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Cytological effects of dimethylformamide, dimethylacetamide and dimethylsulphoxide on root tips of Allium cepa

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Introduction

Dimethylformamide (DMF), dimethylacetamide (DMAC) and dimethylsulphoxide (DMSO) are used as common solvents for industrial organic chemicals such as polymers and dye stuffs. They are extremely powerful solvents; DMSO being the most powerful. They are aprotic solvents being capable also of certain kinds of chelation They are totaly miscible with water; DMSO being even hygroscopic. Moreover, they are fat soluble,

The aim of this investigation was to study the mitotic effect of DMF, DMAC and DMSO on root tips of Allium cepa as steet plant .

Material and Methods

Allium cepa bulbs were grown in tap water, in the dark and at room temperature. When the roots were 2-3 cm in length; water was replaced by the experimental solutions.

The different concentrations used from DMF, and DMSO were 1,3,5 and 7 %. The time of treatment was 3 hourse. After each treatment, the roots were cut, fixed in carnoy's fixative (1 : 3 acetic-alcohol) for 24 hours, then stored in 70% alcohol under refrigeration.

Observations were made from leuco-basic fuchsin stained slides.

Mitotic index was calculated as the average number of dividing cells from 10 different root tips, for each treatment 5,000 cells were counted.

Results and Disussion

The three chemicals used have a mild effect on mitosis of Allium cepa, the inhibition of mitotic index was obvious in the higher concentrations (Table I). They also affected the mitotic phases. Aslight increase in the number of prophases was noted in 1 and 5% DMAC. While slight increase in metaphases was observed in 3 and 5% DMSO. It is also apparent from Table I that the number of ana-telophases was higher than the other phases in 1 and 5% DMF and 7% DMSO.

The percentage of aberrant cells was proportional to the concentration of the chemicals (Tablr 2).

Most of the abnormalities scored were in the metaphase stage, Table 2. This means that the three chemicals used act as stathmokinetic agents. Accumulation of prophases and metaphases may refer to a delay in the spindle formation and not to the blocking of mitosis at metaphase.

The presence of multipolar spindles indicate that the chemicals used were mero-stathmokinetic agents.

The most dominant abnormality is the disturbed type(Table1). Disturbed prophases (Fig I) were observed in nearly all treatments but in small peecentages. Fig 2 shows prophase metaphase which is a sign of stathmokinesis. This abnormality was dominant in 5% DMAC. While figs 3,4,5 show different forms of disturbed metaphases. Figs 6 show a somatic reduction of chromosomes, in which the metaphase chromosomes were seperated into two unqual groups. Disturbed ana-telophases and multi-polar spindles (Figs7,8 and 9) were also observed.

Agents such as acetone (Kaharity I966), folidol (Ravindran I97I), Sevin (Amer et al I97I) and Rogar (Amer and Farah I974) were also known to produce disturbed meta and ana-telophases.

Polyploidy (Fig. IO) was noted in I and 3% DMAC only and in a (Table 3). Ennis et al. (I948) atributed polyploidy to the impairment of the action of the spindle.

Surpassing chromosomes (Fig. II), Iagging chromosomes (Fig. I2), anaphase bridges (Fig. I3), c-metaphase (Fig. I4) and c-anaphase (Fig. I5) were less dominent abnormalities. Micronucleated (Fig. I7) and binucleate of interphase cells (Fig. I8) were also observed in small percentages.

Super contraction of metaphase chromosomes (Fig. 6 and I6) was an abnormality observed after treatment with the three chemicals. This abnormality was also seen by Reib (I975) after treating Allium Cepa roots with the mycotoxin diacetoxyscirpeno

SUMMARY

The effect of dimethylformamide, dimethylacetamide and dimethylsulphoxide on root mitosis of Allium Cepa was studied.

The three chemicals had amild effect on the mitotic index. They also affected the mitotic phases. Their effect was on the spindle. The observed abnarmalities were : disturbed metaphaeses and ana-telophases, lagging chromosome, bridges, c-metaphase, c-anaphase and polyploidy. Super contracted chromosomes were eminent after treatment with the chemicals used.

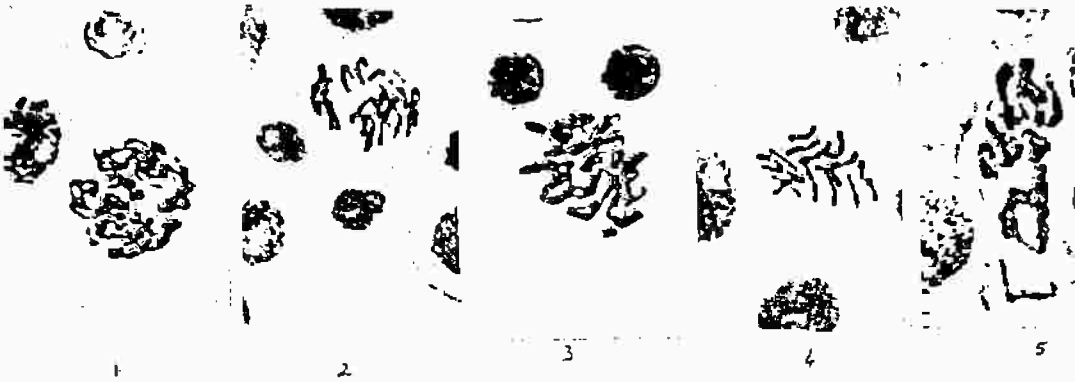

Fig I abnormal prophase (3% D M F)

Fig 2 prophase metaphase (5% D M A C)

Fig 3,4 and 5 Disturbed metaphase (3% DMSO nad DMAC)

Fig 6 Somatic reduciton (5 and 7% D M F)

Fig 7,8 and 9 multipolar spindles (5 and 7% D M F)

Fig IO polyploid metaphase (3% D M A C)

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Fig 11 Surpassing chromosomes 5% D M F

12 Lagging chromosome and bridge 5% D M F

13 Multibridged anaphase. 5% D M S O

14 C-metaphase 1% D M S O

15 C-anaphase 3% D M F

16 Contracted metphase chromosomes (3% D M S)

17 Micro-nuclei. (1% D M S)

18 Binucleate cell (5% D M F)

Mitotic index and percentage of mitotic phases in treated Allium cepa roots

Agents	Total No of Div. cells	Prophase		Metaphase		Ana-telophase		M.I. ‰
		No	%	No	%	No	%	
Control	650	302	46.46	126	19.38	222	34.15	65
D M F								
1%	570	132	23.16	154	27.01	284	49.82	57
3%	518	206	39.76	106	20.46	206	39.76	51.8
5%	580	218	37.58	110	18.96	252	43.44	58
7%	490	208	42.44	112	22.85	170	34.69	49
D M A C								
1%	564	296	52.48	128	24.82	140	24.82	56.4
3%	434	184	42.39	98	22.58	152	35.02	43.4
5%	424	250	58.96	70	16.5	104	24.5	42.4
7%	420	206	49.04	74	17.61	140	33.33	42
D M S O								
1%	680	280	41.17	76	11.17	234	34.41	68
3%	604	208	34.43	168	27.81	228	37.74	60.4
5%	462	170	36.79	120	25.92	178	37.22	46.2
7%	430	184	42.79	70	16.27	176	40.93	43

Table 2

Total percentage of abnormalities and percentage of abnormalities in each phase

Agents	NO of abn. cells	% of abn. cells	Prophase		Metaphase		Ana-telophase	
			NO abn. cells	abn. % cells	NO abn. cells	abn. % cells	NO abn. cells	abn. % cells
Control	20	3.07						
D E F								
I %	52	9.I2	-	-	38	73.07	I4	26.92
3 %	76	I3.5I	I0a	I4.28	40	57.I4	20	28.57
5 %	I86	32.06	4	2.I5	90	48.38	92	49.46
7 %	I92	39.I8	I8	9.37	I00	52.08	74	38.54
D A C								
I %	72	I2.76	8	II.II	46	63.88	I8	25
3 %	66	I5.2	2	3.03	52	78.78	I2	I8.I8
5 %	II8	27.63	52	44.06	62	52.54	4	3.38
7 %	I06	25.23	I8	I6.98	58	54.7I	30	28.30
D M S O								
I %	44	6.47	-	-	28	63.6	I6	36.36
3 %	86	I4.23	I2	I3.95	52	60.46	22	25.58
5 %	80	I6.6I	20	23.25	38	47.78	28	32.55
7 %	I20	27.90	6	5.0	50	4I.66	64	53.33

Percentages of the different abnormalities in treated Allium cepa roots

Agents	Dist.	Lag.	Brid.	c.m.	c. anap	Polyploidy
D M F						
1%	26.92	19.23	11.53	42.3	-	-
3%	88.57	2.85	-	-	8.57	-
5%	87.09	7.52	1.07	-	4.3	-
7%	82.29	9.34	-	-	8.33	-
D M A C						
1%	83.33	-	-	5.55	-	11.11
3%	86.11	2.7	-	-	-	2.7
5%	98.36	1.69	-	-	-	-
7%	92.45	7.5	-	-	-	-
D M S O						
1%	68.18	9.09	9.09	13.63	-	-
3%	81.39	4.65	2.32	11.62	-	-
5%	81.39	6.97	11.62	-	-	-
7%	78.33	13.33	8.33	-	-	-

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التأثيرات السيتولوجية لثنائى ميثيل فورماميد وثنائى ميثيل اسيتاميد وثنائى ميثيل سلفوكسيد على جذور نبات البصل

أمـــال شهـــاب

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درس تأثير ثنائى ميثيل فورماميد وثنائى ميثيل اسيتاميد وثنائى ميثيل سلفوكسيد على الانقســـام الغير مباشر لجذور البصل •

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