular patches of thin, yellow, dead or drought-stressed grass and other common insect pests or pathogens are not evident, sift the soil to look for firm, spherical off-white to purplish-yellow ground pearls attached to grass roots or in surrounding soil.

Metamorphosis: Simple
Mouth Parts: piercing-sucking in nymphs and adults.
Pest Stages: Nymphs

Scientifically: Ground pearls are members of the insect order Hemiptera, Family Margarodidae.

Typical Life Cycle: Generally, the life cycles and biological details for ground pearls are poorly known. Eggs are typically laid inside the female's waxy cyst amid shallow roots of host grasses. Eggs laid in spring hatch by late summer. → Series of Nymphs. After hatching, nymphs disperse, find new feeding sites, and begin to secrete their protective, spherical, off-white to yellowish-purple cysts. While many ground pearls establish themselves along the shallower roots of their hosts, some crawlers attach to grass roots 10-12 inches or more below the surface. Adverse conditions (severe temperature changes, drought, starvation, etc.) can trigger physiological changes in the nymphs, producing quiescent, long-lasting (sometimes a decade or more), environmentally-insensitive survival stages. Ground pearls overwinter in their cysts. Male nymphs of some species become quiescent in early spring and external wing pads appear in the last nymph stage preceding adulthood. Female nymphs continue to mature without obvious changes and lack wing pads. →Adults emerge from their cysts probably in the spring when they move toward the soil surface where mating occurs. Females retreat to their waxy cysts to lay their eggs. At least one year, and probably two or more years, are needed for a complete cycle from egg to egg. At least one species in the southeastern U.S. is known from female-only populations; eggs hatch without fertilization, a situation known as parthenogenesis.



Closeup of a ground pearl cyst, *Margarodes* sp., actual size about 1/10 inch. Photo: C.A. de Klerk, Nietvoorbij Institute for Viticulture and Oenology, Stellenbosch, South Africa, www.forestryimages.org

Description of Life Stages:

Egg---minute, round and rarely seen.

Nymphs---Nymphs are the primary life stages that damage turf. Hatchlings or "crawlers" have six functional legs, dispersing along the roots of their hosts. The soft-bodied, segmented, oval but flattened nymphs attach to grass roots with their mouth parts. Cysts can range in diameter from 1/12 to nearly ¼ inch at maturity. The pearl-like appearance of the cysts gives these insects their common name.

Adults---Depending upon species, males may be winged (only one pair of wings) or wingless, while females are wingless.

Habitat and Hosts: All stages of ground pearls are found in the soil around roots or attached to roots of host grasses including Bermudagrass, Zoysiagrass, Centipedegrass, St. Augustinegrass and several genera of native range grasses. Ground pearls are widely distributed in the warmer parts of the southern U.S.

Damage: Severely infested grasses appear weak, thin, yellow and drought stressed; some plants can be killed. Damage is due to sap removal by the insects and toxins injected with their saliva.

IPM Notes: Turf managers may keep infested turf green, actively growing and competitive with these pests by adjusting fertilization, watering and mowing schedules to promote vigorous plant growth. Raising cutting heights to at least 1.5 inches in late summer may be helpful; avoid scalping turf at other times of the year. No pest resistant turf cultivars have been developed and no effective natural enemies that are known for ground pearls.

Because ground pearls can occur as deep as a foot in the soil and because they can become physiologically inactive when stressed, insecticidal control will be difficult at best. Currently no insecticides are labeled specifically for ground pearl control in turf although several soil treatments applied for other insect pests may have some activity. Wet soil to a depth of at least one foot before applying a soil treatment.

Ground pearl infestations are probably under-reported because they can be so difficult to find unless adequate root and soil samples are carefully taken and analyzed.

Do not confuse ground pearls with perlite, vermiculite, slow-release fertilizer particles, granular pesticides, seeds or similar spherical soil additives.

European and Africanized Honey Bees

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Although common and widely recognized as beneficial pollinators of many crops, landscape and wild plants, honey bees, both European and Africanized, can be potentially dangerous and damaging pests in some turf and ornamental settings. Both European (EHB) and Africanized (AHB) honey bees are members of the same species, look alike and are similar biologically. However, AHBs have a well-deserved reputation for defensive, unpredictable behavior. Bee stings can seriously injure or kill people, pets, livestock and wildlife.

M**etamorphosis:** Complete
Mouth Parts: chewing (larvae); chewing -lapping (adults)
Pest Stage: Adult

Typical Life Cycle: Eggs are laid singly in the 6-sided wax cells of bee combs. → Series of Larvae. Mature worker larvae are about ½ inch long while those of drones (males) are slightly larger. Mature queen larvae are larger yet. Larvae are confined to the 6-sided cells in the wax comb where they are fed and tended by worker bees. → Pupae are found only inside the 6-sided, wax capped cells of the bee comb. Caps of drone pupae are often raised above the surface of the comb since they are larger than workers. Caps of queen cells may be higher yet; slightly larger queen cells also may be located near the edges of bee combs.→Adult, for each of the three castes in both AHB and EHB colonies: queen, worker and drone.

Both EHB and AHB are social insects, living in usually large, perennial colonies of several to many thousands of individuals. In healthy but queenless colonies, surviving workers will raise several potential queens.

Adult honey bee worker, *Apis mellifera*, gathering nectar and pollen. Note the ball of pollen on the hind leg. Photo: John A. Weidhass, Virginia Polytechnic Institute and State University, www.forestryimages.org

Slightly larger than the workers, a virgin queen mates with as many as 15-20 drones during a single mating flight. Upon returning to her colony, she kills all rival queens before settling down to lay eggs for the rest of her life.

When a colony becomes overcrowded, the old queen may “swarm” with part of her offspring, leaving the old colony to

establish a new one elsewhere; the remaining workers again raise several replacement queens which mate and compete for survival in the old colony.

Fertilized eggs produce female bees, including queens and workers. Future queens receive a highly nutritious diet that future workers do not. A queen, the egg-layer in the colony, may live more than a year while workers (sterile females) live only a few weeks or months. Hatching from unfertilized eggs, short-lived drones (males) die after mating or when workers force them out of the colony.

If EHB colonies are large enough to divide and swarm, this generally occurs once annually in the spring. From then until fall, the ever increasing population of workers provisions the colony with honey, their overwintering food. AHB colonies also may divide and establish new colonies when resources are abundant, but they may do so more than once annually, increasing the probability that new problem colonies will be detected in any given area. AHBs also are very responsive to their environment and may swarm several additional times during the year when food or water sources fail or when their colony is disturbed. Such survivor swarms can contain as few as 20-30 bees; smaller numbers of bees may establish new colonies in much smaller spaces where they are less likely to be noticed and least expected, such as water meter/utility boxes, old cars, bird houses, lawn decorations, firewood piles and junk.

Description of Life Stages for Both EHB and AHB:

Egg---tiny, hot-dog shaped, white.

Larva---Larvae are cylindrical to tear-drop shaped, legless, white, segmented, soft-bodied with poorly defined head capsule. They will be less than ½ inch long at maturity.

Pupa---transitional stage between larva and adult; resembles quiescent adult, but whitish and lacking dense "hair" covering on body. A pupa is only found inside the 6-sided cell in the comb, capped with wax. Worker pupae are most common in the combs but are also the smallest in size; drone pupae are slightly larger and caps on their cells may be slightly raised. Though few, future queen pupae are larger yet, with significantly raised caps on their cells.

Example of a queen cell which is considerably larger than adjacent cells built for workers and drones. Photo: Carl Dennis, Auburn University, www.forestryimages.org

Adults---Worker adults are the most numerous caste in the colony but also the smallest at about 3/8 inch long. Although there is some variability in color and pattern among different strains of honey bees, the head and thorax are dark brown and covered with short, dense "hair." Two pairs of colorless, interlocking wings attach to the thorax. The abdomen is usually yellowish orange with dark brown to black banding. Legs are dark brown to black. The lower hind legs are flattened

and bristly and are adapted for carrying balls of collected pollen. The worker's non-functional reproductive system is modified into its stinging apparatus. The stinger is barbed and cannot be removed by the bee from human skin; when the struggling bee tries to escape its victim, the stinging apparatus is torn from the end of the bee's body, killing it but also releasing odors that incite other bees to sting. Adult workers perform almost all essential tasks for the colony. Beginning inside the colony, new workers care for brood, evaporate water from nectar, circulate air around the combs, clean and guard the colony entrance. Older workers forage for nectar, pollen and water, often traveling several miles per collecting trip. Adult workers use elaborate communication methods to recruit other workers to newly discovered food sources. Adult workers may live about six weeks during peak nectar flows or for several months when clustered around the queen during the winter.

Queens are similar in shape, color and patterning to adult worker, only queen bees are slightly larger with longer abdomens. Generally, only beekeepers and researchers see the queens. Queens usually remain deep inside the colony and are totally surrounded and protected by worker bees.

Drones are similar in shape, color and patterning to adult worker but slightly larger with head nearly covered by enlarged, compound eyes.

Habitat and Hosts: All honey bees require sources of food, water and shelter. Honey bees forage for nectar and pollen in blooming flowers, but also will frequent honeydew deposits left on foliage by aphids and other plant feeding insects as well as sugary drinks and food scraps in garbage containers. Bee colonies managed by beekeepers usually are maintained in wooden box-like hives, while feral (wild) EHB and AHB colonies can be found in a variety of habitats ranging from junk or tire piles, hollow trees, mine shafts, rock shelters, abandoned buildings and automobiles, irrigation or utility boxes, wall, ceiling or floor voids in buildings and even among the sheltering limbs of live trees, shrubs and cacti. Worker bees produce wax that is molded into the characteristic 6-sided cells that comprise both sides of a bee comb. Combs are plate-like initially but may be greatly elongated in mature colonies. They are suspended vertically from a structural support; there is enough space between combs to permit egg-laying by the queen and cell servicing by worker bees. Brood is produced in part of the combs during the growing season but ceases during winter. Nectar, honey and pollen are stored in many of the remaining comb cells. Water is required for bee survival as well as to regulate colony temperature, especially in enclosed colonies. European honey bees, the more docile of the two, have been bred and selected by beekeepers for thousands of years for docility, honey production, colony maintenance characteristics and over-wintering success whereas Africanized honey bees have been selected by harsh environmental conditions for adaptability and mobility and by various predators for ferocity.

The earliest European settlers imported numerous strains of EHBs into the U.S. along with their crops, livestock and landscape plants. AHBs were imported into Brazil from southern Africa in 1956 to breed a bee better suited to the tropics. Shortly thereafter, the AHBs escaped their experimental apiary and began dispersing

through South and Central America. They entered Mexico in the early 1980s and south Texas in October, 1990. AHBs were discovered in New Mexico in 1993. Since then, they have been confirmed in at least half of the state's counties and are very likely to occur statewide. Best known for their unpredictable, potentially life threatening behavior, they also swarm frequently and year 'round.

Damage: Both European and Africanized honey bees can be threatening and dangerous stinging pests around homes, businesses and recreational areas, particularly when their swarms or colonies have not been detected previously. While stinging victims may disagree, AHBs are considered highly defensive rather than aggressive. Flying individual bees are easily overlooked and bee warning behavior is easily overlooked by naïve people. Venom chemistry for both bees is similar; AHBs produce slightly less venom/bee than EHBs, but AHBs are credited with recruiting more workers into a defensive response and also chasing their antagonists farther (perhaps half a mile vs. a hundred feet) than EHBs.

Bee stings cause localized pain, swelling and itching in most people, but they can cause severe and life threatening responses in sensitive individuals, a condition called anaphylaxis. Individual responses to bee stings can intensify over time as well. As little as one bee sting can cause death in some highly sensitive people. Hypersensitive responses to bee venom include: drop in blood pressure, dizziness, itchy palms and soles of the feet, blotchy skin ("hives"), unconsciousness, muscle tension, airway restrictions and death. Anyone experiencing any of these symptoms after being stung by bees should receive emergency medical care immediately. In other cases, the sheer numbers of stings sustained by a victim result in venom toxicity, overwhelming body defenses, causing organ failure and even death.

Example of a small swarm of honey bees on a pecan tree limb. Photo: G. Keith Douce, University of Georgia, www.forestryimages.org

Bee colonies established in or near high traffic areas pose the greatest threat to human health and safety. This includes residences as well as commercial structures and recreational areas. Those who grow or manage turf, nursery stock or recreational areas for any purpose are at immediate risk of disturbing these colonies and being stung. Maintenance and utility workers risk severe stinging from bee colonies established in water meter or utility control boxes, storage tanks, utility buildings, and equipment yards. Tree pruning crews and utility linemen can be at increased risk for serious injuries from

stinging bees when they are working from elevated platforms (“cherry pickers”).

AHBs are especially well known for their ability to quickly relocate and reestablish their colonies, requiring constant vigilance around homes, businesses and recreational areas. Visitors and passersby also may be stung, presenting a potential legal liability situation for property owners and managers. In addition, pets, livestock and wild animals may be stung and, if confined or restrained, killed by an overwhelming numbers of bee stings.

Africanized honey bee queen surrounded by her workers, *Apis mellifera scutellata.* Photo: Scott Bauer, USDA Agricultural Research Service, www.forestryimages.org

Neither type of bee should be allowed to establish a colony in the walls of an occupied building. People can be stung by bees entering or leaving the colony. While some believe that plugging a colony entrance will control the situation or kill the invasive colony, the bees soon use their chewing jaws to remove the plug or open a new entrance/exit; sometimes these new entrance/exits are in occupied rooms, creating new problems as well as stinging situations and risks. Steadily accumulating wax combs, brood, and food stores also present risks for proper functioning and maintenance of electrical and electronic devices. While the heat produced by a successful colony in a wall may be difficult to feel, the sound produced by thousands of active worker bees may be difficult to ignore. Such an established colony represents a major health, safety and liability risk to homeowners, business occupants, employees, customers and visitors to recreational or commercial facilities.

IPM Notes: Honey bees, especially AHBs, will be the most dangerous insect pests encountered by pest control operators. Underestimation of colony size and damage potential can be fatal not only to those attempting to control these insects but also result in law suits for personal injury and property loss. While exposed swarms may be easier to access with insecticidal treatments, there still is a potential for the insects to sting and seriously injure the unwary. CONTROL SHOULD BE ATTEMPTED ONLY BY PEST MANAGEMENT PROFESSIONALS WITH ADEQUATE TRAINING AND APPLICATION TOOLS, A FULL BEE SUIT, AND APPROPRIATELY LABELED INSECTICIDES. THE AVERAGE INDIVIDUAL SHOULD NEVER ATTEMPT TO CONTROL HONEY BEE SWARMS OR ESTABLISHED COLONIES especially with an aerosol spray formulated for wasps; in most cases, the active ingredients in these sprays antagonize bees and can incite attack.
In general, respect ALL honey bees; never antagonize them. Foraging honey bees are generally harmless since they are focused on gathering nectar and pollen; do not impede their movement. Exercise extreme care in any situation

where honey bees seem particularly numerous or noisy. Avoid swarms and do not approach colonies too closely, especially around the entry/exit. If you feel threatened by honey bees or sustain one or more "warning stings" RUN AS QUICKLY AS YOU CAN TO SAFETY. If possible, pull up the collar of your jacket or shirt to shield your neck as you run. A building or house with windows and doors that can be closed securely behind you is a good choice. For outdoor workers with a vehicle, keep it reasonably close to the work site with windows rolled up but the doors unlocked; keep an extra set of keys hidden in the vehicle so that if you are attacked by bees and seek protection in your vehicle, you can drive away safely and without delay. Never jump into water to avoid a bee attack; the bees will be waiting to sting as soon as you surface to breathe.

If you are stung, particularly multiple times, emergency medical treatment is preventative and advisable. Adverse reactions to bee venom can occur suddenly and intensely. If you experience symptoms of allergic reaction, have a companion or co-worker take you to emergency medical treatment. If you know you are highly allergic to bee venom, discuss a "bee sting kit" available by prescription only with your physician and keep it handy when you are outdoors. The sting kit may give you a little extra time to seek emergency medical treatment.

Be aware that fire fighters, paramedics and law enforcement officers may not respond or respond efficiently to emergency calls involving bee sting incidents for various reasons. They may be resigned to securing the area and keeping onlookers out of the way. When bees are already excited in a stinging incident and are flying and stinging wildly, even the best pest control operator with the best equipment and insecticides may have poor control results at the outset; persistence can be key. Also, when the sun sets, this may help settle down disturbed bees. Keep onlookers away and safely inside buildings or vehicles in these situations.

Pest control operators should expect to deal with two very different honey bee problems when clients call: swarms and established colonies. The risks of personal injury and property damage are different for each, as well as the approaches to control.

Swarms can be very intimidating to those unfamiliar with honey bee behavior. They may appear suddenly, settle temporarily in a prominent place on the property and buzz loudly. Sheer numbers of "nervous acting" insects can be seen as aggressive although swarming bees are rarely so if they are not molested. Swarms probably will be most numerous and active on sunny, warm, calm days, especially following a rain. In flight, bees in a swarm move in a swirling, dynamic, noisy mass of golden insects usually flying at tree top or house top level. When bees in the swarm tire, the queen settles on a branch, fence post, sign, eaves of a home or other solid perch and all of the workers settle on top of her in a protective ball. When skies are cloudy or temperatures too low, swarms remain temporarily inactive. Homeowners, especially, may request physical removal of a bee swarm rather than killing it. While some beekeepers may have provided bee removal services in the past, no one may want to do this now because of liability problems and

because captured swarms may be Africanized or parasitized by mites. While novices can sometimes successfully treat and eliminate a pest swarm of honey bees without special training or protective gear, the practice is potentially life threatening and is not encouraged. Professional pest control operators can easily take care of problem bee swarms with high volume, low pressure sprays of soapy water or labeled insecticides if the swarms are safely accessible. Be especially aware of live electrical lines, utility boxes and similar potentially life threatening situations in the vicinity of the swarm, having them shut off or disconnected prior to beginning pest control work. Since the queen bee typically is in the middle of many layers of physically protective but fairly calm worker bees, the applicator (wearing a protective bee suit) can approach the swarm slowly and saturate the mass of bees with a persistent spray mist. After several minutes, the outer layers of bees will begin to fall off the swarm, their fuzzy bodies saturated with the liquid. Misting the inner layers of the swarm continues until all of the bees are on the ground. When the last of the fallen bees has stopped spinning on its back, the dead bees should be gathered into a trash bag and disposed of where the insects cannot be contacted by curious people or animals. Follow label directions carefully on these pest control products to prevent phytotoxicity if the swarm has landed on or above live plants.

Established colonies should be approached and treated quite differently. Frequently, colonies are well hidden; openings to the colony may not be obvious and foraging bees leaving or returning to the colony may not be easily noticed. Control may take more than one application of labeled insecticide and require more than a day to verify that a colony is dead. Honey bees will vigorously defend established colonies, that is, those with brood and food stores. The transition time from swarm to established colony may take only a day or two; assume that a colony is established, especially if large numbers of honey bees are not readily visible or if a client states that the bees have been on the premises for any period of time. Treatment of established colonies should only be attempted by professional pest control operators wearing protective gear and using appropriately labeled insecticides. The defense mounted by AHBs may be especially intense with several to many thousands of angry bees responding to the slightest perceived threat. Insecticidal control of a colony in a building's walls can be difficult since the combs and brood can be protected by intervening bee combs, insulation and utility lines. Prior to beginning a control project on an established colony, the pest control operator should "suit up" and study the area where the bee colony may be located. In addition to live utility lines and other hazards, the pest control operator should identify actual or potential entry/exit points for the bees; treatments aimed at one of these points invariably results in angry bees pouring out of other exit points, with potentially disastrous results for any person or animal in the vicinity. Before attempting to treat the colony, make sure the clients, their pets and livestock are in safe, bee-tight locations; in high density housing areas, extend these advisories and precautions to the neighbors as well. Do not attempt to control established bee colonies with soapy water; this treatment can be very damaging to structures as well as hazardous around electrical wiring and equipment. Most pest control operators experienced in bee control opt to use

power applicators and dust formulations of certain pyrethroids that can be blown into wall voids and similar areas. Once the treatment has been planned, the pest control operator should complete it quickly and thoroughly, securing the treated colony before leaving the premises. Retreat the colony area as needed over the next few hours or days, as needed, until it appears the bees are dead and no longer a threat.

Advise clients that they should immediately remove the remains of the bee colony or have a remodeling service remove them. Once a bee colony has been killed in a residence, business or other occupied facility, the comb and bee bodies should be removed as soon as possible to prevent establishment of new colonies of bees, ants, wasps, flies, rodents and other pests. Following any pesticidal treatment of a bee colony, the honey will NOT be safe to extract and consume. Any honey left behind may ferment as well as leak from the melting comb, saturating carpets, flooring, wall boards and trim. Elimination of wax comb will prevent annoying infestations of wax moth as well as the stench of rotting larvae and decomposing bees. Dead bee colonies can harbor large numbers of dermestid beetles, their larvae and other scavengers.

Honey bee colony and four wax combs on a tree limb. The combs are about one foot across and 1.5 feet deep. Photo: Timothy Haley, USDA Forest Service, www.forestryimages.org


Honey bee colony established under the eaves of a shed. Photo: Timothy Haley, USDA Forest Service, www.forestryimages.org

Example of a one-piece bee suit used in a bee removal call. Photo: Timothy Haley, USDA Forest Service, www.forestryimages.org

March Flies

O & T Guide [T-#06]

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Cooperative Extension Service • College of Agriculture and Home Economics • October 2006

March flies are occasional pests of turf, particularly in home lawns with considerable thatch buildup. Adult flies are persistent, annoying but otherwise harmless pests flying slowly above turf in large numbers on calm, sunny afternoons in early spring. Larvae burrow through and feed in thatch, often in large numbers.

M**etamorphosis:** Complete
Mouth Parts: chewing in larvae
Pest Stages: larvae, adults (minor)

Scientifically: March flies are members of the insect order Diptera and the family Bibionidae.

Typical Life Cycle: Eggs are laid in small clutches in the soil-thatch interface; these are rarely seen. → Series of Larvae. These often occur in considerable numbers in late winter-early spring in patches of decaying organic matter and thick thatch. → Pupae are interspersed in the soil-thatch layer in late spring. → Adults are two-winged flies with generally black bodies and appendages and a short, broad proboscis. Some have smoky wings. Most known species have one generation annually although some may have two or possibly more.

Description of Life Stages:

Egg---minute, round, white

Larva---larvae are thin, cylindrical, rough-skinned, legless and off-white. Their rounded head capsules are dark gray to black and bear chewing jaws. Mature larvae are about one inch long.

Pupa---lozenge-shaped, brown to black, smooth, about 3/8 inch long.

Adults---Adults are slightly smaller and thinner than house flies. Most are black or dark-colored. The colorless wings (only one pair) usually have a dark spot near the end of the leading edges.

March fly larvae in turf. Photo: Whitney Cranshaw, Colorado State Univ., www.forestryimages.org

Habitat and Hosts: Adults are commonly seen in spring and early summer flying slowly and in large numbers over turf with thick thatch layers. Some adults have just emerged while others are finding mates in these swarms

and females are ovipositing. Mature larvae are usually discovered by raking spongy areas of infested turf in early spring.

Damage: Adults can be numerous and annoying but are otherwise harmless. Larvae are actually removing or tunneling through thatch that can be so thick as to stifle movement of air, water and nutrients to turf roots. Many homeowners are alarmed by their numbers and appearance. Larvae also can be found in old corrals or other areas where thick layers of animal manure are decomposing.

IPM Notes: Swarms of March flies over turf signal larval presence as well as thatch buildup. Mechanical removal of thatch when turf is still dormant will eliminate the habitat for March fly larvae and adults as well as improve turf aeration and the percolation of water and fertilizer. The larvae are actually penetrating and reducing thatch in the lawn rather than damaging the turf. Although they may appear objectionable to many people, the larvae are harmless to people, pets, livestock and wildlife. Presently, no insecticides for turf list March flies on their labels.

Closeup of a March fly larva, *Bibio* sp. Photo: Whitney Cranshaw, Colorado State Univ., www.forestryimages.org


Hand holding mature March fly larvae. Photo: C.F. Valdez and A.Reyes, Los Alamos Coop. Ext. Service.

Rove Beetles

O & T Guide [T-#07]

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Rove beetles are slender, highly active, black beetles that are occasional burrowing pests of highly manicured golf greens.

Metamorphosis: Complete
Mouth Parts: Chewing (larvae, adults).
Pest Stage: Adult, possibly larvae.

Scientifically: Rove beetles are members of the insect order Coleoptera, Family Staphylinidae.

Typical Life Cycle: Eggs are laid in small clutches near potential food sources (other insects) for the larvae→ Series of Larvae. Larvae of most species will be highly active, searching for food in sheltered, slightly moist habitats below ground or in soil litter. Some rove beetle species are known to be predatory on small insects; other species may be plant feeders since some are known to feed on fungi, algae or plant mulches. → The Pupa stage is found in soil litter or in moist soils near larval food sources. → The Adult is highly active and free-living; many species are active primarily at night. Many species are poorly known biologically.

Description of Life Stages:

Egg---minute, white, nearly spherical to elongate; rarely seen.

Larvae---elongate, cylindrical but slightly flattened, off-white with brownish head capsule and three pairs of prominent, slender thoracic legs. Mature larvae of the largest species are probably less than 5/8 inch long. Most species have two slender projections on the tip of the abdomen; each projection is about the length of two abdominal segments or slightly longer.

Example of a rove beetle adult, Family Staphylinidae. Note the extremely short wing covers and exposed abdominal segments. Two short projections are visible on the end of the abdomen. Photo: Joseph Berger, , www.forestryimages.org

Pupa---bare, off-white to yellowish-tan at maturity. Pupae of the largest species are probably ½ inch long or less. The general appearance of the pupa is like a mummy of the adult it will become with abdomen obviously segmented, three pairs of slender, elongated legs, and a well developed head capsule with compound eyes, chewing jaws and antennae visible and tightly pressed to the head. Forewings are short but wrapped closely around thorax. The pupa is generally immobile.

Adult---Most species are slender and dull black or very dark brown, generally resembling earwigs but without the caudal pincers. The forewings are very short, leaving most of the abdominal segments exposed. Antennae thread-like and extended forward; jaws projected forward and visible from above. A pair of stubby projections may be visible on either side of the end of the abdomen. Some species flex the abdomen upward as they run.

Habitat and Hosts: Rove beetles are agile and highly active predators and scavengers. The nocturnal adults and larvae are active during warm weather. They may overwinter as larvae, pupae, or adults.

Damage: Some species of rove beetles eat mites, beetle larvae, aphids, and small caterpillars both as adults and larvae. Other species are readily attracted to dead animals and dead insects, where they probably scavenge on these tissues and other insects feeding there. While larval feeding habits of many rove beetle species are unknown, members of at least one subfamily are known to feed on fungi, algae and plant-based mulches; at least in the laboratory, many species, including predators, will feed to some extent on fruit slices. Cultural practices associated with turf maintenance on golf courses probably create habitat and perhaps odors attractive to ovipositing rove beetles. Once on site, the nocturnal beetles tunnel in the extremely short turf on golf tees. Adults and possibly larvae burrow, making small holes and mounds of soil on the golf turf, creating poor putting surfaces.

IPM Notes: Over 1500 species of rove beetles are scattered throughout North America. While many are under-appreciated predators of pest insects or scavengers around dead animals or dead insects, others may be omnivorous or even plant feeders to some extent.

Unfortunately, some species of rove beetles have achieved occasional nuisance status on New Mexico golf courses for their burrowing habits on extremely short and highly manicured turf. Rove beetles are not considered pests on home lawn turf or most recreational and ornamental turf.

No insecticides are labeled specifically for rove beetle control in turf, leaving golf turf managers to make spot treatments, as needed, with currently registered, labeled insecticides having activity against various beetle pests on turf.

Scarab Beetles and White Grubs

O & T Guide [T-#08]

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Probably the most common and most damaging pests of turfgrass in New Mexico are the white grubs, i.e., the larvae of scarab beetles. A number of scarab species are involved, varying widely in size, color and biological details. All turf species grown here, including the fine specialty turf on golf courses can be seriously damaged by these root-feeding larvae.

Example of a typical white grub or larva of a scarab beetle. Photo: University of Georgia Archives, The University of Georgia, www.forestryimages.org

M**etamorphosis:** Complete
Mouth Parts: Chewing (larva and adult)
Damaging Stage: larva on turf; adults of some species may be foliage-feeding pests of plants other than turf.

Typical Life Cycle: Egg in soil → Series of 3 Larval instars feeding in root zone→Pupa underground→Adult; above ground, free-flying, some species feed as adults but others do not.

Ataenius has two generations annually, overwintering as adults seeking shelter around perennial shrubs and trees. Known from nearly all of the continguous 48 states, *Ataenius* species were first noted as turf pests in the early 1930s but emerged as increasingly important pests of golf courses in the East, Midwest and adjacent Canadian provinces in the 1970s. Annual bluegrass, Kentucky bluegrass and bentgrasses are favored hosts. Insecticide resistance has been documented in the East. Mature larvae are about the size of rice grains; large populations make turf wilt but can also cut all the roots in patches of turf such that it can be rolled up. The tiny (about 1/8 inch), black adults are active at night.

Mature larvae of the black turfgrass *Ataenius* (compare size to that of the penny). Photo: Whitney Cranshaw, Colorado State University, www.forestryimages.org

Aphodius overwinters as adults but may have more than two generations annually in our lower elevations. Adults of many species are dung feeders; larvae feed on dung, organic matter and live roots. Attacking the same grasses as *Ataenius*, *Aphodius* also is found in warm season grasses grown at lower elevations, particularly those fertilized with manure or compost. Mature larvae are about the size of rice grains and are easily confused with *Ataenius* larvae (*Ataenius* larvae have a pair of distinct pad-like structures on the tip of the abdomen just in front of the anal slit). Adults are dark brown to black and about 1/8 inch long. *Aphodius* adults have two "notches" in the tibia of the hind leg whereas *Ataenius* adults have none, features that require higher magnification. While over 100 species of *Aphodius* have been described from North America north of Mexico, the dominant pest species (in New Mexico and elsewhere) is *A. granarius*, accidentally introduced from Europe.

Adult *Aphodius omisus omisus* in Kentucky bluegrass (compare size to that of the dime). Photo: Whitney Cranshaw, Colorado State University, www.forestryimages.org

Our May and June beetles, *Phyllophaga* spp., fly at night between May and July. After mating, the light brown females burrow 1 to 4 inches into the soil to lay small clutches of 6-10 eggs that hatch in two to four weeks. Females may lay 50-60 eggs total in their adult lifetimes of about three weeks.

May or June beetle larvae, *Phyllophaga* sp. Photo: Clemson University - USDA Cooperative Extension Slide Series, , www.forestryimages.org

Example of a May or June beetle, *Phyllophaga* sp. Photo: Steven Katovich, USDA Forest Service, www.forestryimages.org

Newly hatched larvae feed voraciously on grass roots, often reaching third instar and nearly half of their mature weights before winter. In the fall, larvae of some species burrow several inches to a foot or more into the soil to hibernate; others may remain relatively close to the surface, feeding as temperatures permit. In early spring, all larvae return to the surface and resume feeding on grass roots. For species with annual life cycles, feeding is completed by spring. After pressing a small hollow into the soil, they pupate inside for about a month, resting briefly as young adults in their soil chambers before digging their way to the surface. Rainfall or irrigation stimulate adult emergence and

flight. Adults fly at night and are easily attracted to lights. Adults may feed on new foliage of some trees and shrubs, but do little damage. At least some *Phyllophaga* spp. in New Mexico may require more than one year to complete development as they do in many parts of the U.S.; overwintering initially as larvae, the last winter may be spent as a quiescent young adult below ground.

Masked chafers have annual life cycles, emerging as adults in late summer, hatching shortly thereafter and feeding heavily in early fall and spring. Their larvae also may dig deeper into the soil, becoming quiescent over the winter. Generally darker brown and very shiny, adults fly at night, are easily attracted to lights, but do not feed as adults.

Adult Japanese beetle, *Popilia japonica*, an invasive species known from a very limited distribution in New Mexico. The adult is about as long as your little fingernail. Photo: David Cappaert, , www.forestryimages.org

Japanese beetles (JBs) and the larger Green June beetles are active during the day during mid summer. Male Japanese beetles and apparently some other scarab species find mates by tracking pheromones released by virgin females. Female Japanese beetles and Green June beetles are readily attracted to strong floral or fruity odors. Both behaviors have proven useful in survey trapping programs for JB in New Mexico and elsewhere. Adult Green June beetles are nearly one inch long with dull brassy wing covers; the rest of the body is metallic dark green.

Larva of the green June beetle, *Cotinus* sp., a native to New Mexico. Photo: University of Georgia Archives, The University of Georgia, www.forestryimages.org

Adult of the eastern species of green June beetle, *Cotinus nitida*. Photo: Clemson University - USDA Cooperative Extension Slide Series, , www.forestryimages.org

While Green June beetles are native insects, JBs obviously are not; JBs are currently established in small, isolated areas of north-central New Mexico where they are considered not only threats to turf and ornamentals but also regulatory pests requiring eradication efforts and close monitoring. JBs also have dull brassy wing covers with the rest of the body deep metallic green; however, JBs are only 3/8 inch long and have six pairs of white bristle patches around the edges of the wing covers. While Green June beetles are minor pests of turf, JBs can become primary turf pests as they have in other infested parts of the U.S. Adults of both

species will damage thin-skinned ripe fruit but JBs are also highly destructive to the flowers and foliage of over 300 species of landscape, garden and crop plants.

Adult lined June beetles, *Polyphylla* sp.
Photo: Gerald J. Lenhard, ,
www.forestryimages.org

Lined June beetles, *Polyphylla* spp., can be nearly an inch long and are more elongated than any of the common May or June beetles; longitudinal stripes of off-white and light brown distinguish these insects as well as large antennal clubs, making these structures look elbowed. Larvae are considered as minor pests of turf; however, they will feed not only on grass roots, but also roots of conifers, garden fruits, vegetables and some crop plants. Adults of at least one species are known to feed on conifer needles. Some species are known to have at least 3-year life cycles.

Description of Life Stages:

Egg---minute to the size of seed beads, round, pearly white, laid in small clutches, usually of 6-10 eggs in the soil around shallow roots of host grasses; rarely seen.

Larva---characteristically plump, white, segmented, C-shaped, with 3 pairs of well-developed thoracic legs, well developed brown head capsule with chewing jaws; larger larvae often have longer, stiff bristles, especially along their backs. Spiracle plates visible on larger specimens on the sides of the abdomen. Different groups of larvae can be distinguished by patterns of setae or bristles on the rear of the abdomen (called the raster).

Pupa---Off white initially but adopting the darker colors of the future adult at maturity. Developing wings wrap loosely around the thorax and abdomen; all of the legs are rigid and flexed below the thorax. Developing antennae, and mouth parts well defined but immobile. Compound eyes visible. Pupa typically found in a small cell pressed into the soil near host plant roots.

Adults---Robust, oval or slightly elongated, with prominent wing covers and relatively hard bodies. Lower parts of the forelegs are often broad and flat with the outer edges toothed or scalloped. Antennae short, ending in 3-7 segments that can be spread apart or united to form a compact terminal club. Colors and sizes vary with species as described above.

Habitat and Hosts: The eggs, larvae and pupae of all of the scarab pests of turf are found in the soil around the roots of their grass hosts. *Ataenius* has become a severely damaging and often difficult to control pest of golf turf in the Midwest and East; some populations are known to have some insecticide resistance. *Aphodius* seems most numerous on turf fertilized with animal manures. Green June beetle larvae can be found in these situations also, as well as under compost piles or wherever rotting plant matter accumulates

undisturbed. Neither Green June beetles nor lined June beetles, *Polyphylla* spp., are considered major pests of turf. The May and June beetles plus the masked chafers are extremely common and widespread turf pests throughout New Mexico; unless controlled, they often destroy turf stands, requiring reseeding, overseeding or resodding. Japanese beetles are invasive exotic pests of turf and 300+ other species of landscape and garden plants. Established in isolated parts of north central New Mexico since 1997, they are targets for eradication as well as causes for "insurance treatments" of commercial nursery stock and turf produced in infested counties.

Damage: White grubs root-prune their hosts, weakening and potentially killing plants. Affected turf may appear thinner, weaker or even wilted. Dull green, yellowing or brown patches also may appear in turf; white grubs can usually be found within an inch or two of the surface near the edges of these patches. In extreme situations, large populations of white grubs may make affected turf feel spongy to the feet or make it possible to pull up or even roll up sections of rootless turf. While exit and entry holes made by ovipositing female beetles or emerging adults can be objectionable, more serious turf damage can occur when birds, skunks, raccoons or other animals dig through turf to feed on white grubs near the surface.
IPM Notes: Failure to control white grubs in turf generally results in ever-growing dead patches that eventually coalesce, requiring reseeding, overseeding or resodding. Some turf managers replace patches of damaged turf while others opt to treat affected areas or entire turf plantings with insecticides. A variety of active ingredients and several formulations are labeled for white grub control in turf. Strict adherence to label directions is required for the best results; time of year for application and application techniques are critical for these materials. A least one active ingredient is reported to remain effective against white grubs for several months.

While a biological insecticide containing the bacterium *Bacillus popilliae* is appealing to homeowners, the product performs poorly in the hot, dry, alkaline soils of New Mexico. Studies conducted in other states suggest that, although it may infect a variety of white grub species, the pathogen is widely distributed and has minimal effects on their survival. Even Japanese beetle, the insect from which the specific name *popilliae* is derived, seems to be becoming resistant to this once effective remedy in other parts of the U.S.

Some naturally occurring predatory nematodes have been associated with Green June beetle in New Mexico, particularly with those collected around compost piles. Treatment of white grubs in lawns with commercially available predatory nematodes is generally not economical or feasible, especially for large areas.

Scoliid and tiphiid wasps are fairly common larval parasites wherever populations of white grubs are relatively high. These non-aggressive, sometimes brightly colored wasps fly slowly back and forth over affected turf, getting peoples' attention. Scoliid wasps in particular, may kill more white grubs than they parasitize. However, neither of these wasps is likely to provide acceptable control for a white grub infestation.

Soil-dwelling larvae of various bee flies and robber flies attack the pupae of some

white grubs but probably do little to control a pest population. A variety of insect-eating birds and small mammals will dig through turf to find grubs and pupae. These animals provide better indications of how bad the white grub infestation is rather than effective control.

Sod Webworms

O & T Guide [T-#09]

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The caterpillar stages of these particular snout moths bore into the stems, crowns or roots of grasses. Most larvae feed near the bases of the plants where they construct silk webs.

M**etamorphosis:** Complete
Mouth Parts: chewing (larvae)
Pest Stage: Larvae

Typical Life Cycle: Eggs are laid in small clutches in the soil around shallow roots of host grasses; rarely seen. → As the Larvae mature, they construct tunnels or burrows through the thatch, sometimes extending into the soil. First generation larvae hatch in late spring, feed without interruption and pupate by mid-summer. Second generation larvae are produced in late summer. These soon hatch, feeding on turf in late fall but pausing to overwinter. They resume feeding as temperatures permit or by early spring. → Pupae are interspersed in the soil/thatch layer. → When disturbed in their usual grassy habitats, Adults commonly make short, jerky, flights from place to place. Adults are short-lived and die soon after mating and laying eggs. Two generations usually occur annually. Several species occur in New Mexico.

Description of Life Stages:

Egg---minute, round, and white.

Larva--- Larvae vary in color from greenish to tan, brown, or gray, depending on the species. Larvae are cylindrical with three pairs of short, segmented thoracic legs and five pairs of stubby, abdominal prolegs. When mature, they are ¾ inch long, and most have characteristic dark, circular spots scattered over their body length.

Pupa---lozenge shaped, about 3/8 inch long, and dark brown to black.

Adult sod webworm, *Crambus* sp. Photo: David Cappaert, , www.forestryimages.org

Adults---The moths are usually whitish or tan and about 5/8 inch long. At rest, they hold their narrow forewings close to the body. Although adults in the family are called "snout moths," the snout is actually a pair of long, curled palps associated with the mouth parts. These are easily visible when the moth is viewed from the side.

Habitat and Hosts: Sod webworms feed almost exclusively on members of the grass family, especially permanent sod.

Their primary host plants are Kentucky bluegrass, fine fescue, perennial ryegrass and bentgrass. Apparently, most warm season turf species are uncommon hosts for sod webworms. In addition to lawns and other turfgrasses, many webworms feed on small graints, corn, timothy, pasture grasses and meadow grasses. Some undoubtedly feed on New Mexico range grasses.

Damage: Damage first appears as small, brown areas in the grass. The turf often has a ragged appearance. Feeding and consequent damage occurs only at night, when the larvae feed on grass blades. If feeding is extensive during dry weather, the plants may be killed.

IPM Notes: Biological controls include the nematode *Steinernema carpocapsae*, which attacks sod webworms. A slow-working, but effective fungus that also attacks webworms is *Beauvaria bassiana;* while available as a commercial formulation, this product has not been extensively tested in arid New Mexico conditions. *Bacillus thuringiensis* (Bt) can also be effective in some situations, particularly while the caterpillars are small. Pyrethrum or rotenone, both botanical poisons, paralyze webworms on contact. Insecticidal soaps may help to control sod webworms. Several insecticides are currently registered in New Mexico for this pest.

Cultural controls include reducing the habitat for sod webworms by reducing thatch to ¾ inch or less, and by planting perennial resistant ryegrasses and fescues when they are commercially available. Maintaining adequate nutrient and moisture levels also helps.

Wasps and Bees

O & T Guide [T-#10]

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Members of several families of bees and wasps dig in or near turf, making holes or forming mounds. Some are beneficial, some have intimidating behavior, but others can sting repeatedly or in large numbers. Cicada killers and ground nesting bees are solitary although sometimes gregarious or communal in nesting. Yellowjackets and bumble bees are social insects, supporting large, annual colonies. Tiphiid and scoliid wasps search turf for white grubs (larvae of scarab beetles) that they parasitize. Adults of most species can be active from June until killing frosts. (See a separate fact sheet on honey bees.)

M**etamorphosis:** Complete
Mouth Parts: Chewing (larvae, adults)
Pest Stage: Adults

Typical Life Cycle: Egg → Series of Larvae→Pupa→Adult. **Pest Stage**: Adult.

Cicada killers, scoliids and tiphiids produce one generation per year while ground nesting bees have several. Yellowjackets and bumble bees produce numerous generations annually, but their colonies die in the fall, except for a few mated females that survive until spring.

Description of Life Stages:

Egg---minute, rounded to hot-dog shaped, laid singly on food source supplied by the female for most of the above species.

Yellow jackets lay their eggs singly in the cells of tough, papery underground combs created by the workers. Bumble bee queens lay their eggs singly in grape-sized wax and pollen "pots" in their usually underground nest areas. Eggs of any of these insects are rarely seen by most people.

Larva---soft-bodied, white, usually with poorly developed head capsule, segmented. Restricted to nests as described above; rarely seen. Mature larvae of most are less than ½ inch long; cicada killer larvae may reach ¾ inch.

Pupa---quiescent, white initially, then adopting adult coloration at maturity. Restricted to nests; rarely seen. Lengths at maturity similar to those of corresponding larvae.

Adults---size and appearance varies widely on these various insects.

Cicada killer wasp, *Sphecius speciosa*, carrying a cicada. Photo: Ronald F. Billings, Texas Forest Service, www.forestryimages.org

Common bees and wasps encountered on or near turf include:

Cicada killer wasps are about 1 ½ inches long with sleek, well defined body regions and pointed abdomens; females have well-developed stingers. Most are black or rusty with yellow bands on the abdomen.

Adult Scoliid wasp covered in pigweed pollen. Photo: Theodore Webster, USDA Agricultural Research Service, www.forestryimages.org

Tiphiid wasps may be all black or superficially resemble yellowjackets. Scoliid adults may be somewhat hairy and black with one or more yellow bands on the abdomen. Most tiphiids and scoliids will be less than ¾ inch long.

Example of a digger bee, *Xenoglossa* sp. in a squash blossom. Photo: Whitney Cranshaw, Colorado State University, www.forestryimages.org

Digger bees are robust, hairy, golden brown or grayish-brown bees, usually ½ inch long or less as adults.

Adult bumble bee, *Bombus* sp. Photo: Kristina Simms, , www.forestryimages.org

Bumble bees can usually be recognized by their black-and-yellow banded coloration (especially on the abdomen), fuzzy bodies and robust size, from 5/8 to nearly one inch long.

Adult Western yellow jacket, *Vespula pensylvanica*. Photo: Whitney Cranshaw, Colorado State University, www.forestryimages.org

Yellowjackets are distinctively colored yellow and black wasps about ½ to 5/8 inch long. At rest, their grayish wings fold

longitudinally into narrow straps held at angles to the body. All adults have well defined body regions, fuzzy heads and pointed abdomens ending in stingers. Like many other wasps, yellowjackets can sting repeatedly and do not die as a consequence.

Habitat and Hosts: Several of these insects are predators or parasites of other insects. After mating, the female cicada killer hunts for an adult cicada, stings and paralyzes it, and then air-lifts it back to her previously dug nest hole. After dragging the cicada into a small cell at the bottom of the nest, the female lays one egg on it and then walls off the cell, leaving its offspring to complete its development. Each nest hole may accommodate one to several developing offspring.

Scoliid and tiphiid wasps kill or parasitize white grubs in turf. Sometimes tiphiid adults can be numerous, flying lazily back and forth across turf, a foot or two above the ground. These swarms can include hunting females or males searching for mates; the swarms are otherwise harmless. Both can be found foraging for pollen and nectar on flowers. Scoliid females may kill more white grubs than they parasitize.

Native digger bees are often solitary, but some are gregarious, nesting communally in grainy, well-drained soils or in cut banks. Maturing in individual underground cells at the end of the nest tunnel, digger bee larvae develop independently on balls of pollen and nectar gathered by the female.

Bumble bees are common pollinators often seen gathering nectar and pollen from flowers. Their nests are usually underground and are often in vacant rodent burrows. Nests are initiated in the spring by a previously mated, overwintering queen. Her first brood includes only workers that soon take over all duties of the colony except reproduction. The workers enlarge, maintain and defend the nest, gather food and store it in sac-like “honey pots” that they make from wax and pollen. Larvae are tended and fed on a mixture of pollen and honey. After they pupate and emerge, their empty cocoons are often filled with more stored food. By late summer, males and virgin queens are produced and in the fall, all but the recently mated new queens die.

Yellowjackets similarly establish new colonies each year; queens mated the previous fall lay the initial eggs, often in underground cavities. Over the spring and summer, successive generations of workers construct a papery underground nest composed of a series of horizontal, multi-celled tiers enclosed by spherical papery walls. Adults feed on nectar or other sugary solutions such as honeydew or juice from ripening fruits. They feed developing larvae in the nest with bits of caterpillars or flies that they chew up before taking them back to the nest. In exchange, the larvae produce a sweet solution from their mouths that they feed the workers. Each cell in the nest may be used several times to rear larvae. Males and future queens are produced in the fall; the new queens mate and are the only ones from the old colony to survive the winter.

Damage: Digger bees and cicada killers dig nest holes through turf or in soil near managed turf, leaving holes and small mounds of earth; their behavior can be intimidating and cicada killers, in particular, may sting if annoyed. Tiphiid and scoliid wasps are non-aggressive but their presence on flowers or low altitude

patrolling of turf may be intimidating to some people. Females of both species will dig shallow holes through turf to reach their white grub prey. Bumble bees and yellowjackets create their mostly underground nests in abandoned rodent burrows and similar sites. Openings to these nests can be in tall grass, landscaped areas, around buildings or other structures located in or near turf. They readily defend their colonies and can attack and sting intruders in large numbers. As with honey bees, some people are highly sensitive to the venom of these insects and can suffer the same symptoms of envenomization as well as the health consequences.

IPM Notes: Of the bees and wasps described above, yellow jackets and bumble bees represent the greatest stinging threat to humans and neither can be tolerated in high traffic areas. Appropriately labeled insecticides directed at the nests are most effective. Protective clothing for the applicator is advisable as well as insecticide application after dark when the insects are generally less active.

Spot-treatment of nesting areas or broadcast application of recommended insecticides will usually control most of the other pest bees and wasps that damage turf. Where scoliids and tiphiids are concerned, control white grub populations and the wasps will hunt elsewhere.