



## Pests and Pesticides in Child-serving Facilities: An IPM Newsletter

### Special Points of Interest

### What are all of these larvae in my house? Small hive beetle

Karen Vail and Jennifer Tsuruda, UT Entomology & Plant Pathology, and Amy Dunlap, Davidson County Extension Office

Because honey bees and their pests may also occur in schools, I'm reprinting a recent [article](#) we wrote for the pest management industry below.

We currently lack a diagnostician at the UT Extension Soil, Plant and Pest Center (SPPC) in Nashville, so some insect submission photos are making their way to my inbox. In the June 12<sup>th</sup> submission I refer to in this article, five photos of an insect larva were attached, but no information was provided beyond the name and address of the submitter and their county Extension agent. The original images were slightly out of focus, and at first glance, the larva resembled a fly maggot, but then I noticed what looked like legs (Figure 1 A), shifting my suspicions to a larval beetle.

**Small hive beetle larvae, pests of honey bees, unexpectedly found wandering through a structure**



Figure 1. Lateral (A) and dorsal (B) views of larva in original photos. Note what looks like legs in photo A. (Credit: Robert Florence, UT SPPC)

I first compared these to images of larval stored product pests. I could almost see urogomphi at the terminal end of the larvae (Figure 1B), which would be found in a red or confused flour beetle. But, the larvae in the photos were about 1 cm (although the image measurement in Figure 1A indicates 1.388 cm) and red and confused flour beetles are much smaller and their exoskeletons are more sclerotized or hardened. I continued to compare larvae of other stored product pests, but none were a match. Striking out and not having the actual specimens in front of me to use a taxonomic key, I decided to use Google to search for "1.4 cm beetle larva" images and that's when I noticed a strong resemblance to the small hive beetle larvae. (This beetle larva was actually 0.9 cm, but fortunately, the eggs are 1.4 mm long and the Google search found that 1.4. I'll notify the SPPC lab of the measurement inaccuracy in their photos [Figure 1]).

### This issue

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I indicated my suspicion to the homeowner and county agent and asked for more background information. The follow-up

inquiry yielded the following slightly modified response from the homeowner:

"They are in our upstairs duct work in our 4-year-old house. They come out in the bedroom. There is also a tech room upstairs that they come out in. We don't know if they are in our hardwood floors..or WHERE they come from.

Also downstairs..at entrance to sliding glass doors they come out. Last night lots came out...after we thought we rid of them all. We had exterminator..give up...he didn't know what they were. He never treated it..saying he can not spray duct work. We are going crazy dealing with these maggots in our immaculately clean house. HELP !"

Fortunately, I was scheduled to speak at the Tennessee Department of Agriculture's Apprentice Termite Technician School in Nashville the next day. I arrived early enough to visit the SPPC and peruse Alvah Peterson's two-volume set "Larvae of Insects" which contains many line drawings of immature insects organized by orders and families. Failing to find the specimen of inquiry in this book, I stopped by the diagnostic laboratory, placed a few of the specimens in a vial of ethanol, stuffed it into my purse and headed off to the training. The next morning, I placed a larva under the microscope and confirmed that this 0.9 cm long larva was a small hive beetle, *Aethina tumida* Murray (Figure 2,3).



Figure 2. Dorsal view of the small hive beetle larva, *Aethina tumida* Murray. (Credit: Karen Vail, UT E&PP)

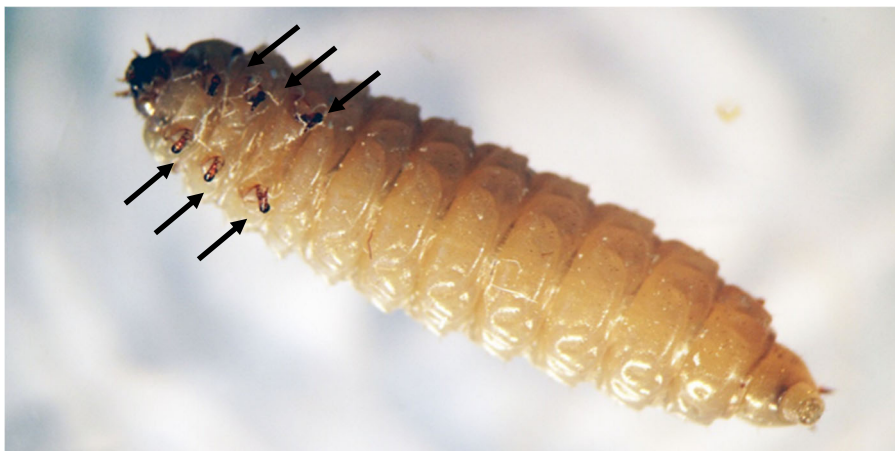


Figure 3. Ventral view of the small hive beetle larva with darkened, nimble legs visible (arrows). (Credit: Karen Vail, UT E&PP)

The small hive beetle (SHB) is native to sub-Saharan Africa and was first discovered in the US in the mid to late 1990s. It's now found throughout the southeastern US and beyond and is considered a significant pest of the honey bee *Apis mellifera* due to its consumption of the brood, pollen and nectar in the hives. The adult beetles emerge from the soil where they pupated and fly to bee hives in the evening (before or just after dusk) attracted by the bee and hive odors. The adult SHB (Figure 4) find a crack or crevice to hide in while worker bees attempt to keep them confined to these spaces and away from the brood combs. The beetles trick the bees into feeding them by soliciting regurgitated nourishment by stroking the bees' mandibles with the beetles' antennae. SHB eggs are laid on food sources including pollen patties or brood cells (Figure 5). With females laying 1000 – 2000 eggs in a lifetime, it's easy to see how populations explode. The larvae eclose and feed for about two weeks (larval development may be slightly quicker or substantially longer, >30 days) after which they wander away from the food source at night, and down to the ground where they pupate. When SHB builds large numbers, the honey bee colony may abandon the nest site (Figure 6).



Figure 4. An adult small hive beetle (5.7 mm, black arrow) about one-third the size of a honey bee. (Credit: Jennifer Tsuruda, UT E&PP)



Figure 5. Small hive beetle eggs (white arrow) on a pollen patty. (Credit: Jennifer Tsuruda, UT E&PP)



Figure 6. High numbers of small hive beetle led to this honey bee colony abandoning the nest site. (Credit: Jennifer Tsuruda, UT E&PP)

SHB belongs to the family Nitidulidae and nitidulids are also called sap beetles, so, I suspected there was a honey bee colony or possibly fermenting fruits, vegetables or other organic matter somewhere indoors. Further inquiry with the homeowner revealed that gutter repairers had recently commented about the number of bees they encountered. So mystery solved – the homeowners saw all of these larvae as they exited the bee colony searching for soil in which to pupate. According to Ellis and Ellis (2019), "Larvae in the wandering stage may wander great distances from the hive to find suitable soil."

Update - Amy Dunlap, Davidson County Extension, just returned from a visit to this home. In this case, the SHB larvae may have wandered two stories in an attempt to pupate in the soil. Discussions with a local beekeeper indicated he believes that homes in this Nashville area are more prone to honey bee infestations. He also speculated that the honey bee colony was probably in decline due to the large number of SHB larvae seen. Approximately 50 – 75 SHB larvae were found on glue boards on several levels of the home in the past week (Figure 7A). SHB larvae were downstairs on the bottom level by a sliding glass door that led outside. The highest numbers were found upstairs in two different rooms on the same side of the house. The homeowner had observed the SHB larvae on the floor, but didn't know where they originated. Amy noticed a bunch of larvae trapped in the light fixture above (Figure 7B) and bees were seen coming and going from an area outside the home that aligned with where hive beetles were seen in the light fixture (Figure 7C).



Figure 7. A glue board (A) and light fixture (B) with SHB larvae trapped inside. Bees were seen going to and from the structure in the area within the white circle that aligned with the light fixture (C). (Credit: Amy Dunlap, Davidson County Extension.)

Throughout the years, we've had several submissions of the small hive beetle larvae that were associated with structures. Interestingly, none of these submitters indicated that bees were present. The residents were often unaware that they were living with bees, and in at least one case, the pest management professional did not think the larvae were related to the bee colony, so they didn't report it.

While we went through great effort to identify the small hive beetle, that was the easy part. Now starts the difficult part of (1) removing or killing the bees, and (2) excavating all of the bee colony materials including (a) the beeswax, which is flammable, can attract moths, and can melt and stain walls, (b) honey which can attract ants, cockroaches and mice, and



(c) any brood (developing bees) which can also attract pests.

Usually, this process requires some destruction of the housing materials which must then be replaced. In the past, we've used an infrared camera and boroscope to help locate bees in a wall (Figure 8), which may also help find the nest in this situation. And if the colony is above the first floor, a cherry picker, ropes and harnesses, and/or ladders (Figures 9) may be required. It will not be a simple task, and may be a prolonged and costly process.

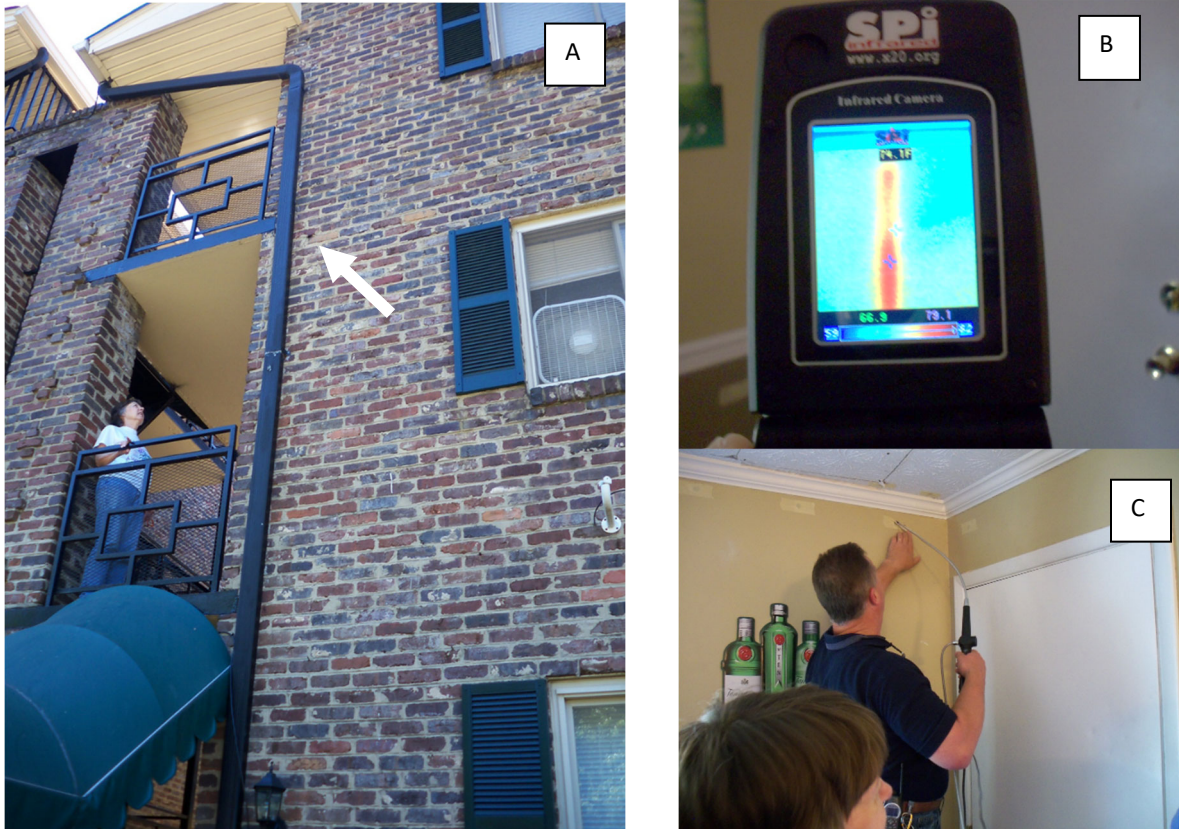


Figure 8. A honey bee colony located on the exterior wall of second-floor brick apartment building (A) was detected using an infrared camera (B) and confirmed with a boroscope (C). A hole in the brick (white arrow) allowed the bees to enter. (Credit: Karen Vail, UT E&PP).



Figure 9. Wood siding cut out from a home reveals the remains of a honey bee colony (A). A ladder and forklift assisted the removal of the remains (B). (Credit: Jennifer Tsuruda, UT E&PP)

Instead of describing the details of removing bees from a wall, we've provided a few links with comments from Jennifer Tsuruda, UT E&PP's apiculture specialist.

TN Dept of Ag's website on "Bees inside a wall" mentions removing the bees and comb from the wall due to the comb being made from beeswax, which is flammable, and the honey attracting pest insects: <https://www.tn.gov/agriculture/businesses/bees/bees-inside-a-wall.html>

Clemson University's factsheet on removing bees from structures - the section on removal from walls mentions how simply killing/removing the bees and leaving is risky due to the comb and its contents attracting moths, ants, and mice. The section on removal by trapping mentions the long timeframe typically involved - it can go on for months and is often still unsuccessful.

<https://www.clemson.edu/extension/beekeepers/fact-sheets-publications/honey-bee-colony-removal.html>

And here is a factsheet from the University of GA on Bees in Walls - this factsheet states that the entire nest, including bees and combs, must be removed and that there is a risk of the comb melting and staining walls.

<https://extension.uga.edu/publications/detail.html?number=C824&title=Honey%20Bee%20Swarms%20and%20Bees%20in%20Walls>

Sources:

Ellis, J. D. and A. Ellis. 2019. Featured Creatures: small hive beetle. [https://entnemdept.ufl.edu/creatures/misc/bees/small\\_hive\\_beetle.htm](https://entnemdept.ufl.edu/creatures/misc/bees/small_hive_beetle.htm) accessed June 14 2023

Zawislak, J. 2019. Managing Small Hive Beetles. <https://bee-health.extension.org/managing-small-hive-beetles/> accessed June 14 2023

#### Upcoming educational event by UT



**9TH ANNUAL TENNESSEE BED BUG, COCKROACH & RODENT  
MANAGEMENT MEETING  
WEDNESDAY AUGUST 2, 2023**

**UNIVERSITY OF TENNESSEE** CONFERENCE CENTER | 600 HENLEY STREET | KNOXVILLE, TENNESSEE 37902

Check-in starts at 8:00 AM | Meeting 8:30 – 4:30 EDT

See <https://bedbugs.tennessee.edu/resources/events/> for the finalized schedule, CEU assignment and registration information.

## Four School Districts Needed to Conduct Fire Ant Baiting Demonstrations

Karen M. Vail

While most people react to fire ant stings with a burning sensation followed by a pustule, a small percentage are hypersensitive to the ant's venom and can experience anaphylactic shock. To help schools limit their students, staff and visitors' exposure to fire ants on their properties, Jennifer Chandler and I seek school systems to participate in a baiting demonstration. For this demonstration, we would guide your staff in a broadcast bait application (Figure 10) and individual mound treatments with a fire ant bait. Demonstrations on fire ant baiting are another free service we provide through a grant by the USDA, NIFA, CPPM, Extension Implementation Grant (#2021-70006-35577) awarded to the University of Tennessee.

Planning a bait demonstration is tricky because we need to be aware of the impending weather. Baits work best when fire ants are optimally foraging which typically occurs when temperatures are between 70 and 95 degrees F at **one inch below the soil surface**, although I prefer to apply the bait when temperatures are in the 80s. Spring and fall tend to be the optimal times to bait.

As we plan for the upcoming school year, we seek four school systems to participate. We can demonstrate baiting techniques in the fall or spring.

**If you would like to schedule a fire ant bait demonstration at your school, please contact me at [kvail@utk.edu](mailto:kvail@utk.edu).**



Figure 10. A broadcast bait application demonstration in a rural Tennessee county.

**BAIT COLLECTION - OUNCES CAUGHT**

Table 1. Chart to determine pounds of fire ant bait caught per acre, based on ounces of product caught for given calibration areas (yellow highlighted areas on the chart are the desired 1 to 1.5 pounds per acre range).

Calibration Area	Ounces Caught																				
	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1	1.05
1	1.391	2.723	4.084	5.445	6.806	8.168	9.529	10.890	12.251	13.613	14.974	16.335	17.696	19.058	20.419	21.780	23.141	24.502	25.864	27.225	28.586
2	0.681	1.361	2.042	2.723	3.404	4.084	4.764	5.445	6.126	6.806	7.487	8.168	8.848	9.529	10.209	10.890	11.571	12.251	12.932	13.613	14.293
3	0.454	0.908	1.361	1.815	2.269	2.723	3.176	3.630	4.084	4.538	4.991	5.445	5.899	6.353	6.806	7.260	7.714	8.168	8.621	9.075	9.529
4	0.340	0.681	1.021	1.361	1.702	2.042	2.382	2.723	3.063	3.403	3.743	4.084	4.424	4.764	5.105	5.445	5.785	6.126	6.466	6.806	7.147
5	0.272	0.545	0.817	1.090	1.361	1.634	1.906	2.178	2.450	2.723	2.995	3.267	3.539	3.812	4.084	4.356	4.628	4.901	5.173	5.445	5.717
6	0.222	0.444	0.666	0.888	1.110	1.332	1.554	1.776	2.000	2.222	2.444	2.666	2.888	3.110	3.332	3.554	3.776	4.000	4.222	4.444	4.666
7	0.194	0.388	0.582	0.776	0.970	1.164	1.358	1.552	1.746	1.940	2.134	2.328	2.522	2.716	2.910	3.104	3.298	3.492	3.686	3.880	4.074
8	0.170	0.340	0.510	0.681	0.851	1.021	1.191	1.361	1.531	1.702	1.872	2.042	2.212	2.382	2.552	2.722	2.892	3.062	3.232	3.403	3.573
9	0.151	0.303	0.454	0.605	0.756	0.907	1.058	1.210	1.361	1.512	1.663	1.814	1.965	2.116	2.267	2.418	2.569	2.720	2.871	3.022	3.173
10	0.136	0.272	0.408	0.545	0.681	0.817	0.953	1.089	1.225	1.361	1.497	1.634	1.770	1.906	2.042	2.178	2.314	2.450	2.586	2.723	2.859
11	0.124	0.248	0.371	0.495	0.619	0.743	0.866	0.990	1.114	1.238	1.361	1.485	1.609	1.733	1.856	1.980	2.104	2.228	2.351	2.475	2.599
12	0.113	0.227	0.340	0.454	0.567	0.681	0.794	0.907	1.021	1.134	1.248	1.361	1.474	1.588	1.701	1.815	1.928	2.042	2.155	2.269	2.382
13	0.105	0.209	0.314	0.419	0.524	0.629	0.733	0.838	0.942	1.047	1.152	1.257	1.361	1.466	1.571	1.675	1.780	1.885	1.990	2.094	2.199
14	0.097	0.194	0.292	0.389	0.486	0.583	0.681	0.778	0.875	0.972	1.070	1.167	1.264	1.361	1.458	1.556	1.653	1.750	1.847	1.945	2.042
15	0.091	0.182	0.273	0.363	0.454	0.545	0.635	0.726	0.817	0.907	0.998	1.089	1.180	1.271	1.361	1.452	1.543	1.634	1.724	1.815	1.906
16	0.085	0.170	0.256	0.340	0.425	0.510	0.595	0.681	0.766	0.851	0.936	1.021	1.106	1.191	1.276	1.361	1.446	1.531	1.616	1.702	1.787
17	0.080	0.160	0.240	0.320	0.400	0.480	0.561	0.641	0.721	0.801	0.881	0.961	1.041	1.121	1.201	1.281	1.361	1.441	1.521	1.601	1.682
18	0.076	0.151	0.227	0.303	0.379	0.454	0.529	0.605	0.681	0.756	0.832	0.908	0.984	1.059	1.134	1.210	1.286	1.361	1.437	1.513	1.588
19	0.072	0.143	0.215	0.287	0.359	0.430	0.502	0.573	0.645	0.716	0.788	0.860	0.931	1.003	1.075	1.146	1.218	1.290	1.361	1.433	1.505
20	0.068	0.136	0.204	0.272	0.340	0.408	0.476	0.545	0.613	0.681	0.749	0.817	0.885	0.953	1.021	1.089	1.157	1.225	1.293	1.361	1.429
21	0.065	0.130	0.194	0.259	0.324	0.388	0.454	0.519	0.584	0.649	0.714	0.779	0.844	0.909	0.974	1.039	1.104	1.169	1.234	1.299	1.364
22	0.062	0.124	0.186	0.248	0.310	0.371	0.433	0.495	0.557	0.619	0.681	0.743	0.804	0.866	0.928	0.990	1.052	1.114	1.176	1.238	1.299
23	0.059	0.118	0.176	0.237	0.296	0.355	0.414	0.473	0.533	0.592	0.651	0.710	0.769	0.828	0.888	0.947	1.006	1.065	1.125	1.184	1.243
24	0.057	0.113	0.170	0.227	0.284	0.340	0.397	0.454	0.510	0.567	0.624	0.681	0.737	0.794	0.851	0.909	0.966	1.021	1.078	1.134	1.191
25	0.054	0.109	0.165	0.218	0.272	0.325	0.381	0.436	0.490	0.545	0.599	0.653	0.708	0.762	0.817	0.871	0.926	0.980	1.035	1.089	1.143
26	0.052	0.105	0.157	0.209	0.262	0.314	0.368	0.419	0.471	0.524	0.578	0.628	0.681	0.733	0.785	0.838	0.890	0.942	0.995	1.047	1.099
27	0.050	0.101	0.151	0.202	0.252	0.303	0.353	0.403	0.454	0.504	0.555	0.605	0.656	0.706	0.756	0.807	0.857	0.908	0.958	1.009	1.059
28	0.049	0.097	0.146	0.194	0.243	0.291	0.339	0.388	0.436	0.485	0.533	0.581	0.629	0.678	0.726	0.775	0.823	0.871	0.920	0.968	1.017
29	0.047	0.094	0.141	0.188	0.235	0.282	0.329	0.376	0.422	0.469	0.515	0.561	0.607	0.654	0.701	0.748	0.794	0.841	0.887	0.934	0.981
30	0.045	0.091	0.136	0.182	0.227	0.272	0.318	0.363	0.409	0.454	0.499	0.545	0.590	0.635	0.681	0.726	0.771	0.817	0.862	0.908	0.953
31	0.044	0.088	0.132	0.176	0.220	0.263	0.307	0.351	0.395	0.439	0.483	0.527	0.571	0.615	0.659	0.703	0.747	0.791	0.835	0.879	0.923
32	0.043	0.085	0.128	0.170	0.213	0.256	0.298	0.340	0.383	0.425	0.468	0.510	0.553	0.595	0.638	0.681	0.723	0.766	0.808	0.851	0.893
33	0.041	0.083	0.124	0.165	0.206	0.246	0.289	0.330	0.371	0.413	0.454	0.495	0.536	0.578	0.619	0.660	0.701	0.743	0.784	0.825	0.866
34	0.040	0.080	0.120	0.160	0.200	0.240	0.280	0.320	0.360	0.400	0.440	0.480	0.520	0.560	0.601	0.641	0.681	0.721	0.761	0.801	0.841

Figure 11. A bait calibration chart used during the demonstration.

Credit: <https://fireants.tennessee.edu/wp-content/uploads/sites/208/2020/11/Publications-CalibratingABaitSpreader-PB1817.pdf>

To learn more about fire ant management on school property, see PB1788 Managing Fire Ants in and around Tennessee's Schools, <https://extension.tennessee.edu/publications/Documents/PB1788.pdf>. For a list of fire ant products registered for use on school property, see <https://extension.tennessee.edu/publications/Documents/W649.pdf>.

Can you please make your pest management professional aware of the following opportunity?

## ACE (Associate Certified Entomologist) Prep Course Fall 2023

Are you certified in pesticide applicator category 7 with a minimum of 5 years of verifiable pest management experience in the United States? Then you may be ready to become an ACE, an associate certified entomologist. Before you can become an ACE, you will need to provide two letters of professional reference, be willing to adhere to the [ACE Code of Ethics](#), [complete the application and pay the application fee to the Entomological Society of America](#) and pass an online test of your knowledge of structural pest control. The program and its benefits are explained in its entirety at <https://entocert.org/ace>. The application process is separate from the training offered below.

To help you prepare for the exam, Dr. Karen Vail, Extension Urban Entomologist of the UT Department of Entomology & Plant Pathology will provide an ACE Prep Course this fall. All training sessions will be virtual and held 5 – 6 pm on select Mondays via Zoom. A new Zoom link will be sent each week. By offering online training, we no longer limit participants to be within a few hours' drive of campus!

2023 Training Date	Subject
September 11	Integrated Pest Management and Tools
September 18	Insecticides and Modes of Actions
September 25	Pesticide Safety, Laws & Labels
October 2	Insect Biology and Morphology
October 9	Ants
October 16	Cockroaches
October 23	Flies
October 30	Stinging and Biting Arthropods
November 13	Stored Products Pests
November 20	Occasional Invaders
November 27	Wood-destroying Organisms
December 4	Common Commensal Pests/Review
December 10	Specimen review in the afternoon
<b>December 11* 5 pm – 8 pm</b>	<b>Exam (limited to 15)*</b>

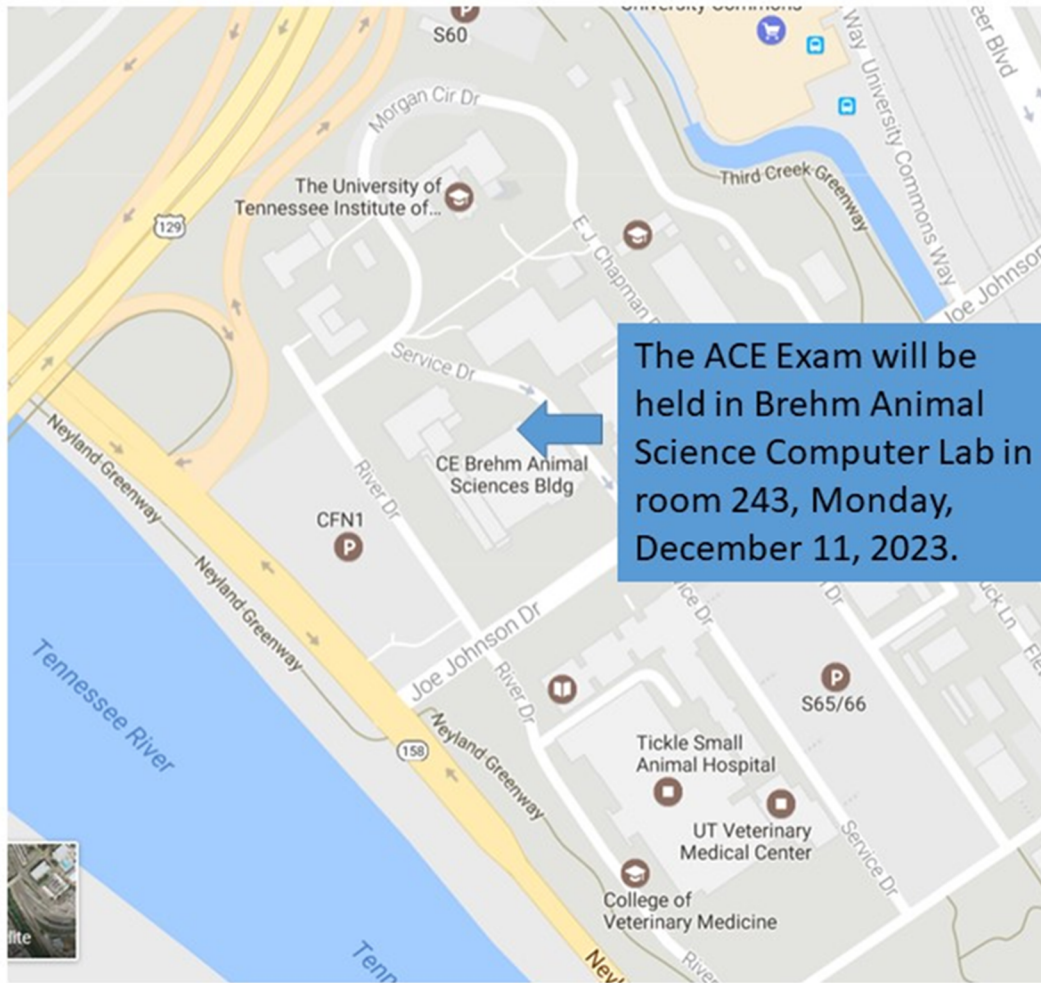
\*The ACE exam will be given in room 243 Computer Lab of the Brehm Animal Science Building.

You can register for all classes of the ACE Prep Course at one time for a discounted price of \$300 or pay \$30 for each class as long as you register at least one week before the training date. Enrollment is limited to 25 per training date. One Tennessee recertification point per session. The course will only be held if at least 5 register before August 31<sup>st</sup>.

**Register for the UT ACE Prep Course online at**  
<https://tiny.utk.edu/ACEPrepFall2023>



## ACE Exam Location - UT Institute of Ag Campus Map



As long as it's after 5pm, you can park in lot CFN1.

We suggest you purchase the *IPM for the Urban Professional: A Study Guide for the Associate Certified Entomologist* from ESA

(<https://entocert.org/ace/resources>) and the *NPMA Field Guide to Structural Pests*

(<https://ebiz6personal.npmapestworld.org/UI/ProductDetails.html?productId=703>) prior to taking the training. The NPMA manual is also available as a downloadable phone app (available for [Apple iOS](#) or [Google](#)) and comes with an annual fee. The ESA study guide is discounted when you purchase it with your ACE application. In the past, shipping of the manuals has been greatly delayed, so order the manuals as soon as you sign up for the class!

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Partial support for this newsletter provided by the USDA  
 NIFA CPPM EIP grant (# 2021-70006-35577) awarded to the  
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For more information about IPM in Tennessee schools and other facilities, or to view past issues of *Pests and Pesticides in Child-serving Facilities*, please visit <http://schoolipm.tennessee.edu>

### NATIONAL IPM INFORMATION

eXtension's Pests in the Home  
<https://pestsinthehome.extension.org/>

National School IPM  
[schoolipm.ifas.ufl.edu/](http://schoolipm.ifas.ufl.edu/)

IPM in Schools Texas  
<http://schoolipm.tamu.edu/>

IPM Institute of North America  
[www.ipminstitute.org/](http://www.ipminstitute.org/)

The Pest Defense for Healthy Schools Online IPM Training  
 for School Employees [pestdefenseforhealthyschools.org](http://pestdefenseforhealthyschools.org)

EPA schools  
<http://www2.epa.gov/managing-pests-schools>

For further information about the IPM program at your school or in your county, contact your county Extension Agent or the school IPM Coordinator. For county agent contact information, please visit <https://utextension.tennessee.edu/office-locations-departments-centers/>

## 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

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 or brand 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, suitable composition, nor does it guarantee or warrant the standard of the product. The author(s), the University of Tennessee Institute of Agriculture and University of Tennessee Extension assume no liability resulting from the use of these recommendations.

Programs in agriculture and natural resources, 4-H youth development, family and consumer sciences, and resource development. University of Tennessee Institute of Agriculture, U.S. Department of Agriculture and county governments cooperating. UT Extension provides equal opportunities in programs and employment.