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Comparative study of chromosomal aberration by fungicide (Thiram) and biopesticide (*Pongamia pinnata)* on *Vicia faba* L.

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Abstract

The present investigation provides a chromosomal aberration and developmental effects of thiram and *Pongamia pinnata.* Plant showed varying degree of miotic abnormalities. Increased application of agrochemicals for the protection of crop plants against the disease. Thiram is a protective fungicide used as a foliar treatment on fruits vegetables and ornamental to control Botrytis species, rust, scab and storage disease and as seed treatment to control seedling heights.

Fungicide induced miotic irregularities like precautious separation, Non-orientation, Stickiness and Univalents in metaphase and chromosomal bridges, laggards micronucleus and multipolarity in anaphase in meiosis 1st and 2nd.

Keywords: Seeds of *Vicia faba*, thiram, leaf extract of *Pongamia pinnata*.

Introduction

Vicia faba (family Fabaceae, 2n=12) commonly known as broad bean is an important crop used as vegetable, silage, forage and stock feed. Since the genotype Vicia faba L. is homozygous because of often self pollination, therefore there is need to create variation to facilitate genetic improvement.

Thiram belongs to the ethylene bisdithiocorbamate (EBDC) chemical class. The EBDCs are fungicides used to prevent crop damage. Pongamia pinnata during hyperammonemice conditions, which may also play a crucial role in disease development. Insecticidal properties of Pongamia leaf extracts can be attributed to Karanjin (3-methoxy furan-2,3,7,8-flavone) and Pongapin [2-(1,3 Benzodioxol-5-yl)-3 methoxy, -4H-furo(2,3,h)-1-benzopyran 4-one] and these are the major flavonoids in pongan (Asolkar et;al.1992, Katekhaye et;al.2012). Each of karanjin and Pongapin has been shown to possess pesticidal properties (Kumar et; al.2006, Verma et; al.2011).

Because Pongam contains both flavonoids, there may be a significant synergistic effect that enhances the toxicity of Pongam (Poonia and Kausik 2013).

Material and Method

The fungicide thiram belongs to the ethylene bisdithiocorbamate (EBDC) chemical class. The EBDCs are fungicides used to prevent crop damage in the field and to protect harvested crops from deterioration in storage and transport. The leaf extract of *Pongamia pinnata* are used because of their insecticidal properties.

Locally brought seeds were cleaned by 0.5% sodium hypochloride solution for 5 minutes, thoroughly washed and soaked in tap water for 10 hrs. Seed coats were removed gently and seeds were sprayed in petri dishes containing cotton beds moistened with test concentrations (100,250,500 and 750 ppm). For each concentration, three sets were used, and each petri dish had 25 seeds. A set of 25 seeds was treated with tap water containing 0.25% DMSO for negative control. *Vicia faba* cytogenetic assay was carried out as described by Kanaya et; al. (1994). For cytological studies of root meristem fixation, staining and scoring of aberrations were carried out. The seeds were left in petri dishes for germination. After 4 days when the primary roots were 3-4 cm, their tips were cut to facilitate lateral roots. When the lateral root becomes 1-2cm. seedlings were exposed to test concentrations (100,250,500 and 750 ppm). Three sets of seeds were employed. One set was exposed for 2h, another one for 4h where as last one for 6h. The collected root tips were washed thoroughly and fixed in Carnoy's (6 ethyl alcohol: 3 chloroform: 1acetic acid) for overnight and then preserved in 70% alcohol at 4°C.

Mitotic index (M_1) and chromosomal aberration (CA's) in mitotic cells frequency were scored from the slide observation. Treatment of fungicide thiram inhibited the mitotic index does dependently. Decline of M_1 was more prevalent in fungicide treated cells of 6h exposure at higher concentration (500 and 750 ppm). The higher concentration (750 ppm) of fungicide thiram significantly ($P<0.05$) affect the mitotic index after 4h and 6h. The plant extract of Pongamia pinnata inhibited the mitotic index. Pongamia pinnata significantly affect the mitotic index at higher concentration. Pongamia pinnata decreases the mitotic index significantly ($P<0.05$) and inhibits the mitotic index at 500 ppm at 6h exposure. It has no pronounced effect on lower concentrations at any exposure. Mitotic index was very low at higher concentration of all presoaking duration in comparison to mitotic index in control cell.

Result and Discussion

As a result, treatment of *Vicia faba* seeds with fungicide thiram and biopesticide *Pongamia pinnata* showed varying degree of meiotic abnormalities. Meiotic abnormalities increase with increase in the concentration of fungicide and it also depend on the dose. Fungicide induced meiotic irregularities like precautious separation, Non-orientation, Stickiness and Univalent in metaphase and chromosomal bridges, laggards micronucleus and multipolarity in anaphase in meiosis 1st and 2nd PMCS of barley with tripolar arrangement of chromosome. Mean percentage of chromosomal abnormalities in faba bean plant show in given table. Table showed the effect of thiram and biopesticide Pongamia pinnata on the mitotic cells of Vicia faba and the types and the

frequencies of chromosomal aberration induced at 2h,4h and 6h duration of exposure at the higher concentrations (500 and 750 ppm) at 6h duration.

Table 1.Chromosomal aberrations in *Vicia faba L.*root meristemcells exposed to various concentrations of fungicide Thiram.

Test Plant and Concentrations (ppm)	Chromosomal Aberrations						
	Exposure period	Breaks	Stickiness	Laggards	Chromosome Bridge	Micronucleus	Total Aberrations[a]
Control	2	ND	0.18	ND	ND	ND	0.18
	4	ND	ND	ND	0.08	ND	0.08
	6	ND	ND	ND	ND	ND	ND
Thiram							
100	2	0.25	ND	0.21	0.16	ND	0.62
	4	0.92	0.63	0.81	0.65	ND	3.01
	6	1.35	0.85	1.05	0.93	ND	4.18
250	2	0.67	0.54	1.21	0.84	0.13	3.39
	4	1.38	0.87	1.65	1.39	0.35	5.64
	6	1.81	1.37	2.14	1.92	0.51	7.75
500	2	1.04	1.12	1.09	1.41	0.90	5.56
	4	1.61	1.51	1.85	2.05	1.25	8.27
	6	1.95	2.34	2.46	2.36	1.41	10.52
750	2	1.35	1.26	1.35	2.14	1.85	7.95
	4	2.49	2.85	2.83	2.61	1.82	12.60*
	6	3.75	4.16	3.65	4.51	1.96	18.03**

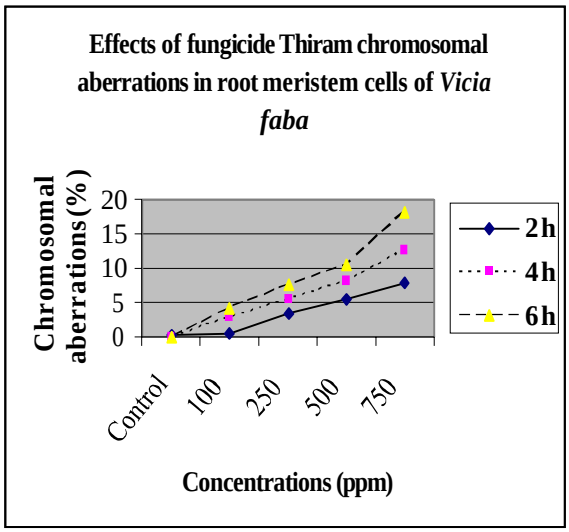
ND = Not Detected; Significant level calculated by New Duncan's multiple tests

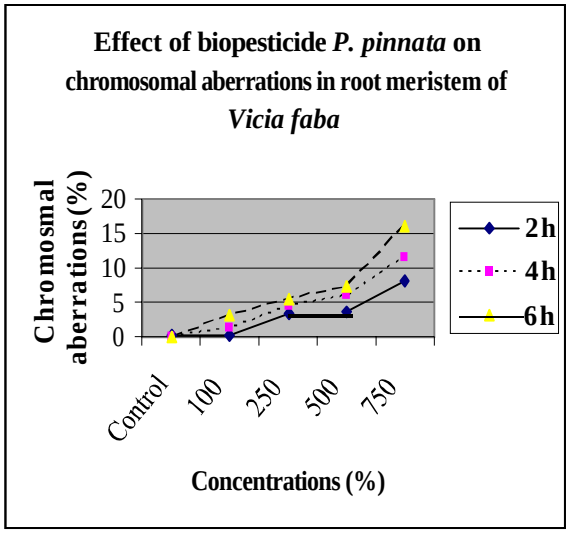
[a]Data present in percent (%); *p < 0.05 **p < 0.01

Table 2.Chromosomal aberrations in *Vicia faba L.*root meristemcells exposed to various concentrations of *Pongamia pinnata*

Test Plant and Concentrations (ppm)	Chromosomal Aberrations						
	Exposure period	Breaks	Stickiness	Laggards	Chromosome Bridge	Micronucleus	Total Aberrations[a]
Control	2	ND	0.18	ND	ND	ND	0.18
	4	ND	ND	ND	0.08	ND	0.08
	6	ND	ND	ND	ND	ND	ND
Pongamia pinnata							
100	2	ND	0.18	ND	0.21	ND	0.39
	4	0.15	0.31	0.24	0.51	0.12	1.33
	6	0.92	0.75	0.59	0.67	0.22	3.15
250	2	0.68	0.54	0.83	1.04	0.31	3.40
	4	1.05	1.12	1.31	0.87	0.25	4.60
	6	1.32	1.09	2.05	0.56	0.45	5.47
500	2	0.85	0.63	0.73	1.03	0.37	3.61
	4	1.14	1.21	1.65	1.31	0.62	5.93
	6	1.06	1.89	1.31	2.19	0.91	7.36
750	2	1.12	1.46	1.87	2.36	1.25	8.06
	4	2.31	2.85	3.14	1.85	1.51	11.06*
	6	3.65	4.81	2.42	3.26	1.96	16.10**

ND = Not Detected; Significant level calculated by New Duncan's multiple tests
[a]Data present in percent (%); *p < 0.05 **p < 0.01





References

1. Patil, T.M. and Shirashyad, V.S. (Effect of methyl parathion and phosphamidon on mitotic chromosomal aberration in some vegetable seeds. Z. Environ.Biol.12(3):249-254.
2. Mustafa, M., Essa, M., Subramanian, P. (2007). Effects of Pongamia pinnata on Lipid Peroxidation Products and Antioxidants in Hyperammonemic Rats: with Reference to Circadian Variations Iranian J. Pharmacol. Therap 62:119-123.
3. Njagi, G.D., Gopalan, H.N. B. (1982). Cytogenetic effects of the food preservatives-sodium benzoate and sodium sulphite on Vicia faba L. root meristem. Mutat.Res. 102:213-219.
4. Mann, K. (1977). Enhancement of chromosomal aberrations and growth inhibition by maleic hydrazide when in dimethyl sulfoxide. Curr. Sei. 46:83-84.
5. Sharma, R.L. 2006. Efficacy of fungicide impregnated paper liners against storage rot of tomato fruit. Journal of Mycology and Plant Pathology, 26:310-311.
6. Mc Gill, M., Pathak, S., and Hsu, T.C., (1974). Effects of Ethidium Bromide on mitosis and chromosome. A possible material basis for chromosome stickiness. Chromosoma 47:157.
7. Randall, S. C. Li, Y.Z. Liang, G.H. (1996). Cytological and morphological effects ofatrazine and propazine application on grain sorghum. Cytologia 61:359-363.
8. Nikam, P.S., Jagtap, G.P. and Sontakke, P.L. 2007. Management of chickpea wilt caused by F. oxysporium f. sp.ciceris. African Journal of Agricultural Research, 2:692-697.
9. Singh, RM, Singh, AK, Singh, RB, Singh, J. (1980). Chlorophyll Mutation induced by seed treatment with certain Insecticides in Barley (Hordeum vulgare). Indian. J. Exp. Biol.18:1396-1397.
10. Yi, H., Meng, Z. (2003). Genotoxicity of hydrated Sulphur dioxide on root tips of Allium sativum and Vicia faba L. Mutat. Res. 537:109-114.
11. Yuzbasioglu, D. (2003). Cytogenetic effects of fungicide afugan on the meristematic cells of Allium cepa L. Cytologia 68(3):237-243.

