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STUDIES ON SOME BIO - ECOLOGICAL ASPECTS OF THE CITRUS BUTTERFLY *PAPILIO DEMOLEUS* L. (LEPIDOPTERA : PAPILIONIDAE) IN THE BARANI ECOLOGY OF PAKISTAN

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In an artificial population of *Papilio demoleus* L. in a citrus orchard of the rainfed (barani) areas of Pakistan, duration of the five larval instars of the insect were 3, 3, 3, 3, and 4 days respectively while the pupal duration was 13 days. The adults longevity was about a week and females started laying eggs on the third day of emergence. The first and the second generations were completed in 33 and 36 days respectively. Out of 1180 eggs inoculated 60% of them hatched to 1st instar larva. Mortality during larval instars was low and suddenly increased at pupal stage. The single important mortality factor was the pupal parasite, *Ptermalus puparum* L. (Pteromalidae : Hymenoptera). On the basis of mortality data, survivorship curves for barani population of *P. demoleus* were prepared.

Key words: Citrus butterfly, Bio-ecology, Rain fed area

INTRODUCTION

Lemon butterfly, *Papilio demoleus* L, (Lepidoptera : Papilionidae) is a serious pest of citrus. It can feed and breed on all varieties of cultivated or wild citrus and some other species of family Rutaceae [1]. Its caterpillar is known to be a vigorous foliage feeder and in severe infestations citrus trees are seriously affected and young seedlings may completely be defoliated.

It is an important pest of citrus trees in Saudi Arabia and many other countries of the Near East and North Africa [2,3]. according to Talbot [4] it is distributed in the whole of India, Iran, Arabia, China and Africa.

Studies on some aspects of biology and ecology of *P. demoleus* have been taken by Mishra and Pandey [5] in India, Badawi [6] in Sudan, Sharifi and Zarea [7] in Iran, Abu Yaman [8] and Badawi [9] in Saudi Arabia. None significant research has been done on this insect in Pakistan. The objective of this study aim at biological study and seasonal abundance of *P. demoleus* in the rainfed citrus growing area of the country.

MATERIALS AND METHODS

Citrus plant, eight feet tall was selected in an orchard at 'Jammu' near Tarbella. A cage (3 x 3 x 3m.) was constructed to cover the whole plant. The cage made of GI pipes and iron nettings was '*Papilio* proof'. There was a screen door for the entrance and exit of a sampler at one side of the cage.

Tender leaves and shoots of citrus containing *P. demoleus* eggs were collected from Khanpur and Tarbella and were brought to the laboratory. The shoots with eggs were placed in beakers filled, up two third, with water to keep the shoots fresh. One hundred and eighty eggs were transferred to the test plant by pinning egg containing leaves with the tender shoots. Flowering plants (ornamentals) in earthen pots were placed inside the cage as a food source for the butterflies.

Citrus plant was thoroughly checked for total population as well as numbers of each stage of *P. demoleus* at two day intervals. The survivorship curve was prepared by plotting the percentage of insect (*P. demoleus*) living at a given stage against the stages (egg, larva, pupa, etc.). Parasitism was also recorded simultaneously. The pupal parasites were collected and reared in the laboratory.

RESULTS AND DISCUSSION

Incubation period of *P. demoleus* eggs ranged from 4 to 5 days during the first generation. The duration of each successive larval instar from the first to fifth instar larva were 3,3,3,3, and 4 days respectively and total larval period was 13 days. Pupal period was overlapping with the late larval instars and again the duration of pupal stage was 18 days. These results are similar to those of Badawi [9], (Fig. 1). Adult longevity was about 7 days; females started ovipositing on the 3rd day of emergence Abu Yaman [8], reported that adult longevity of *P. demodocus* Esp., to be 7-12 days for females and 5-10 days for males. During the present study, the 1st generation was completed in 33 days.

Second generation was 2 little longer (36 days), probably due to a gradual decrease in mean daily temperature (75.5°F during the first generation and 73 °F during the second generation). Duration of different developmental stages of the 2nd generation were almost similar to those of the first generation except a little delayed development of the larval instars ranging 1-2 days, (Fig. 1). According to Mishra and Pandey [5], the duration of larval period as a whole was effected by

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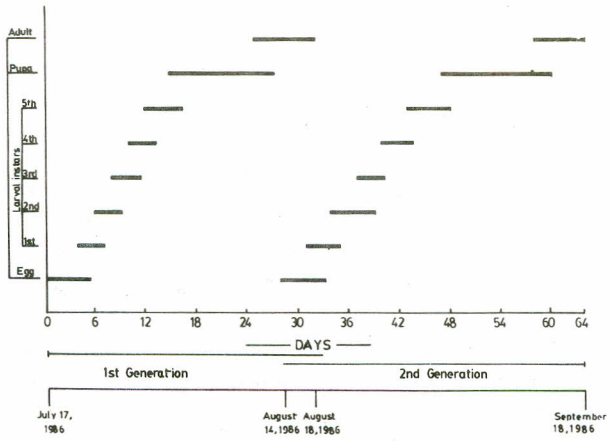

Fig. 1. Duration of each larval developmental stage of *Papilio demoleus* L. in an artificially infested citrus plant at Tarbella, 1986.

temperature and a negative correlation seemed to exist between both. Number of generations per year was not worked out in barani ecology, but the insect was reported that there were 5-6 overlapping generations per year in India and 4 generation in Southern Asia [7].

In Saudi Arabia *P. demoleus* had 5 larval instars but sometime as many as seven instars could be found [9]. During the present study no evidence of 6th or 7th instar was found.

Out of 180 eggs inoculated in the experimental cage, 60% of them hatched and survived as the 1st instar larva (Fig. 2). The reasons for 40% egg mortality included (i) dessication of eggs as the carrier leaves dried out (ii) infertility and (iii) drop-off of newly hatched larvae which couldn't survive. Larval mortality during the 1st generation was low, ranging between 0-8% (Fig. 2). Predation by some unidentified spiders seemed responsible for the reduction of young larvae. Mortality was higher in the pupal stage (34% and 35% in the 1st and 2nd generation respectively). Similar higher death rate of the pupal stage was also observed by Badawi [9]. The reason was infection with *Bacillus*.

During this study the pupal mortality was mostly due to a pupal parasite, *Pteromalus puparum* L. (Pteromalidae : Hymenoptera). Sporadic incidence of this parasite was also reported by Abu Yaman [8] in Saudi Arabia and by Amporn [10] in Thailand but in this region the parasite seems to be one of the biggest limiting factor for the population build-up of *P. demoleus*.

The survivorship curve was a simple graphical presentation of the fall off of numbers with time and thus the shape of curve described the distribution of mortality with age. Slobodkin [11] identified four basic types of curve: in type I, mortality acted most heavily on the old individuals; in type II (a straight line), a constant number died per unit time; in type III (a straight line when the survival scale was logarithmic), the mortality rate was constant; and in type IV, mortality acted most heavily on the young stages. In the case of *P. demoleus* mortality was heavy at the egg stage and less at the larval stages (type IV of Slobodkin). On the other hand, if the mortality at the egg stage was ignored, the survivorship curve followed type 1 of Slobodkin (Fig. 3), because after the 5th larval instars, mortality suddenly increased at the pupal stage. Thus in the case of *P. demoleus*, the survivorship curve seemed to be a combination of type IV and type 1 of Slobodkin [11].

The above studies were nevertheless, the initial steps towards life-table analysis of *P. demoleus* in barani ecology of Pakistan.

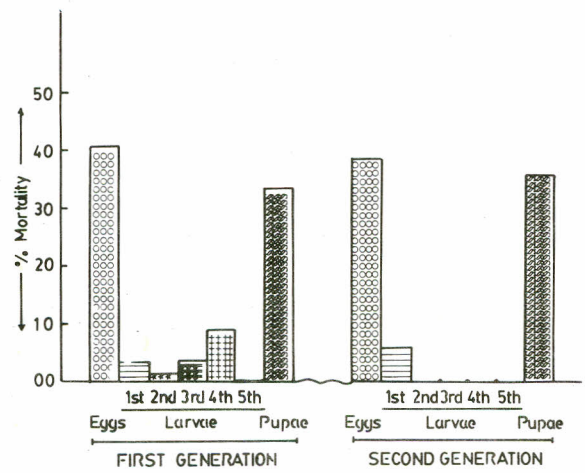

Fig. 2. Histogram showing mortality occurred at different stages of *Papilio demoleus* L. during two succsessive generations. (July-september, 1986).

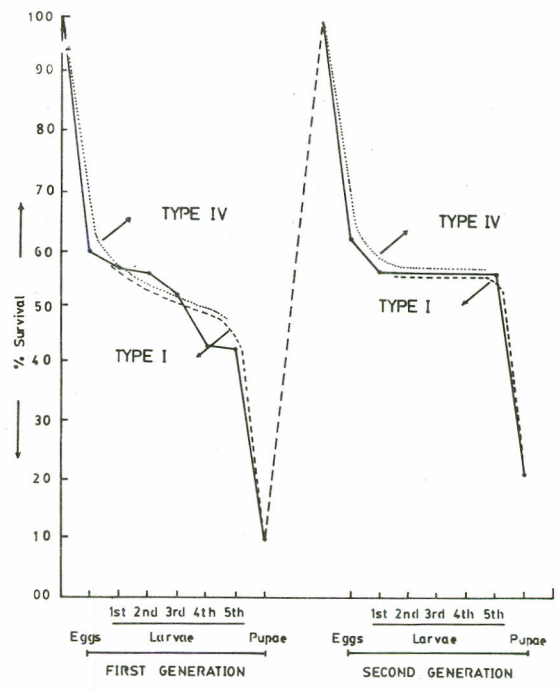

Fig. 3.Survivorship curves of two generations of *Papilio demoleus* L.

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