

Effect of Agrochemical 2, 4-D on Mitosis of *Cassia Tora* Linn

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Abstract

Mitotic abnormalities were studied in the cells of root tip grown from seeds treated with various concentrations of 2,4-D. The chromosomal aberrations such as binucleate, multinucleate cells, clumping of chromosomes and chromosomal bridges were observed. The number of dividing cells in the root tips of *Cassia tora* treated with 2,4-D decreased with the increase in concentrations. The mitotic index decreased from 10.13 to 3.44 at 100 to 500 ppm as against 17.16 in control.

Key word: Mitosis, *Cassia tora*, 2,4-D, Clumping and Grouping of chromosomes and Chromosomal bridges

Introduction

The growth of the plants can be described in terms of cell division, cell enlargement and cell differentiations. Due to spray application of 2,4-D some irregularities were induced in *Cassia tora* Linn. These irregularities have thus imbalance the metabolic activities of plants, which then could not rise to the mature tissue. The present study deals with the inhibition and the behaviour of the dividing cells in mitosis from the following treatment of 2,4-D.

Materials and Methods

A large number of seeds of *Cassia tora* Linn., were treated with 50 ml various concentrations of 2,4-D (100 to 500 ppm) prior to lethal dose for germination up to 24 hours under laboratory condition, similarly seeds soaked in distilled water also allowed to grow for control. After treatment, seeds washed thoroughly in distilled water and allowed to grow in petridishes lined up with double layered-moistened filter paper.

Root tips of seedlings when reached 3 to 5 cm in length; were fixed for 24 hours in freshly prepared Carnoy's solution (3:1; ethanol:glacial acetic acid). Then they were washed thoroughly with distilled water and subsequently stored in 70% alcohol. The root tips were hydrolysed for 10 to 15 minutes in 1 N HCl at 60° C in oven. The chromosomes were stained with acetocarmine and were made permanent by using acetic acid-butanol grades and mount in DPX. The dividing cells in metaphases and anaphases were scored for chromosomal aberrations prior to lethal doses. The mitotic index was calculated by applying the following formula.

$$\text{Mitotic index} = \frac{\text{Total no. of dividing cells observed}}{\text{Total no. of meristematic cells observed}} \times 100$$

RESULTS

In control root tips, the mitosis was normal in *Cassia tora* Linn. with the mitotic index 17.16 in 24 hours treated seedlings. 2,4-D induced some abnormalities such as binucleate cells at all concentrations, clumping of chromosomes and chromosomal bridges at 400 and 500 ppm of the herbicide. The frequency of abnormalities increases with the increasing concentrations of 2, 4-D.

Herbicide	Concentrations (ppm)	Total No. of cells observed	Total No. of dividing cells	Mitotic Index
-	Control	600	103	17.16
2,4-D	100	503	51	10.13
	200	495	40	8.08
	300	560	30	5.35
	400	580	27	4.65
	500	580	20	3.44

Table, shows the mitotic index and percentage of abnormalities in the seedlings of *Cassia tora* Linn. at different concentrations of 2,4-D.

The herbicide also affected the division of meristematic cells in the root tips. The rate of mitosis decreased with the increased in the concentrations of 2,4-D. The mitotic index in treated seedling was 10.13, 8.08, 5.35, 4.65, and 3.44 at the concentrations 100, 200, 300, 400 and 500 ppm respectively. In control mitotic index was 17.16.

Discussion

This herbicide induced chromosomal abnormalities such as binucleolate cells. The binucleolate cell formation might have been due to the constriction of fully formed nucleus in to two pieces and failure of plate formation. 2,4-D affects the number of dividing cells and decreased mitotic index. Similar results were reported by Ryland (1948) in *Allium* and *Narassus*, Doxey and Rhodes (1949) on *Allium cepa*, Nygren (1949) on *Allium cepa*, Sawamura (1964) in *Allium triticum*, *Tradescantia* spp. and *Vicia faba*, Alekperov (1967) in *Allium fistulosum*, Mohandas and Grant (1972) in some weeds, Rojik *et al.* (1973) in *Vicia faba*, Strove (1973) in barley, Dharurkar and Dnyansagar (1974) in *Echhornia crassipes*, Tomkins and Grant (1976) in twelve weeds, Bayliss (1977) in *Daucus carota*, Prasad and Das (1977) in *Vicia faba*, Mauras and Pareyre (1977) in *Allium sativum*, Kolhe (1979) in three farm weeds, Hadke (1980) in *Psoralea corylifolia*, Bakale and Hadke (1981) in *Euphorbia geniculata*, Deshmukh (1981) in *Cassia occidentalis*, *Lagasca mollis* and *Corchorus olitorius*, Sheleg and Deeva (1987) in barley, Dzhelepov (1988) in some wheat variety, Ditomaso (1988) in pea root, Bakale and Srinivasu (1989) in *Psoralea corylifolia*, Grover *et al.* (1990) in onion and barley, Trivedi and Alok (1991) in *Mecardonia procumbens*, Jain (1993) in *Chenopodium album*, Gopal (1993) in *Medicago sativa*, Kulkarni (1997) in *Crotalaria medicaginea*, Tulankar (1998) in *Amaranthus lividus*, Kamble (1999 and 2007) in *Hibiscus canabinus*, and Taduwadi (2005) in *Cleome viscosa*, Hayashi *et al.* (1998) in *Arabidopsis*, Yang *et al.* (2002) in tobacco and Aqeel *et al.* (2002) in *Allium* spp. following 2, 4-D treatment.

Clumping of chromosomes was observed in the present investigation. It was possible that the metaphase chromosomes became thick and swollen and finally forming a compact clump (Nygren, 1949). Similar results were also observed by Crocker (1953) in *Allium cepa*, Shoji *et al.* (1960) in sweet pea, Bayliss (1977) in *Daucus carota*, Kolhe (1979) in three farm weeds, Hadke (1980) in *Euphorbia*, Deshmukh (1981) in *Cassia*, Srinivasu (1986) *Parthenium hysterophorus*, Jain (1993) in *Chenopodium album*, Gopal (1993) in *Medicago sativa*, Kulkarni (1997) in *Crotalaria medicaginea*, Tulankar (1998) in *Amaranthus lividus*, and Aqeel *et al.* (2002) in *Allium cepa* due to 2,4-D treatment.

The chromosomal bridges were observed in the present study. They were found when chromosomes fail to separate at the time of anaphase. Similar results were reported by Dharurkar and Dnyansagar (1974) on *Eichhornia crassipes*, Bakale and Hadke (1981) on *Euphorbia geniculata*, Bakale et. al. (1981) on *Malvastrum coromendelianus*, Jain (1993) on *Chenopodium album*, Gopal (1993) on *Medicago sativa* Kulkarni (1998) on *Crotalaria medicaginea* and Kamble (1999) on *Hibiscus cannabinus* due to application of 2,4-D.

Acknowledgements

Author acknowledges the multidimensional help rendered by my beloved friend Dr. Vishakha Kamble, Assistant Professor, Department of Marathi, V. N. Government Institute of Arts and Social Sciences, Civil lines, Nagpur and my loving daughter Princess Apollo alias Juliet for her research inspiration.

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