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CYTOLOGICAL EFFECTS OF FUNGICIDE CARBENDAZIM 50% WP. (BAVISTIN) ON ROOT MERISTEM OF ONION *(ALLIUM CEPA L.)*

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Treatment of onion roots with Bavistin resulted decrease in root growth rate followed by a decrease in accumulation of fresh and dry weight. Roots of control onion bulbs grew well and showed a good length, whereas bulbs treated with Bavistin were shorter than control. The effect of Bavistin on root length was dose dependent. The 2, 3, 4 and 5% concentration treatments of Bavistin showed various chromosomal abnormalities in root meristem cells of *Allium cepa*. The abnormalities increased with increase in concentrations.

Keywords: Abnormalities; Fungicides; Mutagenic; Root meristem.

Indian economy depends on agriculture. About 60% of Indin population depends on agriculture. Farmers, to bring a quality product from agriculutre, have to use various chemical fertilizers and pesticides on crops. These chemicals have enhanced the production and has also helped to meet the demand of increasing population, but along with some positive things, these chemicals are showing certain negative effects on the environment. Their undesirable residues in water, food and in the environment may cause serious health hazards. They are responsible for change in genetic system of an organism as a results of their mutagenicity. They are also responsible for the decrese in nuclear DNA in cells[1-4].

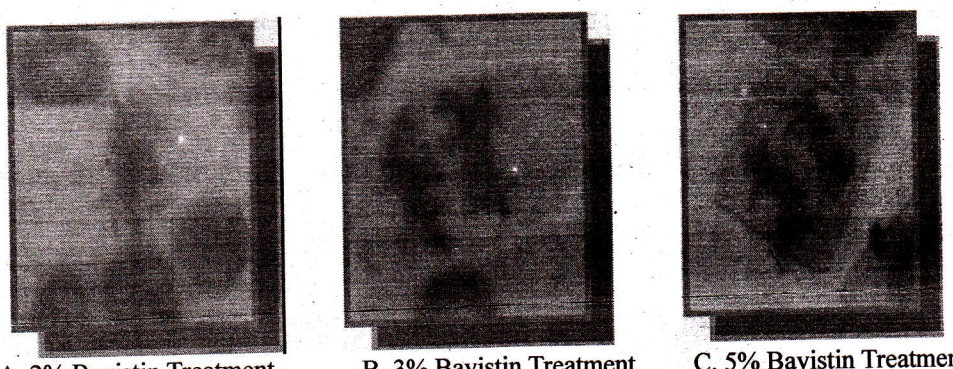
Carbendazim 50% wp. (Bavistin) is commercial fungicide. Carbendazim is the technical name, Bavistin50% WP is the trade name and Methyl-1-H-benzimidazole carbamate-2-yl carbomate is the chemical name of fungicide. The fungicide is systemic and used as a foliar spray to control sheath blight, leaf bligh, loose smut, seedling blight and damping off plant diseases in groundnut, wheat, grapes, chilli, rose, tobacco, rice, maize, pulses, cotton etc. If swallowed or inhaled as fine dust, symptoms like nausea, vomiting abdominal pain and bronchial disorders are observed. In the present investigation an attempt is made to investigate the mode of action of Carbendazim 50% wp.(Bavistin) fungicide on root system of onion *(Allium cepa* L.).

Matured dry bulbs of onion *(Allium cepa* L.) were used as experimental material to study the effect of Bavistin on root meristem cells. Healthy and uniform size bulbs of onion were placed on the mouth of 50 ml beaker filled with tap water in dark. As the roots from the sprouted bulbs reached the length of about 0.5 cm, the bulbs were transferred to beakers containing different concentrations of Bavistin (2, 3, 4 & 5%). These bulb roots were treated in the test solutions for four hours at room temperature. Bulb roots in distilled water were treated as control.

After four hours of treatment in fungicide, the onion bulbs were washed thoroughly under running tap water and immediately transferred to beakers containing tap water. They were allowed to grow for about two days in dark for recovery. Roots from the treated and distilled water (control) grown onion bulbs were cut out. These roots tips were transferred to Cornoy's fixative (Ethanol and Glacial Acetic Acid 3:1 ratio) and kept in it for four hours at room temperature. After fixing, the root tips were stained and smeared in 2% Aceto-orcein-HCl reagent to study cell division with special reference to chromosomal and mitotic abnormalities.

Microphotographs of Aceto-orcein stained preparations were taken on Olympus research microscope fitted with Sony 12X zoom digital camera. The images were then stored in the computer for further use.

Treatment of onion roots with Bavistin resulted decrease in root growth rate accompanied by a decrease in accumulation of fresh and dry weight of bulbs. Roots of control onion bulbs grew well and showed a good length. Roots of bulbs treated with Bavistin were shorter than control. The effect of Bavistin on root length was dose dependent.



A. 2% Bavistin Treatment B. 3% Bavistin Treatment C. 5% Bavistin Treatment

Fig.1. A. Sticky Metaphase; B. Sticky Anaphase; C. Full developed Anaphase bridge.

Onion root meristem cells, grown in distilled water (control) showed normal stages of prophase, metaphase, anaphase and telophases. However the Bavistin induced mitotic abnormalities, like chromosomal stickiness and chromosomal bridges were observed in dividing cells of *Allium cepa* root meristem. The 2, 3, 4 and 5% concentration treatments showed various chromosomal abnormalities. The abnormalities increased with increase in concentrations.

2% Bavistin treated onion root meristem showed sticky metaphase. The 3% treated onion root meristem showed anaphase bridges, spreading of chromosome in metaphase and 3% Bavistin resulted in increased length of one chromosome at anaphase. In 4% concentration, the number of sticky metaphases increased and also showed anaphase bridges. The last concentration of Bavistin, that is 5%, showed sticky metaphase and anaphase bridges, along with increased size of cell (Fig. 1A-C). The mitotic index also reduced with increase in concentration. Thus, the result clearly indicates the inhibitory effect of Bavistin on mitotic index and cytology effect of cells. Inductions of chromosomal aberration by various chemical agents have already been reported by various workers[1-4].

Chromosomal stickiness was the major abnormality produced by Bavistin. The frequency of this abnormality increased as the concentration of fungicide was increased. In c-metaphase aberration the chromosomes are shorter, thick and show no equator orientation. This is due to the effect of Bavistin on the polymerization of microtubules. It is the indication of action of fungicide on the inhibition of spindle fiber formation by their action on microtubules, which play an important role in formation of spindle fibers. Due to the stickiness the separation of daughter chromosomes becomes incomplete even in the presence of spindle fibers and thus remains connected by chromosome bridges. Similar results were observed by several authors.

According to Kumar and Mukherjee[5] stickiness and clumping of the chromosome is due to depolymerization effect of the treatment chemical on the nucleic acid of the chromosome. Arindam[6] opinioned that stickiness of chromosome was a general phenomenon associated with the joining of chromosome arms. Stickiness is considered to be a physiological effect exerted by pesticide[7].

Anaphase bridge may be the consequence of unequal change or formation of dicentric chromosomes. The origin of dicentric bridge in anaphase is the consequence of crossing over between relatively inverted segments, breakage and reunion of chromatids during the meiotic prophase[8]. The failure of chromosome movements causes a delayed terminalization and clumping of chromosome which may result in the formation of lagging chromosome[9]. According to Hess[10], the inhibition of cell division is due to the harmful effects of applied chemicals on the synthesis of DNA, RNA and proteins.

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