**ISSN:** 0974-4908
http://www.rels.comxa.com

*Res. Environ. Life Sci.*
**1(1)** 43-44 (2008)
rel_sci@yahoo.com

# Cytogenetic effect of Bavistin on root meristem cells of *Allium cepa*

**Kiran Gupta, Kumkum Mishra*, S.P. Singh, Shefali Srivastava, Sumati Gaumat and Sunil Dixit**
Department of Botany, Lucknow University, Lucknow – 226007, India
***e-mail:** dr_kumkum@rediffmail.com

**Abstract:** Cytological changes in *Allium cepa* root tip cells induced by Bavistin were observed. Mitotic index and root length decreases with increase in concentration and duration, however, various types of abnormalities increases. These abnormalities are chromosome breaks, c-metaphase and stickiness in metaphase and multipolar arrangements of chromosomes, laggard, diagonal and bridges in anaphase.

**Key words:** *Allium cepa*, Mitotic abnormalities, Chromosomal abnormalities, Bavistin, Fungicide

## Introduction

*Allium cepa* has been used as test material to study the effects of various chemicals world wide (Liu *et al*., 1996; Agarwal and Chauhan, 1997; Yadav and Chauhan, 2000). Bavistin is a fungicide chemical. It is used to control a wide range of fungal diseases in plants such as leaf spot, blotches and blights, fruit spot and rot, scab, corn and tuber decay etc. It is used on cereals cotton, grapes, sugar beet etc under most climatic conditions world wide. At high doses it causes spermatogenic, foetotoxics clastogenic effects on mammals.

Bavistin has been adequately tested for genotoxicity in a range of assay. In the present study the effect of Bavistin on root tip cells of *Allium cepa* were evaluated.

## Materials and Methods

Fungicide Bavistin was first dissolved in a little amount of DMSO (Dimethyl sulfo oxide) to get stock solution of 10,000 mg $L^{-1}$. Subsequently various concentration of bavistin (15, 30 and 60 mg $L^{-1}$) were prepared by using distilled water.

Intact primary root meristem, 2 to 4 cm long, from bulbs of *Allium cepa* L. (2n=16) grown in Hogland's medium (Kihlman, 1975) were used as the assay system. The roots were treated with test solutions for 24 and 48 hr. A batch of bulbs with root meristems treated for 24 hr were subjected to a 24 hr recovery in Hoagland's medium. For pretreatment the root tips were firstly treated with p-dichlorobenzene and after the 3 hr were fixed in fixative. At the end of each treatment the root meristems were excised from the bulbs washed and fixed in glacial acetic acid: ethanol (1:3) for cytological analysis following haemotoxylin method (Darlington and Lacour, 1976) for chromosomal analysis. The results were statistically analyzed to determine any significant difference from respective control (Gomez and Gomez, 1984).

## Results and Discussion

The effect of fungicide Bavistin on *Allium cepa* was observed for both morphological parameters *i.e.* root length as well as cytological parameter *i.e.* mitotic and chromosomal assay.

The root length was found to be 4.9 cm in control whereas in the treated bulbs it was 3.4, 2.5 and 1.8 cm in 15, 30 and 60 mg $L^{-1}$, respectively (Table 1). Thus the results shows that Bavistin inhibited root growth in a dose dependent manner.

The mitotic index in control was 6.46% and in treated root it was 5.22%, 5.02% and 3.71% in various concentrations respectively at 24 hr. The mitotic index in control was 6.13% and 5.16%, 4.28% and 2.83% at different doses respectively at 48 hr (Table 2). Thus significant reduction in mitotic index with increase in concentration and with duration of treatment was observed. However, there was maximum inhibition at 60 mg $L^{-1}$. The percentage of aberrant cells was significantly increase in a dose dependent manner (Table 3). Analysis revealed various abnormalities such as chromosome breaks, c-metaphase and stickiness in metaphase and multipolar arrangement of chromosomes, laggard, diagonal and bridge in anaphase (Table 3).

**Table - 1:** Effect of various doses of bavistin on root growth

| Compound and concentration (mg $L^{-1}$) | Root growth (cm) |
|---|---|
| Control | 4.9 ± 0.45 |
| Bavistin | |
| 15 | 3.4 ± 0.72 |
| 30 | 2.5 ± 0.81 |
| 60 | 1.8 ± 0.28 |

**Table - 2:** Effect of Bavistin on the mitotic index of root meristem cells of *Allium cepa*

| Concentration | Treatment (hr) | |
|---|---|---|
| (mg $L^{-1}$) | 24 | 48 |
| Control | 6.46 ± 0.44 | 6.13 ± 0.68 |
| Bavistin | | |
| 15 | 5.22 ± 0.27* | 5.16 ± 0.75* |
| 30 | 5.02 ± 0.98* | 4.29 ± 0.54* |
| 60 | 3.71 ± 1.02** | 3.14 ± 0.81** |

Data were obtained from 4000-5000 cells and are expressed as mean ± S.E. from three replicates. *p<0.05, **p<0.001 compare to the corresponding control.

**Table - 3:** Chromosome and mitotic aberration in the root meristem cells of *Allium cepa* exposed to bavistin for 24 and 48 hr

| Concentration (mg $L^{-1}$) | Treatments | Chromosome aberrations | | | | | No. of analysed cells scored | No. of dividing cells | Mitotic aberration | | | | | | % aberrant cells | % aberrant cells at 24 hr recovery |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. of metaphase scored | Breaks | Fragments | Total aberration | % chromosome aberration | | | Cmeta phase | Stickness | Multipolar | Laggard | Bridges | Unsynchronised | | |
| 15 | 24 hr | 143 | 1 | 15 | 16 | 11.18 | 517 | 27 | 2 | - | - | 1 | - | 2 | 18.51 | 15.38 |
| | 48 hr | 150 | 2 | 18 | 20 | 13.33 | 503 | 26 | 3 | - | - | 1 | - | 1 | 19.23 | |
| 30 | 24 hr | 138 | 2 | 15 | 17 | 12.31 | 519 | 27 | 3 | - | - | 1 | 1 | 1 | 22.22 | 18.51 |
| | 48 hr | 133 | 2 | 17 | 19 | 14.28 | 582 | 25 | 4 | - | 1 | 1 | - | 1 | 28.0 | |
| 60 | 24 hr | 157 | 1 | 20 | 21 | 13.37 | 511 | 19 | 2 | 2 | - | - | 1 | 1 | 36.84 | 26.31 |
| | 48 hr | 152 | 1 | 23 | 24 | 15.78 | 519 | 16 | 3 | 1 | - | 1 | 1 | 2 | 43.75 | |

Chromosomal aberrations were scored from 150-200 cells. Mitotic aberrations were scored from 400-500 cells

The cells exposed to higher concentration (60 mg $L^{-1}$) did not undergo proper division or recovery whereas in lower concentration (15 mg $L^{-1}$) recovery was seen (Table 3).

From the present study it was revealed that Bavistin causes mitodepression and cytotoxicity in dose dependent manner. It could be due to failure of some of cells entering the mitotic cycle which is a commonly observed physiological response of cells exposed to pesticide stress (Kergommeaux *et al*., 1983). The reduction in mitotic index was also found in *Allium cepa* treated with various concentration of paper will effluent (Mishra, 1997) and in *Vicia faba* treated with leachates from tannery solid waste (Chandra *et al*., 2004).

Various other pesticides have also been shown constituently to produce mitotic abnormalities (Grant, 1978; Bodr, 1983; Panda *et al*., 1989). The increase in mitotic and chromosomal aberration was also found in *Allium cepa* treated with paper mill effluent (Mishra, 1997) and in *Vicia faba* treated with leachates from tannery solid waste (Chandra *et al*., 2004). Mitotic abnormalities such as c-metaphase, lagging chromosome, unequal distribution (unsynchronized) resulting from disruptive effect on spindle apparatus (Grant, 1978). Stickiness has been shown to be the result of entanglement of interchromosomal chromatin fibres and this lead to subchromatid connection between chromosomes. Chromosome aberrations such as bridges and fragments resulting from a clastogenic action on chromosomal DNA (Grant, 1978). Mitotic abnormalities possibly were induced by effecting the spindle microtubules.

Thus the present results show that Bavistin induced mitotic abnormalities as well as some chromosomal abnormalities through its effect on spindle. The occurrence of chromosomal and chromatid break indicated clastogenic action as well. The effect of bavistin on DNA leads to the inhibition of root growth.

## References


Agarwal, S. and S. V. S. Chauhan: Cyto-morphological changes in *Allium cepa* roots caused by some heavy metals. *J. Environ. Pollut.,* **4**: 85-90 (1977).

Bodr, A.: Mitodepressive and chromotoxic activities of two herbicides in *Allium cepa. Cytologia,* **48**: 451-457 (1983).

Chandra, S., L. K. S. Chauhan, P. N. Pandey and S. K. Gupta: Cytogenetic effects of leachates from tannery solid waste on the somatic cells of *Vicia faba. Inc. Environ. Toxicol.,* **19**: 129-133 (2004).

Darlington, C. D. and L. E. Lacour: The handling of chromosomes. Allen and Unwin, London. pp. 201 (1976).

Gomez, K. A. and A. A. Gomez: Statistical procedures for agricultural research. John Willey and Sons, New York (1984).

Grant, F. W.: Chromosomes aberrations in plants as a monitoring system. *Environ. Health. Perspect.,* **27**: 37-43 (1978).

Kergommeaux, de D. J., W. F. Grant and S. S. Sandhu: Clastigenic and physiological response of chromosomes to nine pesticides in *Vicia faba in vivo* root tip assay system. *Mut. Res.,* **124**: 69-84 (1983).

Kihlman, B. A.: Root tips of *Vicia faba* for study of induction of chromosomal aberrations. *Mut. Res.,* **81**: 401-412 (1975)..

Liu, D., W. Jiang and C. Wang: Effect of $Zn^{++}$ on root growth, cell division and nucleoli of *Allium cepa* L. *J. Environ. Sci. (China)*, **8**: 21-27 (1996).

Mishra, K.: Genotoxic and biochemical effects of paper mill effluent on the cells of *Allium cepa* L. *Pollut. Res*., **16**: 55-58 (1997).

Panda, K. K., M. Lenka and B. B. Panda: *Allium* micronucleus (MNC) assay to assess bioavailability, bioconcentration and genotoxicity of mercury from solid waste deposits of a chloralkali plant, and antagonism of *L. cysteine*. *Sci. Total Environ.,* **79**: 25-36 (1989).

Yadav, C. and S. V. S. Chauhan: Cytological changes in onion root tip cells induced by some human hormone drug. *Ads. Bios.,* **19**: 59-66 (2000).