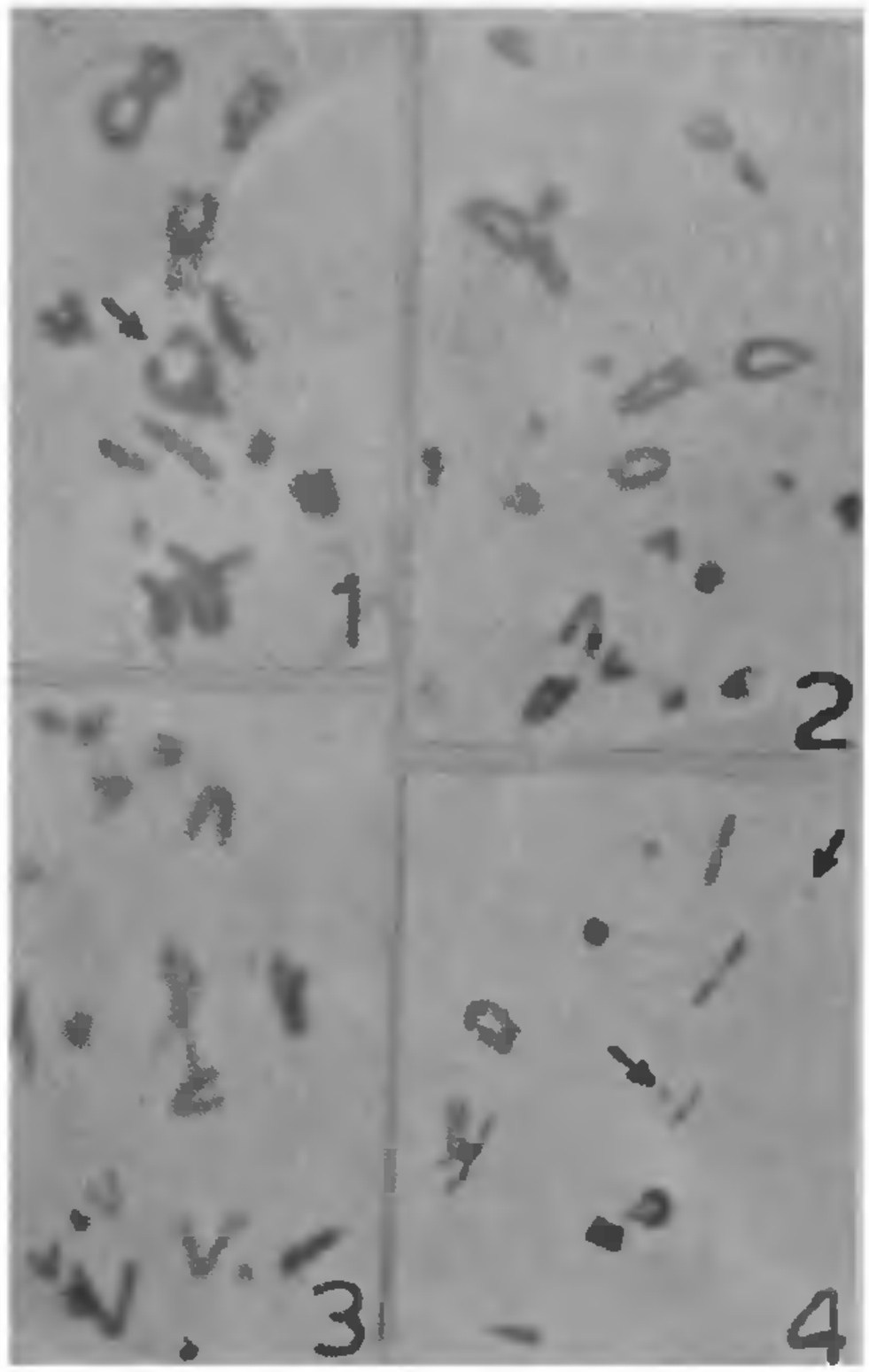
CCC INDUCED MEIOTIC INSTABILITY IN GRASSHOPPER SPERMATOCYTES

WANTON use of fungicides, insecticides and herbicides in modern agriculture has rightly raised the question of their possible adverse effects on the ecosystem at all levels : cell, individual and population. It has been reported that routine application of herbicides to fields leads to genetic and morphologic changes which contribute to the instability in the seed stocks[1,2]. In the present paper the authors have described the effects of the herbicide, chloramquat chloride, commercially known as CCC, on the spermatocytes of an acridid grasshopper *Oxya velox*.

The grasshoppers were injected with 0·5% of the chemical at a dose of 0·05 ml/individual and their testes were fixed at different intervals of time. Individuals injected with an equal dose of distilled water served as the control series.

The treated series on comparison with the control showed a much greater number of abnormal spermatocytes. The frequency of such abnormal cells was highest at 12 hours of fixation (10·6%) after which there was a decline (Table I). However, the over-all nature of the abnormality was the same regardless of the period of treatment. Out of 1788 spermatocytes examined there were only 4 cells with distinct breaks (Fig. 1) while the number of disturbed anaphases was observed in as many as 65 cells. In most of such plates, the chromosomes had failed to seggregate properly (Fig. 2) and in a few cases a number of laggards were seen (Fig. 3). A good number of metaphase I plates also disclosed the presence of two or more univalents which had resulted from the smallest pair(s). Judging from their disposition in the plates it appeared that these univalents had undergone an early separation (Fig. 4).



FIGS. 1–4

TABLE I

Frequency distribution of abnormal cells at different hours of fixation

Hour of fixation	Total No. of cells observed	Dipl.	Diak.	Met. I	Met. II	Ana. I	Ana. II	%
15 minutes	115	..	..	..	..	..	1	0·87
30 minutes	144	..	..	1	..	..	1	1·38
1 hour	110	..	..	..	..	..	2	1·81
2 hours	225	..	2	..	13	..	3	8·00
4 hours	248	..	2	2	14	..	1	7·66
8 hours	312	2	2	6	11	..	4	8·01
12 hours	179	2	2	1	..	14	..	10·61
24 hours	346	7	2	4	11	..	3	7·80
48 hours	109	1	..	1	..	5	1	7·34
Total	1788	12	10	15	49	19	16	6·78

Except for the effect of CCC on the rate of mutation in bacteria and fruit flies[3], no systematic work on its effects on other biological systems, and on the dividing cells in particular, has been, so far as known to us, undertaken. We find that CCC, unlike many of the herbicides and pesticides[4-7], does not have much adverse effect on the structural integrity of the chromosomes as evinced by the absence of stickiness, fragmentation, bridges, etc. Almost similar results have been reported in the meiotic cells of sorghum and other plant materials following the application of Atrazin, a systemic herbicide[8]. The exact mechanism by which these chemicals bring about the cytological damages is not yet clear. However, in the absence of any marked differential effects on the chromosome structure *per se*, it is probable that these chemicals disturb the physiological/biochemical systems of the cells which eventually interfere with the spindle organization.

Post-Graduate Department of Zoology,
Berhampur University,
Berhampur 7,
Ganjam (Orissa), *December* 4, 1976.

R. PRASAD.
H. N. BEHERA.
C. C. DAS.

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SEXING THE PUPAE OF GRAM CATERPILLAR, *HELIOTHIS ARMIGERA* Hbn. (LEPIDOPTERA: NOCTUIDAE) IN RELATION TO CERTAIN MORPHOMETRIC CHARACTERS

SEXING insects in their larval and pupal stages can be advantageously used in studies like sex attractants, chemosterilants and male sterile technique. The position of genital opening is more often used to distinguish sex in pupae than other characters[1-3].

When the gram caterpillar, *Heliothis armigera*, was mass cultured, initially on the leaves of Bengal gram up to the third instar, and then individually on soaked Bengal gram seeds, several external morphological differences between the sexes of the pupae were noticed. The genital opening in the male was located on the posterior region of the 9th abdominal segment and was flanked by a pair of pads. The female pupae had their gonopore located on the anterior aspect of the 8th abdominal segment mid-ventrally, in the form of a dot-like cleft (Fig. 1). The determination of the segment on which the genital opening is located may be facilitated by pinpointing it from the wing pads which extend to the posterior margin of the fourth abdominal segments as shown in the figure.

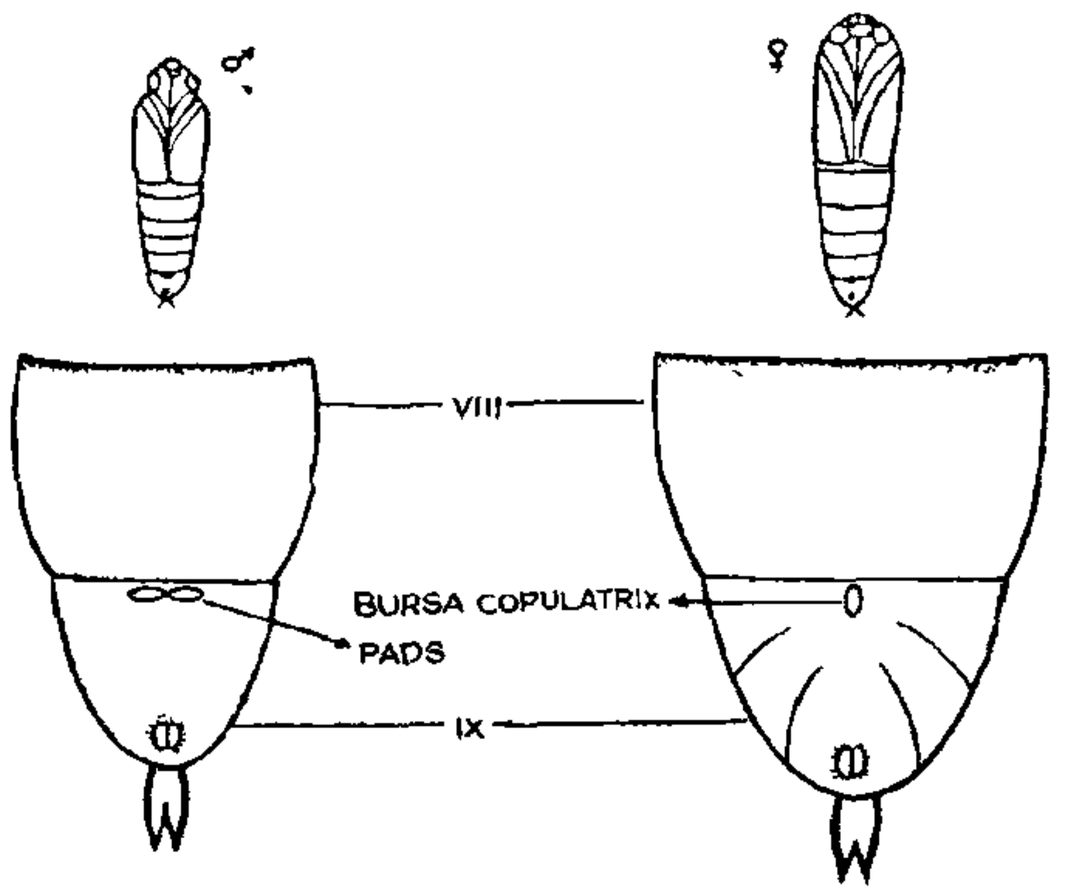

FIG. 1. Sexual dimorphsim in the pupa of *Heliothis armigera* Hbn.

It is evident from Table I that there was a significant difference in the weight, length and width of the pupae of both the sexes. The male pupae were much smaller than the female. Significant correlation

TABLE I

Sex differences in size and weight of pupae of H. armigera (*Mean of* 20 *observations*)

Sex	Weight (mg)	Length (mm)	Width (mm)	Duration (days)
Male	222·58	16·36	4·89	11·95
Female	283·22	18·11	5·43	10·10
Standard error (S.E.)	23·87	1·36	0·50	0·17

was found to exist among all the three characters in either sex. The strength of the association was maximum between the weight and the length, the correlation coefficient (r) being 0·83 and 0·48 in female and male respectively. Significant correlation was also found between width and weight and width and length of pupae of the sexes. The development period of the pupae also varied significantly in the sexes, It lasted 11-13 days with an average of 12·0 days in the male and 10–11 days with a mean of 10·1 days in the female. It was also noticed that the male pupae showed constant twisting and turning movements whereas females were inactive and displayed only occasional movements.