W 658

A Quick Reference Guide to Pesticides for Pest Management Professionals Working in and Around Structures 2020

A Quick Reference Guide to Pesticides for Pest Management Professionals Working in and Around Structures

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This publication provides a quick reference to pesticides and methods for the pest management professional to use in solving pest management problems in and around structures. A thorough description of pest identification including images, inspection and detection techniques, exclusion, sanitation, other environmental modifications, and pesticide formulations can be found in the following UT Extension publications (https://ag.tennessee.edu/PSEP/Forms/F818.pdf):

Vail, K.M., G. Burgess, R. Gerhardt and C. Harper [eds.]. 2007. PB 1673 General Pest and Rodent Control Pesticide Applicator Licensing Manual (GRC). pp. 130.

Vail, K., G. Burgess, R. Gerhardt and C. Jones [eds.]. 2002. PB 1685 Public Health Mosquito Control: The Tennessee Mosquito Control Handbook (Pesticide Applicator Licensing Manual). pp. 54.

Vail, K., D. Hensley, G. Burgess, C. Pless and A. Taylor [eds.]. 2014. PB 1703 Wood-Destroying Organisms Licensing Manual. pp. 76.

Vail, K.M., E. Burgess, R. Gerhardt, and Craig Harper. 2006. PB 1732 Industrial, Institutional, Structural and Health Related Pest Management Certification Manual (Category 7). pp. 105.

Vail, K.M., E.E. Burgess, R. Gerhardt, C. Jones, J. Skinner and C. Harper. 2003. PB 1733. Public Health Pest Control (Category 8). pp. 99.

Further references for household pest identification:

Manuals:

Bennett, G.W., J.M. Owens, & R.M. Corrigan. 2011. Scientific Guide to Pest Management Operations, seventh edition Cleveland, OH: Questex Publishing.

Mallis, A. 2011. **Handbook of Pest Control - the Behavior, Life History and Control of Household Pests**. 10th edition. Mallis Handbook LLC.

Field Guides:

Hedges, S. 2010. **Pest Control Technology Field Guide for the Management of Structure-Infesting Ants, 3rd edition.** G.I.E. Inc. Publishers, Richfield, Ohio.

Hedges, S. 1995. **Pest Control Technology Field Guide for the Management of Structure-Infesting Flies.** Franzak and Foster Co., Cleveland, Ohio.

Hedges, S. 2012. **Pest Control Technology Field Guide for the Management of Urban Spiders**. Franzak and Foster Co., Cleveland, Ohio.

Hedges, S. and M. Lacey. **Structure-Infesting Beetles. Volume 1: Hide and Carpet Beetles/Wood-Boring Beetles.** Franzak and Foster Co., Cleveland, Ohio.

Hedges, S. and M. Lacey. **Structure-Infesting Beetles. Volume 2: Stored Product Beetles/Occasional and Overwintering Beetles**. Franzak and Foster Co.

Klotz, J., L. Hansen, R. Pospischil and M. Rust. 2008. **Urban Ants of North America and Europe: Identification, Biology and Management**. Comstock Publishing Associates, Cornell University Press, Ithaca, New York pp. 196

Smith, E and R. Whitman. 2007. **NPMA Field Guide to Structural Pests**. Second edition. http://npmapestworld.org/

General Identification Guides for Insects:

Peterson's Field Guides: Insects of North America # 19, Beetles of North America #29, Moths of Eastern North America #30

APPs:

NPMA Mobile Field Guide App is now available on iOS and Android devices, npmapestworld.org/technical-resources/npma-field-guide-app

The following tables list recommended procedures and, if necessary, pesticides to manage specific pests. Remember to reduce the pest's access to food, water and shelter. If pesticides are needed, they are more likely to provide control if access to these necessities are limited. In addition to the references provided above, more information can be found in the UT Extension publications (SPs, PBs and Ws) listed in the tables. Extension publications can be found by visiting extension.tennessee.edu/publications/Pages/default.aspx and entering the publication number in the search box. Percentages that appear after the trade name indicate percentage of the active ingredient. Where no percentage is given, see the label for more details. SEE THE LABEL FOR ALL DIRECTIONS!

PESTS	DESCRIPTION	CONTROL MATERIALS AND METHODS	REMARKS
ANTS - ARGENTINE ANT, ODOROUS HOUSE ANT PB 1629 W 473	**ARGENTINE ANT** **Bump (Node) on waist:** one, obvious **Gaster tip:** no circular opening **Odor when crushed:** "disagreeable, rotten-coconut-like" with an additional faint musty odor **Color:** light to dark brown **ODOROUS HOUSE ANT** **Nodes on waist:** one, very flat, barely noticeable node hidden by the gaster **Gaster tip:** no circular opening **Odor when crushed:** "disagreeable, rotten-coconut-like" **Color:** brown to black **Both ant workers:** 1/8 inch The odorous house ant is the most common house-invading ant in TN. It nests in shady, moist areas such as under mulch, pine straw, stones, and logs. Moves indoors during periods of heavy rain and moves nests often. Winged male odorous house ants may be found near lights from May through June. The Argentine ant is not as common as the odorous house ant, but can build up larger populations. Behavior is similar for both species.	Perimeter Spray: Termidor SC 0.06% Arilon 0.10% Optigard Flex 0.1% (to perimeter and plants combined with Optigard Ant Gel Bait in outdoor stations) Outdoor Baiting: Advion Insect Granule (perimeter broadcast) Green Way Ant Bait Liquid Intice Thiquid 1% Maxforce Quantum Ant Bait MAXFORCE COMPLETE Brand Granular Insect Bait Maxforce Ant Killer Bait Gel (for Argentine ant) Niban FG, G baits Optigard Ant Gel Bait PT 388B Advance Ant Gel Bait Terro-PCO (1%) Indoor Crack and Crevice Spray and Outdoor Entry Points Phantom	Our best research results for odorous house ants have been a **0.06% fipronil (Termidor SC) spray** to entry points and 1 foot up and 1 foot out from the foundation base **COMBINED** with (1) a liquid or other bait placed in the landscape near/around the structure where ants are active **OR COMBINED** with (2) Phantom applied indoors as crack and crevice in areas of activity as well as at potential entry points. Gel baits may work longer outdoors when placed in stations. Baits listed under odorous house ant and outdoor baiting have eliminated small, laboratory-maintained odorous house ant colonies within 8 weeks of bait placement or have proven effective in field studies. Ants nesting in structures through the winter can be quite challenging to control and to the pest management professionals' reputation. Often the ant centers of activity are difficult to define because small numbers of ants are in many different locations. You bait one area and activity ceases, only to find ants in another area. It's worth exploring the use of placing Quantum or any other liquid/gel bait in indoor stations near ant activity where residents will not see the station or trailing ants. Moisture is fairly limiting this time of year when indoor heat is running longer because of low outdoor temperatures, and liquid/gel bait in a station may serve as moisture source. Ant feeding is limited in the winter and may not increase until late February/ early March.
ANTS - CARPENTER PB 1599	Large, black, red, or red-and-black ants that nest in damp wood. Wingless workers 1/4 to 3/8 inch long with a one-segmented waist, circular opening at the end of the gaster and evenly rounded thorax when viewed from the side. Winged male and female reproductives will fly from a colony. Carpenter ants do not eat wood, but excavate smooth galleries in the wood to raise their young. Piles of coarse sawdust or splintered wood often mixed with insect parts may indicate a carpenter ant nest nearby.	Outdoor perimeter spray Termidor SC Arilon Transport GHP Demand CS Temprid SC Baits: Indoors in cracks and crevices where ants are seen: Advion Ant Bait Arena Advion Ant Gel Maxforce Carpenter Ant Bait Maxforce Fleet Niban FG, G	1. Correct moisture problem, repair leaks and ventilate. 2. If ants entering from or foraging outdoors, spray a slower acting, nonrepellent insecticide around the perimeter with an emphasis on areas where ants are entering the structure. 3. Place baits where ants are actively foraging. If baiting, do not spray ants, trails or baits with a fast-acting, repellent spray because it will kill ants too quickly and will stop them from feeding on the baits.

PESTS	DESCRIPTION	CONTROL MATERIALS AND METHODS	REMARKS
ANTS - CARPENTER CONT'D		Outdoors: Advion Ant Bait Arena Advion Ant Gel Green Way Ant Killing Liquid Bait Maxforce Carpenter Ant Bait Gel Maxforce Fleet Maxforce Granular Bait Niban FG, G Optigard Ant Gel Bait Dusts: Deltadust Boric acid dusts Tempo 1D Sprays (or foam according to label): Talstar P Tempo SC Ultra Tempo Ultra WP Cy-Kick Transport PT221L Suspend SC Bora-Care Shell-guard Tim-bor (dust, spray or foam), Armor-Guard (dust, spray or foam)	4. Find and treat (dust, spray or foam) nests in wood parts. Drilling into the wood may be necessary. Dust nests in wall voids. Do not apply sprays near electricity.
ANTS - PHARAOH also called "sugar ants" or "piss ants" PB 1629	**Nodes on waist:** two **Gaster tip:** sting (may not be visible or functional) **Worker size:** 1/16 inch **Antennae:** 12-segmented antennae with a three-segmented club **Color:** yellow or orange with the end of the abdomen darkened Nests rarely found outdoors; however, almost any indoor crack and crevice close to sources of warmth and water. These ants do not swarm. Colonies multiply by "budding," in which part of an existing colony migrates, carrying brood with or without a queen to a new nesting site. Hundreds of queens and 10,000 - 100,000s workers may be present.	Baits: Advion Ant Bait Arenas Maxforce FC Ant Bait Station Niban FG Indoor crack and crevice spray and entry points: Phantom SC Outdoor entry points and trails around structure: Termidor SC	Because Pharaoh ant colonies are hidden and can occur in virtually any crack or crevice, baiting is the best way to get an insecticide back to the colony. Give a taste test of baits. Prebait entire structure with honey. Place a bait wherever ants are found. All queen(s) and all immatures must be killed to eliminate a colony. Spraying fast-acting insecticides for Pharaoh ants indoors often worsens the problem by causing the colony to split into many smaller colonies. Apply slower-acting sprays (Phantom, Termidor) around entry points during warm weather when ants are foraging outdoors.
ANTS - FIRE **SP 419, PB 1739, PB 1158, PB 1788** Fire ant infestations on home lawns are often managed with a two step approach: 1. Broadcast a fire ant bait over the entire lawn or area to be managed first. IGR baits are distributed especially well because they don't affect the worker. 2. 7-10 days later, apply granules, a drench, dust, or fast-acting bait (hydramethylnon, indoxacarb, abamectin, or spinosad) to the individual mounds that are likely to be encountered by people. More thorough discussions of IFA management options are provided in the publications listed above. A list of products labeled for fire ants is updated regularly and can be found at "Imported Fire Ants In Tennessee" (fireants.utk.edu) under "Resources" and "Updates," and W 649 and W 652.			

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ASIAN NEEDLE ANT entomology.ces.ncsu.edu/asian-needle-ant	Both workers and winged females can sting, especially when trapped against clothing. Workers (1/5 inch) and queens (1/4 inch) are dark brown, with the legs, mandibles and outer antennal segments slightly lighter. Workers with a middle, side of thorax that is smooth and shiny, a large squarish node on the waist, and a large stinger.	MAXFORCE COMPLETE Brand Granular Insect Bait in stations or broadcast Advion Ant Gel Optigard Ant Gel Bait	This ant does not form strong foraging trails and does not group recruit. Workers may be seen carrying another ant to a food source.
ANTS - OTHER PB 1629	Ants have elbowed antennae, a thread-like waist with one or two bumps. Unmated reproductive ants may have wings. If so, the front wings are larger than the hind wings. Worker ants are wingless. Ants are social insects. Colonies are usually established by a queen. Workers feed the queen, care for the brood and defend the nest. Workers travel along well-marked trails between the nest and food.	Baits: Advion Ant Bait Arena Advion Ant Gel Gourmet Ant Bait Gel Bait in Stations Niban FG Optigard Ant Gel Bait PT Advance 375A Select Granular PT 388B Advance Ant Gel Bait Terro-PCO (1%) Liquid Baiting Systems: Terro-PCO(1%) Dominant 1% Liquid Ant Bait Pyrethroid Sprays: Talstar P Tempo SC Ultra Tempo Ultra WP Transport Suspend SC Demand CS Temprid Slower-acting, non-repellent spray: Termidor SC 0.06% (outdoor perimeter) FUSE (outdoor perimeter) Phantom SC indoor crack and crevice, outdoor entry points	Follow good sanitary and exclusion practices. Exploit worker caste by using baits. Find foragers and place bait near foraging trail. Workers then bring the poisoned bait back to the nest where it is distributed among the members of the colony. If ants are foraging indoors from an outdoor nest, exclude ants by sealing entry points such as window sills and door frames, or spray entry points into the structure.
BATS PB 1868	Night-flying creatures invade attics and similar areas.	Treat area with insecticides to control external parasites including fleas, mites, and bat bugs after bats excluded. See bed bugs.	Close entrance holes with one-way excluders to prevent bats from returning after they have left the resting area. Seal opening once all bats excluded. Do not exclude bats when young bats present. See details in PB 1624.
BED BUGS PB 1763, PB 1807, SP 761, SP 788	Flat, wingless insects. Torpedo-shaped white eggs (1/25 inch) glued to rough surfaces. Five beige to light-brown nymphal stages 1/25 – ¼ inch long. Red to black gut contents of nymph can be seen through cuticle. Adults ¼ - 1/3 inch reddish-brown insect either oval-shaped when unfed or torpedo-shaped when fed. Bloodsucking. Night feeders. Confirm identification. Bat bugs easily confused with bed bugs. Pronotal hairs longer than width of eye for bat bug. If bat bugs are feeding on people, control will not be achieved until bats are excluded and area treated for ectoparasites.	Detection Canine scent detection team especially helpful for inspecting large buildings or areas (check for third-party certification). Monitoring Devices CLIMBUP Insect interceptor, white or black, insect-interceptor.com (Place bed or furniture leg into center well to aid detection of new infestations and protect against re-infestation. Important to prevent other bed bugs access to bed and refill wells with talc as needed.) CLIMBUPS helpful to determine efficacy of treatment when placed additionally in other places around room. Newer version does not require re-talcing.	Check every crack and crevice in bedroom and elsewhere, if needed. Do not spray sheets or blankets. Some PMPs will not treat mattresses with insecticides because of potential human exposure, while others will cover treated mattresses and boxsprings with a bedbug proof encasement after treatment. Others may physically remove bed bugs with vacuums and then cover with bed encasement specifically designed to prevent bed bugs from biting through or escaping (i.e., Protect-A-Bed with BugLock 3-sided zipper system and ALLERZIP seal, or Mattress Safe "Ultimate" zippered encasement - zipper must be kept closed). Some insecticides may need to contact bed bugs directly to be effective.

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BED BUGS CONT'D		BlackOut Bed Bug Detector protectabed.com/lightsout-bed-bug-detector-trap.html. The SenSci Volcano, senscionline.com, is smaller with square base to better fit against walls. Many monitors, check for validity by comparing research results. Mattress and Boxspring encasements Protect-A-Bed (BugLock 3-sided zipper system and ALLERZIP seal) Mattress Safe "Ultimate" encasement Others, ensure bed bug proofed Mattress seams, folds & edges Phantom Aerosol Steri-Fab Bedlam Plus EcoRaider Bed Bug Killer Crossfire Bedbug Conc., Aerosol Other cracks and crevices Crossfire Bedbug Conc., Aerosol Phantom Aerosol Transport GHP Temprid SC, RTS Tandem EcoRaider Bed Bug Killer Bed Bug Patrol Dust for Voids CimeXa Drione PT Tri-Die Pressurized Silica + Pyrethrin Alpine Heat treatment (all bed bug stages will die when exposed to 122 F). Equipment to heat rooms or buildings, trailers, tents and small chambers is expensive and often requires numerous circuits or generators. For whole room treatments, remote monitoring of temperatures using electronic sensors (minimum 5) AND overhead sprinkler disablement or protection that is compliant with fire safety regulations is recommended. All sensors, including those in tight crevices, reached 122 F. Post-treatment should include an inspection and use of monitoring devices to determine efficacy, vacuuming dead bed bugs and a perimeter application of DE or silica (see dusts above). Chemical Fumigation (for licensees only) Vikane	Resistance to pyrethroid insecticides is widespread. Rotate chemicals used and do not rely on one type (use nonresiduals, residuals and dusts). Foggers are ineffective. Incorporating nonchemical controls including vacuuming, low moisture steaming (AmeriVap, Hi-Tec Cleaning Systems, etc.), laundering (dryer on high for 30 minutes for dry clothes), and removing infested items may be necessary to manage bed bugs and may be more important as resistant bed bug populations are encountered. Cold takes longer to kill bed bugs. Bed bugs need to be exposed to ~0 F for at least 4 days and up to 2 weeks for all stages to die. Reducing clutter will reduce callbacks. Heat or chemical fumigation can be conducted on entire buildings or certain materials, including box springs and mattresses, can be placed in a permanent or temporary heat chamber. Fumigation does not provide residual control. Fogging is ineffective. Do not confuse fogging with fumigation. Fumigation requires category 7 certification, supervision of a person licensed in structural fumigation, and strict adherence to the label. Whole heat treatments of rooms should include a perimeter insecticide treatment to prevent bed bugs from moving to surrounding rooms. Wrapping and taping mattresses in black plastic and placing in sun does NOT heat the mattress evenly and does NOT reach the bed bug's lethal thermal threshold on the underside. Difficult-to-treat items (appliances, lamps, etc.) can be treated with Nuvan Prostrips in bags but may not kill all bed bugs in protected locations. CIRKIL VAPROPAD (https://www.cirkil.com) may be more thorough, but odors may linger. See UT Extension publication PB 1763 for more details on bed bug biology. For additional bed bug information and equipment see our *Bed Bugs in Tennessee* website at bedbugs.utk.edu The NPMA has released *Bed Bug Best Management Practices*, pestworld.org/media/562243/npma-bed-bug-bmps-approved-20160728-1.pdf

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BOOK LICE	Small, soft-bodied, cream-colored to grayish or light brown, wingless, fast-moving. Feed on molds, fungi. Found in books, cereals, wallpaper, boxes. May damage starched items.	PT Microcare Pressurized Pyrethrum Capsule Suspension PT 565 Plus XLO PT 221L PT Cy-Kick CS Pressurized Crack & Crevice Residual PT Tri-Die Silica & Pyrethrum Dust PT Tri-Die Pressurized Silica & Pyrethrin Dust	Large numbers of book lice develop under excessive humid conditions, moldy books, papers, bags or cereals. **Dry out infested areas.** Destroy infested material of little value. Space sprays of pyrethrins may cause the book lice to scatter throughout structure.
BOXELDER BUGS SP 341-H	Flat, ½ inch long, 1/3 inch wide, dark brownish-black, with 3 lengthwise red stripes behind the head. Wings leathery at base. Membranous at tip with red veins; abdomen is red. Nymphs are smaller, wingless and bright red.	Treat listed sites on label when bugs are first seen. Tempo SC Ultra Tempo Ultra WP Demand CS Demon WP WSP TalstarP Suspend SC Deltadust	These insects are attracted to buildings in the spring and fall. Large numbers collect on siding, around doors, sunny walls and attics. Use exclusion practices before pests become apparent. Inside, vacuum into a dry vac. Avoid use of space sprays if bugs found in wall voids. Dead bugs in wall voids could serve as carpet beetle food. Eliminate female (seed-pod-bearing) boxelder. Outside: vacuum the bugs into water mixed with 1 teaspoon of a liquid detergent per gallon of water in wet/dry vacuum cleaner tank.
BROWN MARMORATED STINK BUG W 779	BMSB adults are shield shape, about 5/8 inches long, just about as long as wide, mottled brownish grey with black antennae marked with a whitish band on the next-to-last segment, dark bands on the membranous part of the wings, and coppery or bluish metallic punctures (small, round depressions on the head and pronotum). Abdominal segments protruding from the wings are marked with black-and-white bands. Serious agricultural pest that may overwinter in homes. See eddmaps.org/bmsb/distribution.cfm?map=distribution for latest brown marmorated stink bug distribution.	If exclusion methods aren't working completely, they may be supplemented with professionally applied outdoor treatments. Products containing pyrethroids (bifenthrin, beta-cyfluthrin, cyfluthrin and lambda cyhalothrin) and neonicotinoids (acetamiprid and thiamethoxam) have been found to be effective against brown marmorated stink bug. In general, pyrethroids are faster acting than other chemistries; however, new pesticide labels limit professionally applied pyrethroids to 1-inch bands around windows and doors when the surface is over a hardscape. Insecticides will have limited persistence outdoors in the sunlight and rain and may not prevent the brown marmorated stink bug from entering structures. Alpine WSG Talstar P Suspend Polyzone Other pyrethroids (check label)	Pest-proof by late summer using techniques described in PB 1303. If supplemental pesticide applications are deemed necessary, make exterior spot, crack and crevice, and/or void applications where these pests may harbor or hibernate, such as cracks and crevices, in weep holes, wall voids, around window and door frames, attic vents and behind siding, in late summer/early fall before the pests arrive. Pyrethroid labels are more restrictive so read label carefully. Indoor light traps may help reduce populations inside and are most effective late winter/early spring when the bugs are leaving the structure. Vacuum bugs found inside into knee-hi stocking placed on the end of the vacuum tube prior to attachment placement. After vacuuming, remove knee-hi, tie off, place in a sealed bag and in outside garbage can. If BMSB found on walls in large numbers, they can be removed by removing the top of a capless plastic soda bottle at the widest part of the neck, inverting it and placing back on the bottle to create a funnel trap. When the edge of the modified bottle is moved up the wall toward a BMSB aggregation, the bugs will drop into the trap. Soda bottles can be sealed in a plastic bag and placed in the freezer for a few days. Frozen or drowned bugs can be disposed of outdoors in a garbage can or compost pile. Flushing BMSB down the toilet will waste water and is not recommended.

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CARPENTER BEES W 876	½ to 4/5 inch long with a blue-black, green or purple metallic sheen. Color and size resembles a bumble bee, but the top of the abdomen is hairless. These bees chew a circular, 3/8-inch entrance hole into wood and nesting gallery 4-6 inches long at a right angle to the entrance hole. Galleries used for several years may extend 10 feet. Carpenter bees overwinter in previously used galleries, so re-inspect and seal galleries in the fall.	Apply dusts into the gallery openings: Tempo 1D DeltaDust Apicide Sprays: Tempo SC Ultra (spray or foam) Tempo Ultra WP (spray or foam) PT Cy-Kick Suspend SC 0.06% Premise .05%-0.1% (spray or foam)	Use a badminton racket to kill flying adults or use a straight wire to break up cells in tunnels. Individual bees can be caught with a net and killed. In the spring, apply foam, spray or puff of insecticidal dust into nest holes in the evening when the carpenter bees are at rest. Allow bees access to the nest for 24 hours. Seal the hole with putty, 3/8 inch diameter dowel or cork to prevent re-infestation. Dusts are the preferred formulation because they coat the porous wood surface of the bee's gallery.
CARPET BEETLES SP 341-I **Black** Carpet Beetle Common; or Furniture; or **Varied** carpet Beetles	Adult 1/8 inch to 1/4 inch in length; black; brown legs. Larva 3/8 inch in length; carrot-shaped; covered with short hair and has long terminal bristles. Adults 1/8 inch long with white and orange; or yellow, white and black; or white, brown and yellow spots; larva with long black to brown hairs.	Thorough HEPA vacuuming of bed, bedding, carpet edges and upholstered furniture removes dander and pet fur that can serve as protein food for carpet beetles. Place wool or silk articles in sealed containers for long-term storage. Treat cracks, crevices and hidden area of walls, closets, stored materials, under carpets, etc. Do not apply insecticide to clothing. **See precautionary statements about pesticides staining carpets.** Tempo Ultra WP Tempo SC Ultra PT Cy-Kick Demand CS Suspend SC DeltaDust Kicker PT Tri-Die Silica & Pyrethrum Dust PT 565 Plus XLO PT Microcare CS Controlled Release Pyrethrum PT Microcare Pressurized Pyrethrum Capsule Suspension	Carpet beetles infest beds, carpeting, clothing, fur, upholstered furniture, books, bird nests, milk powders, articles of animal products, feathers, wool, silk and other materials of animal origin. Locate food source and remove, if possible. Use good housekeeping such as cleaning floor and carpets regularly. Dry clean clothes regularly. Stored materials subject to damage should be thoroughly cleaned and stored in tight container with moth crystals.
CENTIPEDES	Grayish creature with long feelers and many long, slim legs, one pair of legs per body segment. Fast moving. Long antennae.	Indoors: DeltaDust PT Tri-Die Pressurized Silica & Pyrethrin Dust PT Tri-Die Silica & Pyrethrum Dust Talstar P PT Cy-Kick Crack & Crevice Pressurized Residual PT Cy-Kick CS Controlled Release Cyfluthrin Tempo SC Ultra PT Microcare CS Controlled Release Pyrethrum Outside Perimeter: Demon WP WSP DeltaDust Tempo Ultra WP Tempo SC Ultra Cy-Kick Talstar P Talstar granulars DeltaGard G	Feed on insects. Larger species can bite. Usually not numerous. Active at night. Nonchemical control: leave a 12-18 inch bare zone around building foundations. Move wood piles and other clutter away from structure. Spot treat cracks and crevices, door thresholds and moldings where pests may crawl or as directed by label. Residuals may not provide total control. Treatments may need to come into direct contact with pest.

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CHIGGERS	Very tiny immature mites which get on the person and cause blotches and itching. Don't usually invade homes, but occur in yards and wooded areas.	Use commercial repellents around ankles and waist for personal protection. Apply deet repellent to skin; and Permanone 0.5% spray to shoes, cuffs and socks, heed drying directions before wearing. Apply to infested areas of turf. Tempo SC Ultra Tempo Ultra WP Talstar P	Mow lawn regularly. Remove weeds and brambles from fence rows.
CLOTHES MOTHS SP 341-J	Brownish moths, wingspread 1/2 inch long. Larvae are 1/16-1/3 inch long. Gray silken cases or webbing over surface of fabric.	Vacuum prior to treatment and to remove potential food sources. Apply sprays to cracks and crevices in closets and spot treat other infested areas. Tempo Ultra WP Tempo SC Ultra Cy-Kick DeltaDust Suspend SC Kicker	Adults are not attracted to light and will fly to dark corner when disturbed. Larvae usually found on infested materials, wool, fur, feathers, hair, upholstered furniture, non-synthetic carpets, dust and lint. Do not spray clothes. Dry-clean susceptible items before storage or store with moth crystals in sealed storage container. Heed warning about staining clothing.
CLOVER MITES	Tiny (1/30 inch) mites, brown to olive green with pair of long front legs.	Apply sprays to points of entry such as foundations, windows and doors. Cy-Kick CS PT 221L Talstar P Mavrik Perimeter	Invade homes from the yard in great numbers in fall and spring. Stain walls or fabrics reddish-brown when crushed. Keep grass and shrubs from direct contact with house. Good weed control in turf and a vegetation free border of 12-18 inches around home will help.
COCKROACH German Cockroach Brown Banded or Furniture Cockroach Oriental Cockroach American Cockroach Smokybrown Cockroach	 About 5/8 inch in length, pale brown or tan with 2 parallel dark streaks on pronotum. Usually most abundant in the kitchen and bathrooms. 1/2 to 5/8 inch in length, dark brown with 2 pale bands traversing wings. Widely distributed throughout the house in walls, closets, furnishings, in appliances, but abundant in kitchens. 1 1/4 inches in length, dark reddish-brown to black, wings do not surpass end of abdomen. Usually found in lower floors, outdoors or in crawl space. Frequents water meters, floor drains or moist, dark areas. 1 1/2 inches in length, reddish-brown with pale yellow band around pronotum. May be found throughout house, outdoors, in crawl spaces, sewers, water meters and garbage cans. 1 to 1 1/2 inches, uniform, very dark brown to black; head shield is a solid, dark color. Takes harborage in moist, warm and dark places like tree holes, mulches, soffits in attics with poor ventilation.	Do not spray repellent or fast-acting insecticides near baits. Baits in cracks and crevices: Advion Cockroach Gel Bait Advion Cockroach Bait Arena Advion Evolution Alpine Cockroach Gel Bait Rotation 1 Alpine Cockroach Gel Bait Rotation 2 Maxforce FC Magnum Roach Killer Bait Gel Maxforce FC Select Roach Killer Bait Gel Maxforce Impact Roach Gel Bait Maxforce Roach Killer Small Bait Stations Maxforce Roach Killer Bait Gel Niban G Optigard Cockroach Bait Prescription Treatment Advance Cockroach Gel Bait Reservoir Prescription Treatment Avert Dry Flowable Cockroach Bait Form. 1 Vendetta Vendetta Plus Baits for large roaches: Advion Cockroach Gel Bait Maxforce Granular Bait Maxforce Roach Killer Bait Gel Maxforce FC Magnum Roach Killer Bait Gel MAXFORCE COMPLETE Brand Granular Insect Bait Maxforce Impact Roach Gel Bait Niban G Vendetta	Prevent access to food, water and shelter. Practice good sanitation in food handling, storage and eating areas. Control moisture, prevent leaks or condensation. Seal off harborage sites such as cracks and crevices with caulk, etc. Also use exclusion practices to prevent cockroach movement. Use glue boards or sticky traps placed along edges in dark places to locate and monitor cockroach populations. Baiting is the preferred method for cockroach control. Apply baits to cracks, crevices, pipe openings into walls, joints of furniture and cabinets, pipe conduits, and elsewhere as indicated by glue board catches. Rotate baits regularly. If you choose to spray, use precautions to keep chemicals out of food, spices, and off dishes or eating utensils. Do not apply sprays where electrical shorts may occur; use baits or dusts in these areas. Do not use sprays when baiting because cockroaches may be repelled from the baits. Read label carefully; some products may not be labeled for food handling areas.

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COCKROACH CONT'D Turkestan Cockroach	1 inch; female dark brown with leathery, short, triangular wings that don't meet in the middle and cream stripe along edge; male orange-brown with edges of wings lighter, wings exceed length of abdomen. Often found in-ground containers, hollow block and other cracks and crevices. Sold as pet food via the internet.	Insect Growth Regulators for small roaches containing hydroprene (Gentrol Aerosol, Gentrol IGR Concentrate, Gentrol Point Source) or pyriproxyfen (Archer, Nylar or others). IGRs are slower acting but longer lasting - sterilizes adults. Lightly dust voids with: PT Tri-Die Drione DeltaDust NiBor-D Cimexa Crack and Crevice Sprays: TempoUltra WP, SC Ultra PT Cy-Kick CS Pressurized Crack & Crevice Residual Suspend Talstar P PT 221L Phantom Outdoor perimeter for large roaches PT Cy-Kick CS Controlled Release Cyfluthrin Suspend Tempo Ultra WP DeltaGard G Niban FG, G MaxForce Complete Granular Insect Bait	Increase ventilation in attic to reduce attraction to smokybrown cockroaches. American cockroaches often enter facilities through drains with a dry p-trap. Keep p-trap filled with water. Items, such as ProSet Trap Guard or Sure Seal Inline Floor Drain, prevent sewer gasses and cockroaches from escaping into living spaces, but still allow water to drain.
CRICKETS	Black, jumping insects with long antennae. Cave or camel crickets are humped and brown.	Baits: MaxForce Complete Granular Insect Bait Niban Granular Bait Sprays and dusts: Tempo Ultra WP Tempo SC Ultra Cy-Kick Demon WP WSP Demand CS Talstar P DeltaDust Suspend SC	Black cricket may damage clothing. Repeat treatment as needed. Spray entry points into structure. Dust crawl space. Camel crickets infest damp basements, under slabs and crawl spaces. Ventilate or dry these areas. Active at night. Apply sprays into cracks and crevices where crickets dwell. Use exclusion practices. Glue boards can be used indoors around entry points and other places in basements, etc.
EARWIGS	Easily identified by pair of "pinchers" at end of abdomen.	Outdoors: Talstar P Demon WP WSP Demand CS PT Cy-Kick CS Controlled Release Cyfluthrin	Earwigs are incidental invaders into houses. They usually dwell in leaf litter, mulch and woodpiles and are common "hitchhikers" on vegetables harvested from the garden. Moving compost piles away from the house will aid pest control. Insecticidal control is usually unnecessary for this insect. If needed, spray possible entry points and mulched area around the house.

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FLEAS PB 1596	Small, 1/16" long, reddish-brown, wingless insect. Body compressed laterally, legs long and adapted for jumping.	**On pet:** **CATS, KITTENS and PUPPIES ARE MORE SENSITIVE TO INSECTICIDES!!!!!** Consult a veterinarian and always read label prior to treating a pet. **Veterinarian supplied products - usually kill fleas within 12 - 36 h or sooner and provide 90 - 95% control for about 30 days:** see pesticide recommendation at https://extension.uga.edu/content/dam/extension/programs-and-services/integrated-pest-management/documents/handbooks/2020-pmh-home-chapters/Animals%20(Pets%20and%20Honey%20Bee).pdf for a thorough listing of veterinarian supplied on-pet products. **Indoor Premise C & C Treatment Spot treat infested areas and pet resting areas inside with following:** Insect Growth Regulators [and adulticides]: pyriproxyfen **(Archer** and others) pyriproxyfen [and permethrin or pyrethrin] **(PT Ultracide** and other ready-to-use products methoprene (**Precor IGR Concentrate**) methoprene [and pyrethrins etc]. **Precor 2000 Premise Plus Spray** **Precor Plus 2625 Premise Spray** and other ready-to-use sprays Adulticides Suspend SC, Alpine WSG, others **Outdoors (when specified on label):** pyriproxyfen **(Archer** and others); Alpine WSG Demand CS (outdoors only); Suspend Talstar P Talstar PL Granular	**Keep pets and people out of treated area (indoors and outdoors) until spray dries.** Step 1. With veterinarian supplied products that are currently available, control of fleas in small-to moderate-sized infestations is likely to occur by using those pet treatment products alone. May take 2 months to completely break flea life cycle. Sprays of pyrethrum and pyrethroids may not work as well as the newer chemistry used in pet treatments because of insecticide resistance. If pet treatment alone does not provide sufficient control, initiate a complete control program by April. Step 2. Vacuum infested areas twice a week and prior to treatment to remove eggs, larvae, adults and organic matter. Steam cleaning carpet may also reduce populations. Eliminate fleas from pets, bedding and premises before departing on vacation. Step 3. Treat pet resting areas indoors and clean or remove pet bedding on the same day. Insect growth regulators important to break flea life cycle. A combination of an insect growth regulator and an adulticide may be the most efficient formulation to use. Difficult to kill pupae. Step 4. Mow grass, keep weeds down and trim shrubs to expose flea eggs and larvae to lethal desiccation. Irrigating areas surrounding buildings, but not against building, may kill fleas by drowning. If fleas are surviving outdoors, apply insecticide to labeled areas.
FLIES Face flies, cluster flies, and blue bottle flies	Adult flies of these three species overwinter in attics and wall voids. Cluster flies about 1/3" long, dark gray, with checkered black and silver abdomen, with gold hairs on thorax of newly emerged adults. Face fly similar in appearance to the house fly. Adult blue bottle flies have a dull gray thorax and a shiny blue abdomen.	Exclude flies in the fall by sealing entry points, screening behind all vents, sealing holes in walls and attics prior to pest entry in fall. Can apply pyrethroids to potential entry points prior to pest entry. Vacuum or use pyrethrin sprays to kill exposed flies. Use black light trap with sticky surface. Dust voids (boric acid not very effective) where flies may be over-wintering.	Cluster fly larvae are parasites of earthworms. Face fly larvae develop in cow patties. Adults overwinter in attics and wall voids. Blue bottle fly larvae develop in garbage, decaying meat, dead animals, fish and excrement.

PESTS	DESCRIPTION	CONTROL MATERIALS AND METHODS	REMARKS
FLIES CONT'D House flies	About 1/4" in length, dull gray color with 4 longitudinal dark stripes on the thorax.	**Remove larval food sources.** <u>Spray outdoor areas where flies rest such as garbage collection sites:</u> Tempo Ultra WP, Demon WP WSP Demand CS, Suspend SC, CyKick CS, Cynoff <u>Baits (rotate use of diamide, carbamate, and neonicotinoid)</u>**:** For use around commercial facilities. Should not be used inside or around homes, or any other place where children or pets are likely to be present. Cyanarox Insecticidal Bait (diamide) Starbar Golden Malrin Fly Bait (carbamate) Starbar Quikstrike Fly Bait (neonicotinoid) Maxforce Granular Fly Bait (neonicotinoid) Maxforce Fly Spot Bait (neonicotinoid) Florida-Fly Baiter with Maxforce Fly Spot Bait (neonicotinoid) <u>EndZone Insecticide Sticker</u> Stickers work best when placed on or near a window or other light source. However, in the absence of light or under low-light conditions, stickers may be placed near a potential fly food source (such as inside a garbage can). If needed, use pyrethrin space spray for temporary relief inside home.	Larvae develop in warm organic matter of animal or vegetable origin. Remove trash regularly to reduce fly populations in homes. Screen windows and doors. Garbage cans should have tight-fitting lids. Use insect light traps indoors. Sanitation is very important.
<u>Bottle Flies</u> Green Bottle Fly Blue Bottle Fly Bronze Bottle Fly Black Bottle Fly	1/2" in length; green metallic color 1/2" in length; blue metallic color 1/2" in length; bronze metallic color 1/3" in length; shiny grey thorax and dull blue metallic abdomen.	**Remove larval food sources.** Spray outdoor areas where flies rest or try an insecticidal sticker (EndZone) indoors to reduce adult populations.	Bottle flies indoors often indicate a dead mouse or other animal in wall voids, attic, basement, etc. Dispose of dead animal carcasses, animal excrement, and other potential larval food sources such as decaying vegetation and garbage. Garbage cans should have tight-fitting lids.
Small Fruit Fly or Vinegar Fly	1/8" long, red eyes, tan head and thorax, abdomen gray-black. Some species have darker eyes.	**Remove larval food sources.** Check mops and brooms too. Use a wire brush, or foam or other application of microbials or botanical drain cleaners to labeled sites (which may include drains, baseboards, behind bars, drip trays, bundles of sticky syrup lines, grout ruts, under ice machines and other equipment), that should be cleaned, but are often neglected and difficult to clean. May need to be repeated. Traps may reduce adult fly populations. Use pyrethrin aerosols for temporary relief of adults.	Egg to adult in 8-11 days. Larvae in decaying fruit, vegetables and garbage cans, etc. Adults around larvae.

PESTS	DESCRIPTION	CONTROL MATERIALS AND METHODS	REMARKS
FLIES CONT'D Moth Fly Sewer Fly Drain Fly	Small, scaly or hairy, moth-like flies. Wing veins parallel.	**Remove larval food sources.** Remove moist organic materials, clean drains with wire brush or steam clean. Following initial mechanical cleaning in commercial accounts, botanical, microbial and/or enzymatic drain cleaners can be applied to labeled sites, which may include drains, waste water traps, etc., to maintain clean surfaces. A foam formulation may work best on vertical surfaces. Pyrethrins for temporary relief of adults.	Adults rest on walls or foliage. 3-4 weeks from egg to adult. Larvae found in slimy drains, sewer backup or leaks, unsanitary garbage cans, potted plant saucers, baths or feeders for birds, clogged roof gutters or storm drains, drip lines from air conditioners, moist compost, septic tanks and other places that hold very moist organic solids.
Phorid, Humpbacked Fly, or Scuttle Fly	Adult small, 1/16 - 1/8" long; brown, black or yellow; thorax humped when viewed from side. Dark veins along front edge of wing. Adult scuttles or "runs" erratically over surface.	**Remove larval food sources.** Check bottom of trash cans, cracks under appliances/equipment, garbage disposals, rotting vegetables and meats, mop heads, septic systems, and potted plants that have been overwatered, flowers in vases, mausoleums, and soiled bedding of animals. Use insect light traps to catch adults to determine if potential larval source nearby and to temporarily reduce adult populations. If source cannot be found, consider a cracked sewer or waste pipe. If sewer pipe the cause, remove slab, repair pipe and remove contaminated soil. Insecticidal sticker (EndZone) may also help reduce adult fly population.	Development time 11 days (85 F) to 28 days (72 F) for common species. Larvae found in moist decaying organic matter (feces, carrion, fungi and decaying plants). Phorid flies were abundant in 2009 and sometimes the larval source was outside in decaying vegetation near home.
FUNGUS GNATS SP 341-C	Adults 1/8 to 1/4 inch long. Slender larvae have shiny black head and white thread-like body. Adults attracted to light. Collect in windows and soil in potted plants. Run rapidly over surface.	Pyrethrins aerosol, insecticidal sticker (EndZone) or light traps may also help reduce adult fly population caused by moisture and decay from leaks including roofs. See SP 341-C for list of products labeled for adult and larval fungus gnats in interiorscapes. Need a category 3 certification and working under someone licensed in HRI to make interiorscape pesticide applications.	Larvae feed on fungi and plant root hairs. Avoid overwatering plants, letting soil dry between watering to reduce fungal food source. If plants are not the problem, look for water leaks or other moisture problems. Check flat roof and piles of pet bird droppings which can support fungal growth. Remove moisture or dry moist areas. May enter from outdoors. Rake and reduce mulch depth to 2-3 inches.
HEAD LICE SP 341-S	Tiny, flat insects which infest people and can be found on clothing.	Premise sprays are not recommended for head lice control. Several louse shampoos and other hair products are available for homeowner use.	Considered a medical pest with limited ability to live away from a human host. Wash infested clothing and bedding with strong soap and very hot water; tumble dry on high heat. Dry clean woolens. Do not share hairbrushes, caps, etc. "Selfies" may also increase the probability of transmission. Use special combs to remove nits (eggs). Nits hatch by 10 days, so another application of head lice shampoo may be needed at this time. Follow label directions.
KISSING BUG or CONENOSE BUG	Two species of kissing bugs exist in Tennessee, *Triatoma sanguisuga* and *Triatoma lecticularia*, **but neither are commonly encountered**. These dark insects are approximately 1 – 1 ½ inches long in the adult stage, with 12 yellow, red or orange bands around the edge of the abdomen. The head is cone shaped with large	Prevention Seal cracks and gaps around windows, walls, roofs and doors. Remove wood, brush and rock piles near your house to eliminate harborage for rodents, other vertebrates and kissing bugs. Remove bird nests. Screen doors, windows and vents, and repair holes or tears.	Kissing bugs are nocturnal feeders found near animal nests or pest resting areas. Hosts include opossums, raccoons, armadillos, birds, bats, rodents, skunks, coyotes, cats and dogs, among others. Many adult kissing bugs or multiple nymphal stages could indicate a breeding population is present. These bugs often establish in

PESTS	DESCRIPTION	CONTROL MATERIALS AND METHODS	REMARKS
KISSING BUG or CONENOSE BUG CONT'D	eyes and beak-like mouthparts attached near the front of the head and held under the body at rest. The piercing mouthparts are used to feed on the blood of vertebrate animals including humans. Kissing bugs are the primary vector of the protozoan parasite that causes Chagas disease; however, Chagas disease rarely occurs in Tennessee. One local vector-borne human case occurred in Tennessee between 1955 and 2010; however, nine Chagas cases occurred in Tennessee since 2010, of which one was locally acquired, two were acquired outside the country, and the origin of the other six cases was unknown. The protozoan is present in the state, 6.4% of canines tested positive in 2008. The parasite is spread to animals via feces rubbed into the kissing bug's bite wound, or an animal's eyes, nose or mouth. **Delayed defecation by the kissing bug and well-constructed homes that prevent kissing bug entry are potential reasons for the low Chagas disease occurrence here**.	Sleep under fine mesh netting if unable to exclude pests. Ensure exterior lights are not close to the house (lights can attract the bugs) or use sodium vapor lights next to the home. Seal openings and crevices leading to the attic, crawl space and outside. Pets should sleep indoors, especially at night. Reduce clutter inside homes to reduce potential harborage for kissing bugs as is done with bed bugs. Keep your house and any outdoor pet resting areas clean, in addition to systematically checking these areas for the presence of kissing bugs. Synthetic pyrethroids have effectively controlled kissing bug infestations in areas where Chagas disease regularly occurs; however, kissing bugs or conenose bugs are rarely listed on pesticide labels in Tennessee. If an infestation exists, supplement prevention tactics with the application of a pyrethroid (cypermethrin, lambda-cyhalothrin, deltamethrin or cyfluthrin) to entry points and cracks and crevices of potential harborage sites as long as these sites are listed on the label and the label doesn't specifically exclude kissing bugs or conenose bugs.	homes that are poorly constructed (i.e., not sealed well). If kissing bugs are found indoors, check areas near pet resting sites, rodent infestations and bedrooms, especially around beds and end tables. For more information, see https://www.cdc.gov/parasites/chagas/gen_info/vectors/index.html https://citybugs.tamu.edu/factsheets/biting-stinging/others/ent-3008/ https://kissingbug.tamu.edu/faq/ https://entnemdept.ifas.ufl.edu/Creatures/URBAN/Triatoma_sanguisuga.htm
KUDZU BUG W 358	¼-inch long, almost square-shaped with a brown to olive-green color. The immature stages are similarly shaped but smaller and "hairy." Current distribution at kudzubug.org/distribution-map	If exclusion methods aren't working completely, they may be supplemented with professionally applied outdoor treatments. Insecticides should be applied around windows, doors and other entry points as is done for other occasional invaders. In general, pyrethroids are faster acting than other chemistries; however, new pesticide labels limit professionally applied pyrethroids to 1-inch bands around windows and doors when the surface is over a hardscape. Alpine WSG Tandem Talstar P Other pyrethroids and combination neonicotinoid & pyrethroids (check label)	Exclude the pests before they start aggregating on structures to overwinter. Make spot, crack & crevice and/or void applications where these pests may harbor or hibernate, such as cracks and crevices, in weep holes, wall voids, around window and door frames, attics and behind siding. Apply to exterior wall surfaces around entry points and resting areas where insects congregate. Vacuum bugs found inside into knee-hi stocking placed on the end of the vacuum tube prior to attachment placement. After vacuuming, remove knee-hi, tie off, and dispose in soapy water. Insecticides will have limited persistence outdoors in the sunlight and rain and may not prevent kudzu bugs from entering structures.

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LADY BEETLE, MULTICOLOR ASIAN SP 503-C	Multicolored Asian Lady Beetles (MALB) start searching for overwintering sites, your home, on the first or second day when temperatures are greater the 65 F after a dramatic drop in temperature, usually to near freezing. This usually occurs about the third week in October.	Demand CS Suspend SC Talstar P Temprid FX, SC other pyrethroids	1. Pest-Proof: seal entry points before beetles arrive. 2. Treat roof lines or soffits, vertical contrast areas, and entry points (around the following outdoor items: windows, doors, vents, pipe penetrations) with pesticides before the beetles arrive. 3. Remove dead beetles as they pile up because they may cause other MALB to aggregate. 4. If the beetles make their way into the home, vacuum (with HEPA to prevent allergen circulation) or try a light trap.
MICE PB 1868	Adults weigh about ½ ounce. Dusky gray color, slender body, prominent ears, tail about as long as head and body. House mouse: 6-7 inches, feet small, and head small	Place snap traps, multiple catch traps and glue boards along paths traveled by mice. Traps or glue boards should be placed every 8-12 ft. Traps can be baited with: dry rolled oatmeal, bacon squares, small wads of cotton or gumdrops. Baited traps should be set at right angles to rodent runs. Place trap at right angles to rodent pathway with trigger part of trap against the run. EPA has changed allowances regarding use of rodenticide baits in the urban environment.	Mice move in from outdoors in fall as temperatures decline. Exclusion practices needed, mice can fit through an opening ¼ inch in diameter. Sanitation: remove access to food, water and shelter. Rodents use edges of walls, studs and pipes as guidelines. Remember to set traps where children and pets will not be hurt. Mice are curious and will normally approach traps the first night. If you don't catch a mouse in the first few nights, the trap is in the wrong location.
MILLIPEDES W 357	Slender, brownish, multi-legged, hard-shelled, 1-2" long. Two pair of legs per most body segments. Invade home from outdoors. Harmless.	Outdoors: Cy-Kick CS Cynoff WP Demand CS Scion Suspend SC Talstar P Talstar PL (granular) Tempo SC Ultra Tempo Ultra WP	Millipedes are not insects, so insecticides are not always effective. Best control obtained when pest comes in direct contact with the insecticide. Usually occasional invaders and may invade in large numbers. Under these circumstances, nonchemical control may be more effective: remove mulch and other clutter from near the foundation, dethatch lawns and water in the morning. Prune tree limbs to dry their habitat. Use exclusion practices. Treat entry points into structure, shady areas, ivy beds, flower beds and rock walls, leaf-litter or as directed by label. Millipedes will die within 2-3 days after entering a dry structure.
MITES, BIRD OR RODENT	Mites occasionally found indoors because of rodent or bird nest in, on, or near structures. Some of these mites may bite people. They are small (about the size of a period), but can usually be seen with the naked eye.	Dust or spray cracks and crevices around infested area. Cimexa D-Fense SC Pyrethroid products containing bifenthrin, cyfluthrin, and deltamethrin may be effective but are not currently labelled for this pest, so would need to apply in cracks and crevices for other pests. If widespread, space sprays of pyrethrins may be necessary.	The first step in controlling bird or rodent mites is to eliminate the host animals and remove their nesting sites. Often, the nests will be found in the attic, around the eaves and rafters or in the gutters or chimney. Gloves should be used when handling dead animals. A respirator should also be worn when removing nest materials to avoid inhaling fungal spores and other potential disease-producing organisms associated with the droppings. See chiggers for repellents.

PESTS	DESCRIPTION	CONTROL MATERIALS AND METHODS	REMARKS
MOSQUITOES SP 503-B	Delicate insects that bite humans and animals. Larvae and pupae in water. Adults stay in shrubbery, crawl spaces, etc. See Tennessee Mosquito and Vector Control Association, tennmosquito.com for training opportunities. Repeated use of the same insecticide can lead to resistance, that is, the insecticides no longer work or don't work well. A free Insecticide Resistance Test kit may be requested from the CDC via email USBottleAssayKit@cdc.gov. The kit includes bottles, insecticides and manual. More information on insecticide resistance testing can be found at https://www.cdc.gov/zika/vector/insecticide-resistance.html	Treat standing water with: *Bacillus thuringiensis israeliensis* (Bti): Aquabac xt, 200G Teknar CG and G, Vectobac G, GS and 12AS methoprene (IGR) Altosid Pellets, Liquid, XR- briquets, briquets Pre-Strike Granules Spinosad Natular G, G30, XRT, T30 For *Culex* mosquitoes in septic conditions, treat standing water with: *Bacillus sphaericus* Vectolex FG, WDG, WSP Outside Area ULV applications by ground equipment for use by trained professional personnel: Anvil 10 + 10 Biomist 3 + 15 ULV Biomist 1.5 + 7.5 Biomist 30 + 30 ULV Mosquitomist One Many others Outside residual barrier (permethrin, malathion, Tempo, Suspend, Talstar and others) can be applied to the underside of vegetation around home and on perimeter of property that is prone to rapid infestation of mosquitoes. This kills adults resting in these sites and some may act as a repellent. *Aedes* species found closer to ground (<10 ft) and *Culex* found higher in the canopy. Spray other shady damp areas where mosquitoes rest. **If needed** indoors, use sprays containing pyrethrins in closets, stairwells, behind and beneath furniture for temporary relief. A more extensive list of mosquito control products for commercial and government agencies can be found at https://extension.uga.edu/content/dam/extension/programs-and-services/integrated-pest-management/documents/handbooks/2020-pmh-chapters/Mosquito%20Control.pdf These products have not been verified to be registered in Tennessee.	To reduce mosquito populations, a complete mosquito control program must be followed. See UT Extension publication PB 1685 The Tennessee Mosquito Control Handbook (Pesticide Applicator Licensing Manual) for more details. Pesticide applicators applying mosquito-control pesticides on public lands and waters need to be certified in category 8 and licensed in PHMC. Eliminate larval sites (standing water) around structure by unclogging gutters, emptying bird baths, children's pools, pet bowls, flower pot saucers, old tires, and other containers around home twice a week. Drain or fill low areas where water collects. Easiest to control mosquitoes in immature stage because confined to water. Treat standing water with labeled insecticide. Repair screens. People should wear repellents when potentially exposed to mosquitoes. The CDC recommends repellents with these active ingredients: N,N-diethyl-m-toluamide (DEET) Picaridin IR3535 Oil of lemon eucalyptus (OLE) or para-methane-diol (PMD) 2-undecanone **Do not use OLE or PMD on children under 3 years of age. Do not use repellents on babies younger than 2 months old.** Mosquito netting can be used over infant carriers, cribs and strollers. Do not apply repellent to skin under clothing. If using sunscreen, apply sunscreen first and insect repellent second. More information on repellents and their safe use can be found at cdc.gov/westnile/prevention/index.html EPA's search tool (epa.gov/insect-repellents/find-repellent-right-you) helps find repellents. Children and adults can wear clothing with long pants and long sleeves while outdoors. DEET or other repellents such as permethrin can also be applied to clothing (don't use permethrin on skin), as mosquitoes may bite through thin fabric. Reduce the number of areas where adult mosquitoes can find shelter by cutting down weeds adjacent to the foundation and in yards, and mowing the lawn regularly.

PESTS	DESCRIPTION	CONTROL MATERIALS AND METHODS	REMARKS
PANTRY PESTS Saw-Toothed Grain Beetle Cigarette Beetle Indianmeal Moth Rice Weevil Confused Flour Beetle Red Flour Beetle	Brownish black, 1/8" long, flattened with 6 saw-tooth like projections on thorax. Feeds in a wide variety of stored products, cereals, nuts, dried fruit, cookies. candy, etc. 1/8" long, oval, reddish brown, head not visible from above, antennae saw-like. General feeder in tobacco, seasonings especially paprika, cereal, dried flowers, and a wide variety of stored foods. 3/8" wing span, inner 2/3 of wing grayish, outer 1/3 of wing mottled copper and black. Feeds in coarse grain products, chocolate, nuts, dried fruit. 1/8" long. Long snout on head, dark brown with 4 bright spots on wing cover. Feeds in grains. 1/8" long, reddish-brown, antennae gradually enlarged to end in a club. Cannot fly. Feeds in flour and cereal products. 1/8" long, reddish-brown, antennae has a distinct 3-segmented club and can fly. Feeds in flour and cereal products.	**Locate food source and discard.** Place grains, flours, nuts and other stored products in insect proof containers when they are brought home from store. Pheromone traps can indicate the presence of pests and may provide control without insecticides when populations are low and pests confined. Vacuum cracks and crevices and wipe down pantry to remove pests and food source. Also do this before insecticidal application. Do not contaminate food, dishes, shelves or utensils with pesticides. If insecticide application desired, direct spray into cracks and crevices of storage cabinet shelves when shelves are clean and all food and utensils, etc., removed. Treat only cracks and crevices in the pantry. Do not wash off insecticide residue. Cover with paper if desired. pyrethrins Tempo SC Ultra Cy-Kick DeltaDust Suspend SC PT Cy-Kick CS Pressurized Crack & Crevice Residual PT Microcare Pressurized Pyrethrum Capsule Suspension PT Tri-Die Pressurized Silica & Pyrethrin Dust Drione	To prevent infestations: 1) Inspect stored products periodically, 2) Practice good sanitation, 3) Rotate stored product use so older stores are used first and none remain in storage indefinitely, 4) Have adequate ventilation to prevent moisture buildup in storage areas. 5) Insect proofing; use insect-proof package or storage procedures wherever possible. 6) Pheromone traps can indicate the presence of pests and are available for: Indian meal moth, saw-toothed grain beetle, confused and red flour beetle, cigarette beetle, drugstore beetle, clothes moths and others. Nonchemical control: Either destroy the infested products or salvage them by super heating to 140 F for ½ hour, or super cooling in a deep freeze at 0 F for at least 4 days. Store insect-free beans in containers with tight lids.
POWDERPOST AND OTHER WOOD-BORING BEETLES PB 1703 **Powderpost Beetles** Lyctid powderpost beetle	**Shot-sized holes along with flour-like powder indicate these beetles.** Attacks hardwoods such as oak, ash and hickory found in solid and laminate ring porous hardwood floors and furniture; molding, window and door frames, and wood paneling. Antennae with 2-segmented club. Frass talc-like, smooth, not gritty. Head protrudes forward. Re-infests seasoned wood.	Products listed in this column refer to treatment for all reinfesting wood-boring beetles listed. Beetles that have pupated prior to insecticide application may be unaffected and may continue to emerge. Insecticide applications should prevent reinfestation. Products containing disodium octaborate tetrahydrate (DOT) and glycols **(Bora-care, etc.)** may penetrate wood farther than other residuals, but penetration is variable and depends on moisture content of the wood and other factors. Other DOT products include **Tim-bor**, **Armor-Guard and others**. DOT treatments must be made to unfinished surfaces as they will not penetrate paint or	Determine extent of infestation. Signs for powder post beetles are: flour-like “frass” dropping from pinhead-sized or slight larger holes, Anobiids’ frass are more gritty than Lyctids; adult beetles attracted to light may be found on window sills or foundation vents. Important to determine if infestation active or not. Mark or seal existing holes, vacuum existing sawdust, recheck wood for new holes in spring or early summer. These beetles damage wood slowly. If “frass” is yellow, caked or covered with dust or debris, that damage is old. Old house borers can be detected by hollow sound when wood tapped. **Prevention:** 1) Don’t use old lumber from a barn or wood pile unless it has been treated.

PESTS	DESCRIPTION	CONTROL MATERIALS AND METHODS	REMARKS
POWDERPOST AND OTHER WOOD-BORING BEETLES CONT'D Anobiid powderpost beetle **Roundheaded borers** Old house borers Others	Attack hardwoods and softwoods (beams, rafters, joists, studs and other structural framing). Infestations found in moist, poorly ventilated areas such as crawl spaces, basements, etc. Frass gritty. Head hidden by pronotum. Reinfest seasoned wood that may be decades old. **Presence indicated by large hard-shelled beetles with long antennae.** Broadly-oval ¼ inch emergence hole made by old house borer. Larvae in tunnels packed with frass; 3 eye spots to left and right of mandibles. Beetle 3/4 inch long, grey-brown with 2 patches on wing covers; 2 bumps on thorax. Reinfests seasoned softwoods (pine). Neat ½ inch holes may appear in walls where beetles emerge. Don't usually reinfest seasoned softwoods (pine).	varnish; sand or power wash logs prior to treatment. Paint, spray, inject or brush on. If infestation spreads into walls or between floors, fumigation may be needed. Fumigation is costly and should only be considered as a last resort. If only small articles infested, such as furniture, antiques, etc., they can be fumigated in a chamber at a lower cost. Only professional pest control operators licensed to fumigate can perform this operation. Rule 0080-09-04-.07 (New 2017) Now allows preventive treatment for reinfesting beetles, but prior to treatment, wood moisture content in the intended treatment area must be tested using a moisture inspection instrument designed to read moisture content in wood; at least five locations should show moisture content of at least 18%. The commercial pest control operator should provide a written report to the property owner listing and diagramming the conditions that warrant a preventive treatment.	(2) Don't use improperly dried or stored lumber. (3) Inspect firewood prior to bringing into structure. (4) Paint, varnish or otherwise seal wood to prevent exposed edges. (5) Seal previous emergence holes to prevent egg-laying sites. New houses usually infested by use of infested lumber. Adults may also come from firewood. **Alternative controls** for powder post beetles: small items, such as picture frames, can be heated at 120 to 140 F for six hours to kill existing life stages. Freezing (0 F) infested wood for 72 hours will also kill all life stages. If all evidence indicates the infestation is localized, wood could be replaced. Watch for new holes in adjacent areas. Decrease moisture in wood through ventilation and moisture barriers. Crawlspaces can also be enclosed. Central heat and air may reduce wood moisture so there is insufficient moisture to support large infestations in living areas. Wood kept below 14 percent moisture would be less suitable to Anobiid powderpost beetle reinfestation or development. Professionals should use moisture meters.
RATS PB 1868 EPA has changed allowances regarding use of rodenticide baits in the urban environment. Check for latest updates before using baits.	Norway rat: 12-18 inches, tail shorter than head and body, body heavy and thick, ears small Roof rat: 12-17 inches, tail longer than head and body, body light and slender, ears larger Young rat : 6-7 inches, feet large, head large House mouse: 6-7 inches feet small, head small Droppings: Roof rat: pointed, about ½ inch Norway rat: blunt, about 3/4 inch House mouse: pointed, about 1/8 inch	When rats are plentiful or where unsanitary conditions exist with shelter, poisoned baits are the best control method. Often community-wide control needed. Poison baits are available as ready-to-use premixed baits. They come in many forms: paraffinized blocks for outdoor use and high humidity areas; treated meal; seeds; or paraffinized pellets in bulk or in "place packs" for indoor use. Liquid baits are sold as packets of concentrate that are mixed with water. They are administered with a chick waterer and are useful in areas where rodent food is abundant. Poison baits should be placed where they are inaccessible to children and pets. Where rodent runs are exposed and in most outdoor situations, tamper proof bait boxes should be used and anchored. Vitamin K is the antidote for anticoagulants. **Second-Generation Anticoagulant Products for Professional Applicators** must contain at least 16 pounds of bait. Bait stations are required for all	Exclusion practices needed. Rats can fit through an opening ½ inch in diameter. Locate entrance into structure and exclude. Use materials such as galvanized, stainless or other non-rusting metal such as 24-gauge sheet metal or 19-gauge hardware cloth with 1/4 inch or smaller opening; brick, concrete block, tile or glass; steel wool or copper mesh with expandable foam; and others. Remove debris such as piles of waste lumber or trash, used feed sacks, abandoned large appliances and wood piles from next to structure. Store pet foods and seed in rodent-proof glass or metal containers. Place snap traps, multiple catch traps and glue boards along paths traveled by rats. Of the snap traps, the expanded trigger trap is the most versatile since it can be baited. Place trap 90 degrees to rodent pathway with trigger part of trap against the run. Rodents use edges of walls, studs and pipes as guidelines. Snap traps can be baited with: raisins or grapes for roof rats; sardines packed in oil for Norway

PESTS	DESCRIPTION	CONTROL MATERIALS AND METHODS	REMARKS
RATS CONT'D		outdoor, above-ground placements of second-generation anticoagulants. Bait stations are required indoors if exposure to children, pets, or nontarget animals is possible. Distribution to and sales in "consumer" stores including grocery stores, drug stores, hardware stores, club stores will be prohibited. All outdoor above-ground use must be in a bait station and be applied within 100 feet of buildings.	rats; bacon squares; or small wads of cotton. All rodenticides should be confined to tamper-resistant bait boxes. Baiting should be reserved for heavy rodent infestations, especially outdoors, due to the potential for rodents to die in accessible locations (no rodenticide drives rats outdoors to die). Many rats are shy of new baits. Consider pre-baiting with nontoxic baits. Leave bait stations in place for at least a week before moving. **Often area-wide effort needed.**
SILVERFISH AND FIREBRATS SP 341-O	Grayish, wingless, rapid-moving insects with 3 long tails. Feed on starchy materials such as bookbinding, wallpaper, cardboard, etc.	Niban Fine Granular Bait Maxforce Complete Granular Insect Bait Maxforce Fine Granule Insect Bait Tempo Ultra WP Cy-Kick Demand CS PT565 XLO PT Tri-Die Silica & Pyrethrum Dust (+Pressurized) Suspend SC DeltaDust Drione Talstar P	Treat crack and crevice where silverfish and firebrats may dwell. Attics many times source of infestation.
SKUNKS PB 1868	These animals many times live in the ground around or under homes.	Bac-Azap biological odor control or others can be applied to eliminate odors.	Trap and remove skunks from property. Seal the foundation to prevent entry under building.
SNAILS AND SLUGS	Long, grayish, shiny, soft-bodied creatures. Will attack various plants. Leave slime trails on walks and walls.	Snail and slug killer baits containing metaldehyde.	Remove boards and plastic or plant debris and dry damp areas adjacent to foundation.
SNAKES PB 1868	Snakes of various kinds den around or invade homes and other buildings. Most snake species are harmless and many provide benefits, such as control of rodents. Most venomous snakes in Tennessee can be recognized by their triangular-shaped head and vertical eye pupils.	Place a pile of cool, damp rags in building where snake was last seen. Snake will be attracted and can be removed. Large glue boards can trap snakes. Relocate the snake and use vegetable oil to dissolve the glue and release the snake unharmed.	Mouse-proof building. Mow lawns and field to control grass, weeds and brush. Remove boards, flat rocks, trash piles and other debris.
SOWBUGS OR PILLBUGS	Grayish, hard-shelled, many-legged creatures appear on walks and patios. Roll up in ball when disturbed. Occasional invaders.	Chemical control usually not necessary. If needed, apply to infested areas outdoors around perimeter of structure. This may stop any invasion into the house. Talstar P DeltaDust Suspend SC Tempo SC Ultra Astro	Remove leaf piles, grass clippings, old boards, wood piles and other debris from around foundation. Leave a 12-18-inch plant /mulch-free zone next to foundation base. Use exclusion practices: caulk cracks around foundation and screen vents in foundation. Drain and dry area around house.
SPIDERS or SCORPIONS PB 1193	Many kinds invade homes, basements and roof overhangs from outdoors. Two species most dangerous in Tennessee: **Black Widow**: dark black spider with red hour glass shape on bottom of abdomen. More of an outdoor pest along perimeter of buildings. Use outside perimeter treatment with residuals.	Dusts: Cimexa DeltaDust EcoPCO® D•X Dust Insecticide Tempo 1D PT Tri-Die Pressurized Silica & Pyrethrin Dust Drione Sprays: Demand CS Tempo Ultra WP Tempo SC Ultra	Beneficial organisms because they feed on pest insects. Occasional invaders that can be vacuumed or swept out the door. Remove wood or mulch piles away from house to lower abundance of their insect food source. Apply insecticides to crawl spaces, basements, attic, eaves and outdoor areas of home. Clean up debris where scorpions and spiders hide.

PESTS	DESCRIPTION	CONTROL MATERIALS AND METHODS	REMARKS
SPIDERS or SCORPIONS CONT'D PB 1191	**Brown Recluse**, light brown spider, with legs reaching to the size of a quarter or half dollar, dark violin shape on back of front portion of head, 3 pairs of eyes arranged in a semi-circle. Brown recluse pose a serious threat. Remove unnecessary clutter and webs from indoors and outdoors and vacuum especially, under furniture.	Cy-Kick Suspend SC TalstarP Space or aerosol: Pyrethrins Brown Recluse: Use residual sprays **(Demand, Tempo, Cy-Kick,** or others) around exterior foundation, eaves, closets, storage areas and rugs. Dusts can be applied to wall voids, attics and inaccessible crawl spaces and cracks and crevices. ULV or aerosol treatment with pyrethrins to kill exposed spiders and flush others onto surfaces treated with residuals.	Replace outdoor lights with yellow bug lights. Scorpions will fluoresce under a black light, so they and their breeding areas can easily be seen at night. Use glue boards to trap spiders and locate infested areas. Glue boards should be placed against walls and other guidelines where spiders are suspected. Efforts to control brown recluse will cause spiders to become more active. Prevent bites by checking shoes and clothing before wearing, by pulling beds away from walls, and preventing bed skirting and bedspreads from touching the floor. Place glue boards around home or structure to monitor activity and help reduce spider numbers.
SPRINGTAILS	Small, jumping insects with a forked spring mechanism. A dark species, called snow fleas, may be present in the winter.	If pest-proofing unsuccessful, try a perimeter treatment as for other occasional invaders. Cy-Kick CS Suspend SC Talstar P DeltaGard G Mavrik Perimeter	Usually found in moist decaying vegetation and are incidental invaders into houses. Prevent entry into home by pest-proofing. There are a few reports of large populations entering homes. Dry out surrounding landscape, water only in morning, etc.
TERMITES, SUBTERRANEAN PB 1344	Termites invade and eat wood and other cellulose material, causing extensive damage in structural parts of a building. Their presence may not be discovered until they swarm, years after infesting a structure. Workers light-colored, soft-bodied insects 1/8 to 3/16 inch long, soldier with a darkened head capsule. Swarmers are black, brown or tan with wings. Wings are easily broken off after the mating flight and may be found by windows. Swarmers are easily distinguished from winged ants by termite's straight antennae, broadly attached thorax to waist and four nearly equal wings. Subterranean termites with 2 thickened wing veins traveling the entire length of the fore wing. Inspect for signs of termite infestation such as irregular earthen tubes constructed across walls, floors and foundation. Hammer or probe timbers with a sharp instrument. Damaged wood will be soft, channeled, unsound and may possibly reveal the termite infestation itself. Use a moisture meter. Active termites will increase moisture reading relative to uninfested areas.	+ F = may also be foamed **Soil treatment:** Do not apply near (within 100 ft.) any body of water, cistern, or well. Nonrepellents (Newer a.i.s) Termites do not detect these insecticides and walk over the treated soil. Termiticide may be transferred back to colony. Chlorantraniliprole (no signal word) **Altriset 0.05%** (DuPont) chlorfenapyr **Phantom 0.125, 0.25%** (BASF)+Ffipronil **Termidor HE 0.125%** (BASF) Applications (2 gal/10 lin.ft., up to 2 ft deep, trench only 2 inch deep X 4 inch wide, 18 inch drill holes) differ from other liquid treatments, see Label for details. **Termidor HP, HPII** High Precision Injection System, see Label for details. **Termidor SC, 0.06%, 0.09%, 0.125%** (BASF) +F **Termidor 80WG, 0.06%, 0.09%, 0.125%** (BASF)+F imidacloprid **Premise 75, 0.05, 0.1%** (Bayer)+F **Premise 2 (small jobs and foaming)** (Bayer) Pyrethroids (Older a.i.) In general, this group tends to be repellent, thus treatments must be applied very carefully to create a continuous barrier. Today's uses restricted mostly to pre-construction treatments. Many generic pyrethroids are now on the market. bifenthrin **TalstarP 0.06, 0.12%** (FMC) + F permethrin **Prelude 0.5, 1, 2%** (Amvac) +F	Termidor allows an **Exterior Perimeter/Localized Interior treatment (EP/LIT) and** Premise allows an **Exterior Perimeter/Interior Spot Treatment**. Ensure localized interior treatment is made. Tennessee Department of Agriculture now prefers the use of a disclosure form if less than a complete treatment is applied. Applications following the Exterior Perimeter/Interior treatments of Termidor or Premise are now considered a full treatment. New NPMA 33 Wood-destroying Insect Infestation report required for most real estate transactions. Sample form and directions are found at npmapestworld.org **Follow the product label. Effective control measures for a soil treatment should include:** 1) Inspect basement and underside of house thoroughly to determine the area and extent of infestation. 2) Inspect attic for termite tubes and damage to joists, rafters, flooring and stored materials. 3) Trench the entire foundation inside and out and treat the soil replaced in the trenches with chemicals.

PESTS	DESCRIPTION	CONTROL MATERIALS AND METHODS	REMARKS
TERMITES, SUBTERRANEAN CONT'D	Termites commonly enter homes around doors, wooden steps and porches and unexcavated portions of structures. The easiest access points are where wood is in direct contact with the soil. Some termiticide labels have listed variable rates depending on soil type. Suggested volumes listed below are usually for the lowest rate. In general, horizontal barriers (under slab) should receive 1 gallon of diluted termiticide per 10 square feet or 1.5 gallons if coarse fill. Vertical barriers (along both sides of foundation wall, around plumbing, piers and conduits) should receive 4 gallons of dilution per 10 linear feet per foot of depth (into a trench 6 inches wide) to the top of the footing, not to exceed 4 ft. Voids in hollow masonry foundation walls should be treated at a rate of 2 gallons per 10 linear feet so the dilution will reach the top of the footing. Occasionally, moisture damaged wood in roofs can support an aerial infestation. No mud tubes will reach to ground. Attic inspection is important, too.	Combination product **Transport** 0.11% bifenthrin and acetamiprid (FMC) A more complete list of termiticides is available at https://www.fdacs.gov/content/download/91138/file/Termiticides-Table-Feb-2020.pdf but not all FL termiticides listed may be registered in Tennessee. **Baits:** Termites feed on bait and spread bait to colony to eliminate or suppress it. See PB 1344 for advantages and disadvantages of baits. **Sentricon Colony Elimination System** (DowAgrosciences LLC): Bait (**Recruit IV and Recruit IV AG**) contains a chitin synthesis inhibitor, noviflumuron. Bait **Recruit HD** allows once-a-year monitoring. **Hex-Pro Termite Baiting System** (DowAgrosciences LLC): Bait (**Shatter**) contains a chitin synthesis inhibitor, hexaflumuron. **Exterra Termite Interception and Baiting System** (Ensystex, Inc.) The Labyrinth Termite Bait contains a chitin synthesis inhibitor, diflubenzuron. In ground and above-ground stations. **Advance Termite Baiting System** (Whitmire-MicroGen) contains a chitin synthesis inhibitor, diflubenzuron. **TrelonaATBS** (BASF) contains a chitin synthesis inhibitor, novaluron.	4) Repair all foundation and basement floor and wall breaks with concrete of high cement content. 5) Break all wood-soil contacts, treat such areas with chemicals. 6) Treat infested timbers and replace those which are badly infested. 7) Treat hollow spaces in the foundation — concrete blocks, piers, chimney bases, spaces behind brick veneer. Drill and treat inside of porch foundations, under patios, under concrete slabs and the surface of ground under porches and similar dead places. 8) Provide ventilation and drainage beneath house and porches or enclose crawlspace. 9) Remove all scrap wood from beneath house.
TERMITES, DRYWOOD agrilife.org/aes/files/2010/06/Drywood-Termites.pdf	Swarmer with 3 thickened wing veins along the first third of the forewing. Soldier head capsule either rectangular with teeth on inner margin of left mandible or plug-shaped. All soldiers with pronotum as wide as, or wider than, head capsule. Workers feed in and across wood grain and leave six-sided fecal pellets piled below gallery openings. **No** mud present in galleries. Do **not** require connection to soil.	**Spot or Localized Treatment** Timbor (dust form) Termidor SC Termidor Foam Termidor Dry Others **Whole Structure or Chamber Fumigation** Sulfuryl Fluoride (requires structural fumigation license) Vikane Zythor Heat	Drywood termites may be controlled with a spot or localized treatment if the colony is small and accessible. If they are widely dispersed in structural lumbers, then a whole-house fumigation may be needed. Small infested items can be fumigated in a chamber. Although drywood termite distribution maps do not include Tennessee, several established populations are known from the Nashville area. Drywood termite infestations are most often introduced in furniture from Gulf Coast states, California or other subtropical areas.
TICKS PB 726 W 826	Brown or grey, oval to round, hard-shelled, 6-to-8-legged creatures which invade homes, yards and attach to pets and people. Depending on species, ticks can vector pathogens that cause disease. Exotic Asian longhorned tick now found in eastern and middle Tennessee counties. Females reproduce without males, have high reproductive potential and short generation times. High number of ticks on animals and in pastures. See tnticks.org for more information.	Insecticide applications are most effective when directed into areas where ticks and their animal hosts are likely to frequent. Pay particular attention to borders and fences between wooded or brushy areas and the lawn, around ornamental plantings, beside foot paths, house and dog house. Allow surface to dry before people or pets have access. Tempo SC Ultra Tempo Ultra WP Suspend DeltaGard G	Nonchemical methods for reducing tick problems include mowing the lawn and controlling weeds. This has three advantages — it lowers the moisture in the grass microclimate and allows sunlight to penetrate, which tends to cause ticks to dry out; it discourages rodents (which may serve as hosts) from nesting; and lastly, because there is less plant matter, less pesticide may be needed if a treatment is necessary. Also, removing debris, weeds or clutter from around the

PESTS	DESCRIPTION	CONTROL MATERIALS AND METHODS	REMARKS
TICKS CONT'D		Talstar P Astro and other synthetic pyrethroids Indoors for brown dog tick: Demand CS Talstar P Cy-Kick other pyrethroids Repellents: Apply deet to skin; and Permanone 0.5% spray to shoes, cuffs and socks. Heed directions about drying before wearing. Dogs: See pesticide recommendations at https://extension.uga.edu/content/dam/extension/programs-and-services/integrated-pest-management/documents/handbooks/2020-pmh-home-chapters/Animals%20(Pets%20and%20Honey%20Bee).pdf for a thorough listing of veterinarian supplied on-pet products	house discourages rodents from nesting. Remove leaf litter, especially along property boundaries or fence lines, to reduce tick numbers. Discourage wildlife from entering property. Ticks require a host that can be wildlife. Repair entry points into the house to discourage possible tick hosts from entering. Cracks and crevices, both indoors and out, can be sealed to reduce hiding places for ticks. Inspect and clean pets and their bedding frequently. If bedding is infested, it can be cleaned or destroyed. In the home, ticks stay around baseboards and walls. Use insecticides in cracks and crevice in the home for brown dog tick. Insecticide resistance can be a problem, particularly with the brown dog tick. Steam and vacuuming can suppress populations.
WASPS, HORNETS, YELLOW JACKETS SP 290-A SP 341-M	Many types build paper and mud nests around homes, in ground or in shrubs.	Dusts: Tempo 1D DeltaDust Drione Apicide Sprays: Bee and wasp killer aerosols Tempo Ultra WP Tempo SC Ultra PT Wasp Freeze II Victor Yellow Jacket Trap Traps can be used to reduce foraging yellow jacket populations. Place away from areas people congregate.	Wait until dark when wasps return to nest and are slower due to cooler temperatures. Apply insecticides to nest opening and seal nest opening if possible. Remove mud nests in winter to destroy overwintering forms. Paper wasp and other exposed wasp nests can be treated with pressurized sprays of insecticidal soaps, peppermint oil, eugenol and other natural insecticides. These insecticides most commonly work as contact killing agents only, so re-treatment may be needed.

Trade Name	Chemical Name or Use	IRAC MOA Classification[1]	Website
Advance Termite Bait System	diflubenzuron	15	BASF http://pestcontrol.basf.us/products/product-index.html
Advion Ant Bait Arena	indoxacarb	22	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Advion Ant Gel	indoxacarb	22	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Advion Cockroach Bait Arena	indoxacarb	22	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Advion Cockroach Gel Bait	indoxacarb	22	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Advion Evolution Cockroach Gel Bait	indoxacarb	22	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Advion Insect Granule	indoxacarb	22	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Alpine Cockroach Gel Bait Rotation 1	dinotefuran	4A	BASF http://pestcontrol.basf.us/products/product-index.html
Alpine Cockroach Gel Bait Rotation 2	dinotefuran	4A	BASF http://pestcontrol.basf.us/products/product-index.html
Alpine WSG	dinotefuran	4A	BASF http://pestcontrol.basf.us/products/product-index.html
Altosid Briquets (B), Liquid Larvicide, Extended Residual Briquets (XR-B), Pellets (P), Pro G	(s) methoprene	7A	Central Life Sciences https://www.centralmosquitocontrol.com/all-products
Altriset Termitcide	chlorantraniliprole	28	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Anvil 10 + 10	sumithrin and PBO	3A	Clarke Mosquito Control http://www.clarke.com/
Apicide	carbaryl	1A	Mystic Chemical Company https://www.mysticchemical.com/product-labels/
Aquabac xt, 200	Bacillus thuringiensis subspecies israelensis toxin	11A	Becker Microbial Products http://beckermicrobialproductsinc.com/#!/products
Archer	pyriproxyfen	7C	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Arilon	indoxacarb	22	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Armor-Guard	disodium octaborate tetrahydrate	8	Perma-Chink Systems https://www.permachink.com/preservatives/armor-guard
Astro	permethrin	3A	FMC http://www.fmcprosolutions.com
Bac-Azap	enzyme-producing bacteria and others		Nisus http://www.nisuscorp.com
Bedlam Plus	d-phenothrin. MGK-264, imidacloprid	3A, 4A	McLaughlin, Gormley, King Co https://mgk.com/professional-pest-control
Biomist 3 + 15 ULV, 1.5 + 7.5 ULV, 30 + 30 ULV	permethrin and PBO	3A	Clarke Mosquito Control http://www.clarke.com
Bora-Care	disodium octaborate tetrahydrate	8D	Nisus http://www.nisuscorp.com
CimeXa	amorphous silica gel		Rockwell Labs http://www.rockwelllabs.com
Cirkil	Neem oil	UNE	Terramerra, Inc. http://cirkil.com/products, http://cirkil.com/rag

Trade Name	Chemical Name or Use	IRAC MOA Classification[1]	Website
Crossfire Bed Bug Concentrate, Aerosol	clothianidin and metofluthrin	4A, 3A	MGK https://mgk.com/our-products
Cyanarox Insecticidal Bait	cyantraniliprole	28	Zoecon http://www.zoecon.com/sds-labels
Cynoff EC	cypermethrin	3A	FMC http://www.fmcprosolutions.com
CB-80	pyrethrin, PBO	3A	FMC http://www.fmcprosolutions.com
D-Fense SC	deltamethrin	3A	Control Solutions Inc. http://www.controlsolutionsinc.com
DeltaDust	deltamethrin	3A	Bayer http://www.backedbybayer.com/pest-management
DeltaGard G	deltamethrin	3A	Bayer http://www.backedbybayer.com/pest-management
Demand CS	lambda cyhalothrin	3A	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Demon WP WSP	cypermethrin	3A	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
DominAnt 1% Liquid Ant Bait	Sodium Tetraborate Decahydrate (Borax)	8D	Nisus http://www.nisuscorp.com
Drione	silica gel and pyrethrins	,3A	Bayer http://www.backedbybayer.com/pest-management
EcoPCO® D•X Dust Insecticide	2-phenethyl propionate & pyrethrins	,3A	Zoecon http://www.zoecon.com/products/botanicals
EcoRaider Bed Bug Killer	natural geraniol, cedar extract, sodium lauryl sulfate and natural derivative surfactant		EcoRaider https://ecoraiderusa.com
EndZone Insecticide Sticker	acetamiprid	4A	FMC http://www.fmcprosolutions.com
Exterra Termite Interception & Baiting System, Labyrinth Termite Bait	diflubenzuron	15	Ensystex http://www.ensystex.com
FUSE	Imidacloprid, fipronil	4A, 2B	Control Solutions Inc https://www.controlsolutionsinc.com/
Gentrol Aerosol, IGR concentrate	hydroprene	7A	Zoecon http://www.zoecon.com/sds-labels
Gentrol Point Source	hydroprene	7A	Zoecon http://www.zoecon.com/sds-labels
Gourmet Ant Bait Gel	disodium octaborate tetrahydrate	8D	Innovative Pest Control Products http://www.antcafe.com/index.html
Green Way Ant Killing Liquid Bait	disodium octaborate tetrahydrate	8D	Ant Cafe http://www.antcafe.com
Intice Thiquid Ant Bait	1% borax	8D	Rockwell labs http://www.rockwelllabs.com
Jecta	10% disodium octaborate tetrahydrate	8D	Nisus http://www.nisuscorp.com
Kicker	pyrethrin and PBO	3A	Bayer http://www.backedbybayer.com/pest-management

Trade Name	Chemical Name or Use	IRAC MOA Classification[1]	Website
Mavrik Perimeter	tau-fluvalinate	3A	Zoecon http://www.zoecon.com/sds-labels
Mattress Safe	bed encasement		Mattress Safe http://www.mattresssafe.com
Maxforce Ant Killer Bait Gel	fipronil	2B	Bayer http://www.backedbybayer.com/pest-management
Maxforce Roach Killer Small Bait Stations	hydramethylnon	20A	Bayer http://www.backedbybayer.com/pest-management
Maxforce Carpenter Ant Bait Gel	0.001% fipronil	2B	Bayer http://www.backedbybayer.com/pest-management
Maxforce Fleet	0.001% fipronil	2B	Bayer http://www.backedbybayer.com/pest-management
Maxforce FC Magnum Roach Killer Bait Gel	0.05% fipronil	2B	Bayer http://www.backedbybayer.com/pest-management
Maxforce FC Roach Bait Stations	fipronil	2B	Bayer http://www.backedbybayer.com/pest-management
Maxforce FC Select Roach Killer Bait Gel	fipronil	2B	Bayer http://www.backedbybayer.com/pest-management
Maxforce Fly Spot Bait	imidacloprid, Z-9-tricosene.	4A	Bayer http://www.backedbybayer.com/pest-management
Maxforce Impact Roach Gel Bait	clothianidin	4A	Bayer http://www.backedbybayer.com/pest-management
Maxforce Roach Killer Bait Gel	hydramethylnon	20A	Bayer http://www.backedbybayer.com/pest-management
Maxforce Quantum Ant Bait	0.03% imidacloprid	4A	Bayer http://www.backedbybayer.com/pest-management
MAXFORCE®COMPLETE Brand Granular insect Bait	1% hydramethylnon	20A	Bayer http://www.backedbybayer.com/pest-management
Maxforce Granular Fly Bait	imidacloprid	4A	Bayer http://www.backedbybayer.com/pest-management
Mosquitomist One	chlorpyrifos	1B	Clarke https://www.clarke.com/
Natular 2E,G,G30, XRT and T30	spinosad	5	Clarke https://www.clarke.com/
Niban FG = Niban Fine Granular Bait	orthoboric acid	8D	Nisus http://www.nisuscorp.com
Niban G = Niban Granular Bait	orthoboric acid	8D	Nisus http://www.nisuscorp.com
NiBor-D	disodium octaborate tetrahydrate	8D	Nisus http://www.nisuscorp.com
Nuvan Prostrip	dichlorvos	1B	AMVAC http://www.amvac.com
Optigard Ant Gel Bait	thiamethoxam	4A	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Optigard Cockroach Gel Bait	emamectin benzoate	6	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Optigard Flex	thiamethoxam	4A	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Phantom,PT, Phantom®II pressurized insecticide	chlorfenapyr	13	BASF http://pestcontrol.basf.us/products/product-index.html

Trade Name	Chemical Name or Use	IRAC MOA Classification[1]	Website
Precor Plus 2000 Premise Spray	permethrin, methoprene, phenothrin, etc.	3A, 7A, 3A	Zoecon http://www.zoecon.com/sds-labels
Precor Plus 2625 Premise Spray	etofenprox,tetramethrin, pyrethrins, PBO and s-methoprene.	3A,3A, synergist, 7A	Zoecon http://www.zoecon.com/sds-labels
Precor IGR Concentrate	methoprene	7A	Zoecon http://www.zoecon.com/sds-labels
Premise 75, 2	imidacloprid	4A	Bayer http://www.backedbybayer.com/pest-management
Prelude	permethrin	3A	AMVAC http://www.amvac.com
Prescription Treatment Advance 375A Select Granular Ant Bait	0.011% abamectin	6	BASF http://pestcontrol.basf.us/products/product-index.html
Prescription Treatment 388B Advance Ant Bait Gel	5.4% sodium tetraborate decahydrate (borax)	8D	BASF http://pestcontrol.basf.us/products/product-index.html
Prescription Treatment Advance Cockroach Gel Bait Reservoir	0.5% dinotefuran	4A	BASF http://pestcontrol.basf.us/products/product-index.html
Prescription Treatment Alpine Dust	dinotefuran and diatomaceous earth	4A	BASF http://pestcontrol.basf.us/products/product-index.html
Prescription Treatment Avert Dry Flowable Cockroach Bait Form 1	abamectin	6	BASF http://pestcontrol.basf.us/products/product-index.html
Prescription Treatment Cy-Kick, Cy-Kick CS	cyfluthrin	3A	BASF http://pestcontrol.basf.us/products/product-index.html
Prescription Treatment® Microcare® 3% CS Controlled Release Pyrethrins	pyrethrin, PBO + Other	3A	BASF http://pestcontrol.basf.us/products/product-index.html
Prescription Treatment Tri-Die Dust, PT Tri-Die Pressurized	silica, pyrethrin, PBO	,3A	BASF http://pestcontrol.basf.us/products/product-index.html
PT Wasp Freeze II	Prallethrins	3A	BASF http://pestcontrol.basf.us/products/product-index.html
Prescription Treatment Ultracide	nylar (pyriproxyfen), pyrethrins, permethrin, etc.	7C,3A,3A	BASF http://pestcontrol.basf.us/products/product-index.html
Prescription Treatment®221L Residual Insecticide	lambda-cyhalothrin	3A	BASF http://pestcontrol.basf.us/products/product-index.html
Prescription Treatment® 565 Plus XLO Formula 2	pyrethrin, PBO + others	3A	BASF http://pestcontrol.basf.us/products/product-index.html
Protect-A-Bed with BugLock™ 3 sided zipper system and ALLERZIP™seal (bed encasement for bed bugs)	bed encasement		Protect-A-Bed hhttp://www.protectabed.com/ttp://www.protect-a-bed.com
Recruit IV, Recruit IV AG, Recruit HD	noviflumuron	15	Corteva Agriscience http://www.cdms.net/Label-Database
Scion	Gamma-cyhalothrin	3A	FMC http://www.fmcprosolutions.com
Sentricon Colony Elimination System	noviflumuron	15	Corteva Agriscience http://www.cdms.net/Label-Database
Shatter	hexaflumuron	15	Corteva Agriscience http://www.cdms.net/Label-Database
Starbar Golden Malrin Fly Bait	methomyl	1A	Zoecon Professional Products http://www.zoecon.com/sds-labels

Trade Name	Chemical Name or Use	IRAC MOA Classification[1]	Website
Starbar Quikstrike Fly Bait	dinotefuran, z-(9) tricosene	4A	Zoecon Professional Products http://www.zoecon.com/sds-labels
Steri-Fab	d-phenothrin isoproponal & others	3A	Noble Pine Products Company http://www.sterifab.com/home.html
Suspend SC	deltamethrin	3A	Bayer http://www.backedbybayer.com/pest-management
Suspend Polyzone	deltamethrin	3A	Bayer http://www.backedbybayer.com/pest-management
Talstar P, PL	bifenthrin	3A	FMC http://www.fmcprosolutions.com
Tandem	thiamethoxam and lambda cyhalothrin	4A,3A	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx
Teknar CG, G	*Bacillus thuringiensis* subspecies *israelensis* toxin	11A	Valent BioScience http://publichealth.valentbiosciences.com/products
Tempo Ultra WP	β-cyfluthrin	3A	Bayer http://www.backedbybayer.com/pest-management
Tempo SC Ultra	β-cyfluthrin	3A	Bayer http://www.backedbybayer.com/pest-management
Temprid SC, RTS	imidacloprid, β-cyfluthrin	4A,3A	Bayer http://www.backedbybayer.com/pest-management
Termidor Dry, for drywoods or to supplement other subterranean termite treatments	fipronil	2B	BASF http://pestcontrol.basf.us/products/product-index.html
Termidor SC, 80 WG, HE, HP, HPII, Foam	fipronil	2B	BASF http://pestcontrol.basf.us/products/product-index.html
Terro-PCO Liquid Ant Bait	5.4% borax or sodium tetraborate decahydrate	8D	Nisus http://www.nisuscorp.com
Tim-bor	disodium octaborate tetrahydrate	8D	Nisus http://www.nisuscorp.com/
Transport GHP Insecticide	bifenthrin, acetamiprid	3A,4A	FMC http://www.fmcprosolutions.com
Transport Termiticide Insecticide	bifenthrin, acetamiprid	3A,4A	FMC http://www.fmcprosolutions.com
Trelona® ATBS	novaluron	15	BASF http://pestcontrol.basf.us/products/product-index.html
VectoBac GS, G, 12AS	*Bacillus thuringiensis* subspecies *israelensis* toxin	11A	Valent BioScience http://publichealth.valentbiosciences.com/products
VectoLex FG, WSP, WDG	*Bacillus sphaericus*	11B	Valent BioScience http://publichealth.valentbiosciences.com/products
Vendetta	abamectin B1	6	MGK http://www.mgk.com
Vendetta Plus	abamectin B1, pyriproxyfen	6,7C	MGK http://www.mgk.com
Vikane	sulfuryl fluoride	8C	Douglas Products http://www.cdms.net/Label-Database
Zenprox EC	etofenprox and PBO	3A	Zoecon http://www.zoecon.com/sds-labels
Zyrox Fly Granular Bait	cyantraniliprole	28	Syngenta http://www.syngentapmp.com/labels/labelsearch.aspx

Trade Name	Chemical Name or Use	IRAC MOA Classification[1]	Website
Zythor	sulfuryl fluoride	8C	Ensystex http://www.ensystex.com/pdf/81824-1%2005%2010%202013%20Zythor%20Label%20082120177.pdf

[1]*The IRAC Mode of Action (MoA) classification provides growers, advisors, Extension staff, consultants and crop protection professionals with a guide to the selection of acaricides or insecticides for use in an effective and sustainable acaricide or insecticide resistance management (IRM) strategy*. https://irac-online.org/modes-of-action/

PRECAUTIONARY STATEMENT

To protect people and the environment, pesticides should be used safely. This is everyone's responsibility, especially the user. Read and follow label directions carefully before you buy, mix, apply, store, or dispose of a pesticide. According to laws regulating pesticides, they must be used only as directed by the label and registered for use in your state.

DISCLAIMER STATEMENT

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label takes precedence over the recommendations found in this publication. Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others which may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product. The author(s), The University of Tennessee Institute of Agriculture and the University of Tennessee Extension assume no liability resulting from the use of these recommendations.

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