

Effect of herbicides on meiosis of *Hibiscus cannabinus* Linn.

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ABSTRACT

The plants were sprayed with different concentrations of 2, 4-D, Oxyfluorfen, and Glyphosate and their effect on pollen mother cells was studied. The abnormalities percentage increases as the concentrations of herbicide increase. The abnormalities percentage increased from 0.03 to 1.91 at 200 to 500 ppm of 2,4-D, 0.30 to 1.33 at 400 to 800 ppm of Oxyfluorfen and 0.38 to 1.33 at 600 to 1000 ppm of Glyphosate. The abnormalities like laggards, clumping and grouping of chromosomes were observed.

Key words: Meiosis, *Hibiscus cannabinus* Linn., 2, 4-D, Oxyfluorfen and Glyphosate.

INTRODUCTION

The growth of the plants can be described in term of cell division, cell enlargement and cell differentiations. Due to spray application of herbicides some irregularities were induced in *Hibiscus cannabinus* Linn. These irregularities have thus imbalance the metabolic activities of plants, which then could not give rise to the mature tissue. The present study deals with the inhibition and the behavior of the dividing cells in meiosis from 2, 4-D, Oxyfluorfen and Glyphosate.

MATERIALS AND METHODS

For the meiosis plants growing in plots and pots were sprayed with various concentrations of 2, 4-D (100 – 600 ppm), Oxyfluorfen (100 – 800 ppm) and Glyphosate (100 – 1200 ppm) prior to lethal doses. After 24 hours of spraying the flowers buds were fixed in freshly prepared Carnoy's fluid for 24 hours. Then they were washed thoroughly with distilled water and subsequently stored in 70 % alcohol. The flowers buds from the control plants growing in the same field were also collected for control study. The slides were prepared by squash method using haematoxylin stain and iron alum as a mordant. The permanent slides were prepared by using acetic acid – n-butanol grades and mounted in D.P.X.

The abnormalities were counted in pollen mother cells prior to lethal doses.

The meiosis in pollen mother of control *Hibiscus cannabinus* Linn. was normal. The results are tabulated in Table 1.

2, 4-D

The pollen mother cells treated with 2,4-D showed some abnormalities such as chromosomal bridge at 200, 300, 400 and 500 ppm and laggards at 400 and 500 ppm. The percentage of abnormalities in meiotic cells were 0.33, 0.89, 1.49, and 1.91 at 200, 300, 400 and 500 ppm, respectively (Table 1, fig. 1).

Oxyfluorfen

This herbicide induced chromosomal abnormalities like laggards at 600 and 800 ppm and chromosomal bridges at 400 and 600 ppm of concentrations. The abnormalities percentage was 0.30, 0.87 and 1.33 at 400, 600, and 800 ppm, respectively (Table 1, fig. 2). The percentage of abnormalities increased with increase in concentrations of herbicides.

Glyphosate

This herbicide was found to be less effective to induced chromosomal abnormalities in pollen mother. Abnormalities like laggards were

observed 600, 800, 1000 and 1200 ppm. The total percentage abnormalities were increased with increasing concentrations of this herbicide. The

percentage of abnormalities at 600, 800, 1000 and 1200 ppm was 0.38, 0.50, 0.81 and 0.91, respectively (Table 1, fig. 3).

Table - 1: Showing the percentage of abnormalities at different concentrations of 2, 4-D, goal (Oxyfluorfen) and Glyphosate in PMCs of *Hibiscus cannabinus* Linn

| Herbicide | Conc. (ppm) | Total no. of PMCs observed | Chromosomal laggards | Clumping of Chromosomes | Chromosomal bridges | Abnormalities percentage |
|-------------|-------------|----------------------------|----------------------|-------------------------|---------------------|--------------------------|
| - | Control | 890 | - | - | - | - |
| 2,4-D | 100 | 430 | - | - | - | - |
| | 200 | 445 | - | - | 0.83 | 0.83 |
| | 300 | 417 | - | - | 0.89 | 0.89 |
| | 400 | 425 | 0.34 | - | 1.15 | 1.49 |
| | 500 | 470 | 0.53 | - | 1.38 | 1.91 |
| Oxyfluorfen | 100 | 420 | - | - | - | - |
| | 200 | 435 | - | - | - | - |
| | 300 | 418 | - | - | 0.30 | 0.30 |
| | 400 | 423 | - | 0.23 | 0.64 | 0.87 |
| | 500 | 436 | - | 0.44 | 0.69 | 1.33 |
| Glyphosate | 200 | 412 | - | - | - | - |
| | 400 | 409 | - | - | - | - |
| | 600 | 405 | 0.38 | - | - | 0.38 |
| | 800 | 418 | 0.50 | - | - | 0.50 |
| | 1000 | 415 | 0.81 | - | - | 0.81 |
| | 1200 | 403 | 0.91 | - | - | 0.91 |

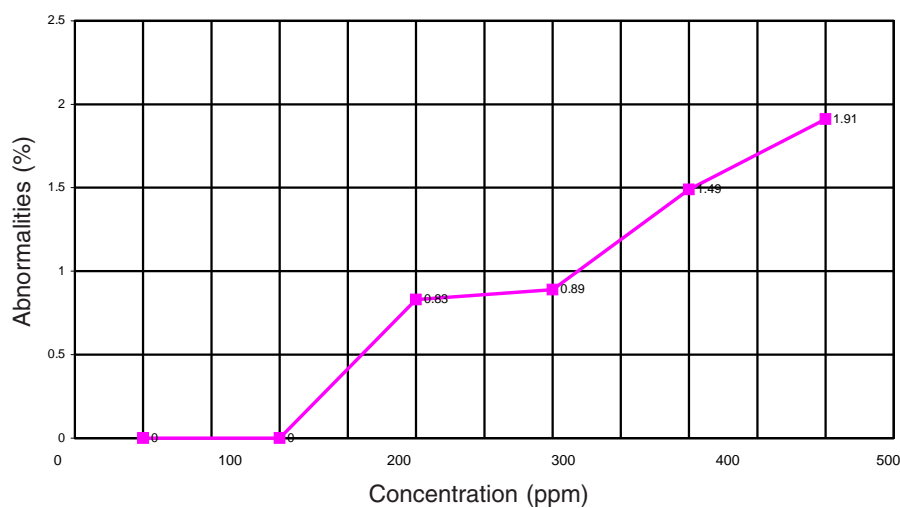


Fig. -1: Graph showing percentage of abnormalities in pollen mother cells due to spray application of 2,4-D.

DISCUSSION

In the present study all the herbicides *i.e.* of 2,4-D, Oxyfluorfen, and Glyphosate showed some chromosomal abnormalities like chromosomal bridges, laggards, clumping of chromosomes in pollen mother.

2, 4-D

This herbicide induced abnormalities such as laggards and chromosomal bridges in pollen mother cells of *Hibiscus cannabinus* Linn. Laggards might be due to the chromosomal fibers, which would lose its fibers. These fibers may be broken into two pieces at the time of anaphase and pole ward movement of chromosomes may be

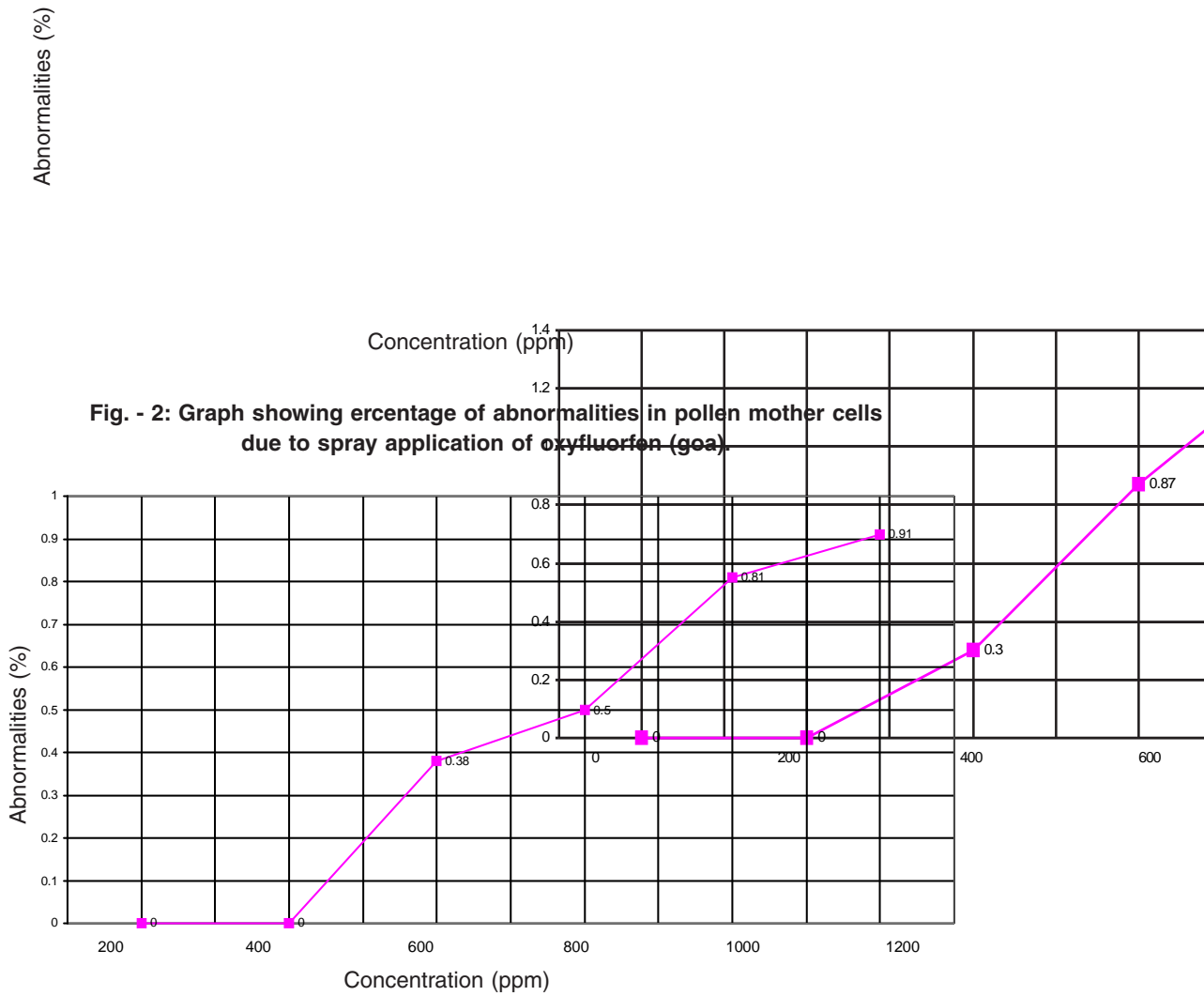


Fig. - 3: Graph showing percentage of abnormalities in pollen mother cells due to application of glyphosate.

interrupted due to the toxic effect of herbicide. Chromosomal bridges were formed when chromosomes fail to separate at the time of anaphase.

The total percentage abnormalities in pollen mother cells increased with increase in concentrations of herbicide. Similar results were by Unrau and Larter (1952) on *Triticum aestivum* and *Hordeum vulgare*, Srivastava (1958) on *Crotalaria juncia*, Liang *et al.* (1969) on *Sorghum vulgare*, Amer and Ali (1974), on *Vicia faba*, Tomkins and Grant (1976) on various weeds, Kolhe (1979) on *Tephrosia hamiltonii*, *Solanum surattense* and *Celosia argentea*, Bakale and Kolhe (1981) on *Solanum surattense*, Bakale and Srinivasu (1990) on *Parthenium hysterophous*, Bobde (1993) on herbicides on Jain (1993) on *Chenopodium album*, Gopal (1993) on *Medicago sativa* and Kulkarni (1998) on *Crotalaria medicaginea* var. *luxurians*.

Oxyfluorfen

This herbicide also induced abnormalities like chromosomal bridges and clumping of chromosomes in pollen mother cells by applications of this herbicide. The clumping of chromosomes due

to the chromosomes of metaphase became thick and finally stick together forming the compact clump. The chromosomal bridges might be due to chromosome fail to separate at the time of metaphase. Total percentage of abnormalities was directly proportional to increases in concentrations. Gopal (1993) on *Medicago sativa* and kulkarni (1998) on *Crotalaria medicaginea* var. *luxuriance*. Reported above mentioned abnormalities due to application of Oxyfluorfen.

Glyphosate

This herbicide induced abnormalities like lagging of chromosome in pollen mother cells of *Hibiscus cannabinus* Linn. The percentage of chromosomal abnormalities increased as the concentrations of herbicide increased. Similar results were reported by Boyle and Evans (1974) on *secale cereal* Bobde (1993) on *Crotalaria juncia*, Jain (1993) *Chenopodium album*, and kulkarni (1998) on *Crotalaria medicaginea* var. *luxurians*. From foregoing discussion it was concluded that the three herbicides used in present study, suppressed the meristematic activity of pollen mother cells and also induced abnormalities, which ultimately lead to sterility.

REFERENCES

1. Amer, S. M. and Ali, E. M. Effects of some herbicides on *Vicia faba*. *Cytol.* **39**: 633 – 643 (1974).
2. Bakale, V.L. and Kolhe, R. R. Mitotic abnormalities induced by herbicides in *Solanum surattense*. *Perspective in Cytology and Genetics.* **3**: 299 – 303. (1981).
3. Bakale, V.L. and Srinivasu T. Foliar spray effects of some herbicides on pollen mother cells of *Parthenium hysterophous*. *J. Indian Bot. Soc.* **68**: 401 – 402 (1990).
4. Bobde, S.N. Comparative effects of herbicides on *Crotalaria juncia* L. *PH. D. Thesis*, Nagpur Univ., Nagpur (1993).
5. Boyle, W.A. and Evans, J. O. Effects of Glyphosate and ethephan on meiotic chromosomes of *secale cereal* L. *The J. Heredity.* **65**: 250 (1974).
6. Gopal, K. R. Herbicidal effect on Cytomorphology of weed *Medicago sativa* Linn. *Ph. D. Thesis*, Nagpur Univ., Nagpur (1993).
7. Jain, S.B. Cytomorphological effects of weedicides on weed *Chenopodium album*. *Ph. D. Thesis*, Nagpur Univ., Nagpur (1993).
8. Kolhe, R. R. Effects of herbicides on the Cytomorphology of farm weeds. *Ph.D. Thesis*, Nagpur Univ., Nagpur (1979).
9. Kulkarni, G. B. Effect of agro-chemicals on *Crotalaria medicaginea* var. *luxurians*. *Ph. D. Thesis*, Dr. Babasaheb Ambedkar Marathwada Univ., Aurangabad (1998).
10. Liang, G. H. L., Feltner, K. L. and Russ, D. G. Meiotic and morphological response of grain *Sorghum vulgare* to atrazine, 2,4-D and their combinations. *Weed Sci.* **17**(1): 8-12 (1969).
11. Srivastava, M.G. Effect of some hormonal herbicides on the *Crotalaria juncia*. *Phyton.* **10**: 99– 109 (1958).
12. Tomkins, D. J. and Grant, W. F. Mentoring natural vegetation for herbicide induced chromosomal aberration. *Mut. Res.* **36**: 73-83 (1976).
13. Unrau, J. and Larter, E. N. Cytological responses on *Triticum aestivum* and *Hordeum vulgare* to 2, 4-D. *Can. J. Bot.* **30**: 22 – 27 (1952).