BULLETIN 186 AUGUST 1919

The University of Minnesota

AGRICULTURAL EXPERIMENT STATION

COCKROACH PESTS IN MINNESOTA WITH SPECIAL REFERENCE TO THE GERMAN COCKROACH

BY

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COCKROACH PESTS IN MINNESOTA WITH SPECIAL REFERENCE TO THE GERMAN COCKROACH

By VERNON RAYMOND HABER

Of the various domestic pests of our temperate climates none are more despised, more widespread, or more wary than cockroaches. Not only do housekeepers suffer from the damage done by these insects, but keepers of restaurants, hotels, soda fountains, confectioneries, bakeries, laundries, and many other establishments find their control a serious problem.

DESCRIPTION

Cockroaches may be recognized by their much flattened bodies, in this respect resembling bedbugs. The head is carried beneath the front end of the body with the mouth directed backward between the bases of the front pair of legs. Two black, kidney-shaped eyes partly occupy the top and sides of the head. To the top of the face region, between the eyes, are attached two bristles or hair-like feelers. The legs are somewhat flat and appear frail and delicate, but they are well suited for rapid running. The upper surface of the back end of the body always bears two blade-like structures which may be directed upward or sidewise. The full-grown cockroach may or may not have wings. This depends on the age, sex, and species, or kind. All immature cockroaches are wingless. Otherwise, except that they are smaller and usually of darker color, they much resemble the adults.

HABITS OF COCKROACHES

In greenhouses or places in which favorable conditions of heat, moisture, food, and seclusion prevail, almost any of the wild cockroaches common to a locality may appear. All cockroaches are exceptionally fond of narrow, dark, damp, warm quarters. Those in residences may be found in crevices back of loose woodwork, around sinks and waterpipes, beneath loose wallpaper, or beneath loose paper accumulating on floors or shelves, or in trash baskets. Domestic cockroaches usually remain near the kitchen and pantries.

Cockroaches are most active at night, but in places where they are abundant they may be seen at almost any time, especially if unmolested. As a rule the young ones are less timid than the adults.

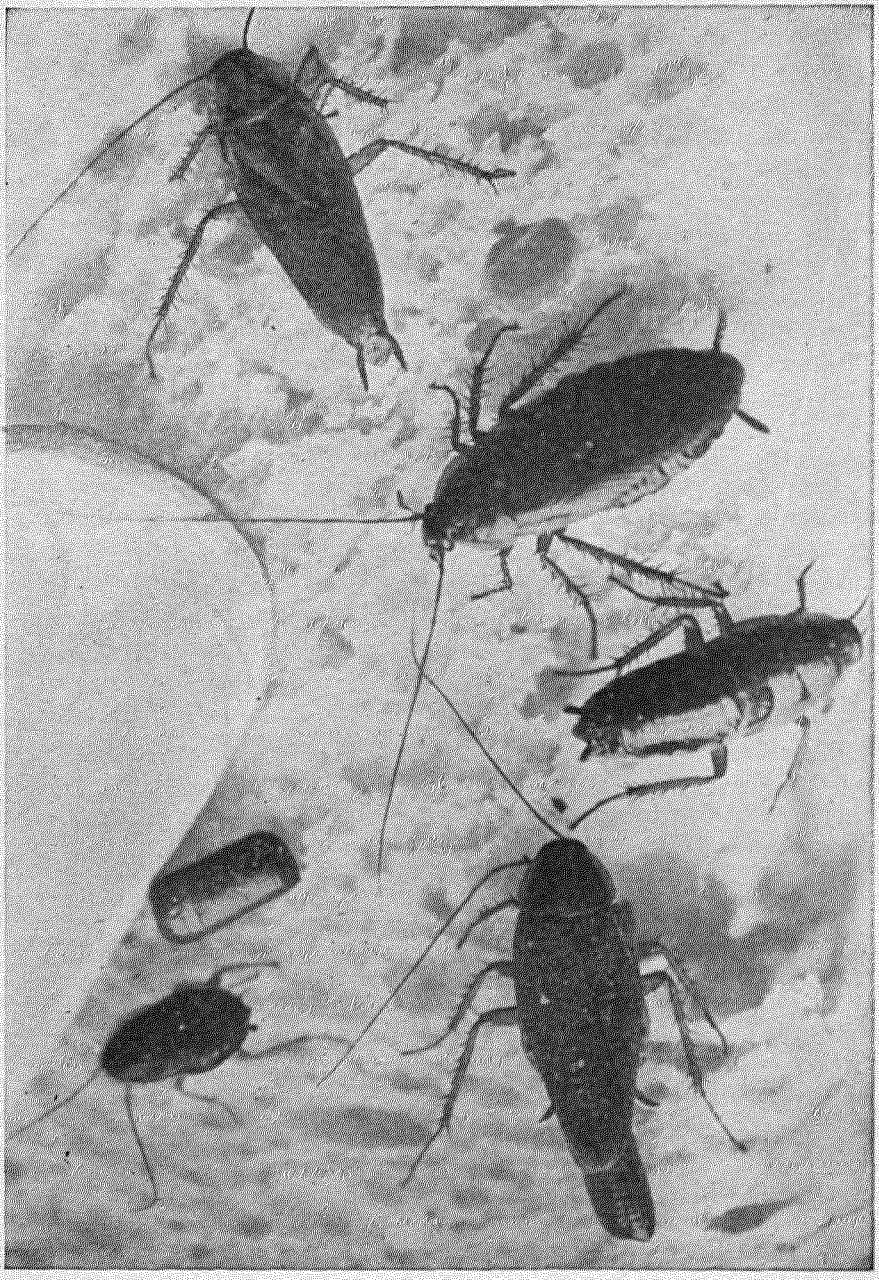

Fig. 1. Cockroaches on Bread, Enlarged Washburn

Owing to their preference for darkness, the people of ancient times named them "lucifuga," light-shunners.

Cockroaches are biting insects. With their powerful jaws they pinch substances to bits. Left unmolested, they devour almost anything that they can chew. They visit the filthiest as well as the cleanest places and greedily gorge themselves with the filthiest refuse and the choicest of pastries and meats. The legs and feet are provided with small hairs and spines which are well fitted to hold small portions of the materials with which they come in contact. They drop liquid from their mouths on substances over which they run. Other cockroaches come along and drink up this liquid, which may contain bits of any material which the insect has eaten. Cockroaches cleanse their legs, feet, and feelers by passing them through their mouths. They are literally washed with spittle. Thus the portions of food which they do not eat they render unfit for use by running over them. Cockroaches taken from a stable deposited droplets of liquid of the same color and odor as the seepage of the manure. It is easily seen that they can be important factors in spreading certain disease germs. Dangers of this rôle must be considered in the study of the importance of these insects as household pests.

All cockroaches give off a waxy secretion from the greater portion of their bodies. This secretion and the excrement, or dung, give off the so-called cockroach odor. The runways and hiding places are generally characterized by the odor and dung stains. A cockroach taken from one house to another where there are others of the same species, usually has little difficulty in locating the places where its fellows are hidden. In this they seem to be directed by the odor and advantage has been taken of this in trapping them.

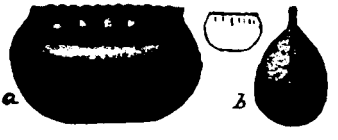

Fig. 2. Egg Case of Cockroach U. S. Bur. Ent.
a. Side view b. End view
Between a and b, outline drawing showing natural size of case.

Cockroaches deposit their eggs in pillow-shaped cases (Figure 2). When an egg case begins to appear at the tip end of the body it is white. As it is filled with eggs it is further pushed out. Fully formed, the case soon becomes about the same color as the first pair of wings or the back of the parent. In this stage it may be left by the mother or she may carry it about until the eggs hatch. Often the mother eats the empty egg case or it may be the first food for the young which

hatch from it, or for other cockroaches and insects. A few may be left to decay. In some species the young are developed inside the body of the mother.

The young cockroach, in growing to maturity, must shed its skin several times. This process is known as moulting. Just after each moult the young cockroach is white with black eyes, presenting the appearance of a newly hatched individual. Several hours after moulting it takes on the normal dark color. Cockroaches usually mate several days after becoming adults.

SPECIES OF HOUSEHOLD COCKROACHES OF MINNESOTA

Only four species of domestic cockroaches are found breeding in Minnesota usually. No reports have been received of all four species living in the same building at the same time.

The most common and the smallest of our domestic cockroaches is the German. Of all cockroach infestation in our cities and villages about 90 per cent is the German. The Oriental cockroach ranks next in numbers and in size. The next largest is the Australian. It is rather scarce, but at times appears in greenhouses or similar places which are sufficiently warm and damp and are provided with food. The American cockroach is the largest of our domestic species. None of the domestic species occurs wild in Minnesota. They are found in buildings of cities and villages but seldom in those of rural districts.

Several species of wild cockroaches are found in Minnesota. They may get into residences in the summer, but seldom in such numbers as to be annoying, and usually only temporarily.

GERMAN COCKROACH *Blatella germanica*

Doubtless the German cockroach (Figure 3), is the most troublesome of our domestic cockroaches. In certain localities it is the only species. It is sometimes called the "croton" or "water" bug owing to its having become numerous in New York City at about the time the Croton water system was installed there in 1842. The adults are of a tawny amber-brown color. They possess well-developed wings and the top of the front end of the body is marked by two more or less parallel conspicuous dark brown to black stripes. From the front of the head to the tip of the wing covers, the adult measures about half an inch. Its body is slightly more than an eighth of an inch wide. Females are usually broader, heavier, and darker in color than males.

HABITS

Because of the extreme flatness and the small size of its body the German cockroach can conceal itself in very narrow crevices. This is true especially of the younger ones. They crowd or squeeze them-

selves into crevices of barely their own thickness. They give off an odor peculiar to the species. In general their habits are much like those of other species.

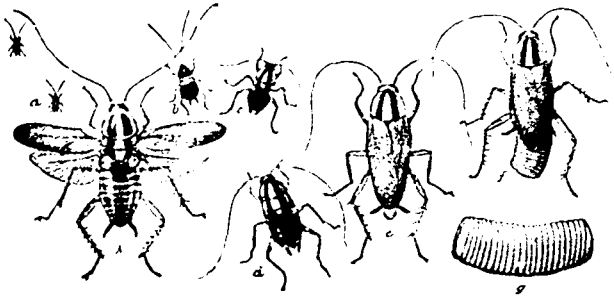

Fig. 3. German Cockroach U. S. Bur. Ent.
a-d. Immature specimens e. Male f. Female with egg case
h. Adult with wings spread g. Egg case, enlarged

LIFE-HISTORY

In from two to four days after mating, the egg case begins to appear at the rear end of the female. If surrounding conditions of heat and moisture are favorable, in about forty-three days the case bursts along the flanged side and the newly hatched young wriggle out. In most cases they emerge while the egg case is still attached to the tip of the body of the mother.

Typically, the German cockroach moults seven times before it is fully grown. If the temperature is maintained at 77 degrees F. (25 degrees C.), in cages well darkened and well supplied with food and water, the complete development is undergone in from 109 to 147 days. In other words, under conditions such as often prevail in nature, the German cockroach may develop from the fertilized egg to the adult stage in from 3½ to 5 months.

The life cycle of this species is the shortest of any of the domestic cockroaches. The sexes mate within a few days after reaching maturity, and breeding may occur throughout the year. This comparatively short life cycle and habit of breeding favor the occurrence of this roach in great numbers where it has become well established.

ORIENTAL COCKROACH *Blatta orientalis*

The Oriental cockroach (Figure 4), is readily distinguished from the German by both color and size. Except at moulting and hatching times these cockroaches are very black. The adults are approximately an inch long and three eighths of an inch wide. Normally the females are longer and broader than the males, the latter appearing frail and weak. In the male, the tips of the wings do not reach the back end of the body; in the female, the upper wings are about three sixteenths of an inch long and are very small in comparison to the body bulk. Often

these cockroaches are noticed huddled together, the younger ones crawling over, around, and beneath the older ones.

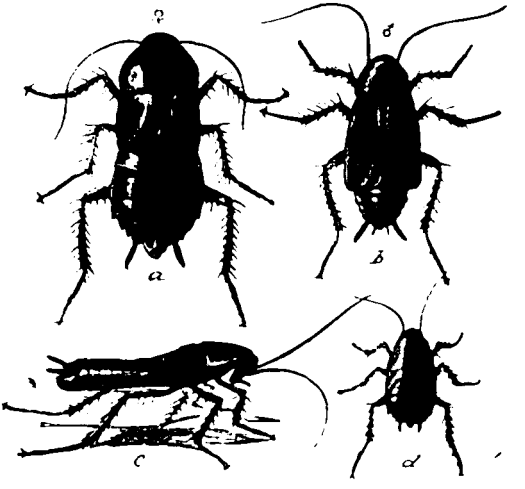

Fig. 4. Oriental Cockroach. U. S. Bur. Ent.
a. Adult female. b. Adult male. c. Side view. d. Immature specimen.

The female usually produces sixteen eggs in a black pod-like case. After this case is fully formed she may carry it about for several days, but finally deposits it in a favorable crevice. A long time is required for the eggs to hatch. They reproduce most rapidly in warm weather.

In captivity the young grow very slowly. Young of this species have been kept for eighteen months, moulting four or five times during that period and failing to become adults at the end of that time.

This cockroach is among the filthiest of our domestic pests. It has been taken at the mouth of storm sewers, near residences, in veterinary and bacteriological laboratories, in carelessly kept quarters of rabbits and guinea pigs, in underground tunnels, in dairies, and in saloons. Like other cockroaches it eats almost anything but is especially fond of starchy materials.

AMERICAN COCKROACH *Periplaneta americana*

The American cockroach (Figure 5), is a beautiful reddish brown color. The front part of the body is edged with yellow. It is slightly more than an inch and a quarter long and about half an inch wide. In both sexes the wings are very long, extending slightly beyond the back end of the body. The legs are usually lighter colored than the body. Cockroaches of this species may become abundant in dwellings. They are most frequently found in cities, in hotels and packing and slaughter houses.

The egg mass is reddish brown. About seventy days were required for hatching when a temperature of 77 degrees was maintained in dark cages. Usually the egg masses are pasted to floor or ceiling joists or sills in dark places. They may be covered over with bits of paper, finely chewed wood, rags, or even roach dung if no other material is available. As the result of a single mating, one female produced thirteen egg masses, one at a time at intervals of from five to twelve days over a period of about four months. All but the seventh hatched. The egg cases of this species may contain from eighteen to twenty-eight eggs and from twenty to twenty-four are common. These cockroaches, like the Australian and the Oriental, reproduce most rapidly in warm weather.

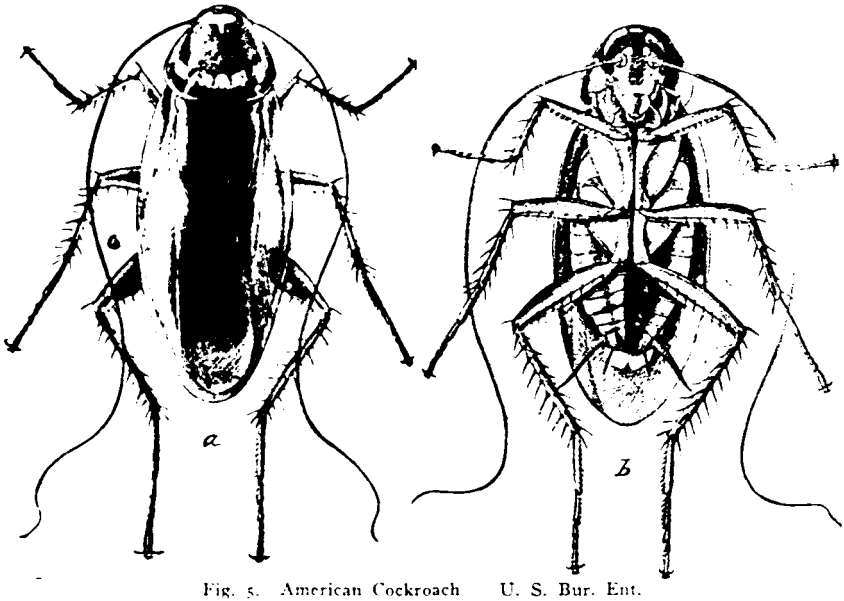

Fig. 5. American Cockroach U. S. Bur. Ent.
Upper and lower views of female.

AUSTRALIAN COCKROACH *Periplaneta australasiae*

The Australian cockroach (Figure 6), is slightly smaller and darker than the American. It is easily distinguished from the latter by the yellow stripe along the outer lateral basal third of each wing cover. The entire length is about an inch and a quarter, the width about half an inch. The wing covers and the wings of both sexes project slightly beyond the back end of the body. As a rule the legs are darker than the body, especially in females. Most specimens come from cities, and particularly from greenhouses and fruit exchanges. They are nowhere abundant in Minnesota.

The egg mass is reddish brown, most commonly pasted to a joist or sill in a dark place. Unlike the egg masses of the American cock-

roach, those of the Australian are generally left uncovered, otherwise its habits are much the same as those of the American.

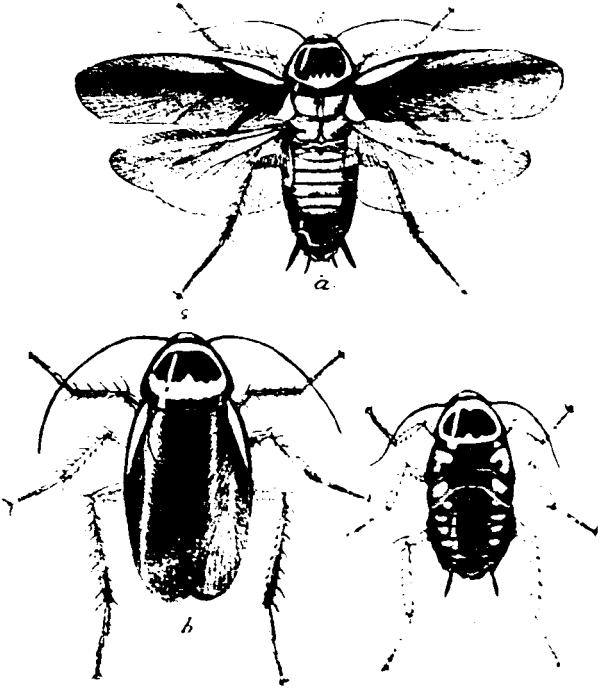

Fig. 6. Australian Cockroach. U. S. Bur. Ent.
a. Adult male with wings spread. c. Immature specimen. b. Adult female.

METHODS OF CONTROL

Cockroaches are very active. To reach or to hit them at all effectively with sprays is entirely out of the question as a means of control. The young of all species seclude themselves in such narrow crevices that to reach them requires a fine powder or mist driven with great force.

TRAPPING

Many methods of trapping have been devised and recommended, but the advantages of such methods are often over-emphasized. The satisfaction of seeing great numbers of the pests cornered may produce an unwarranted confidence in the efficiency of the methods employed. However, trapping is of some value as supplemental to other methods and is not to be wholly deprecated. Only those methods that have proved most satisfactory in our experience are described.

For the larger kinds a quart fruit jar, the inside of which should be absolutely clean and smooth, is used. Lean the jar against the wall

where the cockroaches congregate, preferably in a corner. Place the jar at such an angle that the cockroaches can easily slide down the inclined inside surface but can not crawl up. The jar should be so placed that it will remain tipped merely enough to keep its position against the wall. It may be baited with clearings from the table such as fruit peelings, especially banana, peach, and apple, or bits or bread or cake. If a few cockroaches of the same kind are placed in the trap, they serve as decoys. The contents of the trap should be kept moist, otherwise the cockroaches are not so readily attracted. Drop the captives into scalding water.

At night put old cloths dampened with dish water in the sink or near their runways and places of seclusion. Darken the room and leave it. At half- or three-quarter hour intervals return with a liberal supply of scalding hot water and dash it upon the cloths, thus destroying many cockroaches which have secluded themselves in the folds of the cloth or beneath it. The dead cockroaches should be collected and burned before the cloths are rearranged to trap more.

Obtain two thin smooth boards about three eighths of an inch thick and of equal length and width. Cleat the ends and one long side edge of one of the boards with one-eighth inch strips if the trap is to be used for German cockroaches or with five- or six-sixteenth inch strips if for cockroaches of larger species. Put both boards into water for several minutes, then smear the cleated surface of the one board and the opposite surface of the other with the pulp from the cut surfaces of apple peelings, bruising or crushing the peelings to give the boards an apple odor. Then fasten the smeared faces toward each other so that a crevice is left between them by the cleats. Hang or lean them into or against the runways. At night plunge the traps into a bucket of scalding water. Clean them, recharge, and replace.

The trap with which we have had the best success in trapping German cockroaches is made of a wide-mouthed bottle (Figure 7) and a piece of ordinary window screen. If available, use a finer meshed screen, say twenty or twenty-five meshes to the inch, to prevent the escape of young roaches that may hatch in the trap. Cut from it a triangle, the base of which is slightly larger than the circumference of the inside of the mouth of the bottle. Roll it to form a cone overlapping the wound edges, and with fine wire closely stitch the two side edges to prevent the escape of cockroaches between them. Five or six of the wires running around the tip end of the cone should be pulled out. Then bend the projecting wires of the apex of the cone so that they form a flare around the outside of the tip. With fine wire weave them so that the cockroaches can not crawl through the meshes thus made. The result is a hollow horn-shaped cone of screen with an

outwardly flared collar about its apex, and the hole of the apex not larger than a lead pencil. Next put in the bottle some dampened apple peelings and six or eight living adult cockroaches. Put the cone into the mouth of the bottle, tip end first, with the tip directed upward.

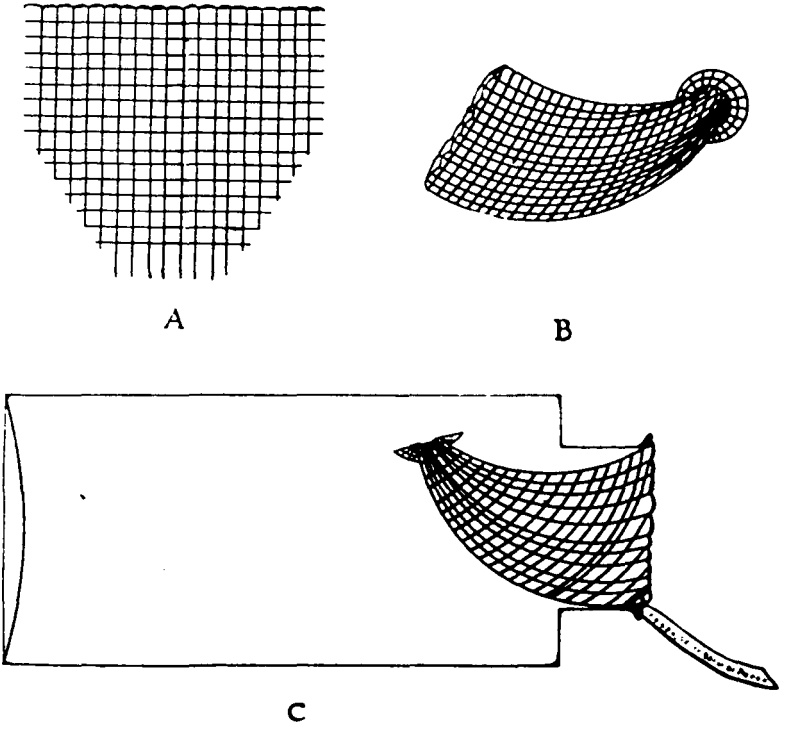

Fig. 7. Efficient Trap for German Cockroach

a. Wire netting cut to form.

b. Cornucopia made by folding netting (a) and fastening it in shape with wire.

c. Wide-mouthed bottle with cornucopia in position and strip of rough paper to form bridge.

and put the mouth thus provided in contact with cockroach runways or places of seclusion. The fermenting apple peelings and the odor of the decoys in the trap attract the cockroaches. Do not wash the inside of the trap more frequently than is absolutely necessary. Chloroform, ether, coal oil, gasoline, carbolic acid, turpentine, or camphor will ruin it for the purpose of catching cockroaches. To empty the trap, jostle the screen cone rapidly up and down in the neck of the bottle (do not force it into the bottle). This will shake the cockroaches off the cone. Immediately empty the contents of the trap into scalding water. Recharge with dampened apple peelings and several adult cockroaches and replace as before. If this trap becomes too dry inside, cockroaches will not enter it, so each evening add a little water. The hole at the

tip end of the cone as well as the size of the bottle may be chosen according to the size of the cockroaches one desires to trap.

Generally cockroaches are found where there is a good food supply at their disposal. They are never obliged to visit traps or poisonous baits for food. Thus the use of traps and poisonous baits may prove rather disappointing. To poison or trap cockroaches successfully, all other food material should be put out of their reach. This necessitates keeping the house scrupulously clean. Poisons or traps or both should be set at night, and the victims should be burned or scalded.

DUSTING

Sodium fluoride is an excellent material for use in combating cockroaches. From a dust gun the fine powder is forcibly driven into the runways and places of seclusion, even into cabinet and furniture drawers. With only a fair degree of success, powdered borax may be used in the same manner, but with sodium fluoride results are much better and more rapid. If practical, spray the walls with a fine mist of water and immediately after dash powdered borax against the freshly dampened walls. Thus the powder sticks exactly where thrown if too much is not used. Powdered borax is not poisonous.

Use coal tar products and powdered borax in the water with which the floors of infested houses are scrubbed. In dairies, the milk products may take up the odor and taste of the coal tar products, and these materials should not be used. There live steam under pressure from a hose may be used, care being taken to direct it into the cracks and crevices of walls, ceilings, and floors.

FUMIGATING[1]

Under certain conditions cockroaches can not be economically and successfully controlled by the above methods, and it becomes necessary to fumigate the infested building. For this purpose hydrocyanic acid gas has proved most successful. This gas is extremely poisonous, in fact one of the most deadly poisons to man, and should therefore be handled with the greatest care. In many of the larger cities there are men who are acquainted with the methods of fumigation and make the fumigation of houses to destroy bedbugs and cockroaches, their business. If such a person is available, the safest plan is to hire him to take entire charge of the treatment; if not, the following directions should be carefully followed. Agricultural experiment stations usually have a member of the staff familiar with fumigation, who can assist.

Chemicals necessary.—Hydrocyanic acid gas is generated by the action of sulphuric acid and water upon sodium cyanide. Commercial sulphuric acid will do, and can be purchased much cheaper than the

[1] This section has been revised by Prof. William Moore, who is responsible for details of recommendations.

chemically pure. Sodium cyanide 98 to 99 per cent pure should be obtained. Since there are several different kinds of sodium cyanide on the market, care should be taken to get the right kind. A mixture frequently found on the market and sold for fumigation purposes is known as sodium cyanide chloride carbonate mixture. This, besides the sodium cyanide, contains sodium chloride and sodium carbonate. Because of the smaller percentage of sodium cyanide present much larger quantities of the mixture must be used to generate the required quantity of gas. The action of sulphuric acid on this mixture will produce carbon dioxide, and hydrochloric acid. The gaseous hydrochloric acid, altho having little or no insecticidal value, will tend to tarnish metal and hence is not desirable. The sodium cyanide chloride carbonate mixture should therefore never be purchased for fumigation purposes.

A powder consisting of pure sodium cyanide is also found on the market. This is manufactured for soil fumigation and should not be used for house fumigation since, being a powder, the poisonous gas is generated too rapidly and is accordingly too dangerous.

The sodium cyanide, 98 to 99 per cent pure, should be purchased in lump form. Sodium cyanide in the form of eggs, each weighing one ounce, is put on the market by one manufacturer under the name of Cyanegg. This is a very convenient form since weighing and breaking up of the lumps with its attendant dangers is unnecessary.

Preparation for fumigation.—Buildings containing more than one family should not be fumigated unless everyone can be removed from the building during the fumigation. Persons living in adjoining or neighboring houses should be warned and it would be well to obtain their approval of the fumigation.

Before fumigation the house should be gone over carefully and all cracks, crevices, and openings tightly sealed to prevent the escape of the gas. Newspaper or glazed paper is the best material to use. Paste the paper over the crevices, or, if too large for this, a tight wad of newspaper may be used. Openings such as pipe holes, fireplaces, and registers, should be made as nearly gas tight as possible. Particular attention should be given to the windows. Food materials, particularly those containing moisture, should be removed from the house. Dry food, such as flour, may be left, providing it is thoroly aired before being used. House plants, cats, dogs, canaries, goldfish, or any living thing must be removed. Nickel sometimes is slightly tarnished by the gas but this can be prevented by covering it with a dry towel or cloth.

Since it will be necessary to ventilate the house after the fumigation before it can be entered, several windows on each floor should be so arranged that they can be opened from the outside. A cord may

be attached to the windows on the second floor by means of which the window can be lowered. The windows selected should be carefully examined and tested before the charge is placed in the house.

Each room should be carefully measured and its capacity in cubic feet determined by multiplying the length by the width by the height. The dose for each room can then be calculated, using one ounce of sodium cyanide to each one hundred cubic feet capacity. The hydrocyanic acid gas is generated in stoneware or earthenware jars or crocks, never in metal containers. Four-gallon crocks are a convenient size, but a charge for such a crock should not exceed three pounds of sodium cyanide. With larger doses the liquid is likely to boil or bubble over on the floor. If more than three pounds is needed for one room, two jars should be used.

The rugs or carpets should be rolled back and several thicknesses of newspaper spread in the center of the room on which the jar should be placed. The object of this precaution is to protect the floor from splashes of acid occurring during the generation of the gas. A container of ashes may be placed under the jars as a further protection.

Preparing the charge.—Everything being ready, the sodium cyanide is made up into little bundles containing the correct charge for each room. If lump cyanide is used it must be broken up and weighed. This process should be carried on outdoors in a safe place. If cyanegg is used the eggs can be directly counted out since each weighs one ounce. If a fraction of an ounce is required, it is most convenient to call it an ounce. The charge for each room is then tied up in a piece of cheesecloth or muslin and carried to the proper room. It may be placed in paper bags but in the writer's experience the paper sometimes chars about the cyanide, protecting it from the action of the acid and thus reducing the dose.

The water and acid are next measured out. This also had better be done outdoors. For each ounce of sodium cyanide to be used in a room, four fluid ounces of water are measured out and placed in the proper jar. The sulphuric acid is next added, using one and a half fluid ounces of acid to each ounce of the cyanide or each four fluid ounces of water. Care should be taken that none of the acid is splashed on the hands, face, or clothing, as it causes severe burns. For this reason the acid is poured slowly and carefully into the water. Should any splash on the clothing a drop of ammonia will neutralize it. A splash on the hands or face should be washed off with water, and soap smeared over the spot to neutralize it. Ammonia should not be used on the hands or face. The mixture of the acid and water generates considerable heat and the jars should be put in position while still hot.

Starting the fumigation.—Everything is now ready to set off the charge. Have one last look around to see that everything that should

be removed has been removed. Accidents have occurred by persons returning to the house to remove something after the charge is started. Two persons can most conveniently send off the charges. Their routes should be so arranged that they meet at the stairway. It is advisable for the operators to go through the rooms and plan their route before attempting to put in the charges. This prevents confusion when actually placing the cyanide in the jars. Care should be taken not to set off a charge in such a position as to cut off the worker from the stairs. Start putting in the charges on the top floor. Do not become excited but move quickly from room to room dropping the package of cyanide into the jar and leaving the room at once. Having finished the top floor, repeat the procedure on the floor next below until all the charges have been set off. The workers should finish at a basement or a first floor door and leave the house at once. No time should be wasted from start to finish since one good breath of the concentrated gas is sufficient to cause death. On leaving the house, lock the door and put a notice on the doors warning people away. If you now find that you have forgotten the cat leave her for she is no doubt already dead, and it would only mean your own death to return for her. The temperature of the house during fumigation should be about 70 degrees F. The fumigation should continue for twelve or even twenty-four hours. This dose will kill cockroaches, bedbugs, fleas, carpet beetles, moths, rats, and mice. If the house has been made quite tight, the eggs of cockroaches and bedbugs will also be killed, thus entirely freeing the premises of these pests.

Small pieces of cyanide lying about where it was measured should be buried. The utensils used should be thoroly washed. Any cyanide left over should be put in a tight container and carefully labeled. Exposed to the air, the cyanide decomposes.

Ventilating the house.—When it is time to remove the charge, carefully open the windows that have been previously arranged to open from the outside. Open the doors if possible and allow the house to air for about half an hour. On entering an almond-like odor will be noticed and if this is at all strong a longer airing will be necessary before venturing into the house. The jars should be removed and the contents poured into a hole in the ash pile or in the garden and covered over. The jars should then be carefully washed. Any water standing about in the house will have absorbed the gas and should be at once poured out. Dry food which has been in the house should be carefully aired before being used.

Hydrocyanic acid gas fumigation is dangerous and should be carried out only by an intelligent person who will carefully follow directions and take no chances.