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Chromosomal Aberrations Induced by Carbaryl in Root Meristem Cells of *Pisum Sativum* L.

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Carbaryl, which is also known as sevin, induced mitostatic and turbagenic leading to clastogenic effects in the root meristem cells of *Pisum sativum*. The study was conducted at Department of Botany, Agra College, Agra. Seeds of uniform size of *Pisum sativum* were germinated on moist filter paper in petriplates. 1to 2 mm root tips were cut and treated with different concentrations (0.1, 0.2, 0.3,0.5%) of carbaryl prepared in distilled water for varying duration (3 to 9 hrs.) of time. It has mitodepressive and mitostatic effects on somatic cell division. These effects are directly proportional to concentration and duration. Common clastogenic effects are stickiness, condensation, breakage and bridges etc. Present investigation clearly revealed that carbaryl showed clastogenic and mitostatic effects. So, it should be used with precautions as it can be hazardous to both targeted and non-targeted biota.

Keywords: Chromosomal Aberration, *Pisum sativum*, Carbaryl.

Carbaryl is a wide spectrum synthetic carbamate insecticide used to control over 100 species of insects on citrus fruit, cotton, forests, lawns, ornamentals and other crop as well as poultry, livestock and pets. It is a contact poison and also used as a molluscicides and acaricides. Carbaryl is a naphthalene derivative which is also known as sevin, septen and 1-naphthyl N-methyl carbamate. Its chemical formula is $C_{12}H_{11}NO_2$. Carbaryl was first synthesized and introduced as an insecticide by Labrech in 1953 nad 1958 respectively. It is gobally used and considered to be environmentally less toxic due to non - persistent nature. Hence, it is more acceptable than the environmentally hazardous organochlorine and organophosphate pesticides[10].

A variety of toxic effects of carbaryl have been observed on various stages of reproduction and genetic material of the animals exposed to it[4]. Carbaryl has been shown to affect cell mitosis (cell division) and chromosomes in rats. It caused chromatid breaks, fragments and clumping of chromosomes in Culex[3]. Environmental exposure to carbaryl may be associated with increased damage in DNA and damage in human sperms[11].

Chromosomal aberrations in plants serve as excellent monitoring system for the detection of toxicity of chemicals that may pose genetic or environmental hazards. In the present paper an attempt have been made to screen the clastogenic and teratogenic effects of carbaryl using meristematic cells of *Pisum sativum* as test system.

MATERIALS AND METHODS

The study was conducted at Department of Botany, Agra College, Agra. Seeds of uniform size of *Pisum sativum* were germinated on moist filter paper in petriplates. 1to 2 mm root tips were cut

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and treated with different concentrations (0.1, 0.2, 0.3,0.5%) of carbaryl prepared in distilled water for varying duration (3 to 9 hrs.) of time. The treated root tips were washed and then fixed in carnoys fixative for 6 hrs and finally transferred to 70% alcohol for longer storage. These fixed root tips were squashed in 1% acetocarmine. The slides were observed in high power microscope and important stages were photographed at magnification of 600x.

RESULTS AND DISCUSSION

It has been observed from the foregoing that carbaryl induced different mitotic disturbances in the root meristematic cells of *Pisum sativum*. Chromosome fragmentation, stickiness, bridges and laggards were observed in different stages of the mitotic cycle. A decrease in mitotic index was observed after the treatment of root tips of Pisum

Fig. 1. Metaphase showing sticky chromosomes in equatorial view

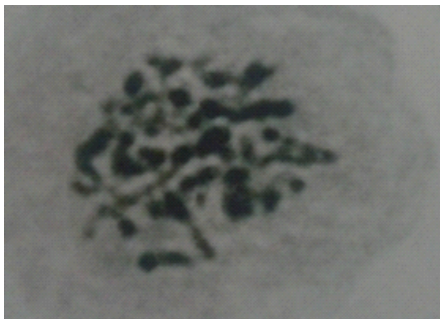

Fig. 4. Anaphase showing bridges with fragments

Fig. 2. Prometaphase showing mosaic nature of chromosome fragments

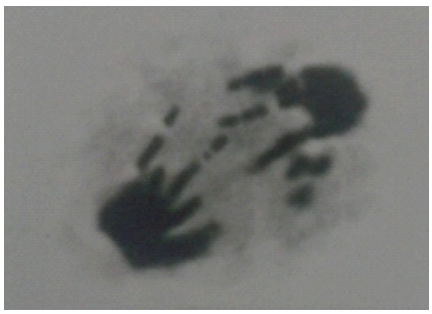

Fig. 5. Anaphase showing chromosome fussiness bridges and fragmentation

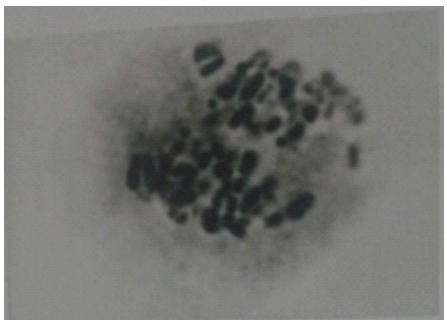

Fig. 3. Disturbed metaphase with fragments

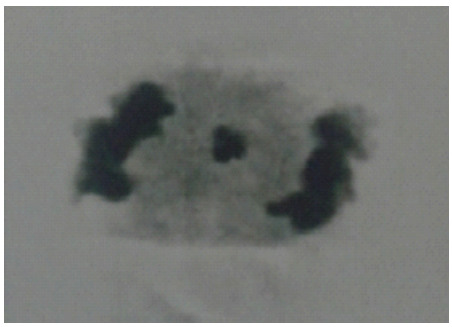

Fig. 6. Sticky anaphase showing a laggard

with 0.1, 0.2, 0.3, 0.5% of carbaryl for 3-9 hrs duration. This concentration dependent decrease in mitotic index suggested a mitodepressive action of carbaryl which is comparable to that of other pesticides in *Vicia faba*[1] and food dyes in *Allium cepa*[7].

Carbaryl induced a number of chromosomal aberration and the frequency of abnormalities was concentration related. Chromosome bridges (Fig.4) and fragments (Fig.3) were common in all concentrations. The formation of bridges could be the result of union of large centric fragments at their distal ends[9].

Stickiness in chromosomes (Fig.1) was also observed. Stickiness has been attributed to an action on the proteins of chromosomes. Chromosome stickiness may be due to degradation or depolymerization of chromosome DNA[2].

Laggards (Fig.6) were also seen which may due to broken acentric chromosome fragment that are unable to get attached to a spindle fibre because of the absence of a centromere[6]. Disturbed metaphase (Fig. 3) and mosaic nature of chromosomes (Fig. 2) were also observed which may be due to an action of carbaryl on the spindle apparatus[8].

CONCLUSION

It can be briefed from the above that carbaryl is a potent clastogenic agent which cause various types of chromosomal abnormalities in the root meristem cells of *Pisum sativum*. These abnormalities increased with the increase in concentration and duration of treatment. Various types of chromosomal aberration include stickiness, fragmentation, bridges and laggards. Carbaryl retarded the mitotic cycle and acted as mitotic poison. The clastogenic effects clearly divulge the toxic nature of carbaryl. Hence, it should be used at moderate level by skilled workers.

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