PRELIMINARY BIO-PHYSICAL AND PHYSIOLOGICAL STUDIES ON THE CATERPILLARS OF DANAIS PLEXIPPUS (LINN.) AND NYMPHS OF POEKILOCERUS PICTUS (FABR.)

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Introduction

In Sind (West Pakistan) wherever *Calatropis* grows, the caterpillars of *Danais plexippus* and the nymphs of *Poekilocerus pictus* are found in large numbers. Both these insects being easily available in the Indo-Pakistan sub-continent, are extensively used in entomological laboratories.

Various workers have studied the morphology, biology and taxonomy of these insects. The authors have however come across no published data on bio-climatic, physiological or bio-physical studies on the two insects with the exception of work in progress on the digestive physiology of *P. pictus* (Khan, 1964).

The present preliminary studies are an attempt to study the effects of centrifugal acceleration, and to observe the effects of the resultant pressures on the caterpillars of *D. plexippus* and the nymphs of *P. pictus.*

Methods

Two Galenkamp centrifuge, Model C.F. 600, were used. One was used as the active experimental centrifuge, while the other was kept as the stationary control. The experimental centrifuge was tested for uniformity of motion prior to putting the insects in it.

The insects to be centrifuged were placed individually in separate centrifuge tubes. The mouth of the tubes was sealed by gauze cloth held in position by rubber bands to prevent the escape of insects. The lid of the centrifuge was closed, and the insects then centrifuged.

Eleven late instar caterpillars of *D. plexippus* and six 4th instar nymphs of *P. pictus* were separately subjected to an average centrifugal acceleration of 4,000 revolutions per minutes (r.p.m.) for two minutes. This resulted in total pressures of 1.17 lb. wt. per square inch and 13.96 lb.wt. per square inch on the caterpillars of *D. plexippus* and nymphs of *P. picuts* respectively. A similar number were placed in identical conditions in the control centrifuge. The average weight of the caterpillars was 202 mgm., and that of the nymphs 2.500 mgm.

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Observations

A. Observations on the caterpillars of *D. plexippus* subjected to an average certifugal acceleration of 4,000 r.p.m. for two minutes, resulting in a total pressure of 1.17 lb.wt. per square inch:

1. All the caterpillars appeared to be conscious immediately after being centrifuged.
2. All were sensitive to touch by pin and pencil point.
3. A green, oily liquid exuded from the body of most of them.
4. All fed normally, except caterpillar 7.
5. The activities of the caterpillars appeared to be normal, as per observations noted at two hours intervals on day zero.

   On day one, pupation occurred in caterpillars 1 and 2, while No. 3 died. The remaining 8 caterpillars fed normally except No. 4 in which movements and activities had slowed down. Three days from day zero Nos. 4 and 5 pupated, while No. 6 pupated on the 4th day. On the 5th day No. 7 pupated. The remaining four pupated on the sixth day.

6. The pupation period was one week. The adults which emerged appeared to be healthy, and normal in behaviour. There was no mortality.
7. The controls appeared normal and pupated on the 10th day. The adults emerged on the 14th day without mortality.

B. Observations on the nymphs of *P. pictus* subjected to an average centrifugal acceleration of 4,000 r.p.m. resulting in a total pressure of 13.96 lb. wt. per square inch:

1. The nymphs when taken out of the centrifugal tubes, appeared to be semi-conscious and un-conscious, as judged by their general stationary condition, as well as by their non-responsive attitude or a weak response to pin and pencil prick.
2. Out of the six nymphs three had ruptured abdomen through which a dark brown slimy secretion exuded. These three nymphs died within a period of three hours after being centrifuged.
3. Of the three survivors, one exuded a dark brown slimy substance through the mouth and solid faecal material through the anus. The

other two appeared normal. None of the three nymphs fed on freshly provided leaves of *Calatropis*, their normal food.

4. On the following day the surviving nymphs appeared normal and one had even fed on freshly provided *Calatropis* leaves. On day 3 it was observed that the entire dorsal surface of the nymphs was deeply cleft. The following day all were found dead.

5. The controls were all normal till day 3. On the following day they were all destroyed.

Discussion

The authors have come across no published data on the effects of centrifugal acceleration on insects. Direct effect of changes in the pressure of the environment can be observed in aquatic organisms. In air breathing organisms this is more difficult. Further, the effects of pressure cannot be predicted; some reactions are speeded up by a rise of pressure, others are slowed down (Baylis, 1962).

The data of the present studies is interesting in relation to centrifugal acceleration and also indirectly shows the effects of centrifugal pressure. Since the centrifugal pressure was not the same for the two insects, no comparisons can be made between the centrifuged caterpillars of *D. plexippus* and the centrifuged nymphs of *P. pictus*, but presumptions may be drawn as regards the centrifuged caterpillars on comparison with their controls. For example, the caterpillars subjected to pressure pupated earlier than the controls. Similarly the duration of pupal stage was also reduced to almost half in the induced pupae. It appears that the increase in pressure rather than the centrifugal force may have exerted its influence on the organs responsible for the release of growth hormones.

It is not however possible at this stage to deduce any specific conclusions on the basis of this limited experimental data. It is, therefore, proposed to continue and expand the present studies in due course of time.

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References

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