Roach Crossing's Cockroach Husbandry Guide

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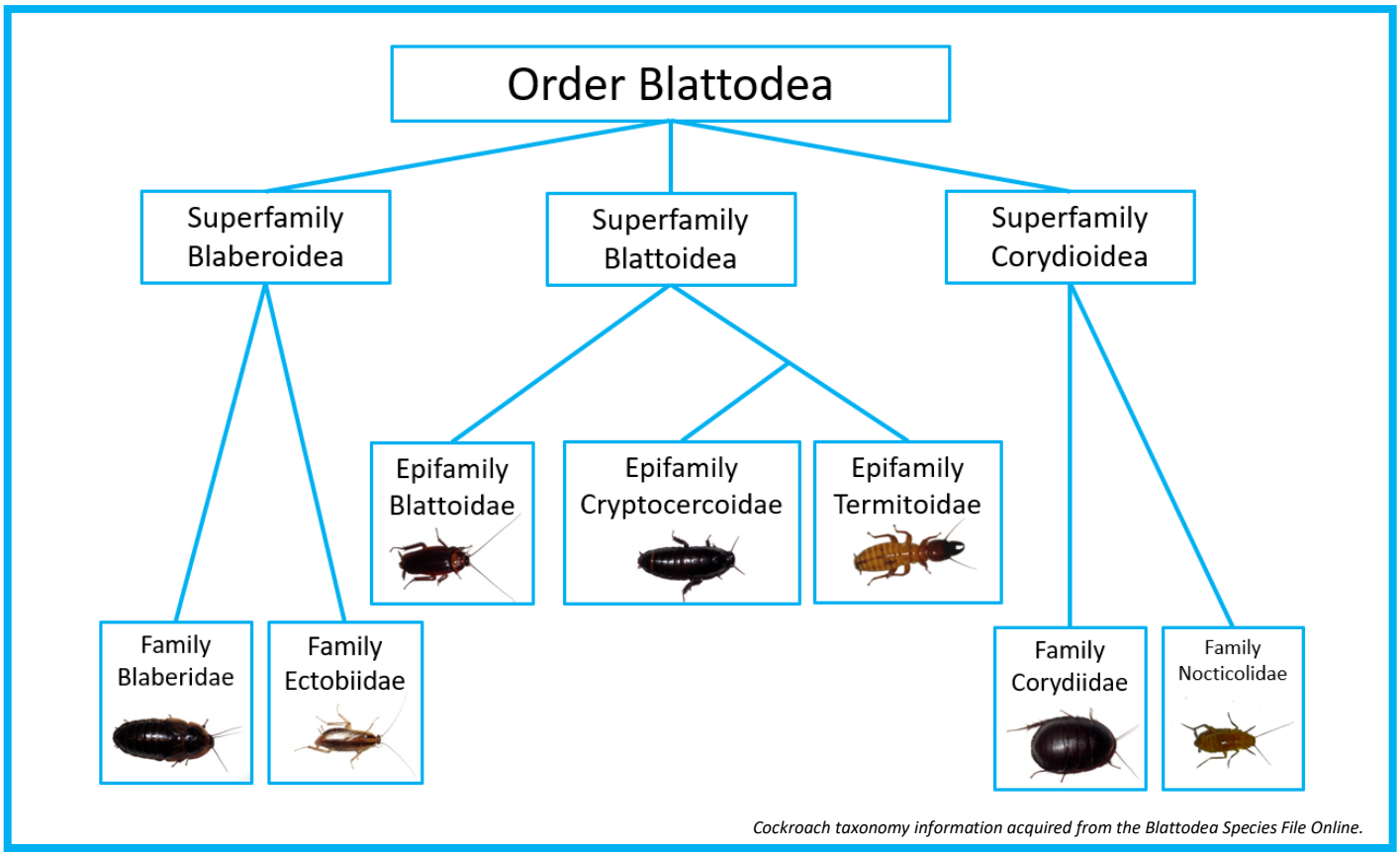
Introduction

Of all organisms reared in captivity, few rival the humble cockroach in its durability, prolificness, and tenacity. The ancient association of *Homo sapiens* and several species commonly referred to as pests extends thousands of years back in time, perhaps even to the very beginning of human civilizations. More archaic than this relatively recent union, it is not unlikely that the often commensal relationship between roaches and a mammalian host extends millions of years into the past, evidenced by present-day relationships between ancient roach lineages (such as the Corydiidae, or sand roaches) and modern hosts (burrowing mammals). It is on the basic premises of providing adequate food, water, shelter, heat, and space that most roaches thrive. Within the stable indoor microclimate of a properly equipped aquarium or plastic bin, it is easy and inexpensive to rear a thriving roach colony for feeding other organisms, watching, for research, and as an exciting and engaging hobby.

Description

Cockroaches are members of the taxonomic class Insecta, order Blattodea. Within this fascinating order are several families and similar groupings, outlined below. Of these groups, the most frequently cultured species belong to the families Blaberidae, Ectobiidae, Blattidae, and Corydiidae.



Cockroach taxonomy information acquired from the Blattodea Species File Online.

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In general, cockroaches are dorsolaterally flattened insects with chewing mouthparts, long, filamentous antennae, large pronota (head shields) hiding a sizable head, robust abdomens, and legs adapted to running or burrowing. The growth style is hemimetabolic, with the immature life stage being called a nymph and no pupal stage. Immature roaches grow by ecdysis, or shedding their exoskeleton, and each growth increment is called an instar. There are about 7 instars between newborn and adult, but unlike in many other insects this number is variable depending on the species and growth conditions. Some roaches may perform stationary molts where no size is gained, but body parts are repaired or sexual maturity is delayed. Wing presence is highly variable; more familiar species are fully winged but many roaches may be wingless (apterous), partially winged (brachypterous), or minutely winged (microptery); even more interestingly, some species may have a mixture of different wing forms depending on sex and locality. Cockroaches become sexually mature after an ultimate molt, during which time the wings emerge (if present in the species) and the internal genitalia become fully developed. Rarely and for unknown reasons, some genera (*Gromphadorhina sp.*, *Byrsotria sp.*) may attempt a postultimate molt, which has been fatal in all recorded occurances.

Reproduction occurs sometime after maturity, and the time between an individual maturing and producing offspring can be as little as three months in some species (*Blattella germanica*), or as long as several years (*Macropanesthia rhinoceros*). Depending on the species, eggs may be laid (oviparous type 1), retained outside the female's body (oviparous type 2), incubated within the female's body (ovoviviparous types 1 and 2), or absent altogether but the embryos retained within the female (viviparous).

Though some species are not exceptionally long-lived, the average of all possible roach adult lifespans (about 8 months) most likely exceeds the average adult lifespan of insects in general (best estimated at 3 months). To accompany their variable life span, cockroaches come in every shape, size, color, and habit imaginable, with members of the order confirmed on 6 continents (and rumored to be all 7). They thrive wherever they occur, from the hottest deserts to the slopes of Mount Everest. Surely, these incredible insects deserve more than a passing glance at best and indignantly thrown shoe at worst. It should come as no surprise that these sturdy creatures require easily obtainable supplies to thrive with even the newest hobbyist.



A few of the diverse habitats that cockroaches inhabit. From left to right, the north rim of the Grand Canyon (Arenivaga cf. grandiscanyonensis), bromeliads on trees in mangrove forests on Big Pine Key (Aglaopteryx gemma), and riparian corridor of the Peace River in Arcadia, Florida (Epilampra maya).

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Supplies

A roach enclosure can be as elaborate as a bio-active, densely-planted vivarium in a glass tank, or as simple as an old take-out deli cup. The scale of the enclosure depends on how many individual roaches one starts with; in general, it is best to start with a smaller than expected enclosure and move the colony into gradually larger enclosures as it grows. The dollar shoe boxes offered at many department and dollar stores are ideal for beginning most non-climbing roach colonies; from here the 20 or so quart containers are an appropriate step up and so on. “Critter keeper” style enclosures are ideal for smaller, climbing and/or flying species, as the snap-on style of the lid may be combined with a piece of frost cloth or muslin fabric underlayment to prevent escapes. Most roaches do best with some ventilation; depending on the size of the species’s offspring, brass microscreen, pin-head sized holes, or 1/16 inch (standard) aluminum window screening are all effective go-tos. For non-climbing species kept in glass aquaria, a screen aquarium lid is typically sufficient; additional underlayment or precaution will be needed for climbing or flying species.

Once the enclosure has been selected, substrate and furnishings can be added. The substrate is perhaps the most vital component of the enclosure and is discussed at length in the following section. Décor for feeder roaches is typically egg carton or other shaped wood pulp products. These hold up best in enclosures with good ventilation and will easily collapse if kept moist for extended periods. In feeder scenarios where egg cartons are not effective, particle board or similar material can be cut to form then stacked or tilted vertically, providing there is consistent spacing. For more exuberant enclosures locally collected wood and bark, cork bark, pine cones, and other fixings can be provided. Though they do run the risk of introducing potential pests and unwanted organisms into the colony, wood materials collected outdoors should not be feared due to potential “parasites” or “pathogens” in most cases. Heating such materials in a standard oven for 30 minutes at 300 degrees Fahrenheit is sufficient for sterilization.

Once the inside of the enclosure has been equipped, a viscous barrier will need to be applied if the enclosure will house a climbing species in order to prevent escape. Roach Crossing currently recommends the proprietary Roach no Crossing material, available on the website. The make up of this material is unknown, but it is inorganic, food-safe, and does not drip or run across a wide spectrum of temperatures. In a pinch or by preference, any persistent oily substance can be used, including cooking oils and old mainstays such as petroleum jelly. Fluon-based products can also be used as a barrier, though their effectiveness seems to vary depending on air humidity. The ideal method for applying the barrier is to first use one’s fingers to apply the material to the enclosure sides. Then, using a piece of paper towel, smudge the material up and down roughly at the width you’d like the final barrier to be. A thickness of 2 and 3 inches works best for smaller and larger species respectively. Then, use the same piece of paper towel to smear the barrier upwards so that there is a distinctive up-down grain to the material. This is critical as smearing the barrier side to side will create small ledges that tiny nymphs or species can use to scale the sides of the enclosure. An up-down grain prevents this. Keep in mind that as with anything inside the roach enclosure, the barrier will be nibbled on, degraded, and soiled over time and will need to be tended to. Wiping debris off using a warm and moist paper towel is a practical way of preserving as much of the original barrier as possible before re-applying more if needed.

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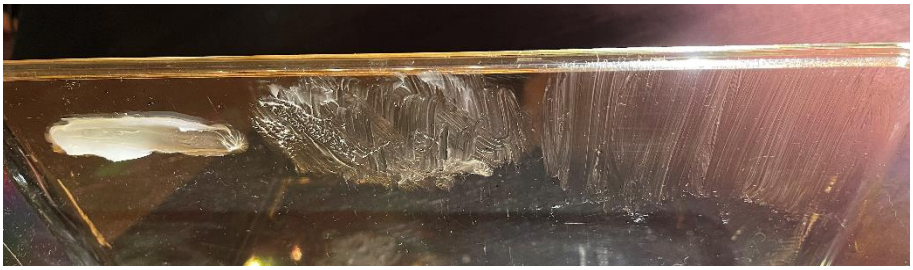
Perhaps the largest misconception in roach keeping is that they are creatures which crave heat; in many cases this is outright false. Many tropical species are nocturnal, avoiding both the heat and predators associated with the daytime and coming out at night to perform their vital activities. Despite the typical perception of the tropics being a consistently warm place, it is important to note that the average temperature difference between day and night is considerably greater than the temperature difference during different seasons. Elevated temperatures also decrease adult size and reduce the frequency and size of successful litters, despite encouraging rapid growth. For these reasons, Roach Crossing does not recommend keeping most roaches consistently at temperatures exceeding 85 degrees Fahrenheit, particularly considering many species appear to benefit from a night time temperature drop. Although there are some groups which thrive at consistently higher temperatures (e.g., species such as *Supella longipalpa* and most members of the subfamily Oxyhaloinae, the hissing roaches and kin), these are certainly the exceptions to the general roach trend. Ideally, a colony should experience its highest temperatures during the day with a cooling off at night. Infrequent dips above and below the usual temperature range are usually not problematic.

If additional heating is needed for a roach colony, either raising the room temperature (i.e., ambient heat) or providing a basking light/ceramic heat emitter are the ideal options. Under tank heat mats and heat tape are acceptable when other options are inviable, but are not ideal as roaches will burrow/hide under cover to escape heat and sunlight in the wild. Providing heat from the bottom up can prevent this behavior with potentially severe consequences. Perhaps even more lethal, if heat is provided ventrally it is possible to dry out the deeper layers of substrate while the surface appears moist. If a species is sensitive to desiccation, this can cause the perception that conditions are sufficient in the enclosure when in actuality the colony may be at immediate risk of drying out. Attentiveness is of the utmost importance in this scenario.

Cage location is a matter of personal choice. Even mostly nocturnal roaches can deal with daily cycles in ambient light without ill-effect, though constant exposure to bright light without retreats can cause stress-related harm on a colony scale in some species. However, in very large, well-established colonies the sheer number of roaches and tactile/pheromonal stimulation may encourage even nocturnal species to feel comfortable hanging out on in plain site even with bright lighting or during the day. Drafts and sudden temperature changes are typically not a problem, as a well-equipped enclosure with substrate will provide appropriate retreats should adverse conditions creep from outside the enclosure inward.



Above, proper barrier application. From left to right, initial application, secondary smearing, and finished up-down grain. Right, a very healthy colony of Ectobiidae sp. "Malaysia" in a critter keeper style enclosure.

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Substrate

Lowly dirt always gets the soiled end of the stick. The opposite could not be truer with respect to roach keeping. Standing firmly next to proper housing and varied diet, substrate is one of the most critical components of a thriving roach colony. In addition to providing additional nutrition, substrate provides a temperature and humidity buffer zone, a comfortable place for young roaches to hide, and a bank of beneficial macro and microorganisms from which the roaches and keeper may benefit. Though many choose to forego a proper substrate, doing so ultimately decreases the vigor and overall health of the colony for most feeder and pet species.

The best primary component of a substrate mixture is coconut fiber, also known as plantation soil, coco coir, and several other commercial names. This miraculous substance is non-abrasive on the insect epicuticle, is wonderfully absorbent and water-retentive, light enough for active burrowing, and considerably hygienic. It can be purchased pre-expanded in bags or in condensed brick form from most pet stores and some garden/hydroponic outlets. Ideally, the average particle size should be about 3 mm; the more powdery material does not seem as absorptive or beneficial. Some brands of this material may come inoculated intentionally or unintentionally with the mycelium of the fungus *Leucocoprinus birnbaumii*, or flowerpot fungus. Its presence in freshly purchased material may not be noticeable, but generally infected batches have a mushroomy smell and the tiny, ball-shaped and yellowish mycelium masses (sclerotia) become apparent within a few weeks of adding the substrate to an enclosure. Many larger roaches don't mind it, but there is fair anecdotal evidence to suggest it may decrease the vigor in tinier or less hardy roach species. The mechanism for this is unknown but may involve altering the chemistry of the substrate to become less favorable for the roaches or other beneficial enclosure organisms. Coconut fiber that is suspected to be colonized by this fungus can easily be sterilized in small quantities by microwaving it in a covered container or boiling/heating larger quantities in large, covered pots on a stovetop.

Most species will thrive on coconut fiber alone, though Roach Crossing substrate mixes combine more organic materials and two particle sizes of coconut husk materials (the aforementioned approximately 3 mm particles and the larger variety often sold as coconut husk, chip, or crouton). A good mulch is appreciated and helps aerate the substrate; hardwood mulches must be used as fresh softwoods (pine, spruce, fir, cedar, etc.) release aromatic insecticidal compounds over time. Well-rotted hardwood or softwood from outdoors can also be used, preferably sterilized. Leaf litter is readily consumed and is usually the first substrate component in need of replacement, though some species are more fond of it than others. Roach Crossing has used oak, beech, birch, maple, sycamore, magnolia, apple, and cherry leaves without problem, though oak is the leaf of choice as it appears to decompose slowly in a manner rendering irresistibly tasty to roaches. It is important that the leaves are dead, dry, and brown; dried greens leaves may retain chemical defenses harmful to roaches. When experimenting with new leaves and wood types, offering a small amount to a colony over time and monitoring the response is an effective way to test their safety.

Other possible substrate additions include sphagnum moss (to provide excellent substrate aeration and microbial activity), sphagnum peat moss (inexpensive and retains water well, historically used in invertebrate rearing moreso), or aged manure or compost (additional nutrition). Tropical wood feeding roaches, such as the genus *Panesthia*, thrive on a substrate of

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hydrated wood pellets colonized with white-rot wood fungus. This substrate subsequently provides both a medium to tunnel through as well as the roaches' sole food source. Roach Crossing is currently experimenting with keeping other species on propagated white rot wood based substrates, with some results being very promising.

Despite original negative sentiments about sand, Roach Crossing has found it to be very useful for rearing some species. Of the utmost importance is that sand with a smooth microscopic structure is used, as this is nowhere near as abrasive on the insect epicuticle as mechanically generated sand. In general, avoid using "play sand" or other types that are the result of human mechanical processes. Sand that is soft or silky when ran through the fingers should be sought after lustfully, with dune sand being the most prized. Mixing sand in a one to one ratio with coconut fiber seems to provide the benefits of both materials without the risks of using either one solely, particularly for members of the genus *Arenivaga*.

A gradient of substrate moisture is important for most roaches. Providing a front-back or top-bottom substrate humidity difference allows the roaches to find just the right spot to rest. This can be accomplished by selectively adding water to the substrate/misting one corner or half of the enclosure during regular maintenance. When given proper substrate and food, most larger roaches do not require an additional water source (e.g. water crystals) and can regulate their hydration without problems. Smaller roaches, particularly Ectobiids, do extremely well with frequent light mistings, and many other species seem to benefit behaviorally when given an activity-stimulating evening spray. When kept in rooms that are particularly dry or if dehydration is suspected to play a role in a colony's poor performance, misting frequency should be increased, enclosure ventilation decreased, or wick waterer added.

Feeding

In addition to sharing our dwellings, another delightful roach trait is their polyphagous nature. Simply put, they are willing and delighted to feed on most of the same food items humans do. Although a roach colony can be maintained on a diet of dog food/fish flakes, carrots, fruit jellies, and apples alone, it is much more fulfilling to provide them with meal scraps and unused/spoiled produce. There are very few things a thriving roach colony won't eat, with tomatoes and potatoes ranking near the bottom of their culinary delight list.

Without belittling their wide appetite, Roach Crossing's colonies are regularly fed apple, banana, orange, pear, squash, apricot, nectarine, peach, tangerine, plum, lettuce, zucchini, carrot, cucumber, pumpkin, sweet potato, and eggplant, topped off with a conservative portion of dry brown dog kibble. Fish flakes may be used in place of dog food for smaller species, as the thin flakes are a bit more palatable/chewable for entities like *Arenivaga sp.* and many Ectobiids. It can be very entertaining to watch roaches claim spots on a chunk of food as it is whittled away over hours (or sometimes minutes), and I encourage roach keepers to experiment with new food items for their roaches. The only foodstuffs that should be offered with caution are tree nuts (which contain natural insect-nibble deterring chemicals and insecticides) and raw meat (which poses a sanitary risk for the keeper). However, in general, roaches tend to be very good at avoiding foods that are toxic or detrimental to their health. Residual pesticides are typically not an issue but are discussed in the "Cockroach Health" section.

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Fruit jellies, a staple of the beetle keeping hobby and recommended for roaches by keeper Orin McMonigle originally, make an excellent food source for tiny climbing roaches. Fruit jellies do not aggressively mold or desiccate as quickly as fruits do in the drier or better-ventilated set-ups that many Ectobiids prefer, making them an ideal choice over fruits and vegetables in those scenarios. Once a large colony is established, fruits or vegetables may be considered again, as the constant chewing/drinking by hundreds of roaches will discourage mold growth. Roach saliva may keep the surface moistened as well.

It must be noted that powdered, blended roach diets do not provide ideal nutrition. It has been established that roaches are driven to select food items based on their present micro-nutrient needs and do best when given a selection. Feeding a powdered, blended diet bombards the roach with nutrients it may already have in excess, decreasing fitness, stunting adult size, and impeding reproductive ability.

Excessively proteinaceous diets (those where only or mostly high-protein foods, such as cat food, are offered) are detrimental to cockroach fitness as well. Thanks to their internal nitrogen-recycling symbiosis with bacteria in the aptly-named genus *Blattabacterium*, cockroaches are able to thrive on low protein diets. Providing only protein or high-protein foods can cause gout and ultimately death in species not equipped to deal with it. Some species are capable of passing extra nitrogen in the form of white fecal pellets (*Parcoblatta sp., Paratemnopteryx sp.*), but are not immune to the effects of an overly protein-rich diet. It is thus important that if high-protein materials are offered, a diversity of other foods are also provided to give the roaches a choice.

In terms of how much to feed, this varies greatly by colony size and species. Often, a zealous keeper will over-feed a small colony of new roaches, only to panic when little of the food is consumed. In these situations, it is best to gauge the colony's appetite over some time: ideally, all food should be consumed within a few days of being added. Food can be provided ad infinitum as long as older material is consumed as fresher material is added. Large quantities/pieces of durable food items (sweet potatoes, apples, carrots, and zucchini) can be provided prior to extended vacations and effectively fill the colony's nutritional requirements for weeks.

Above, a colony of light acclimated Aeluropoda insignis with diurnal activity. Left, a colony of Gyna cafforum happily swarming a piece of apple. As relatively intelligent and adaptive insects, roaches will modify their behaviors based on factors such as food and abiotic resource availability.

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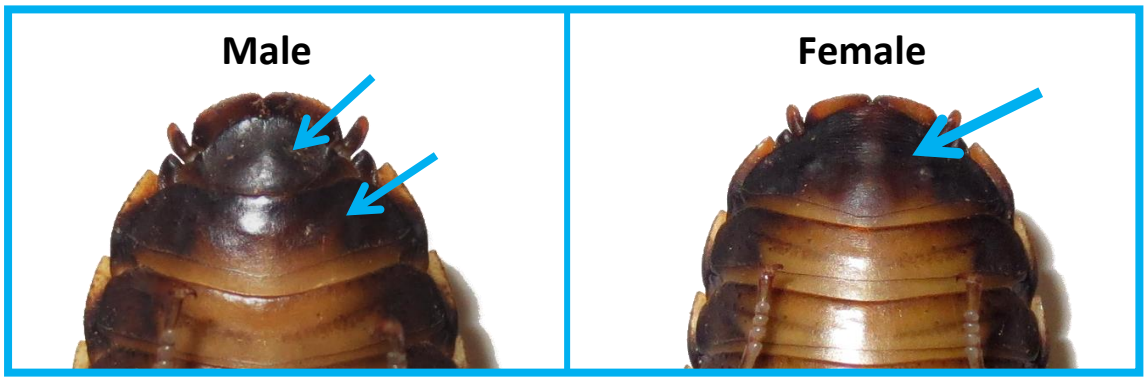
Sexing and Breeding

Most cockroach species are sexually dimorphic externally. In hissing cockroaches, this is obvious in the "horns" of the adult male and relatively smooth pronotum and thicker abdomen of the female. In other species, males are typically less robust and smaller than females; males are also often winged while females err towards brachyptery or aptery. Fortunately, even in species where males and females seem identical, most roach species may be sexed ventrally as early as the third instar using the below method.



In most male roaches, there are two small segments on the bottom side of the end of the abdomen; females have one larger segment. The segments of very young roach nymphs tend to look male. Additionally, members of the family Blattidae have two thread-like structures, the styles, extending from the opening at the tip of the abdomen. These may be retracted or hard to see on some individuals. Cryptocercids cannot be sexed using either of these methods.

Assuming all of the previously discussed parameters have been met, a mixed-sex group of roaches is almost guaranteed to reproduce. If a group of roaches has been in your possession for over a year without reproducing, consider the following:

1. Are the roaches sexually mature? If so, are both sexes present?
2. Are the roaches comfortable? Is there too much or too little space?
3. Is the temperature sufficient for reproduction?
4. Is the diet varied? Are the roaches offered a good selection?
5. Is there a substrate humidity gradient? Do they appear to favor one end over the other?
6. Is a long gestation typical of this species?
7. Is the container escape-proof for all life stages of the species?
8. Do the roaches need a cold diapause to mature or reproduce?
9. For egg-laying species, is there a sufficiently moist or appealing place to deposit oothecae (egg cases)?
10. For dry-area or specially adapted species, has there been a humidity cycle, either subtle or dramatic?
11. Are the roaches in good physical condition? Do they appear vigorous and responsive, or do they appear too old or decrepit to reproduce?
12. Is the original colony the roaches came from in good health, and has it been thriving for some time?

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If the above series of inquiries does not yield any insights, it is possible the species may require something quirky to reproduce (a particular food, certain structures or substrate, temperature cycles, etc.). One of the most rewarding aspects of roach keeping is "cracking the code" to a difficult or challenging species; it is incongruent with Roach Crossing's experience that any roach is unbreedable. It may simply take time, persistence, or creativity to figure the species out.

Clade-Specific Set-Ups

Many of the large, charismatic roaches in culture are members of the family Blaberidae. These subtropical and tropical insects mainly dwell in soil, leaf litter, rotting logs, and caves, and are correspondingly are adapted to consistently moist conditions. Likewise, members of the family Blattidae can be found in similar environments and appreciate similar housing. However, some cockroach clades trend towards adaptations to other habitats and may require differently outfitted enclosures.

Family Corydiidae

Usually referred to as "sand roaches", Corydiids can be found in caves, deserts, under bark, and many other places. This family retains some traits considered ancient among roaches, such as the formation and shape of the wing veins. Despite the common name, Corydiids do not require sand in captivity. Among those most deserving of the name, *Arenivaga sp.* from the southwestern United States transliterates to "sand wanderer". There are dozens of species in this genus, occupying a variety of microhabitats from the duff at the bottom of rodent burrows to free-living in leaf litter. Other genera, such as *Eremoblatta sp.*, are even better suited to a life of sand-digging as suggested by the dense fur which envelopes the body, protecting it from excessive contact with sand particles and slowing the loss of water from the body during respiration.

As noted in the substrate section, the biggest problem with using sand is acquiring the right kind, followed by water management. Damp sand allows for excellent drainage, but simultaneously it compacts easily and may dry out faster than organic materials. Mixing sand and coconut fiber in a one to one ratio captures the benefits of both materials. The roaches can easily move through the sand without their epicuticle being abraded and may comfortably rest at the bottom of the enclosure, while the coconut fiber holds moisture without being too loose or moist. Some Corydiids, like *Arenivaga sp.*, are able to absorb water directly from the air using specialized mouth parts, and humid air in an enclosure after misting or from high atmospheric humidity allows them to use this skill. It is still advisable to provide a moist corner of substrate, as adult males seem to lack this ability and females may prefer to deposit oothecae there.

Other Corydiids prefer more humid substrate with good ventilation in the air column. The infamous *Therea sp.* and *Ergaula sp.* fall into this category. Allowing the top 1/3 of the substrate to dry while maintaining typical humidity in the remainder allows the roaches to vertically orient themselves in the substrate column, and providing a front-to-back gradient provides the ideal spread of options.

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Family Ectobiidae

The Blaberidae and Ectobiidae form the clade Blaberoidea, and the similarities between these groups is visible when observing the sub-anal plate of the adults. Ectobiids are typically tiny roaches about a centimeter or so in length, but also include the titanic *Megaloblatta sp*. They tend to be quick, prolific, and numerous, even in the wild. Their habitats include homes (in the case of *Blattella germanica* and *Supella longipalpa*), leaf litter, grassy areas, and under bark. Despite their small size and fecundity, many of the tiniest species have proven tricky to culture due to misperceptions about their needs.

"Critter keeper" style enclosures provide the perfect conditions for rearing and maintaining large numbers of Ectobiids. Even when stacked, the ventilation and air flow of these enclosures is excellent and most models have enough height to allow for plenty of substrate, enclosure furnishings, and a generous application of non-climbing barrier. With a muslin or frost cloth underlay beneath the lid, escape for even the tiniest nymphs is impossible.

Many Ectobiids traditionally considered to be difficult are found in environments that experience some degree of wet-dry cycle. Ectobiidae sp. "Little Penguin", *Cariblatta sp.*, *Ectobius sp.*, etc., are found in leaf litter. *Euthlastoblatta sp*. and *Aglaopteryx sp*. are usually found under bark on dead, still-standing trees. These habitats become very moist during rain but dry out quickly. With their high mobility and activity levels, these roaches are used to relocating between different microhabitats as conditions oscillate, whether that's up and down in layers of leaf litter or back and forth between different spots beneath bark. Forcing them to constantly tolerate extremes at either end of the spectrum will inevitably lead to colony collapse (though some may rebound when unhatched oothecae hatch).

These factors mean the best way to keep many Ectobiids is a dry enclosure with a complex substrate matrix of wood, sphagnum moss, or coconut crouton chunks and moist conditions only sparingly in a back corner. A light mist daily allows the roaches to drink without overwhelming them with moisture. Condensation should not linger for more than a few hours in these set-ups, as its presence is a sign of too little ventilation, overwatering, or low temperatures. Some oviparous Ectobiids, such as *Ectobius pallidus* and *Luridiblatta trivittata*, have oothecae that require some degree of moist-dry-moist cycling in order to hatch. Though this may seem like a lot of work, Ectobiid colonies tend to grow quickly and once a colony reaches good density the keeper can become a bit lax with watering depending on how dense they'd like to maintain the population.

Family Cryptocercidae

The Cryptocercids, or hooded roaches, represent a unique evolutionary split in the roach family tree, branching off from their closest stereotypically "roach-y" relatives (the Blattidae), before splitting from their closest kin: the termites. Intriguingly, their overall build resembles that of the unrelated hissing cockroaches (Gromphadorhini), perhaps due to convergent lifestyles of living in and under rotting logs. Their namesake cryptic habits, gut microorganism communities, and dutiful parenting skills have long made them subjects of both professional and scientific intrigue.

For years it was believed that Cryptocercids were not easy to cultivate. Speculation ran amok, blaming the sensitivity of their gut flora to heat and cold, shipping stress creating hyperoxic body chemisty, the need for family units to pass microorganisms onto young

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individuals, and the old standby of failure to thrive in captivity. Despite years of unsuccessful culture attempts under these assumptions, an extremely practical breakthrough was pioneered by roach enthusiast Mark Mayer. Cryptocercids can be reared solely on powdered cellulose, which is readily available as a cosmetics and dietary additive. Simply fill the desired enclosure with powder, hydrate it until it forms a homogenous clump, add the roaches, and enjoy. A 16 ounce enclosure filled three quarters of the way with cellulose powder can conceivably last a fledgling colony of a dozen mixed sized *Cryptocercus* a year or more, making what was once believed to be a difficult species into perhaps the easiest and lowest maintenance roaches. However, in recent times this set-up style has not achieved the most practical standard for cultivating roaches. That standard, of course, being reproduction.

In 2020 beetle keeper Junkai Wang reported offspring from *Cryptocercus punctulatus* in a tiny enclosure with solely rotten wood. Kai quickly became bored with the roaches and attempted no long-term propagation.

Avid bug person Samson Braden has made repeated observations of *Cryptocercus wrightii* in the wild, including using a temperature gun to record wild individuals resting comfortably in wood well over 80 degrees Fahrenheit. This sheds a scrutinizing light on previous laboratory reports regarding high temperature sensitivity of *Cryptocercus* endosymbionts, particularly when wild individuals choose to subject themselves to those conditions. In July 2022 Roach Crossing made observations of wild *Cryptocercus wrightii*, supplementing previous investigations. A colony was found in wet, brown-rotted wood on a roadside. Brown-rotted wood is chemically different than white-rotted wood, and the fungi that break down materials in this manner are restricted to temperate climates unlike the wide-ranging white rot fungi. The relationship between *Cryptocercus* and this material is currently being explored and may be fruitful for culturing endeavors, as well as explaining the geographic restriction of the taxon.

Subfamily Perisphaerinae

Perisphaerines, sometimes called the roly-poly or pillbug roaches, are unique roaches with universal charm. Some, like *Perisphaerus sp*., can roll up into a ball to protect themselves (and sometimes their offspring) from predators such as ants. Others, like *Bantua sp*., are adapted to xeric habitats and produce a waxy coating that protects them against desiccation. This diverse subfamily also contains the living jewel *Pseudoglomeris magnifica*, whose offspring cling to the mother's underside and back for several instars.

These roaches can be finicky regardless of their exact preferences, and it's not uncommon for expert keepers to find them frustrating. In general, the members currently commonly cultured like good air flow combined with the humidity of their choice. *Perisphaerus punctatus* has proven quite hardy in both moist and dry conditions, but those new to roachkeeping should err on the drier side. *Bantua robusta* prefers dry conditions most of the time, with bumps in humidity seeming to stimulate females to give birth. *Pseudoglomeris magnifica* "Cuc Phuong" prefers high heat and humidity, though this can be provided either with lower ventilation or with very frequent misting. Stagnant conditions, particularly cooler ones, are extremely detrimental to this strain, and good judgement must be used if going the low ventilation humidity management route.

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All Perisphaerines currently commonly cultured are excellent climbers, and a reliable barrier and escape-proof enclosure are necessary. They are generally very active in their enclosures, and make good use of the verticality provided by upright bark and sticks. While they are perceived as being picky eaters, Roach Crossing has had no issues keeping and breeding these species on fish flakes, dog food, apple chunks, and fruit jellies alone.

Cockroach Health

The popular culture depiction of cockroaches is of an indestructible nuisance capable of surviving a nuclear blast, decapitation, drowning, starvation, and essentially every horror nature could dish out. This could not be further from the truth, as millions of cockroaches perish each day due to parasitoids, viral infections, fungal attack, and bacterial illness. It is imperative to note that the conditions which afflict roaches do not affect humans; they are simply organisms and pathogens with harmful effects on the physiology of roaches and their relatives and are of no threat to mammals. That being said, the roach immune system is quite impressive, and there is much to be learned from it for the benefit of human medicine. In captivity, the average roach has been isolated from its wild kin for many generations, feeding on a completely different diet and under relatively cushy care. Occasionally, a long-term captive colony may have health issues arising from accidentally introduced pathogens, inadvertent changes in husbandry, or physical damage. See the following table for approximate diagnoses.

Condition	Symptoms	Severity	Causes	Treatment
Aborted oothecae	Unhatched oothecae from live-bearing species in the enclosure	Mild to Severe	Stress, poor physical condition, unknown	Check husbandry to ensure proper conditions
Cockroach Antennae “Herpes” (*Herpomyces sp*.)	Fuzzy material on the antennae of Ectobiid roaches, antennae often shortened as well	Mild to Moderate	Fungal infection of the antennae	None, check husbandry to ensure proper conditions
Colony Death Spiral (CDS)	No or minimal reproduction, adult roaches living for varying amounts of time, inexplicable deaths; symptoms manifesting during an observation period of a few weeks to months after receiving roaches or after correcting husbandry in your own colony	Moderate to Severe	Lingering effects of previous poor husbandry/colony stress	None, but may be reversed in a generation or two if good husbandry is maintained
Densonucleosis virus	Excessively swollen abdomen, organ prolapse	Severe	Unknown	Lethal but not highly contagious
Disecdysis or failed molts	Molting individuals trapped/stuck partially in shed exoskeletons	Moderate to Severe	Dehydration, malnutrition	Check husbandry to ensure proper conditions

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Entomophagous fungus infection (usually *Trichoderma sp*.)	Recently dead individuals with white or green fungus covering the body	Mild to Severe	Fungal spore presence and/or stress; excess protein in diet	Lethal to some roach species; increase ventilation, and/or decrease humidity, and/or increase temperature, feed less protein
Fatal or non-fatal cannibalism	Decreasing population size, freshly molted individuals with missing body parts, tattered wing tips	Mild to Severe	Dehydration, malnutrition, starvation	Increase food variety and/or quantity, cull/split the colony, mist or provide water source, or increase frequency of feeding and watering
Grain mite (*Acarus sp*.) hypopus	High-density, whitish mites clinging to body segments, on upper legs, and on face	Moderate to Severe	Overfeeding, wet substrate	Isolate unaffected individuals, manually remove mites using fingernails or stiff brushes, change substrate, feed sparingly until no mites are detected, introduce predatory mites
Hissing cockroach mite (*Androlaelaps schaeferi*)	Fast-moving, dark red/brownish mites crawling across the body surface and between the leg joints of hissing cockroaches	Harmless	None	Commensal organism, numbers will fluctuate due to enclosure conditions
Hyperpigmentation disorder	Increased contrast between normally dark pigment areas and light/translucent areas	Mild	Low temperatures, high humidity	Increase temperature, decrease humidity
Jigsaw disorder	Abdomen or thoracic segments uneven or mismatched, giving a “jigsaw puzzle” appearance	Harmless to Mild	Damage to embryo during incubation, unknown	None

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Male Bullying	Adult males with shortened antennae, rarely, missing legs or leg pieces	Harmless to Moderate	Natural behavior between adult male roaches (Oxyhaloinae, some Blaberinae)	None, cull/split colony, increase enclosure size
Myiasis	Fly larvae colonizing/actively growing on living roaches, particularly the abdomen tip	Moderate to Severe	Wet conditions or low ventilation, overcrowding	Decrease humidity or increase ventilation, cull/split the colony, manually remove fly larvae from infected roaches (euthanize individual if severe)
Old age	Missing limb tips, tattered wings, discolored patches on body, lethargy, broken antennae	Mild	A life well-lived	Personalized care
Organ prolapse	Organs extruding from the abdomen tip, appearing balloon or “worm”-like	Severe	Physical trauma, viral infection, unknown	Lethal in most cases; euthanize
Oribatid mite (Oribatida) hypopus	Shiny reddish mites clinging to and feeding on limbs, abdomen vent, or mouth; infesting substrate	Mild to Moderate	Unknown; possibly due to wet substrate or certain foods	Remove and keep roaches dry for several days, change substrate, feed sparingly until no mites are detected
Pesticide, wood-induced, or bacteria-induced poisoning	Lethargy, unusual and uncoordinated twitching movements, inability to flip over when on back	Moderate to Severe	Contaminated food or substrate	Lethal to affected individuals; wash and carefully select produce; ensure the substrate does not contain fresh softwoods
Serratia bacterial infection	Abnormally bright red or orange coloration, decreased reproduction, mismolting	Mild to Severe	Dehydration, overcrowding, malnutrition, previous infection in colony/stock	Check husbandry to ensure proper conditions; cull infected individuals if desired

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Subcutaneous *Serratia* bacterial infection	Recently dead individuals or living individuals with non-functioning reddish/purplish limbs and other body parts	Mild to Moderate	Wet conditions or low ventilation; different strain of bacteria from cuticular infection	Decrease humidity or increase ventilation
Terminal dehydration	Dead, dry individuals on the substrate surface with the front of the body "lunged" forward, legs sticking out behind; this same posture but laying on their backs	Moderate to Severe	Dehydration	Check husbandry to ensure proper conditions
Wing, limb, and body deformities; mismolts	Curled, tattered, deformed, or torn wings; missing or twisted limbs and bodies	Mild to Severe	Dehydration, overcrowding, malnutrition	Increase humidity, increase diet variety, increase enclosure size or cull, or provide vertical surfaces for molting
Yeast ooze	Dead individuals slumped over in corners, cracks, etc.; body "drips" apart when picked up, particularly foul odor	Severe	Internal yeast infection	Typically fatal and contagious, uncommon in long-term captive colonies but occurs occasionally in wild-caught stock; may be treatable with increased ventilation, diet change, or temperature increase

It is important to note that although some conditions are reversible in roach nymphs, many illnesses cannot be fixed in adults. This includes missing limbs and traumatic physical damage, among other things. In general, the nymph stage is the most adaptable part of the cockroach life cycle, and they will respond to husbandry improvements or treatments the best.

Left, hissing cockroach mites (Androlaelaps schaeferi) on a member of the Gromphadorhini. Right, Byrsotria fumigata var. fumigata nymphs believed to be infected with cuticular Serratia bacteria.

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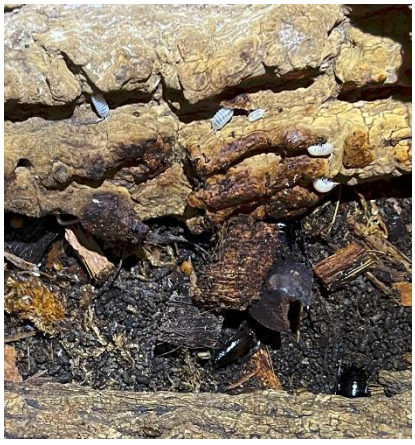
Clean-Up Crews and Enclosure Pests

Nature exists as a complex, integrated system. In some cases, removing a single gear in this metaphorical machine can have dramatic consequences on the whole. It has been the tradition in laboratory and zoological practice to keep each species in a relatively sterile, tightly monitored system. While this ideology has its place in rigorous experimentation, it is not always ideal from an aesthetic and functional standpoint. In roach cultivation, it is usually healthier and more practical to maintain a small ecosystem within the enclosure, replicating the various roles performed by a diverse cast of organisms in the wild. Scavengers, aerators, decomposers, and predators may all be introduced with purpose into roach colonies to better replicate wild conditions and to deal with roach waste and pests when the roaches themselves cannot.

In large-scale feeder roach set-ups, there may sometimes be an abundance of deceased adults, and with the large number of individuals there can be occasional (but unsubstantial) losses of nymphs due to the rigors of mass-production. In these cases, clean-up crews may be introduced to prevent the reproduction of pest organisms and to improve the aesthetics.

On the other end of the spectrum, even decorative and pet roach breeding set-ups have their problems; mold on uneaten food, deceased adults, and competing organisms can cause problem in certain scenarios. Clean-up crews can be used in these situations to reduce or prevent mold, consume roach frass, outcompete detrimental organisms, or simply add to the look of the enclosure.



Cockroaches and isopods do very well together, with the roaches providing unbeatable nutrition in the form of beneficial bacteria loaded fecal pellets. Often, isopods fare far better when housed with roaches than when housed alone. At top from left to right, Gromphadorhini sp. with Porcellio magnificus, Rhyparobia maderae with an Armadillidium vulgare project and Cubaris sp. "Red Edge, Orange", Blaberus craniifer "University of California, Riverside" with Armadillidium corcyraeum. At right, Periplaneta americana "Venom" with Armadillidium vulgare "Magic Potion".

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The table below includes some common pests and problems encountered in roach rearing, as well as suggested clean-up crews for dealing with them. Some issues may be fixed without use of a clean-up crew, though having one present substantially reduces the need for frequent maintenance. Over time and with enough roaches, clean-up crews may not be necessary for some roaches (*Eublaberus sp*., *Pycnoscelus sp*., *Ergaula sp*., etc.).

Problem	Description	Causes	Clean-Up Crew
Food mold	Variably colored molds growing on or engulfing food items..	Overfeeding, high moisture or low ventilation	Springtails, isopods, amphipods
Frass build-up	Exuviae (shed exoskeletons), hatched oothecae, and carcass bits accumulating in the enclosure.	Typical of healthy colonies; excessive build-up due to colony problems	Springtails, isopods, amphipods
Fruit flies (*Drosophila sp.*)	Tiny, yellow to brown flies with bright red eyes. Tending to hover about the enclosure, resting on fruit or vegetables.	Overfeeding	Isopods, amphipods
Fungus gnats (Sciaridae sp.)	Tiny, black flies. Relatively delicate-looking, tending to flutter clumsily about the enclosure.	High substrate moisture and/or organic matter content	Isopods, *cf. Dalotia coriaria* rove beetles
Grain mites (*Acarus sp.*)	Microscopic, white-ish mites, often forming a “powder” around grain-based food items or on the enclosure sides.	Overfeeding	Springtails, isopods, amphipods, lesser mealworms (*Alphitobius diaperinus*), dermestid beetles (*Dermestes sp*.) (depending on enclosure humidity)
Phorid flies (*Megaselia sp*.)	Tiny to small brown flies. Prefer to scuttle around the enclosure, moving in short spurts. Usually found on dead roaches or very rotten food items.	Overfeeding, overcrowding, frass and carcass build-up	lesser mealworms (*Alphitobius diaperinus*), dermestid beetles (*Dermestes sp*.), isopods
Substrate mold	Fluffy or fuzzy molds carpeting the substrate	Overfeeding, frass build-up, strong fungal presence in substrate, high moisture or low ventilation	Springtails, isopods, amphipods
Unpleasant odor	Foul or discouraging smell wafting from the enclosure	Overfeeding, overcrowding, wet conditions, numerous other causes	Springtails, isopods, amphipods, lesser mealworms (*Alphitobius diaperinus*), dermestid beetles (*Dermestes sp*.) (depending on exact cause)

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Cohabiting Species and Hybridization

Unlike hobbies such as fish-keeping, which have had decades to experiment with mixed-species enclosures, roach keeping has not yet explored this fascinating and potentially groundbreaking concept. In general, roaches are not aggressive or defensive insects and many are more than content to commingle as long as there is apt space and resources. It is advisable for those seeking to culture multiple species in one enclosure that a good amount of space be given to allow each its own special niche. Species of dissimilar habits, such as burrowers and climbers, may be suitably accommodated if given enough space. Differently sized roaches are also good candidates for mixing, as this can enable spatial separation of the species by providing décor with features only the smaller species can access, such as pores, holes, or tight spaces. It is likely that within the next few decades as the understanding and popularity of roach keeping continues to increase, cohabiting multiple species in luxurious planted and outfitted enclosures will become commonplace.

It is ***critical*** to note that some roach species will hybridize readily if kept together, with two popular examples being some *Blaberus sp.* and *Gromphadorhina/Princisia sp*. crosses. Hybridization is detrimental to the keeper because it:

1. Dilutes the genetic composition and identity of a species or strain which may already be rare in captivity
2. Contributes to misinformation about the phenotype of the species
3. Runs the high risk of distribution of hybrid stock as pure stock among those unversed in roaches (which may lead to contamination of pure stock as well)

Some hobbyists argue that as captive organisms, it is in human interest to create hybrids in search of desirable characteristics like new colors or vigor. In Roach Crossing's experience, hybrid roaches tend to be smaller, less vigorous in growth and reproduction, prone to deformities, and frequently plagued by spontaneous death. Sometimes, there is hybrid vigor, but this raises questions regarding the true taxonomic relationship of the parent species. The hybrid's appearance often tends to be a muddied or pastiche version of the parent species' colors, and while it is conceivable such variations could be selected for and modified, it may ultimately take more time and effort to do so than if one were to do the same using pure stock.

The following genera/species groups that have been proven to hybridize in captivity (as well as those in which hybridization may be possible) are shown below.

Proven Hybrid-Forming Groups	Suspected Hybrid-Forming Groups
Gromphadorhina sp. (all in culture) *Princisia vanwaerebeki* *Aeluropoda insignis*	*Elliptorhina sp.*
	Gyna sp.
Blaberus discoidalis *Blaberus boliviensis* *Blaberus parabolicus* *Blaberus atropos* *Blaberus sp. "*Venezuela*"*	*Rhyparobia sp.*
Blaberus craniifer *Blaberus cf. peruvianus* *Blaberus fusca*	*Eurycotis sp.*
Therea sp. (all in culture)	
Luchihormetica sp. (subcincta and *verrucosa)*	

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Philosophy

What is the goal of the roach keeper? Is it to propagate a species to better understand its biology? To produce a massive culture for laboratory research, or to feed to other organisms? Is there value in having as many types of cockroaches in one place at the same time? Or perhaps having one familiar colony to observe day in and day out as we go about our lives. We can learn a lot from the cockroach paradigm: to be adaptive yet unchanging in a world that swirls with change around us. A reminder that some things will always be here as long as we are, and even beyond.

Conclusion

From their humble beginnings in the Carboniferous era over 300 million years ago to their current global presence, cockroaches have intrigued, disturbed, and persisted with man as long as man has existed. Be it as household pests or pets, the fates of cockroaches and humans are forever intimately intertwined. With time, perhaps the world will gain a greater appreciation for these rugged survivors, regardless of whether they are encountered in the urban jungle or elsewhere. For now, those of us who cultivate and admire them must do our best to share and spread our passion, just as our six-legged subjects have spread across the planet.

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