



Cytotoxic Effects of *Raphanus Sativus* Root Extract on Root Meristem of *Allium Cepa*

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ABSTRACT

The cytotoxic effects of radish root were investigated on meristematic cells of *A. cepa* roots. Actively growing root tips of *A. cepa* were treated with five concentrations (100%, 75%, 50%, 25% and 10%) of the root extract for 2, 4 and 6 hours respectively. The results showed that the root extract induced various types of nuclear and chromosomal abnormalities such as binucleate cells, nuclear disintegration, scattered metaphases, chromatid separation, stickiness of chromosomes, bridge formation, chromosomal condensation and polarity abolition. It was recorded that radish root extract not only disturbed mitotic activity but also showed considerable impact on chromosomal behavior.

KEY WORDS: Cytotoxic, *Raphanus sativus*, chromosomal abnormalities.

INTRODUCTION

Raphanus sativus root is a widely consumed vegetable. The roots of this plant are chiefly used as salad, pickle and curry. Although several plant extracts have been tested in relations to their mutagenicity and cytotoxicity such as spinach and beet root (Kato, 1957); *Allium fistulosum* (Kato, 1960); ginger (Nakamura and Yamamoto, 1982); garlic, turmeric and asafoetida (Abraham and Kesavan, 1984); onion (Kaushik and Yadav, 1993); tomato (Yadav *et.al.* 2001) and *Hibiscus rosa-sinensis* (Ali, 2010) but the cytotoxic effect of radish root extract has not so far been tested.

MATERIAL AND METHOD

Fresh radish roots were washed thoroughly, cut into pieces and transferred into electric juicer and after filtration, extract was prepared. Different concentrations were prepared by dilution of root extract with distilled water.

Allium cepa was taken as test material. The bulbs of plant were grown in a plastic tray containing sterile moist soil. When secondary roots developed, the bulbs were transferred to cups containing 100%, 75%, 50%, 25% and 10% of the radish root extract. The treatment of each concentration was given to the roots for the time period of 2, 4 and 6 hours. All the treatments were carried out at 22-25°C. After each treatment root tips were excised and fixed in Acetic-Alcohol (1:3) for at least 24 hours and then transferred to 70% alcohol for preservation. The root tips had been hydrolyzed by 1N HCl for 3 minutes and squashed in 2% acetocarmine for cytological studies. The slides were temporarily sealed, examined and micro photographed. Mitotic index had been calculated using the method of Mousa (1982). Chromosomal aberrations and their percentage in each concentration and duration were also recorded.

TABLE-I, MITOTIC INDEX, FREQUENCY OF ABERRATIONS AND THEIR PERCENTAGE AS INDUCED

BY *Raphanus sativus* ROOT EXTRACT IN *Allium cepa* (2n=16)

Concentration	10%						25%						50%						75%						100%					
	2		4		6		2		4		6		2		4		6		2		4		6		2		4		6	
	% of abr. (Conc. Wise)						% of abr. (Conc. Wise)						% of abr. (Conc. Wise)						% of abr. (Conc. Wise)						% of abr. (Conc. Wise)					
Duration (in hours)	14.2		13.3		12.8		13		12.9		11.6		12.2		11.9		10.8		11.7		11.6		10.5		11.3		11		10.2	
Mitotic Index (in %)	14.2		13.3		12.8		13		12.9		11.6		12.2		11.9		10.8		11.7		11.6		10.5		11.3		11		10.2	
Types of aberrations																														
B.N.	-	-	B.N.	0.30	-	B.N.	0.58	B.N.	B.N.	B.N.	B.N.	1.22	B.N.	B.N.	B.N.	B.N.	B.N.	1.40	B.N.	B.N.	B.N.	B.N.	B.N.	B.N.	B.N.	B.N.	B.N.	B.N.	1.74	
N.D.	-	-	N.D.	0.15	-	N.D.	0.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.24	
Con. 'p'	Con.	'p'	Con.	3.57	'p'	Con.	3.50	'p'	Con.	Con.	Con.	7.01	'p'	'p'	Con.	Con.	Con.	5.26	'p'	'p'	Con.	Con.	Con.	Con.	'p'	'p'	'p'	7.81		
C.S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.33	-	-	C.S.	C.S.	C.S.	C.S.	C.S.	C.S.	C.S.	7.14	
Sc. 'M'	Sc.	Sc.	Sc.	27.14	'M'	Sc.	26.91	'M'	Sc.	Sc.	Sc.	34.30	'M'	'M'	Sc.	Sc.	Sc.	36.66	'M'	'M'	Sc.	Sc.	Sc.	Sc.	'M'	'M'	'M'	39.57		
St. 'M'	St.	'M'	St.	12.85	'M'	St.	24.42	'M'	St.	St.	St.	26.56	'M'	'M'	St.	St.	St.	40	'M'	'M'	St.	St.	St.	St.	'M'	'M'	'M'	40.14		
P.A.	P.A.	-	-	33.00	-	-	-	-	P.A.	-	-	0.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bri. 'T'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Bri.	T'	-	-	2.50	

Abbreviations---B.N. = Binucleate Cells, N.D. = Nuclear Disintegration, Con 'p' = Condensation at Prophase, C.S. = Chromatid Separation, Sc. 'M' = Scattered Metaphase, St. 'M' = Stickiness at Metaphase, P.A. = Polarity Abolition, Bri. 'T' = Bridge at Telophase.

RESULTS AND DISCUSSION

The results of radish treatment on the root meristematic cells of *A. cepa* are given in Table I. Mitotic index was significantly retarded as the concentration of root extract was increased and

the duration of treatment prolonged. The mitotic index in controlled sets maintained in distilled water was 17.25% which decreased to 14.15% in 10% concentration when root tips were exposed to root extract for 2 hours duration. But when root

tips were treated with 100% concentration for 6 hours, the value of MI dropped to 10.24%. The data indicates that the radish root extract is mitodepressive.

At interphase, aberrant cells showed binucleate condition and nuclear disintegration. Nuclear disintegration was observed only in 10%, 25%, and 100% concentrations whereas binucleate cells were found frequently in all the concentrations and their percentage increased with an increase in concentration of root extract.

At prophase, all the concentrations in long duration treatments resulted in condensation of chromosomes. Chromosomal condensation was also reported by Yadav *et.al.*(2001), in root tips of *A. cepa* when treated with tomato fruit extract.

The most prominent types of abnormalities at metaphase were stickiness and scattered metaphases. The percentage of each abnormality was increased with an increase in concentrations. Stickiness have been attributed to an action on the proteins of chromosomes (EL-Sadek, 1972). Only treatments of 75% and 100% of aqueous solution of radish root extract with the treatments duration of 4 to 6 hours were found to be able to cause chromatid separation at metaphase.

The aqueous solution of root extract possibly acted as stathmokinetic agent, so reduced the number of anaphases and telophases, since it affected on spindle (Shehab, A.S. 1979). Being stathmokinetic in nature, the root extract caused most of the abnormalities at metaphase. At anaphase polarity abolition was observed only in 50% concentration. At telophase, bridges were observed only in 100% concentration.

The root of radish (*Raphanus sativus*) is used excessively in salad and preparation of various types of edibles. The characteristic pungent flavour of radish is due to the presence of volatile isothiocyanates. Kassie *et.al* (1996) observed the genotoxicity of 8 cruciferous vegetables and concluded that 70%-80% of the total genotoxicity of the vegetables juices is due to the isothiocyanates and other breakdown products of glucosinolates. They also concluded that

cruciferous vegetables contain DNA damaging constituents.

It is clear from the experimental observations that radish root extract induced various types of chromosomal abnormalities. It has been pointed out by number of workers that chromosomal aberrations serve as elegant indicator of mutation. Therefore it is essential that vegetable should be evaluated for possible cellular damage in other systems also.

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