Dermestid beetle care sheet

There are many different methods for keeping dermestid beetles. If you read different recommendations from various sources, don’t consider the suggestions to be conflicting advice, but rather alternative methods. This is how I care for my beetles but you should feel free to use whatever methods work best for your own circumstances.

A happy home

I keep my colonies in my garage in glass aquariums with screen lids. A small colony can be kept in the house for a while, but eventually it will develop an odor. Every colony I have tried to keep outside was eventually infested with parasitic mites and wiped out. The temperature in my garage is usually in the 40’s to 50’s in the winter and in the 90’s for most of the summer.

The main purpose of the screen lid is not to keep your beetles in, but to keep other insects out. Flies and other bugs will be attracted to the food in the cage, and can bring mites and diseases with them. Dermestid beetles can fly but don’t usually try to escape, especially if food is available. On summer days in Texas (over 95 °F) I have only seen five or six beetles at a time in a colony of thousands fly up to the screen lid, and this happened only when they had no food in their cage. The larvae can climb up the silicone in the corners of the aquariums, so I put a smear of petroleum jelly in each corner near the top. If they make it that far they can’t go any further. My aquariums also have undertank electric heaters that I use in the winter. The bugs will stop eating if it gets below about 60 °F, so the heater helps them stay productive. If you need a cage for your beetles, look for old reptile cages for sale in the Pets section on your local craigslist.org.

I use aspen shavings as bedding. This is reptile bedding from a pet store. Don’t use cedar shavings (mammal bedding) because the cedar kills insects. I typically use between 1/4 inch and 1/2 inch in an aquarium, but in a large colony it might be an inch deep. The depth provides more living space for the bugs and gives them somewhere to hide.
The larvae love to burrow, especially when they’re looking for a protected place to pupate. Their favorite material that I’ve found is Styrofoam that’s soft enough to squish between your finger and thumb. If you drop a piece that’s an inch or two thick into their cage, within minutes you’ll see the larvae climbing on it and burrowing into it. Eventually the larvae will reduce the Styrofoam into a shapeless gray blob, and then it’s time to replace it.

If you don’t provide something like soft Styrofoam or thick corrugated cardboard for the larvae to burrow into, they will pupate out in the open in the aspen shavings. They will be vulnerable here to predation by hungry larvae, but if you keep the colony well-fed, they’ll be okay.

It’s easy to lose small bones in the aspen shavings, so I push the bedding aside and put the bones on the cage bottom on a piece of paper or on a screen of some kind. The bugs always push the aspen back where it was, but the bones remain on the paper. If I have a carcass with really small bones, I’ll temporarily move some bugs to a small container with no bedding at all, then return them to the colony when they’re done. This rattlesnake was cleaned on a piece of paper. (The bugs did not decapitate the snake, a shovel did that. They did dislodge some ribs, though.) The anole was put in a cage whole and was cleaned to scattered bones overnight.
Dermestid beetles will create little grains of material at the bottom of their cage called frass. Frass has a consistency like sawdust and is made up of bug poop and chewed materials. Frass is also what gives a dermestid beetle colony its distinctive odor. Over time the bedding will slowly get deeper because of the accumulated frass. If I feel it’s getting too deep or too smelly, I’ll scoop out some of the bedding and pour it through a screen (I just use the lid of the cage). The screen allows the frass to pass through while catching the aspen shavings and bugs. I return the aspen and the bugs to the cage. You might lose some of the smallest larvae through the screen, but if you catch the frass in another container, you can pick them out and return them home.

Some people use cotton batting as a substrate. I tried this but I went back to aspen shavings because sometimes the bones stuck to the batting and the bugs didn’t fully clean the bones. I don’t dry my meat as fully as some people do, so if you dry your meat to a beef jerky consistency, cotton batting might work better for you than it did for me.

**Dinnertime**

I feed my bugs almost every night. Ideally they have finished eating everything in their cage by sometime the next morning, and the cage remains dry throughout the day until the next evening’s meal. I do it this way to minimize the smell and to limit moisture in the cage. Sometimes I’ll put in a larger skull that takes a few days to clean, and there’s no avoiding the smell then. In general, though, I try to put in only as much food as they can eat in a day. The beetles will eat both raw and cooked meat, so save those trimmings and leftovers. For a close-up video of a dermestid beetle eating, go to [https://www.youtube.com/watch?v=PMADT0VmiZU](https://www.youtube.com/watch?v=PMADT0VmiZU)

Any roadkill or outside animal meat you obtain is guaranteed to be already contaminated with insect eggs. All outside meat should be frozen for at least 24 hours to make sure any insect eggs
and larvae on it are dead before you put it into your colony. I try to clean off as much meat as I reasonably can from the bones before putting them in. I also remove the eyes and brain from any animal larger than a squirrel.

Brains will liquefy if they are not eaten quickly, and a putrefying brain is truly the worst odor you will ever smell. If you put a skull in your cage and later notice a really terrible stink, take the skull out of the cage (carefully!) and tip it backward to see if the brain oozes out. Don’t do this in your house! It’s not easy to remove all the brain – sometimes I think I’ve gotten it all, but there’s still some in there. I’ve learned the hard way to double- and triple-check to make sure I’ve gotten all of it.

Some people dry their meat by having a fan blow on it for 24 hours before giving it to their bugs. When I have done that my bugs have sometimes left dried tissue on the bones and just refused to eat it. I get better results when I dry the meat by simply pressing it in paper towel to remove excess moisture before putting it in the cage. The bugs get their food and their water this way, and I almost never give my bugs any additional water. Sometimes I’ll use a fan to help dry the meat on a skull, but I have found that overnight is too long and I get a cleaner skull in less time if I fan-dry the skull for only about 3 or 4 hours before giving it to the bugs.

The bugs will always eat the meat first, and when they run out of meat they will eat cartilage. Sometimes I trim down the cartilage before I give the bones to my beetles so they finish the job faster. Dermestid beetles will also eat hooves and horns, so these should be removed before the animal goes into the bug box. I have never fed my beetles dry dog food, but some people say it makes a nice odor-free option for when you run out of animal remains.
Living the bug life

Dermestid beetle eggs are invisibly small. After hatching, the larvae grow through seven different stages called *instars* before becoming pupae. They shed their skin each time they advance to the next instar, and once more when they become pupae.

The shed larval skins are dark brown, and the freshly-moulted larvae are pale yellow. These blonde larvae will gradually darken up over the following days. The larvae grow through the smallest instar stages quickly, and spend a lot more time in the largest instars. The natural result of this is that you will always have more large larvae in your colony than you have small ones.

When the larvae are ready to pupate, they will burrow into Styrofoam or some other protective place if possible, then curl up into a comma shape and stop moving. This is their prepupal stage. *They appear dead, but they are still alive!* When I first starting working with dermestid beetles I threw away hundreds of these prepupal larvae thinking they were dead. It wasn’t until I saw one molting his skin that I finally realized my mistake.
The larvae spend up to eight days in the prepupal stage, then shed their skin and emerge as yellow pupae. They remain in the pupal stage for another two weeks, and then become adults. (Some websites say this happens in 3 days or 7 days, but I have studied hundreds of dermestid beetle pupae, and at room temperature it was nearly always 14 or 15 days from emergence as a pupa to emergence as an adult beetle.) Female beetles are slightly larger than the males, but otherwise they look the same. This photo shows the entire dermestid beetle life cycle.

This photo was shot looking down into a colony in a 40 gallon aquarium. This colony can clean a deer skull in about two days, and cleaned the coyote skull in the middle overnight. Most of the bugs are hiding in the bedding, and the dark brown color you see on top of the bedding is primarily molted larval skins. (I should have taken the skulls out as soon as they were finished, but I was either too busy or too lazy to deal with cleaning them out at the time. Each deer skull will have over a hundred beetles and larvae hiding inside its narrow passages, so the skull has to be stored in a safe container for a while so the bugs can make their way out of the skull. The only danger to leaving skulls in the cage for too long is that more larvae will make themselves at home in the skull, and it will be more difficult to get them all out.)

The more plentiful the food is, the faster your beetles will reproduce. If you feed them less, they will reproduce more slowly. But if you feed them too little, two things can happen:

- First, the adults will stop mating and laying eggs. Your bugs will continue to grow older, but there will be no (or very few) new baby larvae. You might notice that your colony is not eating as quickly as it used to. You’ll know you’re underfeeding them if your colony consists primarily of adult beetles, pupae, and large larvae.
• If you stop feeding the colony the larvae will begin to eat the defenseless pupae. This can happen after two or three weeks with no food in the cage. This will bring a quick end to your colony, because you will have no new adults to lay eggs. You’ll know this has happened if your colony consists almost entirely of larvae in the largest instar stage, with few adult beetles and with many dead, damaged pupae. When this happened to me I counted a thousand large larvae and six adult beetles in the colony. It took a couple months before the colony returned to a fully productive state.

To maintain a healthy, growing colony you generally want to feed them every day or every other day. It’s okay to leave the colony with no food or water for a week or two if you need to, as long as you don’t make a regular practice of it. You’ll know life is good for the beetles in your colony if you see a lot of double-decker beetles – males riding on the backs of females, mating.

**Learn from my fail**

I’ve made many mistakes with my colonies over the years. Some were fatal, most were not.

**DO NOT:**

• Do not keep your beetles in a Rubbermaid container. Mine chewed holes in the bottom. Glass aquariums and Sterilite containers work well.

• Do not add any wild dermestid beetles to your colony. They may have mites or disease. I killed off my first colony by doing this. I thought the beetles on top of the cage had somehow escaped, so I threw them back in. I later realized they were wild, but by then it was too late. I don’t put my colonies outside at all anymore.

• Do not keep your beetles in a sealed container. The trapped moisture encourages mold and mites, and can cause the meat to putrefy. The smell is like a bathroom in hell and the beetles won’t eat putrefying meat. You have to dry it out before they will work on it. Air flow is critical to keeping the cage dry. This squirrel began to putrefy in a closed container.
• Do not pick up rotting roadkill for your beetles. You have to freeze all roadkill before giving it to your bugs, and freezing a rotting carcass will not stop it from smelling bad. Instead everything in the freezer will smell like rotting roadkill. Fresh roadkill is okay after you freeze it. If it’s already rotting, macerate it instead.

• Do not allow too much moisture into your bug box. Excess moisture is probably the main cause of colony death because it allows mites and mold to grow. Your beetle cage should be allowed to dry out completely on a regular basis. I try to let mine go dry every single day – that means it’s out of food and has no water, and sometimes I’ll leave it that way for an extra day just to be sure. Some people suggest misting your cage occasionally with water, or putting in a piece of wet paper towel for the bugs to drink from, or laying a wet towel on top of the cage on dry days to increase the humidity. I have done all of these, and I still do – you just have to be very careful about how much water you introduce to the cage and how long the moisture is allowed to remain there. I have left dermestids in a closed bucket in my garage with no water for over six weeks and they survived just fine. I don’t recommend doing that (it was an accident), I’m just making the point that these are not puppies and kittens who need water every day to stay healthy. Their exoskeletons trap water inside their bodies, so a little bit of water goes a very long way with them. Any excess moisture in the cage only helps invaders to thrive.

This photo is a microscope view of parasitic mites on a dead dermestid beetle larva. The mites are invisibly, but under a microscope they look like tiny white spiders. To the naked eye a mite infestation looks like a tan dusting on your larvae. There is a photo of this on page 11 of this document.

You can see a short video of parasitic mites on a dermestid beetle larva on YouTube at https://www.youtube.com/watch?v=cxhu24NtvKo

General tips

• Be gentle with your beetles and larvae. Dermestid beetles don’t bite and can be safely handled with bare hands, but I usually pick mine up using a plastic spoon so I don’t squish them with my big fingers. I use plastic spoons, clear plastic cups, and paper plates when working with my beetles.
• Clean out your cage every few months or as needed. As the frass builds up at the bottom, the cage will smell more strongly. Also, the beetles don’t burrow through the denser frass as easily as they do through the aspen shavings. Every few months I’ll filter out the frass from the bottom and then top off the bedding with fresh aspen shavings. Sometimes I’ll replace all the shavings, but this is time-consuming because I haven’t found an easy and effective way to separate all the beetles from the shavings. Trying to lure them out with meat doesn’t work as well as you would hope. Some people say not to clean the cage at all because in doing so you throw out eggs and disrupt the life cycle, but if your colony is healthy and well-fed, the adults will quickly lay more eggs.

• Keep your beetles out of direct sunlight. They prefer the dark and are okay in shade, but they don’t like bright light (including camera flashes). This is why undertank heaters are better than heat lamps for dermestids.

• If you find you can no longer keep your colony and can’t find someone to take them, you have two options for disposal. These beetles are native to pretty much the entire populated world, and if they’re already native to your area you can simply bring them to a wooded area and release them. They will get right to work filling their niche in the ecosystem. If this is not an option, then as a last resort you can freeze the colony and dispose of it in the trash.

• You may see some strangely-colored larvae and beetles in your colony. A blonde larva of any size has just shed its skin and will develop its normal brunette color over a period of days. Adult dermestid beetles are black with white bellies, but when they are fresh out of the pupa they are a pale whitish-green color with a red head. Over the course of about 24 hours their backs will turn coppery-red and then darken to fully black. In this photo newly emerged adult beetles, all less than one day old, are being introduced into an established colony.

• Sometimes beetles will emerge damaged from their pupal stage. Their backs and wings didn’t develop properly and are visibly deformed. In the wild these beetles would not survive for long, but in a captive colony they can live a long and happy life.
• In general, the more larvae you have the faster your colony will clean bones, and the more adults you have the faster your colony will grow.

• Dermestid beetles are sensitive to humidity. If the air gets too dry, I lay a damp towel on top of the cage, leaving plenty of screen uncovered for air flow. Remember, moisture in a dermestid beetle colony is the leading cause of problems. If you have too much humidity the bedding will start to absorb moisture and this can lead to the problems described below. When it is very humid out, such as on rainy days, I will sometimes plug in the undertank heater to help drive moisture from the colony.

Why have my beetles stopped eating?

Usually the first indication that there’s something wrong with your colony comes when the bugs are not cleaning bones as quickly as they used to. The best way to inspect the health of your colony is to scoop out a cupful of bedding and bugs, pour it into a shallow plastic container, and check to see what you find there. The appearance, numbers, and ratios of the beetles and larvae will help you identify what the problem is. These are the most common problems I’ve seen.

• They’re too cold. Dermestid beetles prefer temperatures around 80 °F and will slow way down when the temperature drops below about 60 °F. I use undertank reptile heaters on my garage colonies to help keep them comfortably warm through the winter.

• You’ve been underfeeding them and the beetles have stopped laying eggs. You get the most production out of a healthy colony with all stages of the life cycle present. If your colony consists only of adolescent larvae and adult beetles, they won’t eat as much as a complete colony will. At this point I would not ask them to clean bones, and instead just feed them fresh meat every day, as much as they will eat overnight, and the colony should quickly spring back to full strength. When you see lots of beetles mating in the cage you’ll know your colony is on the road to recovery.
• You’ve severely underfed them and the larvae are eating the pupae. If your colony consists mostly of adolescent larvae but has very few adults, this is probably what happened. When this happened to me I counted over 1000 large larvae in the colony but only six adult beetles. The solution is to feed them as much fresh meat as they will eat each day, but it will take a while for this problem to correct itself because the larvae have to go through their prepupal and pupal stages before becoming egg-laying adults. At room temperature the prepupal and pupal stages combined can take about three weeks, and during that time those individuals will not eat anything at all. Once you have a population of adult beetles, your colony will begin to grow quickly again.

• Your cage has mold. If you use aspen shavings, your colony bedding should be loose and there should be no clumping. If there is any clumping in the bedding, the bedding has gotten too damp. This can happen most easily in the more densely-packed frass at the bottom of the cage, and that’s probably where you will see it first. You will need to remove the bugs, clean the cage and then add the beetles back with fresh aspen shavings.

• You have parasitic mites. If your adult beetles are holding their shells open and your larvae appear to be covered in a tan-colored dust, mites have infested your colony. Your beetles and larvae will also be very slow-moving and lethargic. By the time the problem is evident, it is already too late to save your colony. I recommend putting them in the freezer and starting over with a new colony. You can see a video showing the visible progression of a mite infestation here: https://www.youtube.com/watch?v=jNnMglvGKI

What are the downsides of using dermestid beetles to clean skulls?

• Dermestid beetle colonies smell bad. A beetle cage doesn’t smell anywhere near as bad as maceration does, but it can’t be left outside, either. Keeping it in the garage is a nice compromise. Just don’t give them more meat than they can eat in a day or two, and occasionally freshen their bedding by filtering out the frass and adding some new aspen shavings. If you dry your meat to a soft beef jerky consistency, the meat itself won’t smell bad in the cage but it may take longer for the bugs to eat it.
• Dermestid beetles reproduce quickly. If you take good care of your colony, it can soon outgrow its cage. I use this to my advantage by splitting the colony. That way if anything happens to one colony, I have another healthy colony to rebuild from.

• Dermestid beetles are least productive during hunting season. The bugs are most active when it’s warm out, and least active during the winter hunting seasons (this is a problem with maceration as well). I bring small colonies into the house temporarily and heat the larger ones in my garage to help keep them active. During deer season I stockpile skulls and deer meat in a chest freezer in my garage to feed the beetles when it gets warmer.

• Dermestid beetles hide inside skulls and are hard to remove. The bugs get into every single nook and cranny in a skull, and they never want to come out. After shaking out every bug I can from a deer skull, there are still typically over 100 beetles and larvae hidden inside. Pressurized air from an aerosol can isn’t strong enough to blow them out. My best solution is to lure them out by placing the skull in a container with some meat and wait for them to come out to eat, or just put the skull in my backyard and wait for the beetles and larvae to leave. This can take weeks. At Skulls Unlimited they use a high-pressure air hose to blow bugs out of the finished skulls.

• Escaped dermestid beetles can cause damage in your home. If the beetles escape in large numbers, they will chew anything made of paper or cloth. You really need a whole rogue colony living in your house for this to happen, though. Individual escapees tend to die before they’ve done any noticeable harm.

Dermestid beetles are faster than maceration and do a much better job with delicate bones. They also don’t leave the residual odor on bones that maceration does. Despite the drawbacks outlined above, every single university and museum that cleans bones uses dermestids to do it. After seeing the Dirty Jobs video with Mike Rowe, I asked one of the top brass at Skulls Unlimited how often they use maceration to clean bones. He said, “Never.”

If you have any questions or would like to order beetles, e-mail me at BrianAnderson@utexas.edu.