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Cytological Studies in Oil treated Seeds of Maize (*Zea mays* L.)

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ABSTRACT

The present work was undertaken to study the spectrum of chromosome aberrations produced by three oils *viz.* argemone oil *(Argemone mexicana* L.*)*, castor oil *(Ricinus communis* L.*)* and jatropha oil *(Jatropha curcas* L.*)* on a popular of maize variety *malan* from Udaipur region (Rajasthan). Dry and water soaked seeds for 12 hours were treated with these three oils for 12, 24 and 36 hours. Root tips from the treated seeds and control (untreated) seeds were scored for cytological aberrations. There was a significant decrease in cell division with increase in treatment duration. The effect of different oil treatments was more with water soaked seeds as compared to dry seeds treatment. The per cent of aberrant cells and cells showing fragmentation was more with water soaked treated seeds. The per cent of fragmented cells was more at metaphase as compared to anaphase. Maximum per cent of cells showing aberrations and stickiness of chromosomes observed was due to castor oil treatment. Treatment for 36 hours gave maximum per cent of cells showing fragments and stickiness.

INTRODUCTION

The artificial chromosome aberrations can be induced by radiations, chemicals, oils and other treatments. Most of them produce physical effects such as stickiness, pycnosis etc. along with important radiomimetic effects on chromosomes. Such conditions as generally accepted are due to imbalances in metabolic set up of chromosomes. Chromosome aberrations act as an important source for increasing variability in plants to the extent desired for selection and improvement. Unsaturated fatty acid components constitute the probable mutagenic fraction of the vegetable oil. Chromosome fragments have also been reported in the germinating roots of *Triticum aestivum* L., *Oryza sativa* L. and *Vicia faba* L. after soaking seeds in vegetable oils and fats (Swaminathan and Natarajan, 1956). The present work was therefore, undertaken to study the spectrum of chromosomal mutations produced by three oils *viz.*, argemone oil *(Argemone mexicana* L.*)*, Castor oil *(Ricinus Communis* L.*)*, and jatropha oil (*Jatropha curcas* L.) on maize *(Zea mays* L.*)*

MATERIALS AND METHODS

The dry and water soaked seeds of maize variety *malan* were treated with three different oils *viz.*, argemone, castor and jatropha oil. Dry and 12

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hours water soaked seeds were first disinfected with 0.1 per cent mercuric chloride solution for 1-3 minutes and washed in distilled water. Treatment was given by immersing seeds in different oils separately for 12, 24 and 36 hours. After the treatment the oil sticking to seeds was removed with a muslin cloth. Dry and water soaked untreated seeds were taken as control. Treated and untreated seeds were germinated in petridishes over a moist blotting paper separately for each treatment.

About 5-7 mm long root tips were cut from germinated seeds and pretreated with 0.002 M 8-hydroxyquinoline for 1½ to 2 hours. After pretreatment root tips were washed thoroughly with distilled water and fixed in Farmer's fluid (acetic acid and alcohol in 1:3 ratio). After keeping root tips in the fixative for 24 hours they were transferred to 70 per cent alcohol and stored in a refrigerator. Root tips were collected between 9-00 and 10-00 a. m. when maximum stages could be differentiated. Hematoxylin was used for staining purpose. Stained root tips were squashed under glass cover slip by applying gentle pressure and then different observations were recorded.

RESULTS AND DISCUSSION

There was a significant effect of different oil treatments on cell division. Scoring was done for cells showing division in root tips. Increase in treatment duration reduced the number of cells under division. In the highest treatment duration the maximum decrease in cell division was observed in dry and water soaked seeds as compared to control.

Aberrant Cells: Aberrant cells were analysed in both dry and water soaked seeds. The percentage of aberrant cells was more in water soaked seeds as compared with dry seeds. The maximum percentage of aberrant cells was recorded with castor oil treatment which was 13.73, 6.55 and 24.06 for 12, 24 and 36 hours treatment respectively with dry seeds (Table 1) whereas with water soaked seeds it was 16.45, 24.67 and 27.10 per cent for 12, 24 and 36 hours treatment respectively (Table 2). Treatment for 36 hours gave a maximum per cent of aberrant cells in both dry and water soaked seeds. Novick and Sparrow (1949) observed that the process of mitosis was checked in 6 hours when young roots of *Allium cepa* were transferred to freshly prepared nitrogen mustard solution.

Chromosome Fragmentation and Breaks: The oils had a tendency to induce chromosome breaks. In treated material percentage of cells showing fragmentation was more at metaphase as compared to anaphase. More fragmented cells were also observed in water soaked seeds as compared to dry seeds. The maximum percentage of cells showing fragmentation was observed with castor oil treatment as compared to argemone and jatropha oil treatment. When dry seeds were treated with castor oil for 12, 24 and 36 hours the cells with fragmentation was 9.87, 5.24 and 18.39 per cents at metaphase whereas it was 3.86, 1.31 and 5.67 at anaphase (Table 1). In water-soaked seeds for 12, 24 and 36 hours it was 11.68, 18.94 and 20.56 per cent at metaphase

TABLE 1. Cytological observations of dry seeds treated with different oils

Treatments and treatment duration	No. of dividing cells analysed		Aberrant cells analysed		No. of cells showing fragments at				No. of cells showing stickiness	
	No.	%	No.	%	Metaphase	%	Anaphase	%	No.	%
Control	268	17.86	—	—	—	—	—	—	10	3.73
Argemone oil 12 hours	232	15.46*	23	9.91	21**	9.05	2*	0.86	35*	15.08
Argemone oil 24 hours	228	15.20*	14	6.14	13**	5.70	1*	0.44	43*	18.85
Argemone oil 36 hours	223	14.86*	40	17.95	35**	15.69	5*	2.26	46*	20.62
Jatropha oil 12 hours	225	15.00*	14	6.22	12**	5.33	2*	0.89	24*	10.66
Jatropha oil 24 hours	222	14.50*	8	3.60	7**	3.15	1*	0.45	29*	13.06
Jatropha oil 36 hours	201	13.40*	26	12.93	20**	9.95	6*	2.98	37*	18.40
Castor oil 12 hours	233	15.53*	32	13.73	23**	9.87	9*	3.86	32*	13.73
Castor oil 24 hours	229	15.36*	15	6.55	12**	5.24	3*	1.31	37*	16.15
Castor oil 36 hours	212	14.13*	51	24.06	39**	18.39	12*	5.67	43*	20.28

*Significant at 5% level.

**Significant at 1% level.

TABLE 2. Cytological observations of water soaked seeds treated with different oils

Treatments and treatment duration	No. of dividing cells analysed		Aberrant cells analysed		No. of cells showing fragments at				No. of cells showing stickiness	
	No.	%	No.	%	Metaphase	%	Anaphase	%	No.	%
Control	268	17.86	—	—	—	—	—	—	10	3.73
Argemone oil 12 hours	229	15.26*	30	13.10	27**	11.79	3	1.31	28*	12.22
Argemone oil 24 hours	218	15.53*	37	16.97	31**	14.22	6	2.75	31*	14.22
Argemone oil 36 hours	198	13.20*	40	25.43	36**	18.18	4	2.02	33*	16.66
Jatropha oil 12 hours	219	14.60*	14	6.39	11**	5.02	3	1.36	29*	13.24
Jatropha oil 24 hours	207	13.80*	19	9.17	16**	7.72	3	1.44	31*	14.97
Jatropha oil 36 hours	204	13.60*	21	10.29	17**	8.33	4	1.96	41*	20.09
Castor oil 12 hours	231	15.40*	38	16.45	27**	11.68	11	4.76	48*	20.77
Castor oil 24 hours	227	15.13*	56	24.67	43**	18.94	13	5.72	59*	25.99
Castor oil 36 hours	214	14.26*	58	27.10	44**	20.56	14	6.54	64*	29.90

* Signficant at 5% level.

** Significant at 1% level.

whereas it was 4.76, 5.72 and 6.54 per cent at anaphase (Table 2). Treatment for 36 hours showed maximum fragmented cells in all the treatments. Swaminathan and Natarajan (1956 and 1959) reported several aberrations like chromosome and chromatid breakage, minute fragments at metaphase and anaphase when seeds of *Triticum monococcum*, *T. dicoccum*, *T. aestivum*, *Oryza sativa* and *Vicia faba* were treated with mustard oil, groundnut oil, castor oil, gingelly oil, coconut oil, linseed oil, hydrogenated groundnut oil and ghee. They also reported chromosome and chromatid breaks at metaphase when einkorn, emmor and bread wheat were soaked with peanut oil, mustard oil and castor oil and concluded that breakage occurred was due to chromosome reduplication. Susan Thomas (1960) also reported chromosome breaks in *Chlorophytum heyneum*, *Allium cepa*, *Trigonella foenumgraceum* and *Typhonium flagelli forme* when compost, groundnut cake, castor cake and gingelly cake were used in agricultural practices. This was further supported by Abraham (1965).

Stickiness: There was significant effect of oil treatments on chromosome stickiness. At metaphase they were clumped together. At anaphase these chromosomes could not separate out resulting in bridge formation. Treatment with castor oil gave maximum per cent of cells showing stickiness. When dry seeds were treated for 12, 24 and 36 hours the cells showing stickiness were 13.73, 16.15 and 20.28 percent (Table 1) and with water soaked seeds treated for 12, 24 and 36 hours it was 20.77, 25.99 and 29.90 per cent (Table 2). Treatment for 36 hours gave maximum per cent of cells showing stickiness of chromosomes in both dry and water soaked seeds. Darlington and Koller (1947) reported that stickiness as clumping of chromosomes was due to the depolymerization and cross linking of the DNA. D' Amato and Avanji (1949) also reported chromosome fragmentation and stickiness when *Allium cepa* was treated with mustard oil and essential oils like, euganol oil, lavender oil, eucalyptol oil, fennel oil, oleum canadium oil and turpentine oil.

The present studies, therefore, signifies that chromosomal aberrations due to oil treatments may result in genetic variability in the population and better economic plant types.

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