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THE BEDBUG

ITS RELATION TO PUBLIC HEALTH, ITS HABITS AND
LIFE HISTORY, AND METHODS OF CONTROL

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THE BEDBUG.¹

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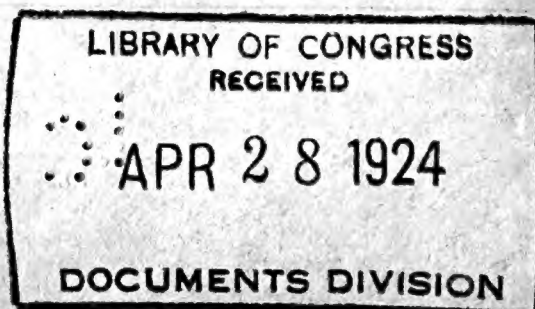
The bedbug is one of the numerous insects which have been suspected of conveying disease to man. Compared with such insect pests as mosquitoes, lice, and fleas, however, its rôle is decidedly a minor one. It has been claimed that the bedbug can take up the microparasites of European relapsing fever, plague, and possibly leprosy, along with the blood of men or animals suffering from these diseases. It is also possible that in rare instances the bedbug may transmit plague or European relapsing fever to man. On the other hand, there is no convincing evidence that the bedbug is the usual and ordinary insect transmitter of these or any other diseases at present known to us.

If the bedbug acts as a transmitter of disease, it apparently does so by the accidental carriage of disease elements on the mouth parts; but this occurs only under the most favorable conditions. These would require, first, the presence of great numbers of microparasites on the skin or in the blood of a man or animal sick with some disease transmissible to man by subcutaneous inoculation; second, it would probably be necessary that there should be many bugs biting in order that one or more of them should bite some healthy person within a rather short space of time after these insects had fed on the infected individual.

In actual practice these conditions would be found only in the most filthy and insanitary surroundings and would call for drastic measures to exterminate all vermin. It is, of course, possible that under unsettled conditions where sick and well are crowded together with no facilities for cleanliness, bedbugs might act as transmitters of septicemic diseases. Experience has shown that under such grossly insanitary conditions such insects as fleas and lice appear to be and are far more dangerous as carriers of disease. Special measures for their extermination should be taken. Added precautions for the examination of bedbugs under these conditions would probably not be justified by the results.

Notwithstanding the minor rôle which must be assigned the bedbug as a carrier of disease, its presence is an offense against sanitary decency. Its bites are quite poisonous to some people and its odor is most disagreeable; and every effort should be made to keep all

¹ Reprint from the Public Health Reports, vol. 35, No. 50, December 10, 1920, pp. 2964-2970.



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dwelling, hospitals, ships, and other premises free from these disgusting insects.

Dr. L. O. Howard, Chief of the Bureau of Entomology, United States Department of Agriculture, and consultant United States Public Health Service, has permitted the quotation of the following passages from Farmer's Bulletin No. 754, by C. L. Marlatt, which gives an authoritative account of the habits, life history, and the means of control of these insects.

"General Characteristics.

"The bedbug belongs to the order Hemiptera, which includes the true bugs or piercing insects, characterized by possessing a piercing and sucking beak. The bedbug is to man what the chinch bug is to grains or the squash bug to cucurbs. Like nearly all the insects parasitic on animals, however, it is degraded structurally, its parasitic nature and the slight necessity for extensive locomotion having resulted, after many ages doubtless, in the loss of wings and the assumption of a comparatively simple structure. Before feeding, the adult is much flattened, oval, and in color is rust red, with the abdomen more or less tinged with black. When engorged, the body becomes much bloated and elongated and brightly colored from the ingested blood. The wings are represented by the merest rudiments, barely recognizable pads, and the simple eyes or ocelli of most other true bugs are lacking. The absence of wings is a most fortunate circumstance, since otherwise there would be no safety from it even for the most careful of housekeepers. Some slight variation in length of wing pads has been observed, but none with wings showing any considerable development has ever been found.

"Habits and Life History.

"The bedbug is normally nocturnal in habits and displays a certain degree of wariness, caution, and intelligence in its efforts at concealment during the day. Under the stress of hunger, however, it will emerge from its place of concealment in a well-lighted room at night, so that under such circumstances keeping the gas or electric light burning is not a complete protection. It has been known under similar conditions to attack human beings voraciously in broad daylight. It usually leaves its victim as soon as it has become engorged with blood and retires to its normal place of concealment, either in cracks in the bedstead, especially if the latter be one of the wooden variety, or behind wainscoting, or under loose wall paper; and in these and similar places it manifests its gregarious habit by collecting in masses. It thrives particularly in filthy apartments and in old houses which are full of cracks and crevices, in which it

can conceal itself beyond easy reach. As just noted, the old-fashioned, heavy, wooden-slatted bedsteads afford especially favorable situations for the concealment and multiplication of this insect, and the general use in later years of iron and brass bedsteads has very greatly facilitated its eradication. Such beds, however, do not insure safety, as the insects are able to find places of concealment even about such beds, or get to them readily from their other hiding places.

“The bedbug takes from 5 to 10 minutes to become bloated with blood, and then retires to its place of concealment for 6 to 10 days for the quiet digestion of its enormous meal, and for subsequent molting, or reproduction if in the adult stage.”

“The eggs hatch in a week or 10 days in the hot weather of mid-summer, but cold may lengthen or even double this incubation period or check development altogether. The young escape by pushing up the lid-like top with its projecting rim. When first emerged, they are yellowish white and nearly transparent, the brown color of the more mature insect increasing with the later molts.”

“Unfavorable conditions of temperature and food will necessarily result in great variation in the number of generations annually and in the rate of multiplication, but allowing for reasonable checks on development, there may be at least four successive broods in a year in houses kept well heated in winter.”

“Food and Longevity.

“Under normal conditions the food of the common bedbug is obtained from human beings only, and no other unforced feeding habit has been reported. It is easily possible, however, to force the bedbug to feed on mice, rats, birds, etc., and probably it may do so occasionally in nature in the absence of its normal host. The abundance of this insect in houses which have long been untenanted may occasionally be accounted for by such other sources of food; but probably normally such infestation can be explained by the natural longevity of the insect and its ability to survive for practically a year, and perhaps more, without food.”

“Influence of Temperature.

“As a messmate of human beings in dwelling houses, the bedbug is normally protected from extreme cold and is known to be an abundant and serious pest far north. In fact, it is often more troublesome in north temperate latitudes than farther south. This may be accounted for partly by the fact that the bedbug is very sensitive to high temperatures, and a temperature of 96° to 100° F. or more, accompanied with a fairly high degree of humidity, results in the death of large numbers of the bugs. The mature or partly mature bedbugs can stand comparatively low temperatures, even

below freezing, for a considerable period. The eggs and newly hatched larvæ, however, succumb to a temperature below freezing, if this condition is prolonged for from 15 days to a month. The feeding and developing activity of the insect practically ceases at 60° F., the insect remaining quiescent and in semihibernation at temperatures below this point. The most favorable temperatures for activity are between 60° and 98° F. The activity of the insect is controlled entirely by temperature and food supply, and, therefore, in heated houses the insect may remain active throughout the winter. There is some protection in winter, therefore, in sleeping in cold bedrooms."

"The Bite of the Bedbug.

"The bite of the bedbug is decidedly poisonous to some individuals, resulting in a slight swelling and disagreeable inflammation. To such persons the presence of bedbugs is sufficient to cause the greatest uneasiness, if not to put sleep and rest entirely out of the question. With others, however, who are less sensitive, the presence of the bugs may not be recognized at all, and, except for the occasional staining of the linen by a crushed individual, their presence might be entirely overlooked. The inflammation experienced by sensitive persons seems to result chiefly from the puncture of the skin by the sharp piercing setæ which constitute the puncturing element of the mouth parts, as there seems to be no secretion of poison other than the natural fluids of the mouth.

"The biting organ of the bedbug is similar to that of other insects of its order. It consists of a rather heavy, fleshy under lip (the only part ordinarily seen in examining the insect), within which lie four thread-like hard filaments or setæ which glide over one another with an alternating motion and pierce the flesh. The blood is drawn up through the beak, which is closely applied to the point of puncture, and the alternating motion of the setæ in the flesh causes the blood to flow more freely.

"To allay the irritation set up by the bite of the bedbug, peroxide of hydrogen or dioxygen may be used with good results.

"Tincture of iodine either at ordinary or double strength is also a good counterirritant for use in cases of flea, mosquito, bedbug, and other insect bites, but should be used with caution on the tender skin of small children and on those who are affected with or disposed to eczemic disorders."

"Natural Enemies of the Bedbug.

"Living always in houses as it does and being well concealed, the bedbug is not normally subject to much if any control by natural enemies. Certain other household insects, however, do occasionally prey upon the bedbug, as, for example, the house centipede and the

common little red house ant. Such enemies, however, are of very small importance and yield little, if any, effective control except under very exceptional circumstances."

"Remedies.

"Undoubtedly the most efficient remedy for the bedbug is to fumigate the infested house or rooms with hydrocyanic-acid gas. This gas will penetrate into every crevice in the house or room where the bedbugs conceal themselves and has an immediate effectiveness which gives it an important recommendation, especially when the infestation is considerable or of long standing. This method of fumigation should be intelligently employed, as the gas is deadly poisonous." Five ounces of potassium cyanide per 1,000 cubic feet of space should be employed; exposure, one hour.² Ten ounces per 1,000 cubic feet would be better.

"The fumes of burning sulphur are also a very efficient means of control where the conditions are such that this method can be used, readily destroying the insect in all stages, including the egg. The treatment is inexpensive compared with the use of hydrocyanic-acid gas and offers much less risk of danger to human beings. There is, however, a considerable risk of injury to household fabrics, furnishings, and wall papers from the strong bleaching quality of sulphur fumes. This danger will be somewhat diminished if the fumigation can be done at a time when the room or house is thoroughly dried out, as in winter by a furnace or other heating system. Further precautions should be taken by removing all metallic surfaces from the room or building, or by protecting them with a coating of vaseline."

Four pounds of sulphur are recommended for each 1,000 cubic feet of space, and the building should be closed for the treatment for at least five or six hours. "Sulphur candles may be used where available, or the sulphurous gas or fumes can be generated by burning the sulphur in a dish placed in the center of the room, and for protection set within a larger vessel. Thoroughgoing precautions must be taken to prevent accidental overflowing or the starting of a fire, and after the fumigation the house should be given a thorough airing.

"Other gases have been experimented with, such as formalin and the vapors of benzine, naphthalene, and camphor, but these gases are of little value. Similarly, insect powders are of little value, largely from the difficulty of getting them into the crevices and other places of concealment of the insects.

"The old-fashioned household remedies referred to below are effective enough, though at a greater cost of time and personal effort. They will, however, be often of much service in the case of slight or

² Creel, R. H., and Faget, F. M., Cyanide Gas for the Destruction of Insects, with Special Reference to Mosquitoes, Fleas, Body Lice, and Bedbugs: Public Health Reports, June 9, 1916, pp. 1464-1475; Reprint No. 343.

recent infestations, or where the employment of more poisonous and troublesome gases is objected to or is impracticable. Of these simple methods of control perhaps the most efficient is in very liberal applications of benzine or kerosene, or any other of the lighter petroleum oils, introduced with small brushes or feathers, or by injecting with syringes into all crevices of beds, furniture, or walls where the insects may have concealed themselves. Corrosive sublimate is also of value, and oil of turpentine may be used in the same way. The liberal use of hot water, wherever it may be employed without danger to furniture, etc., is also an effectual method of destroying both eggs and active bugs.³ A 5-per cent solution of compound solution of cresol (liquor cresolis compositus) in kerosene forcibly applied with a large plant sprayer is effective if frequently applied.

“Various bedbug remedies and mixtures are for sale, most of them containing one or another of the ingredients mentioned, and these are frequently of value. The great desideratum, however, in a case of this kind, is a daily inspection of beds and bedding, particularly the seams and tufting of mattresses, and of all crevices and locations about the premises where these vermin may have gone for concealment. A vigorous campaign should, in the course of a week or so at the outside, result in the extermination of this very obnoxious and embarrassing pest.”

“*Temperature control.*—The possibility of temperature control is indicated in the discussion elsewhere of the effect of temperature on this insect. A temperature maintained below freezing for 10 or 15 days destroys the eggs, and this temperature continued for 15 days to a month will destroy the newly hatched young. It may be, therefore, that if infested houses in cold climates should be opened up and allowed to remain at a temperature well below freezing for a considerable period, all eggs and the young, and possibly most if not all of the adults, would be exterminated. This method of control

³“A remedy for the bedbug has been devised by Mr. R. H. Pettit (‘Notes on two insecticidal agents,’ 10th Rpt. Mich. Acad. Sci., p. 159-160, 1908) as a substitute for hydrocyanic-acid gas and sulphur, and is reported to have proved very successful. The preparation of this insecticide and its application are described as follows:

“Alcohol is drawn through pyrethrum in a funnel until the powder is well washed and a large part of the resinous principle extracted. To do this, the powder is placed in a large funnel with filter-plate and a layer of cotton wool at the bottom. An aspirator is attached and the alcohol is at first slowly and later rapidly sucked through six or eight times, during which operation it becomes highly colored. To this liquid as a basis, are added several oils to give permanence to the application. Both alcohol and pyrethrum evaporate so quickly that it was thought best to carry in some heavier volatile oils whose effects would last several days or even weeks. The formula when completed stands as follows:

“To the extract made by washing 400 grams of pyrethrum with 2,000 c. c. of strong alcohol, are added—
 50 grams gum camphor.
 150 c. c. cedar wood oil.
 25 grams oil citronella.
 25 grams oil lavender.

“The application is best made with a large-sized atomizer, one holding a pint or more and working with a piston instead of a rubber bulb. * * * To obtain the best results, repeat the treatment after about two weeks. We have tried this mixture repeatedly and with uniformly gratifying results. Usually one application, if thoroughly made, put a period to the complaints, about eight to ten ounces being required in an average sleeping room. The odor remains some little time in a room, but is not disagreeable to the average person.

“This remedy can be readily prepared by a pharmacist in any drug store.”

might perhaps be practicable at least in the case of summer houses in the North which are left untenanted in the winter.

"The maintaining of high temperatures may be an even more efficient method of control. The activity of the bedbug is at its greatest between 60° and 70° to 75°. As indicated elsewhere, in a temperature of 96° to 100° F., accompanied with a high degree of humidity, newly hatched bedbugs perish within a few days, and, if this temperature is raised to 113° F., in a few minutes.⁴ A temperature of 113° will also destroy the eggs, and with these higher temperatures the item of humidity is not apparently important."

⁴ EDITORIAL NOTE.—An account of successful use of live steam to eradicate bedbugs in bunkhouses, as practiced by a lumber company in Oregon, was published in Public Health Reports, Nov. 23, 1919, pp. 2713-2714. In that instance steam pipes were tapped, after closing all doors and windows, and a temperature of 160° F. was held for approximately 3 hours. The officials of the company stated that 2 months after the steaming no signs of bedbugs had been found.

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