The Gloworm

We carry home as prizes
funny bugs, of handy sizes,
just to give the day a scientific tone.
–Charles Edward Carryl

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Celebrating 20 Years of Chasing Bugs and Raising Entomologists!

After some confusion as to what year Bug Camp started, we can now report completing our 20th year of Bug Camp, now Bug and Plant Camp. During this time we have conducted 27 camps and introduced over 1,200 campers to entomology. Of those, between 12 and 15 that we know of have pursued Masters or Doctorates in entomology, with a lot more the pipeline! Several others have reported camp was responsible for their going into Extension Service–related careers or other professions including computer science and horticulture. Campers have found insects new to science and new to their states and counties, warned of the potential arrival of agricultural pests, and produced a wealth of research papers and popular articles. Many campers have assisted with entomology field days and class presentations. Breanna Lyle leads her own field day on spiders, and Dr. Stephanie Hill has led the University of Florida's Insect Day Camp. To cap it off, I am very excited to report our bug campers are now moving into the Entomological Society of America!

Bug & Plant Camp 2013 Was One for the Record Books!

Young entomologists from all over the hemisphere converged on Mississippi State University to collect insects and learn from some of the most knowledgeable entomologists and plant enthusiasts in the Southeast. The sustained interest of returning campers and the steady supply of new young scientists is the hemolymph of camp! We thrive on their enthusiasm and they are a perpetual reminder of why we do this! Camp was full, in spite of the cockroaches that have been hacking our website for the last few years— no disrespect to Dictyoptera (including the revered praying mantids) intended! We are thankful for your patience and persistance as we work through these problems.

Former bug campers Philip and James Kelly (l-r) stopped by camp this year.

Camp would not be possible without an incredible staff that returns every year to sustain our academic entomology and plant camp. Dr. Mike Williams still shares the helm and his sage advice is ever valued. The seasoned staff of Karen Benson, Heather Blackwell, Peggy Guyton, Lelia Kelly, Breanna Lyle, Deanna Lyle, Matthew Thorn, Janet Chapman, Sherry McMullin, and Edward Entsminger keeps camp on an even keel. Biochemistry, Molecular Biology, Entomology, and Plant Pathology department faculty members Frank Davis, Jerome Goddard, Blake Layton, John Riggins, John Schneider, Richard Brown, and Clarissa Balbalian insure camp's

academic integrity. Research associates Joe MacGowan, Amanda Lawrence, Audrey Sheridan, Teresa Ziegelmann, Kathy Knighten, and Dr. Ashli Brown's team shared their knowledge with campers. Of course Department Head Scott Willard and the Sam D. Hamilton Noxubee National Wildlife Manager Steve Reagan's support were of key importance.

Associates Lois Connington and Jennifer Seltzer; faculty Drs. Jeff Harris, Natraj Krishnan, and Kristine Edwards; graduate students Daniel Fleming and Santos Portugal; and undergraduate student Kyle Hoppens joined the camp staff this summer and made themselves indispensible!

4-H Bug Clubs—We Are Here to Help You!

Over the past year we have been excited to learn there are a number of 4-H Bug Clubs around the state and we want to get involved with them. We encourage county Extension personnel to send us the contact information for interested bug club leaders, and to copy and distribute or email Gloworms to bug club leaders and/or youth interested in entomology. If you are a bug club leader or would like to start a bug club, please contact John Guyton or Lois Connington (see p. 6) and let us know where you are, what you have been doing with your group, and how we can be of assistance.

We are interested in increasing participation in entomology-related contests at 4-H State Congress and Project Achievement Days and in helping bug clubs prepare for those events, so we will be sending out tips via this newsletter throughout the year. We also plan to supply club leaders with ideas for monthly bug club activities, some of which will be geared toward the contests.

Plan Ahead for 4-H Entomology Contests **by Lois Connington**

In Mississippi, junior and senior 4-Hers (ages 10 and up) interested in entomology can share their fascination about and knowledge of insects in several ways. Youth can make and enter an insect collection in competition, prepare a visual presentation highlighting a topic they have researched or a study they have conducted about insects, or compete in an insect identification contest. Depending on their age and the event they attend, winners receive ribbons, plaques, and sometimes cash prizes. Some youth work on entomology projects individually, while others are members of 4-H Bug Clubs. If you are interested in starting or joining a bug club, contact your county agent, or Dr. John Guyton or Lois Connington at MSU (see p. 6).

Insect collection submitted for judging at 2013 Northeast Project Achievement Day by bug camper Shelby Lindsey. Shelby won a blue ribbon for her collection.

Each year, 4-H competitions take place from May to October. State Congress, for senior 4-Hers (ages 14 and up), takes place in late May on the campus of Mississippi State University. During the week, attendees can enter several contests, insect-related or otherwise, and meet hundreds of 4-Hers from across the state. Junior 4-Hers (ages 10–13) compete at regional contests held at Project Achievement Days (PAD) around the state during the month of June. Participants can enter 2 contests during these one-day events (in addition to submitting an insect collection for judging). The final event of the year is the Mississippi State Fair, held in Jackson each October. Insect collections are selected from those brought to State Congress or a PAD, as approved by the Entomology Department. More information about state fair competition is available at http://msucares.com/4h_Youth/4hfair/fairschedule2012.pdf.

Summer is a great time to collect insects, whether starting a new 4-H collection or adding to an existing one. During cooler months and the school year, it may be harder to find insects—and time to collect. Keep in mind that junior collections must contain at least 50 insects, while seniors need 100. In both cases, collections should represent as many insect orders (e.g., Coleoptera [beetles], Diptera [flies], and Odonata [dragonflies and damselflies]) as possible. Collectors will need a net, a kill jar, insect pins, a spreading board, a temporary holding box for pinned specimens, and eventually a display box. More information

about how to make or where to buy these items, as well as insect identification, collecting/preserving tips, and ideas for 4-H projects can be found in the *Mississippi 4-H Manual*, available from the MSU Dept. of Entomology or your local county agent. Specific information about preparing for the 4-H entomology contests is available at http://msucares.com/4h_Youth/4hentomology/index.html. Field manuals such as *National Wildlife Federation Field Guide to Insects and Spiders and Related Species of North America* or Peterson Field Guides are hlepful for identifying insects. For younger collectors, *Insects*: *A Golden Guide from St. Martin's Press* is a good introductory resource.

For 4-Hers who entered insect collections at the junior or senior level this May and June, now is the time to clean up your display boxes and implement changes suggested by the judges. Discard any specimens that are damaged by scavengers, twirling on pins, or broken. Refresh the no-pest strips or moth balls in the display box as needed. Collect insects in unrepresented orders, or add to orders that are already present. Consider entering a different entomology contest next year or putting together a specialty collection, e.g., focus on one order or family of insects, or insects from a certain habitat.

Featured Insect: The Eastern Dobsonfly, or King Bug **by Dr. John Guyton**

Dobsonflies, ferocious-looking, 2- to 3.5-inch-long insects with sickle-shaped mandibles, segmented antennae, and a wingspan almost twice their body length, showed up around 250 million years ago in the Permian Period of the Paleozoic Era. They predated the dinosaurs, along with Coleoptera, Diptera, Hemiptera, Thysanoptera, and other insect orders. Their densely lined wings with intersecting veins fold along their bodies. The male's mandibles may be half its body length, and its flexible neck enables it to turn its head to reach your fingers when holding it by its back. Fortunately, its threat is worse than its bite! The female has much smaller but more powerful mandibles. That adult dobsonflies are generally unknown to the public is likely due to their aquatic and nocturnal nature.

Dobsonflies undergo complete metamorphosis. After hatching, the "hellgrammites" spend the next few years as predacious aquatic larvae before leaving the water to pupate. Hellgrammites are poor swimmers and typically move by crawling. The 2- to 3-inch larvae use hooks on their abdomens to keep from being swept downstream while hunting with their strong jaws. Their preferred prey includes the nymphs of damselflies, dragonflies, mayflies, and stoneflies. Pupation occurs from fall to spring, after which the adults emerge, mate, and lay eggs within a week.

Dobsonflies are classified in the phylum Arthropoda, class Insecta, order Neuroptera, and family Corydalidae. The eastern dobsonfly, *Corydalus cornutus*, is the only species in the eastern U.S., where they are popular bait for fishers. Dobsonfly larvae are sensitive to pollution and their presence indicates good water quality. In comparison, stoneflies and mayflies are more sensitive. Mature larvae leave the water and build underground chambers under logs or rocks in which to pupate. They are known to synchronize their life cycles to regional seasonal patterns. When adult dobsonflies emerge, they mate on the ground or on plants. They are poor fliers and generally spend their lives around the body of water from which they emerged. The males may not eat, save imbibing a little water but the females ravish nectar plants. It's thought that the males use their mandibles in a mating ritual or to flip competing males from their perches. Females lay from 1,000 to 3,000 eggs in organized rows in an oval mass covered with a white protective material that may resemble bird droppings on the undersurfaces of leaves or branches. After hatching, the larvae drop into or near a stream and the cycle repeats.

While in Kentucky, with its fast-flowing, clear streams, we would stretch a mesh net between large rocks, holding it against the stream bottom while turning over rocks upstream and shuffling our feet to dislodge invertebrates, including hellgrammites. We trapped these in our nets to use in an assessment of water quality.

An Introduction to Forensic Entomology: Part 2 **by Breanna Lyle**

In the previous edition of The Gloworm, we discussed the very basics, and some other areas of forensic entomology. This time, we will cover what everyone wants to hear about: using insects or other arthropods found around a corpse to make inferences about the time that a body has been exposed. This area of forensic entomology is more properly referred to as *medicocriminal entomology*.

Due to television shows such as "CSI" and "Bones," the public in general tends to believe that medicocriminal entomology is the only piece of forensic entomology, and that it is a fast method of determining how long a person has been deceased. This isn't entirely accurate. In the last issue, we saw that there are many forms of forensic entomology, including investigating cases of structural damage by termites, insects in food, and neglect in nursing homes.

Medicocriminal entomology is a process that begins with knowing which insects are the first to come to an exposed body. As soon as an organism dies, blowflies (in the family Calliphoridae) will begin to arrive. This is a very fast process—the first flies generally land within 5 minutes of exposure. They immediately begin to lay eggs at any opening in the body (the nose, mouth, eyes, ears, and anus, as well as the site of any wounds present on the body). The next insects to arrive as the body decomposes will be the beetles. Some of these beetles eat the body, while others eat the flies and maggots that are present. Mites, which are small arachnids, are also considered 'forensically important.'

The job of the medicocriminal entomologist is to collect the insects on and near the body, and to try to determine the post mortem interval (PMI), or the time that the body has been exposed. Sometimes if bodies are moved or hidden well, the time of death will be impossible to know, but time of exposure is able to be calculated. The entomologist collects the oldest maggots in the body because they have been there the longest.

By knowing the life cycle of the insects that are collected, as well as the temperature readings of the area and any other reading that could be useful, such as rainfall, the medicocriminal entomologist can use a formula to calculate the degree days that the insects have taken to grow to that size. This will give a pretty accurate (within 12 hours) measurement of how long the body has been exposed.

When collecting the insects, several procedures must be followed to ensure that the evidence is admissible in court. Insects should be appropriately preserved, larvae and mites kept in alcohol or on slides, and adult flies and beetles pinned. Labels should be accurate and contain as much information as is possible. Samples should also be stored. Chain of custody should be maintained, which means that every time the samples pass from person to person, there is a record kept of each interaction. This record helps to keep fraud out of the specimens.

The insects should be identified by an expert in that area so that the life cycle used is completely accurate. Misidentification can mean the difference between days! All data and observations should be recorded in a journal with numbered pages. Any gaps will throw suspicion on the investigation.

The entomologist will be called in to testify if the case goes to trial. As was said in the last issue, it is important that they not say anything outside of their area of expertise, nor should they show any bias. The other side may have another entomologist called in to contest or try to dispute their findings. It is critical that this not shake the nerves of the medicocriminal entomologist.

To conclude, the area of medicocriminal entomology is what most folks think of when they hear the words forensic entomology, and it is important in solving homicides and other crimes in which there is human mortality. The field of forensic entomology is an interesting path for anyone with a passion for the study of insects.

Wolf Spiders by Breanna Lyle

Beginning in the spring, anyone with a careful eye can see one of North America's largest families of spiders prowling amongst the leaf litter and vegetation near their homes. Darting amongst the dried leaves, these spiders can be seen toting their precious egg sacs while prowling for a meal. These are the wolf spiders, agile hunters in the family Lycosidae named for their prowess at catching prey. Their swift movements enable them to rapidly chase down any insect or other small organism that they think would make a delicious meal.

Wolf spiders are equipped with large forward-facing eyes that enable them to see at a relatively great distance. They are able to track their prey through the underbrush and, using their lightning-quick agility, catch their prey easily. Using their powerful fangs and chelicerae to crush their prey, thry reduce it to nothing more than a dry ball of its former self. This dry ball is called a *bolus* and many of the larger species of spiders, such as tarantulas and wolf spiders, make these when they eat.

Their hunting ability isn't the only thing that sets wolf spiders apart. Wolf spiders show what is arguably the best maternal care in spiders. When the mother wolf spider is ready to lay her eggs, she wraps them in a protective case of thick silk. She then picks up the little ball of silk and eggs and attaches it to her spinnerets. Once her precious cargo is secure, she continues as normal, carrying her eggs along with her.

For the next several days, up to almost two weeks, the wolf spider will carry the egg sac. She rotates it to ensure that the eggs get just the right amount of warmth from the sun, ensuring that they will grow into healthy young spiders. When the mother senses that it is time for her young to hatch, she uses her chelicerae and fangs to open a hole in the sac. From that hole come the dozens of young that have developed from the eggs. The wolf spider's care for her young doesn't end there, though! The mother spider stands up on the tips of her feet and allows all of the young spiderlings to crawl onto her back.

The tiny spiderlings use a small amount of silk to hold themselves in place on the mother's back, and then the mother, loaded down with young, goes on her way. She hunts as usual, a little heavier than before, perhaps. When the spiderlings are ready for their first molt, they leave the mother spider and balloon away to find a place to call their own. These spiders will grow up into the stealthy hunters that their mother and father were, and the cycle continues.

From the Apiary

Summer Beekeeping by Dr. Jeff Harris, Extension Bee Specialist

Most southern beekeepers extract their honey crop during July, or August for those living a little further north. Generally, the amount of incoming nectar from blooming plants declines rapidly after mid July. In response to the reduced rate of incoming food, queen honey bees lay fewer eggs, and the area occupied by broodnest decreases. Colony size decreases over the summer because older workers that die will be replaced by a lower rate of newly emerging bees. This is a critical time for protecting bees from themselves: a beekeeper's biggest threat is honey bees stealing honey from each other.

The theft of honey by marauding bees is termed "robbing". This is a confusing term because many beekeepers also use this term to refer to the harvesting of the surplus crop by the beekeeper. Robbing must be prevented at all costs this time of year. Once started, robbing can spread like a fever throughout an apiary as colonies are stimulated to steal honey from pools of spilled honey or the weaker colonies in the apiary. The resulting frenzy will result in many stings to the beekeeper trying to work in the bee yard, but much worse, robbing bees can literally kill one another. Usually the weakest colonies are attacked by several stronger colonies. However, once the frenzy begins, strong colonies begin to pick on one another. The result can be that the beekeeper has a few strong colonies full of stolen honey and many dead colonies killed by the continuous onslaught from the strongest colonies.

Beekeepers can protect their colonies in several ways. First, evaluate and remove the weakest colonies from an apiary. Perhaps a couple of weak colonies can be combined to form one strong colony (ways of doing this will be discussed in a future article). Second, all entrances can be reduced using special wooden blocks aptly named "entrance reducers." These strips block about 85% of the entrance, which gives the guard bees in a colony a much smaller opening to defend. The only problem with entrance reducers in the summer is that they dramatically reduce the ability of a colony to cool the nest, so only use entrance reducers when using a screened bottom board. The screen on the floor of the hive will help the colony keep cool when the entrance reducers are in place. When using solid bottom boards, staple number 8 hardware cloth across most of the entrance and leave a couple of inches open to serve as a reduced entrance.

The most important way to protect bees is not to open the colonies after taking the honey off until later in the summer. Simply opening a hive will allow odors of honey to waft through an apiary, and this is enough to stimulate worker bees to snoop around the opened hive. When taking the honey supers off of hives, be very careful and try not to spill or drip honey in the bee yard. This will stimulate robbing.

The other important creature to keep in mind this time of year is the small hive beetle (SHB). This hive pest usually increases in numbers in our area during July–August. Strong colonies can handle the beetle and prevent them from laying eggs in the combs. It is the larvae of this beetle that damage combs. However, the other situation that benefits the beetle is a stack of unprotected supers full of honey on the floor of a honey house. The eggs from these beetles can hatch in less than 24 hours during the summer, so any stack of honey supers can fall victim to larvae of the SHB tunneling through the combs— which will spill the honey crop onto the floor. The most important rule is to extract honey as soon as it is removed from the bees.

Once extracted, the supers of wet combs can be returned to colonies to be licked dry. Be careful! Just carrying the wet combs back to the apiary can stimulate robbing. Give the bees 24 hours to dry the extracted combs, and then remove the combs from the hives. This is very important. Some of the strong colonies may be allowed to keep a super of combs because they can protect the combs from invasion by SHB. However, almost all colonies will actually decrease in population over the summer months, and placing empty combs on top of the nest is actually a stressor. The additional combs will greatly increase the volume of hive that the bees must patrol to protect from the SHB. Remember there is no food coming into the hive (unless the beekeeper is feeding the bees), so the extra combs really are not needed until the autumn honey flow begins.

It is best simply to remove the dried and empty combs from all hives that cannot protect the combs without risk of attack by the beetles. The best procedure is then to freeze all of the supers of combs for a few days, thaw them, and then stack them in a cool dark place with a moth repellent placed within the stacks. Be sure to follow all label instructions for use of these repellents. The only material legal to use for this purpose is para-dichlorobenze (sold as "Para-Moth").

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