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THE HAEMOLYMPH PROTEIN PATTERNS OF *PERIPLANETA AMERICANA* INFECTED WITH CYSTACANTHS OF *MONILIFORMIS MONILIFORMIS* BREMSER (ACANTHOCEPHALA)

K. RAMALINGAM, M. KRISHNAN AND R. N. GARGESH

Entomology Research Institute, Loyola College, Madras 600 034, India.

STUDIES on haemolymph proteins of the developmental stages of insects are considerable, but the role of insects as intermediate hosts of several species of parasites introduces a new dimension regarding their

influence on the chemical composition of host tissues like haemolymph, fat body and muscles. Species—specific and stage—specific patterns of the haemolymph proteins, in particular, of albumins and globulins through either paper or starch or gel media have been analysed with respect to many insects¹. In view of the large scale infection of nymphs and adults of both sexes of *Periplaneta americana* by the cystacanths of *Moniliformis moniliformis* which complete their development in the haemocoel of the cockroaches, an attempt has been made to examine qualitative changes in the haemolymph protein patterns in the nymphs and adults of both sexes through paper electrophoresis.

Haemolymph (20 μ l) of both uninfected and infected *P. americana* was run on Whatman No. 1 filter paper, in vertical paper electrophoresis. The different fractions were characterised by staining in bromophenol blue, and eluted in 0.01 N NaOH and their optical densities were measured in Spekol spectrophotometer (GDR) at 520 nm. The percentage of the relative fractions in the infective specimens, taking the total absorbance values of the control to represent 100, is given in table 1.

In the uninfected female nymph, of all the fractions, the albumin showed high peak of absorbance. Among the globulins three of the fractions (2, 3 and 5) showed comparatively higher peaks of absorbance than the rest. In the female nymph, infected with 78 cystacanths

TABLE I

Percentage of different protein fractions in the control and infected *Periplaneta americana*

Sex and stage of maturity	No. of cystacanths of <i>M. moniliformis</i> (Albumin)	Percentage of Fractions*					
		Fr-1	Fr-2	Fr-3	Fr-4	Fr-5	Fr-6
		(Globulins)					
Uninfected control (adult male)	—	15.63	62.50	3.13	3.12	15.62	—
Uninfected control (adult female)	—	26.32	2.63	10.53	19.74	40.78	—
Infected (adult male)	20	187.50	37.50	93.75	87.50	87.50	—
Infected (adult female)	23	59.21	19.74	19.74	98.68	72.37	—
Uninfected control (Nymph female)	—	33.33	16.66	16.67	6.09	10.58	16.67
Infected (Nymph female)	78	33.33	17.77	5.55	1.11	—	13.33

N.B. * The percentages of infected individuals are calculated taking the total of control values as 100.

Fr—Fraction

the total number of fractions was reduced to 5. The concentration of albumin fraction showed no change from that of the control. However in the globulins, the fractions 3, 4 and 6 showed lower peaks of absorbance in contrast to the uninfected ones.

Clarke and Ball² using the same technique, located six protein components in the adults of *P. americana*. However in the uninfected adults of both male and female of *P. americana*, a total of five fractions was discernible in the present study. The albumin in the female showed higher concentration as compared to that of the male. Among the globulins, a single fraction (fraction 2 in the male and 5 in the female) showed higher peak of absorbance than the rest. In the adults of both male and female, infected with 20 and 23 cysts respectively, there was no change in the total number of fractions, but all the fractions showed high peaks of absorbance. In the male, the albumin (No. 1) and three of the globulins (Nos. 3, 4 and 5), and in the female the albumin and all the globulin fractions showed high peaks of absorbance in comparison with their respective controls.

The observations showed an overall increase both in the albumin and in the globulin concentrations in the infected adults of both sexes, and an overall decrease in the globulins concentration alone in the infected female nymph.

The decline of globulins concentration in the female nymph would appear to be due to the infection of more cystacanths and their consequent utilisation of protein reserves from the host, while the increase in the intensity of the fractions of the infected adults could be due to the increased protein synthesis in the fat bodies for the growth of the cystacanths. Changes in the intensity of albumin and globulin fractions in the serum of *Rattus rattus* (final host) at different inter-

vals during post-infective period of *M. moniliformis* has already been noticed³. Changes in the concentrations of the relative fractions of albumin and globulins in the infected individuals would also support the view extended by Singhvi and Johnson⁴ that *M. moniliformis* seems to require protein rich food in the intestine of *Rattus rattus* for its survival. The results of the present investigation, in the light of the above studies and also of the report that helminths show selective accumulation of host albumin and globulins in their cyst fluid⁵ seem to suggest that *M. moniliformis* needs protein rich environment, irrespective of its intermediate or final host, to complete its life cycle, thus obtaining energy as well as immunity against the host.

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ANNOUNCEMENT

Proceedings of the Symposium on Tissue Culture of Economically Important Plants organised by the Botany Department, National University of Singapore in collaboration with the Singapore Institute of Biology, Singapore, 28-30 April 1981.

The Proceedings of the above symposium will be published by June 1982. The list of contributors and the titles of the papers is mentioned. The authors have revised the work connected with a particular crop plant or group of plants and outlined the suggestions for future work. Some of them are country reports reviewing the work done on tissue culture in that particular country. This volume will be very useful as a source of reference on tissue culture of tropical crop plants and trees for many years to come.

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