THE EFFECT OF DIFFERENT TEMPERATURES AND RELATIVE HUMIDITIES ON THE LIFE STAGES OF *Callosobruchus maculatus* (F.)

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The effect of four different temperatures viz., 20, 24, 30 and 35°C each in combination with 30, 60, 90 and 100 per cent relative humidity on the life stages of *C. maculatus* (F.) was determined during 1967-68. The highest mean number of 85.0 eggs laid by a female at 25°C x 90 per cent relative humidity, differed significantly from all the rest of the combinations of temperature and relative humidity. The shortest oviposition period of 1.75 days was recorded at 30°C x 90 per cent relative humidity and at 35°C x 90 per cent relative humidity. The shortest durations of larval, pupal and complete life cycle viz., 12.75, 8.0 and 24.25 days, respectively, were recorded at 30°C x 90 per cent relative humidity.

INTRODUCTION

Callosobruchus maculatus (F.), Bruchidae: Coleoptera, causes severe damage to pulses like 'moong' (*Phaseolus aureus*) 'mash' (*P. mungo*) 'moth' (*P. aconitifolius*), gram (*Cicer arietinum*), etc. under storage conditions. According to Ahmad and Ahmad (1969) in the grain markets, surveyed in Lyallpur and Lahore districts, an annual loss of 1.98, 7.86 and 9.72 per cent in gram, 'moong' and 'mash' respectively was caused by bruchids. Since the intensity of attack and extent of damage by insects are greatly influenced by variable seasonal and environmental factors like temperature, relative humidity, etc., information regarding the effect of these factors on the life cycle of pest insects would be helpful in forecasting the intensity of attack and planning and devising control measures against them.

Ouchi (1936) found that female of *C. chinensis* L. laid the lagest number

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of eggs at 29.7°C and 93 per cent relative humidity. However, 30°C and 90 per cent relative humidity were optimum for the development of the pest Arora and Pajni (1959) reported 35°C as the optimum temperature for the development of *C. analis*.

Schoof (1941) reported that the development period of *C. maculatus* (F.) fed on cowpeas at 30°C took 21.0, 22.7, 26.1 and 29.1 days at 91, 44, 21 and 3 per cent relative humidity, respectively. El-Sawaf (1956) observed that this insect laid more eggs at 25°C than at higher or lower temperature, and between 55 and 90 per cent relative humidity. He also stated that the food and temperature on which the beetle was bred influenced the number of eggs laid. Howe and Currie (1964) reported chick pease to be the best of the six different types of food they tried for breeding *C. maculatus*. They also observed that 32.5°C and 90 per cent relative humidity were optimum for the rapid development of the pest. Mookherjie and Chawala (1964) reported that the optimum zone of development was between 20 to 30°C and 45 to 60 per cent relative humidity. Raina (1970) found that *C. maculatus* at 30°C and 70 per cent relative humidity laid 116 eggs and completed combined larval and pupal development in 24 days.

In the present investigation an attempt has been made to find out the effect of different temperatures in combination with various relative humidities on the life stages of *C. maculatus* (F.)

MATERIALS AND METHODS

Adults of *C. maculatus* (F.), were collected from Lyallpur grain market and released for multiplication in a glass jar containing gram grain. The jar was kept in an incubator running at 30°C. The progeny of these insects was used in all the subsequent experiments.

The effect of four different temperatures viz., 20, 25, 30 and 35°C in combination with four relative humidities, viz., 30, 60, 90 and 100 per cent, on the life stages of this insect, was studied during 1967-68. The requisite humidities were maintained in different desiccators according to the technique followed by Solomon (1951).

Pairs of copulating beetles were caught and each pair put into a glass beaker of 50 ml. capacity having gram seeds to serve as the substratum for oviposition. The beakers were covered with small pieces of muslin cloth and kept in the respective desiccators of various constant temperatures. The hatching of the eggs was observed by examining five grains from each beaker

under binocular and the larval development was studied by dissecting two or three grains daily.

RESULTS

The data obtained from experiments have been shown in Fig. These data show that the highest mean number of 85.0 eggs, laid by a female at 25°C×90 per cent relative humidity, differed significantly from all the rest of the combinations of temperature and relative humidity. The shortest oviposition period, recorded both at 30°C×90 per cent relative humidity and at 35°C×90 per cent relative humidity was 1.75 days and it differed significantly from the other treatments. The longest oviposition period was 8.50 days recorded at 20°C×60 per cent relative humidity followed by 8.25 and 7.75 days at 20°C×30 per cent relative humidity and 20°C×100 per cent relative humidity, respectively.

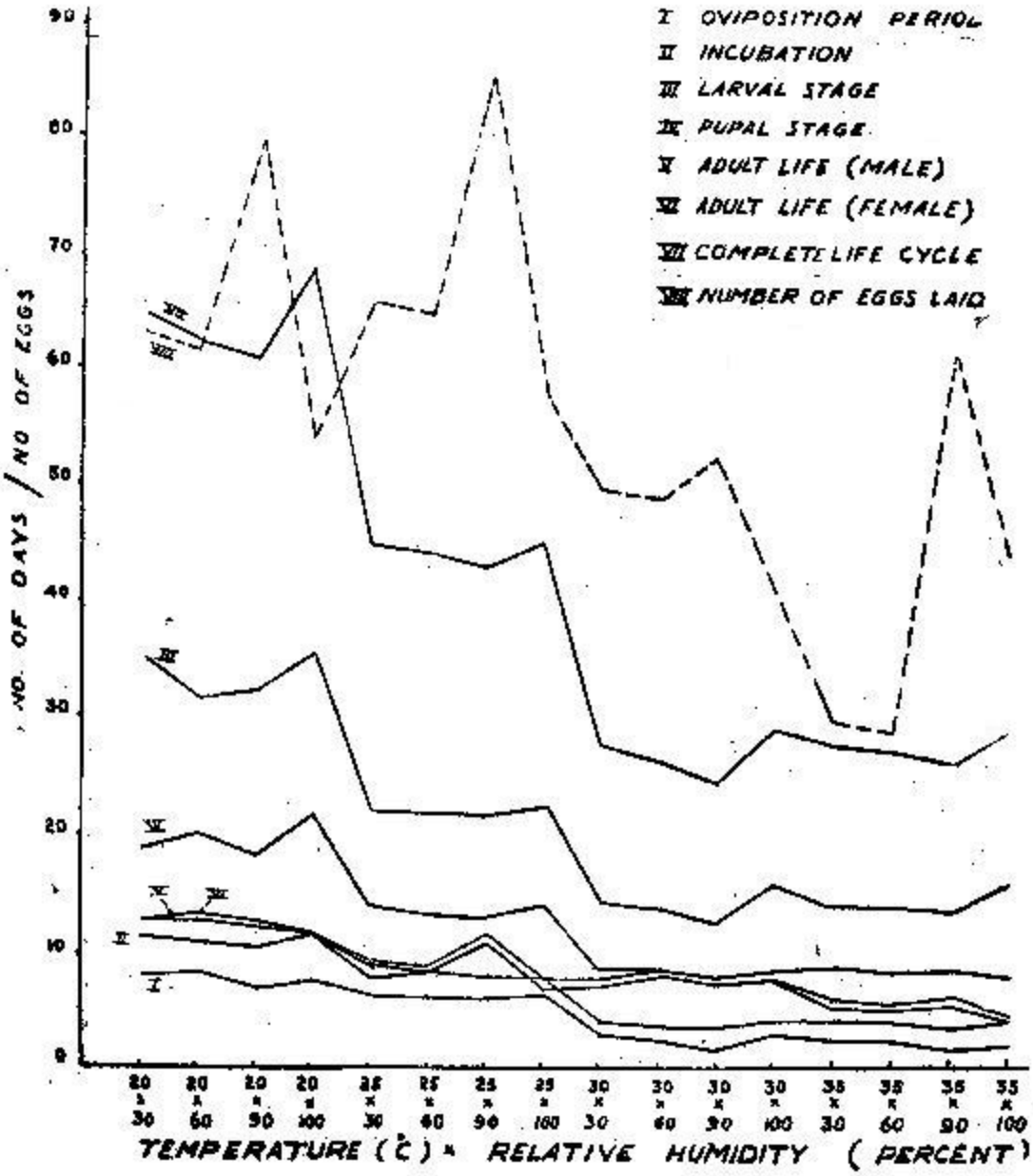
The duration of egg-stage at all the four levels of relative humidity, was minimum (3.5 to 4.5 days) at 30°C and 35°C and maximum (10.5 to 11.50 days) at 20°C while at 25°C it ranged between 8.0 to 8.50 days.

The shortest duration of larval life was found to be 12.75 days at 30°C×90 per cent relative humidity, while the longest duration of 35.50 days was at 20°C×100 per cent relative humidity. The longest duration of 21.50 days in case of pupal stage was recorded at 20°C×100 per cent relative humidity and it differed significantly from the rest of the combinations. The shortest duration of 8.0 days, recorded at 30°C×90 per cent relative humidity, however, did not differ significantly from the results obtained at 30°C with 30, 60 and 100 per cent relative humidity and at 35°C with 30, 60, 90 and 100 per cent relative humidity.

The shortest duration of adult life, observed at 35°C × 100 per cent relative humidity was 4.25 and 5 days in case of male and female, respectively. It differed significantly in all the rest of the combinations of temperature and relative humidity. The longest duration of adult life was 12 to 13.25 days and 11.50 to 12.75 days in case of female and male respectively at 20°C with all the combinations of relative humidity. The effect of

30 per cent and 90 per cent relative humidity on the longevity of adult life at 20°C was not significant.

FIG. 1 EFFECT OF DIFFERENT TEMPERATURES AND RELATIVE HUMIDITIES ON THE LIFE STAGES AND EGG LAYING OF CALLOSOBRUCHUS MACULATUS. (F)



DISCUSSION

The present finding that the optimum development of *C. maculatus* was at 30°C x 90 per cent relative humidity corroborates with the results of Howe and Currie (1964) who reported 32.5°C and 90 per cent relative humidity to be the optimum for the rapid development of this insect and Mookherjie and Chawala (1964) who found the optimum zone of development to lie between 20—30°C and 45 to 60 per cent relative humidity. Results reported by El-Sawaf (1956) on the oviposition of *C. maculatus* (F.) that at 25°C and 55 to 90 per cent relative humidity the insect laid more number of eggs than at higher or lower temperature, are also similar to the present finding. The optimum conditions for completing all the life stages, in the shortest period of 24.25 days in the present study, have been found to be 30° and 90 per cent relative humidity. These results compare favourably well with those of Raina (1970) who found that at 30°C and 70 per cent relative humidity, the combined larval and pupal development took 24 days.

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