SYSTEMIC FUNGICIDES AS PRETREATMENT CHEMICALS FOR ROOT MERISTEM SQUASHES

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The importance of arresting mitotic metaphases for studying the morphology of chromosomes is well known. The chemical agents causing such an arresting effect are considerable in number and variety[1-2] In the course of our studies on the genetic toxicology of pesticides, certain fungicides have exhibited properties to arrest metaphases and to condense and spread chromosomes in some plant systems.

The systems employed are the primary root meristems of *Allium cepa*, *Allium sativum* and the secondary root meristems of *Vicia faba* and *Pisum sativum*. The fungicides tested are all systemic in nature[3]. One of them is a Diazosulfonate compound, five are Benzimidazoles and two are Oxathin derivatives. Also included is another compound, Dimethyl pherylene diamine (DMPDA), a metabolite of Dexon[4]. The nomenclature of the fungicides and the concentrations tested are given in Table I.

Young and healthy root meristems from germinating bulbs/seeds are kept in aqueous solutions of varying strength, *i.e.*, 10–2000 ppm (Table I) of the test compounds, for 1, 2, 3 and 4 hours followed by fixation in acetic alcohol (1 : 3). The meristems are feulgen-stained and squashed by conventional methods[5].

Satisfactory chromosome spreads (Fig. 1) are obtained in all the test systems after pretreating them in different concentrations for 1-4 hours. The effective

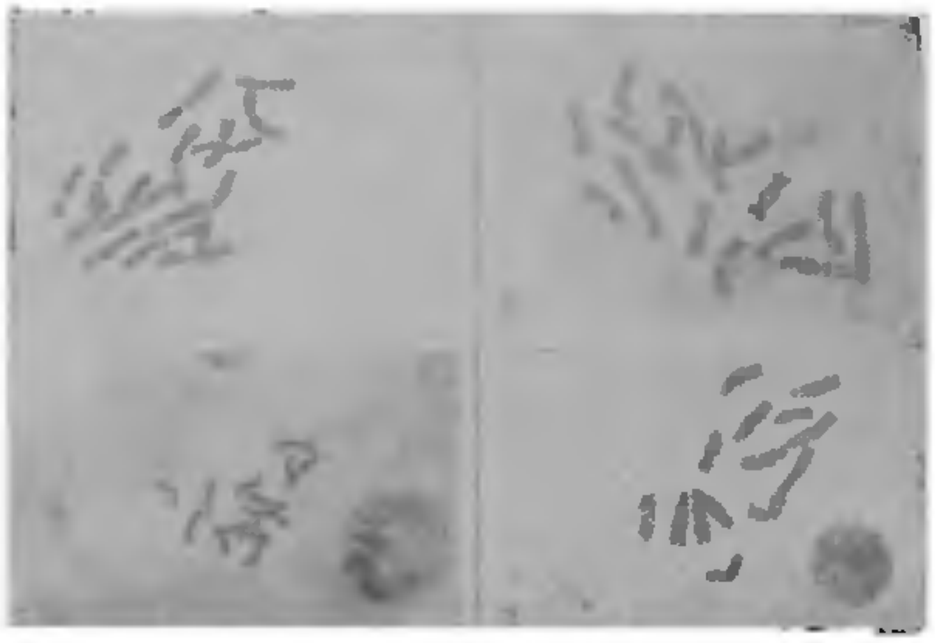

Fig. 1. Chromosome speads of (*a*) *Allium cepa*; (*b*) *A. sativum*; (*c*) *Pisum sativum*; and (*d*) *Vicia faba* facilitated by fungicide treatments (× 1,200).

Table I

Test fungicides and their effective concentrations in arresting metaphases

Common name	Trade name	Chemical name	Concentrations tested (ppm)	Effective strengths in ppm (moles/ml)
Dexon	Dexon	P (Dimethyl amino benzene-diazo sodium sulfonate	25–1000	250 (10×10^{-7})
DMPDA	..	N.N. dimethyl-*p*-phenylene diamine	25–1000	250 (18×10^{-7})
Benomyl	Benlate	Methyl-1 (Butyl carbanoyl)-2-benzimidazole carbamate	10–250	25 (1×10^{-7})
Carbendazim	Bavistin	Methyl-2-benzimidazole carbamate	100–2500	2000 (10×10^{-7})
Thiophanate-methyl	Mildothane Cercobin-M	1, 2, bis (3-methoxy-carbonyl-2-thioureido) benzene thiophanate methyl	25–1000	100 (3×10^{-7})
Thiabendazole	Tecto	2 (4-Thiazolyl) benzimidazole	25–1000	100 (25×10^{-7})
Fuberidazole	Veronit	2 (2-Furyl) benzimidazole	25–1000	500 (5×10^{-7})
Carboxin	Vitavax	2, 3-dihydro-6-methyl-5-phenyl carbamoyl, 1, 4-oxathiin	25–1000	250 (10×10^{-7})
Oxycarboxin	Plantvax	2, 3-dihydro-6-methyl-5-phenyl carbamoyl, 1, 4-oxathiin 4, 4-dioxide	25–1000	500 (19×10^{-7})
Colchicine				100 (26×10^{-7})

concentrations, where at least 50% of the metaphases are arrested, are presented in Table I. Benomyl has its effective strength at as low as 25 ppm while Carbendazim, to produce similar effects, required a strength of as high as 2000 ppm. Effective concentrations of other test compounds lie in between these two extremes. Meristems of *P. sativum* and *A. sativum* require a longer period of treatment (3 hr) than those of *A. cepa* and *V. faba* (2 hr). If these periods are increased, *i.e.*, up to 4 hours in the present study, chromosomes tend to condense more in case of the optimum concentration (Table I), and clump up gradually as the concentrations are raised. Thus there appears a slight differential response to treatment period depending upon the concentration. However, a duration of 1–3 hr appears to be the minimum required for metaphase arrest even if the concentrations are very high.

All these fungicides are respiratory inhibitors in their target systems[3]. Therefore it is felt that spindle dysfunction in the meristems also, resulting in metaphase arrest, has been caused by a cellular deprivation of energy by the test fungicides, as reported with most respiratory inhibitors[6]. Furthermore, since no tetraploidy has been noticed in the meristems recovered from any of the fungicide treatment, the mechanism of action may not involve affinity to the tubulin protein in spite of similarity between the active groups of Colchicine and the Benzimidazole test compounds[7–8]. Notwithstanding this difference from colchicine, it is believed that systemic fungicides offer a very inexpensive tool for routine chromosome analysis.

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1. Sharma, A. K. and Sharma, A., *Chromosome Techniques—Theory and Practice.*, Butterworths, London, 1972, pp. 575.
2. Sharma, C. B. S. R. and Dash, S. K., *Beitr. Biol. Pflanzen.*, 1977, **53**, 212.
3. Erwin, D. C., *Annu. Rev. Phytopathol.*, 1973, **11**, 389.
4. Karanth, N. G. K., Bhat, S. C., Vaidyanathan, C. S. and Vasantarajan, V. N., *Appl. Microbiol.*, 1974, **27**, 43.
5. Darlington, C. D. and La Cour, L. E., *The Handling of Chromosomes* (6th edn.), Allen and Unwin, London, 1976, pp. 201.
6. Wilson, G. B., *Chromosoma (Berl.)*, 1965, **16**, 133.
7. Davidse, L. C., *Pest Biochem. Physiol.*, 1973, **3**, 317.
8. Seiler, J. P., *Mutat Res.*, 1976, **40**, 339.

A NEW SPECIES OF *CENTRATHERUM* CASS. (COMPOSITAE) FROM SOUTH INDIA

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Centratherum sengaltherianum B. M. Narayana sp. nov.

Centratherum rangacharii Gamble, affine, a quo autem notis differt sequentibus : capitula 9–10 mm longa et 5–7 mm in diametro; flores 45–72 in capitulo; foliolis bracteis subvectum capitulum saepius singulare, lanceolatum, villosum; exteriores bracteae involucrales, obovatae, hirsutae, acuminatae; mediae bracteae ellipticales cum scariosa basi; interiores bracteae lineares, scariosaeque. Typus : India BMN 175 A-D (Holotypus, CAL; isotypi, K).

Affinity to *Centratherum rangacharii* Gamble, but differing from it in the following characters : Capitula 9–10 mm long and 5–7 mm in diameter; florets 45–72 per capitulum; foliar bracts subtending the capitulum usually single, lanceolate, villous; outer involucral bracts obovate, hirsute, acuminate; middle bracts elliptical with scarious base; inner ones linear, scarious.

Erect, stunted, perennial (?) herb with spreading branches. Stem terete, inconspicuously ribbed, villous by dark purple hairs. Leaves alternate, elliptical at the base and elliptic-lanceolate at the apical region; petiole 3–5 mm long, upper leaves sessile; lamina hirsute, acuminate, cuneate with sharply serrate margin, 4·5–9 cm long and 1·5–3·8 cm wide, white tomentose on the lower surface. Capitula solitary, globose, axillary or terminal, pedunculate (peduncles thin, short or long, tomentose), 5–7 mm in diameter, subtended usually by a single leafy lanceolate bract of nearly 12 mm long. Involucral bracts 4–5 series: outer phyllaria obovate, prominently nerved, hirsute, 6 mm long and 3–4 mm wide; middle phyllaria the longest, upto 7 mm long and ± 3 mm broad, elliptical, basal portion scarious, apical half with indumentum, nerves similar to that of leafy bract; inner phyllaria scarious, linear, 6 mm long. Receptacle flat. Corolla infundibuliform, purple, 7 mm long; lobes recurved, 1·5 mm long. Anther linear, 1·7 mm long, shortly sagittate with truncate base and acute tip. Ovary oblong, 1·9 mm long, 10-ribbed, glabrous; pappus very few, 6–10 in number, dirty white, 2 mm long of ascendingly barbellate setae. Style ± 8 mm long; arms 2, linear, subulate, puberulous on the outer surface. Achenes like the ovary, pale brown, 1·9–2 mm long.

India, Tamil Nadu, Tirunelveli District, Sengaltheri, at an altitude of 1100 meters. Rare, in tropical rain