CHAPTER VII

SUMMARY
Present investigation for the first time offers clear experimental evidences to indicate that the nymphs and adults of the *D. similis* do not require phenylalanine when the nymphs were fed with tyrosine the rate of growth and moulting was normal.

In another set of experiments it was observed that the three non essential amino acids namely aspartic acid, glutamic acid and glycine when provided separately along with essential amino acids to the nymph of *D. similis*, the rate of growth and moulting was normal. The results show that these three amino acids help in the process of moulting but not directly in the process of reproduction.

Similarly the nymphs of *D. similis* were treated along with only sugar solution to see the rate of growth, moulting and reproduction. It is found that the insects could not survive only on sugar solution. When sugar solution was given with ten essential amino acids, the rate of growth was a bit normal.

Vitamins are vital for life but in the present study when only vitamins were provided to the *D. similis*, the insect could not survive and when vitamins were provided in combination with amino acids and sugar the rate of growth was normal. Vitamin A, B complex, they help in moulting process. Vitamin A was less essential than vitamin B. Vitamin B was provided in the form of thiamin, riboflavin, biotin, folic acid, carnitine (BT) and B-complex. In the case of riboflavin, the rate of growth was
rapid in comparison with that of other vitamins but thiamin showed poor results. It retarded the growth. Although moulting took place, it was less than the normal rate of moulting. Vitamin C when provided in the form of ascorbic acid and vitamin D showed no satisfactory results. When vitamin E in the form of α-tocopherol was provided to the *D. similis* in combination with amino acids and sugar, the rate of growth and moulting were quite normal and the insects were healthy and they reached the state of maturity normally. The egg laying took place. Insects laid eggs twice and the number of the eggs was from 55 to 60 per laying as in the case of a normal insect. The second egg laying was after six days and the female could not survive more than two or three days but male *D. similis* could survive from six days to ten days.

Lipid played a poor role in the nutrition of *D. similis*. When it was provided separately the insects could not reach the state of maturity. They became thin and dark in colour and could not survive more than three to five days. When lipid was provided in combination with amino acids, carbohydrates and vitamin, the rate of growth was normal and egg laying took place. The results indicate that lipids do not play important role in the moulting as well as in the reproduction because even in the absence of lipids egg laying was observed.

Two dimensional paper partition chromatography showed the presence of total sixteen ninhydrin positive spots which included free arginine, histidine, lysine, leucine, isoleucine,
Proline, tyrosine, glycine, glutamic acid, aspartic acid, β-alanine, cystine, serine, valine, methionine and threonine.

Free phenylalanine was not found in the haemolymph of D.similis. It confirms the results given in the beginning of the chapter i.e. 'Amino Acid Requirement'. When tyrosine was provided instead of phenylalanine, the rate of growth and moulting was normal. The absence of this essential amino acid in the haemolymph of the treated D.similis can only be indirectly explained on the basis that phenylalanine gets converted readily into tyrosine in the insect body. Free aspartic acid, glutamic acid and glycine were present in the haemolymph of D.similis and it was observed that they are essential for moulting and normal growth.

In the haemolymph of D.similis and A.conqueberti the composition of free amino acids is the same but there is a slight differences. Tyrosine is more in quantity and cystine and serine are less in quantity in D.similis. Rest of the amino acids show no change qualitatively as well as quantitatively except free glutamic acid. It was observed more in quantity in D.similis. The third terrestrial insect S.pandurus shows slight change in the composition of free amino acids in haemolymph. They are free ω-alanine, arginine, aspartic acid, cystine, glutamic acid, glycine, histidine, isoleucine, leucine, lysine, methionine, proline, threonine, tyrosine and valine. In this insect serine is absent.
In another study three aquatic Heteroptera were chosen to observe the free amino acids composition in the haemolymph. It is suggested that the distribution of proline is related to the habitat of these insects. Proline probably plays a role in the retention/conservation of water in the terrestrial insect. This study was further confirmed by giving 2% saline solution to D.similis and it was observed that free proline is absent from haemolymph. Deficiency of free glycine in aquatic insects indicates that it also play an important role in asmoregulation.

Seven different insecticides namely agallof, blitox, butox, B.H.C., dithane, D.D.T. monison were applied separately to the female adults of D.similis and observations were noted and it was found that the few insecticides e.g. D.D.T., dithane and B.H.C. are more toxic than agallof, blitox, butox and monison. Insects could survive unto four hours and in later cases six hours respectively. The composition of free amino acids is the same. It was observed that gradually free tyrosine disappeared from haemolymph and free aspartic acid, glutamic acid and glycine gradually became less in quantity. It was also noted that free cystine increased in quantity. This study of free amino acids in the haemolymph confirms again the results that tyrosine is very much essential for D.similis. All these insecticides affected free tyrosine hence it disappeared from haemolymph. The decrease in quantity of free aspartic acid, glutamic acid and glycine also show that all the insecticides affected the quantity of free amino acids so they also decrease
in quantity. But cystine increased in quantity. It is present in the haemolymph of normal *D. similis* but it is observed that in increased quantity it is toxic to *D. similis*.

It can be concluded that the tyrosine is more essential for *D. similis* than phenylalanine. Aspartic acid, glutamic acid and glycine are also essential for normal growth and moulting. Carbohydrates and α-tocopherol are essential for reproduction. Lipid (in the form of oleic acid, linoleic acid and linolenic acid) does not play important role in growth, moulting and reproduction. Proline helps in retention/conservation of water in terrestrial insect. Glycine helps in osmoregulation. Excess of cystine is toxic for *D. similis*. Insecticides effect in the free tyrosine in the haemolymph so that it disappear and free aspartic acid, glutamic acid and glycine become less in quantity and insects could not survive more than four to six hours.