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

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


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 coromandelianus*, 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.

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