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Nucleic Acids and Protein Changes in Larvae of *Spodoptera litura* F., Infected with a Nuclear Polyhedrosis Virus*

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ABSTRACT

The changes in DNA, RNA and protein contents in the larvae of *Spodoptera litura* following infection with a nuclear polyhedrosis virus were studied. The total DNA content in diseased larvae increased on the third day of infection and decreased on the fourth and fifth days though its concentration during this stage remained significantly higher than that in normal larvae. RNA also increased on the third day and then decreased. The total protein content in diseased larvae showed an increase on the third and fourth days followed by a decrease on the fifth day of infection.

INTRODUCTION

Results of previous studies on nucleic acid changes at the cellular level indicate that DNA increased in the nuclei of tissues infected by nuclear polyhedrosis viruses (Morris, 1966, 1968; Watanabe and Kobayashi, 1969). Nuclear polyhedrosis viruses induce an early increase in nuclear RNA which then decreases as the pathogenesis progresses. Studies on protein synthesis show that the total protein content of larvae infected by nuclear viruses is higher than that of normal larvae (Bergold and Friedrich-Freska, 1947; Shigematsu and Noguchi, 1969; Watanabe and Kobayashi, 1969; Morris, 1971). The present paper reports on the changes in total DNA, RNA and protein in the larvae of *S. litura* during the course of a nuclear polyhedrosis.

MATERIALS AND METHODS

Early forth instar larvae of *S. litura* reared on castor (*Ricinus communis* L.) leaves were used in these studies. The larvae were inoculated with 1,00,000 polyhedra each by a spot-feeding technique. Larvae treated similarly but without the virus inoculum served as control. Both the treated and control larvae were reared individually in small plastic containers and virus free castor leaves were provided as food.

The analysis were done on fresh whole body homogenates at intervals of 1, 2, 3, 4 and 5 days following inoculation. Three samples from control and treated groups were analysed at each stage and the number of larvae per sample varied depending on the weight. The preliminary separation of nucleic acids and protein from

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other fractions were done as described by Orr (1964). Nucleic acids were extracted according to Kilgore and Painter (1964) and the residue was reserved for protein extraction. DNA was determined by the method of Burton (1956) and RNA by the method of Ceriotti (1955). Protein was extracted following the procedure of Orr (1964) and estimated by the method of Lowry *et al.* (1951).

RESULTS AND DISCUSSION

The DNA and RNA contents in healthy and virus-infected larvae are given in Table 1.

TABLE 1. DNA and RNA contents in healthy and virus-infected larvae of *S. litura*

Post inoculation period in days	DNA (μg / mg body weight)		RNA	
	Healthy	Diseased	Healthy	Diseased
1	1.13	1.02	6.16	4.80
2	0.74	0.84	4.04	3.79
3	0.78	1.62	3.18	5.29
4	0.55	1.44	3.79	3.38
5	0.45	1.31	2.60	3.39
CD (P = 0.05)	0.18		0.72	

There was a progressive reduction in the DNA content of healthy larvae as the age advanced. But in diseased larvae, a sharp increase in the DNA was registered at the end of three days after inoculation. It was followed by a decrease on the fourth and fifth days though the level of DNA remained significantly higher than that in normal larvae during this period. Jacob (1972) observed that in nuclear polyhedrosis infected larvae of *S. litura*, polyhedra appeared for the first time in many tissues on the third day of inoculation followed by further spread of infection during the subsequent days. This leads to an increase in total DNA content resulting from its synthesis and incorporation into the viral particles.

RNA decreased with age in both healthy and virus infected larvae except for a conspicuous increase on the third day of inoculation in the diseased larvae. It is also observed that the concentration of RNA in diseased larvae was significantly higher than in healthy larvae on the third and fifth days. Thus it appears that RNA increased simultaneously with DNA. Morris (1966) also made similar observations in nuclear polyhedrosis infected larvae of *Lambdina fiscellaria somniaria*.

The results summarised in Table 2 show that in healthy larvae, the protein content increased from the fourth day onwards, the maximum level being recorded on the fifth day of the test. In the present experiment the healthy larvae were fully matured by this time and according to Wigglesworth (1965) the synthesis of blood proteins will be very high during this stage. The protein content in diseased larvae started increasing from the third day onwards followed by a significant

decrease on the fifth day of inoculation. The levels of protein in these larvae were significantly higher than those in healthy larvae during the third and fourth days indicating that the increase was much more than can be accounted for by age. The conspicuous increase in total protein content in diseased larvae is evidently due to increased protein synthesis leading to the formation of large numbers of polyhedra. Studies by Morris (1971) also showed that in the larvae of *Lambdina fiscellaria lugubrosa* the total cell protein increased at the intermediate stage of infection which then decreased.

TABLE 2. Protein content in healthy and virus-infected larvae of *S. litura*

Post inoculation period (days)	Protein (mg/g body weight)	
	Healthy	Diseased
1	57.04	59.95
2	54.22	52.59
3	50.99	56.95
4	61.56	67.59
5	64.25	63.38
CD (P = 0.05)	3.29	

Morris (1966) suggested the sequence of events in the infection process of DNA viruses as follows: the DNA virus directs its host cell towards increased production of nuclear DNA. The increased DNA stimulates increased RNA synthesis which in turn stimulates increased production of nuclear protein. It would appear that a similar sequence occur in the nuclear polyhedrosis infection of *S. litura* also.

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