

**CHROMATOPHOROTROPIC SUBSTANCES OF THE
GRASSHOPPER, *POECILOCERA PICTUS*, AS COLOUR CHANGE
ACTIVATORS IN THE MARINE CRUSTACEAN, *GELASIMUS
ANNULIPES***

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THE comparative distribution of the chromatophorotropic substances among the arthropods has been studied by several investigators and has been reviewed recently by Carlisle and Knowles (1959). The chromatophorotropins are reported to be present in crude extracts of the nervous systems of various malacostracans. These substances are also extractable from the corpora cardiaca of the cockroach, *Periplaneta* (Brown and Meglitsch, 1940) and from the nervous system of the horseshoe crab, *Limulus* (Brown and Cunningham, 1941).

In insects, as in crustaceans, chromatophorotropins appear to be neurosecretory products. The brain and the corpora cardiaca form a functionally related group of neuroglandular organs. The corpora cardiaca serve as reservoir for neurosecretory material produced in the brain. It was mentioned by Hanstrom (1948) that the extracts of the heads of a number of insects activated the melanophores and other dark chromatophores in crustaceans.

While studying the neurosecretory system of the grasshopper, *Poecilocera pictus*, it was thought worthwhile to investigate the influence of the extracts of the brain, corpora cardiaca and corpora allata of this insect on the chromatophores of the marine crustacean, *Gelasimus annulipes*.

MATERIAL AND METHODS

Poecilocera pictus used in the present investigation were collected from the campus of Andhra University, Waltair, and the experiments were carried out in the zoology department. Extracts of the brain, corpora cardiaca and corpora allata were prepared in sea water. These extracts were never boiled. The dose of each extract injected into the test animal (*Gelasimus*) was 0.05 ml. The concentration of each extract injected into the animals was 1 brain/0.05 ml., 2 corpora cardiaca/0.05 ml. and 2 corpora allata/0.05 ml. The control animals received sea water injections. Twenty-four hours before chromatophore assay, both eyestalks were removed from a group of crabs. This operation causes the pigment in the black and red chromatophores to concentrate. Using a hypodermic syringe and a 26-gauge needle, the extract from the insect nervous system was injected at the base of the fourth walking leg into the ventral haemocoel of *Gelasimus*.

The chromatophores on the walking legs were staged with the aid of a stereoscopic dissection microscope and transmitted light. The chromatophores were classified according to the system of Hogben and Slome (1931) in which maximum

concentration was represented by stage 1 and stage 5 represented maximum dispersion. The experiment were carried out in the day at temperatures varying from 26° to 29°C.

RESULTS AND DISCUSSION

For the initial experiment ten eyestalkless *Gelasimus* were injected with the brain extracts of *Poecilocera*. As a control each of ten similar eyestalkless *Gelasimus* was injected with sea water. The chromatophores of each animal were staged at 15, 30, 60 and 120 minutes following the injection. The experiment was repeated once and the results are presented in Table 1. By examination of the table it can be seen that the black and red pigments are dispersed when the brain extracts of the insect were injected.

TABLE 1
Effect of brain extract of Poecilocera on the chromatophores of the crab, Gelasimus (Each reading is average of 20 crabs)

Time in minutes	Red chromatophores		Black chromatophores	
	Experiment	Control	Experiment	Control
0 (Before Injection)	1.3	1.5	1.0	1.2
15	2.2	1.7	2.5	1.3
30	3.0	1.5	3.3	1.0
60	3.3	1.3	4.0	1.0
120	2.5	1.3	3.0	1.0

For the second experiment, the extracts of the corpora cardiaca were injected into eyestalkless *Gelasimus*. The chromatophores were staged for 2 hours following the injection. The experiment was repeated once and the results are presented in Table 2. The extracts of the corpora cardiaca also brought about pigment dispersion in the red and black chromatophores.

TABLE 2
Effect of corpora cardiaca extracts of Poecilocera on the chromatophores of the crab, Gelasimus (Each reading is average of 20 animals)

Time in minutes	Red chromatophores		Black chromatophores	
	Experiment	Control	Experiment	Control
0 (Before injection)	1.0	1.2	1.0	1.2
15	1.5	1.2	2.2	1.0
30	2.0	1.4	2.8	1.0
60	1.8	1.3	3.0	1.2
120	1.4	1.3	3.0	1.2

For the third series of experiments, the extracts of the corpora allata were used and the same procedure used to study the effect of brain and corpora cardiaca extracts on chromatophores was followed. The results are shown in Table 3. The extracts of corpora allata did not bring about any change in the pigment migration in the red and black chromatophores.

TABLE 3

Effect of corpora allata extracts of Poecilocera on the chromatophores of the crab, Gelasimus (Each reading is average of 20 animals)

Time in minutes	Red chromatophores		Black chromatophores	
	Experiment	Control	Experiment	Control
0 (Before injection)	1.0	1.5	1.2	1.0
15	1.0	1.7	1.2	1.2
30	1.2	1.7	1.3	1.2
60	1.2	1.5	1.3	1.2
120	1.2	1.5	1.3	1.2

From the three experiments described in the present paper, it is obvious that the extracts of the brain and corpora cardiaca of *Poecilocera* contain black and red pigment dispersing substances while the corpora allata do not have any chromatophorotropins.

The fact that *Poecilocera*, though do not possess chromatophores, produce chromatophorotropins appear to be intriguing. But chromatophorotropins are also reported in some other insects (Brown and Meglitsch, 1940; Pautsch, 1952 and Gersch, 1956). Dupont-Raabe (1951) found that removal of the corpora cardiaca, corpora allata and the frontal ganglion had no effect on colour changes in *Carausius*. Removal of the brain, however, always resulted in total cessation of colour changes. Brainless animals remained pale. Extracts of brains darkened *Carausius* whereas extracts of corpora allata and frontal ganglion had no effect. However, implants of corpora cardiaca produced a slight darkening. It is possible that the physiologically active substances demonstrated in the present study do not function for *Poecilocera* as they do for *Carausius* or *Gelasimus*, but may serve in moulting or reproduction which are hormonally regulated in all insects.

SUMMARY

The extracts of the brain and corpora cardiaca of *Poecilocera pictus* brought about pigment dispersion in the black and red chromatophores of the marine crustacean, *Gelasimus annulipes*. The corpora allata appear to have no chromatophorotropins.

ACKNOWLEDGEMENTS

We wish to express our thanks to Prof. P. N. Ganapati for kindly providing facilities to carry out the work and to Prof. S. Mehdi Ali for his keen interest. Thanks are also due to C.S.I.R., New Delhi, for financial assistance.

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