

ner fill  
riations  
mitted.

# UNIVERSITY OF KENTUCKY

COLLEGE OF AGRICULTURE

Extension Division

THOMAS P. COOPER, Dean and Director

in the  
t in the

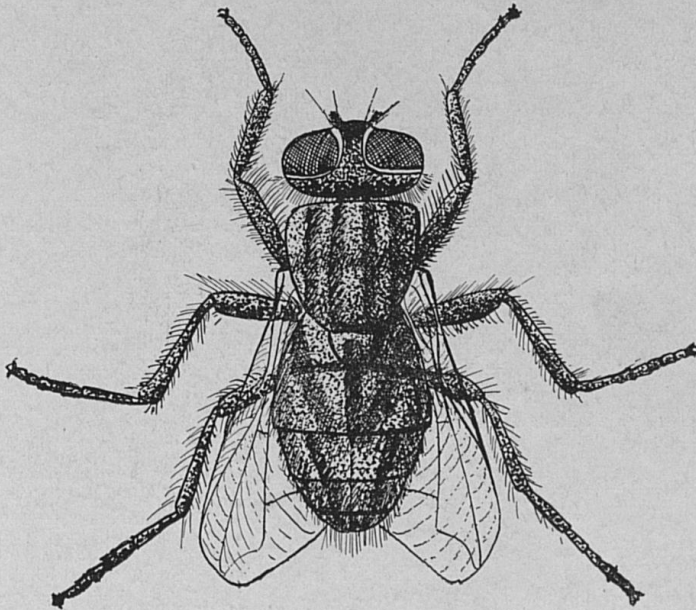
---

CIRCULAR NO. 345

---

to each  
d, reads  
ght and  
never be  
e butter  
it.  
ter it is  
lways in  
s blessed  
yes they  
ne keeps  
horse to  
a cuts it  
rd gave  
crossed  
made a

## COMMON HOUSEHOLD INSECTS



Lexington, Ky.

January, 1940

---

by you?  
The road

Published in connection with the agricultural extension work carried on by co-operation of the College of Agriculture, University of Kentucky, with the U. S. Department of Agriculture, and distributed in furtherance of the work provided for in the Act of Congress of May 8, 1914.

ma  
of  
Ex  
qu  
an  
is  
in  
ter

in  
acc  
of  
site  
tio  
win

the  
as  
affo  
are  
hou  
qua  
win  
are  
wh  
Ho  
dor

Circular No. 345

---

**COMMON HOUSEHOLD INSECTS**

By **W. A. PRICE**

---

Household insects are a source of great annoyance and loss to many people in Kentucky. This is indicated by the large number of requests, received almost daily, at the Kentucky Agricultural Experiment Station, for information about control measures. Inquiries arise only where problems exist. Promptness in recognizing and solving these problems will prevent much worry and loss. This is especially important in view of the fact that household insects, in addition to their attacks on individuals, buildings and their contents, sometimes carry dangerous diseases.

**HOUSE FLIES**

Flies commonly found in dwellings in Kentucky develop largely in the manure of farm animals and in refuse from the home. On account of their habits of visiting filth, flies are important carriers of typhoid fever, dysentery, cholera, and other diseases and parasites of man. In the home, they are repulsive and annoying in addition to being direct sources of loss thru their tendency to befoul windows, woodwork, fixtures, wall paper, pictures and hangings.

*Life History and Habits.* As a usual thing, the house flies pass the winter in the adult stage, however, they can winter as pupae and as full-grown larvae in manure piles and similar locations which afford protection against low temperature. In the adult stage, they are usually found in the winter in cracks and crevices about the house. Loose-fitting window and door frames offer good wintering quarters. As warm weather begins in spring, flies come out of their winter retreats and for egg laying seek decaying substances which are giving off a small amount of ammonia. Favorite materials in which to lay eggs are horse manure and decaying vegetable matter. However, they also readily deposit eggs in excrement of other domestic animals and in human feces.

Each female is capable of laying during her lifetime more than

2,000 eggs. These may hatch into larvae in 8 hours under favorable conditions of moisture and temperature, tho 24 hours is the usual time for incubation. The white larva, or maggot, feeds on the material where the eggs were laid and often becomes full-grown in only 4 or 5 days. At the end of this period, it moves to a dry part of its surroundings, or into the soil, where it pupates, or passes into a quiescent stage, which lasts from 4 days to several weeks, when the adult fly issues. It is full-grown and no increase in size, due to growth, takes place during the remainder of the life of the insect. Little flies do not develop into big flies.

Under optimum conditions, the fly may develop from egg to adult in about 8 days; however, 10 to 14 days is the usual period in mid-summer. Adult flies have been kept in captivity for about 2 months. In the winged form, they feed on liquid or semi-liquid substances, or upon materials that are readily liquefied in the saliva of the fly. A list of such foods may include human feces, excrement of domestic animals, sugar, molasses, honey dew, and vegetable matter.

*Control.* Cleanliness is essential in combating the fly nuisance. Flies may be expected where there is available food or favorable breeding material. To eliminate this pest, remove both conditions. Since breeding takes place in manure, garbage, sewage, food wastes, human excrement, and other organic waste materials, prompt removal, treatment or destruction of these is important. Manure should be hauled and scattered thinly on fields daily. If it is not possible to do this, a trap may be used to destroy most of the maggots without depreciation of the fertilizing value of the manure. Such a trap can be made by simply piling the manure upon a slatted platform above a cement basin containing water. If the manure is kept moist, the full-grown larvae, seeking a dry place to pupate, fall into the water and drown. A platform 10 by 20 feet will take care of the manure from four horses for a period of 4 months. It can be made with 2 by 4 inch timbers placed 2 feet apart, over which are nailed 1-inch strips spaced  $\frac{1}{2}$  to 1 inch apart. The platform stands about 12 inches in and above a cement vat 4 or 5 inches deep. The vat should contain 2 inches of water. It should be cleared out once a week and the debris thrown back onto the platform.

Garbage should be stored in fly-tight containers until such time as it can be destroyed by burning or burying. Carcasses of animals also should be burned or buried to a depth of 2 feet or more. Privies exposed to flies should be treated regularly, or better, after each usage, with chlorinated lime or borax.

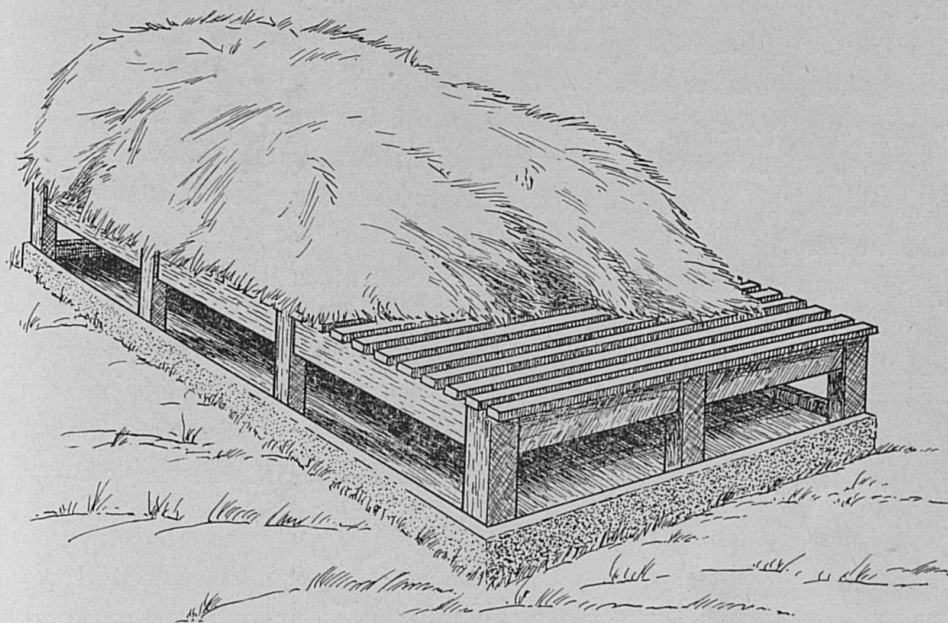


FIGURE 1. A trap for house fly maggots in stable manure. The manure is piled on a slatted rack which stands in a shallow concrete basin containing 2 or 3 inches of water.

All dwellings, milk houses, and other buildings where food is kept should be well screened. Care should be taken to see that window screens and screen doors fit tightly enough to prevent flies entering. If flies have already gained entrance to the house, they may be killed by swatting, spraying or poisoning. A fly swatter should be readily available in the house at all times during the fly season. Several poison baits are in use, perhaps the most commonly used one is made by diluting  $\frac{1}{2}$  pint of milk with  $\frac{1}{2}$  pint of water and adding 3 teaspoonfuls of fresh commercial formalin. Another one that is equally good is made by adding the same amount of formalin solution to 1 pint of water in which has been dissolved 1 ounce of brown sugar. The solutions can be exposed in shallow receptacles, such as saucers or pans, in which pieces of bread have

been placed. Another favorite method of exposure is to fill a drinking glass with the formalin bait solution, place a circular piece of blotting paper, larger than the opening of the glass, over it; invert a saucer over the blotting paper and then turn the whole device upside down and insert a match under the edge of the glass to admit air.

Many commercial fly sprays are now on the market, most of them made of refined kerosene in which is dissolved an extract of pyrethrum. When properly made, these sprays are effective in killing flies. Usually they are applied with a small hand atomizer. Flies that drop to the floor after an application should be swept up and burned.

Fly traps are useful in reducing the number of flies. Satisfactory ones can be purchased or made at home. As a rule, the larger ones are more effective. Farmers Bulletin No. 734 gives details for the construction of the one shown in figure 2. The materials necessary are 4 wooden barrel hoops, 1 barrel head, 4 laths, a few strips of  $\frac{1}{2}$  inch box lumber and  $8\frac{1}{2}$  lineal feet of screen 24 inches wide.

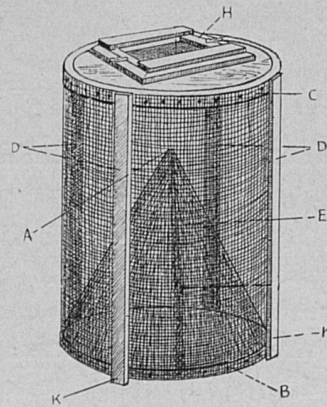


FIGURE 2. Conical fly trap. A. Aperture in cone. B. Hoop forming frame at bottom. C. Top of trap made of barrel head and hoop. D. Strips to support ends. E. Cone. H. Door in head.

To be effective, traps must be provided with a good bait, such as a fermenting solution of 1 part blackstrap molasses and 3 parts of water, or a mixture of equal parts of brown sugar and the curd of sour milk, moistened and allowed to stand for 3 or 4 days. Such baits should be placed beneath the cone of the trap.

Fly papers are useful in catching flies in the house. They may be purchased, or prepared at home by heating 2 pounds of rosin and 1 pint of castor oil. While hot, this combination is smeared with a brush on ordinary paper.

Electric fly traps are now available and under proper conditions seem to operate satisfactorily. Electrified screens mounted on doors and windows may also be obtained. They are particularly well adapted for use in restaurants and bakeries.

The fly nuisance in cities and towns will depend a great deal upon the competence of inspectors in having manure, garbage and other refuse moved and destroyed promptly. The problem on the farm is one for the individual.

#### MOSQUITOES

Mosquitoes are really a kind of small fly differing from house flies in size and in their power to "bite". They are no more abundant today than they were a century ago; but we are paying more attention to them now than formerly because we now know that they may carry such dreaded diseases as malaria and yellow fever. Of the 400 or more species in North America, 60 are found in the United States. At least 35 species have been reported in Kentucky. So far as known, only 1 species is concerned with the dissemination of yellow fever and only 4 with the spread of malaria.

*Life History and Habits.* The details of the development of the different mosquitoes will vary somewhat with the species. However, generally speaking, they are all much the same. For purposes of illustration, the life cycle of the common house mosquito will be used. It breeds in almost every place where fresh water is found, in pools, roadside ditches, rainbarrels, cisterns, tin cans, watering troughs, and other receptacles.

Adult mosquitoes, in the fall, hide in cellars, outhouses, garages, barns, or other suitable places and there pass the winter. Many of these hibernating individuals die before spring. The females that survive become active in early spring, and, after feeding, deposit eggs, in masses on the surface of water. Each mass contains from 75 to 200 eggs which stand on end in regular rows. At first, the masses appear yellowish white, but later become dark brown. De-

pending upon the temperature, the eggs may hatch in from 24 hours to several days.

When the eggs hatch, larvae or "wigglers" are produced. These "wigglers" are common sights in water barrels during warm weather. Close examination of a larva reveals the presence of a tube on the eighth abdominal segment. This is a respiratory tube thru which the larva takes air. Because of the location of this tube, the larva hangs in the water with its head down and the tip of the abdomen reaching the surface. In this position and while swimming thru the water 2 dark brushes of hairs about the mouth are kept in constant vibration. By this action, currents of water are set up and food is brought to the animal. The length of the larval period depends upon temperature, food supply, and other conditions, but usually it lasts 5 to 10 days.

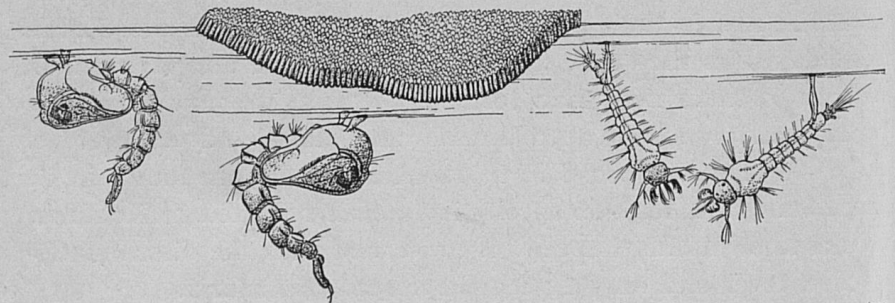


FIGURE 3. Three stages in the life cycle of the mosquito; egg mass, in upper center, larvae, at right, pupae, at left (enlarged).

After becoming full-grown as larvae, the insects pass into another stage called pupae. They live in the water with the larvae and are often mistaken for the latter because they are active, wriggle about in the water and rest near the surface. They may be distinguished, however, by the fact that the breathing tubes are located on the thorax in the pupal stage and there are two of them, whereas in the larva there is one tube located near the tip of the abdomen. In the pupa, the head is very large and the body curved. The pupa at rest has the head near the surface of the water with the tail hanging down. The opposite is true of the larva. After 5 or 6 days, the skin on the back of the pupa splits and the adult mosquito gradually works its way thru the opening. The cast skin serves as a raft



upon which the emerged adult rests while drying its wings in preparation for its flight to food and perhaps to another breeding place. As a rule, our Kentucky mosquitoes do not fly far—seldom more than a few hundred yards. So when mosquitoes are present it is an indication that their breeding place is nearby.

The male mosquito is a vegetarian, feeding largely upon the sweet juice of plants. Only the female sings and bites. At the time of biting, an irritating substance is injected into the wound. This causes a sensation of itching and soon the area affected turns red, becomes inflamed and often results in considerable pain. The itching may be relieved by the application of dilute solution of ammonia, a 5 percent solution of carbolic acid, a 1 percent alcoholic lotion of menthol, or plain water as hot as can be borne.

*Control.* No satisfactory method of destroying adult mosquitoes has been devised, hence our efforts to control this pest should be directed against the egg, larval, and pupal stages. Most practiced methods of control fall into three general groups; drainage, water treatment, and the use of fish.

Drainage is the most desirable means of combating mosquitoes because it is permanent in effect. It removes one condition necessary for the development of the pest; namely, water. Often it is possible to drain, with comparatively little expense, marshes and swamps near dwellings. Also small pools can sometimes be eliminated by dumping a few loads of dirt in the low spots. Wherever possible, these expedients should be followed. Buckets, barrels, tanks, crocks, tin cans, and other receptacles should be emptied at least once each week.

Water which cannot be drained may be rendered mosquito-free by applying a thin film of oil to the surface, using about 1 pint of oil to each 200 square feet of surface every 10 or 12 days. Ordinary kerosene is very effective when used in this manner, or used crankcase oil, adding 1 gallon of cresylic acid to each 100 gallons of oil to make a cheap and effective material for treating water to kill mosquitoes. These oils kill plants and fish and render the water unpalatable and obnoxious to other animals and leave an unsightly residue. Where oils cannot be used because of injury to plants and waterfowl, some pyrethrum larvicides may be employed with satis-

faction. Water to be used in the laundry but not for drinking, can be kept mosquito-free permanently by adding 2½ ounces of borax per gallon.

Ornamental pools can be kept fairly free of mosquitoes by stocking them with top-feeding minnows (*Gambusia affinis* recommended), goldfish, and other kinds of fish that feed on the larvae and pupae. If fish are not able to reach the margins of the pool, because of growing plants or shallow water, the efficiency of this method of treatment is reduced.

Complete screening of the house with 20-mesh screen gives good protection indoors. The mosquitoes in the house may be killed by spraying with commercial oils, particularly those containing pyrethrum. A certain amount of protection may be had out-of-doors by the use of household sprays containing derris or pyrethrum. These materials are applied to the clothing, chairs, and other objects near the place where one wishes to sit.

#### CARPET BEETLES

Carpet beetles, sometimes called "buffalo moths" are the source of considerable damage to clothing and to household furnishings containing wool, fur, hair, feathers or other animal substances. The injury is caused by the larvae which make small holes in fabrics and eat the nap from woven articles leaving the foundation bare.

Several species of carpet beetles are found commonly in Kentucky. The adults are small beetles about  $\frac{1}{5}$  inch long, ranging in color from solid black to gray or brown-spotted. The larvae are very hairy, brownish or blackish and, when full-grown, less than  $\frac{1}{2}$  inch in length. They are blunt at the head end and taper toward the tail.

*Life History and Habits.* The adult beetles, capable of strong flight, are attracted to sunlight. They are seen commonly crawling about on window sills in late spring. On such excursions, mating occurs and soon thereafter egg laying starts. Each female may lay 60 to 100 eggs. These are placed promiscuously about the house, usually in such places as floor cracks, about baseboards, and in clothing and upholstery. The eggs hatch in about 10 days and the small larvae begin to crawl about, feed and develop to maturity.

Growth in this stage requires usually 10 to 12 months, sometimes longer. During this period, they cast their skin several times. Unlike the adults, the larvae shun the light and seek darkened places along the carpet edge, beneath baseboards and in articles long in storage. After the larvae become full-grown, they pupate and soon thereafter adults appear. There is usually one generation a year.

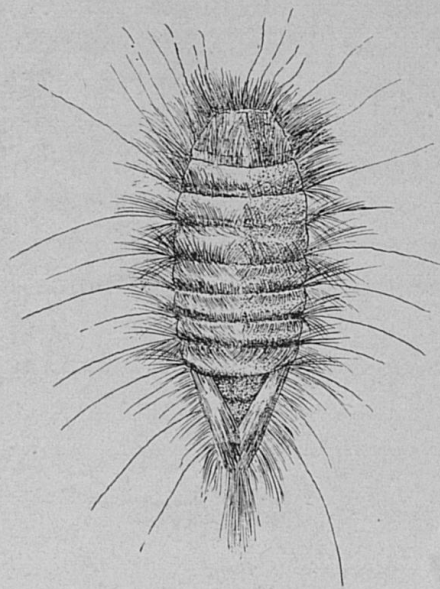


FIGURE 4. Larva of the furniture carpet beetle (enlarged).

*Control.* Control may be divided into two phases, prevention and extermination. Under the former, the importance of good housekeeping should be stressed. Keep all closets, drawers, chests, air registers, and other places about the house free of dust and lint. Do not store unprotected, in the attic, basement, or elsewhere in the home, any woolen goods, leather, bristles, feathers, hair, silk, dried meat, insect specimens, stuffed animals or fur. Close all cracks in the floor, around the baseboard and quarter round with a good crack-filler. Do not permit floor coverings, draperies, blankets and clothing to remain long undisturbed. Frequent sunning, beating, brushing, and vacuum sweeping will be very helpful in preventing infestation. Carpets and rugs should be cleaned on both sides. The vacuum sweeper should be emptied after each operation and the debris burned promptly. Clothing stored in tight trunks, boxes

and closets can be protected by using paradichlorobenzene or flake naphthalene, at the rate of 1 pound per trunk and a similar amount for every 20 cubic feet of closet space. When used in trunks and boxes, the chemical should be put between thin sheets of paper or tied up in squares of cheesecloth, placed at various levels among the stored articles. In closets, it may be scattered on the shelves or tied in cheesecloth and hung in the upper part of the closet. Either material should be used liberally and a fresh supply added to closets and other containers before the last crystals of the chemical have disappeared. Protection in closed containers can be secured indefinitely if the supply of chemical and the resultant gas concentration is maintained. Naphthalene is cheaper than paradichlorobenzene, but the odor of the former clings and is offensive to most people. For this reason, paradichlorobenzene is preferred. Cold storage is sometimes used to protect costly rugs and furs. Where the temperature is kept at 40° F. or below, this method is very effective.

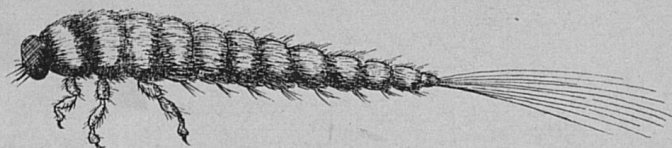


FIGURE 5. Larva of the black carpet beetle (enlarged).

An infestation of carpet beetles can be eliminated by the frequent cleaning of rugs on both sides and the persistent use of contact sprays, such as the oil-pyrethrum sprays commonly found on the market. They should be applied to floor cracks and spaces about the baseboard and quarter round. These sprays kill by contact and to be most effective they should be applied with power sprayers, altho hand sprayers may answer the purpose.

Overstuffed furniture and other infested articles can be cleared of carpet beetles and other pests by the careful use of uncolored, high-test, lead-free gasoline. The article to be treated should be taken to the garage, or other outbuilding, where there is little fire hazard, and thoroly soaked, using as much as 5 gallons of gasoline on one upholstered davenport. After treating, allow the articles to air about 3 days and do not use them until the odor has about dis-

appeared. (Caution. Observe the fire hazard during the period of treatment and airing.)

Commercial or home dry cleaning will rid garments of fabric pests. Such treatment kills the insects present but gives no protection against future attacks. Paradichlorobenzene and naphthalene not only act as repellents but are good fumigating materials when properly used. Articles to be fumigated should be placed in a tight container. If a trunk or box is used, put the articles in loosely, alternating layers of chemical and cloth. In a closet, the garments should hang loosely with the chemical in porous bags or open receptacles above the clothing. Use 1 pound of the chemical for every 10 cubic feet of space in the fumigating chamber. After placing the chemical, seal the fumigator and leave it undisturbed for a period of one week.

Piano felts often become infested with clothes moths and carpet beetles. To treat them, hang on the inside of the top of the piano a cheesecloth bag containing 2 pounds of paradichlorobenzene. Close the piano and keep it covered with blankets or a tarpaulin for at least one week; longer if desired. Temperature during fumigation should be 70° F. or above.

Larvae can be trapped by placing woolen cloths, red ones if possible, in closets. Such cloths serve as a lure and when larvae congregate, they should be shaken onto pieces of paper and destroyed.

Fumigation with hydrocyanic acid gas is the most satisfactory method of clearing the house of infestations of carpet beetles as well as other household insect pests. Because of the deadly poisonous nature of the gas, it should be used only by experienced exterminators.

#### **CLOTHES MOTHS**

Since man began to live in houses, clothes moths have pestered him by consuming his woolen and fur garments. To a lesser extent, he has been annoyed by their feeding upon his stored animal materials such as hair, wool, feathers, and dried skins. Moths are found in nearly all dwellings. Their abundance is influenced largely by the kind of care given to the protection of articles susceptible to attack while in storage or out of use and the degree of thoroughness

of house cleaning. Two species of moths are ordinarily troublesome in Kentucky. These are the webbing clothes moth and the case-bearing clothes moth. The adult moths are about  $\frac{1}{4}$  inch long with a wing spread of  $\frac{1}{2}$  inch. They are buff-colored with irregular dark patches on the fore wings, the amount of color varying with the species.

*Life History and Habits.* The adult moths are not attracted appreciably to light, consequently they are seldom seen flying. They may be observed to flit about when objects upon which they are hiding are suddenly moved or the insects are otherwise disturbed. Under cover of darkness, the female moth lays about 100 to 200 eggs which are dropped promiscuously and unattached, on articles which afford food for the larvae. The eggs hatch in 4 to 10 days in summer, and in 3 to 4 weeks in the colder part of the year. The larvae are small, seldom more than  $\frac{1}{2}$  inch in length when full-grown, and creamy white, with a dark head. Their period of

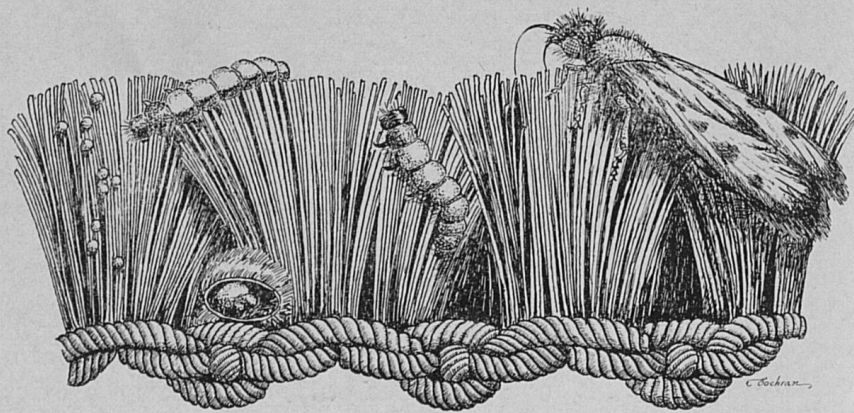


FIGURE 6. Diagrammatic view of edge of rug, showing from left to right, eggs of clothes moth, pupa in an open cocoon, larvae crawling on the pile, and the adult moth.

development may vary from two months to three years, depending upon available food, temperature, moisture, and other conditions affecting growth. The worms feed and construct silken shelter tubes and cases, resulting in the characteristic moth damage familiar to most men fortunate enough to have more than one suit of clothes. When full-grown, the larvae transform to pupae. After

3 or 4 weeks in this stage, adult moths emerge. Under optimum conditions, the complete life cycle may be passed in 6 weeks or, under less favorable circumstances, 3 or 4 years may be necessary for the completion of the four stages of development.

*Control.* Serious clothes-moth injury can be prevented by giving proper attention to the storage of susceptible articles, doing a thoro job of house-cleaning and following instructions given in this circular for the control of the carpet beetle. Special emphasis should be placed upon such practices as brushing and sunning on the clothes line at frequent intervals and dry cleaning clothing before storing in moth-tight bags. For this, the so-called "moth-proof" bags are not necessary. Any large unbroken paper bag will serve the purpose. It should be sealed or rolled at the top and fastened to prevent moths entering. Liberal amounts of paradichlorobenzene should be used in storage boxes, trunks, and closets. Kill all adult moths seen flying about the house.

Certain chemicals are now being used to render fabrics moth resistant or moth-proof. In most instances, these are applied to the cloth in the hot dye bath during the manufacturing process; however, some are applied to the finished cloth. In the latter instance, the articles should be saturated (not simply sprayed) with the chemical solution and allowed to dry without squeezing or wringing. It is believed that none of the moth-proofing materials on the market will give absolute and permanent protection against moth attack. Some of them, when properly applied, give satisfaction for a considerable length of time, depending upon the way the garment is handled after treatment. Dry cleaning and washing tend to destroy the effectiveness of the original treatment.

#### COCKROACHES

Cockroaches, dreaded by all careful housekeepers, are among the most common of our household pests. They occur in laundries, warehouses, stores, restaurants, dwellings, slaughterhouses, factories, and other places where foodstuffs are handled and where there is heat, moisture, and litter in which they can hide. Their diet includes a number of different kinds of soft foods; their preference, however, is for starchy things.

There are several species of cockroach in this country; three are found here without difficulty. These are the German roach (sometimes called the "water bug" and "croton bug"), light brown and, when mature, about  $\frac{5}{8}$  inch in length; the Oriental roach, about 1 inch long and dark brown to nearly black; and our largest species, the American roach, chestnut brown and  $1\frac{1}{2}$  inches long. All are swift runners and some are able to fly. Their bodies are flat enabling them to escape into their retreats thru small cracks.

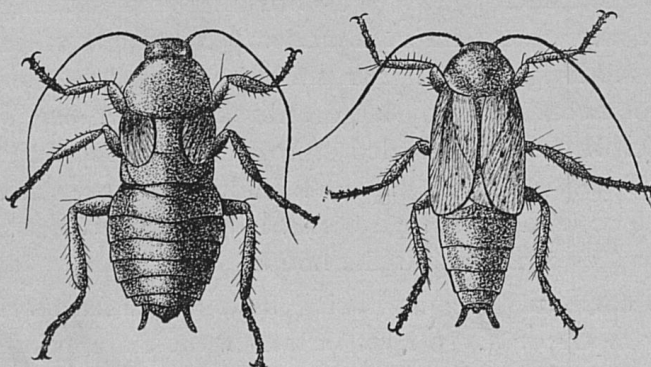


FIGURE 7. The Oriental cockroach; female at left, male at right.

*Life History and Habits.* The eggs are laid, several at a time, in leathery capsules which are carried by the mother roach for several days partly extruded from her body. Finally, before hatching, which



FIGURE 8. The German cockroach.

requires about 30 days, the capsules are dropped promiscuously where the roaches run. The young are small and in shape resemble the adults. They grow, cast their skins 5 to 7 times, and after the



last molt appear with wings. The period of development from egg to adult varies with the species and conditions, such as moisture, temperature, and available food. Under favorable circumstances, the croton bug can produce a generation in 4 or 5 months. This appears to be the shortest period for the complete development of any of our species of roach, some require a year or more.

Roaches abound in warm, dark, damp places. They avoid light and for that reason are most active at night. If a dark room in which they are active is suddenly lighted, the roaches scamper for

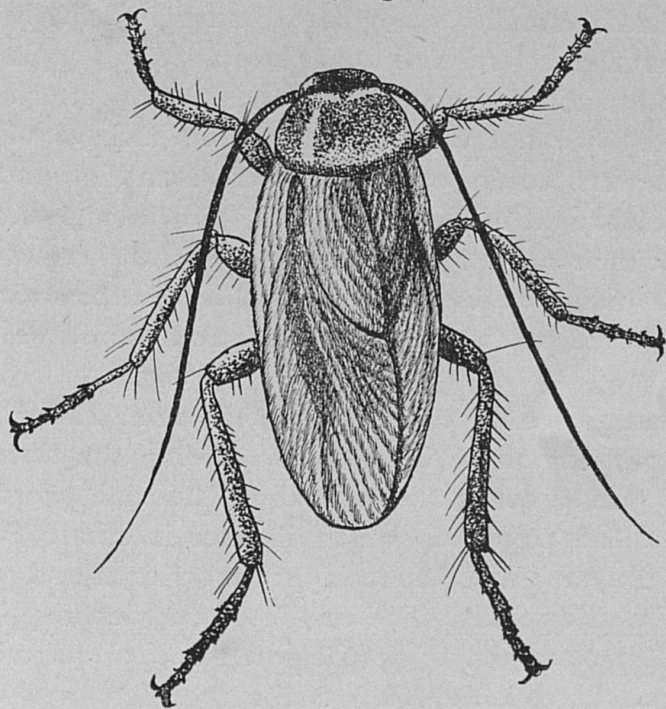


FIGURE 9. The American cockroach.

cover of darkness. They crawl under objects, run to shaded sides of fixtures and furniture and escape thru cracks about the baseboard, sink, windows and doors. In the home, the pests are found usually in the basement, kitchen and pantry, but may be located in other places, particularly where food is stored or available to them. Because of their ability to run and fly, they spread naturally; however, their spreading is aided by delivery in the home of infested laundry bundles, grocery boxes, trays and bags.

*Control.* Every precaution should be taken to prevent the establishment of roaches in the house. Cleanliness and diligence in keeping the premises, particularly the basement, free of litter and debris, stopping leaks in the water pipes, keeping food and garbage properly protected in closed containers, and eliminating cracks and other hiding places in the vicinity of the kitchen and pantry, will do much to discourage roaches. It should be said, however, that even under the most sanitary conditions, roaches may come into the house. Often they are brought in packages from the grocery or laundry, and they migrate from neighboring infestations. It is important, therefore, to trade at sanitary stores, open all packages promptly upon delivery and kill with a fly swatter all roaches so delivered. The reservoirs of infestation, such as neighboring buildings, sewers, covers of wells, cisterns, and ground pits for utility meters should receive attention. It is often possible to kill hundreds of the roaches by sprinkling them with kerosene or gasoline in their hiding places under metal covers in the street. This is a community and public utility problem and should be treated as such.

If the insects become established in the home, after the above preventive measures have been observed, only the liberal use of insecticides will dislodge them. Sodium fluoride powder is the best remedy. It is poisonous to man if taken internally in sufficient amount, and it should be kept away from children and pets, but is harmless if used carefully. The undiluted powder may be applied with a small hand duster, an electric power duster equipped with an extension rod curved at the end to enable the operator to deliver the powder into the hiding places, or it can be sprinkled by hand or spoon along the back of shelving, particularly about sinks, drainboards, and baseboards. In out-of-the-way places, it can be left indefinitely and it will be effective as long as the material is dry. When wet the chemical loses its value as a roachicide. If used on the kitchen floor, it is suggested that a band 3 or 4 inches wide be placed next the baseboard. It can be spread at night before retiring and swept up the next morning. Repeated and liberal applications may be necessary. A wide ring (4 or 5 inches) of the chemical should be kept around the sewer drop in the basement, and the powder

should be strewn on the basement floor next the walls and in other places where the roaches travel. To be effective when used in this manner the insecticide must be used very liberally and the roaches must run thru it. In so doing, the powder adheres to the antennae, feet and legs. In cleaning it off, the insects swallow it and thus are poisoned.

Fresh pyrethrum powder, used in the same way as sodium fluoride, is very effective. It is especially good when applied with a power duster. This insecticide is not poisonous to man or pets. It loses its effectiveness in a short time when exposed to the air, therefore frequent applications of fresh material are necessary.

Phosphorus pastes are sometimes used with success against the larger species of roach. They are recommended especially where damp conditions prevail. The paste is spread on small pieces of cardboard which are rolled into cylinders, with the poison on the inside, and placed where roaches will have ready access to them. Phosphorus paste is poisonous and care should be taken in its use.

#### HOUSE ANTS

Ants, on account of their colonial development and highly specialized organization, constitute one of our most interesting groups of insects. These interesting and fascinating features, however, do not quite overshadow the exasperation caused to the housekeeper when the little fellows invade the house. Of the many species that come into the house, there are three that might be considered frequent callers. These are the little red ant, the little black ant, and the big black ant.

*Life History and Habits.* Ants, like honeybees, are social insects, living in colonies where there is great specialization and division of labor among the members. The typical colony has at least three kinds of individuals: the queen or mother of the colony; the kings or males; and the sexually undeveloped females, which are the workers. The majority of the members of the colony and the ones seen more often are the workers. They keep the nest in tidy condition, feed and care for the larvae, carry the pupae to safety when

the nest is disturbed, and gather food. The males' sole job is to fertilize the queens, of which there may be one or more in a colony. The duty of the queen is to establish a colony and to lay eggs for its perpetuation.

The queen, after swarming and mating, tears off her wings, makes a burrow in the soil or in soft, decayed wood, closes the opening of the chamber and deposits a few eggs. Soon small white larvae appear. These are nurtured by the queen and fed from the reserve material from her body. When full-grown as larvae, the insects pass into the naked (in some cases), white pupal stage and from this the adults emerge. The first adult workers produced in a new colony are diminutive, perhaps due to scant rations. They are able, however, to carry on the work of the colony. The brood chamber is enlarged and the new brood is this time cared for by the workers instead of the queen who now devotes most of her time to egg laying. The food of the larvae is a mixture of chewed sweets, seeds, and bits of dead insects predigested and regurgitated. Under proper conditions, the colony thrives, increases in population and extends the boundaries of the nest until such time as crowding makes it necessary or desirable to swarm. In the swarm will be found winged, sexually mature males and females. Soon after mating, the males die and the females break off their wings and try to establish new colonies. Fortunately, a high percentage of these attempts are unsuccessful.

*Control.* The most effective ant control is based on the destruction of the queens and the young in the nest. This may be accomplished by treating the nest with a chemical or by serving poisoned bait of the proper kind and strength to the worker ants who, in turn, feed it to the queens and larvae, and so poison the colony. Based upon the kind of food they take, ants, troublesome in the house, fall generally into two groups—sweet-loving and grease-eating—so the kind of bait to use will depend upon the ant to be treated. If it is the kind that likes sweets, give it a poisoned syrup. This may be purchased under various trade names or made at home or by your druggist. Some formulas that have been found satisfactory in the preparation of baits are as follows.

1. Sugar ..... 1 pound
- Sodium arsenate ..... 125 grains
- Water ..... 1 quart
- Honey ..... 1 tablespoon

Mix the first three ingredients and boil until the sugar and arsenate are thoroly dissolved. Allow the concoction to cool and add the honey.

2. Sugar ..... 1 pound
- Water ..... 1 pint
- Thallium sulfate ..... 27 grains
- Honey ..... 3 ounces

After mixing all ingredients thoroly, bring to a slow boil and allow to cool. Thallium sulphate is a potent poison and should be handled with great care. Do not inhale the vapors while preparing the bait and do not get any of it into the system thru the mouth or sores.

3. Sugar ..... 4 ounces
- Water ..... 1 quart
- Tartar emetic .....  $\frac{1}{2}$  ounce

Dissolve the sugar in water, add the tartar emetic and mix thoroly.

4. Tartar emetic ..... 1 part
- Grease ..... 20 parts

Mix the two ingredients. A small amount of tartar emetic can be worked into pieces of bacon rind.

Any one of the first three formulas is recommended for sweet-loving ants and formula four for the grease-eating ant. Regardless of the formula used, the bait should be placed in small containers, having provision for easy entrance and exit. Small pill boxes with perforations in the sides serve very well for this purpose. The box containing the bait may be placed beside the line of march or in the vicinity of ant activity. In either instance, the food under attack should be removed. An average infestation can be cleaned out usually with a single dose of 8 to 10 drops of the bait. These baits are poisonous and care should be used to keep children and pets away from them.

Often it is possible to find the nest in the ground where it can be treated with carbon disulfide or calcium cyanide. Make holes in the mound with a broom handle, or similar object, to a depth of 2 to 4 inches and pour into each hole from 2 to 3 tablespoonfuls of carbon disulfide or of calcium cyanide dust. Close the holes with plugs of mud or by pushing the soil together at the top. In large

ant hills, it may be necessary to make more and deeper holes and to use more carbon disulfide. When ant hills are numerous in a small area, a wet blanket or canvas may be thrown over the entire treated area to prevent the escape of gas. Cyanide in any form (gas, liquid or solid) is poisonous, so keep it out of the system. Do not breathe the fumes. Carbon disulfide is very inflammable and its vapor makes an explosive with air; therefore, keep fire away from the fumigating operations.

Ants can be driven away sometimes by dusting sodium fluoride powder about the window sills, sink, drainboard, foundation walls, and other places where the pests crawl. This is the same material recommended for roach control. It may, therefore, serve a dual purpose.

Ants can be kept off tables, refrigerators, and other movable pieces of furniture by placing the legs of such articles in shallow dishes containing a small quantity of kerosene or other oil. Also, ant tapes fastened around the legs of furniture serve as barriers. These tapes are made by boiling strips of cloth for a short time in a saturated solution of mercuric chloride. After boiling, hang the strips up to dry and, later, use as needed, by wrapping them firmly around the legs of furniture to be protected. Mercuric chloride (bichloride of mercury) is a poison; handle it with care.

Because of the many species of ants and their varying habits, it is not always possible to predict the formula that will be effective. Therefore, it may be necessary to try different ones until the right one is found.

#### **SILVERFISH**

Silverfish are wingless, scale-covered insects about  $\frac{3}{8}$  inch long, with 2 long feelers on the anterior end of the body and 3 long appendages on the posterior end. There are at least 2 species in Kentucky. The more common one has a uniform silvery color; the other has a silvery background punctuated with dusky spots on the back. Both species are slender with the body tapering toward the rear end. The shiny, silver-like color of silverfish and their agility in seeking cover when disturbed usually betray their identity. They are nocturnal, and are seldom seen in the daytime except when

disturbed in their hiding places or when they are trapped in the bath tub or wash bowl. At night, they may be seen in rooms that have been lighted after previously having been dark. Silverfish seek damp, warm conditions. They thrive in heated basements and from such places, scatter thru the building, feeding upon any starchy materials available. This often results in damage to wall paper, book-bindings, lace curtains, and rayon fabrics.

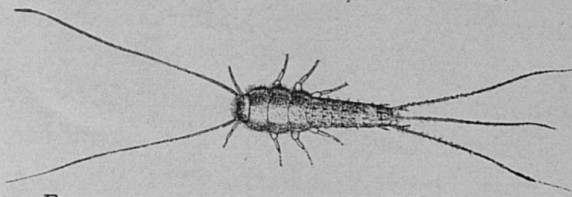


FIGURE 10. Adult of the silver fish (enlarged).

*Life History and Habits.* Definite and conclusive information on the life cycle of the silverfish is not available. From the fragmentary notes, covering the observations of different people on the subject, it would seem that in temperate climates the females lay 8 to 10 eggs each, during the spring period. However, in heated buildings, eggs may be found at other times of the year. They are deposited promiscuously, without attachment, in places frequented by the insects. The incubation period in warm weather covers 8 to 10 days; with low temperatures this period may be extended to 2 months or more. The young silverfish resembles the adult in general appearance. It is said that in the tropics, the insect matures in 7 to 9 months, while, under temperate conditions, 2 years may be required to reach maturity. The adults are hardy and able to live under rather adverse conditions, as shown by the fact that adults have been kept without food for more than 300 days.

*Control.* Silverfish can be controlled by the use of a poisoned bait. One recommended by Back contains the following ingredients in the proportions indicated:

White arsenic or sodium fluoride .....	$\frac{1}{4}$ teaspoonful
Oatmeal, finely ground .....	$1\frac{3}{4}$ cupfuls
Powdered confectioners sugar .....	$\frac{1}{2}$ teaspoonful
Salt, powdered .....	$\frac{1}{4}$ teaspoonful

Mix the materials dry. If white arsenic is used as the poison, add enough water to bind the mass together and mix thoroly again.

Do not add water if sodium fluoride is used as the poison. When thoroly dry, grind the bait and scatter in places where it need not be disturbed, including area behind baseboard and behind books on shelving. In other haunts of the insect, including trunks and bureau drawers, place small cardboard boxes containing about 1 teaspoonful of the bait. Over the bait in the box, put a piece of crumpled paper to serve as a hiding place for the insects.

Fresh pyrethrum powder dusted liberally about the house or blown into places frequented by the silverfish may be depended upon to reduce their numbers. Sodium fluoride used in the same way is helpful. It should be remembered that sodium fluoride is a poison and care must be exercised in its use.

#### BEDBUGS

It is claimed by some that bedbugs are as old as man and that this parasite has been man's bedfellow as long as human beings have slept in beds. It has followed, or perhaps better, accompanied,

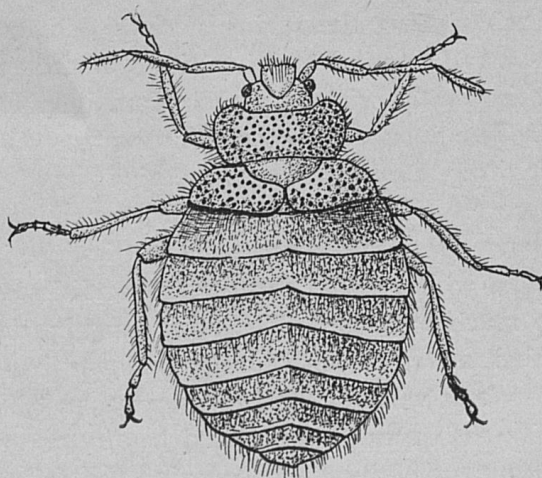


FIGURE 11. A hungry bedbug (enlarged).

man to the remote corners of the civilized world. It is known by different names in the various sections of the country. The list includes "wall louse", "chinch", "red coat", and "night rider".

The mature bedbug is wingless, reddish-brown, about  $\frac{1}{5}$  inch long, flat, and somewhat oval in shape. It has sucking mouth parts



and feeds upon the blood of such warm-blooded animals as man and poultry, as well as guinea pigs, white rats, canaries, rabbits and other pets. It is a renowned traveler, having ridden long distances in clothing, baggage and parcels, on every means of conveyance used by civilized man. For short trips in the neighborhood, such vehicles as used furniture, the maid's coat and hat, and the laundry basket of the washerwoman are employed by the bug. It is quite at home in the covered wagon, the automobile, the bus, the railroad coach, the steamship, and the airplane. In its travels, it stops in hotels, auto courts and rooming houses. After making a new friend in such places, it accompanies him to his home (usually in the luggage). Upon being liberated in the bedroom where the baggage is usually opened, by the unsuspecting, the guest seeks a dark crack in which to hide during the day. At night, when its host has retired, the wily little parasite visits the bed and pilfers a snack of food (blood), after which it retires to the seams of the mattress, to the cracks in the wooden bedstead, to the coils in the spring, or to any other convenient hiding place. In due time, having become established with plenty of food, shelter, and all the comforts of home, the little visitor gets the urge to build a family of her own. This brings trouble for the housekeeper!

*Life History and Habits.* The adult female bedbug, under favorable conditions, may live 7 to 8 months and during that period may lay about 200 eggs. In summer and in heated buildings in winter, the eggs hatch in 6 to 12 days. The young bugs in all stages of development resemble the parent insects and, in reaching maturity, pass thru five molts, feeding once before each molt. The period between molts will depend upon temperature and available food, being 6 to 8 days, under favorable conditions, thus enabling the insect to complete its development from egg to adult in 5 to 6 weeks. In the average house there may be 4 or more generations per year. In vacant houses, the development is much slower. The pests can live several months without food, and an infestation in houses uninhabited except by mice, upon which the bugs feed occasionally, can be maintained for a long period of time.

*Control.* Every precaution should be taken to prevent bedbugs gaining entrance to the house. The maid's coat, hat, and satchel

should be hung on a tree in the basement; the laundry basket should be emptied promptly upon its arrival and returned or stored outside the house; used furniture should be fumigated before it is put into the home; frequent inspections should be made of the bed and clothes closets used by guests. Members of the household upon returning from trips where public conveyances and sleeping quarters were used should inspect clothing and baggage promptly upon arriving home and, if possible, this should be done out of doors.

As a usual thing, bedbug infestations in the home are confined to the sleeping quarters, altho they are sometimes found in davenport and over-stuffed furniture. In the latter case, remove the infested article to an outbuilding or porch and saturate it with uncolored, high-test, lead-free gasoline. After treating, allow the article to air about three days and do not use it until the odor has about disappeared. (Caution. Observe the fire hazard during the period of treatment and airing.)

Infestations in bedrooms can be eliminated by persistent use and thoro application of gasoline or benzene to all bug retreats or hiding places. Such places are all crevices in the wooden bedstead, seams or tufts in the mattress, coils and other hiding places in the bed springs, cracks in the plaster, and areas back of the baseboard, window and door casings, loosened wall paper, pictures and picture moldings.

Gasoline or benzene can be applied with a turkey feather used as a swab to force the insecticide into the places where the bugs are hiding. Make the application thoro and remember that in order to kill, the oil must touch the insects. Treatments should be made at weekly intervals until eradication has been accomplished. (Caution. Observe the fire hazard when using these liquids. Keep windows open and all fire away during the period of application.)

Fumigation with hydrocyanic acid gas gives prompt and effective control of this pest where the house can be sealed tightly and other conditions permit. No building or part of a building that is not completely vacated before the treatment is started, should ever be fumigated with this poison. Because the gas is so deadly to human beings, it should be used only by experienced or well-informed persons, preferably by professional fumigators or exterminators.

**FLEAS**

Of the nearly 500 species of fleas now known in the world, 3 are found commonly in Kentucky. These are the dog flea, the cat flea, and the human flea—the name suggesting the host. The last named is less common and consequently less troublesome than the other two mentioned. The dog flea and the cat flea are the subject of frequent inquiry and the cause of much discomfort to dogs and cats and other small animals about the house. All three species prefer the usual hosts but in the absence of these will attack other animals including man.

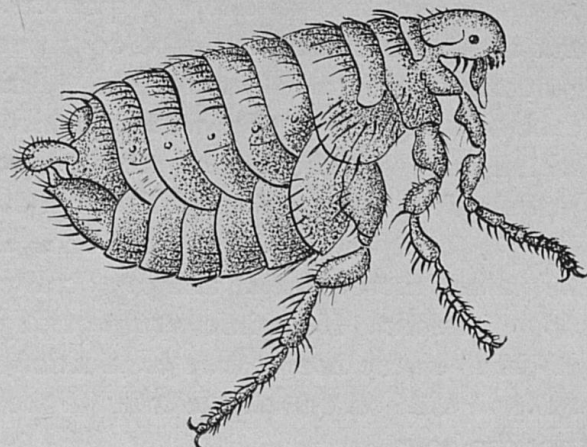


FIGURE 12. The dog flea (enlarged).

The degree of intimacy of the flea and its host varies with the species. The human flea remains upon man but little, being elsewhere the greater portion of the time, whereas the adults of the dog flea are on the host almost continuously. The individual host may change from day to day among free ranging dogs.

*Life History and Habits.* Fleas, as is the case with many other insects, pass thru 4 stages, the adult, the egg, the larva or maggot, and the pupa, or resting stage. Eggs are laid by the adults while on the host, but since they are not cemented to the hair, feathers or skin, they fall off into the bed or other resting place of the host. The pearly-white eggs of the dog flea can often be found in numbers in dog nests or on mats or cushions where infested dogs sleep. Hatching usually takes place 2 to 12 days after deposition. The young larvae are whitish, very slender and worm-like. They live

in the lint and dust under the bedding of the host or in cracks of the floor. They feed on organic matter of vegetable or animal origin, including the excrement of adult fleas and of mice, rats and other rodents. After feeding about 10 days, the larva is full-grown and measures about  $\frac{1}{5}$  inch in length. At this time it spins a silken cocoon covered with dust and lint, within which it changes to a pupa and the adult flea may emerge in less than a week. The entire life cycle may thus be completed, under favorable conditions in 2 weeks, or may be extended to several months.

*Control.* Serious flea infestations often can be averted by giving proper attention to the host and its sleeping quarters. Rats, mice and other rodents about the house should be destroyed. Dogs and cats should be given frequent treatments for fleas. Animals having free run should be treated every 2 or 3 weeks, particularly during the summer and fall seasons. The dog or cat should be provided with a sleeping cloth or rug which should be beaten or shaken and hung in the sunlight for a few hours at least once a week. The kennel should be washed thoroly inside and out occasionally with a 5 percent solution of creolin. If an infestation of dog or cat fleas has become established in the home, start eradication measures by barring the hosts from the house until the infested areas have been treated; then treat the hosts.

To free the dog of fleas, bathe him in strong soapy water or in a 3 percent solution of creolin, made by adding 4 tablespoonfuls to a gallon of water. Wash the head first and proceed to the remainder of the body. After about 15 minutes, the animal may be rinsed; in the meantime, prevent him from licking himself, if possible. If bathing is undesirable, the animal may be treated effectively by applying derris powder containing at least 0.5 percent of rotenone. Apply the dust thoroly, next to the skin. Since this insecticide works rather slowly, stupefying the insect at first and then causing it to drop from the host, the animal undergoing treatment should be placed on a piece of paper. As the fleas drop, they should be swept up promptly and burned or sprayed with a pyrethrum oil fly spray. Because the cat does not take kindly to bathing, it should receive the dust treatment.

If the infestation is in the basement, sweep up all litter and burn

it. Spray the floor, until the surface is saturated, with creosote or with a half and half solution of kerosene and an oil-pyrethrum mixture. Both sprays are very effective against fleas. The former has an unpleasant odor but it is cheap. One thoro application should be sufficient for an infestation.

If the fleas have spread to the rooms above the basement, remove rugs, beat or vacuum clean them thoroly and apply a commercial fly spray to the rooms, with an atomizer. It may be necessary to repeat this part of the treatment once or twice at intervals of a day or two, in order to get those fleas missed in the previous application. If a vacuum cleaner is not available, the floors should be sprayed with a pyrethrum-oil spray, thoroly swept and the sweepings burned. All cracks in the floor harboring the larvae should be treated with kerosene. Adult fleas can be killed also by scattering flake naphthalene on the floor of each infested room. The chemical should be used at the rate of 10 pounds to each 1,000 cubic feet of air space. The room should be closed tightly, or better, sealed, and allowed to fumigate for 48 hours. At the end of this period, the remaining crystals of naphthalene may be swept up and stored in a tight container, or they may be used to treat another infested room. More chemical should be added, if necessary, to give the proper dosage.

In cases of general infestation, fumigation with hydrocyanic acid gas may be the best solution of the problem. Because of the deadly poisonous nature of this fumigant, the work should be done by an experienced or well-informed person—preferably a commercial exterminator.

Occasional infestations of fleas are found out of doors, particularly in lawns adjacent to the house, and in pig stys. To kill the fleas in the lawn, apply a spray made by dissolving 1.6 ounces of 40 percent cocoanut oil soap in 1 gallon of cold water, stirring in  $\frac{1}{4}$  ounce of 20 fold alcoholic pyrethrum extract. The extract should be dissolved in a small amount of water before adding it to the soap mixture. The application should be thoro. If the materials in this formula cannot be obtained, it is suggested that nicotine sulfate, 1 part to 400 parts of water (2 teaspoonfuls to a gallon), be used.

If fleas are breeding in hog pens or barns, the litter should be raked up and scattered on fields or burned. The ground in the area of infestation should then be sprayed with creosote. The hogs should be provided with a scratching post wrapped with a burlap sack which is kept well soaked with used crank case oil or crude petroleum.

Cleanliness and eternal vigilance on the part of the householder are necessary if one would be free from the annoyance of common household insects.