Dichlorvos Exposure—Rate of heart beat
METHOD

Isolated Silkworm Heart Technique

The isolated heart technique described by Krijgsman et al., (1950) and Naidu (1955) was followed. The heartbeat can be noted down by dissecting the worm. The worm to be dissected was first made inactive by immersing in physiological solution for few minutes. Then the worms were fixed on a wax plate with its dorsal side down.

This plate was placed in a shallow petridish containing physiological solution. An incision was made at the posterior end of the insect. This was continued up to the thorax region of the insect. The heart was exposed carefully by removing the digestive tract and fat tissue. Then the heart was allowed to recover from shock and with resumption of regular heart was allowed to recover from shock and with resumption of regular heart rate in about 15-20 min. The frequency of heartbeat was taken. The values are expressed in beats/min. The rate of heartbeat was calculated on 4th day of IV instar of silkworm, Bombyx mori L.

COMPOSITION OF PHYSIOLOGICAL SOLUTION

The physiological solution used by Naidu (1955) has been employed in our present investigation. The composition of the solution was NaCl 9.62 gr, KCl 0.77 gr, CaCl2 0.5gr, NaHCO3 0.18 gr, NaH2PO4 0.01 gr/litre, dextrose 1 gr + 2 drops of
0.1N HCl per one litre of distilled water pH and temperature were maintained at 7.0 and 29°C respectively.

RESULTS

The data on the rate of heart beat of IV instar of silkworm are presented in Table 6 and Fig.4. The results obtained from the data, it is an interesting to note that, the rate of heartbeat is relatively very much inhibited by 49.99% at lethal dose at higher temperature. Where as at low temperature it is 17.14% and moderately increased by 19.56% at sub-lethal dose at higher temperature when compared to 14.2% at lower temperature. In the control as well as in the sub-lethally exposed larvae, the heartbeat increases as the ambient temperature increase, where as in lethally exposed larvae, the rate of heart beat decreases as the ambient temperature is raised in Bombyx mori L. Between ambient temperatures of this investigation are found to be highly significant at both lethal and sub-lethal exposures.

DISCUSSION

Various physiological and pharmacological studies in relation to heartbeat have been made. Wigglesworth (1972) provided a detailed structural information of silkworm heart. Besides this, few works are available on the effect of different insecticides like, Carbofuran, Phorate, Sumicidin and Endosulfan by Madhukar et al., (1988).

In insects variations in nutrition and the level of metabolic would directly influence the rate of heartbeat. The consumption and utilization of mulberry leaves exhibited enormous increase in the rate of ingestion of food in V instar. So, increase in feeding would stimulate the rate of heart beat.
Legay (1971) has reported decrease in the heartbeat by the fast development of silkworm larvae. These results coincide with findings of Ito and Kobayash (1978).

The consumption and utilization of mulberry leaves is a leaf is less in the spinning of cocoon. This might be the reason for the decline of heartbeat in the later instar than the IV instar.

In the present study the obtained results indicates that the rate of heartbeat is very much inhibited by the lethal dose and moderately increased by sub-lethal dose at higher temperature in silkworm. The decrease of heartbeat by the lethal dose is due to insecticidal stress. On the other hand, the heartbeat is enhanced by the sub-lethal doses of dichlorvos at higher temperature because the sub-lethal doses may stimulate the neurogenic heart of silkworm, *Bombyx mori* L. Thus the lethal dose of dichlorvos is acting as inhibitor. Where as the sub-lethal dose of dichlorvos is acting as activator in the IV instar of silkworm. Further, the toxicity of dichlorvos is found to be temperature dependent and at higher temperature, dichlorvos is found to be more potent and toxic when compared to the lower temperature.
TABLE 6

The rate of heartbeat in IV instar of PM x NB₄D₂ race of silkworm, *Bombyx mori* exposed to dichlorvos at different ambient temperatures

± Standard deviation  

<table>
<thead>
<tr>
<th>Dose</th>
<th>Low Temperature 21°C</th>
<th>Optimum Temperature 25°C</th>
<th>High Temperature 29°C</th>
<th>P. Levels of significance (&lt; 0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>35 ± 3.01</td>
<td>41 ± 4.04</td>
<td>46 ± 3.29</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>Lethal</td>
<td>29 ± 2.22</td>
<td>32 ± 3.04</td>
<td>23 ± 2.09</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>-17.14%</td>
<td>-21.95%</td>
<td>-49.99%</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>Sub-lethal</td>
<td>40 ± 2.01</td>
<td>47 ± 3.45</td>
<td>55 ± 4.02</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>+14.28%</td>
<td>+14.63%</td>
<td>+19.56%</td>
<td>P&lt;0.005</td>
</tr>
</tbody>
</table>

Values are expressed in bts/min.

Each value is a mean of six estimations.

Percentage increase (+) / decrease (-) relative to control is given in parenthesis.
Fig. 4

Rate of heart beat (bts/min)

Ambient temperatures in Degree Centigrade

- Higher (29°C)
- Optimum (25°C)
- Lower (21°C)

- Control
- Lethal
- Sub-lethal