ANR-ENT-01-2024

Periodical Cicadas in Tennessee

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Background

Every year, several species of annual cicadas can be found in Tennessee, like the familiar dog-day cicada that produces the loud screeching chorus calls in the late summer. In addition to annual species, there are also periodical cicadas including three distinct species of 17-year cicadas (Magicicada septendecim, M. cassini, and M. septendecula) and four species of 13-year cicadas (M. tredecim, M. neotredecim, M. tredecassini, and M. tredecula) (Figure 1 a & b).

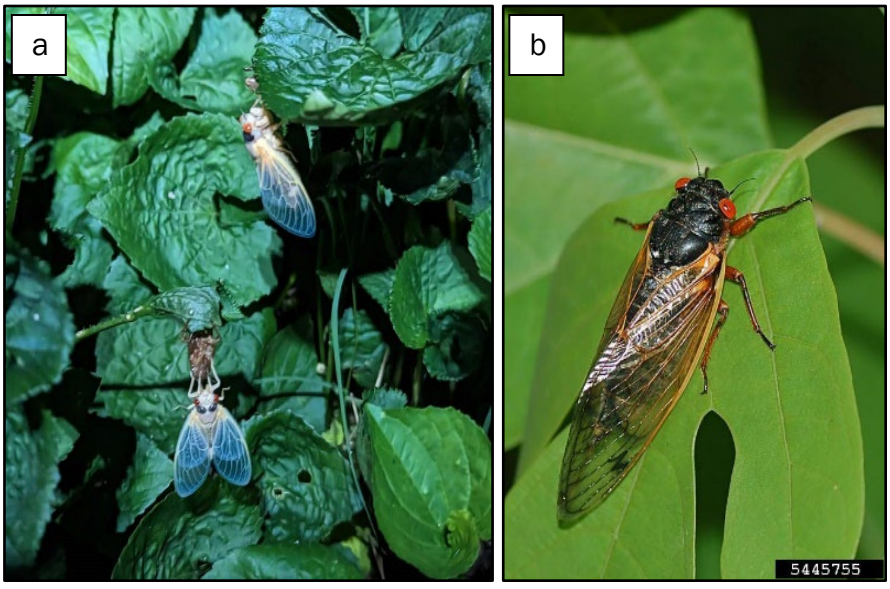


Figure 1a. Newly emerged adults, ©Karla Addesso, b. mature adult cicada, ©Jon Yuschock, Bugwood.org

The populations of these periodical cicadas emerge simultaneously in great numbers called broods. A single brood is made up of combinations of different species [8,9,14,15]. In the U.S., fifteen periodical cicada broods have been confirmed (Figure 2).

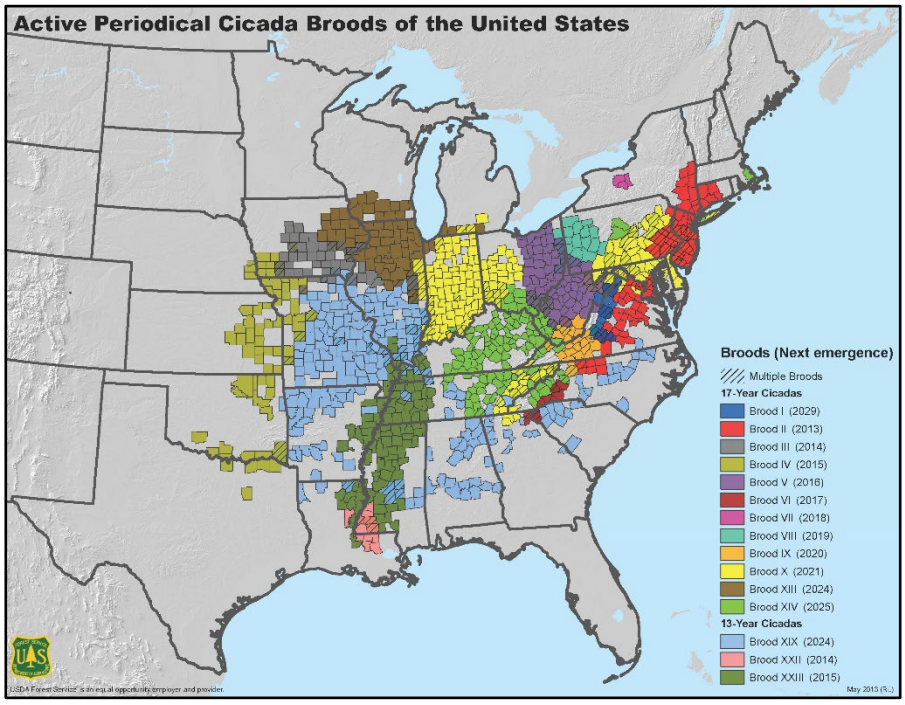


Figure 2. Active periodical cicada broods of the United States [14].

The chronological history of broods revealed that 13- and 17-yr cicadas (those appearing every 13 or 17 years, respectively) appear separately in the state of Tennessee [15]. Counties with substantial emergence reported are shaded grey in the following maps (Figs. 3-6) [8,9].

Figure 3. Brood XIX, known as The Great Southern Brood of the 13-year cicadas, last emerged in 2011 and returns in 2024.

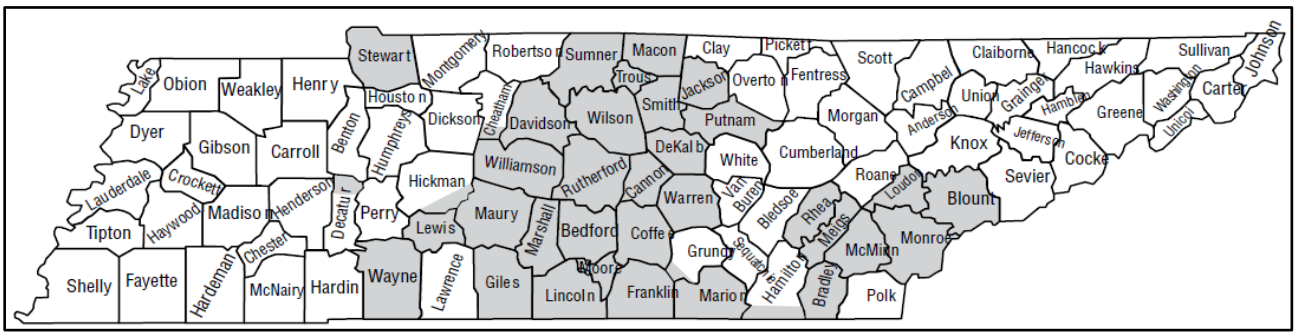


Figure 4. Brood X, The Great Eastern Brood of the 17-year cicadas, found primarily in East Tennessee, emerged in 2021 and returns in 2038.

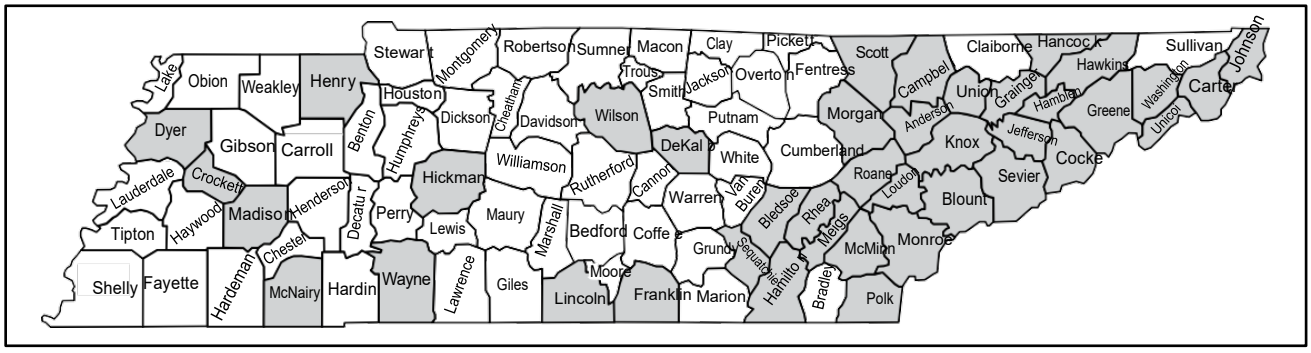


Figure 5. Brood XIV, 17-year periodical cicada distribution, emerged in 2008 and returns in 2025.

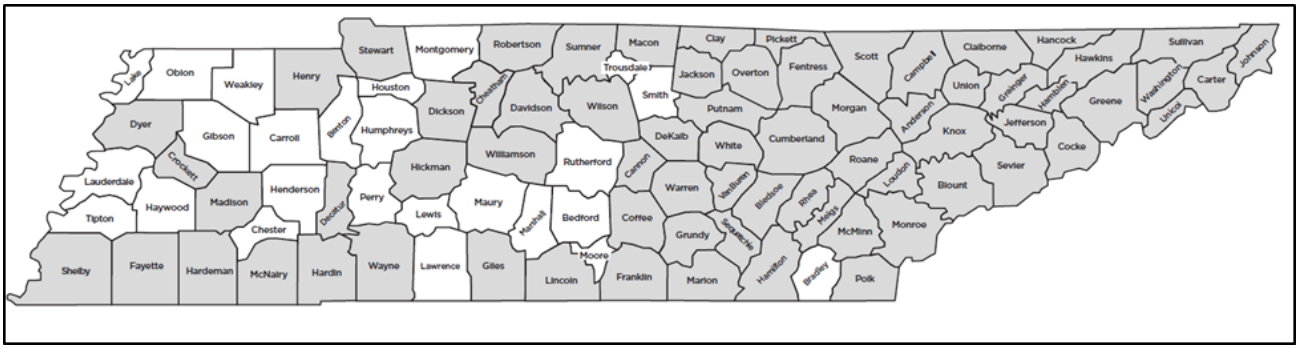
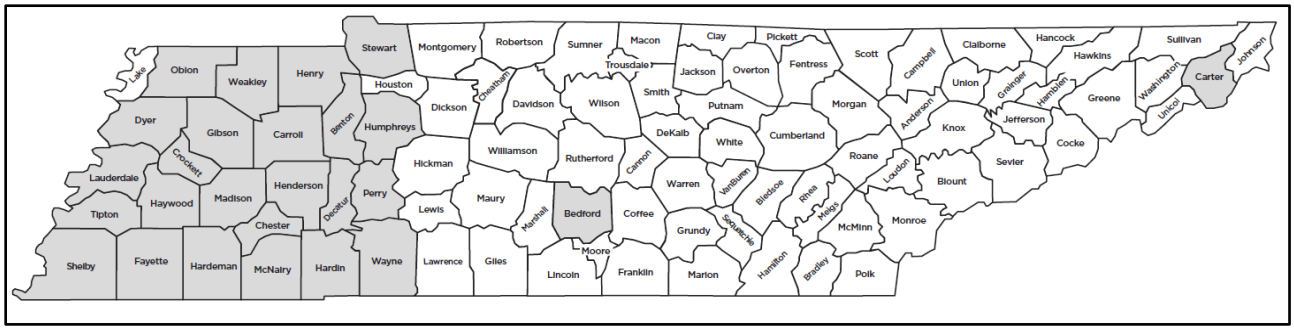


Figure 6. Brood XXIII, The Mississippi Valley Brood of the 13-year cicadas, last emerged in West Tennessee in 2015 and returns in 2028.



Description, Life Cycle, and Damage

Adult periodical cicadas are medium-size insects of ~2.5–4 cm [~1–1.5 in.] length [8]. The body is black, while the legs, eyes and wing veins are reddish-orange (Figure 1b) [8,15]. Mature nymphs are commonly found within the top 20 cm (~8 inches) of soil. When soil temperatures reach 18.0°C (~64.5°F), nymphs will begin digging to the surface. They

usually emerge in early May and the population count can differ greatly in density across the emergence area ranging from 20,000 to 3.7 million acres. After 5 days or longer and depending on temperature, adult cicada activities begin, both in flight and song, as they gain strength in their muscles. Adult males usually produce characteristic sounds in chorus trees during courtship to attract females. This high-pitched, shrill call is produced by two drum-like membranes on the side of the abdomen [8,11,16,20]. Following mating, the female cicada uses her knife-like ovipositor to deposit eggs into slits made on twigs of 3–14 mm (~0.12–0.55 in) diameter (Figure 7) [7,17,27]. The female can lay 24 to 28 eggs in each slit and will repeat this procedure, cutting numerous slits along the same branch and

Figure 7. Oviposition damage, © Cindy Perkovich

depositing more eggs. Each female can lay approximately 400 to 600 eggs during her lifetime, which can be four to five weeks [8,18].

Egg laying is the major cause of cicada damage in nurseries and newly planted orchards (Figure 7). Egg laying punctures cause the twig tips to wilt and leaves to turn brown; a condition referred to as “flagging” [22,28]. Also, egg-laying wounds can serve as entry routes for other insects and diseases [8,15,29]. After about a month, eggs hatch into wingless white nymphs with an ant-like appearance [8,18,20]. These nymphs fall from tree branches and dig into the moist soil using modified (fossorial) front legs until a suitable root is found [20,23]. Cicadas have piercing-sucking mouthparts, and nymphs feed by sucking xylem sap from the roots [13,25]. The nymphs continue to feed and develop for 13 or 17 years, depending on the species [8]. In their final year, the mature nymphs will emerge from the ground (Figure 8a) shortly after sunset and crawl onto a vertical surface, which is often the bark of young trees or neighboring vegetation [8,15,25]. At this stage, they molt for the last time and metamorphose into fully-winged adults on young trees [13,20, 25] during nighttime hours between 6pm and 9pm [20]. Newly emerged adults

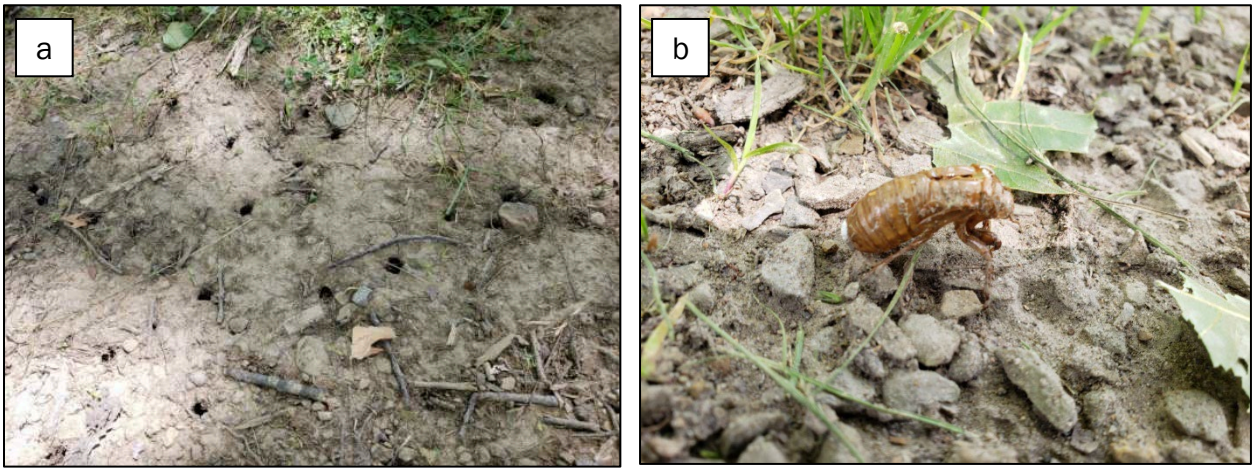


Figure 8 a. Cicada emergence holes and b. nymphal skin.

(called tenerals) have creamy white soft-bodies with red eyes. [8,13,15] (Figure 1a). During this process, the old empty nymphal skin (exoskeleton) is left behind (Figure 8b) [13,19, 20]. Over a few hours, the wings expand fully, and the body obtains its natural pigmentation (Figure 1b). Once the adult is fully hardened, it will fly into a nearby tree canopy and the life cycle repeats [8,13, 20].

Host Plants

Egg-laying damage by female cicadas have been observed on over 200 woody tree species (Figure 7) [19]. Woody trees with the most noticeable symptoms include American hophornbeam (Ostrya virginiana), American hornbeam (Carpinus caroliniana), apple (Malus spp.), ash (Fraxinus spp.), cherry (Prunus spp.), cypress (Cupressus spp.), dogwood(Cornus spp.), elm (Ulmus spp.), grapevines (Vitis spp.), hickory (Carya spp.), maple (Acer spp.), oak (Quercus spp.), peach (Prunus spp.), pear (Pyrus spp.), redbud (Cercis spp.), serviceberry (Amelanchier spp.), and willow (Salix spp.) [3,7,8,13,15,17,21,22].

During insurance appraisal of egg-laying damage in 2011 by Brood XIX (13-yr cycle) at seven Middle Tennessee nurseries, those trees determined to be “Damaged Beyond Repair” included: 7 species of oak, 4 species of maple and cherry, 3 species of redbud and peach/plum, and 2 species of elm, dogwood, and willow; single species included golden raintree, holly, honeylocust, London planetree, serviceberry, sourwood, sugarberry, and tulip poplar. During the 2021 cicada emergence at the TVA Melton Hill Dam Park, oviposition damage was observed on glossy abelia, Abelia × grandiflora [4].

Female cicadas have been reported to lay few or no eggs on pine trees or other resinous conifers [15, 20], on Japanese hollies (Ilex crenata ‘Compacta’, ‘Helleri’ and

‘Strokes’), burning bush (Euonymus alatus), spirea (Spiraea spp.), and mountain laurel (Kalmia latifolia) [22]. In 2021, after Brood X emergence at two commercial nursery sites in Milton, KY (Trimble County), little or no cicada injuries were observed on Cercis canadensis (L.) ‘Forest Pansy’, Liquidambar styraciflua (L.) ‘Hapdell’ and ‘Slender Silhouette’, and Prunus virginiana (L.) ‘Canada Red’ [4], suggesting some undesirable traits (e.g., color and scents) to female cicadas (31, 32, Airhart pers. comm., 2021).

Management Options

Adult cicadas of both sexes do not feed on foliage but have limited feeding activity on sap from twigs. They spend a major part of their adult lifetime engaging in chorusing, courtship, mating, and ovipositing behaviors. Management involves several distinct approaches, including mechanical, cultural, and chemical controls [1,5,6,7,8,15].

Mechanical control. Small trees can be protected by enclosing them in cheesecloth, tobacco canvas [8], mesh screenings (<1/2-inch or 3/8-inch openings [1.27 or 0.95 cm]) [19,21], and polypropylene fabric [7]. Ahern [1] reported netting gave the best protection and cost less than chemical control. Covering protection should be applied just before emergence until adults are gone 6–8 weeks later [2,16,19]. Protect ponds in ornamental plant facilities with screen or plastic mesh to avoid any buildup and decay of periodical cicadas (oxygen depletion of water has been observed when decaying cicadas are present); and regularly clean irrigation pond skimmers or filters during periodical cicada emergence to avoid any blockage [19].

Cultural control. The first step is to anticipate the next emergence year and modify the fall planting operations. If possible, plant trees that are less susceptible to periodical cicadas; avoid planting trees and shrubs on the land/site located in the vicinity of old orchards or deciduous forests; and delay fall and spring planting, budding, or grafting procedures prior to an emergence year [2,15,21]. In young tree plantings, delay canopy pruning until after cicada emergence so damaged branches can be removed and proper scaffold branches can be established.

Chemical control. Multiple insecticide products have been tested or recommended in the past for cicadas (2, 5,12,21,24). However, many of these reports are extension recommendations for other states or the products have been tested in fruit and nut tree crops and are not labeled for landscapes or nursery sites. Another concern is some of these products do not have periodical cicada on the insecticide label. After reviewing these publications and recommendations, one trend was that the most effective products on cicadas were pyrethroids (IRAC Group 3). Among the pyrethroid products labeled for

nurseries, the only one we could find with cicadas on the label was OnyxPro. Talstar P Professional also had cicadas on the label and was labeled for ornamentals in landscapes. An extension report from North Carolina reported kaolin clay (Surround WP) worked better than weekly pyrethroid sprays on cicadas [24]; however, be aware that the only kaolin label we could find allowing cicada treatments was Surround WP Agricultural Crop Protectant and that the cicada use was restricted to pome fruits (apple, quince, crabapple, pear, and loquat). One study found that imidacloprid reduced cicada oviposition damage by 50% [1], but again, we could not find a single imidacloprid label for nursery or landscape use with cicadas on the label. More research is under-way at Tennessee Tech University to evaluate other promising treatments, but some of these also may require label amendments. For the present time, it appears bifenthrin products like OnyxPro and Talstar P Professional may be the only insecticide products with labeling for cicadas and nursery and landscape use sites. Follow label instructions for application site and pest restrictions.

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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 always takes precedence over the recommendations found in this publication. Use of trade, brand, or active ingredient names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others that may be of similar and suitable composition, nor does it guarantee or warrant the standard of the product. The author(s) and Tennessee State University assume no liability resulting from the use of these recommendations.