# ASPECTS OF THE LIFE CYCLE, BIOLOGICAL PERFORMANCE AND QUALITY OF THE BLACK LYRE LEAFROLLER

*'Cnephasia' jactatana* ( **Walker** )

J. P. OCHIENG'- ODERO

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## ABSTRACT

The thesis answers the general question of whether the quality of artificially reared insect species should be based on performance tests for intended use or whether quality should be based on a more holistic biological approach. The empirical research is carried out using the lepidopteran leafroller *'Cnephasia' jactatana* ( Walker ).

The thesis defines biological performance and quality in terms of the success of an insect population in survival and reproduction and regards the laboratory environment as an artificial habitat that insects must colonise in order to survive and reproduce. Changes in biological performance that occurred during 12 successive generations of laboratory rearing were due to selection, acclimatisation and domestication and not adaptation. Artificial colonisation is theoretically successful within a limited range of environmental factors. As the inherent genetic variability of the founder population determines the resilience of the population to changes in performance, the ranges of environmental factors during colonisation should be wide to 'capture' much of the variability.

Using body size ( weight ) as an aspect of overall quality, the thesis presents evidence that the final instar larva of *C. jactatana* has a threshold mechanism ( larval critical weight, $L_{CW}$ ) that determines pupal and adult size. There is a proportionate

decrease in weight from the maximum weight that a larva attains in the final instar ( $L_{MW}$) to pupa ( described as constant $D_P$ ) and to adult ( $D_A$ ). There is a direct relation between the latent feeding period ( period between attaining an $L_{CW}$ and $L_{MW}$), $L_{MW}$, pupal and adult size, and the reproductive performance ( fecundity ). Within the experimental conditions diet quality, temperature, photoperiod and artificial selection had no effect on the larval critical weight, $D_P$ or $D_A$, the larval threshold mechanism in *C. jactatana* is probably a mechanical trigger that initiates pupation. Diet quality, temperature and thermophotoperiods affected pupal size, adult size and reproductive performance. Photoperiod had no significant effects on size and reproductive performance. Positive assortative selections for slow development and low pupal weight significantly decreased pupal and adult size, and reproductive performance. Selection for fast development and heavy pupal weight for three generations had no significant effect on size or reproductive performance. Larval critical weight is demonstrated as useful to define quality indices and predict the performance of laboratory reared insects.

The general conclusion of the thesis is that insect quality should be defined more in terms of the success in survival and colonising ability rather than solely on the success for 'intended role' or 'fitness for use'.

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| | |
|---|---|
| $A_{CW}$ | Adult critical weight |
| $A_W$ | Adult weight |
| $D_A$ | Decrease in weight from larval maximum weight to adult |
| $D_P$ | Decrease in weight from larval maximum weight to pupa |
| **GPD** | General purpose diet |
| $L_{CW}$ | Larval critical weight |
| $L_{MW}$ | Larval maximum weight |
| $P_{CW}$ | Pupal critical weight |
| $P_R$ | Pupation rate index |
| $P_W$ | Pupal weight |
| $S_A$ | Adult synchronism index |
| **SBD** | Sheep nut bean-based diet |
| $S_P$ | Pupal synchronism index |