paraffin sections of Bouin-fixed ganglion were stained in Gomori's chrome alum haematoxylin phloxin[2] or in aldehyde fuschsin[3].

In the third (final) instar larva of *O. rhinoceros* (figure 1) all the ganglia in the ventral nerve cord are fused into a single mass, but in the adult (figure 2) there are three ventral ganglionic masses; the suboesophageal ganglionic mass, the thoracic ganglionic masses and the abdominal ganglionic mass. It was found that the single ventral ganglionic mass in the larvae and all the three ventral ganglionic masses of the adult in the water-logged condition contained dense colloids whereas those of animals from which water was withheld or saline was injected contained little of the secretory material. In the larvae, there are 14 such A cells in all, in the single ventral ganglionic mass; in the adult, there are two A-cells in the suboesophageal ganglia, none in the thoracic ganglion and 12 in the abdominal ganglion. It appears that the neurosecretory A cells of the ventral ganglionic mass are apparently antidiuretic in function, as in *Clitumnus extradentatus*[4], *Leucophaea maderae*[5] and in *Schistocerca gregaria*[6]. In this respect they are comparable to the single pair of A cells of the brain in this animal described earlier[1]. These cells also have an antidiuretic function as opposed to the rest of the brain neurosecretory cells having a diuretic function. Thus the ventral ganglionic mass neurosecretory cells supplement the single pair brain neurosecretory cells in the discharge of their antidiuretic function, but are antagonistic in their activity to the majority of the A cells of the brain which are diuretic in function. This confirms our earlier suggestions that (i) water metabolism in *O. rhinoceros* is controlled by two sets of neurosecretory cells, one elaborating diuretic principle and the other elaborating antidiuretic principle, and that (ii) the single pair of cells elaborating antidiuretic principle in the brain might be supplemented by some other organ, which has turned out to be in this case the neurosecretory cells of the ventral ganglionic mass. It may be noted that such a well-developed and segregated antagonistic neurosecretory system controlling water metabolism or osmoregulation is rather rare in insects as far as is reported[4].

The authors thank the Government of India, Department of Science and Technology, New Delhi, for a research grant. SK is also indebted to the Head of the department for facilities afforded.

13th November 1985; Revised 27 January 1986

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PRODUCTION OF SUPERNUMERARY LARVA BY THE JUVENILE HORMONE ANALOGUE-FED IMAGINES OF *TRIBOLIUM CASTANEUM* H

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JUVENILE hormone analogues (JHA) are primarily utilized to affect the developmental stages of the insect pest. Application of these compounds during sensitive periods of insect development, produces morphological abnormalities which in many species lead to death or formation of intermediates which are unable to reproduce. One of the main physiological functions of JHA is the formation of supernumerary and intermediate forms among insects belonging to different orders. Such a formation of supernumerary or extra larval stages has been demonstrated in *Dysdercus cingulatus*[1], *Graphosoma italicus*[2] and *Triatoma infestens*[2]. Thus the supernumerary larval or pupal instars and all types of adultoids have already been induced in many orders of exopterygota and endopterygota. It is also evident from the literature that in many species of Diptera, Hymenoptera and Coleoptera application of any amount of JHA during the last larval instars is never followed by a supernumerary larval moult[2]. The usual effect of JHAs on last larval instars of these insects was characterized by a delay of pupation. However not much is known on the effect of the JHA when administered during the stages of development other than the last larval instar. In the present studies Kinoprene a JHA (ZR 777) was administered to the adult beetle through food (oral application) and observations were made on the subsequent generations for a considerable period which revealed formation of a supernumerary larva.

Randomly selected *Tribolium castaneum* (H), adult insects were released in July 1984 into wheat flour treated with Kinoprene (ZR 777) at the dose of 80

ppm/20 gm. Each batch consisting of 50 insects in triplicate was kept in the plastic container along with the treated medium at an isolated place in the laboratory for observations. Simultaneously a similar batch was maintained on wheat flour treated with acetone solution of JHA. Monthly observations were made during which the dead insects, dried larvae and pupae as well as exuviae were removed while keeping the remaining insects in the same medium. For about seven months the supernumerary larvae were found active and finally the mortality count of the larvae was made after six months.

The larvae that emerged from the eggs laid by the insects exposed to the treated food passed through the normal development until the last instar larva and a majority of them moulted into pupae and adults. A few larvae were noticed not entering into pupation and in the subsequent observations till the seventh month the size of these larvae increased considerably and moulting into extra larval instars more than once. During the later stages these supernumerary larvae were cylindrical in shape and considerably increased body size (0.9 to 1.0 cm as compared to the normal size of 0.4 to 0.6 cm) with hard segmental tergum and striped inter-segmental membrane (figure 1). Head capsule and thorax were heavily chitinized and enlarged setae all over the body. At this stage these larvae looked totally different from the normal last instar larvae of *Tribolium*. They were very active with periodical shedding of cuticle but there was no pupation. Stoppage of further growth and cessation of feeding was observed.

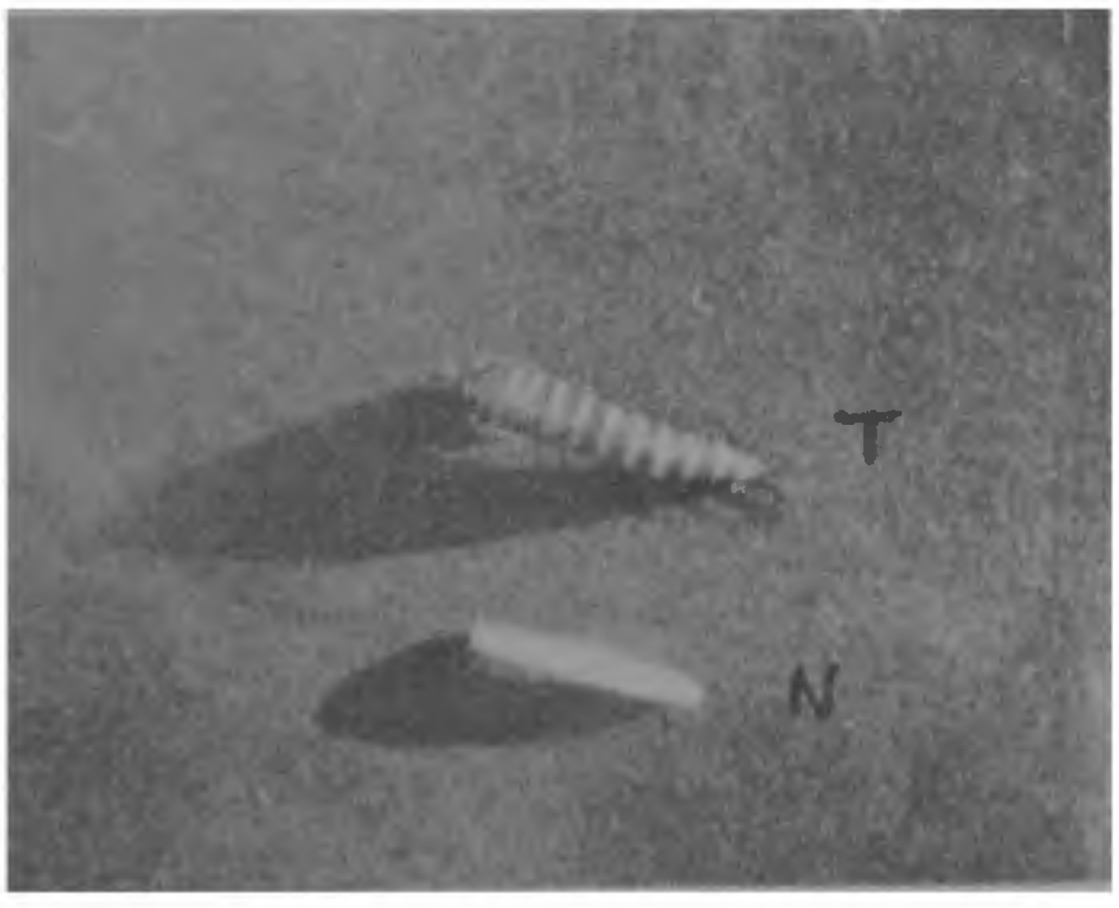

Figure 1. Supernumerary 5th instar larva of *T. castaneum* after the treatment of Kinoprene ZR 777. T-Treated, N-Normal.

Earlier reports showed juvenoids causing delay of pupation or puparium formation when treated to the last larval instars of certain endopterygotes including the Coleoptera[3]. Delay of pupation in these insects was also correlated with the dose of JHA applied. It was assumed by Slama[2] that there is an incomplete breakdown or excretion of the endogenous corpora allata hormone in the young larval stages due to which, development of last larval instar into pupae was suspended as long as JH remained in the body. Therefore, some of the larvae remaining as supernumerary larval forms for a prolonged period may be attributed to the above contention besides the constant presence of JHA applied in the food medium. However what is interesting in the present observations is the formation of supernumerary larval moult with the treatment of JHA orally to the adult insects which normally does not take place in Coleoptera when last larval instar is exposed to the juvenoid[2]. This interesting findings, suggesting the possibility of forming extra-supernumerary moults besides delay in the pupation, merit further investigations.

15 November 1985; Revised 12 February 1986

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AN ASSESSMENT OF THE MOSQUITO-PATHOGENIC FUNGUS *LEPTOLEGNIA* (SC-I) AS A BLACKFLY (DIPTERA: SINULIIDAE) PATROGEN

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SEYMOUR[1] reported the isolation of a water mold from a parasitized mosquito larvae which he tentatively identified as *Leptolegnia*; however, he attempted no further experiments with artificial infection. Mortality