Notes on the Bionomics of Roaches Inhabiting Houses

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Cockroaches are gregarious and are usually found in the kitchen and other places where food is stored. All of our species are nocturnal in habit, hiding away in dark, damp, warm places during the day and coming out at night in search of food. Of the six species found in Indiana homes, the German roach (*Blatella germanica* (Linn.)), the American roach (*Periplaneta americana* (Linn.)), and the Oriental or black roach (*Blatta orientalis* Linn.) are common household pests; and, because of their frequent occurrence around sinks and water pipes, all three have had the common name of "Water bugs" applied to them. A tropical species, the brown-banded roach (*Supella supellectilium* (Serv.)), which was first found in Indiana at Bloomington in October, 1937, shows a preference for staying in furniture, bedding, and closets, and behind picture mouldings, etc. The Pennsylvania wood-roach (*Parcoblatta pennsylvanica* (De Geer.)) has been found in many rural and urban homes where it has migrated from nearby wooded areas. The smoky brown roach (*Periplaneta fuliginosa* (Serv.)) is a subtropical species and has been found breeding throughout the year in greenhouses. It has been reported as a household pest in Iowa[1].

The German roach is the most common and abundant species in dwelling houses. It increases more rapidly than do other roaches because it produces more eggs per capsule, and the young complete their growth in a shorter period of time. The time required for a complete generation is about 90 days for eggs produced in July, and about 130 days for eggs produced from September to April. The small size of this species enables it to crawl into cracks and crevices. In an infested home it is confined to the kitchen and lavatories where it hides behind baseboards, in cupboards, iceboxes, and dark corners, and around water pipes. The German roach is quite active, but it seldom flies. When it does, its flight is of a gliding nature.

The American roach, the largest of the house-infesting species, has a long developmental period requiring from 300 to 500 days. It is more common in restaurants, grocery stores, and packing houses than in homes, where it usually hides in the kitchen or basement. At night it wanders about through the infested premises, and during the summer nearby yards and alleys may be overrun with it. It has fully developed wings, but its rare flights are sluggish.

The Oriental roach is the most loathsome of the household forms as it travels through sewer pipes and lives on filth. It feeds on a wide range of organic matter and remains in dark, damp basements most of the time. This species enters the home through sewer and drain pipes and is rarely seen. The males have full wings and probably can

[1] Fulton, B. B., 1928. Cockroach destruction in buildings. Iowa Agri. Expt. Sta. Cir. 112.

fly, but the females have rudimentary wings and are comparatively sluggish. The developmental period is about a year and the adults live nine to twelve months.

The brown-banded roach is similar in shape and size to the German roach and, like it, is quite active. It has a tendency to fly when disturbed. Except when in search of food, it seldom visits the kitchen and confines its activities to other parts of the house. Egg capsules are often stuck under furniture and in closets. There are possibly two generations of this species a year in warm houses.

The wood-roach is a common inhabitant of woods where it lives under the bark of dead and fallen trees. In rural areas where a house is surrounded by or near a woods, these roaches are common invaders. The males are capable of long flights, while the females may migrate some distance by crawling. During the past summer a trip was made to investigate an infested farm house. Many mature males and a single female were found on an inclosed back porch, and a few males were in the house, but there were no young anywhere. About dusk the roaches began flying in short flights around an old building used for a garage and chicken house. By watching carefully, an occasional roach was observed to fly to the house which was about 40 feet away or to the woods which was about 100 feet in the other direction. This species is the one frequently encountered by motorists driving by woods about dusk. In nature the wood-roach passes the winter as a partially grown nymph, and even in zero weather is quite active when exposed by pulling away bark. Adults are present from May until early October.

The smoky brown roach is regarded as a household species, although records from Indiana show it to be present and breeding in a greenhouse. In the same location the American roach is common, and so it undoubtedly finds sufficient organic matter for its food requirements. It is quite active and capable of flying.

In maintaining living colonies of these six species, all are reared in gallon-size glass battery jars on a mixed food known as Haydak's mixture[2], consisting of corn meal, whole-wheat flour, wheat bran, dried skim milk, powdered yeast, honey, and glycerin. Raw potato is given them once a week, and water is present at all times. The rearing jars are kept on a laboratory table, and, after a few days, daylight does not seem to bother the roaches. An inch band of vaseline around the top, inside of the jars, is an effective barrier to prevent the escape of all species except the German and the brown-banded roaches. Adults of the Oriental roach, and some nymphs are unable to crawl up the sides of the glass jars.

The food requirements of roaches are not restricted, as they seem to thrive on a wide variety of organic material. The American roach was maintained for over a year on a diet of raw potatoes alone. When given a choice of several foods, this species was attracted to chocolate and to a mixed food containing honey. In trapping, bananas proved to be the best bait, although at a meat packing house roaches were readily attracted to hamburger. Commercial bait containing cereals,

[2] Haydak, M. H., 1936. A food for rearing laboratory insects. Jour. Econ. Ent. 29:1026.

honey, and phosphorus attracted the American roach in large numbers, but, when arsenicals were used in a similar mixture, the roaches would not feed.

Thermal-gradient tests were conducted to determine the temperature range preferred by the American and Oriental roaches. The chamber used was six feet long and about four inches square. One end was placed on a hot radiator and the other end packed in a salt and ice mixture. Thermometers were placed 10 inches apart for obtaining records in various sections. Twenty roaches were released in the chamber in each test and allowed 30 minutes to find the most suitable temperature. A number of tests performed with different sets of roaches indicate that both species prefer a temperature between 79° and 82° F. in a chamber where maximum range was from 40° to 99° F. In one test, five American roaches ran down to the cold end and in a few minutes fell over on their backs numbed.

Although the processes of capsule formation and egg-deposition inside the capsule are similar in all six species, the number of eggs per capsule and the care of the capsule varies. In the capsule of the American and Oriental roaches there is a maximum of 16 eggs, in the brown-banded roach 18 eggs, in the smoky brown roach 24 eggs, in the wood-roach 32 eggs, and in the German roach 42 or 44 eggs. Less than 24 hours are required for capsule formation and egg deposition in it, and as a rule the first five species will deposit the capsule before the 24-hour period is ended. In captivity the roaches deposit the capsule on paper, on food, or on the side of the jar. Capsules are usually glued in place by secretions from the mouth of the roach, and in most cases are covered by a coating of small bits of paper, pieces of food, or pellets of excrement. The wood-roach takes less care of its capsules, which are often found loose in the jar.

The female German roach differs from those of the other five species in that she does not deposit her capsules but carries them until hatching. In the deposition of eggs in the capsule, the process is similar to that of the other species, that is, the seam is uppermost and the eggs are placed in it head-end up. About 12 hours after egg laying is completed, the capsule gradually shifts over on its side so that the seam is usually to the right. The actual hatching of the eggs has been witnessed by the writers only once. The capsule split open along the seam, and the white heads of the numerous young roaches appeared. After much struggling and squirming, about 12 worked themselves out and soon were pulling their antennae and legs free from their individual egg shells. They then dropped to the bottom of the jar and remained motionless for a few minutes. Their struggles to free themselves had taken approximately five minutes. At the same time, the adjoining young roaches were working themselves free, so that at the end of ten minutes 32 young were on the bottom of the jar, and two were still struggling to free themselves. After remaining motionless for a minute or two, their inflated, elongate shape disappeared, and the roaches became flattened and somewhat oval in shape and ran around the jar normally. Several of the young crawled up on their mother and ate the egg shells pro-

truding from the open seam of the capsule and even ate the head of an unfortunate mate that was unable to free itself of its egg shell.

The actual mating of cockroaches has not been observed, although courtship is a common occurrence at night, and on one occasion a pair of American roaches was found coupled together. When the capsule attached to the German roach described in the preceding paragraph started to hatch, the five males in the same jar became quite excited and made numerous attempts to mate with her. Time and time again they would approach the female but were kept at a distance by the constant twitching of her antennae. Then the males would turn around, and, with their wings at right angles to the body and the abdomen greatly extended, would attempt to back under the body of the female. These attempts were usually made from in front, although often the approach was made from the side.

Cannabalism among roaches, especially when they are crowded, is common in the laboratory. American roaches frequently attack one that is injured or unable to extract itself from its old skin in the act of molting. When food is scarce, the injured roach is often completely consumed except for wings, legs, and antennae. It has been noted also that when adults are dying in jars where insecticides are being tested, other roaches often eat into their abdomens. German roaches often attack newly molted nymphs and cause them to deflate.

Although roaches are considered the most loathsome insect invaders of the home, they are exceedingly clean about removing any foreign material on their body. A little dust on an antenna will set the roach to cleaning this appendage and often other parts of the body. The skill by which the roach hooks a front leg over an antenna, draws it down into its mouth, and then by rapid movements of the mandibles forces it between the upper and lower lips, is truly remarkable. Any foreign particle on the antenna is scraped off on the exterior of the lips and seldom enters the mouth. In order to clean the legs or the underside of the abdomen, the roach arches its back and uses its mouth to remove the source of irritation. An attempt was made to mark individual nymphs by placing black lacquer or shellac on their backs, but these materials would always peel off in a day or so. However, it was quite amusing to watch a roach attempt to remove this shellac by arching its back and rubbing it against the glass jar much as a cat rubs against a person's leg.

In order to determine if roaches can reproduce parthenogenetically, observations were made on four virgin female American roaches and one German. Two of the American roaches produced no capsules, a third produced a single imperfectly formed capsule, and the fourth two capsules, one imperfect and one perfect in size but light in color. The German female produced three capsules, the first being eaten after two days, the second after 38 days, and the third remaining attached when the female died after 30 days. None of the eggs in these capsules were fertile.