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Cytological Effect of Malathion (Pesticide) on Lensesculenta

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Abstract

Pesticides are known to induce environmental degradation and affect all biotic factors. Their use has manifested in creating a large number of adverse effects. Their cumulative effects disturb one or other metabolic processes of the plants and produce various types of chromosomal abnormalities which in the turn adversely affect the genetic system.

Keywords: Pesticide, Somatic, Chromosomes.

Introduction

Pesticide is a generic term embracing the whole family of the plant protection material used to crops, weeds, soil and stored commodities. Pesticides continue to play a major role in the production and storage of our food, feed and fiber supply, being important agent for the control of the large number and variety of pests. The benefits derived from the use of such chemicals in agriculture include better crop quality, less loss of stored crop and increased crop yields.

Since most organic pesticide chemicals are by their very nature toxic and many of them degrade to toxic materials, it is important to know their transitory and ultimate fate, both in amount and composition, in or on plants.

Pesticides are known to cause environmental degradation and affect not only the non–infective plants, but also animals and human beings.

The uses of pesticides has increased manifolds and dominated the fields of disease control without considering their harmful effects. Some of these adversely affect the genetic system by producing various types of chromosomal abnormalities in plants, animals and human beings. The various types of chromosomal abnormalities caused by pesticides are chromosomal fragmentation stickiness, laggards, chromatin bridge, formation of micronuclei, break down of spindle mechanism, leading to the formation of polyploid cells. These chromosomal aberrations play an important role in evolution, hereditary characters and affect many vital activities. These are induced by organochlorous pesticides and organophosphorous pesticides. Malathion is a contact insecticide with a high initial toxicity. It is effective mainly in controlling sucking insects and is highly toxic to houseflies, mosquitoes, and bees. It controls mustard aphid Lipphis erysimi Kalt.

The present paper reveals the cumulative effects of malathion on the cytological behaviour of Lens esculenta.

Method

Effects of pesticide on somatic divisions were studied through germinating seeds. The root-tips when 2 – 3 mm long having maximum meristematic activity were subjected to the pesticide treatment of different concentration (0.10%-0.40%). After treatment the root tips were cut from seedlings, fixed in acetic alcoholsolution (1:3) for 6 -12 hours and then transferred to 70% alcohol. After this, the slide was prepared with aceto–carmine solution and the observations were taken both from temporary and permanent slides.

Effect on the Somatic Chromosomes

Various somatic chromosomal abnormalities were observed in root–tip cells of Lens, through root-tip treatment of malathion. It induced condensed and sticky chromosomes, laggards, chromatin bridge, fragments, unequal separation polyploidy etc.

Mitotic Index

A considerable fall in mitotic index was noticed with respect to concentrations and duration of treatment. This fall was from 10.02 to 7.67 m% in Lens**.**

Abnormalities of Metaphase

The long exposure to the pesticide treatment caused the condensation of chromatin material; hereby the chromosomes appeared short, below their normal size and sticky in nature.

An important abnormality caused by malathion treatment was the scattering of chromosome at metaphase due to inactivation of spindle mechanism.Mean % of abnormality decreased with the increase in duration of treatment from 14.17–8.34 m%.

Abnormalities of Anaphase

Normal anaphase stages have been observed in all the treatments. Generally there was a tendency of the arrestment of division at metaphases with the increase in duration of treatment.Multi-polar spindle as well as unequal separation of chromosomes were observed.This abnormality increased with increasing duration from 2.83 to 6.06 m%.

Somatic Chromosomal Abnormalities (%) Induced by Different Concentrations of Malathion (Root-Tip Treatment) in Lens

For 1 Hour Duration

Concen - trations in %	Mitotic Index	Metaphase			Anaphase				Telophase		Multi nucleate	Polyplo-idy
		Normal	Inactivation of spindle mechanism	Condensed & sticky chromoso-me	Normal	Laggards	Chromatin Bridge	Multipolar & unequal separation	Normal	Chromatin Bridge		
Control	13.79	29.54	-	-	20.45	-	-	-	9.09	-	-	-
0.10	10.50	11.94	10.44	14.92	5.97	-	2.98	-	7.46	-	-	-
0.20	10.18	10.79	12.30	18.46	6.15	3.07	4.61	1.53	7.69	-	-	3.07
0.30	10.03	7.81	15.62	20.30	4.68	4.68	7.81	3.12	1.56	3.12	1.56	-
0.40	9.40	3.33	18.33	25.00	-	5.00	8.33	6.66	-	5.00	3.33	6.66
Mean	10.02	8.46	14.17	19.67	4.20	3.19	5.93	2.83	4.17	2.03	1.22	2.43

For 2 Hour Duration

Concen - trations in %	Mitotic Index	Metaphase			Anaphase				Telophase		Multi nucleate	Polypo -idy
		Normal	Inactivation of spindle mechanism	Condensed & sticky chromoso-me	Normal	Laggards	Chromatin Bridge	Multipolar & unequal separation	Normal	Chromat in Bridge		
Control	13.44	29.09	-	-	20.00	-	-	-	9.09	-	-	-
0.10	10.26	10.71	8.33	17.85	4.76	-	3.57	-	2.38	-	-	-
0.20	9.77	10.00	11.25	20.00	3.75	5.00	6.25	2.50	5.00	1.25	2.50	-
0.30	9.53	6.41	12.82	23.07	1.28	5.12	8.97	3.84	-	2.56	3.84	5.12
0.40	9.16	4.00	16.00	29.33	-	6.66	10.66	8.00	-	5.33	2.66	6.66
Mean	9.68	7.78	12.10	22.56	2.45	4.20	7.36	3.59	1.85	2.29	2.25	2.95

For 4 Hour Duration

Concen -trations in %	Mitotic Index	Metaphase			Anaphase				Telophase		Multi nucleate	Polypo-idy
		Normal	Inactivation of spindle mechanism	Condensed & sticky chromoso-me	Normal	Laggards	Chromatin Bridge	Multipolar & unequal separation	Normal	Chromatin Bridge		
Control	14.42	28.57	-	-	18.04	-	-	-	10.52	-	-	-
0.10	8.13	8.00	-	21.33	1.33	2.66	5.33	4.00	2.66	-	1.33	-
0.20	7.80	6.94	8.33	2.50	-	2.77	6.94	5.55	-	1.38	4.16	4.16
0.30	7.59	5.71	11.42	25.71	1.42	4.28	10.00	7.14	-	2.85	5.71	7.14
0.40	7.15	3.03	13.63	28.78	-	6.06	12.12	7.57	-	9.09	9.09	10.60
Mean	7.67	5.92	8.34	25.20	0.68	3.94	8.60	6.06	0.66	3.33	5.07	5.48

The present study reveals that malathion caused more hindrance in chromosome movement. The disturbances in the movement is in different magnitudes. Presumably the chemicals capable of affecting ATP and Sugar synthesis by creating annoxious conditions are responsible for causing this abnormal movement.

Pesticides treatment may give rise to a new variants due to interchange of chromosomes so the increasing use of pesticides may have played an important role in generation of new species.

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