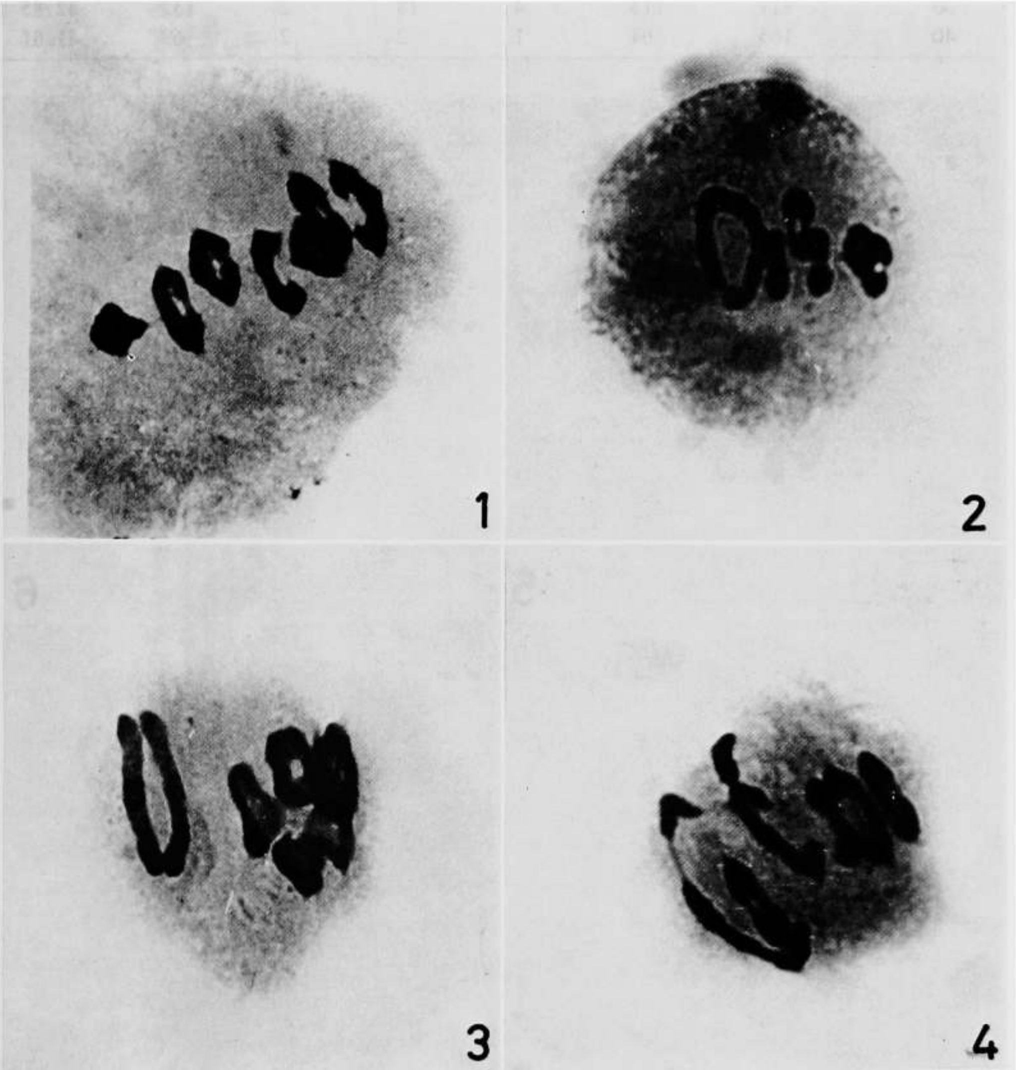
subsequent stages were normal.

Meiotic analysis of gamma irradiated and pesticide treated plants revealed various abnormalities which included:

1. *Multivalents and univalents*: In contrast to the usual metaphase configuration of 7 bivalents, trivalents and quadrivalents were noticed with both gamma irradiated and pesticide treated plants. The quadrivalents were of ring (⟨⟩), open ring (◇) or rod (⌐∟) type (Figs. 2 and 3). In many cases, single or three unpaired chromosomes were accompanied by a trivalent. The trivalents were of (<>) or (¬¦) type (Fig. 4). The maximum frequency of quadrivalents was 45.11% at 40 kR dose of gamma rays (Table 2). The number of univalents when present, varied from one to four.

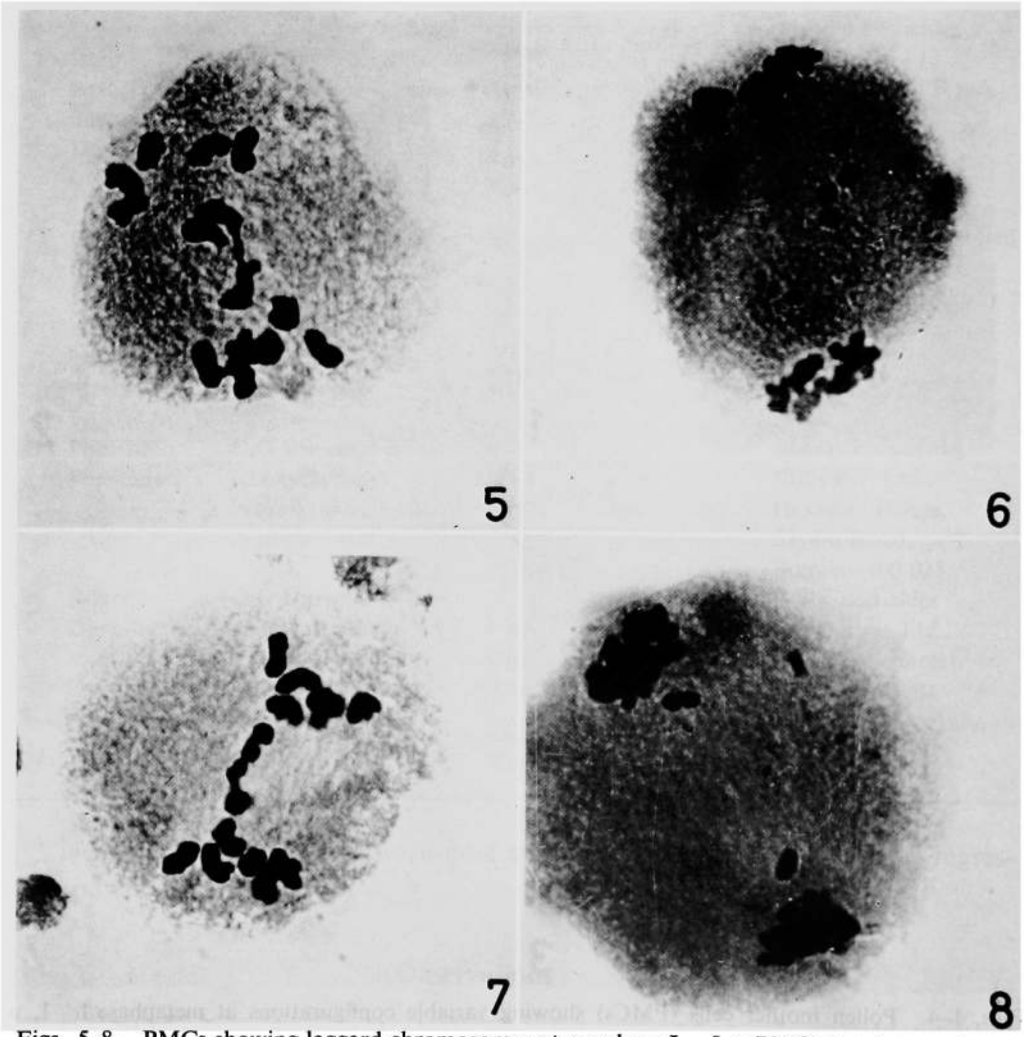


Figs. 1–4. Pollen mother cells (PMCs) showing variable configurations at metaphase I. 1, a PMC from untreated plant with 7 ring bivalents. 2, a PMC with a ring quadrivalent and 5 ring bivalents (Gamma irradiated). 3, a PMC showing one ring quadrivalent and 5 ring bivalents. 4, a PMC showing an open ring trivalent (Gamma irradiated).

2. *Stickiness/despiralization of chromosomes*: The chromosomes with no sharp boundaries at metaphase I were observed with dursban treated plants. This feature (stickiness) was more predominant at 0.2 and 1.0% treatments of dursban.

Table 2. Meiotic analysis following treatments with different doses of gamma rays in barley

Treatment (kR)	Total dividing cells	Metaphase abnor-malities	Anaphase bridges	Laggards	Spindle inhibition	Total aberrations	
						Total	Per cent
Control	395	—	—	—	—	—	—
Gamma rays							
10	500	12	9	6	2	29	5.80
20	219	8	6	4	4	22	10.04
30	417	113	4	18	2	137	32.85
40	165	64	1	2	2	69	41.81

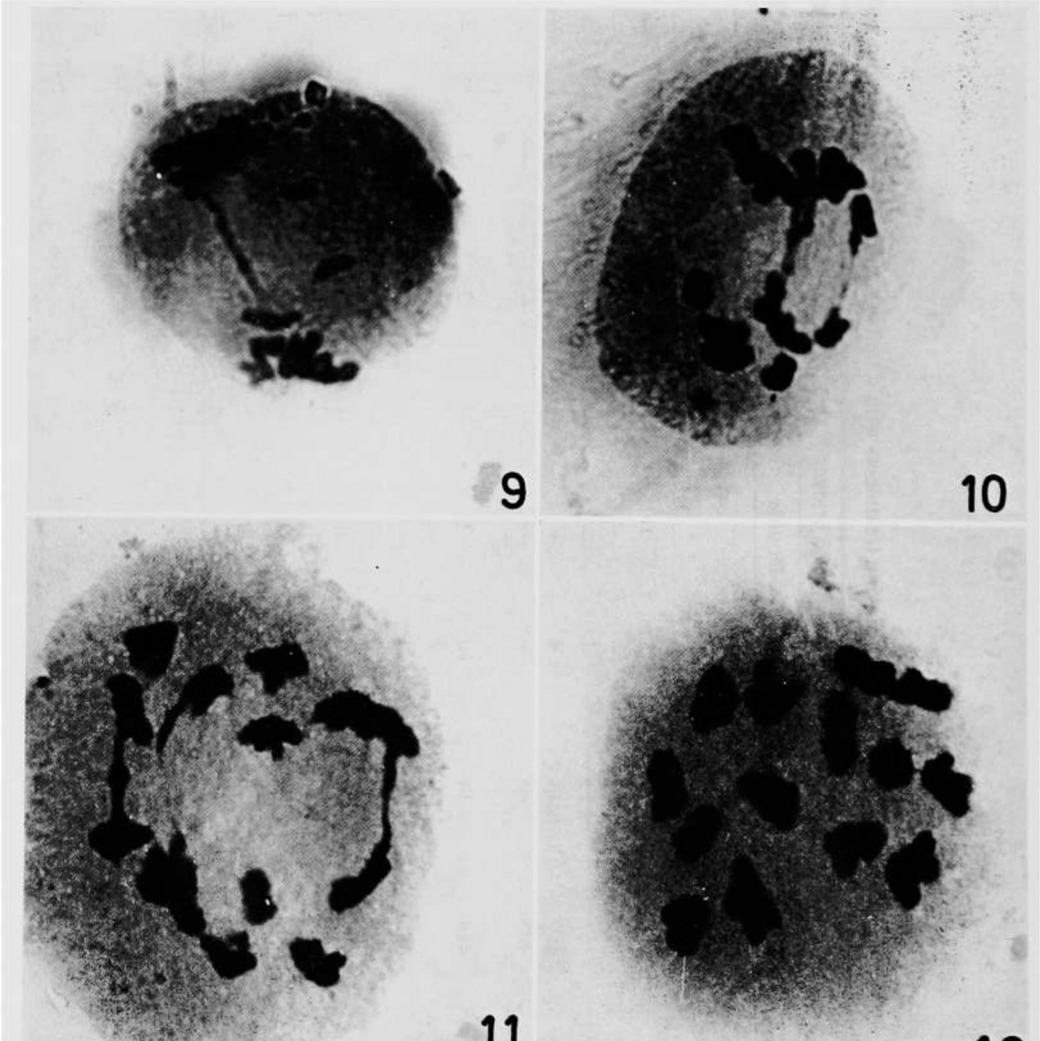


Figs. 5–8. PMCs showing laggard chromosomes at anaphase I. 5, a PMC showing one laggard chromosome. 6, a PMC with five chromosome laggerds. 7, a PMC with two laggard chromosomes. 8, a PMC with one chromosome lagging near each pole.

Besides this, despiralization of the chromosomes was also observed at M-I in predominant cells with dursban treatments.

3. *Fragments*: A small ring like chromosome in addition to normal complement of 7 bivalents was noticed at M-I with almost all the pesticide treatments. Normally it was lying away from the equatorial plate.

4. *Lagging chromosomes*: Laggards resulted may be due to delayed terminalization or perhaps stickiness of chromosome ends were common with almost all the pesticides tested. The size of laggards varied from a small fragment to a full chromosome (Figs. 5–7). One PMC was found to have two laggard chromosomes each lying near to the either pole (Fig. 8). As many as 5.91% of PMCs had a laggard chromosome with 0.75% methylparathion treatment (Table 3).



Figs. 9–12. Aberrant pollen mother cells at anaphase-I. 9, a PMC showing chromatin bridge and laggards. 10, a PMC showing two chromatin bridges. 11, a PMC with three chromatin bridges. 12, a PMC showing inhibition of spindle formation.