J. Phytol. Res. 2(1), 1989

ANTIMITOTIC AND RADIOMEMATIC NATURE OF *LATHYRUS SATIVUS* SEED EXTRACT

K. PRASAD and T. PRASAD*
Department of Botany, College of Science, Sukhadia University, Udaipur-313001, India.
*Department of Botany, Government Meera Girl's College, Udaipur-313001, India.

The onion roots were exposed to different concentrations of water soluble seed extract of *Lathyrus sativus* (Fabaceae) for varying growth periods. The mitotic study was carried out through root squash method. The normal mitotic index and per cent abnormalities were calculated. The mitotic index fell down with the gradually increasing concentrations of the seed extract. The roots exposed to lower concentrations of the seed extract showed several mitotic abnormalities viz., (i) disturbed metaphase and anaphase with an unusual spread of the chromosomes, (ii) multipolar spindles, (iii) delayed or suppressed cytokinesis which generally allowed formation of bi-, or rarely trinucleated cells, (iv) anaphasic and telophasic bridges and (v) chromosomal stickiness and clumping which ultimately formed dumble-shaped, tetraploid nucleus. The observed mitotic index and percentage of cell division were suggestive of a radiomematic and antimitotic nature of *Lathyrus sativus* seed extract.

Keywords : *Lathyrus sativus;* Seed Extract; Antimitotic; Radiomematic.

Introduction

Lathyrus sativus commonly known as "Khesari" or Lakh or Teora is an important pulse crop of Fabaceae and has been under cultivation in Asian and African countries since times immemorial. Further, *Lathyrus sativus* seeds are also known to cause paralysis in the human beings. The toxicity is often refered as neurolathyrism. Biochemical and physiological studies carried out, to pin down the toxicity, have lead to phytales, free amino acids or high selanium content of the seed (Kumar and Dahiya, 1976). In the present study, the effect of *Lathyrus sativus* water soluble seed extract on mitosis in roots of *Allium cepa* was looked into for varying period of time.

Material and Method

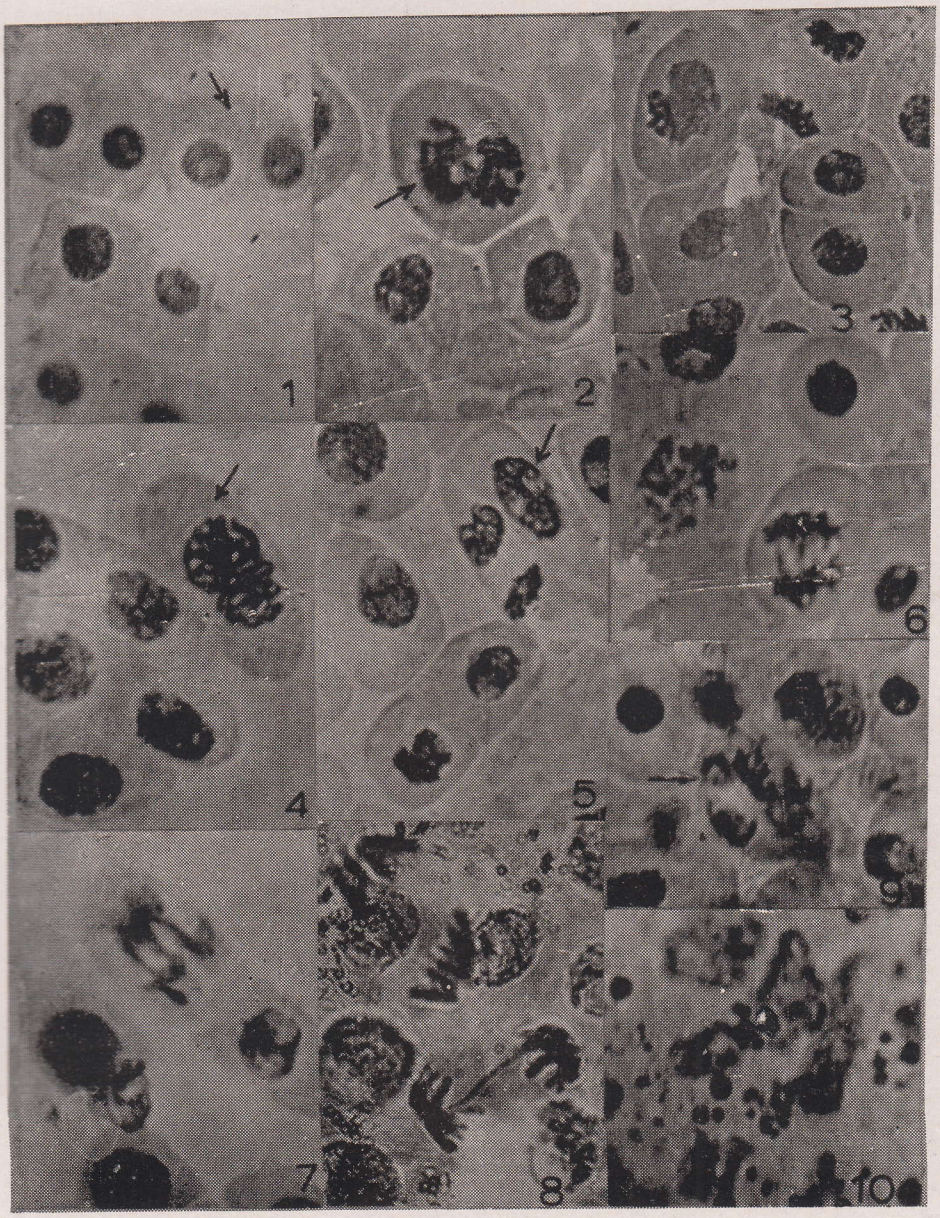
Certified *Lathyrus sativus* seeds were supplied by Directorate of Agriculture, Udaipur. The water soluble extract was obtained by soaking 50 gram of seeds in 100 ml of glass distilled water. The clear filtrate served as stock solution of 50 per cent concentration. Various dilutions i.e., 1, 5,

10, 20 and 50 per cent, were prepared by adding required quantities of distilled water The dilutions were selected after determining lethal and subthreshold concentrations. Roots of *Allium cepa* were exposed to the test solutions for varying period of times, ranging from 24 to 72 hours and in some cases upto a week. At the end of the desired intervals, the roots were taken out, washed, cut and fixed in Carnoy's solution (1:3:6). The material was examined by aceto-carmine-squash method.

Result and discussion

The effects of different concentrations of the aqueous *Lathyrus sativus* seed extract on mitotic index of *Allium cepa* are depicted in Table 1. The data corroborate antimitotic properties of the extract. For control, the mitotic index was 6.76. It declined with increase in the concentration of the extract and/or duration of treatments. Associated with the division, several chromosomal anomalies were also observed. At one per cent concentration, delayed cytokinesis chrosome-stickiness and clumping were evident. The suppression of cytokinesis was, however, significant at 5 and 10 per cent concentrations. This abnormal behaviour invariably led to the formation of binucleate or occassionally trinucleate cells (Fig. 1). In addition, chromosomal non separation coupled with the clumping and marked condensation was also of much significance (Fig. 7). The nonseparation of the chromosomes as the *modus operandii* of mitotic inhibition is well documented and therefore its observation in the present investigation is of much significance. Due to the stickiness of certain arms of the separating chrosomes or by the union of broken end of the nonsister chromatids, anaphasic and telophasic bridges were also observed at 5, 10 and 20 per cent concentrations (Table 1; Figs. 6–8). Very often, a nuclear membrane developed around the non-separated chromosomes (Figs. 2–4) and formed a dumbell-shaped, tetraploid nucleus at the median position (Figs. 4, 5). The percentage of the tetraploid cells was quite appreciable at 10 and 20 per cent concentrations (Table 1) of the extract. Such a behaviour could be attributed to the failure of spindle formation due to inhibition in spindle protein systhesis. More or less similar abnormal behaviour of chromosomes was observed in barley with maleic hydrazide(Mann *et al.*, 1974) *Vicia faba*, *Gossypium barbadense* treated with certain insecticides (Amer and Farah, 1974) and *Allium cepa* exposed to bracken toxin (Prasad *et al.*, 1976). The observed chromosomal anomalies affected by *Lathyrus* seed extract undoubtedly suggest its radiomematic mode of action.

The other but comparatively less frequent abnormalities caused by *Lathyrus sativus* seed exract were (i)



Figs. 1–10 : The onion root cells showing effects of water soluble seed extract of *Lathyrus sativus*.

Table 1. Mitotic index and percentage of abnormalities in onion as affected by root treatments with various concentrations of *Lathyrus sativus* aqueous seed extract.

Treatment Conc. %	Time (hour)	Mitotic index	Abnormal mitosis %	Percentage of different type of abnormalities				Polyploid cells
				Delayed cytokiness	Stickiness clumping	Non separation		
						Anaphasic bridge	Telophasic bridge	
	24	6.78	Nil	—	—	—	—	—
Control	48	6 63	Nil	—	—	—	—	—
	72	6.61	Nil	—	—	—	—	—
	24	6.23	0.32	78	22	—	—	—
1	48	6.60	0.41	62	38	—	—	—
	72	5 98	0.76	74	24	2	—	—
	24	5.48	1.04	68	26	4	2	—
5	48	5.00	1.16	69	25	5	1	—
	72	4.94	1.60	63	33	1	3	—
	24	5 68	1.83	43	34	12	8	3
10	48	4.76	1.92	48	36	10	4	2
	72	3 92	2.06	44	46	7	3	—
	24	3 30	1.63	38	56	3	1	2
20	48	2.24	0.98	40	58	1	—	1
	72	1.57	0 86	34	64	—	—	2
	24	1.42	0 44	42	58	—	—	—
50	48	0.86	0 35	32	68	—	—	—
	72	Nil	Nil	—	—	—	—	—

the multipolar anaphasic apparatus (Fig. 9) which are also described in *Secale cereale* and *Allium cepa* when treated with isopropylphenyl carbamate (Doxey, 1949), (ii) unusual spread of chromosomes all over the cell cytoplasm probably as a consequence of perturbations of events during metaphase and the anaphase. Kabarity (1966), Amer *et al.* (1971), Amer and Farah (1974) and Prasad *et al.* (1976) correlated such abnormalities with the malfunctioning of the spindle apparatus. The constituents of *Lathyrus sativus* seed extract probably bind the protein that constituents the microtubules of the spindles and acted as a mitostatic agent like that of colchicine, colcemid, podophyllin, vincristine etc. (Snyder, 1976).

Exposure of *Allium cepa* roots to higher concentrations of the extract viz., 20 and 50 per cent invariably led to the suppression of mitosis, nuclear deformity, cytoplasmic shrinkage and eventual death of the cell (Fig. 10). An identical behaviour was recorded with 5 and 10 percent concentrations of the extract as well but after prolonged treatment.

Accepted March, 1989

References

Amer S M, Hammonda M A and Farah O R 1971, *Flora* **160** 433

Amer S M and Farah O R 1974, *Cytologia*, **30** 507

Doxey D 1949, *Ann. Bot.* **13** 329

Kabarity A 1966, *Bitr. Biol. Pflanzen.* **42** 317

Kumar J and Dahiya B S 1976, *Sci. Report.* **13** 51

Mann S K, Ved Brat S and Sushil Mhach 1974, *Acta Botanica Indica* 2 44

Prasad K, Shrimal S K and Prasad T 1976, *Ind J. Exptl. Biol.* **14** 523

Snyder A J 1976, *Ann. Rev. Biochem.* **45** 699