

Effect of temperature on food intake, growth and conversion efficiency of *Eupterote mollifera* (Insecta: Lepidoptera)

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Abstract. The effect of temperature on food intake, growth and conversion efficiency has been studied in the final instar male and female larvae of *Eupterote mollifera*. Food consumed, assimilated and metabolised decreased with increase in temperature. The larval duration decreased from 12 days for the group reared at 22° C to 5 days for the group reared at 37° C. While the rates of feeding, assimilation and conversion increased with increase in temperature, high conversion efficiencies (K_1 and K_2) were observed for the larvae reared at 27 and 32° C.

Keywords. Temperature ; food intake ; *Eupterote mollifera*.

1. Introduction

Many species of lepidopterous larvae are known to cause serious damage to economically important plants (Ayyar 1963). While the energetics of food utilization in relation to temperature have been reported for a few lepidopterans (Waldbauer 1968 ; Mathavan and Pandian 1975 ; Pitchairaj *et al* 1977), there are no such studies on *Eupterote mollifera* which is a common pest on drum-stick plant. This paper, based on the earlier studies of energy intake and expenditure pattern (see Palanichamy *et al* 1979), reports the effect of temperature on food utilization in the tropical moth *E. mollifera*.

Lepidopterous larvae consume more than 70% of the total food intake during final instar (Waldbauer 1968 ; Mathavan and Pandian 1975) and accumulate sufficient energy (Delvi and Pandian 1972 ; Pandian 1973) to tide over the non-feeding pupal stage. Palanichamy *et al* (1979) reported that the final instar larvae of *Eupterote mollifera* consumed 71.4% of the total food intake at $30 \pm 2^\circ \text{C}$. Hence, the effect of temperature on food utilization has been studied only in the final fifth instar larvae of *E. mollifera*.

2. Materials and methods

Newly hatched first instar larvae of *Eupterote mollifera* were collected from the field and reared as a group in 8 litre glass trough. As soon as the larvae entered the final instar, the males and females were separated out, weighed and reared individually in 1 litre glass container at four different temperatures (22, 27, 32 and 37° C) with an accuracy of 1° C. Sex identification was confirmed after adult emergence and any larvae identified wrongly was discarded from the experiment. The larvae were fed *ad libitum* with fresh leaves of *Moringa pterygosperma* (drum-stick plant) daily throughout the experimental period. Daily food intake was measured by a standard gravimetric method (Waldbauer 1968) with all weighings accurate to 0.01 mg. Food, faeces and larvae were dried overnight at $90 \pm 2^\circ \text{C}$ to constant weight for purposes of calculations (see Palanichamy *et al* 1979).

3. Results

3.1. Larval duration and growth

The changes in the instar duration, live body weight and growth in relation to four different temperatures are indicated in table 1. While there were distinct differences in the live body weight of male and female larvae at all temperatures, least differences were observed between the two sexes reared at different temperatures. However, the instar duration decreased from 12 days for the larvae reared at 22° C to 5 days for the larvae reared at 37° C. While the maximum weight of male (710 mg) and female (916 mg) larvae was observed when reared at 22° C, highest growth was observed (male : 124 ; female : 164 mg) for the larvae reared at 32° C.

Table 1. Initial and final live weight of fifth instar larvae of male and female *Eupterote mollifera* fed on the leaves of drum-stick plant *Moringa pterygosperma* at different temperatures.

Temperature (° C)	Fifth instar duration (days)	Initial weight (mg)		Final weight (mg)		Growth (mg)	
		Male	Female	Male	Female	Male	Female
22	12.0±1.00	229±36.2	253±32.6	710±90.4	916±84.5	101±10.9	134±14.2
27	7.5±0.50	227±39.6	240±38.9	649±82.2	855±94.7	103±12.1	142± 9.7
32	77.0±0.00	216±32.8	231±27.4	691±88.1	748±92.9	124±11.3	164± 8.6
37	5.0±1.00	151±29.7	167±24.1	562±79.3	601±77.9	82± 9.0	87± 8.1

3.2. Food utilization

The amount of food consumed and assimilated were high for either sexes of larvae reared at 22° C and least for those reared at 37° C (figure 1). However, the values remained similar for males and females reared at 27 or 32° C. In spite of higher food consumption and assimilation for the larvae reared at 22° C, maximum growth (male : 124 ; female : 164 mg) was observed for the larvae reared at 32° C. These values are higher than those reported for the same species (male : 107.7 ; female : 148.5 mg) reared at 30 ± 2° C (see Palanichamy *et al* 1979).

3.3. Rates of bioenergetics of feeding

At all the temperatures tested, the rates of bioenergetics of feeding did not vary much between the male and female larvae (figure 2). While the rates of bio-

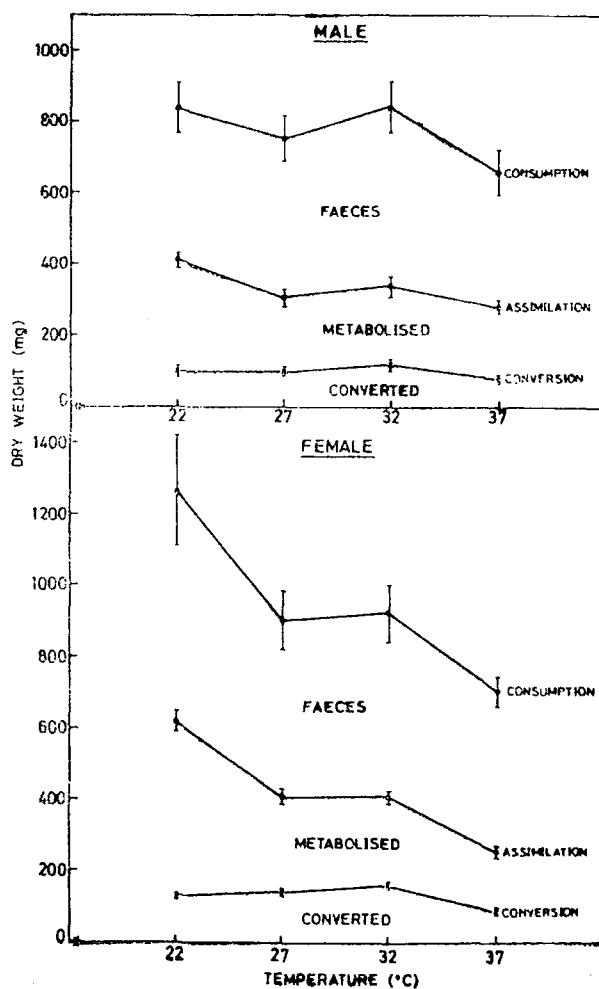


Figure 1. Effect of temperature on food intake, assimilation and conversion in fifth instar larvae of male and female *Eupterote mollifera* fed on the leaves of drum-stick plant *Moringa pterygosperma*. Each value represents an average of 10 larvae (= ± S.D.).

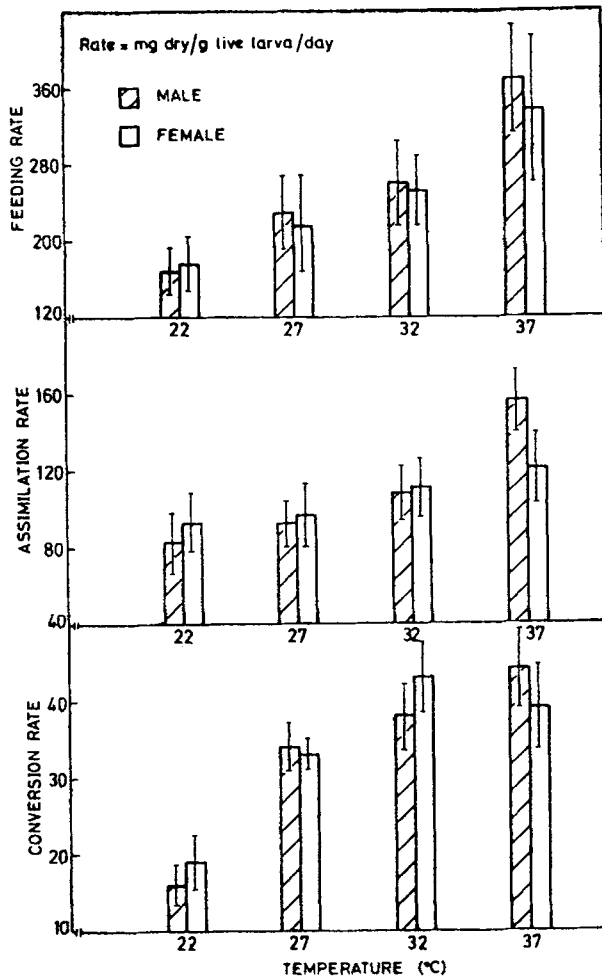


Figure 2. Histogram represents the effect of temperature on the rates of feeding, assimilation and conversion in male and female of fifth instar larvae *Eupierote mollifera* fed on the leaves of drum-stick plant. Each value represents an average of 10 larvae (\pm S.D.).

energetics of feeding indicated gradual increase with increases in temperature, the conversion rate did not show much variation for the larvae reared at 32 and 37°C. However, distinct differences were observed in conversion rate for the larvae reared at 22 and 27°C.

3.4. Assimilation and conversion efficiencies

The changes in the assimilation and gross and net conversion efficiencies are represented in figure 3. Assimilation efficiency decreased for either sexes with increase in temperature (male : 50 ; female : 49% at 22°C to male : 36 ; female : 31% at 37°C). However, high gross (K_1 : %) and net (K_2 : %)

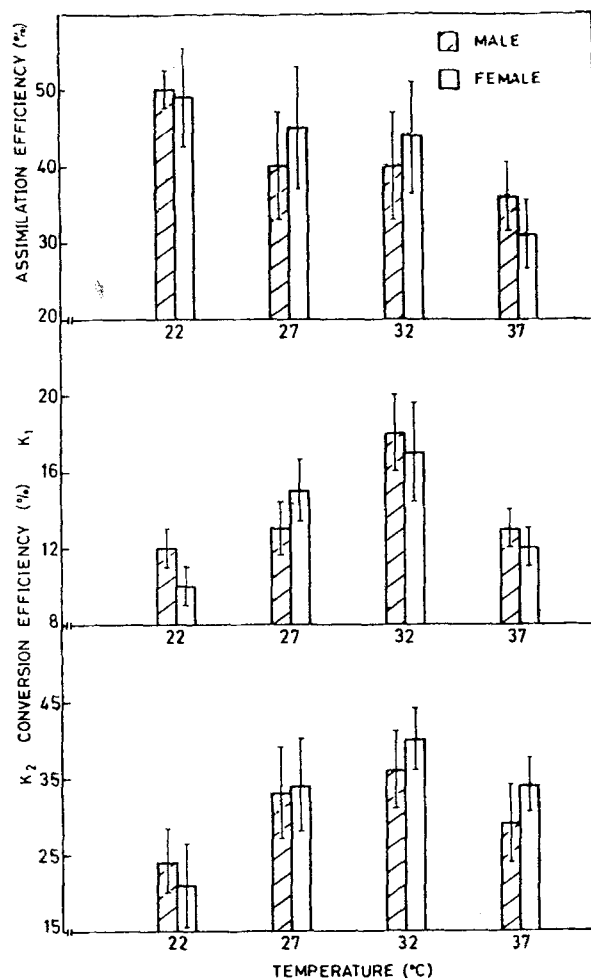


Figure 3. Histogram represents the effect of temperature on the assimilation and conversion (K_1 and K_2) efficiencies in male and female of fifth instar larvae *Eupterote mollifera* fed on the leaves of drum-stick plant. Each value represents an average of 10 larvae ($= \pm$ S.D.).

conversion efficiencies were found for either sexes reared at 32° C. As observed in the rates of bioenergetics of feeding, assimilation and conversion efficiencies remained similar for both the sexes at all the temperatures tested.

4. Discussion

The final body weight of fifth instar female *Eupterote mollifera* showed an increase of 51% at 22° C as against the larvae reared at 37° C ; whereas the increase in weight was only 32% for the fifth instar female *Danaus chrysippus* reared at 19° C as against the larvae reared at 37° C (see Mathavan and Pandian 1975). Probably the variation in temperature (22 and 19° C) provided for these two

species may account for the difference. This information supports the fact that many species attain larger final body size in the cooler parts of their distribution (Kinne 1970) and explains the variation in the maximum weights of different ecotypes of insects with seasonal and geographical distribution (Odum 1971).

Food consumed, assimilated, converted and metabolized by *Eupterote mollifera* showed distinct differences between the larvae reared at 22 and 37° C. However, the values did not exhibit distinct differences for the larvae reared at 27 and 32° C. This is in conformity with the findings reported for the lepidopteran *Danaus chrysippus* (Mathavan and Pandian 1975). The high conversion observed for the larvae reared at 27 and 32° C indicates that these temperature ranges are optimum to elaborate best growth.

On an average, the larvae of *Eupterote mollifera* showed nearly 1½ times higher rates of feeding (353 mg/g live larvae/day) and assimilation (138 mg/g live larvae/day) at 37° C than those reared at 22° C. However, this temperature proves to be lethal for the larvae as evidenced by high mortality. The mortality was observed due to reduction in the thickness of the skin which in turn changes the colour from dark brown to reddish brown. The larvae reared at 37° C consumed less food (680 mg) and assimilated with 33.5% efficiency. Thus the assimilated food which are available for metabolic and growth processes is not proportionally increased. This explains the finite body size of the larvae reared at 37° C though the net and gross conversion efficiencies were more than those reared at 22° C.

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