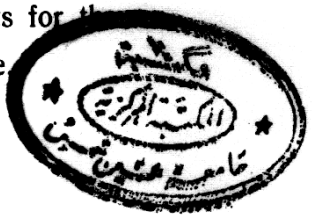
MOREHOLOGY AND BIOLOGY AND SUSCEPTIBILITY OF THE BED BUG SIMEX LETULARIUS L. TO INSECTICIDES.

A thesis

Submitted in partial fulfilment of the requirements for the award of the degree of Master of Science



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A C K N O W L E D G E M E N T S

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C O N T E N T S

Page

I N T R O D U C T I O N

Several species of bed bugs feed exclusively on blood. They are adapted for living parasitically in human houses in different parts of the world, feeding on man. Despite of considerable amount of experimental work, the bed bug was not proven to be a regular disease carrier. Objection to this bug is partly on account of the unpleasant irritation and - consequent loss of sleep - it causes to humans by its bites.

The bed bug probably originated as a parasite in a semi - tropical region, possibly in the Middle East. The more northerly countries of Europe were not invaded until comparatively recently (Germany in the 11th century, England in the 16th century, Sweden as late as early 19th century).

On the other hand, the Mediterranean region was infested in earlier times. Thus,this insect has attracted the attention of several entomologists all over the world, to find a suitable method for its control. Unfortunately after a short time resistance to used insecticides appeared in the bed bug Cimex lectularius.

A study of both the biology and the genetics of resistance in this insect was sought as a help to facilitate its control. This was thus planned for the present work.

Aim of the present study :

1- To study the biological activities of the insect for determination of the different factors affecting fertilization, fecundity, and duration of the life cycle of the bed bug.

2- Detection of the insecticide susceptibility - level in a field resistant strain in comparison with a laboratory susceptible strain of the bed bug.

3- Determination of the method of inheritance of dieldrin - resistant gene in the field.

4- To study the effect of sublethal doses of organic insecticides on egg production.

The present study is a trial to reveal some of the unknown aspects concerning this medical insect hoping for its successful control.

IDENTIFICATION AND SYSTEMATIC POSITION

Cimex lectularius is a member of the family Cimicidae, Series Gymnocerata, Suborder Heteroptera, Order Hemiptera.

Synonymy of this bed bug species is as follows :

Cimex lectularius Merett, (1667)

Cimex lectularius Linné , (1758)

Acanthia lectularia Fabr.,(1794)

Cimex lectularius Doane, (1910)

& *Clinocoris lectularius* Cast et Chalmers (1913)

Family Cimicidae includes the bed bug, swallow bugs, and the poultry bugs. Members of this family are characterized by :

1- a very short, broad head broadly attached to the prothorax.

2- oval body.

3- well developed compound eyes

4- absence of ocelli.

5- four-segmented conspicuous antennae.

6- a three-segmented proboscis laying in a groove beneath the head and thorax.

7- a very short pad - like hemielytra

8- the bodies flat enabling the bugs to escape into the narrow crevices.

9- a nasty pungent odour is attached to the group as a whole with few exceptions.

10- They are night-prowling and blood sucking in habit, some feeding on birds and bats, and others on human beings.

11- peculiar to these bugs is the organ of Ribaga located in the fourth and fifth abdominal segments. The presence or absence of this organ and its particular location when present provide a character useful in identification of species.

The bed bugs belong to the genus Cimex and the two common well known species are Cimex lectularius (Linnaeus), the ordinary or temperate region bed bug which is almost cosmopolitan, and C. hemipterus (Fabricius), the tropical bed bug (also known as the Indian bed bug Cimex boueti Joyenx), which abounds in Southern Asia and also in Africa. These two species will not interbreed and can be readily distinguished on morphological grounds.

Cimex hemipterus may be distinguished from C. lectularius by the fact that the pronotum lacks the wing-like expansions so prominent in the latter, nevertheless, they are obviously closely related and are very similar in their bionomics.

The main difference is biological, at temperatures below 30°C C. lectularius can breed more prolifically than C. hemipterus while between 30°C, and 35°C there is no difference. Above 35°C, C. hemipterus may be slightly more efficient.

C. hemipterus is restricted to the tropical parts of the world, but Cimex lectularius which originated in a warm temperate part of the old world, has spread to localities all over the temperate and tropical regions. It appears to be a more efficient insect and may displace C. hemipterus in hot countries (Mellanby, 1935).

In addition to the two species of Cimex which regularly feed on man, other related bugs such as C. columbarius the pigeon bug and C. pilosellus, the bat bug and Leptocimex boueti and C. pipistrelli, all resemble one another very closely.

The pigeon bug, C. columbarius, is so closely similar in morphology to C. lectularius that it is difficult to separate both.

In a careful analysis, Johnson (1939) has shown that the two forms differ in the ratio of the 3rd and 4th antennal segments. However, their means are distinct. Pigeon bugs are found in pigeon nests and also in hen houses, but their different body form is genotypic and can be maintained through several generations. They are quite infertile with C. lectularius.

Presumably their status is that of sub-species adapted (by habit) to another host. They have virtually no medical importance.

Leptocimex boueti attacks man in New Guinea. The bed bug Cimex pilosellus, at times becomes a household pest in U.S.A.

In a similar way, some species of bugs infesting birds may sometimes invade human habitations and cause serious annoyance to their occupants. These species are Haematosiphon, in which the rostrum is long, reaching to the posterior coxae.

H. inodorus (Duges) is the only known species (Herms, 1961). This species infests poultry in the South Western U.S. and in Mexico.

According to Herms (1961) other North American genera include Hesperocimex, represented by two species parasitic on martins (Ryckman has studied the bionomics of H. sonorensis (Rychman)).

Synxenoderus is represented by one species on swifts in California and Nebraska. Cimexopsis contains a small species distributed widely in the eastern U.S. in nests of the chimney swift. Primicimex, contains the largest of the species of Cimicidae. The latter genus has been found in bat caves in Texas and Guatemala.

A number of species of bugs feed on plant juices and are occasionally mistaken for the bed bug. In parts of the west it is the belief that bed bugs can live for long periods in logs or dead trees. However, in this instance the bed bug has been confused with another insect, Arodus sp., which subsists entirely on plant material (Wright, 1964).

The bed bug has a number of common names including such terms as the "Chinch","red coat", and "mahogany flat".

Morphological characteristics of the adult bed bug :

The adult bed bug Cimex lectularius (Linn.) is a flat, oval insect, measuring approximately 1/5 inch in length and about 1/8 inch in breadth. The body is covered with microscopic hairs.

The bugs are usually of a rusty red or mahogany colour but become a brighter red after feeding. In a starved condition the bugs are paper thin, but after feeding become plump and elongated.

The body of the engorged insect presents a banded appearance due to the hairless areas between the segments.

The head is short and broad and is provided with a pair of compound eyes, between which are the two antennae, each consisting of four segments. The first segment is relatively short and thick and does not extend beyond the front of the head; the second segment is longer and thinner while the third and fourth are characterized by increasing slenderness.

Beneath the head is situated the jointed beak or proboscis which passes backward between the first pair of legs. The beak contains two pairs of stylets which act as