Effect of intraspecific competition on immature phases of *Phalanta phalantha* and food preference of larvae (Lepidoptera, Nymphalidae)

Level II, Friday Group 4, Department of Zoology and Environment Sciences, University of Colombo

Introduction

Phalanta phalantha, commonly known as Leopard or Spotted Rustic butterfly is a medium sized butterfly distributed throughout the island and found in sparsely wooded gardens and scrublands. Larvae feed on Salicaceae plants including *Flacourtia indica* (Uguressa), *Flacourtia jangomas* (Rata Uguressa).

In general, Lepidopterans are specialized in the selection of oviposition places. However, some "aberrations" are frequently observed such as large egg clutches, egg–laying on small or old leaves, on small or old plants and egg-laying on the stem. Other than that oviposition on plant species outside the normal range of acceptable hosts can also be observed. (Thompson & Pellmyr ,1991)

Such "aberrations" can ultimately lead to competition for food within individuals of immature stages. This competition can affect the development of adult characteristics of organisms. Increased larval densities can affect mean mass of larvae, larval development period, pupation time and fecundity of adult butterflies. This study mainly focuses on the effects of intraspecific competition for food due to larval crowding on immature phases of Common Leopard butterfly.

Objectives

- To investigate the effects of intraspecific competition for food on immature phases
- To investigate the food preference of immature phases

Hypothesis 1

H_0 ; There is no any significant effect on growth of immature phases of Common Leopard butterfly due to intraspecific competition.

H_A ; There is a significant effect on growth of immature phases of Common Leopard butterfly due to intraspecific competition.

Hypothesis 2

H_0 ; There is no any significant preference towards tender leaves or young (mature) leaves during immature phases.

H_A ; There is a significant preference towards tender leaves or young (mature) leaves during immature phases.

Methodology

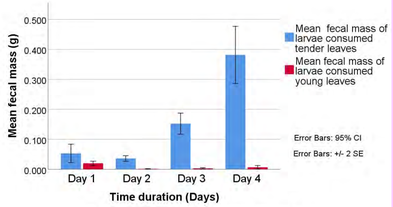
Eggs were collected from Governors plum (*Flacourtica indica*) leaves in the garden behind Department of Plant Sciences, University of Colombo. These eggs were placed in transparent containers until hatching.

Food preference of immature phases was obtained by using six identical immature larvae of same stage. Three of them were provided with tender leaves and other three were provided with young leaves. They were given enough amount of leaves required for one day. Leaves were changed once a day. Fecal mass after each day was measured until pupation.

Intraspecific competition was obtained by randomly assigning larvae on second instar stage to glass containers at densities of either 1,2 or 3. From each density, duplicates were made. Each group was provided with a branch of tender leaves similar in size with 20 blades per branch. Branches were changed daily, so that there was food limitation but not food deprivation and moisture content was maintained so no leaves were wilted.

Length, mass and stage of each day and time period till pupation for each individual were recorded.

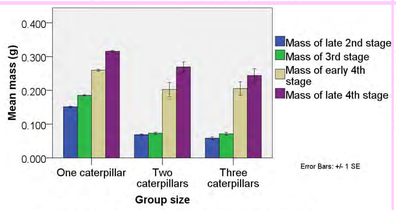
Results and Analysis



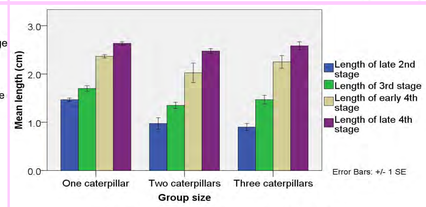
Mean fecal mass vs time duration (Figure1)

One-way ANOVA for effects of type of leaves on food consumption in ***Phalanta phalantha*** immature stages. (Table 1)

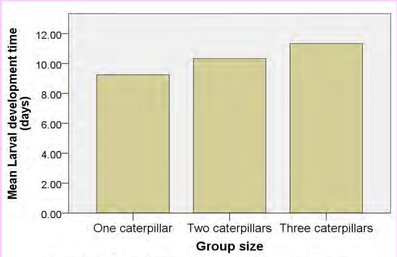
ANOVA						
	Source	Sum of squares	df	Mean square	F	Sig.
Between groups	Type of leaves	0.131	1	0.131	11.771	0.002
Within groups		0.246	22	0.011		
Total		0.377	23			



Mean mass of immature stages vs group size (Figure 2)



Mean length of immature stages vs group size (Figure 3)



Mean larval development time vs group size (figure 4)

One-way ANOVA for effects of larval density on life history traits in ***Phalanta phalantha*** (Table 2)

Trait	Source	df	Mean square	F-ratio	Sig.
Length (cm)	Density	2	0.402	0.963	0.389
Mean larval mass (g)		2	0.030	4.070	0.023
Larval development time (days)		2	3.257	33.500	0.001

Discussion

There was an overall significant effect of larval density on the duration of larval development (Table 2; F-ratio = 33.500, df = 2, P = 0.001). Development time increased linearly with increasing density as shown by figure 4. There was not a significant effect of larval density on mean length of immature phases but the mean masses of individuals were significantly affected by larval density (Table 2; F-ratio = 4.070, df = 2, P = 0.023). Mean mass of individuals in each stage decreased with increasing larval density as shown by figure 2. During pupation, larvae do not feed on leaves. Therefore it must accumulate as much as energy to spend time inside the cocoon and first few hours after eclosion. This suggests that crowded larvae grow for longer in order to overcome the consequences of competition and achieve a large mass before pupation. But increased larval development time would increase the susceptibility of larvae to predators. Therefore that would affect the survivorship of larvae till adulthood. Female fecundity is largely depend on resources accumulated during immature phases. Therefore small females due to reduced larval mass can cause reduction in fecundity.

There was a significant tendency towards tender leaves than towards young leaves during immature phases (Table 1; P= 0.002). A possible reason may be because tender leaves are less tough; hence, easier to chew and digest. Also tender leaves typically have more nitrogen content than young leaves.

In each phase, mass of faeces was used as an indirect method of estimating food consumption. It would have been more accurate to use another parameter; Approximate Digestibility (AD) instead of fecal mass along. But taking dry weights of leaves was not possible due to uptake of water daily by plant leaves. Therefore food consumption was assessed indirectly.

Conclusion

These results show that there is a significant effect of intraspecific competition due to larval crowding on larval mass and larval development time in *Phalanta phalantha.* Also there is a significant preference towards tender leaves than young leaves during immature phases of *Phalanta phalanta*. Therefore null hypothesis (H_0) of both occasions can be rejected at 95% CI.

References

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2. Melanie Gibbs, Lesley A. Lace, Martin J. Jones & Allen J. Moore. 2004: Intraspecific competition in the speckled wood butterfly *Pararge aegeria:* Effect of rearing density and gender on larval life history. *Journal of insect science*, 4:16.

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Group Members

- s13693- N.G.A.A.Lakmal
- s13697- H.D.C. Nadeesha
- s13712- R.R. Ranasinghe
- s13723- M.A.Sandaru
- S13744-A.D.C.M. Wimalarathna
- s13739- K.A.C. Weerasinghe
- s13707- W.M.N.M. Perera
- s13702-C.J. Pasquelge
- s13728-D.K.H. Thalagala
- s13718- B. K. U. R. D. Rodrigo
- s13734- W.A.A.D.M. Viduranga

Eggs

Second instar stage

Third instar stage

Fourth instar stage

Pupa just after moulting

Adult butterfly