
HOST RELATIONS.

Adults and larvae attack dead and living mice (*Mus*); *columbarius* feeds on human blood.

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I. *Clinocoris lectularius* (Linnaeus).

In experimental medicine, the host relations of our common bedbug are of importance from the fact that if they attack animals other than man, their scope in the potential transmission of diseases becomes greatly enlarged. In reviewing the entire entomological and medical literature, as far as it concerns the bedbug, the writers have been unable to come to any definite conclusion concerning these host relations. As far as the entomological literature is concerned, no conclusions at all are possible, for the simple reason that authorities differ, and that no definite experiments have been cited to show that the host of the bedbug is other than man himself. In fact, most of the statements to the contrary are purely conjectural or theoretical.

In the literature of experimental medicine, however, it has been quite frequently stated that bedbugs attack mice, living and dead, and these mice were so used in the experiments performed. But the statements of these facts have been so general, and in a way, so unscientific, that the writers could not, in strict justice, come to any other conclusion than that it was very probable that *lectularius* attacked animals other than man. Nuttall (1897, 1898), in his most important experiments on the transmission of diseases by the bedbug, however, nearly convinces us that both living and dead mice are readily attacked by *lectularius*, but doubt could not be eliminated, because of the use of the general term *wanzen* instead of a specific name, and on account of the presence of a single ambiguous sentence (Nuttall, 1898, p. 626, footnote).

Correspondence with some of the leading hemipterists and personal communications from economic entomologists, all tend to throw doubt on the statements thus made in the medical literature. Scepticism coming from such sources cannot be better evidence, and practically shows that the question remains as yet unsettled.

*Clinocoris* is masculine, not feminine, as would be inferred from its ending. (Kirkaldy.)
In view of the foregoing facts, and because of the importance of the question, the following preliminary and rather crude experiments have been performed, showing that lectularius will readily attack both living and dead mice. The experiments also explain to a certain extent, the supposed occurrence of the bedbug in long unoccupied houses, from the fact that writers, now, will not have to theorize in regard to moisture, and so forth as a food, in order to support their statements.

The specimens used in these experiments were all obtained by jarring beds in one of the large mission houses in the city of Washington, about 7 P. M., September the eleventh, 1905. They were then full-fed, and the majority of them in the last larval instar (instar V). They soon molted, and then, were specifically determined by comparison with specimens in the collection of the United States National Museum.

A. Experiment with a recently dead mouse.

A single mouse killed in the insectary of the Department of Agriculture at 8.40 A. M., September 20th, was immediately placed under a large bell-jar, on a clean sheet of white paper.

1. Nymph. Six minutes afterwards, 8.46 A. M., a nymph in instar III, which was starved when captured on September 11th, was placed under the bell-jar. It was nearly transparent. The larva paused a few seconds, and then went to the carcass; at 8:46:35 A. M., it was feeding from the toes of the left hind leg, from which it was apparently unable to extract much blood. At 8:51 A. M., it left the toes and crawled completely around the head end of the body to the right hind leg, and there again attempted to feed from the toes of that leg, but with little or no success. At 8:53:30 A. M., it left its last position, crawled around the head end of the body, and attached itself to the abdomen. Up to this moment, the larva was but slightly tinged with blood. Attached to abdomen at 8:54 A. M.; larva’s abdomen red from blood at 8:54:30 A. M.; larva half full of blood at 8:57 A. M. The larva appeared to be weak, and was having much trouble to obtain blood. After 9 A. M., the larva remained the same, as far as the amount of food obtained is concerned, but frequently changed its position on the carcass. It was removed from the carcass at 10:30 A. M., having voluntarily left it at 10:20. The body of the mouse was getting cold at 9:08 A. M. The larva was not fully gorged with blood, but it is evident that this was due to its weakness, a condition apparently due to its age, combined with its previously starved condition. Cases of this kind are often met with in this species. It molted on September 28th, without having been fed again.
2. Adult. An adult, not recently fed when captured on September 11th, was placed under the bell-jar at 9:26 A.M. The body of the mouse was then cold, and a little stiff.

The adult wandered about, and then at 9:27:30, crawled under the carcass; body then flat and fully colored. Hiding from light. In a few minutes, crawls from beneath the carcass to the side of the bell-jar, not having fed. Jar covered with a black cloth

At 9:44 A.M., jar uncovered and the adult found fully gorged with the blood from the carcass. It was found at rest on the back of the mouse, but began to wander on exposure to the light. Body of mouse now stiff and cold. Adult removed.

Another hungry adult placed under the bell-jar at 11 A.M., the mouse then being dead 2 hours and 20 minutes. It was pale, having just recently passed the fifth ecdysis. At once hid under the carcass.

It did not feed up to 3 P.M., and was then removed. The blood in the carcass had by that time coagulated. Experiments discontinued on account of the lack of material.

B. Experiment with a living mouse.

A mouse trapped in the insectary of the Department of Agriculture during the night of September 21-22, 1905, was confined under a bell-jar as in the first experiment at 9 A.M., September 22nd.

At 9:40 A.M., three adults, captured when full-fed in instar V, on September 11th, and since molting on September the 18th, and a single larva in instar IV, hungry when captured, were placed under the jar and the latter covered with a black cloth to exclude the light. None of the insects had fed up to 6 P.M.

At 7 A.M., September the 23rd, the day following, the cloth was removed from the jar, and all of the insects found fully gorged with blood, the abdomens of the adults immensely swollen. Upon exposure to the light they as usual wandered quickly about. The experiment was not repeated because of the lack of enough suitable material,—hungry bedbugs.

C. Experiment with recently born mice.

At 6.30 P.M., September 28th, three recently born mice were placed in a group on a clean sheet of white paper and covered with a small bell-jar. Although much alive, their bodies were cold.

Immediately afterwards, three adults of lectularius, full-fed nymphs in instar V when obtained on September 11th, molting on September 19th, and now, therefore, hungry adults, were introduced. Left over night in a dark room.
At 7 A. M., September 29th, adults found greatly swollen with blood from the mice. The latter still alive.

These experiments show clearly enough that *lectularius* will readily feed on mice, at least under the conditions in foregoing. It has now to be proven whether or not they can breed under such conditions. There appears to be no reason why they cannot, yet experiments are necessary to prove that they can. The writers have been unable to experiment in this direction because of the difficulty experienced in obtaining either eggs from confined adults, or very young nymphs from other sources.

It is hardly necessary to say that more experiments are needed on all points in the question involved.

II. *Clinocoris columbarius* (Jenyns).

As with *lectularius*, so with this species. The host relations are entirely unknown. That is, the statements concerning these relations are so confusing, that no positive conclusions are possible. The following preliminary experiments may help to a better understanding of them.

Thirty-two specimens, in all stages, were obtained on September 24th, 1905, from a chicken house, in a large fowl yard at Anacostia, D. C. The house in which they were found was a barn-like structure, consisting of an elevated first floor and a loft above. On the former, which consisted of a main hallway running the entire length of the building, and of pen-like rooms of rather large dimensions, on each side, made of closely fitting laths coated with whitewash, was occupied entirely by chickens. Each room contained about three nests, made of boxes filled with straw. The loft above was occupied by pigeons.

The first floor of the structure was reached from the ground by means of a stairway. The building itself was surrounded by quite extensive yards, all alive with different kinds of poultry and pigeons, and was not very distant from the dwelling of the superintendent.

The bugs were not easily found at first. In fact, none were found in the nests. The first sign of their presence was found in the spider nests along the walls, which sometimes held large masses of dead bugs and exuviae; generally, however, but one or two. Finally, the insects were found hiding in cracks between the laths, or in dark corners of the room; in such places, eggs were quite frequently found. Nearly all of them were full-fed, showing a constant supply of food at hand. They were in all stages, and it was quite difficult to dislodge them. The attendant, who was following, said that no bugs were present. But a casual observer would hardly have noticed their presence.
It struck the writers at once, that an excellent opportunity here offered to prove whether or not this species would naturally leave their preferred hosts, chickens, and go to the dwellings of man; or whether they would crawl onto man, thus be transferred to his dwellings, and breed there. But this could not be determined because of the absence of the superintendent, and nothing could be obtained from the attendant, who denied all knowledge of bugs, especially those found in beds.

This species found associated with chickens agrees well with the description of *columbarius* given by Osborn (1896), and they agree with supposed specimens of that species now in the collection of the United States National Museum. On comparison with other species in the National Museum collection, they are at once easily separated from the species associated with the bat (*pipistrelli* Jenyns), and with the swallow (*hirundinis* Jenyns). They are closer to *lectularius*, but differ in the shape of the body, which has the greatest width of the abdomen at the middle, and which, in general, is smaller, and in the relative lengths of joints 3 and 4 of the antennae, which are subequal in *columbarius*, but joint 3 much longer than 4 in *lectularius*. They cannot possibly be *Acanthia inordora* Dugès. The specimens in the National Museum are from the United States.

A. Experiment with human blood.

At 6.45 P. M., September 25th, an adult of this species, full-fed when captured, was placed into a small glass vial and the latter then inverted over a portion of the fore arm, just above the wrist. In this way, the insect was forced to rest on a portion of the skin.

Upon regaining its position, after the fall down the sides of the vial, it remained perfectly motionless for nearly a minute. Then, very quietly, it inserted the beak and began to feed. In ten minutes, it was gorged with blood, and the body was therefore much elongated. About eleven minutes after beginning to feed, the bug withdrew its beak, its body greatly distended with blood.

Another recently fed adult captured on September 24th, showed willingness to feed from the fingers of the hand on the afternoon of September 29th, when they were placed near it.

Accordingly, it was transferred to a vial, and the latter inverted over a portion of the under surface of the fore arm, at 6:08 P. M., in the presence of a bright light.

It tried to escape at first, but at 6:09 P. M., it inserted the beak and began to feed. The vial was then removed, leaving the insect attached to the arm. It was wholly unmindful of the light. The abdomen gradually commenced to
swell, until at 6:16 P. M., it was greatly distended, and cylindrical, apparently unable to hold more. Yet the insect remained attached until 6:18:15 P. M., when it withdrew the beak and began to run off. It now resembled a gravid termite female, all abdomen. At 6:20 P. M., it voided a drop of thick, dark, liquid excrement.

B. Experiments with living mice.

At 8 P. M., September 28th, three recently born mice were placed under a bell-jar, and three adults and two larvae of columbarius added. They were left over night in a dark-room, and were found gorged with blood on the morning of September the 29th.

While placing them under the bell-jar the evening before, one of the adults accidently fell on the body of one of the young mice, which it immediately attacked. When its beak was inserted, the mouse jumped from the pain, and a struggle then ensued, the almost helpless little animal trying desperately to dislodge the sucking insect by rolling and kicking. Several times, the bug lost its hold, but turned at once and renewed the attack, until at last, it obtained a position on the breast of the mouse, between the fore legs, where it was simply impossible for it to be reached. Here it fed until satisfied.

The insects showed no hesitancy in attacking these mice, after gaining access to them; but on account of the presence of light being necessary in order to watch them, they would not as a general rule, go at once to feed. Some do not seem to mind the light at all, however. This is seemingly dependent on the state of their appetite.

At 7:30 P. M., September the 29th, the experiment was repeated, using the same mice, now nearly exhausted from lack of nourishment. Two adults and one larva were left over night with the three mice. The following morning they were gorged with blood. The mice were dead.

Young mice are very sensitive to the attacks of these insects. They start with pain when bitten, and in their helpless way, struggle frantically to keep the insects away, or to dislodge them. But the activity and persistency of the "bed-bugs make their struggles useless."

The writers could not find any marked differences between lectularius and and columbarius, in their behavior towards the foregoing hosts. The former is perhaps, more bold and active than the latter.

Literature referred to.


Centralblatt f. Bakteriologie, Parasitenkunde, u. Infektionskrankheiten, Jena, Bd. XXII, erste abteilung, pp. 91–93. (Versuche mit Wanzen.)


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